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ECONOMIC GEOGRAPHY

(THIRD EDITION)

By

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Published by

SOUTH-WESTERN PUBLISHING CO.

CINCINNATI NEW YORK CHICAGO
DALLAS SAN FRANCISCO

G87

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Printed in the
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PREFACE

ONE of the most notable phenomena of the past few years has been the extent to which man has brought himself and his environment into better adjustment and, in so doing, has improved his economic welfare. Because of his increased effort at adjustment, new trends have appeared in commerce and industry. Some of these trends are probably only temporary in character; others are undoubtedly permanent. In this new edition of *Economic Geography* the authors have endeavored to interpret and evaluate some of these trends.

Because of their long experience in teaching geography in secondary schools, the authors realize the necessity of presenting the subject in such a manner that the technical words will present no difficulty to the high-school student. They have therefore given much consideration to the diction of this book in an effort to make the text suitable and adapted to the reading ability of the average high-school student. Simplicity in vocabulary has been maintained not only to catch and hold the interest of the student, but also to ensure that he thoroughly understands the subjects presented. Technical words, peculiar to the subject and probably new to the student, are printed in italics and are defined directly in the text material the first time they are used.

Special attention has been given to the visual equipment of the book. A selection from a wide variety of sources has resulted in pictures that illustrate the text material directly and effectively. The use of an up-to-date format has made it possible to use pictures of generous size without making the book too bulky. The liberal use of color greatly enhances the artistic and pictorial values of the book.

New and more complete maps have been prepared to help fix the locative concepts of the student in regard to products and places. All foreign maps carry the latest spelling of proper names in accordance with the rulings of the United States Geographic Board. The conventional spelling is given in parentheses on the maps and is used in the text discussion.

A comparative list of the new and old spellings of the names of foreign places is given at the end of the book for ready reference.

The organization of the subject matter is unique in that it may be readily adjusted to the varying requirements of different courses of study. As in the previous edition the book is divided into twenty-five distinct and independent units of subject matter under three general headings: (1) Man and His Environment, (2) Products of Commerce and Industry, and (3) Regions of Commerce. This division of material permits the teacher to use any desired approach or arrangement of chapters. It also makes possible the supplementary use of one chapter while another is under discussion. Constant reference to the index is unnecessary because similar types of information, as well as all information about one topic, are grouped appropriately. Elasticity of methods and of subject matter is made possible, and hard and fast sequence of material is eliminated. A wide variety of procedure may be followed so that monotonous, prolonged study along just one line of approach may be avoided. The teacher has complete freedom in the choice of subject matter; he may therefore emphasize the topics most pertinent to the situation of the community.

Perhaps the most important change is the expansion of the material, especially in Part III, "Regions of Commerce." This part has been completely rewritten and enlarged. Attention has also been given to such subjects as new phases of agricultural production, including soil conservation and strip cropping; advances in communication, including the radio; progress in transportation, including aviation; governmental activities in irrigation and power projects; and some of the basic geographical factors underlying economic conditions.

The authors have incorporated sound pedagogical procedures throughout the book, emphasizing cause and effect after a solid groundwork of factual information. Text questions at the end of each section summarize the information therein. Problems and projects, topics, and statements for class discussion are suggested at the end of each chapter for further study if additional emphasis is desired. These have been

carefully arranged in order of difficulty so that graded assignments may be made. For further assignments the teacher may refer to the lists of pertinent, up-to-date statistics from authoritative sources given at the end of the book.

The authors thank their associates who, by their encouragement and assistance, have aided materially in the completion of this book. In this group special acknowledgment should be given to Mr. Robert F. Denvir, Jr., of the English Department of the Dorchester High School for Boys, Boston, for his painstaking care in reading the manuscript and proof; to Mr. Ralph E. Wellings, of the Science Department of the same school, for his aid in drafting some of the attractive graphs and maps; and to the students in the geography classes in the New York State College for Teachers, Albany, who used much of the material in trial classes and who gave many suggestions as to arrangement and presentation.

The authors also thank the many teachers who have made valuable suggestions based on the previous edition of *Economic Geography* and on a study of the manuscript or the proof for this new edition. In this latter group special credit is due to Dr. Howard H. Martin and Dr. Frances M. Earle, of the Department of Geography, University of Washington, and to Mr. Alfred A. Thorn, of the Roosevelt High School, Port Angeles, Washington, each of whom read and criticized the entire manuscript.

In recognizing the valuable assistance that has been given them, the authors do not wish to avoid full responsibility for the form in which statements are made and for the accuracy of all facts, as the final decisions were theirs.

Z. C. S.
G. M. Y.

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PART I

MAN AND HIS ENVIRONMENT

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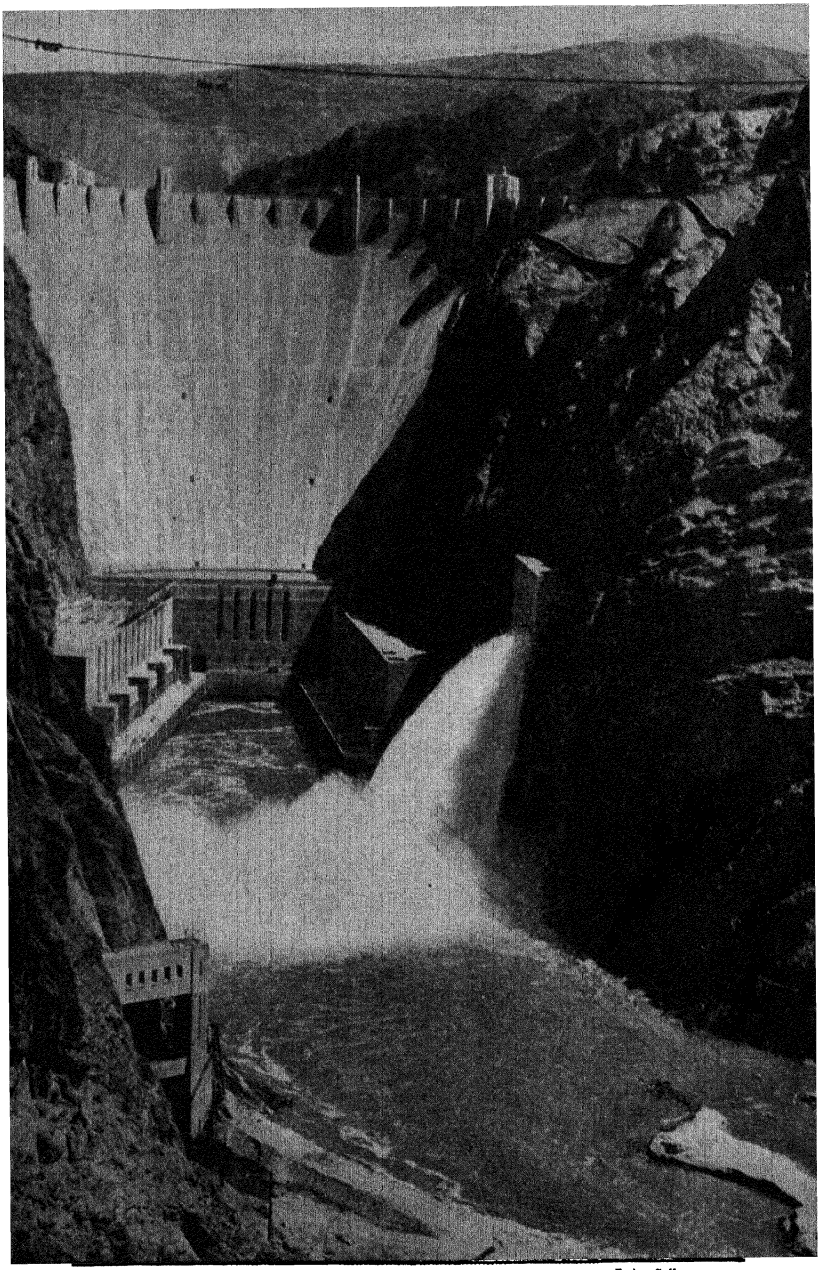

Ewing Galloway

Boulder Dam, on the Colorado River, shows how man adapts natural resources for his benefit.

CHAPTER I

SOCIETY AND COMMERCE

Introduction. For many centuries the American Indian was content to accept his surroundings as he found them. Depending upon the free gifts of nature, he feasted in times of plenty and starved in times of scarcity. What a change has taken place in America since the coming of European civilization, wherein man has learned to change, adapt, and control the natural resources in his vicinity, and to make them serve not only his present needs but also his future wants!

Large cities, the homes of millions of people, are now found where only an occasional Indian hunted or trapped a few centuries ago. Mighty factories, making goods to be sent to all

Chicago one hundred years ago and modern Chicago. The amazing speed with which this city has grown has been made possible by man's use of the natural resources that have been available for ages.

Keystone View Company *Underwood and Underwood*



parts of the world, have within recent years replaced the ancient forests. Fertile fields and pleasant homes are to be seen where little over a century ago were open prairies and an occasional tent of a wandering red man. Great rushing trains, giant threshing machines, and thousands of trucks are heard where until recent years the lonely hunter heard only the thunder of the storms or the rumbling of the hoofs of vast herds of buffalo.

For untold centuries America made a very small contribution to the welfare of mankind, because her inhabitants, the Indians, made little use of natural resources. But almost during the lifetime of one person, the appearance of the entire country was changed; and America, through the genius of civilized men, began to use her natural resources and to play a major part in the commerce and industry of the world. The rapid development of America is evidence that the economic welfare of man depends not only upon the presence of favorable geographical conditions, but also upon the use that man makes of them. Such so-called social factors as the economic stage in which a man lives, his degree of civilization, his race, his religion, and his government determine the quantity and the quality of his wants and his ability to use natural resources in the satisfaction of those wants.

SECTION 1—ECONOMIC STAGES OF COMMERCE

Division of Commerce into Stages. For convenience, we may divide the rise and the growth of commerce into five economic stages:

1. The hunting and fishing stage
2. The pastoral stage
3. The agricultural stage
4. The handicraft stage
5. The industrial stage

It must be understood that each of these stages of commerce did not cover an exact number of years; nor were they distinct from one another. They merged gradually one into another, with no hard and fast division between them. Not every nation

has passed through all of them in the order named, but most nations have followed this general course in their development from primitive times to present-day civilization. A few backward nations are still in the earlier stages, but nearly all civilized nations are now in the industrial stage.

Hunting and Fishing Stage. The hunting stage is possible only in regions with large areas of thinly settled land, because wild animals need large tracts of land over which to roam in their search for food. Our early ancestors, comparatively few in number, lived in this stage; but to find such conditions today, we would have to go to some place like the heart of Africa or the northern part of the American Continent. The life of the American Indian, before the coming of the Europeans, was an excellent example of this stage. His food consisted of animals killed in the hunt, fish caught in the streams, wild fruits and berries, sometimes corn, and nuts. His clothing was made from the skins of wild beasts, and the implements he used were very simple. Each tribe, or family, formed a separate economic group. There was little exchange between the different families and tribes, chiefly because they owned nothing worth trading and made only those things that were absolutely necessary to satisfy their own wants.

Early American Indians in the hunting stage. Food for those in this stage consisted of wild animals, fish, berries, and nuts. Clothing was made of the skins of wild beasts. Only crude tools and utensils were used.

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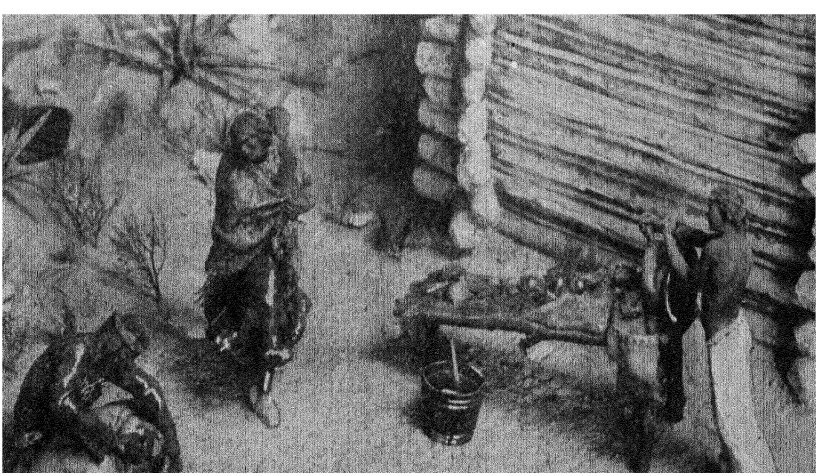
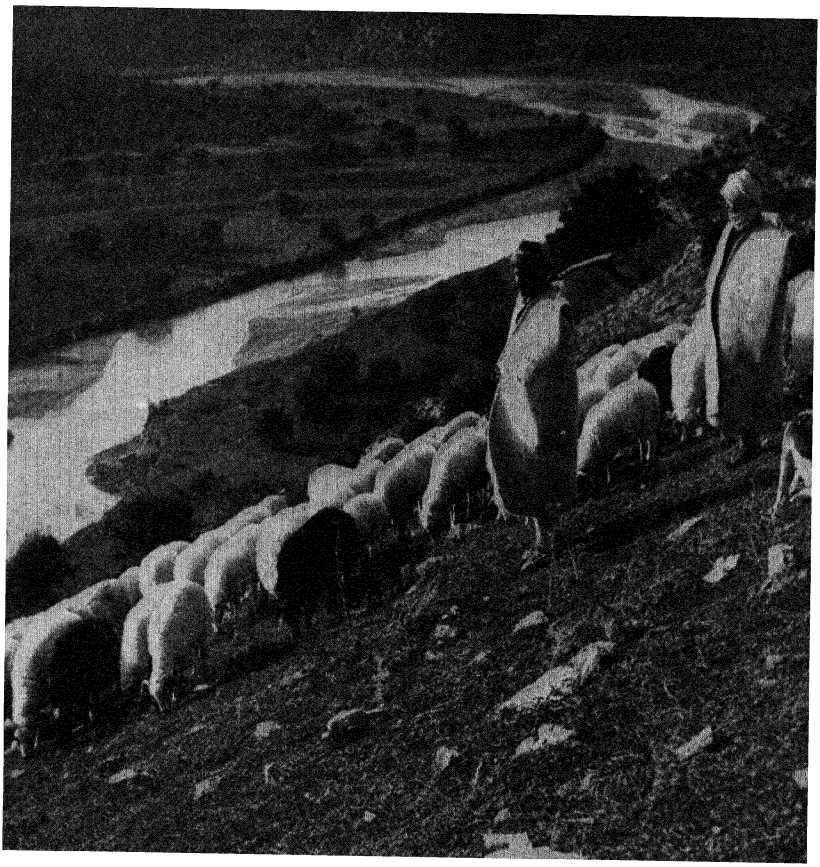


In the fishing stage it is possible for people to exist in a more thickly settled area. Large tracts of land are not necessary, because the food supply largely depends upon the richness of the fishing waters. Since fishermen must have shelters, boats, nets, and other fishing equipment, a small industry was created in very early times to supply these needs. As a result, a division of labor gradually arose, each man making what he could make best and trading that product for needed articles made by others. Barter, or "swapping," became common. After a time, fishermen began to push farther and farther out to sea and thus to meet people living on other shores. In this way began navigation and commerce. The best example of this stage in ancient times was the early Phoenicians; in modern times, the Eskimos.

Pastoral Stage. In the pastoral stage ancient man tamed wild ancestors of our domestic animals, such as horses, cattle, and sheep. Then he increased the size of his flocks and herds and, instead of hunting, wandered from place to place, seeking new pastures for them. Whole tribes were nomads, or wanderers, without any permanent home. For this sort of life they needed much thinly settled grazing land. The story of Abraham in the Old Testament is an excellent picture of this stage. As countries became more thickly populated, these nomads were obliged to fight in order to protect their pastures or to move on to other regions. Lot's separation from Abraham, because there was not enough pasture for the herds of both, is a good illustration of this. The need and the struggle for pasture land also explain, in part, many of the great racial movements and invasions of history.

A certain amount of industry was necessary in connection with the herds, and there was some barter in animals, hides, and wool. Later, people learned how to make cloth from wool, which became a very important article of early trade. As a result of all this, the accumulation of wealth began.

There are but few people in the pastoral stage today. Some regions, however, are suitable for nothing but grazing, and in these places we find people still living the pastoral life. Across the extreme northern part of Europe, where arctic moss is



Underwood and Underwood

A pastoral scene in Asia Minor showing a stage of civilization that has continued here for thousands of years.

plentiful, the Laplander, with his large herds of reindeer, and in Mongolia, near the center of Asia, where only grass grows well, the Mongol, with his flocks of sheep and herds of cattle, have not yet passed beyond this stage.

Agricultural Stage. Just as men tamed wild animals for use, they also tamed their favorite wild plants for their edible seeds, roots, nuts, and fruits. They therefore set off certain areas for the cultivation of these crops. At first such farm land was worked in common by all the people of a tribe, living in a compact village for mutual defense against thieves and robbers. Because of the necessity of protection, strong governments arose and patriotism had its birth.

In the pastoral stage actual ownership of land was of small concern; in the agricultural stage every man wanted control of the plot where he obtained his food supply. The natural result of this desire for individual control was that private ownership of land gradually became the general rule.

In the more fertile areas industrious farmers often had for exchange a surplus of grain, meats, dried fruits, or wine, and the villages became small trade centers. Barter was soon displaced by the use of metal money as a medium of exchange; standards of weights and measures became necessary; and business rules and laws became fixed and permanent. A merchant class, which carried on trade within the larger villages and cities, arose. Great fairs where merchants could meet and exchange goods were a noticeable feature of this stage. In the farming regions of backward countries today, we find much the same conditions.

The agricultural stage was characterized by primitive methods of agriculture such as are found in certain backward regions even today.

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Handicraft Stage. As agricultural communities became larger and larger, the population grew denser and a greater division of labor developed. For example, certain men, excelling in making cloth into garments, confined their labor to the tailoring trade, receiving returns for their work in other commodities. Thus arose a class of skilled workers who followed one trade exclusively. As manufacturing by hand increased, the craftsmen formed guilds and societies for the governing of their various trades. Later, these societies played an important part in history and in trade. As the population continued to increase, villages grew into cities, some of which grew to large size. As industry developed, commerce kept pace with it. Regions gradually began to exchange articles with one another. Foreign commerce became important and, with it, the merchants who conducted it. Professional men, such as teachers, lawyers, priests, artists, and writers, grew

In the handicraft stage small units of manufacturing, such as the work of the hand carver in Switzerland illustrated below, are found in the home.

Vitaphone



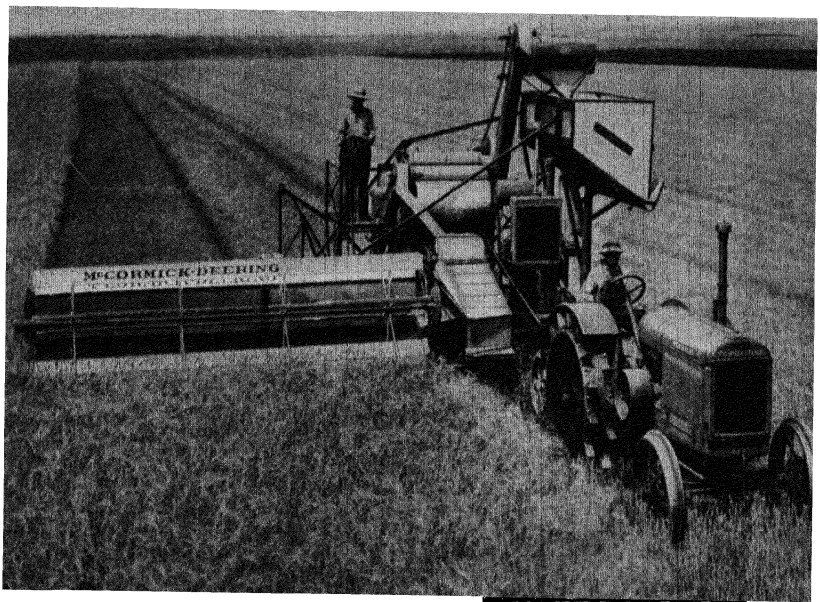
more numerous. Gradually, nations became strong, wealthy, industrious, commercial, and highly civilized. Many of the coastal nations built great trading fleets; their merchant adventurers went on long voyages of discovery, often resulting in the colonization of new lands. The great nations of the world remained in this stage until the discovery of the value of steam, at which time the present industrial stage began.

Industrial Stage. The invention of the steam engine and the machinery run by steam revolutionized the industrial world. Goods formerly made by hand in the home or in small shops were now turned out in large factories by hundreds and thousands. Articles of commerce were made by machinery more easily, more rapidly, more cheaply, and more uniformly than they could be made by hand. As a result industrial production has advanced during the past century many times faster than it did during all previous history.

Machinery has increased man's power of production along other lines also. The farmer of today with his tractors, cultivators, and combines can produce much more food than could the farmer of a hundred years ago. The miner and the logger have likewise speeded up their output.

Parallel advances in transportation and communication have improved the means of distribution, so commerce can keep abreast of manufacture. With increased output and better distribution have come better wages, higher standards of living, shorter hours of work, and less drudgery for everyone.

Economic Stages in the United States. When the first colonists landed in America, they found Indians living in the hunting and fishing stage. In the decades when huge herds of cattle and sheep roamed the Great Plains and mountain basins in search of free pasturage, western United States had what might be called a pastoral stage. The agricultural stage has long been present in our great corn, wheat, and cotton belts. During pioneer days farming and the handicrafts often developed together. Later, because of power resources and raw materials, certain sections of the United States shifted easily to the industrial stage.



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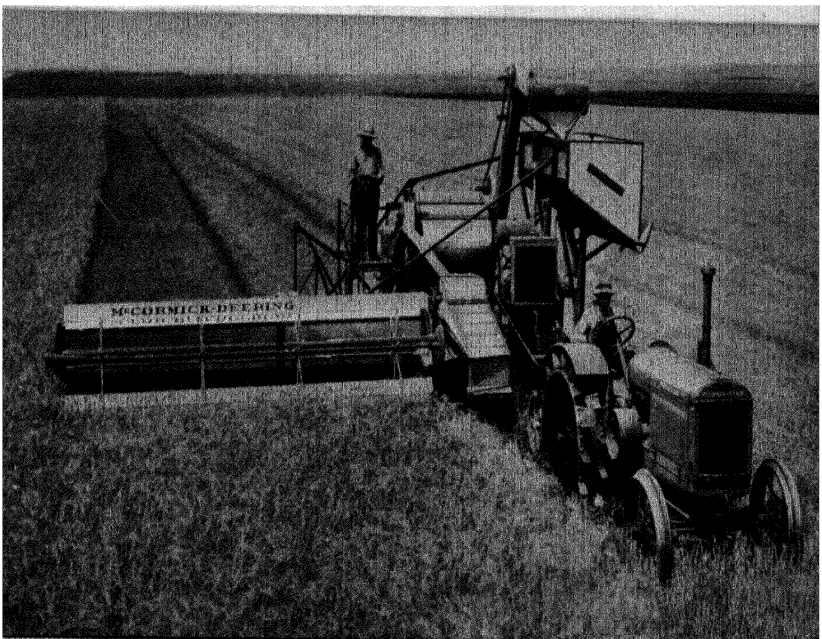
In the industrial stage much machinery is used in agriculture.

These stages have not been entirely distinct as separate stages because of the advances in transportation and communication. We still have a few traces of hunting, fishing, and trapping; a few people still follow a pastoral existence; and a larger number are engaged in skilled handicrafts. The greatest amount of American activity today, however, is found in agriculture and industry and in the commerce arising from them. These, existing side by side, tend to dominate our national life.

TEXT QUESTIONS

1. Contrast the life led by an early American Indian and the life led by a man in the industrial stage in regard to the effects of environment on them and their effect on their environment.
2. Contrast the use of the natural resources in this country now with the use of those resources before the coming of civilization. Explain the reasons for the differences in these uses.
3. Name the five stages of economic development.
4. Why can the hunting stage exist only in thinly settled areas?
5. Why is barter not common in the hunting stage?
6. Show how the fishing stage brings about a simple division of labor.
7. Show how barter depends upon a division of labor.



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7. Show how barter depends upon a division of labor.

8. Why is it natural for men in the fishing stage to become traders?
9. Tell why many of the world's racial movements and invasions occurred in the pastoral stage.
10. Why did the ownership of land by individuals arise?
11. Discuss the origin of government in the agricultural stage.
12. Show why money, merchants, standards of weights and measures, and business rules and laws arose in the agricultural stage.
13. Discuss the growth of trade division of labor in the handicraft stage.
14. In what stage did professional men first appear in numbers?
15. Why did trade increase in the handicraft stage?
16. Why did men remain for a long time in the handicraft stage?
17. What invention made the industrial stage possible?
18. What has made it possible for commerce to keep pace with industry in the industrial stage?
19. Illustrate the existence of the five economic stages in the United States.
20. What effects have transportation and communication had on these stages in the United States?
21. Illustrate each of the stages in the world today.
22. Name some of the social factors that determine not only the quality and the quantity of man's wants but also his ability to use the natural resources about him.
23. Give a list of the earliest occupations of mankind.
24. Define any words in this section which were new to you.

tribute to trade in order to obtain the satisfaction of these increased wants.

Semicivilized people have more wants than do savages. It is in their attempts to satisfy these wants that industry and trade have their beginnings, principally as barter or the exchange of goods for goods, whereby the surplus products of one tribe are exchanged for the surplus products of another. This exchange among tribes requires some organization and some enlightenment, and indicates progress.

Civilized man has many wants, some of which he can never satisfy. He has learned the advantages of organization, cooperation, production, manufacturing, and of trading his surpluses for money with which he may obtain articles from others. These advances in civilization promote a necessary commerce, and the civilization to which a people has risen may be measured, to a large degree, by the amount of its commerce.

Language. Perhaps someone has talked rapidly to you in a language you did not understand. You found it puzzling, even impossible, to follow even a single word. Imagine how difficult it would be to do business under such conditions. The lack of a universal language, understood by everyone in the business world, has been one of the most serious handicaps commerce has had to face since its beginning. Attempts have been made to create a universal language, but they have not yet been successful. It seems evident that only by the leadership of some existing language shall we arrive at a common language of business. English is fast becoming the language of world commerce, as well as taking the place of French as the language of diplomacy.

There are several combination languages. The two most important are *lingua franca,* a mixture of French, Italian, and Arabic, which is used somewhat among the traders around the Mediterranean Sea, and *pidgin English,* a mixture of English and Chinese, which is used in the ports of the West Pacific Ocean.

Improved means of communication, printing, and education have helped the different peoples better to understand one another.

Race. For our purposes, man may be classified into three great races. These races are the Indo-European, or white, race; the Mongolian, or yellow, race; and the African, or black, race.

The Indo-European race lives chiefly in the temperate zone. It is composed, in large part, of European peoples and those of European descent. Although the Indo-European race consists of only about one third of the population of the world, it controls nine tenths of the area of the globe. This is due to the fact that it has characteristics which make great civilizations and that it has led, throughout history, the commerce of the world.

The Mongolian race ranks next to the white race in numbers and in importance in commerce. Partly because the yellow race was out of touch with the rest of the world, the commercial progress of that race was slow until recent times. The great discoveries and the growth of world trade, made possible by improved ocean navigation, have brought the Mongolian peoples into closer touch with the white race. By adopting Western methods, the Mongolians have advanced very rapidly in recent years. Japan, in the last one hundred years, has developed greatly and is now leading the other countries of the Orient in commerce.

The African race has never taken any serious part in commerce. The majority of this race, living in the torrid zone, have characteristics that naturally result from a tropical life.

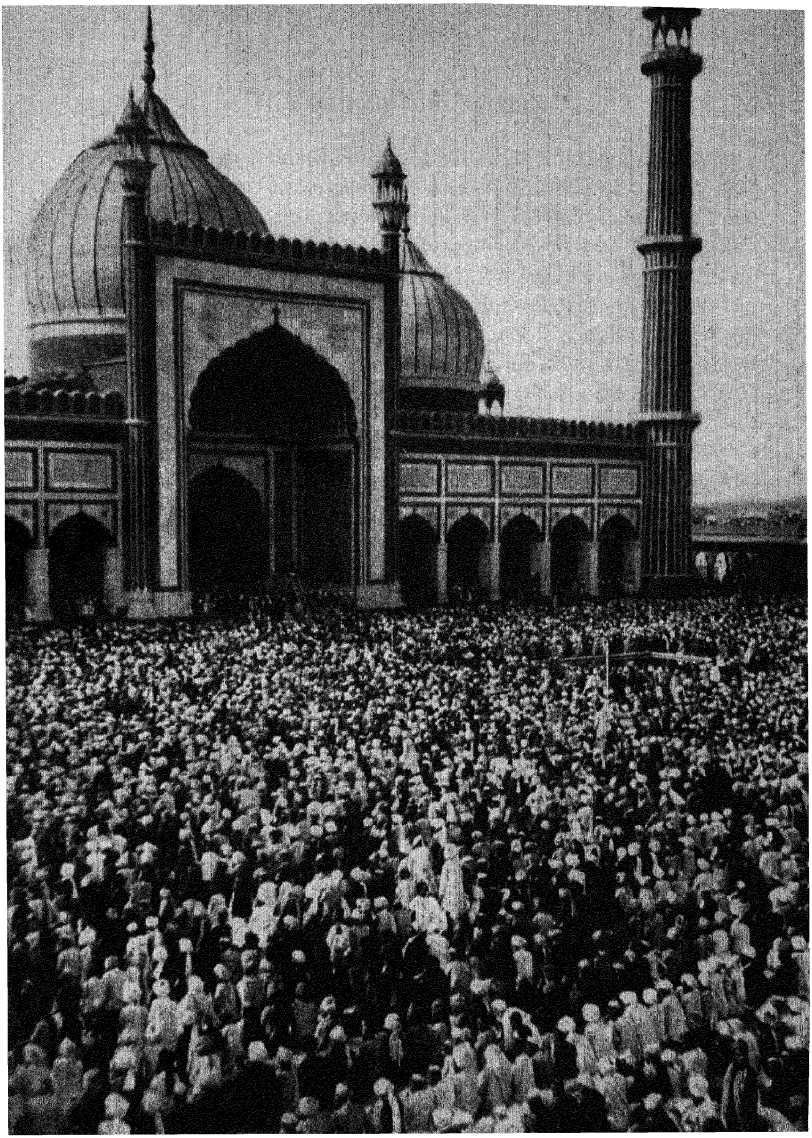
Population. Some regions of the world are very crowded with people, whereas other regions are very sparsely or thinly settled. Within the boundaries of our big cities, many hundreds of people are crowded into comparatively small areas; but in northern Canada, you might travel hundreds of miles without seeing even one person. The average number of persons living in each square mile of a region is called the *density of population* of that region, and is one of the most important factors affecting commerce and industry. In sparsely settled areas, certain activities, such as hunting, trapping, grazing, and lumbering, are possible, but they would be out of the question in a more densely settled region. As

a region becomes more thickly populated, these occupations give way to agriculture, which becomes more and more necessary and profitable as the inhabitants increase. Eventually, villages and towns, and finally cities, crowd out some of the farms, until manufacturing and trade become necessary to support the growing number of persons. Products of the factory are sold for money with which the city dweller buys foodstuffs from the farmers; the farmer exchanges his foodstuffs for money with which he buys factory-made products; and so the cycle of trade keeps going. Financial depressions occur when this cycle slows up or stops. The large populations of our cities could not exist without commerce; and the greater the number of people per square mile, the greater becomes the necessity for commerce, and the greater its volume.

With the increase in population comes the demand for more production. The rapid increase in population in the last one hundred years has been possible only because of the increased production of the necessities of life and the improved means of distribution.

Density of population also tends to bring about emigration. When conditions in one locality become economically unsatisfactory, part of the population moves on to a more favorable location. This has been particularly true of the people in European countries and has led to the colonization of practically all the desirable open spaces in the temperate zone. European emigration spread the white race over the Americas and Australia, and has thereby greatly increased commerce.

Religion. The religion of a people affects their commerce to some degree. The Jew eats no pork; the Brahman eats no beef; the Mohammedan is forbidden pork and alcoholic liquors; and on certain days the Catholic denies himself meat of all kinds. The fish industry of Puritan New England was greatly increased by the demand for salt codfish in Catholic countries. Religious festivals and holidays also encourage commerce. Thus, Christmas and Easter increase commerce, and religious pilgrimages create demands that commerce supplies.



Underwood and Underwood

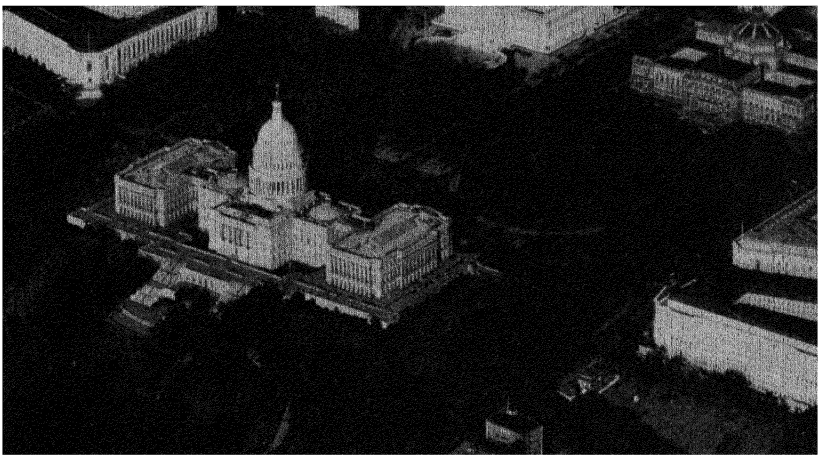
Part of a great religious gathering before a Moslem mosque in Delhi, India.

The caste system in India, with its ironclad rules, restricts the commercial and industrial activity of a man to that of his own class, or caste. In Tibet, every third man becomes a monk, and man power in industry and trade is thereby reduced. Confucianism, with its opposition to all things new, has held China back. Mohammedanism creates in its followers an attitude of mind that is not favorable to world commerce. On the other hand, the religions of the white race have helped commercial expansion. Their followers have been among the first in discovery and colonization. Their missionaries have oftentimes preceded their merchants and have made commerce possible.

Government. With civilization and commerce comes the need for law and order. Before a large amount of commerce is possible in any region, there must be a firm and strong government that provides protection for, and is favorable to, traders and people in general. Under weak, inefficient, and corrupt governments, commerce and industry are held back; under strong governments, they grow and expand. For example, Mexico, in spite of her excellent natural resources, has lagged far behind her possibilities in commerce and industry, in large part because of the unstable character of her government. England, on the other hand, with comparatively few natural resources, has forged ahead, principally because of a well-organized government of high character that is favorable to trade and industry.

Courts must be fair, real protection must be given to business, and honesty and justice must prevail, or commerce and industry will seek other places. Where graft and dishonesty dominate, trade languishes. Men will not work and toil if they are afraid that their government will allow them to be robbed of the results of their labor.

A brief examination of our own government will show one of the most highly organized systems of governmental aids to commerce and industry. Up to the coming of the financial depression in 1929, this governmental aid was confined principally to the maintenance and regulation of routine channels of trade; the gathering, printing, and distribution of valu-



The center of our Federal Government is in Washington, D. C.

able information; and the dispensation of justice. Because of the abnormal conditions during the depression beginning in 1929, however, the Government has increasingly taken over the responsibility of experimentation in attempts to solve the more serious economic problems. Naturally, this experimentation has led to more and more governmental control of certain avenues and phases of commerce and industry.

TEXT QUESTIONS

1. Name and illustrate three degrees of civilization.
2. Prove that as man's wants increase, his degree of civilization improves likewise.
3. How is commerce conducted among semicivilized men?
4. How does civilized man satisfy many of his wants?
5. What has been the language of diplomacy?
6. What language will probably become the language of commerce? Why?
7. Name two combination languages, and tell where they are spoken.
8. What agencies are helping different peoples to understand one another better?
9. Name three racial divisions of man.
10. Where is the greatest percentage of the white race found? Why?
11. Why is the white race the leading commercial race?

12. What is one factor that has held back the progress of the Mongolian race?
13. Why has the African race never led in commerce?
14. Define the term *density of population.*
15. Discuss the effect of density of population on industry in general.
16. Discuss the effect of density of population on commerce.
17. How has the great growth in population been made possible because of commerce?
18. Name one reason for emigration to colonies. Explain.
19. Show how great religions affect commerce.
20. Why must a government be strong to encourage commerce and industry? Explain.
21. Give an example of a country with an unstable government.
22. Name some of the ways in which our Government influences our commerce and industry.

PROBLEMS AND PROJECTS

1. In which economic stage of society would you prefer to live? Give reasons for your choice.
2. Why have the Mongols remained in the pastoral stage so long? Explain.
3. How have the oriental races profited by contact with the white race? How have they lost?
4. Why are Japanese and Chinese laborers excluded from the United States? How does this exclusion affect the labor situation in this country?
5. Give illustrations of the effects of weak and of strong government on commerce and industry.
6. Explain why a universal language and a universal standard of measurements are difficult to establish.
7. Does the use of Niagara Falls show the superiority of the white man over the Indian? Give reasons for your answer.
8. Show how commerce has changed from dealing in luxuries to dealing in necessities. What articles that were luxuries one hundred years ago are necessities to us now?
9. Has the change from the handicraft stage to the industrial stage benefited labor in general? Prove your answer.
10. Discuss briefly the influence of religion on the settlement of America.
11. Explain the dominance of the white race over the greater part of the world's surface.

12. Show that agriculture is the basis of commerce and industry.
13. Compare the productive ability of the individual of today with that of the individual of one hundred years ago. Explain why the number of working hours has decreased.
14. Trace the growth of the Hebrews through the various economic stages.
15. Show how increased and improved means of communication and transportation have made possible the enlarged population of the world.
16. Why did not the early American Indian advance beyond the hunting and fishing stage? Prove your answer.
17. Show how the coming of the white race has frequently resulted in the ruin of native races. Can you justify civilization in such cases?
18. Make a list of magazine articles, pamphlets, and books dealing with the subject matter in this chapter.
19. List new activities of the Federal Government since 1929, giving points in their favor and points against them.

TOPICS

1. The advance of commerce in the last one hundred years.
2. The rise and fall of previous civilizations.
3. The advance of industry in the last one hundred years.
4. What is civilization?
5. The social status of the merchant in the past and in the present.
6. Food supply and increased population.
7. Racial characteristics that have an influence on commerce and industry.
8. Economic nationalism and its commercial effects.

FOR CLASS DISCUSSION

1. The savage, with few wants and desires, and those easily satisfied, is better off than the highly civilized man, with numerous wants and desires, many of which can seldom, if ever, be satisfied.
2. The greatest men of our country have come from densely populated areas.
3. Of all the existing languages, English is best suited to become the universal language.
4. Commerce insures peace rather than causes war.

5. As the material prosperity of a nation is increased, its cultural growth is retarded.
6. Our commercial expansion threatens our future welfare as a nation.
7. The world is growing better.
8. Each nation should be self-supporting in the production of necessities.
9. War and pestilence always have been, and probably will continue to be, necessary evils in the world.
10. The world faces the grave danger of overpopulation.
11. Most of the wars in history have been waged because of economic causes.
12. If all barriers to world free trade were removed, and all nations had access to all natural resources on an equal footing, the principal cause of war would disappear.
13. The Mongolian race will eventually control (a) all of Asia, (b) all of the world.
14. The increasing activity of the Federal Government since 1929 is justified.
15. The caste system in India is one of the primary causes of the poverty of millions of people in that country.
16. Economic nationalism caused the present conditions in Europe.
17. Man has developed his environment too much for his own welfare.
18. A man is more satisfied if he does not know of certain conveniences, such as automobiles, than if he knows about them and is unable to have one.
19. Man is less satisfied in the industrial stage than he is in the pastoral stage.

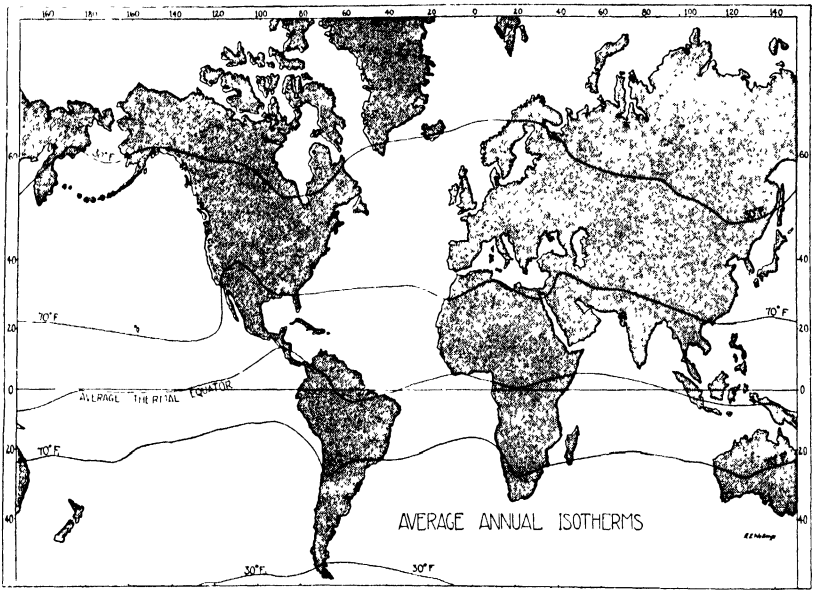
CHAPTER II

NATURE AND COMMERCE

SECTION 1—CLIMATE

Importance of Climate. Have you ever stopped to realize that there are no great factories in the jungles of Africa or on the frozen wastes of the North? The chief reason for this is the unfavorable climate. *Climate* may be defined as the average weather conditions of a region, including especially the temperature of the air and the amount of moisture in it. Climate is the most important physical factor affecting commerce and industry because it determines which plants and animals can live and thrive in the various regions of the world. As we shall see later, it determines also the character of the people of a particular region. From the plants and the animals come most of the raw materials of a region; upon the character of the people depends whether or not these products are used to the best advantage. Regions that have a favorable climate contribute much to commerce and industry because they have an abundance of commercial raw materials and because their inhabitants are industrious and energetic.

Climatic Zones. There are three *climatic belts* or *zones* of temperature: the *torrid,* the *temperate,* and the *frigid.* The temperate and frigid zones are subdivided into northern and southern. The exact boundaries of these zones cannot be determined by drawing straight imaginary lines around the earth at certain distances from the equator, because several other factors are present that affect or modify climate. The zones are therefore bounded by imaginary lines called *isotherms,* which connect places in the world that register the same degree of heat at a given time, or the same mean, or average, temperature for a given period of time. The average annual isotherm of seventy degrees Fahrenheit is taken as the boundary between the torrid zone and the temperate zones; the average annual isotherm of thirty degrees is taken as the



boundary between the temperate zones and the frigid zones. Although the isotherms are the real *climatic* boundaries of the climatic zones, the Tropic of Cancer is the *geographical* line that separates the torrid zone from the north temperate zone; and the Tropic of Capricorn is the *geographical* line that separates the torrid zone from the south temperate zone. These two imaginary lines do not correspond to the isotherms since the isotherms are necessarily irregular and seldom parallel because of the factors that modify climate. The isotherm that connects the places of the world registering the greatest heat at any given time is called the *thermal,* or *heat, equator;* it lies usually a little north of the geographical equator.

Effect of the Tropical Climate. Although the tropical regions are furnishing us with more and more raw materials, the natural resources of the tropics have not yet been developed to anywhere near their capacity. The hot climate makes life relatively easy. Food, clothing, and shelter are obtained with little effort. Hard work and planning ahead

are unnecessary, and an easygoing, carefree life results. The hot, humid days discourage physical activity on the part of the natives, and men from the temperate zones are unable to do hard physical work because of the heat and the many tropical diseases.

With the growth of industry in the temperate zone has come a greater demand for the products of the tropics. To secure an adequate supply of these, men from the temperate zone have gone into the tropical regions and established large plantations. Only where natives of the tropics work under the organization and management of men from the temperate zone has any effective commercial development of the tropics taken place. Almost all the tropical products grown commercially are shipped to the temperate zone to be manufactured.

Effect of the Frigid Zones. The extremely cold climate of the frigid zones, on the other hand, limits plant life and restricts the raw material produced for commerce. What little is produced comes almost wholly from mines and animals. Man is forced to struggle for an existence, and only a few inhabitants are found in these regions. Even the wonderful skill that the Eskimo shows in adapting himself to his surroundings makes his life little better than that of a savage.

Effect of the Temperate Zones. From the temperate zones comes three fourths of the world's commerce. In these regions have been, and still are, located the great civilizations of history and all the great commercial cities and nations. The climate of the temperate zones is one of the chief reasons for the centering of commerce and industry there. It permits the growing of crops during only part of the year, thus forcing men to work hard during those months to store up enough food to last through the part of the year when nothing grows. Although men have to work hard, so well organized is their work that they have time for mental growth and the higher things of life. These conditions naturally tend to produce industrious, energetic, and intelligent people.

Because of the changing seasons, with alternating heat and cold, these zones are the most healthful regions in the world.

Naturally, in these places the people are better physically than they are elsewhere. The commerce that is found in the torrid and frigid zones has been largely developed by men born in the temperate zones, who have directed and organized the work. There are peoples within the temperate zones who have contributed little to commerce, but their lack of contributions has been due to factors other than climate, such as topography, remoteness, and poor government.

Effect of Latitude on Climate. *Latitude* is the distance, north or south, from the geographical equator. The sun's rays, more vertical and direct at the equator than at any other place, tend to make the equator the hottest region in the world. The rays grow fewer in number and slant more as they approach the north and south poles, making the temperatures lower and lower as the distance from the equator increases. Moreover, these rays are somewhat cooled by passing through more air as the distance becomes greater. If distance from the equator were the only modifier of climate, we could easily determine the temperature of a place by its latitude; but as other factors enter into the determining of climate, it is impossible for us to do so.

Effect of Altitude on Climate. *Altitude* is the distance upward from sea level. You would have to dress warmly if you were to go up into the sky in an airplane or balloon for several thousand feet, because up there you would find the temperature of the air to be very cold. For every thousand feet we ascend, the thermometer drops approximately three degrees. The air receives much of its warmth from the radiation of heat from the earth. In low places the air contains more tiny particles of dust and solid matter, which retain the heat for longer periods, than the thinner air at higher altitudes. It should be noted here that while one result of altitude is cooler atmosphere, another is thinness of the air. This thin air weakens the energy of people living in these higher altitudes, and also determines to some extent the kinds of animals and plants found there.



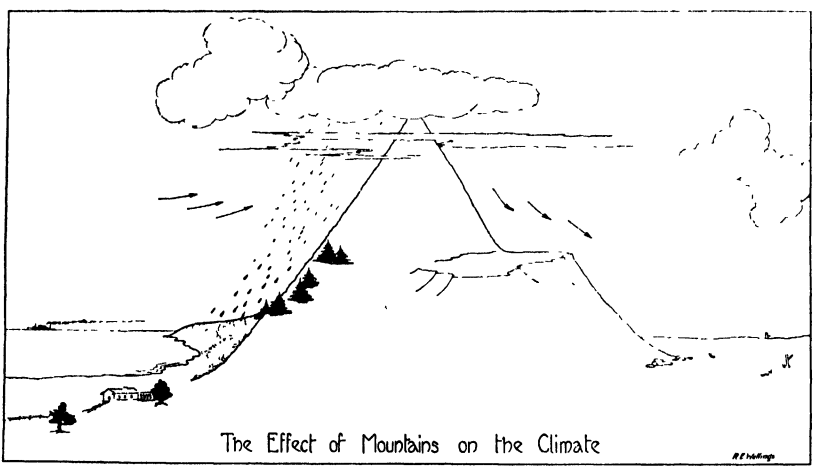
In the San Gabriel Valley, in California, orange groves flourish within view of snow-capped mountains.

Effect of Topography on Climate. *Topography* means the surface features of a region, such as mountains, slopes, valleys, plains, highlands, lowlands, rivers, coast line, water areas, and other factors that make up the surface of the region. The topography of a region affects very much its climate, as we shall see.

Effect of Mountains on Climate. We have already noted that as a mountain rises, the increasing altitude lowers the temperature. Mountains have a powerful influence on neighboring regions also, when they intercept prevailing winds and thus change the climate on the leeward, or sheltered, side.

Whatever moisture the winds have been carrying is dropped on the windward side of the mountains, because the air is forced upwards against the side of the mountains, becoming cooler as it ascends and dropping its moisture in the form of rain.

The Himalaya Mountains, blocking the winds from the south, force them to drop their moisture as rain. Hence, India is productive, but the regions north of the mountains are unproductive and dry. The winds from the Pacific Ocean are intercepted by the Sierra Nevada Mountains. In this way, California is given her water supply, but the eastward regions



The Effect of Mountains on the Climate

are robbed of rain. The direction of the mountain slopes plays an important part in agriculture. The southern slopes are much preferred in the Northern Hemisphere, especially for fruitgrowing, since the sun's rays fall more directly on them. In the Southern Hemisphere, the opposite condition is true, the northern slopes being the preferred ones.

Effect of Land and Water Areas on Climate. The size and the distribution of land and water areas decidedly affect the climate of a region. Land areas are heated by the rays of the sun much more quickly than are water areas. They also give up their heat much more rapidly when the sun's rays

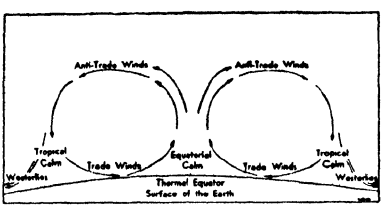
are withdrawn. Large bodies of water, therefore, have a steadying influence on the temperature of the air over and near them. In the interior of a country, far from this steadying influence of large bodies of water, the extremes of heat and cold during summer and winter are much greater than those in regions in the same latitude located on the sea coast.

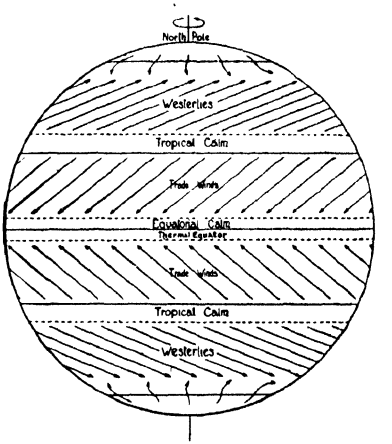
Seasonal Changes. Because the earth is inclined on its axis as it goes around the sun, the vertical rays of the sun move northward until, in June, they are over the Tropic of Cancer; then they move southward until, six months later, they are over the Tropic of Capricorn. As the isotherms follow this movement, the boundaries of the climatic zones move northward during the summer and southward during the winter. This movement causes the seasons and the annual changes in temperature. The highs and lows of temperature during these seasonal changes, as well as the average temperature, have an important effect on the plant and animal life of a region. Not only is the temperature of a region modified by this movement, but also the amount of moisture in the air as well, because the direction of the prevailing winds sometimes changes with the seasons.

Winds and Climate. Winds, whether warm or cold, blowing over a region exert a great influence on the climate of the region. Cold winds blowing southward from the north affect the climate of our western states and make them colder in winter than they would otherwise be. Winds are carriers of moisture, and to them the even distribution of rain may be laid. We have already noted how moisture may be dropped when warm winds become colder as they strike and rise up over mountains. Cold, dry winds becoming warmer collect moisture, and dry and desert regions result.

Winds and Calms. At the thermal equator, where the sun's rays are almost perpendicular to the earth, the air becomes warm, expands, and rises. As it rises, it becomes cool and drops its moisture as rain almost continually over an area called the *equatorial calms*. As more hot air keeps rising under the cooled air, the cooled air cannot come down. The

cooled air therefore divides; and some of it moves northward and some, southward, high above the surface of the earth. These moving currents of air are called the *antitrade winds.* They come down at a distance of about forty degrees, north and south, from the thermal equator, where they create belts or areas of clear, calm weather called the *tropical calms* because of their nearness to the Tropic of Cancer in the Northern Hemisphere and the Tropic of Capricorn in the Southern. Some of the cold air descending at the tropical calms starts again toward the equator, where it is once more drawn in by the rising hot air. These winds blowing toward the equator





Graphic representations showing the origin and the general directions of the trade winds and the westerlies, and the attendant calms.

are known as the *trade winds.* The air descending at the tropical calms which does not start toward the equator moves toward the poles and forms winds known as the *westerlies.*

Trade Winds. As the earth rotates from west to east, the atmosphere tends to move with it. Seemingly calm air is therefore moving from west to east at the same rate as that of the surface of the earth at the same point. Just as a wheel rotates most slowly at the hub and most rapidly at the rim, so does the surface of the earth rotate most slowly at the poles and most rapidly at the equator. The trade winds, blowing toward the equator, therefore cross areas that are moving successively faster and faster. As a result the winds tend to lag behind the surface of the earth. This lagging behind gives

them an apparent movement to the west, so that the trade winds in the Northern Hemisphere blow from the northeast and those in the Southern Hemisphere from the southeast. These winds can be depended upon to blow in the same directions almost continually. In planning the routes of sailing vessels, mariners take this fact into consideration.

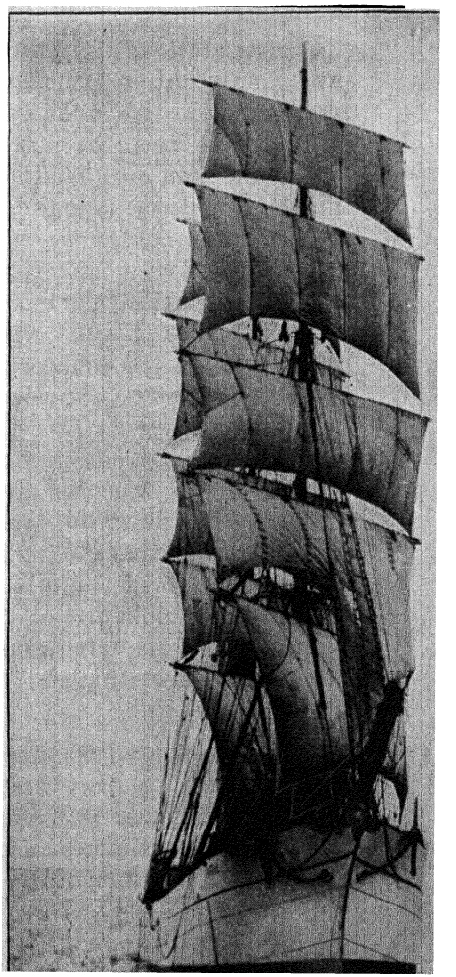
Westerlies. The winds that blow from the tropical calms toward the poles move across areas that rotate successively slower and slower. As these winds tend to maintain their original movement from west to east, they run ahead of the surface of the earth; in other words, instead of blowing directly north or south, they blow partly from the west—from the southwest to the northeast in the Northern Hemisphere and from the northwest to the southeast in the Southern Hemisphere. They derive their name, westerlies, from the fact that they blow from the west.

Varying much more in their regularity and speed, these winds are not so dependable and steady as the trade winds. They are, however, of great importance to sailing ships, which use them when sailing eastward in the middle and high latitudes.

Effect of Ocean Currents on Climate. Ocean currents affect

Sailing vessels have always been greatly aided by favorable winds and retarded by calms or unfavorable winds.

Wide World Photos

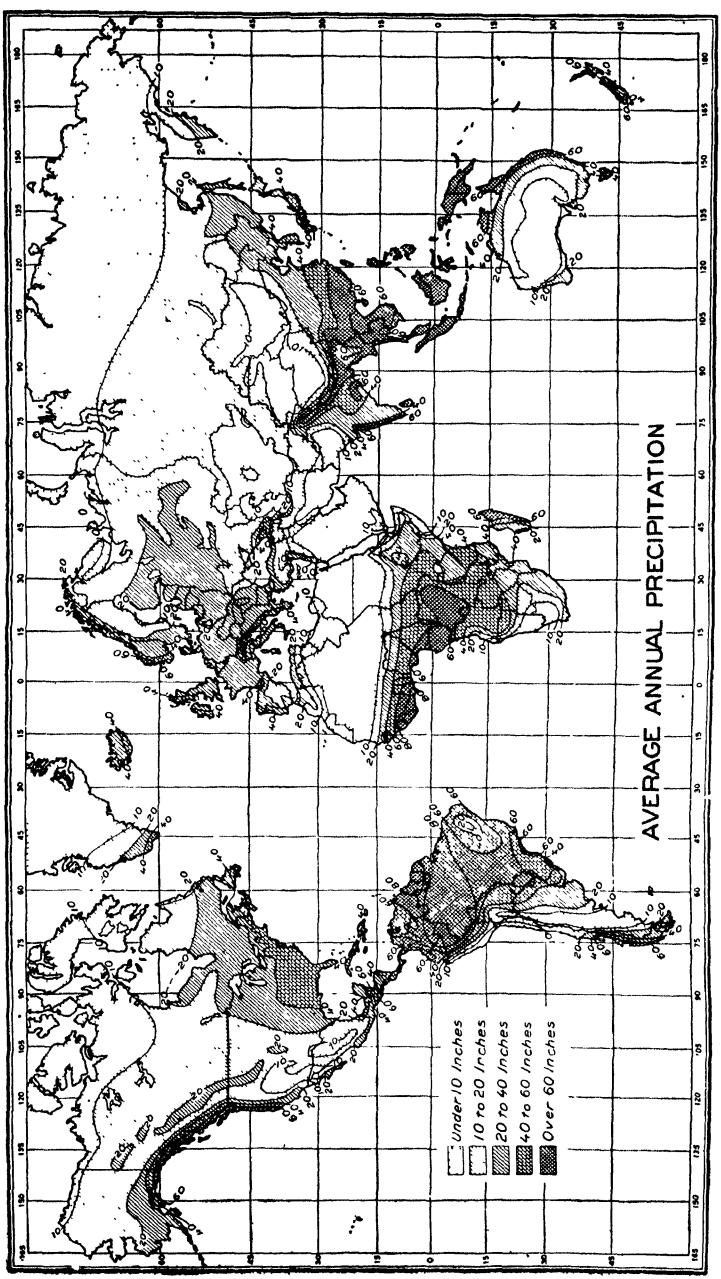


the climate of regions near them when the prevailing winds blow toward the shore. The climate of England and of northwestern Europe is made warmer by the westerlies blowing across the warm Gulf Stream, whereas Labrador is chilled by winds blowing across the cold Labrador Current. Alaska, on the western coast of North America, has many ice-free harbors because of the warming influence of the westerlies blowing over the Japan Current; whereas in the same latitude on the eastern shore of Siberia, the seaports are ice-bound for months because of the winds blowing across the cold ocean current from Bering Strait.

Causes of Rainfall. Rain comes as a result of three processes: evaporation of moisture from the surface of the earth, transportation by winds, and condensation. Evaporation, naturally, is much greater over large bodies of water, like the ocean, than over land. When moisture is evaporated into the air, it is carried along by winds. The trade winds, as they approach the heat equator, become warmer and are able to pick up and hold more moisture. Unless intercepted by mountains, they carry this moisture until, growing cooler upon rising over the thermal equator, they drop it in the form of rain. Thus, in the equatorial calms, we find almost continual rainfall. As this belt travels north and south with the seasons, tropical lands have a wet and a dry season.

The southeast trade winds blowing against the Andes Mountains in South America are forced upward. Their moisture is condensed into rain, which falls on the east side of the mountains, creating the immense rainfall of the Amazon River Valley. The westerlies, blowing against our Pacific Coast, deposit their moisture on the western slopes of the coastal ranges. While the windward side of mountains often receives extremely heavy rainfall, the leeward (or protected) side is dry.

Rainfall. Rainfall plays an important part in commerce and industry, because upon it depend the agricultural activities of a region. Not only is the amount of rainfall important, but also its distribution throughout the year, especially in the growing season. Generally speaking, about twenty inches of



U. S. Department of Agriculture

Our largest agricultural regions are within the twenty-inch rainfall line. Some regions do well with less rainfall because the rain comes at the right time.

annual rainfall are sufficient for successful agriculture in the temperate zone, provided the growing season receives its necessary share. There are regions where crops are successfully raised with less than twenty inches of rainfall a year because the rainfall comes at the right time. On the other hand, there are regions with an annual rainfall of twenty inches and more where it is necessary to supplement the rain with irrigation, because the rainfall is not well spaced in the growing season. Palestine has well over twenty inches of rainfall annually, but less than one inch falls during the growing season; this seriously hampers agriculture and makes irrigation necessary for successful farming.

In the United States we are fortunate because in our great agricultural regions our annual rainfall is well distributed throughout the growing season, although at times some regions are subject to summer drought, which ruins the crops. On our great western plains, where the annual rainfall is not abundant enough for sustained good farming, there is sufficient rain for growing grass, and this gives rise to cattle raising and sheep herding. At the present time our great power and irrigation projects are turning immense areas with insufficient rainfall into fertile sites for vegetable and fruit farms.

Rainfall and Cyclonic Storms. The pressure of the air on the surface of the earth is not the same everywhere because of various conditions such as differences in temperature, humidity, and altitude. Air pressure is measured by an instrument called a *barometer.* Areas where the barometer registers high pressure are called *high-pressure areas;* areas where the barometer registers low pressure are called *low-pressure areas.* On a weather map, places with the same air pressure at a given time or for a certain period of time are connected by imaginary lines called *isobars.*

Air rushes from high-pressure areas toward low-pressure areas and thereby creates winds, the velocity of which varies with the differences in pressure between the areas. These winds are deflected from a direct course by the rotation of the earth, which gives them a spiral motion and thereby creates immense whirlpools of air covering hundreds of square miles

and moving in a counter-clockwise direction. These gigantic whirlpools are called *cyclones,* or *cyclonic storms.* They should not be confused with *tornadoes,* which are fast-moving whirlpools of comparatively small dimensions.

These storms, under the influence of the westerlies, generally move across our country from west to east with a slight northerly trend, at a speed of about three hundred miles a day. These winds drop their moisture in the form of rain as they become cooler as they pass into cooler regions, or as they rise, and when they expand.

From information telegraphed daily from many weather stations all over the United States, our Weather Bureau is enabled to plot the general progress and direction of cyclonic storms. Daily weather bulletins are sent out over modern communication channels, forecasting weather conditions in the various parts of our country, in time for adjustments and plans to be made for the next twenty-four hours. These reports are of great value to commerce and industry. They are also of value to farmers, aviators, and navigators, who often avoid losses and disasters by consulting them.

Deserts. Deserts are regions where less than ten inches of rain fall annually. The small amount of rainfall may be due to the fact that moisture-laden winds have been intercepted by mountains, as in the Gobi Desert in Asia; or it may be the result of winds becoming warmer in blowing toward warmer regions and taking up moisture as they go, as in the Sahara Desert. High altitudes and latitudes have little rain because the air, having been cooled, has already dropped its moisture.

TEXT QUESTIONS

1. What is the most important physical factor affecting commerce? Why?
2. Define the following terms: (1) isotherm, (2) thermal equator, (3) isobar. Explain your definitions.
3. What isotherms bound the torrid zone?
4. What isotherms bound the temperate zones?
5. Why have the tropics not been developed by native races?

6. What are the benefits to commerce of tropical development under the supervision of the white man? Illustrate.
7. Why are not the cold regions commercial?
8. Prove that the climate of the temperate zones is the most favorable to commerce.
9. What effect have the temperate zones on the industry and health of men?
10. Prove that latitude does not altogether determine the temperature of a region.
11. Explain the effect of altitude on climate.
12. Discuss the effect of mountains on climate.
13. Why is climate steadier near large bodies of water than it is elsewhere?
14. What causes seasonal changes?
15. Explain how winds affect climate.
16. Define the following terms: (1) tropical calms, (2) equatorial calms, (3) trade winds, (4) westerlies, (5) antitrade winds.
17. Explain the origin and directions of the trade winds.
18. Discuss the effects of the trade winds.
19. What are the westerlies? Explain.
20. Discuss the effects of the westerlies.
21. Why are the trade winds so called? the westerlies?
22. What winds blowing across ocean currents warm neighboring lands? Locate these winds.
23. What winds blowing across ocean currents cool neighboring lands? Locate these winds.
24. Show how the distribution of rainfall throughout the year is fully as important as the amount of annual rainfall.
25. Explain the various causes of rainfall. Illustrate each.
26. Explain the wet and dry seasons in tropical regions.
27. What are cyclonic storms? How do they arise? Explain fully.
28. How does the Weather Bureau forecast weather conditions?
29. What are deserts? What causes them? Illustrate each cause.

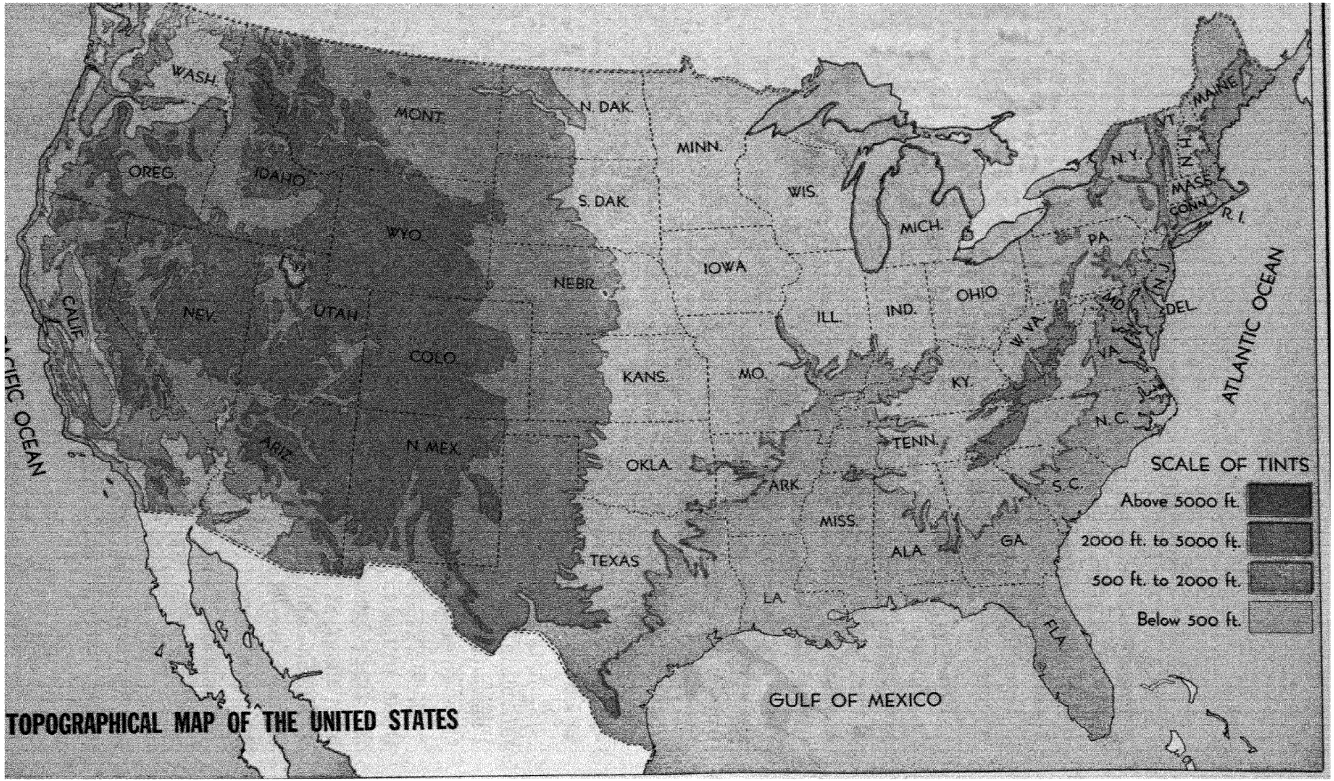
SECTION 2—TOPOGRAPHY

Importance of Topography. *Topography,* the surface features of a region, has a great influence on commerce and industry. In large part the topography of a region affects its agricultural possibilities, and thus its products. Unfavorable topographical conditions, even with favorable climate, limit agricultural production.

Effect of Mountains on Commerce. The effect of mountains on climate has already been noted. In addition, mountains act as barriers to trade, since they make difficult, and sometimes almost impossible, commercial transportation across them. An example of this is the difficulty of overland trade between China and India because of the Himalaya Mountains. For years our Rocky Mountains were a barrier to trade between the eastern and the western sections of our country. Only by wonderful engineering feats were railroad connections between the two regions made possible. Since the beginning of history, the Pyrenees Mountains successfully held back land commerce between Spain and France, although engineers finally made railroad connections through these mountains practicable.

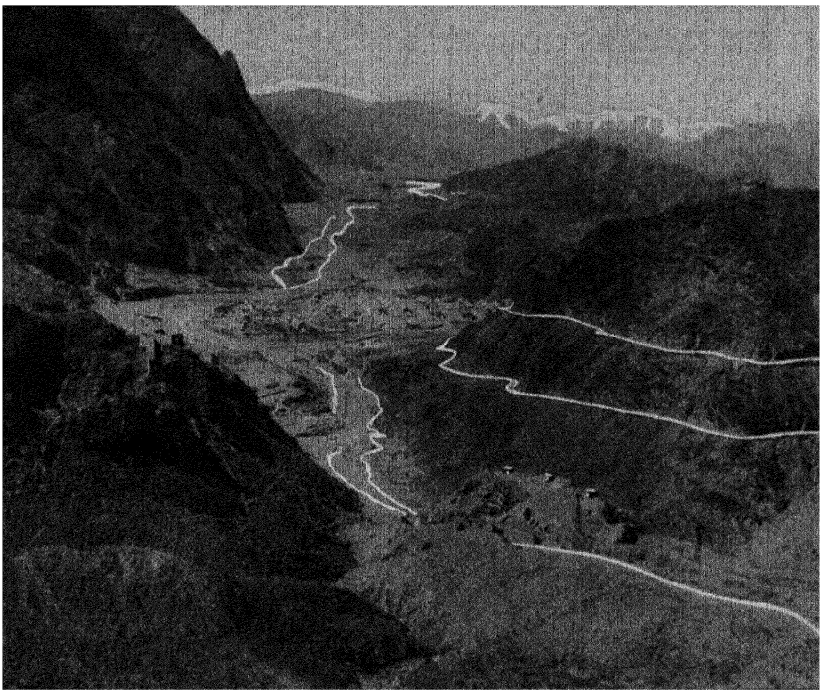
Mountain Passes. Wherever a valley occurs through a mountain range, even at a high elevation, it is called a *pass.* Passes are important because they favor transportation through mountain ranges. Khyber Pass, between India and Afghanistan, takes care of most of the overland trade between these sections. The passes through the Alps form channels for trade between Italy and the North. Tunnels have been built at great expense to enable railroads to run from Italy to France and Switzerland. In the United States the passes through the Rocky Mountains are extremely important in transcontinental railroad building.

Mountain Products. The plant life of high mountains is limited by low temperature of the air and poor soil. The higher one ascends, the nearer he approaches the freezing point, where plant life becomes impossible. The soil on the higher parts of mountains is poor because of the constant



TOPOGRAPHICAL MAP OF THE UNITED STATES

Adapted from the United States Relief Map Prepared by the Department of the Interior, U. S. Geological Survey

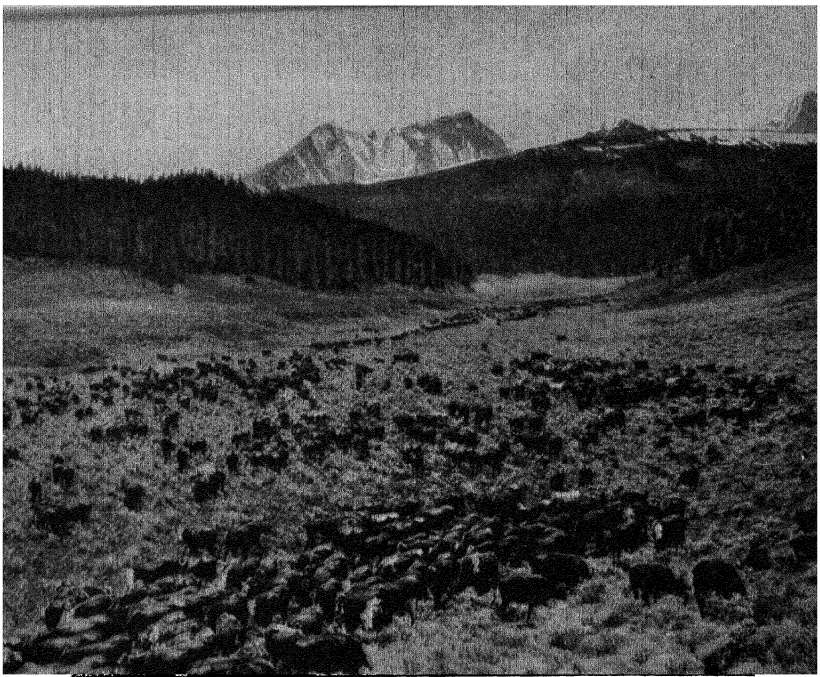


Underwood and Underwood

Landi Kahn, the northern entrance to Khyber Pass. Since ancient times trade has flowed to and from India through this pass in the Himalaya Mountains.

washing away of soil materials by rain and melted snow. In temperate zones, grass may grow abundantly enough on mountains to satisfy the grazing industry; and up some distance from the base, trees, which may be used for lumber, will grow well. For this reason, mountain districts are limited chiefly to grazing and lumbering. In the tropics, tea and coffee grow well on the lower slopes of mountains if the mountains are located where there are enough moisture, plenty of sunshine, and a quickly drained soil. Rubber also does well in some countries on the lower parts of tropical mountains. Because of the geological formations found in mountains, minerals are easily located and obtained there. Where transportation is easy and cheap, mining is an important industry.

Water-power resources are usually abundant in mountainous regions, because water power depends not only upon the volume of water but also upon the distance it falls. Many of the water-power sites in mountains remain undeveloped because their location lacks other factors necessary to successful



Ewing Galloway

Mountain districts such as this district in western United States are frequently suitable for grazing.

industry, or because of the difficulties of transmitting power, through electricity, to locations suitable to industry.

Plateaus. *Plateaus* are highlands with fairly level surfaces. With but few exceptions in the temperate zones, they are generally too cold and too dry to be important to commerce, except as grazing districts. They are generally inhabited by people who live by tending their herds of cattle and flocks of sheep, principally the latter. In the tropics are found some plateaus that are more productive than those in the temperate zones because of the rainfall and the warmer temperature. Some of these in India, South America, and Central America grow crops such as cotton, corn, and coffee. Africa has a high plateau that could be very productive; at the present time parts of it are being reached and developed by transportation facilities.

Plains. *Plains* are broad, flat regions with low elevation. On the plains we find a large majority of the world's population, as well as a great amount of commerce and industry. Generally, plains are well watered and fertile, because the

soil from higher lands has been washed down upon them and has never been taken away. Agriculture flourishes on such plains, and large cities spring up. When the climate and the soil are favorable, and the use of machinery is practicable, there, too, are the great cereal crops of the world. Roads, canals, and railroads can be built at comparatively small cost, making possible cheap transportation of products to market.

Great river flood-plains are the richest regions of agriculture in the world. The coastal plains near the ocean have the densest population, especially where the coast affords good harbors.

Well-located coastal plains often become the sites for industrial cities. The narrow coastal plain of New England has at its back the *fall line,* where small rivers drop from higher elevations. Nearness to both water power and ocean transportation was an important factor in the location of many of New England's early cotton mill towns.

In the development of our great agricultural plains, the use of rivers by the early settlers played a very important part. The Ohio River, the Mississippi River, the Missouri River, and their tributaries formed the easiest highways to and through these plains and largely controlled the settlements between the Appalachian Mountains and the Rocky Mountains. Later, these rivers became the great channels of trade through the plains; their importance declined only with the coming of the railroads.

Coast Lines. The continents differ greatly in the irregularity of their coast lines. The coast line of Europe is broken by many bays, gulfs, and estuaries, which extend far into the interior. The huge continent of Africa has few breaks in her coast line. North America and Asia show more irregularity in their coast lines than Africa, but far less than Europe. South America has no breaks of any size on her west coast, but the east coast is broken by several great river mouths.

Protected bays and river mouths provide shelter for ships; if well located, natural harbors often develop into great shipping centers. Although an irregular coast line does not in itself create commerce, it assists commerce greatly if the re-

gion behind the ports is productive. Rich regions with poor harbors are often obliged to build breakwaters and do costly dredging to create artificial ports.

TEXT QUESTIONS

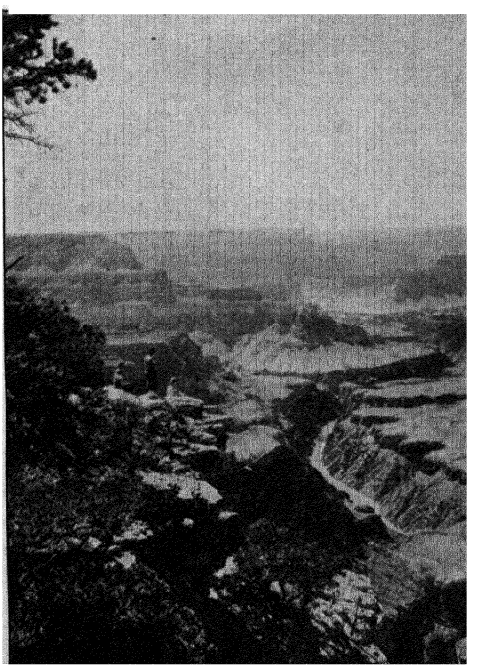
1. What does topography mean? Illustrate.
2. Show how mountains affect commerce.
3. Name and locate some important mountain passes that greatly affect commerce.
4. Name the principal commercial products found on mountain sides. Why are these the principal products of these regions?
5. Why are water-power resources in the mountains of the United States not developed to a greater extent? Explain.
6. To what kind of industry are the people of plateaus usually limited? Why?
7. How do tropical plateaus differ from those in the temperate zone?
8. Name the reasons why plains are important to commerce and industry. Illustrate.
9. Where are the densest populations usually found? Why?
10. How has the fall line of New England affected its growth and development?
11. How did rivers aid in the settlement of our great agricultural plains? Explain.
12. What is a bay? a gulf? an estuary? a breakwater?
13. Which continent has the most irregular coast line? Which continent has the fewest breaks in its coast line?
14. Compare the coast line of Europe with that of Africa and show how the coast line of each affects its commerce.
15. Define any words in this section which were new to you.

SECTION 3—SOIL AND MINERALS

Importance of Soil. If climate and other conditions are favorable, the plant life of a region depends upon the quantity and the quality of the soil. All animal life is dependent upon plant life. This is true even of meat-eating animals, because they live on other animals which, in turn, live on plants. The soil determines, in large part, which plants will grow well; and the plant life influences the animal life of a region. As most of our products in commerce and industry come from plants or animals, it is easy to understand the important part that soil plays in the prosperity not only of a particular region but also of the country as a whole, farm and city. Someone has truly said, "Agriculture is the groundwork of prosperity." No nation can long survive without agriculture, and no agriculture can succeed without soil. It is, therefore, highly important that we study briefly the soil situation in our country, and examine the factors that waste or conserve it.

Geologic Changes. Through thousands of years, tremendous geologic changes have taken place over the surface of the earth, the detailed study of which can be covered in a course in geology. Gigantic upheavals have raised and twisted the strata of the earth; great surfaces have been depressed and sometimes buried; great mountain systems have been formed with valleys between them; river systems have cut their way to the oceans; enormous glaciers have ground their ponderous way, leaving changes as they went; various types of rock have solidified into a shell around the earth;

The Grand Canyon is an example of geologic erosion.
Soil Conservation Service, U. S. D. A.



and water and wind have carved great gashes in the surface of the earth. All these changes have influenced the formation and the distribution of soils and minerals. Because they have been accomplished so slowly over such a long period of time, we have come to regard them as permanent, although geologists tell us that great changes are still taking place.

For countless ages rain, running water, glaciers, winds, and other natural forces have been wearing away the land. This action is called *geologic erosion,* while "man-induced" erosion is called *accelerated erosion.* Geologic erosion is fundamental to natural processes over which man has little control. Under natural conditions a partial balance exists between soil formation and soil erosion. When the ground is covered by vegetation, geologic erosion takes place very slowly and topsoil develops. When man removes the ground cover, accelerated erosion increases at an ever-growing rate, and the soil is worn away faster than it is built up.

Formation of Soil. Soil materials may be classified into *residual soil* and *transported soil.* The first is soil formed where it is found from the decay of rocks and of vegetable and animal matter. The second is soil that has been carried to its present location by running water, glaciers, or winds. When transported by water, soil is called *alluvial material.* It is generally found on plains, especially river flood-plains, deltas, old lake bottoms, reservoirs, and valleys. If it is not mixed with too much sand and gravel, it is generally fertile. Soil-forming material carried by glaciers is called *glacial drift.* It is spotty in its fertility, depending upon its source, and usually contains many rocks and boulders. Soil materials carried by winds are known as *aeolian soil,* and range in type from worthless and menacing sand dunes to fine-grained material called *loess,* which is very fertile if adequately watered. When any transported soil material reaches the ocean, it is lost to agriculture forever; when it has become mixed with sand and gravel and other materials, it is frequently worthless. Oftentimes it ruins downstream farms,

and is a nuisance when it fills up reservoirs and dams and buries otherwise fertile areas.

In most soils there are two layers or *horizons* that, taken together, make up the true soil, called the *solum* by soil scientists. The top layer is called *topsoil* and is most important to agriculture. It is composed of small particles of disintegrated rock mixed with decaying organic material, such as leaves, cover vegetation, roots, twigs, and grasses, called *humus*. Earthworms play an important part in mixing the various parts of the topsoil and in leaving tiny holes through which the air and water can circulate. Channels left by decayed roots also provide openings in the soil. Generally speaking, our topsoil has an average thickness of from eight to ten inches. The second layer is called *subsoil*. It differs from the topsoil in structure and lacks the organic matter and humus. Beneath the true soil there is a layer composed wholly of disintegrated or decomposed rock. Underneath all of these is the solid, firm rock formation of the earth's crust.

Alluvial material upon original flood-plain soil in Wisconsin. The elements necessary to life are in the top layer.

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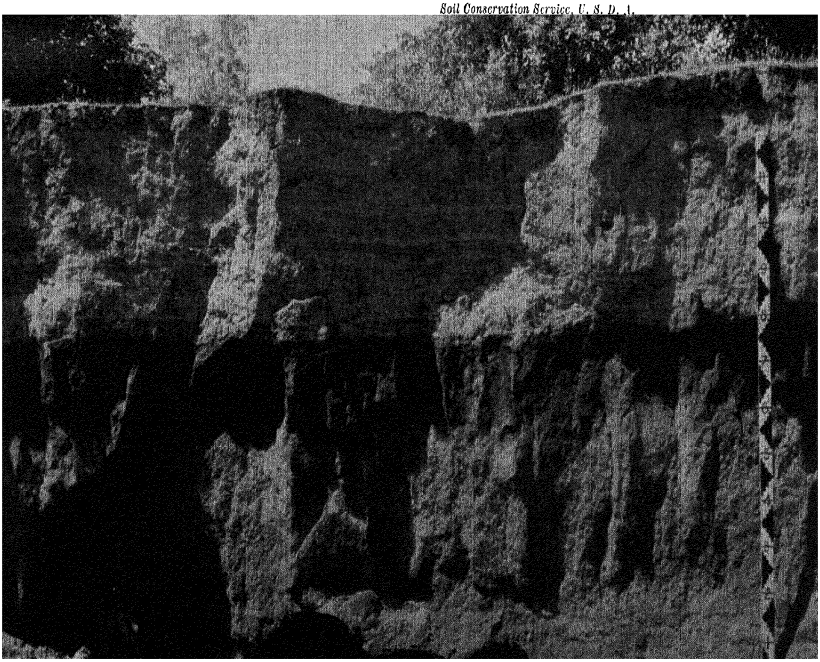


Soil is formed by the action of climate and living organisms upon the parent rock material and upon organic matter derived from the bodies of plants and animals. This action is conditioned and influenced by the relief of the land. The length of time during which these forces operate and the drainage conditions are of great importance in determining the character of the soil.

Rock decomposition is accomplished by chemical and physical means. Chemicals in the soil, in the air, and in the rain that falls, slowly react on the rock and gradually dissolve it. The physical means are more obvious. From above, the roots of growing vegetation, and rills of water, percolate into the many tiny crevices, cracks, and holes in the rock, always enlarging them and reducing the rock to smaller and smaller pieces. The running water washes away the surfaces of the rock and sometimes, by alternate freezing and thawing, splits the rock into fragments. Rapid changes of temperature expand and contract the rock with resulting disintegration. It must be borne in mind, however, that the process of soil formation is slow, very slow, and that the weathering and decomposition of the rock formation takes hundreds and hundreds of years.

Plant Nutrients in the Soil. While man cannot regulate and govern some of the factors of plant life, such as climate and topography, he can supply, through the addition of fertilizers, the needed elements that are lacking; and through using soil-conserving methods, he can keep much of the needed elements in the soil. In all soils there are present many elements, some of which plants do not use; but to be fertile, soil must contain the following ten elements: oxygen, hydrogen, nitrogen, potassium, calcium, iron, magnesium, phosphorus, sulphur, and carbon. Some of these are supplied by the air and water; others may be obtained from mineral deposits and from materials like marl, seaweed, barnyard manure, guano, sewage, and the refuse from street sweepings, slaughterhouses, and cottonseed mills.

In general, good topsoil contains all the elements necessary to successful farming; but where soil has been robbed for long periods of time by crops and water, some of the elements

must be replenished. This fact accounts for the wide use of commercial fertilizers for this purpose.

Types of Soil Erosion. The primary cause of soil erosion is man's interference with nature's balance between soil formation and its erosion. Man has leveled and burned large forest areas; he has allowed overgrazing and the consequent destruction of the ground cover of grasses; he has ruined many square miles of ground cover by allowing the acid fumes of his smelters to kill surrounding vegetation; and he has broken the sod with countless plows to plant crops, leaving large spaces of loosened soil. By doing these things, he has bared much of the topsoil to the ravages of rushing winds and running water, which transport the topsoil away and eventually ruin the land for agriculture.

Sheet erosion occurs on sloping areas of unprotected soil as the thin layers of topsoil are washed away. Often this process goes on so gradually that for a long time it is unnoticed. Eventually, sheet erosion results in what is called *gully erosion*, as tiny rills of running water turn into larger streams that cut huge gullies, getting larger and larger as they cut away their banks. This type of erosion has already affected almost half of the entire land area of the United States.

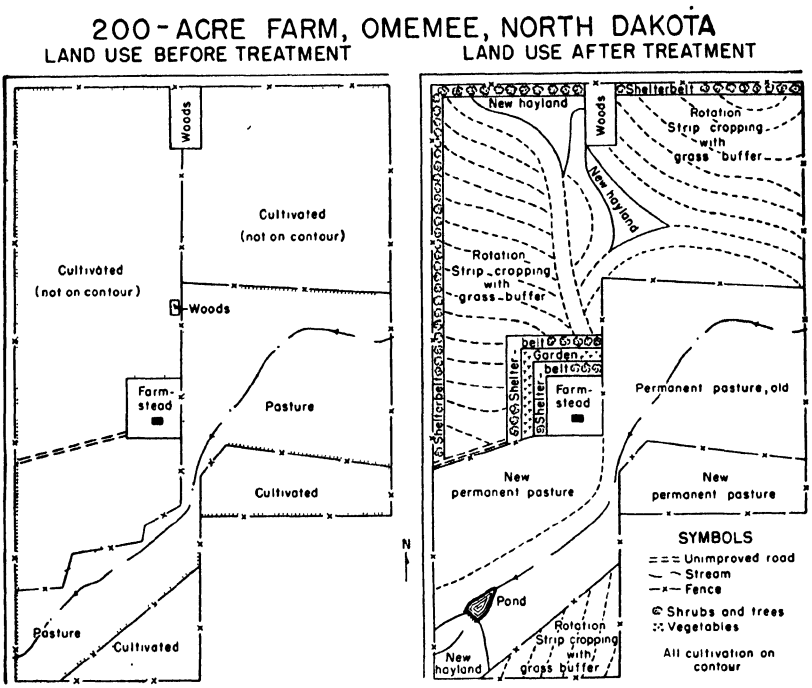
Wind erosion frequently results, in arid and semiarid areas, in great dust storms in dry weather, which sweep lands entirely bare of their topsoil and carry it from the prairies even to the Atlantic Ocean, in what are called *dust storms*. Often, too, large quantities of sand from deserts and sand dunes are carried by the wind to fertile farm lands, completely ruining them.

Methods of Soil Conservation. Today, any farmer may apply to a county agent, to the many representatives of the Soil Conservation Service, or to the Agricultural Colleges and Experiment Stations, for advice as to which methods of soil conservation are best adapted to his particular problems. Arrangements are often made for technical aid from the Federal Government to make the soil conservation program effective.

Farmers are adopting a method of planning their farm work different from that which they have followed for many years past. They are realizing that they must collect definite facts as to soils, length and degree of slope, amount of erosion, kind of land use, and climatic conditions. Consequently, with the aid of men technically trained in the field of soil conservation, maps of farms are made showing the facts as to soil, slope, erosion, and land use. The farmer thus has before him a map picture of his farm. The landowner and the conservation experts study this map and similar maps and groups of facts regarding adjacent farms and the watershed as a whole. In the light of the facts shown, they decide how each part of the land on this particular farm should be used. The most badly eroded spots may be put into trees or bushes that will regulate runoff and heal over the badly washed and gullied areas. Other less steep but possible eroded slopes may be put into permanent pasture; and on the portions of the farm adapted to cultivated crops, they decide what crops shall be grown and where they shall be grown.

On a new plan the old rectangular field pattern is replaced by fields and fences laid out on the *contour*, that is, across the slopes instead of up and down the slopes. All plowing and planting will be done on broad strips of land on the contour. In this way each furrow and seed drill line will form a tiny dam to hold the water back, thereby retaining more moisture in the soil and preventing the water from running off the slope and washing away the soil, as was formerly the case when the plowing and planting went up and down the hill.

On these broad strips, rotations of crops are planned. This is known as *strip cropping*. For example, in one year a given strip may be planted in corn, and the strips on each side of it in wheat. The next year, wheat may replace the corn in the strip, and corn or a hay crop may take the place of the wheat. Or the strips may run in groups of three—corn, wheat, and oats or hay—which could be the basis of a three-year crop rotation. Thus the crops are moved year by year up the slope so that a close-growing crop like wheat follows a clean-tilled crop like corn.



Soil Conservation Service, U. S. D. A.

The soil conservation expert first makes a map of the farm to be studied and then draws up a new map based on the original one.

Where the slope is long, strip cropping is not sufficient, because of the increased volume of water, and must be supplemented by *terraces*. These terraces are broad at the base, about twenty feet, and not more than four feet high in the center. They are really broad, flat ridges running around the hill, not at all like the so-called *bench terraces* used by grape growers in Italy and the Rhine Valley.

Natural drainageways occur on many slopes, and these can be used to carry surplus water runoff from terraces or strips. Grassed water channels are established at these points and effectively prevent erosion. Very rarely is it necessary to build concrete or masonry channels, because experience has shown that grass is the most effective obstacle to erosion. The tiny rootlets and grass stems make millions of tiny dams to



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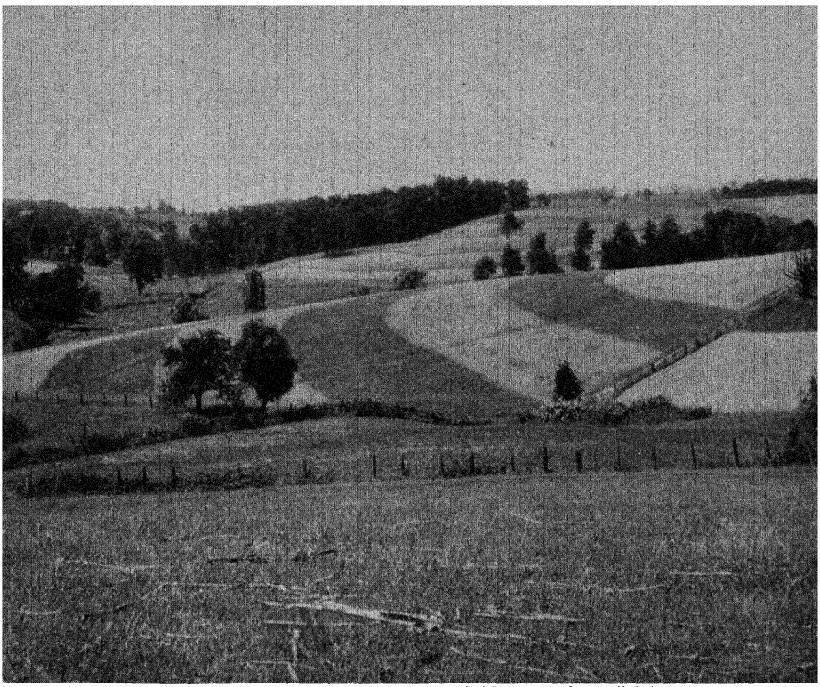
Strip cropping on a farm in Ohio. In the first year the strips are planted in corn and other crops.

slow up the flow of water and thus hold in the grass any deposits of sediment and soil.

On pastures and ranges, regulation of the number of head of stock using the land, and of the season at which they are put onto it, will permit the grass to grow and the range to remain in good condition. Rotation of range and of pasture-land areas is also practiced.

Gullies are the final result of sheet erosion. Grass, as well as trees and shrubbery, has been found the most effective agent for gully stabilization. Small trees, like the black locust tree, binding grasses, and vines are planted along the course of the gully. While these are getting a foothold, it may be necessary to place sod-bag dams in the gully bottom. The sod or seed is placed in a coarsely meshed bag, and the sprouts come through it. By the time the grass is established, the bag has rotted. When the plants have grown, they and their roots form a series of tiny dams that hold back the violent rush of waters, and, as someone has put it, "they make the water walk rather than run."



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The second-year cultivation of the farm illustrated on page 56. The crops in the strips have been rotated. For example, the strips planted in corn during the first year are now planted in wheat.

Importance of Minerals. World commerce today would be impossible without an abundance and a wide use of minerals. The mighty machines of industry and the great transportation agencies are built from minerals and run by the power made from minerals. Present-day civilization demands countless articles into which various minerals enter. Our present financial organization depends upon gold and silver for money. Invention follows invention, and minerals are necessary to maintain them. Science is constantly perfecting additional and new ways in which to use minerals.

With the coming of the machine age, minerals took on much more importance, an importance that increases more and more as the number of machines grows, and as the demands on minerals as sources of power increase. At the present time our mightiest industrial nations look to minerals to supply their factories with metals and power, and minerals that have been buried in the earth since the dawn of history are now mined to supply the enormous demands of a highly mech-

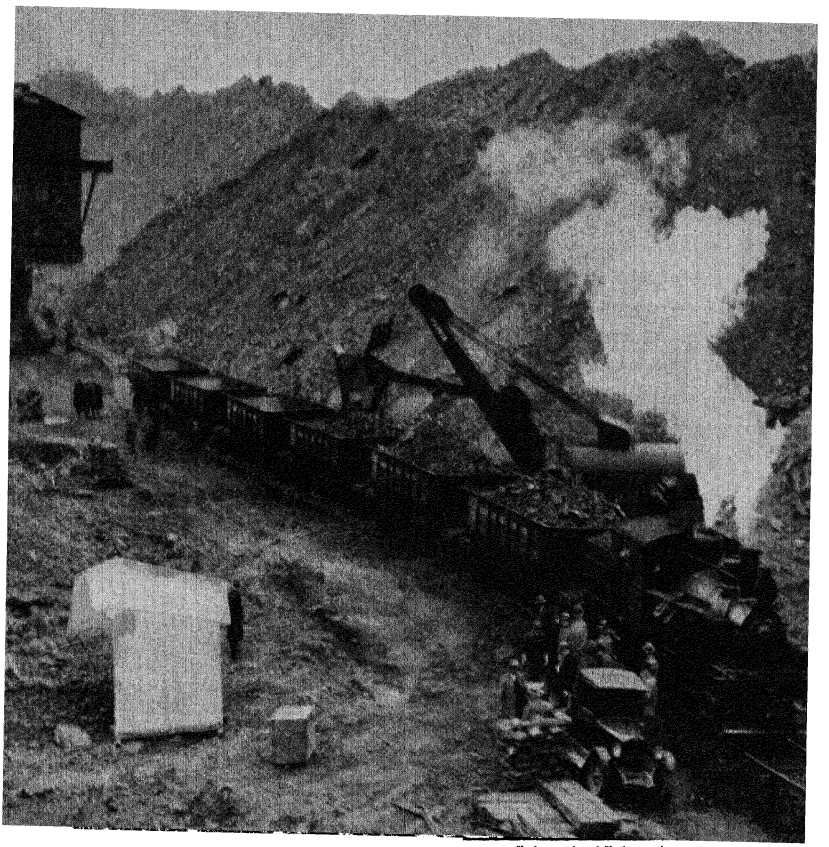
anized civilization. The supply of minerals loses none of its importance when we realize that this supply is not inexhaustible; perhaps some time in the future a civilization absolutely dependent upon minerals may seriously suffer when the mineral supply has been exhausted.

Distribution of Minerals. Unlike plant products, minerals are fixed in their locations and in their amounts, neither of which man can alter. During the geologic ages minerals were formed in a very uneven distribution throughout the world. While the extent of known deposits can be readily estimated, new deposits are constantly being discovered, so that estimates of mineral reserves become only expert guesses. Some minerals, like iron, coal, and petroleum, are generously distributed; whereas others, like tin and platinum, are found only in limited localities.

Some regions are highly favored in having coal and iron in close proximity; as a result, these regions invariably became industrial. Other regions are favored by being able to obtain minerals near at hand for their industries; still others, by having minerals near to a market with good transportation facilities. Mineral deposits are more easily discovered in mountainous regions, because there geological formations come to the surface more frequently.

Accessibility of Minerals. By accessibility of minerals we mean the degree of ease with which they can be reached and mined. To be of the greatest value to commerce and industry, minerals must be easily reached and so located that transportation facilities are available at a cost not too high. The easy access to the coal and iron mines of England has helped to make that nation highly industrial.

Practical transportation means have made the iron and coal deposits of Pennsylvania important to her large iron and steel industries. Great steel cities grew up along the shores of the Great Lakes when the iron ores from the Mesabi district, west of Lake Superior, were made available by transportation. Alabama has become a great iron and steel center because of readily accessible minerals and adequate transportation. On



Underwood and Underwood

The accessibility of the coal in this open-pit mine near Duquoin, Illinois, greatly increases the value of the coal to commerce and industry.

the other hand, the enormous mineral deposits in Alaska remain practically untouched because they are not easily accessible and satisfactory transportation is lacking. Some day, when accessibility and transportation are available, the great mineral deposits of China will be mined at a much faster rate.

Frequently, some kinds of minerals are mined from locations that are not accessible and have poor transportation facilities. This is generally true of minerals like gold that are scarce and command a high price. Meanwhile, the people of the world go on mining the minerals that are most easily accessible and enjoy practical and efficient transportation facilities.

TEXT QUESTIONS

1. Prove the importance of good soil to successful agriculture and therefore to prosperity.
2. What are geologic changes and how have they affected soil and minerals?
3. Describe briefly the different kinds of transported soils.
4. Describe the layers of soil.
5. How is soil formed?
6. Describe briefly the various processes that decompose rock.
7. Name nine elements necessary for soil fertility.
8. Name the various sources of fertilizers.
9. Show how man has interfered with nature's balance between soil formation and soil erosion.
10. List and describe the various kinds of soil erosion.
11. Discuss the various measures now being taken to avoid soil erosion and to conserve our soil.
12. Prove that minerals are important to commerce and industry.
13. Contrast the permanency of the locations of minerals and of plants.
14. Prove that most minerals, to be of the greatest value to industry, must be easily accessible and have practical transportation facilities. What are some exceptions?

PROBLEMS AND PROJECTS

1. On a graphic representation of the globe, show the locations and the directions of the prevailing winds in April.
2. On an outline map, indicate the principal deserts of the world. On the reverse side of the map, explain the causes of each desert.
3. On an outline map, indicate the regions of the world where there is excessive rainfall. On the reverse side of the map, explain the causes of excessive rainfall in each region noted.
4. On an outline map of the United States, indicate regions with a heavy annual rainfall, a medium annual rainfall, and a light annual rainfall.
5. On an outline map, trace the twenty-inch rainfall line running north and south through the prairie states.
6. On an outline map, trace a mean annual isothermal line of seventy degrees. Explain what factors draw the line toward or away from the equator.

7. Why do most of the world's trade routes run east and west, and not north and south? Give an explanation.
8. Explain the popularity of the seashore in summer.
9. If you were sailing from Liverpool to Rio de Janeiro, what winds and calms would aid or hinder you in July? in December?
10. Obtain the itinerary of a world cruise from some steamship company. Explain what winds and calms will affect the progress of the boat during the cruise.
11. Why is it that the nearer we go toward the sun the colder the air becomes?
12. What physical factors affect the commerce and industry of the region in which you live? Show the effect of each factor.
13. Show how western Pennsylvania is particularly favored in having mineral deposits.
14. List the causes of the wet and dry seasons in the tropics.
15. Show why some selected region in the north temperate zone is backward in commerce and industry.
16. Show why some selected region in the world ranks high in commerce and industry.
17. Why is the development of the tropics a difficult problem? Can you suggest some possible solutions?
18. Alaska is rich in minerals. Explain why Alaska does not rank high in commerce and industry.
19. Explain why Egypt was formerly great even though it has a hot climate.
20. What effects do the Alps have on the climate of Italy?
21. What would be the probable effects on commerce if the course of the Gulf Stream should be diverted to the shores of the United States? Give reasons for your answer.
22. Make a list of magazine articles, pamphlets, and books dealing with the subject matter in this chapter.
23. Make a model showing the layers of soil.
24. Obtain pictures showing transported soil, and explain each.
25. Obtain pictures showing soil erosion, and explain how the erosion shown in each picture occurred.
26. Obtain pictures of dust storms in the United States, and explain how these dust storms arose.
27. Draw a graph showing the amounts of soil eroded in the United States by sheet erosion, by gully erosion, and by wind erosion.
28. Draw a picture showing how contour strip crops are planted.
29. From statistical sources make a graph showing the annual cost of soil erosion in the United States at the present time.

30. Prepare a graph contrasting the amounts of the annual production of the leading minerals (a) throughout the world, (b) in the United States.
31. Draw a map showing the distribution of mineral production throughout the world today.
32. List and define all the italicized words used in this chapter.

TOPICS

1. Physical barriers to world commerce.
2. Famous mountain passes of the world and their effects on commerce.
3. Famous tunnels of the world and their effects on commerce.
4. The effects of topography on human activity.
5. The effects of climate on human activity.
6. The effects of winds on commerce and industry.
7. The effects of ocean currents on commerce and industry.
8. The effects of some large river system on commerce and industry.
9. The effects of physical factors on commerce and industry.
10. The work of the Weather Bureau.
11. The causes of winds.
12. The commercial development of the tropics.
13. Climate and civilization.
14. The formation of commercial minerals.
15. The effects of geologic changes on the formation and distribution of soils and minerals.
16. The geography of soils.
17. The agencies that are fighting soil erosion in the United States, and the results of their efforts.
18. The Soil Conservation Service of the United States: its powers, its functioning, and its results.
19. Fertilizers.
20. Soil conservation in Europe and in America: Contrasts.
21. World areas where soil erosion has seriously affected prosperity.
22. The value of maps in plotting farms for more effective use.
23. Dust storms: their causes and effects.
24. Minerals and industrialization.
25. Minerals as a possible cause of invasion.
26. The importance and the use of mineral products in the world.

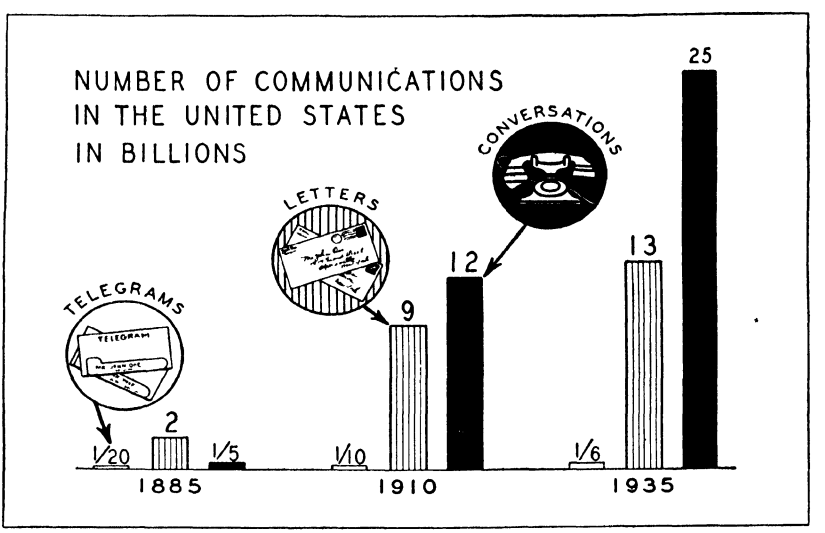
FOR CLASS DISCUSSION

1. Climate is the most important factor in commerce and industry.
2. Topography has a greater effect on commerce than does climate.
3. The tropics can never be fully developed.
4. The physical factors of the north temperate zone are more favorable to commerce and industry than those of the south temperate zone.
5. Adversity is the mother of prosperity.
6. If the tropical climate prevailed everywhere, the world would be a better place in which to live.
7. Geologic changes result in more soil erosion than that caused by man.
8. Government aid in soil conservation is not justified.
9. Climate has more effect on soil erosion than man has on soil conservation.
10. River mouths are the best locations for great world ports.
11. The policy of "get while the getting is good" rather than "conserve for the future" is justified in our economic order as constituted today.
12. The danger of soil erosion is greatly overemphasized in the case of the United States.
13. To commerce and industry, gold is a more valuable mineral (a) than iron, (b) than coal.
14. A time will come when the food supply will not be sufficient to support the people on the earth.
15. The topography of Europe has encouraged racial disagreements more than has any other factor.
16. The topography of the United States has helped the progress of our country more than it has hindered it.
17. Iron has been more of a detriment to mankind than a benefit.

CHAPTER III

COMMUNICATION

Importance of Communication. In the space of one second, a telegraphic signal can be sent seven times around the world. The news of the signing of the Armistice in the World War was transmitted almost immediately to persons interested. The program of the coronation of King George VI, in London, reached hundreds of millions of listeners within a few seconds after the events occurred. The messages of the President of the United States are radioed to millions of citizens, who hear his words as they are spoken.



News of important events affecting commerce is immediately available to those concerned, and they adjust their plans accordingly. The speed with which business information can be communicated influences markets, steadies prices, and makes world-wide trade possible. The world has now become one big market place, where traders can conduct business with

complete and prompt knowledge of conditions in all parts of the world.

Our social life is greatly affected by these modern means of communication. Social contacts are multiplied by the use of the telephone and telegraph, and the possibilities of entertainment and education are enlarged by the use of the radio. International methods of communication knit a closer relationship with other peoples of the world. Radio listeners, and readers of newspapers, magazines, and books, can now learn of current events, the personal attitudes of world leaders, and the points of view held in other lands. This not only encourages a world-mindedness and world-wide viewpoint, but also tends to break down the barriers of narrow, provincial thinking.

The functions of government, in local and foreign affairs, run much more smoothly because of the immediate knowledge of situations as they arise and the possibility of taking prompt action as difficulties occur. Political candidates can now address millions over the radio, and governmental officials can talk directly to thousands of citizens, often supplying vital and valuable information, and viewpoints as well, in regard to controversial subjects. The successful administration of our government is made much easier by the efficient and rapid communication systems of today.

Post Office. One of the greatest aids to modern commerce is the regular and cheap postal service conducted by the Government to encourage communication by printed and written words. In addition to handling ordinary letters, the Post Office renders many special services. Special-delivery stamps insure quick delivery of mail at its destination. Mail may be registered so that authorities can trace and fix the responsibility for any loss. Great quantities of bundles are handled by parcel post, thereby encouraging small shippers to send goods through the mail, and also making it possible for mail-order companies to use the postal service. When merchandise is sent C.O.D., the postal authorities *collect on delivery* for the sender any sums due on the goods, thereby saving him much expense for elaborate credit systems and collection re-



Eastern Air Lines

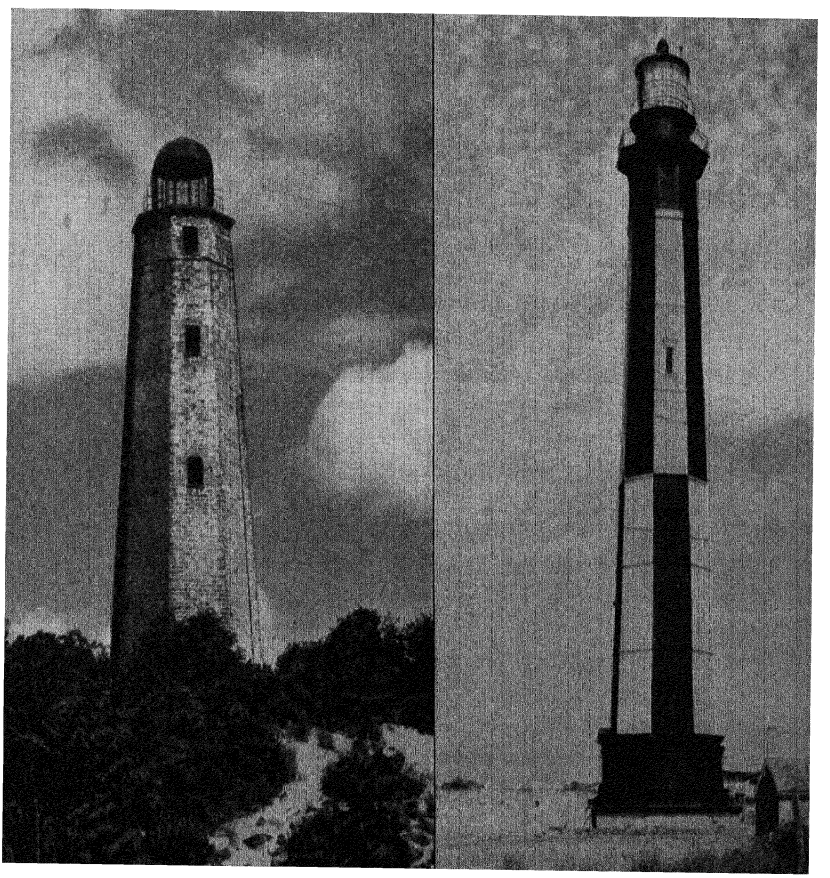
This modern airplane carries not only a captain, a pilot, a flight steward, and twenty-one passengers, but also a heavy load of mail and express.

sponsibilities. Savings may be deposited in the Postal Savings Bank, another service of the Post Office. The Post Office maintains a system of rural free delivery (R.F.D.), delivering mail to farmers at some distance from towns and cities. The speed with which a letter is transmitted by air mail often is well worth the extra rate charged for this service. One of the most successful methods of reducing the time in the carrying of mail is the Railway Post Office. Huge quantities of mail are loaded into special mail cars at the terminals of large cities. This mail is classified and sorted while the train is en route to its destination, so that the mail is ready for immediate delivery at the completion of the run. Often, mail bags are picked up or dropped by mechanical means at stations where the train makes no stop.

Signals. Signals were one of the earliest means of communication, and their many and varied uses today have a very important effect on commerce and industry, especially in the field of transportation. On the water, mariners depend upon lighthouses, fog horns, submarine bells, submarine telegraph, buoys, channel markers, flags, whistles, semaphores, colored lights, rockets, bells, radio, and the radio compass. On land, the railways depend much upon colored lights, flags, sema-

Contrast the lighthouses at Cape Henry, near Norfolk, Virginia. The one at the left was the first lighthouse built by the Federal Government; that on the right is one of the latest and is equipped with the most modern signal appliances.

Norfolk-Portsmouth News Bureau



phores, block signals, torpedoes, flares, whistles, bells, hand signals, and other signals. Automobile traffic is governed largely by signals, both human and mechanical, such as the hand signals of policemen and drivers, stop-and-go lights, white lines on the road, road signs that caution and direct drivers, route numbers, bells, whistles, horns, and other signals. Signals also play an important part in certain lines of trade, such as auctions and the stock exchange.

Telegraph. A great step forward in communication was made in 1844, when Samuel F. B. Morse placed the first telegraph line in operation, having invented the telegraph six years before, in 1838. Adaptations of the telegraph are now used extensively by the police and fire departments of our towns and cities. Many millions of commercial messages are sent annually over the telegraph by businessmen, who find the service fast, accurate, and relatively cheap, especially for long distances. The telegraph also provides a written or printed record of messages transmitted. In many countries the telegraph is owned by the government; in this country it is owned by more than thirty private companies, although the great bulk of the service is controlled by the Western Union and Postal Telegraph Companies, the former handling over eighty per cent of the volume.

The great volume of telegraph traffic in our large exchanges is handled with a high degree of efficiency and organization, based largely on experience, modern inventions, and machines. A machine called the *teleprinter*, resembling a typewriter in general appearance, transmits outgoing messages and receives incoming messages.

Over the first practical telegraph invented by Morse, only one message was sent at a time. Later, the multiplex system was developed, by which eight telegrams may be sent over one wire at the same time. This system is in general use today on lines between the principal cities of the country. A new system, now in commercial use between New York City and the cities of Chicago, Washington, Atlanta, and Buffalo, is called the *carrier current* and uses musical tones that enable operators to send ninety-six messages over a



Western Union Telegraph Company

Sending a telegram by the teleprinter over telegraph wires.

single wire in one direction simultaneously. Facsimile material can now be transmitted by telegraph by the use of devices involving the use of an electric "eye" on the sending end, which transmits electrical impulses to a tiny stylus on the receiving end, which records the facsimile there. By the extension of these new methods of transmission, it will be possible to provide for the growth in telegraph business during many years over intercity wires.

From the floor of the stock exchanges, the prices and amounts of stock bought and sold are quickly telegraphed to the offices of brokers by means of a machine called the *stock ticker*. This instrument, in the office of the broker, receives

and automatically prints in Roman type, on a narrow strip of paper, the messages so transmitted. The strip of paper is called *ticker tape* and is often made of transparent cellophane so that messages can be flashed on a screen where all the customers can see just how the market is moving.

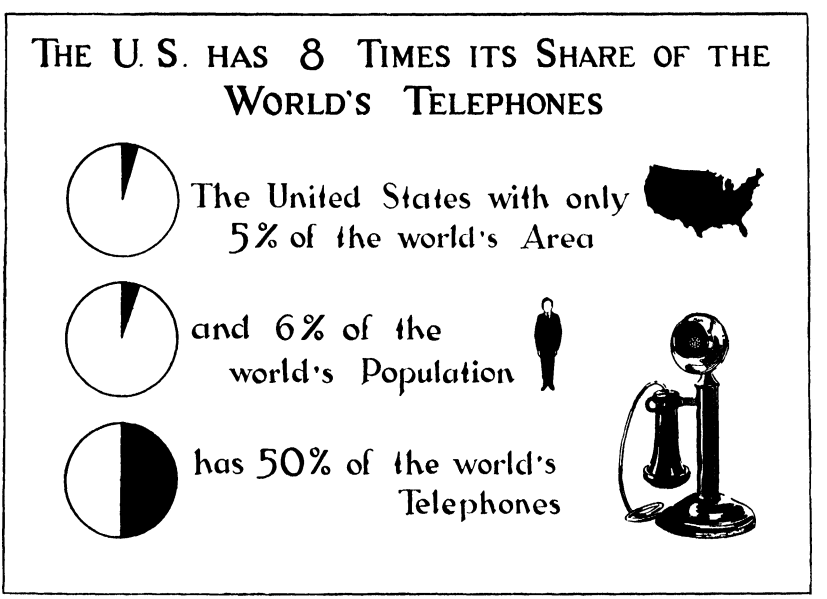
Ocean Cables. Cyrus W. Field, in 1866, after several unsuccessful attempts, finally succeeded in laying the first permanent submarine cable across the Atlantic Ocean, thereby connecting the New World with the Old World. It is estimated that at the present time there are over eighteen hundred cables, on which are sent daily more than forty thousand messages.

Because of the long distances that electrical impulses have to travel over submarine cables, the power of the signals at the receiving end is very small. Some cables still use what is called a *siphon recorder,* an ink-filled glass tube, which is so moved by the tiny electrical impulses that it leaves a wavy line made by ink discharged by the small siphon. This line can be translated into letters and words. Modern improvements in cable construction enable newer cables to transmit a number of messages simultaneously, and also permit messages to be sent at a much faster speed. From these newer cables the messages are received by machines that print them in Roman type on a narrow strip of paper. All important cables are protected in time of war by international law, whether they are government owned or owned by private companies.

Telephone. The telephone, invented in 1875 by Professor Alexander Graham Bell, has grown to be the greatest means of communication between businessmen in the United States. With this rapid and immense growth of the telephone have come problems of tremendous size; but, by inventions, consolidations, and careful planning with an eye to the future, the telephone companies have kept pace with the demands made upon them.

Telephone wires in cities now run underground, encased in large cables, thus doing away with millions of unsightly poles and great snarls of overhead wires; inventions have

made our telephone exchanges marvels of mechanical ingenuity; automatic dials are reducing the cost and errors of human labor; radio programs, originating outside the regular studios, are transmitted over special wires and exchanges to the various broadcasting stations; the great radio networks depend upon telephonic transmission to carry their programs to the broadcasting stations; long-distance calls are now put through with a minimum of delay, and their transmission has been so improved by special devices that the conversations are as clear as those made short distances; several receivers may be linked together to enable business executives to hold conferences over the wires; toll calls at night, when the telephone traffic is smaller, are encouraged by low rates; through



American Telephone and Telegraph Company

organization and co-operation with wireless stations, it is possible to hold conversations with persons in foreign lands or on the sea—these, and many other services, are available to the public.

The *teletypewriter*, resembling an ordinary typewriter in keyboard and general appearance, is one of the most modern

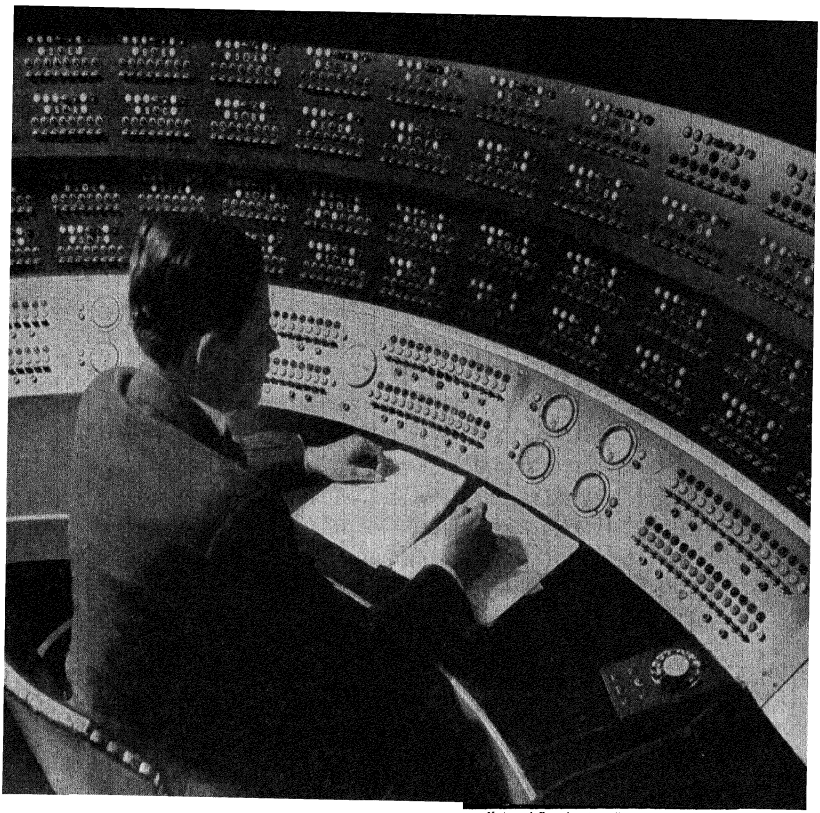
devices by which telephone companies are rendering service to businessmen. Through special exchanges, offices having these machines may be connected. The sending teletypewriter is operated in a manner similar to that of a typewriter, except that as each letter is depressed, it creates an electrical impulse which operates an identical letter-key on the receiving machines many miles away, so that a typed message appears exactly like the one on the sending machine. In place of the usual vocal tones sent over telephone wires, electrical impulses are transmitted.

Within recent years, the improvement in telephoning messages to ships on the oceans, and across the oceans to foreign lands, has been marked. By means of land wires, the conversation is transmitted to powerful wireless stations, where it is sent out into the air. A receiving station catches the conversation and places it on land wires connecting with the person with whom the conversation is being held. Great international telephone exchanges are strategically placed so that world-wide telephonic service has become possible and practical.

Wireless. About the year 1900 wireless communication was invented by Guglielmo Marconi. Since then it has been greatly improved and developed by him and other men, such as Lee DeForest. The use of the wireless may be divided into four general classes: transoceanic, across the oceans to other lands; marine, to and between ships at sea; aeronautical, to and from planes in flight; and general broadcasting, from central stations to listeners at radios.

In transoceanic wireless, messages are generally relayed by land wires to huge and powerful short-wave sending stations and are hurled out across the oceans to foreign stations, which receive the messages and forward them to their destinations. The rapidity of transmission of these messages across the oceans has greatly speeded up international communication, thereby tending to increase world trade.

All large passenger ships and most freighters are now equipped with sending and receiving devices that enable them to keep in touch with land stations and with other ships. Not



National Broadcasting Company

Section of the control board in the master control room of the National Broadcasting Company, New York City.

only is this a great service to passengers, but it is also a valuable safety factor in times of stress and danger. Many ships are also equipped with a device called the *direction finder* or *radio compass* by means of which they can determine the directions of various wireless stations located up and down the coast line.

In aviation most airplanes are so equipped with sending and receiving sets that there can be constant communication between the planes and various ground stations, thus enabling the pilot to keep informed at all times in regard to weather conditions ahead, location, general orders, and landing facilities. Wireless is used to keep planes on their routes by the use of what is called the *radio beam* or *radio range*. This is a system of wireless signals so arranged as to create a path of sound along which planes fly, exactly as an automobile follows a highway.

General broadcasting has greatly increased the fields of entertainment and education. It has a distinct bearing on commerce and industry by supplying valuable information to farmers, commission men, and traders in general; and it has become one of the leading mediums of advertising in this country. In most foreign countries all broadcasting stations are owned and operated by the government. Because the expense of these stations is met by taxes on radio sets, there is no commercial advertising on government-selected programs.

In our country the broadcasting stations are owned by private corporations, but are licensed, regulated, and supervised by the Federal Communications Commission. Under this commission, and by international agreements, much of the early confusion of broadcasting has disappeared. In the United States the private broadcasting stations sell radio time to advertisers who "sponsor" or pay for the programs. The stations themselves pay for the expense of what are called "sustaining programs," generally of a musical or educational nature.

Wireless television has been developed into a definite possibility, but as yet has not reached a stage where it is a means of practical communication, although this may be expected in the near future. Wire transmission of pictures and photographs has been developed to a place where it is now common and practical, especially in newspaper work.

TEXT QUESTIONS

1. Give examples of how events of world-wide importance have been immediately communicated to millions of people by modern devices.
2. Show how modern communication affects (a) commerce and industry, (b) our social life, (c) our political life.
3. Make a list of all the types of service rendered by the Post Office today.
4. In what ways does a low postal rate benefit commerce? the community?
5. What signals are in common use on water? on land?

6. Discuss the various ways in which the telegraph excels as a means of communication.
7. Show the importance of submarine cables to commerce. How may secrecy be obtained in sending cable messages?
8. Prove that one reason for our commercial supremacy is the telephone.
9. List the different ways in which the telephone companies give service.
10. Describe the various devices and machines now used in connection with the telegraph and telephone to increase communication.
11. Show how wireless communication in various forms is used in commerce.
12. How are transoceanic messages and telephone conversations handled?
13. What is a direction finder? a radio beam?
14. How are programs transmitted to broadcasting stations in a network?
15. Contrast the programs of foreign broadcasting stations with those of our own, in regard to the methods of payment for programs.

PROBLEMS AND PROJECTS

1. What signals does one of your local transportation agencies use? Explain how these signals are used.
2. Make a list of all signals used in your vicinity.
3. Explain the block system of signals on a railroad.
4. Compare the means of communication in Colonial days with those of today.
5. Explain the popularity of the telephone.
6. What effect have the telephone and the telegraph had on letter writing?
7. Explain how cable messages are sent and received.
8. Explain briefly the principles involved in wireless communication.
9. How does the radio compass work? Explain.
10. What are code messages? Why are they used? Explain.
11. Make a study and report on the lighthouse system in the United States.

12. Why does the traffic of the United States go to the right while that of England goes to the left?
13. Make a list of magazine articles, pamphlets, and books dealing with the subject matter in this chapter.
14. Show how the radio beam guides airplanes, and explain how it works.
15. Write a paper on the differences between English broadcasts and American broadcasts.
16. Report on the way broadcasting is regulated in the United States.
17. Explain the difference between ordinary radio wave and short-wave broadcasting.
18. Explain in detail how the teletype machine works. Of what importance is this machine?
19. Explain in detail the working of the stock ticker. Of what importance is this device?
20. Visit a telephone exchange and report on your visit.

TOPICS

1. Primitive means of communication.
2. Inventions that have speeded up communication.
3. The history of the telegraph.
4. The history of the telephone.
5. The stock ticker.
6. The Railway Post Office.
7. The Post Office and its methods of handling mail.
8. The air mail.
9. The effects of wireless communication.
10. The effects of radio broadcasting.
11. International signal codes.
12. Television.
13. The transmission of pictures.
14. The working of the carrier system, whereby many messages may be sent simultaneously by telegraph.
15. The broadcast networks in the United States.
16. Submarine cables.
17. The radio as an advertising medium.
18. The part that radio plays in general education of the public.

FOR CLASS DISCUSSION

1. The Government should own and control all telephone systems.
2. The Government should own and control all broadcasting stations.
3. Express companies should be controlled by Post-Office authorities.
4. The Post Office should be operated by private companies.
5. The telephone is more valuable to commerce than is the telegraph.
6. Mechanical signals control automobile traffic better than do police officers.
7. All cables should be controlled by the League of Nations.
8. Wireless communication will eventually displace all communication by wire.
9. Radio broadcasts in the United States should be censored.
10. The English system of government ownership of broadcasting systems is preferable to the private ownership system in the United States.
11. Money orders and postal savings are not a proper function of the Post Office Department.
12. The present system of radio-broadcasting supervision by the Government could be improved.
13. Lighthouses, channel markers, and other protective devices should be maintained by the shipping interests rather than by the Government and the taxpayers.
14. The monopoly of the telephone business by one large company brings about the highest type of service.
15. The Government should seize all means of communication in time of war.

CHAPTER IV

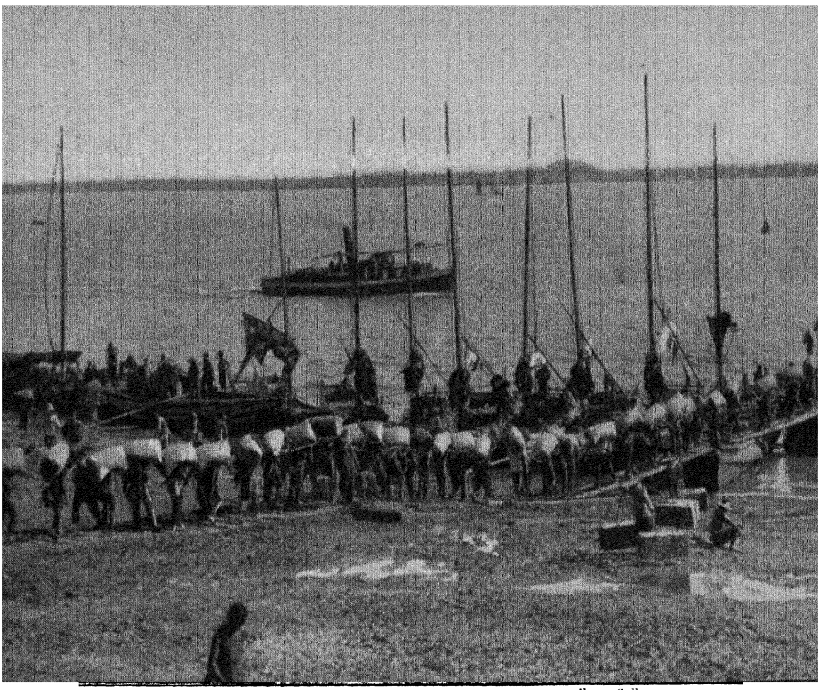
TRANSPORTATION

SECTION 1—TRANSPORTATION ON LAND

Importance of Transportation. Kipling once declared that *transportation is civilization.* It is plain that our civilization, based largely on commerce and industry, is dependent on transportation for its existence. Transportation makes possible the distribution of the surplus products of one region to other regions where those products are scarce. Imagine what would happen to our civilization if all the facilities of transportation suddenly stopped. The great amount of food supplies necessary for our large cities would fail to reach them. Economic ruin and social disaster would follow if the flow of commerce was interrupted for even a short time.

To be efficient, transportation facilities must be dependable, comparatively cheap, and fairly rapid. Although most of the means of transportation are dependable, they all vary in costs and speeds. If we consider the load carried, the time consumed, and the distance covered, we shall find that man power is the most expensive form of transportation. Pack animals come next on the list, then beast-drawn carts, airplanes, trucks, railroads, and finally boats. When cheaper forms of transportation are lacking, human porters, pack animals, and beast-drawn carts are necessary. The airplane is the fastest means of transportation and is used when great speed is required. The automobile truck is used for comparatively short land hauls. Railroads are used much for long land hauls. Boats are used on water hauls, and compete with railroads for hauling heavy, bulky, and nonperishable materials between ports connected by land and water, when speed is of secondary importance.

Human Porters. Man power was one of the earliest forms of transportation and is still in use. Practically all savage tribes "tote," most of the work being done by women. In



Ewing Galloway

Chinese coolies as longshoremen.

Japan and China, where animals are few because it is necessary to use the land to support the people, man power is used extensively in the movement of commodities. In China this man power is added to and helped by the use of man-driven wheelbarrows. In some parts of Africa human porters are necessary because of the surroundings and the presence of the tsetse fly, the sting of which is deadly to animals.

In large commercial centers, an enormous amount of man power is required to load and unload freights. At railroad terminals these men are called freight handlers; at wharves they are called longshoremen. Our country leads in the use of machinery for loading and unloading. Great cargoes of wheat, iron, and coal are handled with a minimum of man power; but some kinds of freight, such as packages, boxes, and bales, require the labor of freight handlers and longshoremen. This kind of man power is one of the costliest items in transportation. Because of the expense of the man power involved, it often costs more to transship goods across New York City from one terminal to another, than it does

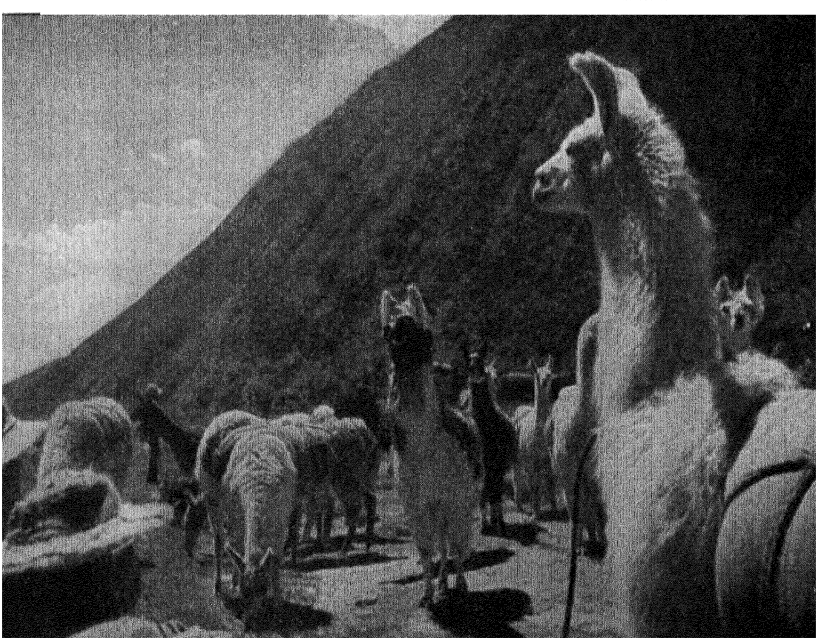
to bring the goods from Chicago, or to ship them to Liverpool. To get a ton of coal into the cellar of a house by man power costs more than the transportation of the coal for long distances by railroads or boats.

Pack Animals. Where other forms of transportation are not practicable, man uses animals peculiarly adapted to the region. Donkeys are used as pack animals in the mountainous regions of the Americas, in Europe, and in some parts of Asia. The llama, used on the trails of the Andes Mountains in South America, is especially valuable in high altitudes. The camel and the elephant are used as pack animals in tropical countries, the camel being particularly well adapted for caravan transportation in desert regions. Sometimes dogs are used as pack animals. The yak is the pack animal of the Himalaya Mountains.

Roads. In this country the first roads, which followed the old Indian and buffalo trails, were very poor. As the need for

Llamas are used as pack animals in the highlands of Peru.

Grace Line

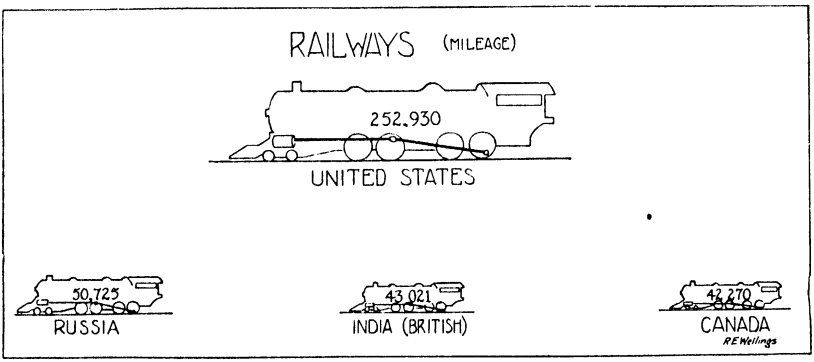


roads increased, turnpikes were constructed by private companies, which were allowed to charge a toll, or a fee, for their use. As the movement toward the West increased, the Government took an interest in road building, and the National Road was constructed from Cumberland, Maryland, to Vandalia, Illinois. Over this road went stage coaches and Conestoga wagons. These wagons were constructed for rough use and later became the prairie schooners of the western plains.

With the coming of the automobile, people realized the advantages and economy of good roads. They began to understand that poor rural roads place a great handicap on the American farmer in the cost of getting his produce to market. Today people recognize that the cost of good roads is more than made up by the cheaper and quicker transportation that they afford. Huge sums of money, raised chiefly by taxes on gasoline, are spent annually by federal and state governments in constructing and maintaining modern, scientifically built automobile roads. Autoists can now drive from the Atlantic Ocean to the Pacific Ocean, or from the Great Lakes to the Gulf of Mexico, over through routes, without being off hard-surfaced roads at any time. The miles of roads suitable for motor traffic in the United States almost equal the total mileage of the roads in all the European nations combined, and greatly exceed that of all the continents combined excepting Europe.

Railroad Transportation. Most of the railway trunk lines of the United States run east and west, following the flow of commerce, which has been greatly influenced by the Great Lakes with their water-borne commerce. The heaviest railway traffic in the world is found between the Atlantic Coast and the fertile and populous farm lands of the Middle West. Freights moving eastward are composed chiefly of raw materials and food. Freights moving westward consist principally of imports, manufactured articles, and coal.

The largest railway systems connecting the Atlantic Coast with the Middle West are the Pennsylvania, the New York Central, the Baltimore and Ohio, the Chesapeake and Ohio, the Wabash, the Erie, and the Norfolk and Western. New



The railroad mileage in the United States greatly exceeds that of any other country. In fact, it is much greater than the combined mileages of the next three countries—Russia, India, and Canada. These countries are not great industrial nations like England and Germany; their railway mileages are great because they are countries of great distances.

England is served chiefly by the New York, New Haven & Hartford Railroad Company and the Boston and Maine Railroad. The principal railroads in the southeastern section of our country are the Atlantic Coast Line and the Seaboard Air Line. The Louisville and Nashville Railroad and the Illinois Central System run north and south in the Mississippi Valley.

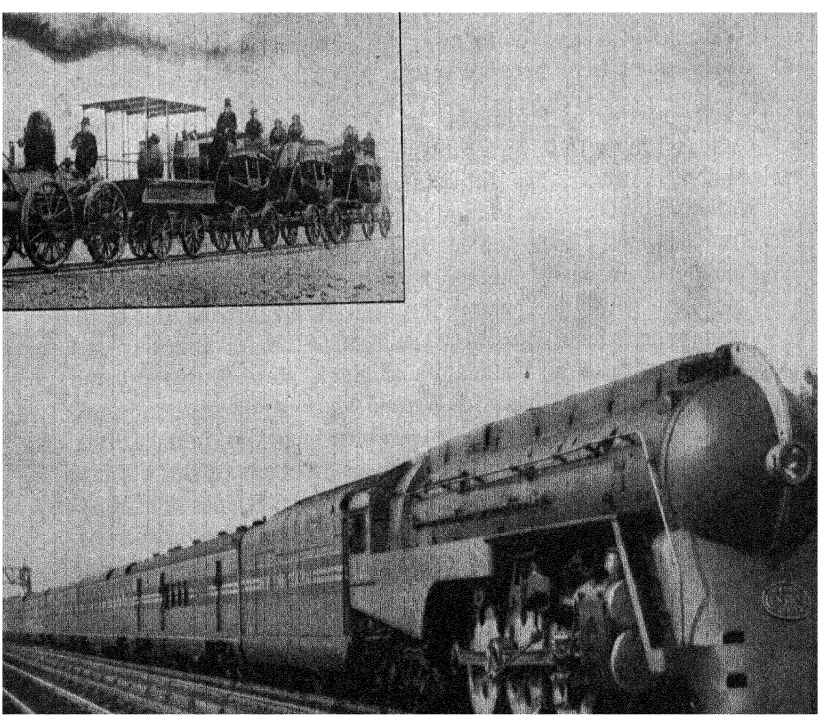
In the Central States are many railway systems, the largest of which are the Chicago, Burlington & Quincy Railroad; the Chicago and North Western Railway; the Chicago, Rock Island & Pacific Railway; the Missouri Pacific Lines; the St. Louis–San Francisco Railway; the Minneapolis, St. Paul & Sault Ste. Marie Railway; and the Pere Marquette Railway.

The systems connecting the Mississippi Valley and the Pacific Coast are called the *transcontinentals,* although none of these railways runs east of Chicago. In the southern section are the Southern Pacific Lines and the Atchison, Topeka & Santa Fe Railway. In the central section is the Union Pacific System. In the northern section are the Chicago, Milwaukee, St. Paul and Pacific Railroad; the Great Northern Railway; and the Northern Pacific Railway. In Canada the Canadian Pacific Railway and the Canadian National Railway System run from coast to coast.

Improvements in Railroad Equipment. Railroads have made wonderful advances in equipment and service. Steel and steel alloys have made possible better rails, safer cars, and more powerful locomotives, which can haul longer and faster trains. We now have improved and specialized cars for hauling fruits, meats, ore, coal, petroleum, tannin extracts, gasoline, livestock, horses, milk, and other materials. Today, modern sleeping cars, drawing room cars, dining cars, buffet cars, library cars, lounge cars, observation cars, and standard coaches are far superior to those even of ten years ago. All through trains are now air conditioned, a feature that assures passengers of a steady supply of fresh air at automatically controlled temperature. Beautiful streamlined trains, built of special alloys to reduce weight and shaped to lower air resistance, now flash across the country at speeds undreamed of a generation ago.

The locomotive at the left was the first train used over the New York Central Lines. Contrast it with the streamlined train of the present time.

New York Central System.



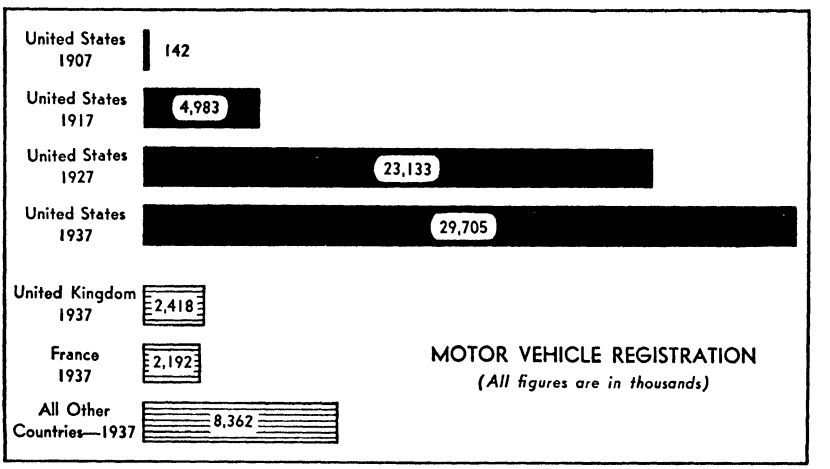
These trains, pulled by steam or Diesel engines famous for their speed and comfort, even in this modern age, connect our large cities on regular schedules that can be counted upon to the minute. Because of the increasing competition of other means of rapid transit, railroads are using every means at their command to make railroad travel attractive, comfortable, safe, and rapid. Many of our important railroads have electrified large stretches of their tracks to eliminate the smoke nuisance of coal-burning locomotives, especially near large centers of population. Electric traction is also used by some railroads in mountain districts where much hydroelectric power is near at hand. Automobile buses, owned and operated by the railroads, are displacing steam trains on short and unprofitable lines and also act as feeders to larger trunk railroad lines.

The railroads in this country have an enviable record for safety. Automatic couplers, air brakes, and other safety devices of all kinds keep the death list extremely low in comparison with the hundreds of thousands of passengers carried daily. The gradual doing away with grade crossings is making this record even more favorable.

Regulation of Railroads. In the beginning, railroads were allowed to fix their own rates and to do about as they pleased. Later, however, the Interstate Commerce Commission was created by Congress to regulate the railroads carrying freight or passengers back and forth between states. This Commission has gradually become more powerful, until it now has absolute power to regulate the *interstate* railroads and to fix minimum rates. *Intrastate* railroads, those doing business wholly within the boundaries of single states, are regulated by state commissions. In Europe most of the railroads are owned and operated by the governments. In the United States, where about one third of the railway trackage of the world is found, railroads are owned by corporations composed of thousands of stockholders. Some of our railroads are prosperous, and some are in poor financial condition. Because railroads are so important to our commerce and industry, some people believe it would be best if they were owned and run by the

Government here in the United States; others believe it is wiser to leave the ownership in private hands with the control and regulation in the hands of the Government. The railroad situation is one of the most complicated economic problems of the present day, and upon its proper solution depends, in no small part, our future economic and social welfare.

Automobiles. The comparatively cheap power and ease of operation have made the gasoline-driven automobile a highly desirable and important kind of transportation, especially in the United States. There is an automobile registered for every



Motor-vehicle registration in the United States and in foreign countries. New York has the greatest number of motor vehicles of any state in this country; California ranks second. Both of these states have more motor vehicles than does the United Kingdom.

five persons in the United States, and all the inhabitants could be carried at the same time in some kind of a car, if it were possible to arrange it. More than twice as many automobiles are registered in the United States as in all the other countries of the world combined. More automobile trucks are driven over our roads than are found in all of the rest of the world. This popularity of the automobile in the United States may be explained by our high standard of living, low costs in mass

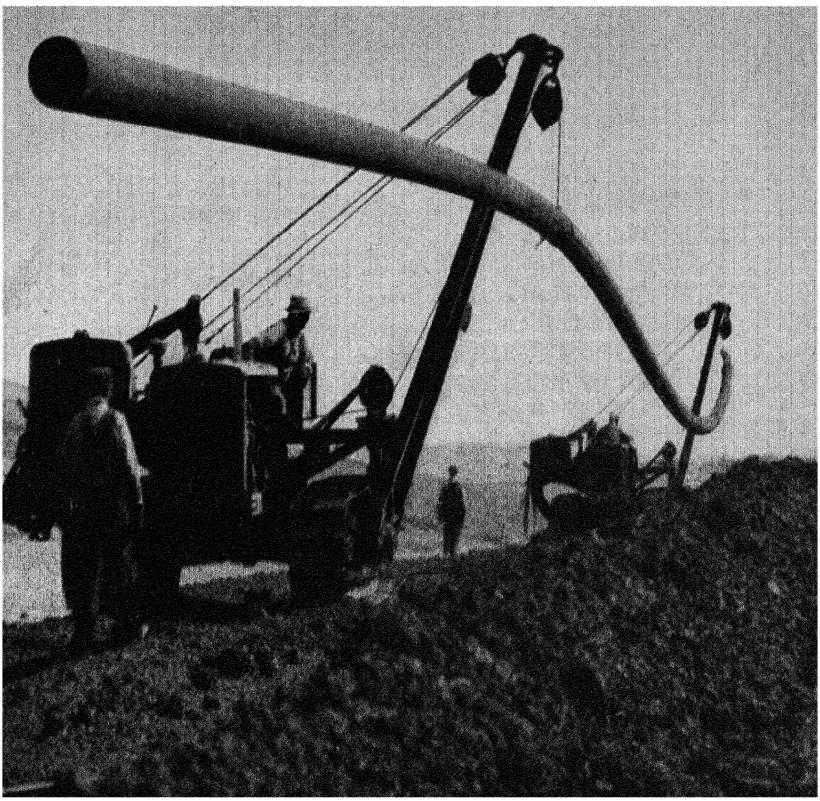
production, relatively cheap maintenance, good roads, and low-priced gasoline.

Because it is cheaper, quicker, and more powerful, the automobile truck has largely displaced horse-drawn vehicles, especially in our large cities. It competes successfully with railroads, especially in short hauls. It can carry its load in smaller units directly from the producers to the consumers without costly intermediate loadings and unloadings, and, by its direct service, it saves many of the usual delays. It has also proved its worth on deserts, in many cases taking the place of pack animals and caravan animals. The invention of the *caterpillar tread* has made possible the use of automobile trucks in rough and sandy country. On farms gasoline-powered tractors have largely displaced horses.

Many large passenger buses now run on regular schedules between important terminals, and fill a need for frequent service in small units. The railroads, in self-defense, are adopting this method of local transportation, using the buses as feeders. The competition of the automobile with the railroad has had a serious effect on the latter, so much so that great consideration is now being given in many places to a readjustment of local transportation.

Pipe Lines. The pipe line is one of the least known but most efficient and economical ways of transporting petroleum, gasoline, and natural gas. The present mileage of petroleum and gasoline pipe lines is probably more than one hundred and fifteen thousand miles. Several thousand miles of pipe lines also transport natural gas from its source to the great cities and industrial concerns that use it for heat and light. Some pipe lines are built, owned, and run by private companies entirely for their own use, whereas others are common carriers, open to use by the public in general.

From the oil regions the oil is pumped through pipes to the great refineries near large centers of population or, on the coast, where foreign shipments can be easily made. The pipes are usually made of iron, and vary from four to ten inches in diameter depending upon the amount of traffic handled. They are generally laid underground, although where the weather



Shell Oil Company

Tractors swing a 200-foot section of pipe into place for a new pipe line.

does not get too cold, they can be operated on the surface of the ground. Pumping stations are situated every thirty or forty miles. The pumps keep the petroleum moving through the pipes at a speed of about three miles an hour. According to the best estimates, enough oil to fill forty million barrels is flowing through pipe lines at any given time. Moreover, great quantities of oil are stored, at the terminals of these pipe lines, in reservoirs capable of storing four hundred million barrels of oil.

Great quantities of natural gas, formerly entirely wasted, are now piped to consumers many miles away. Often, the volume of natural gas coming from one source grows too small; then it becomes necessary to make new pipe connections with fresher sources to maintain a sufficient flow of gas to meet the demands.

TEXT QUESTIONS

1. Prove that civilization depends upon transportation for existence.
2. Name three requirements for efficient transportation.
3. List the different kinds of transportation in the order of costs.
4. Why are human porters used as carriers in China? in Africa? in New York? in your own locality?
5. Explain the high cost of man power in transshipments.
6. List the different animals used as pack animals. Tell where each is used and why it is used there.
7. Show how the automobile has influenced the construction of good roads.
8. What kinds of freights move eastward on trains? What kinds of freights move westward on trains?
9. Discuss the improvements in railroad equipment in the last few years.
10. How have railroads secured their good record for safety? Explain.
11. How are the railroads in the United States owned and regulated?
12. Account for the large number of automobiles in the United States.
13. Explain the successful competition of automobile trucks with other transportation agencies.
14. Discuss the competition of buses with railroads.
15. Discuss the use of pipe lines in the United States.

SECTION 2—WATER AND AIR TRANSPORTATION

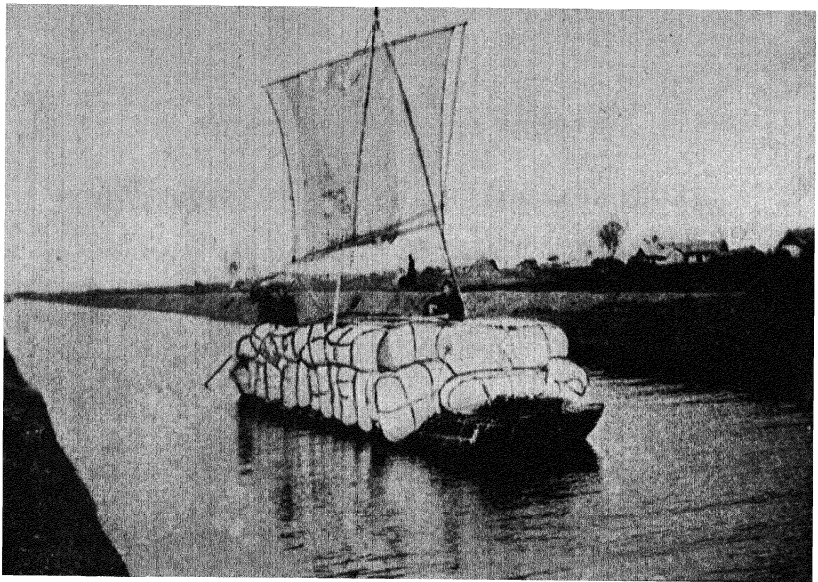
Importance of Waterways. Transportation by water is one of the oldest kinds of transportation, and has been a very important factor in shaping the history of the world. In the early settlement of America, waterways were the main channels of transportation used by the colonists and pioneers long before the coming of roads, and, in some cases, even before the time of crude trails. In the subsequent development of our country, these waterways were used, and still continue to be used, to carry the freights of growing commerce and industry.

Many of our great cities owe their development to a well-selected site along some waterway of early travel; later these cities grew and expanded because their locations were favorable to the flow of commerce. Some of these cities were also helped later by railroad facilities, which stimulated and increased the amount of freight passing through them. Other large cities, not favorably located on some waterway, owe their growth to the fact that they became great railroad centers.

One of the chief factors in the growth of commerce and industry in the United States has undoubtedly been the fact that the country is well endowed with many excellent waterways over which products can be taken to market.

Rivers. In North America rivers furnish almost twenty thousand miles of inland navigation. At the head of the list are the Mississippi River and its many branches. This system of waterways drains a basin of more than a million square miles; includes all, or portions of, thirty-one states; and affords nine thousand miles of navigable waterways. Over ninety per cent of the traffic on this system consists of bulk commodities like coal and coke, sand and gravel, petroleum and its products, and cotton.

The rivers on the Atlantic Seaboard carry only a small amount of the inland waterway traffic, chiefly because the *fall line* of these rivers (the place where the rivers fall rapidly from higher elevations to almost sea level) is near the coast, and their navigation is limited to relatively short distances. The Pacific Coast of the United States has few navigable



U. S. Department of Agriculture

Moving cotton on one of the canals in the Thungchow District, China.

rivers, the principal systems being those of the Columbia River in the northwest and the San Joaquin-Sacramento system in California.

The rivers of Europe are natural highways for the commerce of her countries. Today Europe leads all other continents in the use of inland waterways. A great network of canals, connecting all the important rivers in Europe, greatly increases the facilities of this kind of freight carrying. The rivers of Asia are used chiefly for local commerce, although a few of them are deep enough for the entrance of ocean-going boats.

The rivers of Africa play an unimportant part in commerce, because the fall line of the rivers is close to the coast. South America is particularly well favored by navigable rivers, and ocean-going steamers can enter her northern and eastern coasts for hundreds of miles. By the use of lighter boats, which can be used in shallower water, many more miles are added to her navigable inland waterways.

Canals. By means of canals, rivers are connected and supplemented, falls and rapids avoided, and cargoes carried directly to their destinations without costly transshipment. On canals are shipped heavy, bulky, nonperishable freights, like coal, ore, lumber, and grain.

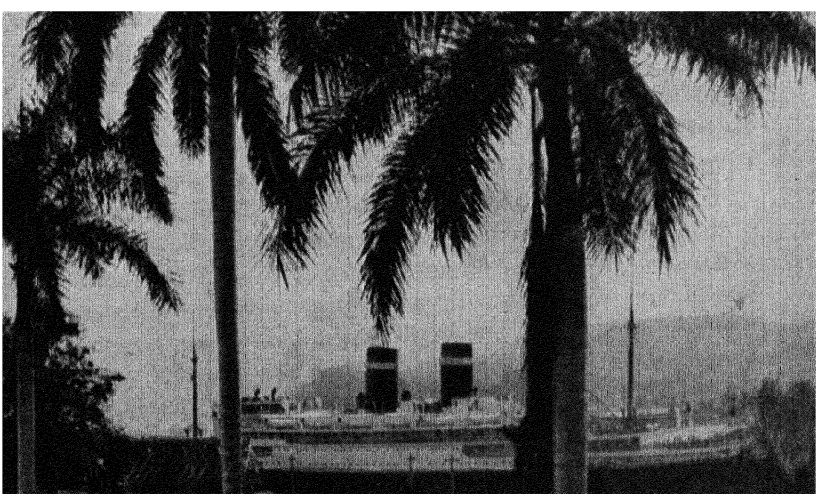
In the United States today, there are about forty canals, with a total mileage of about twenty-five hundred. The longest of these is the famous Erie Canal in New York, connecting the Hudson River with the Great Lakes. The Erie Canal has been deepened to twelve feet and is now a part of the New York State Barge Canal. Although the Sault Sainte Marie Canals, connecting Lake Superior and Lake Huron, and only little over a mile long, are closed for several months each year by ice, they carry twice as much tonnage as the Suez Canal, which connects the Mediterranean and the Red seas. The Welland Canal around Niagara Falls and the Saint Lawrence Canals in Canada form an outlet from the Great Lakes to the sea for good-sized ships.

The Federal Government has gradually built up a waterway system inside the coast, stretching from the Cape Cod Canal, in Massachusetts, to Miami, Florida, and from Apalachicola, Florida, through New Orleans, Louisiana, to Corpus Christi, Texas. In this continuous waterway we find rivers, stretches of ocean protected by outlying reefs, and canals.

Some canals are so constructed that they permit the passage of large ships; they are therefore called *ship canals*. The more important ship canals aiding world commerce are the Panama

A modern motor ship, SS. California, going through the Panama Canal. This liner operates on a regular schedule between New York and San Francisco.

Underwood and Underwood

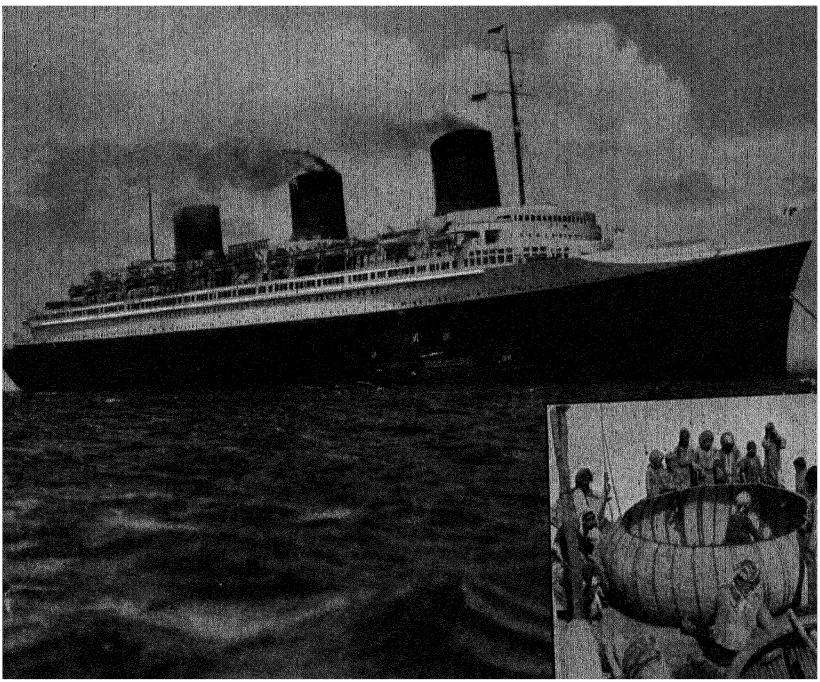


Canal, in Panama, which connects the Atlantic and Pacific Oceans; the Manchester Ship Canal, in England, which connects Manchester and the Irish Sea via Liverpool; the Kiel (Kaiser Wilhelm) Canal, in Germany, which connects the North Sea and the Baltic Sea; the Suez Canal, in Egypt, which connects the Mediterranean Sea and the Red Sea; the Corinth Canal, in Greece, leading into the Aegean Sea; and the new Russian canal, which connects Leningrad and Archangel.

The Panama Canal. The largest ship canal owned and operated by the United States is the Panama Canal. Its completion, in the year 1914, greatly shortened many important ocean routes between ports in the Atlantic Coast and Pacific Coast regions. While the greater part of the traffic passing through the Panama Canal is between seaports of our own country, the commerce between our eastern seaports and western South America and the Orient, as well as the trade between our western seaports and eastern South America and Europe, has been greatly increased by this canal.

Freights moving from our Pacific Coast ports to our Atlantic Coast ports are composed chiefly of grain products, refined oils, sugar, lumber, paper and pulp, fruits, crude oils, copper, vegetables, fish, and canned goods. Freights moving from our Atlantic Coast ports to our Pacific Coast ports are composed mainly of iron and steel, metals, cotton, phosphates, lubricating oils, greases, sulphur, and general merchandise.

The Great Lakes. The Great Lakes are our greatest asset in inland waterways, and form one of the most efficient water transportation highways in the world. Vessels, so designed that they can be loaded and unloaded quickly by machinery, carry enormous cargoes of iron ore and grain eastward, and of coal westward. Along these lakes are many good harbors with ample dock facilities, huge grain elevators with great storage capacity, ore docks sometimes over a half mile in length and equipped with unloading machinery capable of handling twenty-five hundred tons an hour, car dumpers for handling coal, and all the modern devices and machines for speeding up the time a vessel is delayed at the wharf.



Underwood and Underwood

The primitive boat, without bow or stern, used on the Tigris River in Asia Minor since earliest times, may be contrasted with the modern liner, SS. Normandie. This liner shows the latest improvements in present-day water transportation.

Ocean Transportation. The ocean is the great natural highway of commerce. For some time the United States dominated ocean trade, but her merchant marine became less and less important as steam vessels displaced sailing vessels and Great Britain took the leadership.

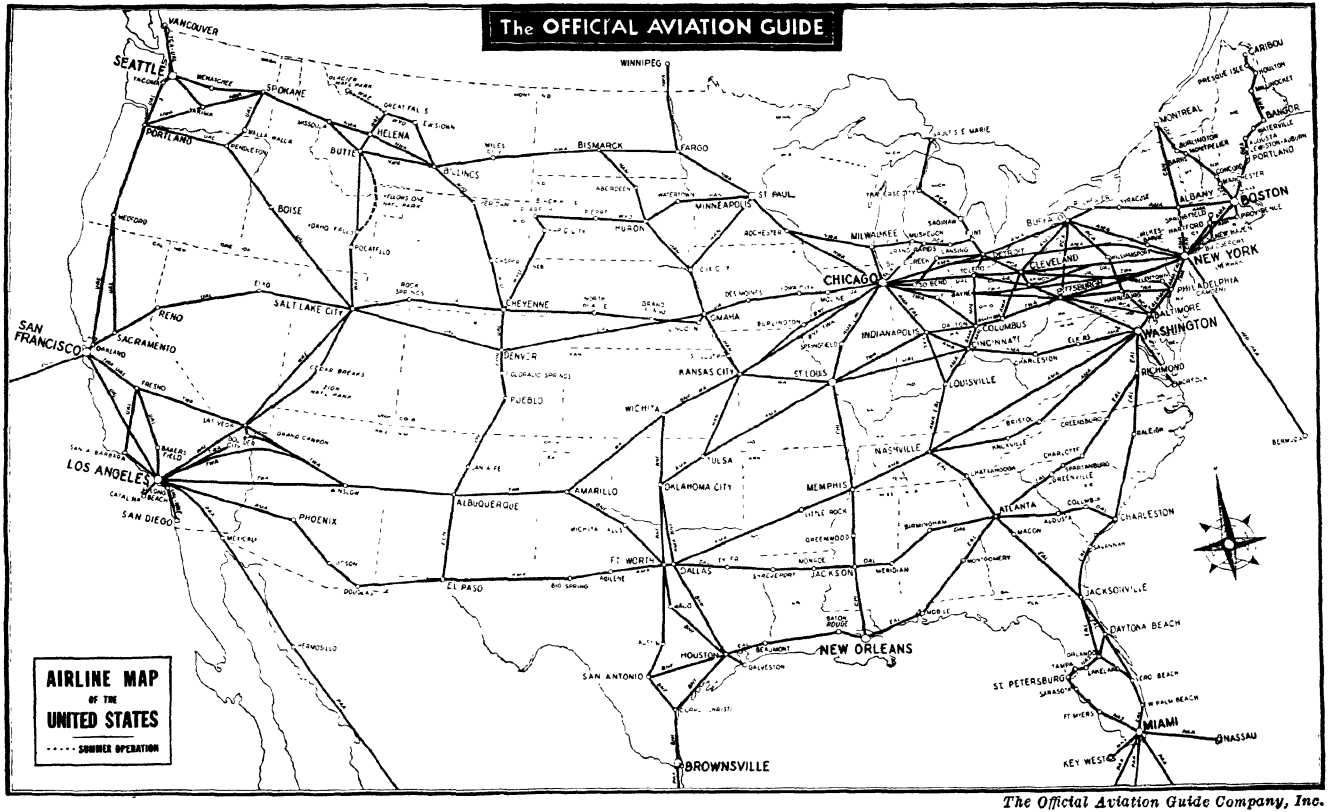
Some freight carrying on the ocean today is still done by sailing vessels. Many of these are now made of steel and carry auxiliary gasoline engines, which propel them into harbors, and during calms. Much loading and unloading on sailing vessels is also done by gasoline engines. These sailing ships have the advantage of having more space for freight, in proportion to their size, than steam vessels. Although they are slower and more irregular in time schedules, they are much cheaper to operate and less costly to build. These advantages are very important.

In general, two kinds of steam vessels may be distinguished as ocean carriers—the *liner* and the *tramp steamer.* The liner

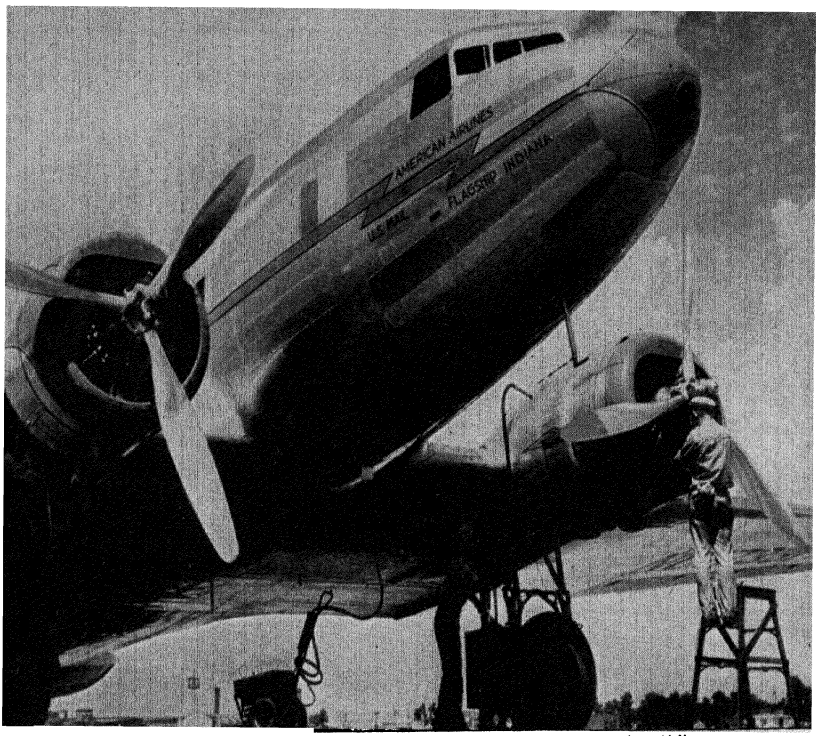
plies between certain ports on a regular schedule, and relies upon its speed, its comfortable equipment, and its regularity to obtain and hold the passenger and light freight business upon which it largely depends. The tramp steamer is leased by its owners to shippers, and carries anything, anywhere, anytime. Whole shiploads of cargo may thus be carried directly to their destinations. Unlike the rates of liners, the rates of tramp steamers vary, depending upon the nature of the cargo, the distance it is to be carried, the prospect of obtaining another load at the foreign port where the cargo is to be unloaded, and the scarcity of shipping facilities at ports.

Air Transportation. Air transportation may be classified into two general kinds: *heavier-than-air* and *lighter-than-air.* In the first group, we find three types: the airplane, the seaplane, and the autogiro. These are alike in that they depend upon their wings and speed for suspension in the air; they differ in their landing devices. The airplane lands on wheels on land; the seaplane lands on pontoons, or small floats, on water; and the autogiro has apparatus that enables it to land and take off almost vertically, thus saving much space in these operations. The lighter-than-air ship is called a dirigible, or Zeppelin, and depends upon hydrogen or helium to make it lighter than air. In landing, it slowly settles down to a mooring mast, to which one end is hitched.

The airplane dominates air transportation except over long stretches of water where the seaplane is used. The autogiro has not yet been developed commercially to a point where it is important in commercial transportation. In the United States the use of the dirigible is of no importance except for occasional advertising purposes or for experimental demonstrations. It has little advantage over fast trains in speed, is very dependent upon favorable weather conditions, and is not well adapted to compete with airplane service at present. It is possible that improvements may be made in dirigibles that may make them a serious competitor for transoceanic transportation, but the principal interest shown in them so far has been among military and naval forces for their possible value as combat aircraft.



The Official Aviation Guide Company, Inc.



American Airlines

A modern airplane.

Airplanes. Travel by air is much more dramatic and attracts much more publicity in our newspapers than do land facilities of transportation, but the traffic carried through the air is less than one per cent of all the traffic in our country. However, the rapid growth of air travel and transportation in recent years points to an increasing importance in this type of transport. At the present time the airplanes of the United States are carrying more than one hundred thousand passengers monthly, in addition to millions of pounds of air mail, express, and light freights annually. There is more air mail carried in the United States than in any other country in the world. In round figures, there are four times as many civil and commercial airplanes as there are military airplanes in the United States; in Europe, the opposite is true, the military planes there outnumbering the civil planes by four to one.

Most of our commercial airplanes now have two motors, carry about twenty passengers, and have a top speed of around

two hundred miles an hour. A few of our transport planes are larger, speedier, and higher powered, with three and four motors, but there is a noticeable tendency to standardize the regular planes to present size, power, and speed and to pay more attention to comfort and safety than to excessive speed. Progress is being made in designing great airliners capable of carrying forty passengers long distances at elevations above 25,000 feet, where flying conditions are superior to those in lower elevations. Much interest is being shown also in developing regular trans-Atlantic air lines, and their establishment has been greatly encouraged by international agreements.

TEXT QUESTIONS

1. Discuss the importance of inland navigation to transportation in the United States.
2. Show how rivers have been a big asset to the United States, to Europe, to South America, and to Asia.
3. Explain the importance of the Mississippi River system of waterways.
4. Name and locate some of the most important canals in the Western Hemisphere.
5. Name and locate some of the important ship canals of the world.
6. What kinds of freights move eastward, and what kinds of freights move westward in the commerce between our Pacific ports and our Atlantic ports?
7. Prove that the Great Lakes form one of the world's most efficient transportation systems.
8. Describe the freights moving eastward and those moving westward on the Great Lakes.
9. What facilities to aid transportation are found on the Great Lakes?
10. Give one reason why Great Britain leads in merchant marine.
11. Discuss the improvements in sailing vessels.
12. Show the causes of competition between sailing vessels and steam vessels.
13. Describe the types of steam vessels now being used for commerce.
14. Describe the four kinds of air carriers. Explain the good points of each.
15. Discuss the modern trends in airplane construction.

16. What percentage of all our traffic is carried by air? How many passengers are carried monthly?
17. Contrast the United States and Europe in regard to kinds of airplanes, civil and military.

PROBLEMS AND PROJECTS

1. Make a list of all the various kinds of transportation used in your community.
2. Collect all the pictures you can showing the various kinds of transportation.
3. Draw up a list of the articles you use during one day. Show how transportation made possible your use of these things.
4. On an outline map, indicate the principal seaports of the world.
5. On an outline map, indicate the principal lake ports of the Great Lakes. Show also the principal canals connected with the Great Lakes.
6. On an outline map, indicate the principal trade routes touching the Pacific Coast. Show terminal cities.
7. On an outline map, indicate the principal trade routes of the world.
8. On an outline map, indicate the principal ship canals of the world. On the reverse side of the map, explain how these canals are great timesavers.
9. On an outline map, indicate our principal inland waterways.
10. On an outline map, indicate the principal railway systems of the United States.
11. Make a comparison of the great canals: the Suez, the Sault Sainte Marie, the Panama, the Kiel, and the Erie Canal.
12. What country now has the largest merchant marine? Why? Explain why ours is not larger.
13. Show how good roads benefit the farmer, the city dweller, the motorist, the merchant, the manufacturer, and commerce in general.
14. Describe the various kinds of airplanes. Describe a dirigible. Which type of plane is best for commercial transportation? Why?
15. Explain the decrease in electric streetcar mileage.
16. Draw a diagram showing how canal locks work.
17. Discuss boat cargoes on the Great Lakes.

18. Plan a trip from Boston to San Francisco and return. By what railroads would you go and by what railroads would you return? Give reasons for your choice of railroads.
19. Make a list of magazine articles, pamphlets, and books dealing with the subject matter in this chapter.
20. Make a map of the world indicating where different kinds of transportation are used. On the reverse side explain why each kind is used in that particular section.
21. Collect pictures of modern equipment of railroads.
22. Explain in detail how an automobile engine works.
23. On an outline map, indicate the location of the principal pipe lines in this country.
24. On an outline map, show the routes of the principal airlines in the United States.
25. On an outline map, trace the route of the Federal waterway system along the Atlantic Ocean and along the Gulf Coast.
26. List and indicate the terminals of the principal steamship lines using the Panama Canal.

TOPICS

1. The Panama Canal.
2. The great ship canals of the world and their effect on commerce.
3. Transportation facilities of the Great Lakes.
4. Canal building in the United States.
5. Canals of Europe.
6. The part played by the Sault Sainte Marie Canals in commerce on the Great Lakes.
7. The fall line of the rivers on the Atlantic Seaboard.
8. River transportation in the United States.
9. The increasing use of the truck as a means of transportation.
10. Competition between trucks and railroads as carriers of both passengers and freight.
11. A great railroad system.
12. A brief history of railroad growth and development in the United States.
13. Air transportation: its history and development.
14. The Mississippi River system of inland waterways.
15. Radio communication in air transportation.
16. The service rendered by some leading airline.
17. The Pan American Airways and their effects on commerce.
18. Pipe lines in the United States.

FOR CLASS DISCUSSION

1. The Government should own and operate the railways.
2. The Panama Canal should be tax-free for all vessels.
3. Interstate trucks and buses should be regulated by the Interstate Commerce Commission.
4. Our merchant marine should be heavily subsidized and built up.
5. Overland buses and trucks should be taxed more for using the highways.
6. Air transportation should be subsidized.
7. Pipe lines should be common carriers.
8. The extra charge for air travel is justified.
9. The Government should own and operate our air-mail service.
10. The automobile companies should own and control the supply of gasoline.
11. State and federal governments are not justified in using any part of the tax on gasoline except for good roads and their maintenance.
12. The diverting of gasoline taxes for general purposes is unfair.
13. The cost of building good roads should be met by present-day taxation.
14. Government subsidies to the railroads are justified.
15. All forms of transportation between the states should be under the Interstate Commerce Commission.
16. The cost of the proposed St. Lawrence-Great Lakes Canal would be justified.
17. Automobiles have had a detrimental influence on civilization.

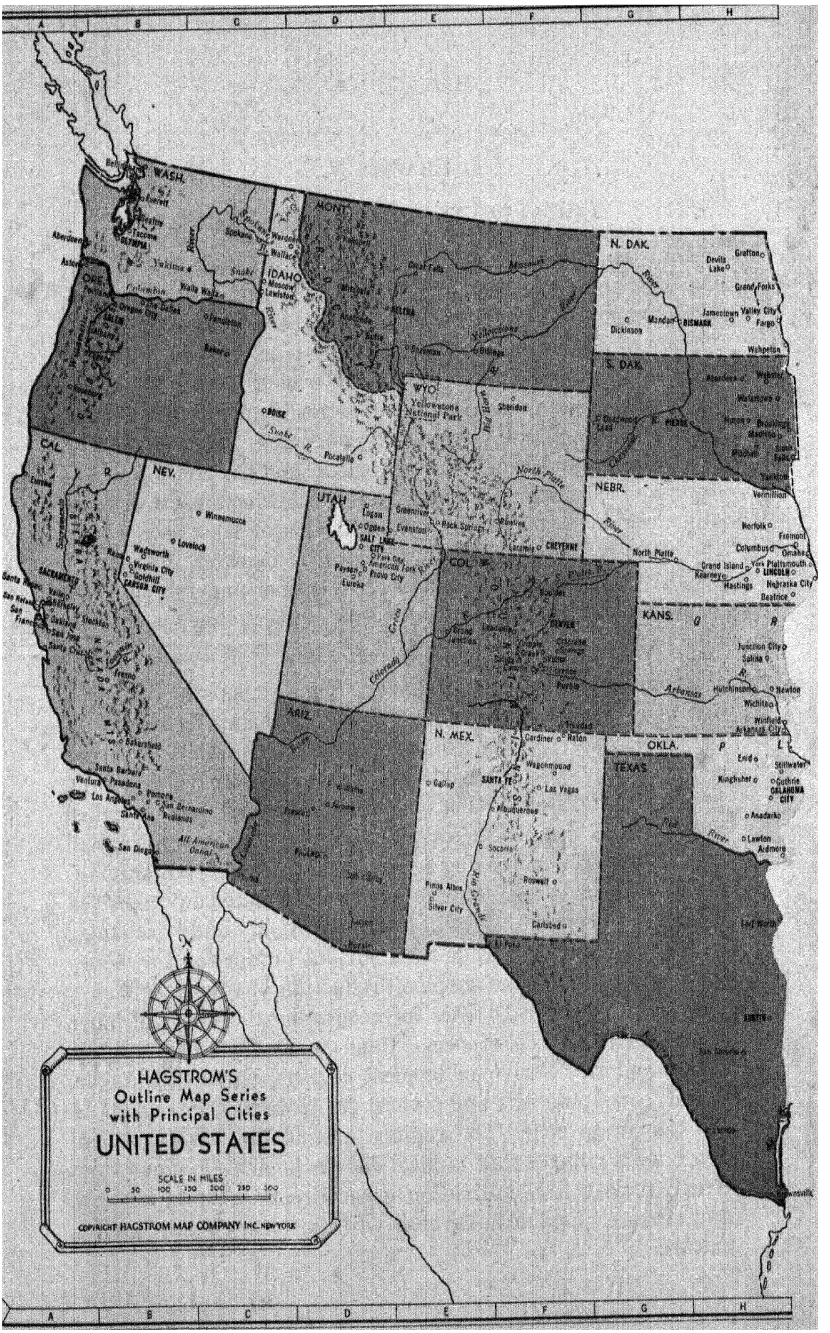
CHAPTER V

LOCALIZATION OF INDUSTRIES

Division of Labor. What a mess we should make of it if we tried to produce by ourselves all the things we need! A brief examination shows how dependent we are, for the satisfaction of our wants, upon other persons and regions. Robinson Crusoe, by being a Jack-of-all-trades, managed to get along in a crude way. How much better is our modern system of commerce and industry! Regions and persons produce those things that they can most easily and most cheaply produce, and sell them for money to buy other commodities from other regions and persons. This division of labor is not only the basis but also the result of world commerce. A study of the division of labor is essential to a proper understanding of economic geography. The subject is so great that we shall be able to present, in this book, only a brief survey.

Geographical Division of Labor. Some regions in the world are more favored in the production of certain commodities than are other regions, which, in turn, can produce different commodities to better advantage. This condition, which results in some regions producing only certain commodities, is called *geographical division of labor*. A study of this subject will disclose an ever-increasing tendency toward regional specialization in production. This is greatly stimulated by improved means of communication, transportation, and exchange, whereby regions can trade their surplus production for money with which to buy the surplus production of other regions.

Among the several causes for geographical division of labor we find climatic differences. Cane sugar, bananas, rubber, cacao, and rice thrive in tropical regions, while beet sugar, wheat, corn, potatoes, and several fruits do best in regions in the temperate zone. The regions around the Mediterranean Sea have a climate that is ideal for grape and olive growing. Brazil finds coffee cultivation especially suitable to her soil and climate. Ceylon is favored with an ideal climate for tea culture.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Harrisburg
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Annapolis
Hagerstown
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Bangor
Lewiston
Waterville
Rutland
Springfield
Worcester
Boston
Providence
Hartford
New Haven
Bridgeport
Stamford
Newark
Jersey City
Paterson
Elizabeth
Trenton
Camden
Atlantic City
Wilmington
Dover
Salisbury
Annapolis
Hagerstown
Cumberland
Altoona
Johnstown
Williamsport
Elmira
Ithaca
Auburn
Oswego
Watertown
Plattsburg
Burlington
Montpelier
Concord
Manchester
Nashua
Portsmouth
Portland
Augusta
Bangor
Lewiston
Waterville
Rutland
Springfield
Worcester
Boston
Providence
Hartford
New Haven
Bridgeport
Stamford
Newark
Jersey City
Paterson
Elizabeth

The presence of minerals encourages some regions to engage in mining, such as the Saar Basin in Germany, the Mesabi District in the United States, and the regions of nitrate deposits in South America. Some regions, because of the presence of coal and iron, have become highly industrialized, such as some parts of our own country, Great Britain, France, and Germany. Special skills and training, sometimes of racial origin, sometimes because of environment, have led to some regions becoming famous for specialized products, such as Switzerland for handicraft products, China and Japan for intricate and beautiful works of art, Belgium for fine laces, Ireland for high-grade linens, our Southwest for Indian-made objects, and the Near East for fine rugs. The Orient, with its immense amount of cheap labor, leads in the production of tea and silk.

Within the limits of the countries themselves, there is still further division of labor. A few examples in our country will illustrate this point. California produces a large part of our fruits; our northwestern states contribute much lumber and salmon; our prairies and mountain states furnish grazing for cattle and sheep; our corn belt specializes in livestock; the South is supreme in cotton; our Great Lakes area finds iron production and also manufacturing profitable; our eastern states rely greatly on manufacturing for support; and New England is highly specialized in industry.

Carrying this geographical division of production still further, we find a concentration of certain industries in a few cities, which have become famous for their specialties. In England, the woolen industry is centered at Leeds, the cutlery business at Sheffield, and the textile industry at Manchester. Lyon, in France, is known the world over as a great center of silk manufacturing. Essen, in Germany, specializes in making iron and steel. Budapest is famous for its flour mills.

In our own country innumerable illustrations may be given. The meat-packing industry is centered in Chicago, Illinois. Brockton and Lynn, Massachusetts, specialize in making boots and shoes. Almost all cameras are manufactured in Rochester, New York. The area around Detroit, Michigan, is the great automobile-making district. Pittsburgh, Pennsylvania; Bir-



Underwood and Underwood

The lumber industry is located in regions near the source of supply.

mingham, Alabama; and Gary, Indiana, are steel centers. The collar-and-shirt industry revolves around Troy, New York. Paterson, New Jersey, is the principal silk-manufacturing city. Minneapolis, Minnesota, is one of our important flour-milling cities. East Liverpool, Ohio, and Trenton, New Jersey, control the country's pottery industry. Waltham, Massachusetts, and Elgin, Illinois, are noted for their watches. So important is this concentration of industries in certain cities that we shall study more in detail the reasons for it.

Industrial Division of Labor. Within the industries there is a high degree of division of labor called *industrial division of labor.* This takes the form of highly specialized factories and specialized operations within them. In Detroit there is a high concentration of the automobile industry. Many factories specialize in the making of certain parts and accessories, while other factories specialize in assembling these parts. Within the factories themselves, labor is so organized that workers become highly skilled in some one operation. The enormous output of a modern automobile factory is possible because of the highly organized process of production, wherein each man does quickly one simple operation.

In Lynn, Massachusetts, there is a great concentration in the shoe industry. Several factories are found there, each manufacturing only certain parts of the shoe. In these factories are skilled workers specially trained to do one operation.

A trip through the establishments of the meat-packing industry at Chicago will show how each worker does one simple operation, at which he becomes extremely skillful.

Industrial division of labor is increasing rapidly, in large part because of the advances made in machinery and inventions. It greatly speeds up output, lowers the cost of production, and increases the efficiency of industry. On the other hand, it tends to make workers dependent upon only one specialty, wholly reliant on machinery and the owner thereof for livelihood, and less interested in the work because of the monotony of doing the same thing over and over again.

Industrial division of labor so dominates our economic life at present that it is necessary for the worker to be highly specialized. Our educational system, with its various courses and kinds of schools, is founded on this principle. Young people will do well to consider carefully how they may fit into this division of labor and do the work for which they are best fitted. So great is the economic cost of misfits, which result in a great labor turnover, that stricter attention is being given to the importance of expert vocational guidance and advice, by means of which young people are enabled to find the work

for which they are best fitted, without the waste of time and the loss of money that follow the hit-or-miss way.

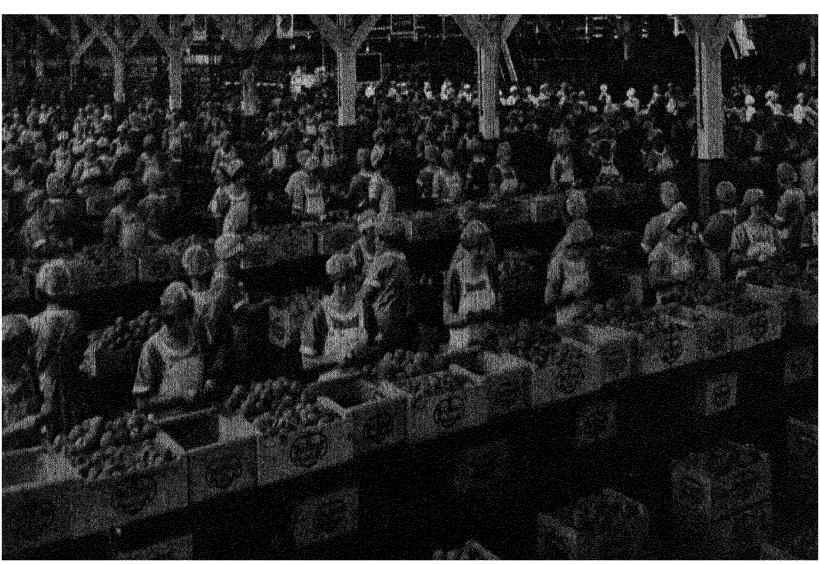
Concentration of Industries. As we study commercial products themselves, we note a number of facts concerning the geographical division of labor and, among them, the causes for the localization and concentration of industries in certain cities. The causes of this localization may be classified as follows:

1. Nearness to raw materials
2. Nearness to markets
3. Climate
4. Power supply
5. Labor supply
6. Capital supply
7. Momentum of an early start

In applying these causes to special cases, we find that all but the last affect the general location of an industry in a region, whereas the last one determines the exact city. In some cases several of these causes are the reasons for the location of an industry, while in others one or two causes are

A fruit cannery in Sacramento, California. Large canneries of perishable fruit are located near the raw materials.

Californians, Inc.



responsible. So complex is modern industry that oftentimes it is impossible to determine the exact relative value of the various causes. In considering the first two causes, nearness to raw materials and nearness to markets, nearness may be taken to mean "easily reached."

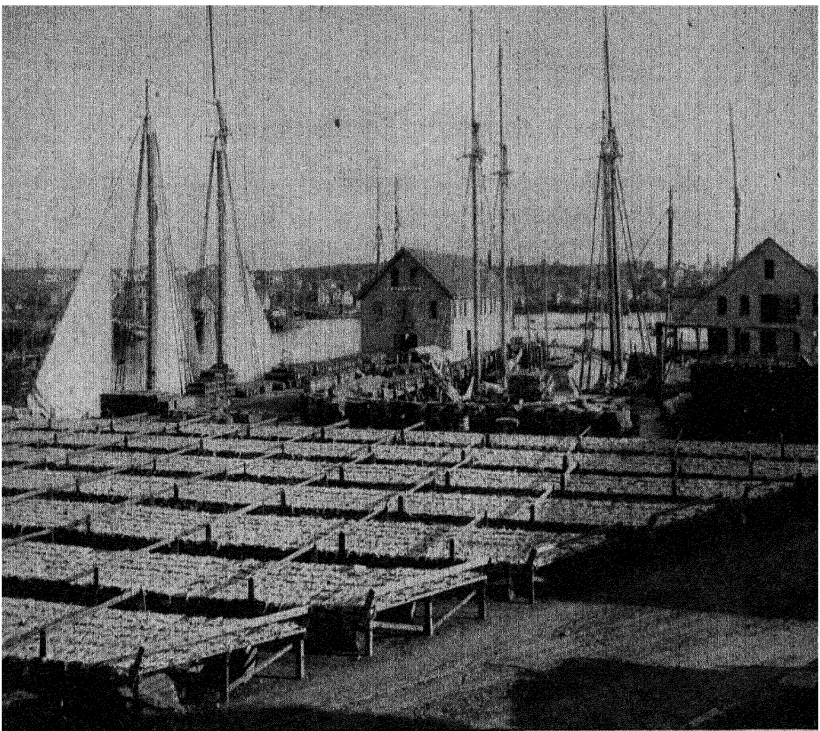
Nearness to Raw Materials. In general, industries dealing with bulky or perishable raw materials are located as near as possible to their sources. The sweet-corn canning industry is located in New York and Maine, near the sweet-corn fields. The fruit-canning factories are situated in California. Baltimore leads in canning oysters and vegetables, supplied from neighboring oyster beds and vegetable gardens.

The canning of salmon is carried on in the Pacific Northwest and Alaska, where salmon are numerous. The salt-cod industry is located at Gloucester, Massachusetts, where the fishing boats unload. Logs are cut into boards as near the forests as possible. The wood-pulp industry is located near the forests where the raw material is changed into pulp, which later may be made into paper nearer the markets.

Originally the tanning industry was located near the supply of tanbark in the East. As the supply of tanbark decreased, this industry moved westward so that it would be nearer a new supply and also nearer the meat-packing centers, from which it obtained hides. Many of the tanneries, however, are still located in the East, because modern methods and the use of concentrated and mineral tanning materials have decreased the transportation cost to a point where it is profitable to continue operating the established factories and, hence, to save the benefits of the capital invested.

Because iron ore, coal, and limestone were near at hand, the iron and steel industry naturally located in and around Pittsburgh, Pennsylvania. Later the opening of the Lake Superior district with its cheap iron ores expanded the area of iron and steel making to the large cities on the Great Lakes. Birmingham, Alabama, is especially favored by its nearness to iron ore, coal, and limestone.

Many of the flour-milling cities of New York began this specialization when New York was the leading wheat state.



U. S. Department of Commerce

Drying cod. The salt-cod industry finds a favorable location at Gloucester, near the raw materials.

The relatively cheap transportation charges enable these cities to maintain their mills even though at some distance from the sources of raw material. Minneapolis, which was a sawmill center at first because of the nearness of power and forests, changed to flour milling when the forest gave way to wheat fields.

The manufacture of carriages found a favorable location near the hardwood forests of Ohio, Indiana, Illinois, and Michigan. Later these factories turned to the manufacture of automobiles because of the change in demand. Their location was favorable to this change because of the nearness of iron and other raw materials.

Nearness to Markets. The greatest concentration of industrial activity is found near the areas of dense population, which provide the markets. In the United States many industries found their location when almost the whole population, and therefore the market, was in the East. It is true

that, as the center of population has moved westward, the center of manufacturing also has, to some degree, moved westward. Many of the industries still remain in the East because of the large markets and the nearness to the European markets. In respect to nearness to markets, Pittsburgh is very well situated in comparison with other steel centers, because it is able to ship more easily than cities farther removed great iron and steel products to the markets of the East and also of Europe.

Whenever raw material is perishable, it must find a market near at hand. This fact accounts for the large milk industry of New England. Bulky finished articles can be manufactured to advantage near the markets. The location of the agricultural machinery industry in and near Chicago is explained by the nearness of the market and also of the raw materials needed.

Favorable location near the eastern and the European markets has helped New England hold its industries, although these industries are not near the raw materials. As the population in our West grows denser and as markets improve, the center of manufacturing will move westward as new factories are established near these markets. The manufacture of shoes in St. Louis is growing because of the increasing market in the West.

The relative importance of nearness to raw materials and nearness to markets depends a great deal on the nature of the manufactured article. Because of relatively low costs of transportation, the manufacturer of small but expensive articles is more independent of nearness to markets and raw materials than the manufacturer of large, bulky, or perishable articles, where the cost of transportation is an important factor. Older, established industries must consider also the amount of capital invested in plants. For this reason established industries are relatively fixed and less able to follow the changes of either factor.

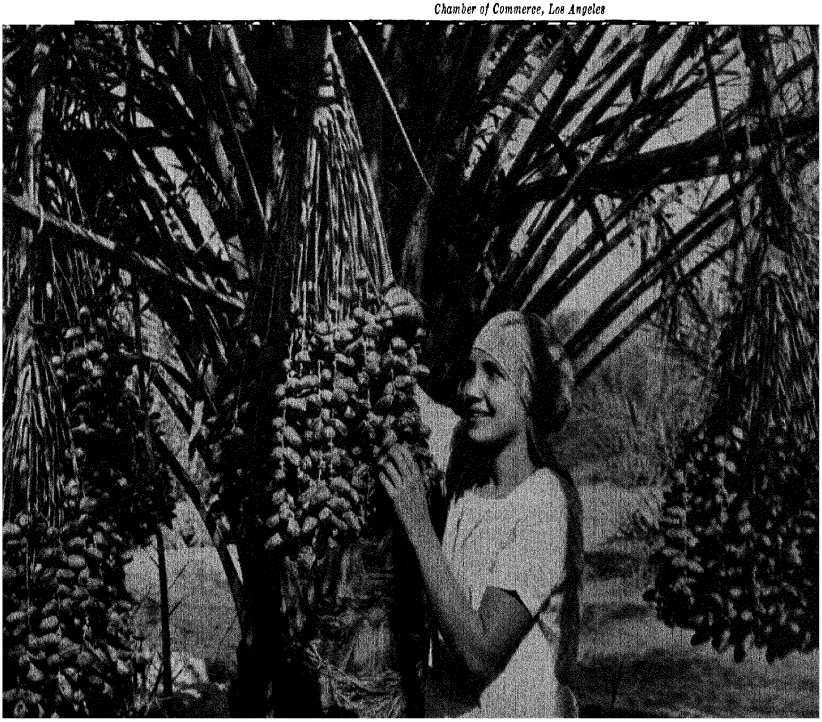
Climate. We have already studied, in another chapter, the general effects of climate on people, and we found that the

more energetic and capable people of the world are located in the temperate zones, where conditions favor health and energy. Because of this fact, as well as for other reasons, world industry is most heavily centered in temperate lands.

Climate has a direct influence on some industries. The dried-fruit industry in California finds an ideal location near the fruit orchards and has the advantages of good drying sun and air. The makers of moving pictures have found the climate of southern California well adapted to the taking of pictures and have centered their industry at Hollywood. The moist climate of England is favorable for certain processes in the making of textiles. In the modern factory, however, it is possible to control indoor temperature and moisture. As a result climatic conditions now play a minor part in the location and efficiency of manufacture. The region around the Finger Lakes of New York is preferred for growing grapes because of the climatic conditions that prevent destructive

Picking dates in Coachella Valley, California. The date industry is located in this region because the climate is suitable.

Chamber of Commerce, Los Angeles



frosts in late spring and early fall. Similar conditions prevail in the Southern Puget Sound area.

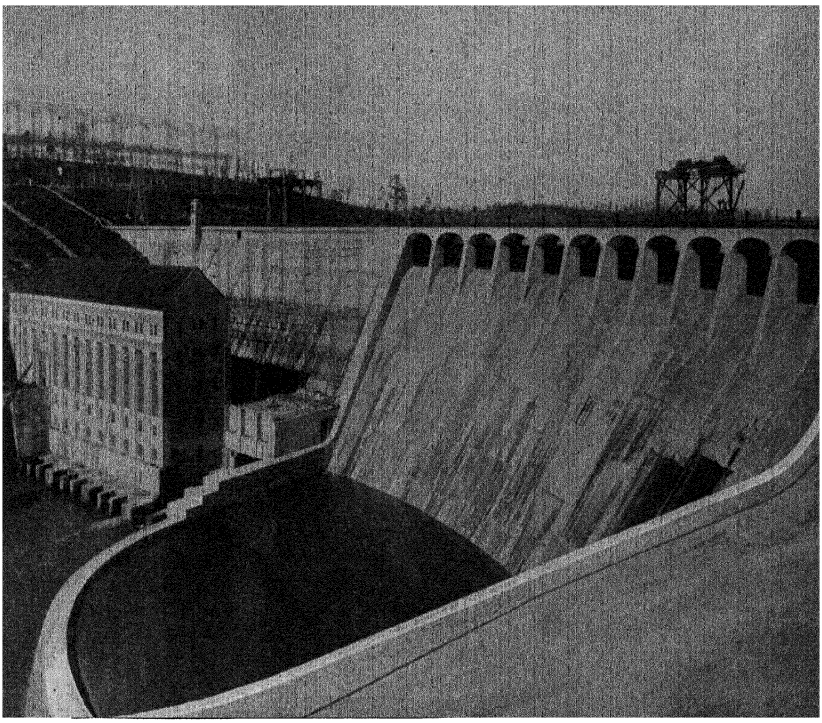
Power Supply. Power is essential to manufacturing and industry. All large manufacturing regions and cities of the world are located where some form of power is available. The two great sources of industrial power are water power and steam power from coal. The use of petroleum and natural gas as power agents is increasing. Electricity must be produced by one of the power sources, but at present the difficulty of transmitting electricity economically over four hundred miles is a limiting factor in its use.

New England early became a manufacturing region because her colonists, who were mechanically minded, made use of the presence of abundant water-power sites. Her many manufacturing cities began at water-power sites. Later, as steam power from coal became available at reasonable costs, these cities used it to supplement seasonal water power and to increase the number and size of their factories.

Our eastern and central sections have rapidly forged ahead in industry because they are generously endowed with easily worked coal deposits and many available water-power sites, coupled with accessibility to ample raw materials. Our southern section is fast becoming more industrial by its use of water-power sites, supplemented by coal power. Our Pacific Northwest, with its huge supply of water power, and the Southwest, with its petroleum, both have resources and valuable aids for manufacturing.

Several of our important manufacturing centers have ignored the use of water power in their growth and expansion, depending upon coal entirely, thus eliminating the necessity of location near water-power sites. Some cities have become great manufacturing centers because of their location comparatively near large water-power sites from which the transmission of electricity is practical.

Labor Supply. Industries with many years of success behind them naturally draw to them many skilled workers, and gradually a community where industry has become highly specialized finds itself with a large body of workmen highly

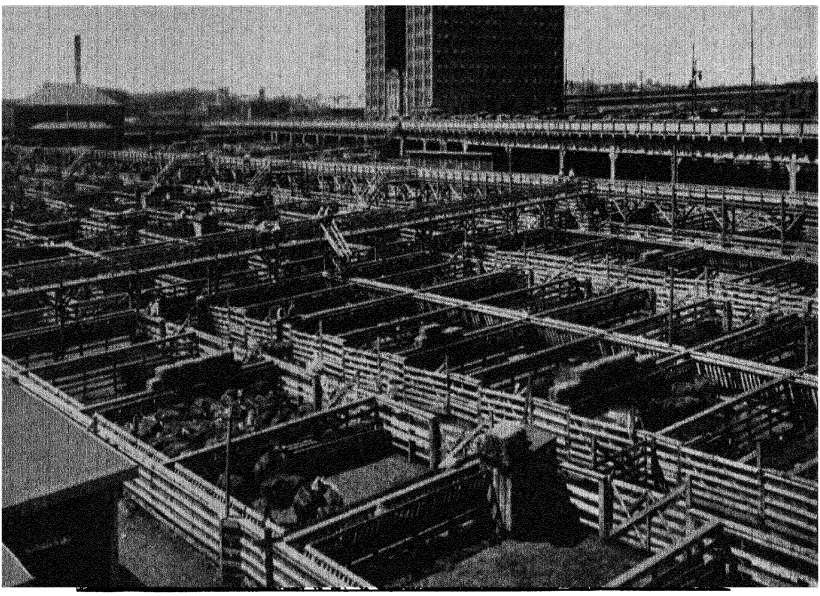


Southern Ry. System

Martin Dam, Alabama. The presence of water power is one reason why manufacturing is increasing in the South.

trained in particular lines. When a new factory of the same type is being planned, it is natural to locate it where there will be a plentiful supply of skilled workers for the industry. Cities like Elgin and Waltham have built up a reputation for fine watchmaking. It is logical, therefore, that these cities should have large numbers of skilled watchmakers and workers. Because of the presence of a number of skilled workmen, a new watch factory might find it advantageous to locate in one of these cities.

Industries in general prefer to locate in regions of dense population, where a steady supply of labor is available. In New York we find a concentration of the clothing industry because of the presence of large numbers of workers trained in the tailoring trades. Chicago attracts industries because of large numbers of available workers. The textile cities of New England are filled with operatives skilled in textile manufacturing; and, in so highly specialized an industry, a large number is necessary. The same is true of shoe production. In



Missouri Pacific R. R.

Union Stockyards, Omaha. Meat-packing centers are located in or near the corn belt, where cattle are fattened.

and around Pittsburgh, we find hundreds of workers trained in the iron and steel industry. A manufacturer seeking to locate a new factory will carefully study the labor situation; and if the industry is specialized, requiring many different kinds of skilled workers, he will naturally locate in a city specializing in the industry, where a supply of such labor is at hand.

Capital Supply. The highly organized industry of today requires a large amount of money to run its plants, to erect new ones, to pay wages, to buy raw materials, and to finance its production. This money is called *capital.* Manufacturing will grow wherever there is capital to support it. Sometimes an industry is begun in a small way in a small community. It succeeds, and the townspeople put more capital into this home industry because they can feel reasonably certain that their investment will be profitable. As the industry grows, other industries are attracted to the locality and are financed by either local or outside capital.

Outside capital is easier to obtain after local funds have built up a successful industry. Large capitalists are more willing to risk their money in a business in which conditions have already shown that the situation is favorable to success.

It is interesting to note that the savings of the people in the eastern section of our country are invested in industrial concerns near home, while the savings of the people in our western section go naturally into the expansion of agriculture.

The present system of organizing large companies by permitting all classes of people to own small amounts of stock helps to build up huge amounts of capital for investment in industry. The capital supply of several of our largest railroad systems has been furnished by the buying of stock by thousands of investors and stockholders, many of whom own but a small number of shares. Some corporations encourage their employees to invest savings in their stock; in this way added capital is brought to the companies, and increased interest in them is displayed by the employees. The presence of large amounts of capital in the East and the Middle West accounts for the location of many industries there.

Momentum of an Early Start. The peculiar circumstances present when a specific industry begins are generally the reason why that industry centers in a particular city or town, rather than in some other neighboring city.

Perhaps some man had special skill or training in the making of a particular article, and, having made a name for himself, drew others interested in his kind of work to the same town to avail themselves of the reputation thus acquired. Lynn acquired fame as a shoe city in Colonial times through the skill of an excellent shoemaker named Dagyr. It quickly became known that fine shoes could be obtained in Lynn, and this knowledge attracted other shoemakers to Lynn to share in the profits that the fame made possible.

Possibly a band of immigrants, especially skilled in some line of work, settled in a town and worked at its trade so well that a demand arose for the products. Competitors moved to the town to gain the benefit of this reputation, and so the town grew and, with it, the industry. Gloversville and Johnstown, New York, now the center of the glove trade, were settled in this manner by expert glovemakers. An Englishman named Lowell, skilled in textile making, began making textiles first in Waltham and later in Lowell, Massachusetts.

From this beginning, a concentration of the factories engaged in the textile industry has developed at Lowell.

The collar-and-cuff industry located at Troy, New York, because someone there invented the detachable collar and cuff. When these came into popular use, the industry started at Troy grew rapidly. The camera-making industry centered at Rochester, New York, principally because the first factories there were successful.

TEXT QUESTIONS

1. Explain industrial and geographical division of labor.
2. Show how modern commerce is dependent upon division of labor.
3. Discuss geographical division of labor, giving illustrations.
4. Show how geographical division of labor may be applied to cities and states. Illustrate each case.
5. Describe industrial division of labor. Give its good and bad points.
6. Give the principal causes of the concentration of industries.
7. Show in different cases how these vary in importance.
8. Discuss nearness to raw materials, using illustrations.
9. Explain the importance of being near to markets. Illustrate.
10. Show how the nature of the article manufactured influences the location of the industry.
11. What bearing has climate on the localization of industry?
12. Discuss the importance of a power supply in locating an industry. Illustrate.
13. Explain the increasing importance of the Middle West in manufacturing.
14. Why did New England, early in its history, become industrial? Why has it remained so?
15. Illustrate the necessity of a constant supply of skilled labor.
16. Show why our system of supplying capital tends to concentrate industries in certain localities.
17. Explain how an early start has been an important factor in the concentration of industries. Illustrate.
18. Which of the causes of concentration tend to locate an industry within a certain territory? Which tend to locate it at a certain point? Prove your answers.
19. What do you think was the chief reason for the location of the town or city in which you live?

PROBLEMS AND PROJECTS

1. From your own locality, give an illustration of industrial division of labor; of geographical division of labor.
2. Is it better for a man to be a Jack-of-all-trades or a master of one (a) in an isolated situation? (b) in a dense population? Prove your answers.
3. Where would you locate a factory to make each of the following? Give reasons for your choices.

a. Shoes
b. Textiles
c. Flour
d. Watches
e. Cameras
f. Beet sugar
g. Canned vegetables
h. Cheese
i. Collars
j. Iron and steel

4. Apply the following reasons for the concentration of industries in the cities given below, listing the reasons by letter in the order of their importance. Be able to locate the cities on the map.

a. Nearness to raw materials
b. Nearness to markets
c. Favorable climate
d. Labor supply
e. Power supply
f. Capital supply
g. Momentum of an early start

Minneapolis—flour
Buffalo—flour
St. Louis—shoes
Lowell—textiles
Manchester—textiles
Lawrence—textiles
Pittsburgh—iron and steel
Birmingham—iron and steel
Gary—iron and steel
Bath—wooden ships
Grand Rapids—furniture
Boston—wool
Butte—copper
Detroit—automobiles
Dayton—cash registers
New York—clothing
Lynn—shoes
Brockton—shoes
Haverhill—slippers
Gloversville—gloves
Denver—mining machinery
Troy—collars
Hollywood—films
Rochester—cameras
Chicago—implements
New London—hardware
Trenton—pottery
New Orleans—sugar
Omaha—meat
Waltham—watches
Elgin—watches
Philadelphia—textiles
Paterson—silk
Baltimore—canning
Cleveland—iron and steel
Akron—rubber goods
Seattle—pleasure boats
Tacoma—cereals
Savannah—cotton
Houston—cotton

5. Show how transportation tends to spread industries.
6. Illustrate the concentration of industries in Europe. Give reasons for this concentration.

7. Show industrial division of labor and geographical division of labor as applied to one industry in the United States.
8. Why does not the center of industry move westward equally with the center of population?
9. Give reasons for the industrial leadership of the eastern states.
10. Give the probable effects on industry if our country had been settled from the Pacific Coast eastward, instead of from the Atlantic Coast westward.

TOPICS

1. The history of the glove industry at Gloversville, New York.
2. The effects of the Great Lakes and the New York State Barge Canal on the industries of New York State.
3. The effect of the Mesabi District iron on the Great Lakes States.
4. The importance of power in industry.
5. The origin and the rise of industry in New England.
6. The westward expansion of industry in the United States.

FOR CLASS DISCUSSION

1. Chance has played the most important part in the localization of most of our industries.
2. Each country should strive to produce for world commerce those things for which it is best adapted, rather than to be self-supporting.
3. Concentration of industry is not beneficial to the country.
4. A high degree of specialization in industry is unfavorable to the interests of labor.

CHAPTER VI

GROWTH OF LARGE CITIES

Trade and Cities. Without the highly organized trade of the present time, the densely populated cities of the world could not exist. Cities must, of necessity, depend upon commerce to supply the enormous demands of their great populations. Trade, in turn, must look to the centers of industry and commerce to supply its needed commodities, to provide organization for distribution, and to furnish a market. Thus the existence and the growth of cities not only create industry and commerce but also depend upon them.

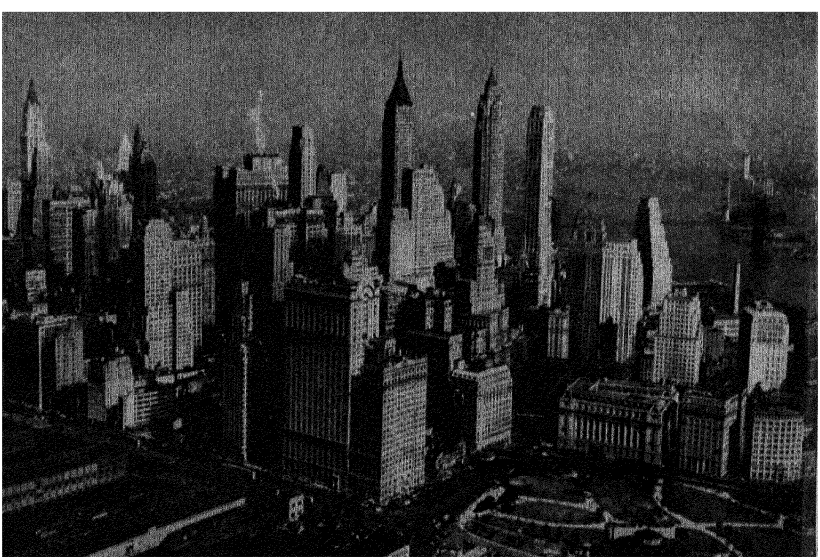
Examining the factors that enter into the origin and the growth of cities, we find oftentimes that the original reasons for the location of a city have been replaced by other elements, notably factors involving industry and commerce. Some factors that formerly were influential are now unimportant, while others have become more important. In many cases trade predominates, and cities are said to be commercial; in others manufacturing predominates, and cities are said to be industrial. Some are both commercially and industrially important. A brief glance at history shows that many cities that were formerly great trade centers have now fallen into decay, while others, although unimportant in the past, have grown to be of great commercial consequence. Although there are various reasons for the rise and the decline of cities, the principal cause is the flow of trade.

Suitable Site. It seems perfectly plain that a small city, to become large, must have a suitable site for its expansion. Some cities, not realizing at their beginning that they must some day in the future be great, paid little, if any, attention to the selection of a site; consequently, in subsequent developments lack of this attention proved costly. The city of Galveston, Texas, started on a very poor site, but has overcome this handicap at great cost. In Russia, Leningrad, formerly St. Petersburg, has found expansion costly because its original

site was poor. Cities founded in localities where expansion became easily possible have grown more readily and at less cost. Some places can never become great cities because of certain limiting physical factors in their local sites, like swamps, mountains, and other barriers to continued growth.

Hinterland. The surrounding region, called the *hinterland,* is another important factor in the growth of a city. A large city, in order to be supported, must be near a region from which products for commerce and industry can be drawn. The hinterland may contribute to more than one city, but no city can become a commercial center without a region upon which to draw. Sometimes this hinterland is sufficient to furnish all necessary products for the commerce of the city. In other cases the city may reach out for its commerce to other regions that are made accessible by transportation. Thus, although New York has a rich surrounding region, it has become a powerful trade center, reaching far into the country, to gather, even from the middle western areas, the articles of its commerce. Boston, not content with trading in the articles that come to it from its neighborhood, reaches out for its

New York has a suitable site and a great region to draw from. Through this city passes a flow of commerce both inland to the country and outward across the ocean.



commodities through all New England. New Orleans draws on the entire Mississippi Valley.

Transportation Facilities. Our commerce and, through it, our industry depend upon the rapid, easy, and cheap transportation of commodities. It is perfectly natural, therefore, that sites favored in the matter of transportation should become the important industrial and commercial centers. History shows that cities which cannot maintain equality with other cities in transportation facilities are eventually unable to compete with them. A change in trade routes, due to a change in transportation facilities, has resulted in ruin to some cities. The discovery of an all-water route to India, coupled with the discovery of America, brought about a great increase in water transportation and a consequent decrease in overland transportation. As a result the Italian cities of Venice and Genoa, and their dependent allied cities on the overland routes, lost their leadership, while the seaports of the Atlantic grew in power.

The coming of railroad transportation to our country, with a corresponding decrease in canal and river transportation, had a somewhat similar effect on some of our cities. Many of the new railway towns grew rapidly, while older Mississippi-Ohio river towns declined. The change from small sailing vessels to large steamships during the last part of the nineteenth century increased the growth of seaboard cities having deeper and better harbors, to the injury of the cities with shallow harbors.

Land Transportation Facilities. Some locations are favored in being natural topographical centers of districts. Cities grow up at junctions of valleys and at ends of mountain passes, because trade naturally follows these channels. Wherever trails crossed in early times, towns, which eventually became cities, arose. The great caravan cities of ancient times depended, in large part, for their prosperity on their location where caravan routes crossed or ended.

A place where the method of transportation must be changed, or where it is necessary to break loads and repack,

often becomes a city. Places where pack animals begin their transportation of merchandise form good sites for towns or cities. Where camels take on their loads and begin their desert routes, we may expect to find a town or city. A location where water transportation stops and land transportation begins, is one of the best locations for a city. A place where land transportation is interrupted by a river, which makes a bridge, a ford, or a ferry necessary, has frequently been chosen for the site of a town, which later grew into a city. The names of certain cities indicate clearly that this cause was prominent in their origin. Examples are: Harpers Ferry, in West Virginia; Grand Rapids, in Michigan; Bridgeport, in Connecticut; Biddeford, in Maine.

The most important kind of land transportation now is the railroad. To it, many cities owe their continued growth and prosperity. The cities on the Mississippi River looked to the river for their transportation until the coming of the railroad, which has continued their growth by increased and superior transportation facilities. As a rule, railroads have found it to be advantageous to build their lines to cities already in existence, rather than to create new cities. Some cities, however, have been greatly aided by being the junctions or terminals of railroads. Indianapolis owes its growth largely to the fact that it is a junction of several important lines. Chicago is favored in being the terminal of many railroads.

The wonderful organization of our railroads today, with their mechanical perfection, their facilities for loading and unloading, their well-laid tracks and superior equipment, accounts, in large part, for our ability to compete in world markets.

Water Transportation Facilities. Until the coming of the railroads, a favorable location along inland rivers was more important in the growth of our inland cities than it is at present. Formerly, water transportation on rivers was the easiest, quickest, and cheapest way of transporting goods. A number of famous river towns of the past, such as Cincinnati, St. Louis, and New Orleans, have retained their importance in the modern age and now use both rail and river. A site where

river transportation was interrupted by falls was particularly desired. The falls caused a break and made necessary a transshipment of goods, and therefore more men were demanded. Spokane, Washington, is an outstanding example of this fact.

The place where navigation of a river started was also favored because there, too, a break in cargo occurred. Some cities grew on well-selected locations on large bodies of water, like the Great Lakes. Duluth, Buffalo, Chicago, and Cleveland found this situation greatly to their advantage. An excellent location is where a navigable river and a good harbor are together.

Many small, shallow seaports, which did a thriving business a century ago when ships were smaller, have lost this business to seaports whose harbors are not only large and deep enough to take care of the great vessels of today, but also equipped with excellent docks and rail connections. Some are occupied chiefly with export trade; others, because of their hinterland, form the neck of a bottle through which flows a mighty stream of exports and imports.

Artificial Transportation Facilities. The construction of great artificial waterways like the Suez Canal, the Panama Canal, the Soo Canals, and the Erie Canal has changed the flow of commerce and brought about the growth of some cities and the decay of others. The Suez Canal stimulated the commerce of the Mediterranean cities. The Panama Canal has stimulated the growth of seaports on both our eastern and our western coasts. The Soo Canals made possible the transportation of huge loads of ore, which the cities of the Middle West needed to expand their industries. The Erie Canal shifted commerce coming from the West toward New York City. Inland canals, carrying great loads of slow freight, influence greatly the cities that they touch.

The building of bridges across rivers has aided the growth of some cities. The dredging of channels and harbors affects cities that need this help. Cities that have taken action to provide improved facilities for docks, like the Bush Terminals in New York, and the docks at San Pedro, Los Angeles, Cali-



Chamber of Commerce, Los Angeles

Los Angeles, the home of the motion-picture industry, is one of the important cities of the West.

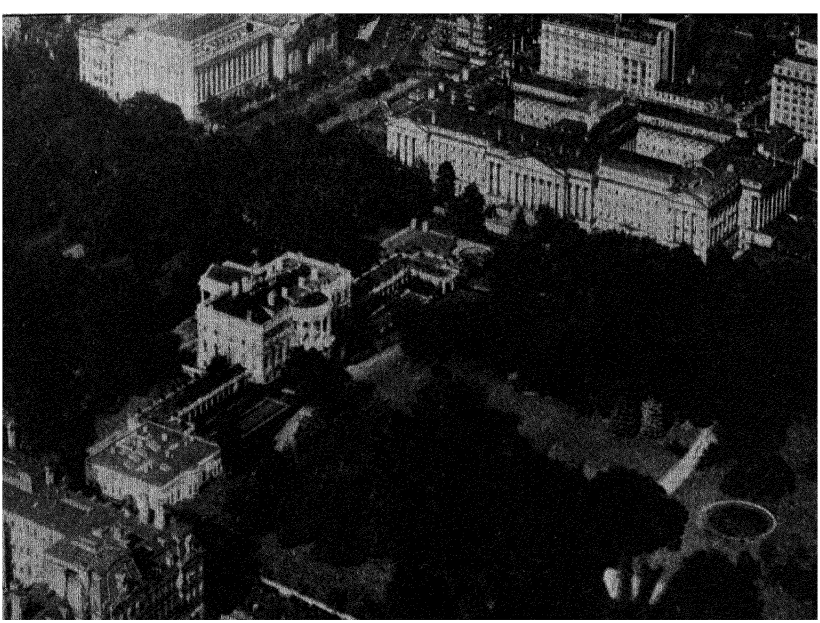
fornia, reap a harvest in increased growth. Wherever a defect in transportation facilities exists in a city today, that city must, if it wishes to continue to grow in competition with other cities, remedy the defect.

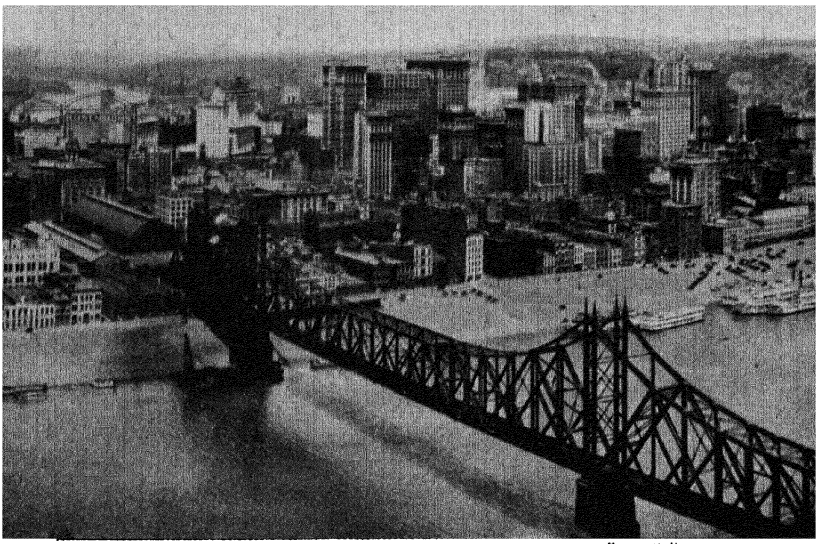
Political Causes. Many a city owes its origin to the fact that it became a seat of government and, as the capital city, obtained advantages over less favored cities. This cause was more important in olden times than it is now. Formerly the protection afforded by government played a necessary part, and trade was secondary to it. Many of these political cities, however, became natural centers of trade and so grew beyond the bounds of political needs. Rome and Athens, in ancient times, illustrated this type of origin. In more recent times also, we find cities that have grown to large proportions from a political start.

The city of Washington was made the capital of our country and drew to itself a population of lawmakers and governmental employees. Other factors have increased this population beyond governmental workers. Many of our state capitals, had they not been made seats of government, would today be small towns. Some of them have become great cities, because, in addition to their political origin, they possessed other factors favorable to commerce and industry. These advantages have made St. Paul, Indianapolis, Albany, and many other capitals large cities.

Some cities owe their start to the fact that they had a favorable location for a military stronghold or fort. A few of these cities have kept to their original purpose, but by far the greater number have outgrown it and have become mighty cities of commerce because of other favorable circumstances. Pittsburgh was at first a frontier post. Its nearness to raw materials and its wonderful transportation facilities soon helped it grow into one of the leading industrial cities of the

Washington, D. C. Three important buildings in this city are, from left to right, the Navy Building, the White House, and the Treasury Department.
Keystone View Company





Ewing Galloway

Pittsburgh, Pennsylvania. Originally a frontier military post, Pittsburgh is now a leading industrial city because of its proximity to raw materials and to markets and its excellent transportation facilities.

country. The military purpose for which it was founded has entirely disappeared. Detroit is a similar illustration. Chicago, Quebec, Paris, London, and many other old cities were founded because they were favorably located for purposes of protection.

On the other hand, some cities, prominent in early times on account of their military location, have declined because their importance as strongholds has decreased, and because they did not possess advantages to favor the flow of trade. Rome no longer holds its former high position among cities. Athens is today comparatively insignificant. Jerusalem is now a small city.

It may be of interest to note here that many cities, the origin of which may be traced to military reasons, would fare badly as strongholds today. It has been said that none of our great cities at the present time would be chosen as a site for a defensive position.

Modern commercial methods and the changes in military methods render today the founding of cities for protection purposes of little or no importance. The military factor has little, if any, value at present; only where the making of cannon, munitions, or warships is carried on, is it any longer of any influence.

Closely allied to the military factor is another. Many cities began as colonies of certain mother countries. History is full of examples of the establishment of such colonies. These colonies gradually shook off their standing as colonies and eventually became cities in their own right. Carthage was started as a Phoenician colony. Marseille was a Greek colony. San Francisco was founded by Spanish colonists. New York was settled by the Dutch. Quebec and Montreal started under French colonists.

Another phase of political power that has influenced the growth of cities is the collection of customs duties. In Europe, where customs frontiers are close together and barriers are frequent, these seats of customs collection are not, as a rule, large cities. In countries like the United States, where the boundaries are far apart, the concentration of customs collections into a few large seaports influences the growth of these *ports of entry* by causing the stream of imports to flow through them for inspection and collection of duties.

Social Causes. Religion gave rise to towns that later became cities because of the people attracted to them and the necessity of trade to supply their needs. Jerusalem, in Palestine, was the religious center of the ancient Hebrews. Mecca, in Arabia, drew multitudes of Mohammedan believers and pilgrims. Lourdes, in France, became famous for its religious atmosphere. Sainte Anne de Beaupré, in Canada, annually attracts thousands. Rome has maintained its status as a great city because it has been the home of the Pope and the principal city of a great religion.

Other cities have become famous for their educational facilities. Oxford, in England, and Cambridge, in Massachusetts, look to their great educational institutions as one of the factors in their growth. Among the chief attractions of Paris are its wonderful museums and its schools, which are visited annually by thousands of tourists and students.

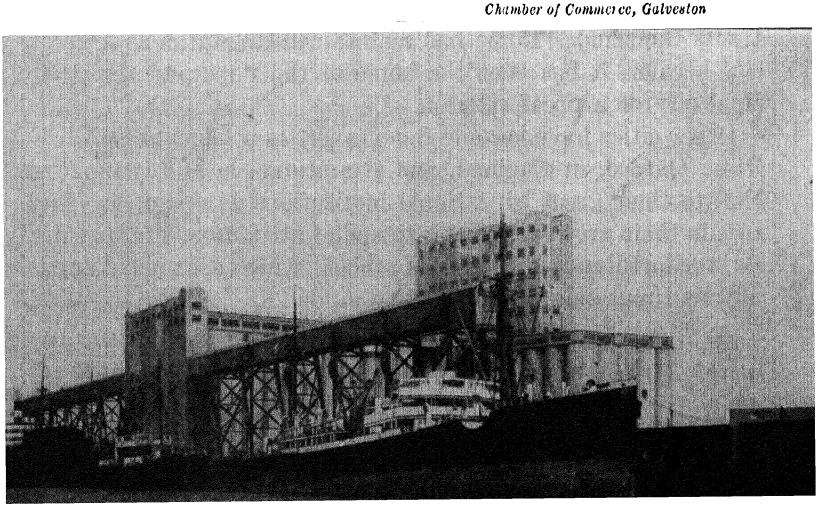
Manufacturing Conditions. It goes without saying that cities depend much upon industry. The factors upon which industrial cities depend have already been discussed in detail in a previous chapter. These factors must be present if the city

looks to industry to any great extent in order to maintain itself. Many cities began as industrial cities and have continued their growth in this respect, engaging in commerce only to provide the necessary means of disposing of the manufactured articles and to supply the demands of their populations. Other cities that depend almost wholly on commerce for their growth need not depend so much upon industrial factors.

Industry predominates in most of our middle-sized cities, while commerce generally is of major importance in our larger cities. In some large cities, however, notably Chicago and Philadelphia, manufacturing outranks commerce. It is plain to be seen that, even when commerce is its principal interest, a city cannot greatly increase in size unless industry is also present to support its great population. Some cities, like Galveston and Santos (in Brazil), have for their principal occupation commerce in exports from their hinterlands. Under such circumstances, these cities can never attain greatness. The greatest cities combine, within their limits, both industry and commerce, and have facilities for both to maintain their great populations. Only where conditions are favorable to both industry and commerce will a great city arise.

The nation's largest export grain elevator, Galveston, Texas. This elevator has a capacity of six million bushels and can load three ships simultaneously at the rate of two hundred thousand bushels an hour.

Chamber of Commerce, Galveston



TEXT QUESTIONS

1. Show how the growth of large cities has been a factor in and also a result of commerce and industry.
2. What is the principal cause of the rise and fall of commercial centers?
3. Outline the importance of good transportation facilities in the origin and the growth of cities. Illustrate.
4. Discuss the importance of land transportation facilities. Illustrate.
5. Why is a place where a break in transportation is necessary favorable to the location of a city? Illustrate.
6. Show how the cities on the Mississippi River changed from river transportation to railroad transportation.
7. What American cities are now using both railway and river transportation?
8. Show how railroads can build up a locality.
9. In water transportation, what sites are the most favored? Why?
10. Why, in the last fifty years, have our cities with deep harbors grown to the detriment of our cities with poor ones? Illustrate.
11. Make a list of some artificial transportation facilities that have greatly influenced commerce.
12. Show how some localities have built up their commerce by means of artificial transportation facilities.
13. Name three ways in which political causes affect the growth of cities.
14. Discuss the origin of cities as seats of government. Illustrate.
15. Why are not all capital cities commercial centers? Illustrate.
16. Explain the importance of military strongholds as commercial centers in the past; at the present. Illustrate.
17. Discuss the influence of religious centers on commerce, and the rise of such centers as commercial cities.
18. Illustrate the effect of educational institutions on some cities.
19. Why is it not possible for a city to become great unless there is some industrial life present to supplement commerce?
20. Give several illustrations of cities that are primarily commercial.
21. Give several illustrations of cities that are chiefly industrial.
22. Define "hinterland."

PROBLEMS AND PROJECTS

1. Apply these causes of growth to the following cities. Use the letter preceding each cause. Arrange the causes in the order of importance in each case. Be able to locate each city mentioned.

    a. Suitable site
    b. Land transportation facilities
    c. Inland water transportation facilities
    d. Good harbor
    e. Manufacturing conditions
    f. Social conditions
    g. Political causes
    h. Hinterland, or surrounding region

New York	Syracuse	Los Angeles
Philadelphia	Ann Arbor	Cambridge
Buffalo	Cleveland	Salt Lake City
Pittsburgh	Springfield, Mass.	Bangor
San Francisco	Boston	Amherst, Mass.
New Orleans	Memphis	Kansas City
Minneapolis	Albany	Princeton
St. Paul	Chicago	Baltimore
Rochester, N. Y.	Detroit	Quebec
Portland, Ore.	Hartford	Montreal
Portland, Me.	Seattle	Providence
Washington	Galveston	
Paris	Genoa	Liverpool
London	Shanghai	Calcutta
Manchester	Berlin	

2. Which of the preceding causes of growth are perpetual? Which are temporary? Give reasons for your answers.
3. Explain the fall and the loss of leadership of the following cities:

Jerusalem	Alexandria	Athens
Rome (Ancient)	Babylon	Carthage
Nuremberg	Florence	Venice

4. Illustrate how some cities grow prosperous by trading in articles produced in other cities.

TOPICS

1. A historical sketch showing the causes of growth of some large city in the United States.
2. College cities in the United States.
3. Political cities in the United States.

4. The social effects of large cities.
5. The necessity of good transportation facilities.
6. The problems of large cities.
7. The economic effects of large cities.
8. The political effects of our large cities.
9. The effects of the shifting of the trade routes during the fifteenth and sixteenth centuries on commercial cities of that period.
10. The decline of the importance of protective features in locating a city.
11. The importance of a good hinterland.
12. The future growth of large cities.

FOR CLASS DISCUSSION

1. The Golden Rule is practicable in the business of our large cities.
2. More great men have come from the country than from the city.
3. Large cities are dangerous to our form of government.
4. Efficient administration of government under conditions that prevail in large cities is impossible.
5. Large cities are desirable.
6. The political rights of our large cities are not sufficiently protected by our state legislatures.
7. Commercial and industrial competition among cities is uneconomic.
8. New York City is too large for efficiency.
9. Cities of medium size offer better opportunities to youth than do large cities.

CHAPTER VII

USE OF POWER RESOURCES

Growth of the Use of Power. In the earliest days, man depended solely upon his own strength in obtaining food, shelter, and the few comforts he had. Later, family groups grew in size and became tribes. The more powerful tribes captured and made slaves of the weaker. They forced these slaves to do the disagreeable and heavy work. Thousands of slaves toiled for their harsh masters for many generations to build the ancient pyramids. Galley slaves, chained to benches, rowed the ships of commerce and of war. The glory of Greece and the power of Rome were due, in large part, to the thousands of miserable slaves, who worked away their lives in unending drudgery to provide for the welfare and comfort of their conquerors.

We find also that man learned early in history to train and tame animals to use their strength for his benefit. Oxen drew the plows and hauled heavy loads. Camels carried heavy burdens of merchandise for traders. Horses were used for personal transportation. These and many other kinds of animals greatly lessened man's labor.

The greatest advance in man's use of power came, however, when he learned to use the great natural forces all about him. He harnessed the winds and made them drive his ships and turn his windmills. He caught the power of rivers with water wheels and made it run his machines. Eventually, he developed the great power in steam until it now does the work of millions of men.

In the United States alone, it is estimated, the work done by power-driven machines is more than equal to the work of four billion slaves, an average of more than thirty to each inhabitant.

Importance of Power Resources. So dependent are we upon machines and the power that runs them that stoppage of the power supply would result in the downfall of our present

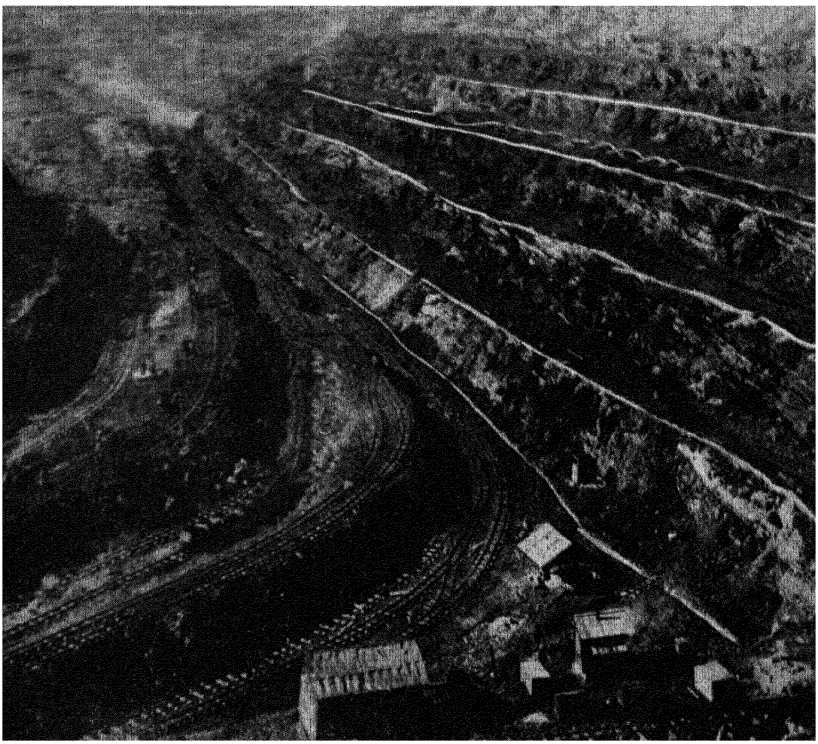
civilization. The social structure we have built on steam power alone would probably fall if the coal supply should give out. The mighty increase in the world's population and the maintenance of this population through world commerce have been made possible by steam-driven machinery. We are now so placed that even necessities of life depend upon mechanical agencies for their production and distribution. The great avenues of transportation throughout the world are maintained almost wholly by machines.

With the machine age has come also the freedom of man from much drudgery and from many mean jobs of life. So also has come a corresponding advance in man's economic life. With our higher standards of living, we find men less and less inclined to dirty and hard, but necessary, work; they prefer to throw more and more of the burden on mechanical power. With this growing demand comes a greater drain upon our power resources. Our power supply must keep pace with our industrial demands. It is of the highest importance, then, that we look to our power resources and make certain whether we are using them intelligently or wasting them foolishly.

SECTION 1—COAL AS A POWER RESOURCE

Use of Coal for Power. Coal has been used for heating purposes in China for centuries. For several hundred years England has used her coal for heating houses and for smelting. The use of coal as a steam maker, and hence as a source of power, however, is of comparatively recent origin in the world's history, dating from the Industrial Revolution in the latter part of the eighteenth century. Lacking an adequate wood supply, England seized at once upon coal as a fuel to make steam for power; and being a well-settled and naturally industrial nation, she soon led all other nations in the use of coal.

England's use of coal for steam power preceded our use of it for the same purpose, by almost two hundred years. On this continent we were busy settling our country, and our



Keystone View Company

The Fushun collieries, China, illustrate the open-pit type of mining.

population was growing at a very rapid rate. Our first sources of power were wood and water, which were much more abundant here than in England and the rest of Europe. For a while, water power was sufficient for our needs, and many leading industrial centers were built on water-power sites. Water-power locations were not, however, always the best, and the water supply was sometimes irregular in volume. It was not until about 1850 that we began to use coal much to create power.

Coal permitted a wider choice of location and also provided, at all seasons, a regular supply of power. Thus, power from coal soon came to be used in our country more than water power. While some of our large manufacturing cities, located near sources of good water power, still employ this type of power, they use steam power in time of low water to supplement the water power. At the present time coal is a source of about fifty-one per cent of our power in the United States.

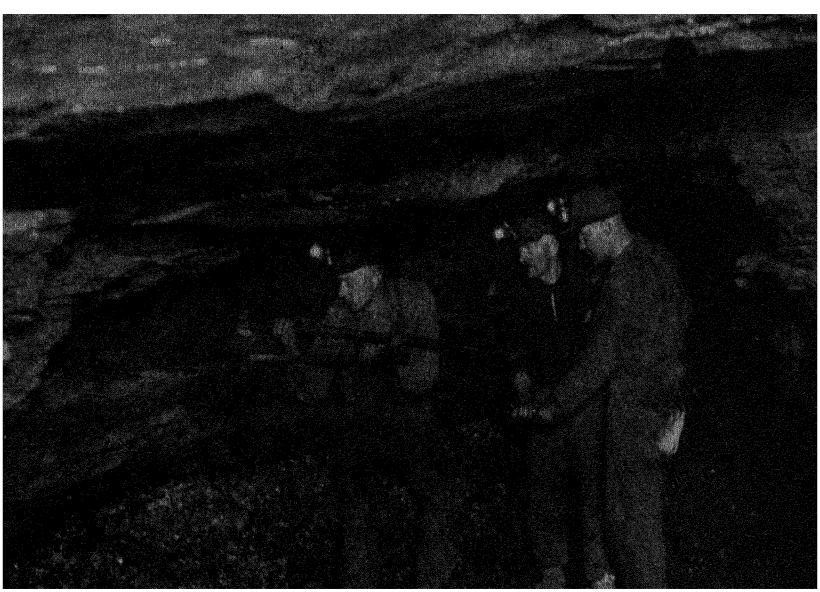
Extent of Coal Deposits. It is estimated that at present we have, in the United States, about five hundred thousand square miles underlaid with coal of various grades that may be taken from the ground with more or less ease. The ease of mining coal is, of course, an important item in the cost.

There are important deposits of coal in Canada, Germany, England, and some of the other countries of Europe. Large deposits, as yet practically untouched, are found in China. Japan's supply is limited, but she is using it in her industries. So far, coal in large deposits has not been found in Africa or in South America. Generally speaking, coal is lacking in the tropics.

The coal production of Pennsylvania alone is greater than that of all the rest of the world, except Europe, which produces about twice as much as our great coal state. In the United States, we are now mining more than one third of the world's production. Most of the coal is used at home, with relatively little being exported. Even the tremendous quantities already mined in this country amount to only one half of one per cent of our reserve supply. The significant fact to

Mining coal in a deep mine in Pennsylvania.

Keystone View Company

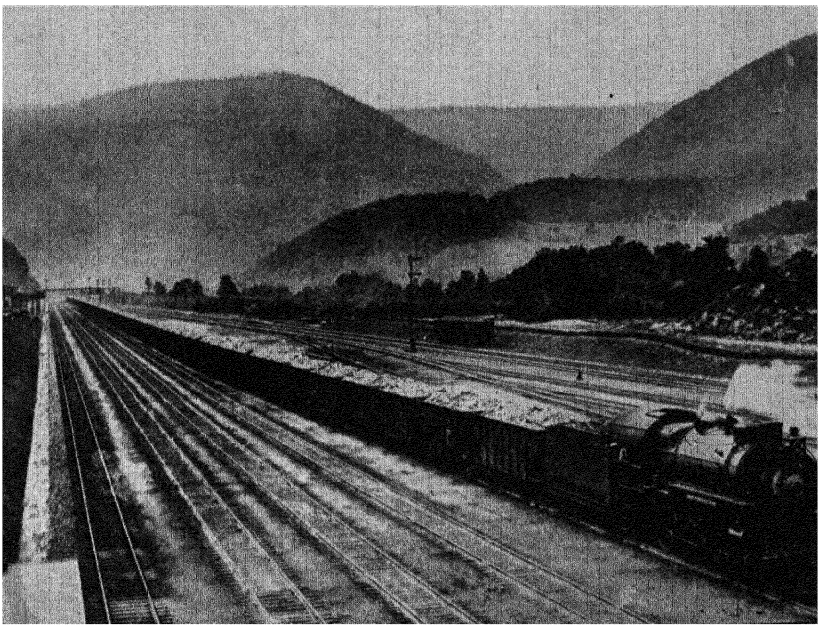


be kept in mind in connection with our tremendous production, however, is that we are mining our best grades, which are most easily obtained. This will compel future generations to pay much higher prices for inferior coal. As we go deeper for our coal, the price must rise as the cost of extraction increases. This rise in price will affect the cost of all manufactured articles and will gradually increase until coal probably will no longer be available for industrial use because of its high price.

Wasteful Methods of Mining. The present system under which our bituminous coal is being mined is far from satisfactory. Herbert Hoover has said that the coal industry is the worst managed industry in the United States from the standpoint of organization. This industry, which is the starting point of all our manufacturing, should be the most highly organized and most wisely managed of all our industries. Yet the opposite is true. This condition is due to the fact that the competitive system under which our mines have been operated leads individual owners to mine the coal in large quantities as cheaply as possible, without thinking of the future and without making any effort to save our supply. The result is wasteful methods of mining, whereby much valuable coal is lost to coming generations.

Attempts of the mine owners to organize the industry on a noncompetitive basis have so far been unsuccessful. So the wasteful competitive system goes on, and the mines are worked in an unwise way for present gain. The effect is already beginning to be seen in abandoned mines that still contain much excellent coal. This coal, however, can never be mined because of the wasteful methods, which make it impossible to get out the remaining coal and still to sell at a profit. Unscientific methods have depleted many mines and have decreased production in certain areas with great losses to our coal supply of the future.

Wasteful Methods of Distribution. Another source of waste is found in present methods of distribution. Annually, one third of our freight cars are laden with coal. It requires more



Pennsylvania Railroad

A hundred-car train loaded solidly with coal and moving through the mountains of western Pennsylvania.

than fifty million tons of coal to get these cars to their destinations. Some of this carrying could be avoided by intelligent organization of distribution, because often coal is carried from one coal field to localities near another coal field. Although it is difficult to calculate this waste, it has been estimated to be millions of car miles (a car mile means one car hauled one mile) each year.

Waste of Coal in Consumption. There is much waste in coal after arrival at its destination. The worst offenders in the wasteful use of coal have been the beehive coke ovens, in which thousands of tons of coal were made into coke for smelting purposes. This method of coke making took no account of the gases and the chemicals that were wasted in making the coke.

The usual consumption of coal to make steam provides another source of great waste. The smoke nuisance of our large cities is proof of many unconsumed parts in coal. We are anxious to use the coal to get heat, but have no thought of its other properties. Although large plants are beginning to

use coal more scientifically, thousands of small plants and householders are destroying great quantities needlessly.

Conservation of Coal. We are now, however, beginning to stop this waste in coal consumption. Producer gas plants that conserve all the coal, using the gas for power, reducing the chemicals to by-products, and producing coke for the iron industries, are being used more and more, especially in the coke-making areas; and their spread into large cities, where gas can be used profitably for power, is growing.

The manufacture of coal briquettes is increasing, especially in Europe. In this process, the coal dust and some sticky material are pressed into small balls. The briquettes not only make good fuel but also utilize what would otherwise be wasted.

Powdered coal is now being used in boiler rooms, giving an intense heat that is excellent for making steam.

One of the most promising movements to conserve our coal supply began with the Federal Government. The Government has begun a study to learn the needs for power, heat, and light, and also what would be necessary to locate several super-power stations to generate enough electricity to supply the demands in certain areas. These super-power stations could be so located as to avail themselves of power from either coal or water.

By the centralization of the production of power, enormous savings could be made. Much would be saved by eliminating waste in the transportation of coal and by using scientific methods in its consumption.

TEXT QUESTIONS

1. Trace the rise of the use of power by man from earliest times up to the present.
2. Discuss the importance of mechanical power to society today.
3. List the various sources of power in order of importance at the present time.
4. Why did England early take to the use of coal as a source of steam power?

5. Why was America slow in beginning to use coal?
6. Explain why coal power took the lead away from water power in the United States.
7. What is the extent of the world's coal deposits? What part of the world's production is mined in the United States?
8. Explain why coal must rise in price, even though we still have a great deal left.
9. Show how this rise in the price of coal will affect the price of all manufactured articles.
10. Why are our mining methods wasteful? Explain.
11. What are some of the results of poor mining methods?
12. Show how we waste a great deal of coal in its distribution to consumers.
13. Define the term *car mile.*
14. How are we now conserving our coal?
15. How do we waste coal in its consumption? Explain.
16. How may we stop this waste in coal consumption? Explain.
17. Show how super-power stations could save much coal.
18. How may much coal be saved in the coke industry?
19. In what way do coal briquettes and powdered coal effect a saving?
20. Which is our greatest coal state?
21. Define any words in this section which were new to you.

SECTION 2—PETROLEUM AS A POWER RESOURCE

Growth of the Use of Petroleum. Although its presence was known several hundred years before Christ, petroleum was little used and did not enter into commerce until the discovery, in the latter part of the last century, that kerosene could be used for lighting purposes. The refining of kerosene from petroleum and the use of kerosene for lighting purposes revolutionized the lighting methods of mankind. The sinking of new wells spread rapidly; pipe lines were constructed to conduct petroleum to the refineries; and a whole industry was built up around the extraction of kerosene from petroleum.

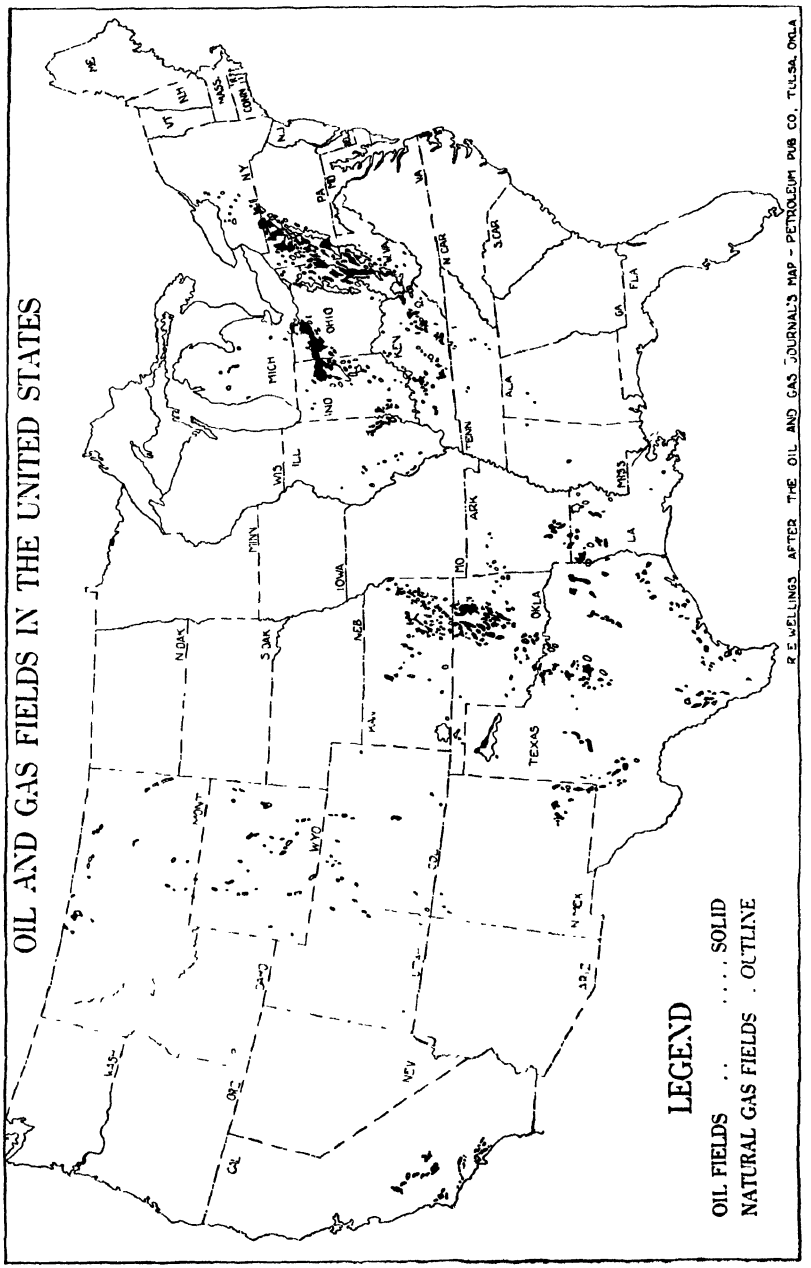
About 1900 the automobile began to demand more and more gasoline, which, up to this time, had been merely a by-product of the kerosene-refining process. Gradually the emphasis changed from the extraction of kerosene to the extraction of gasoline.

The United States leads the world in oil production. In 1936 the United States produced sixty-one per cent of the world's oil. This country produces annually almost six times as much as Russia, the second largest producer. One day's output now exceeds the annual production of only a few decades ago.

The first American commercially drilled well, sixty-nine and a half feet deep, has been succeeded by three hundred and fifty thousand wells. Many of these wells are from five thousand to ten thousand feet deep; some exceed two miles in depth.

The total economic value of crude oil to the twenty-two oil-producing states has been estimated at twenty-one billion dollars. Currently, oil constitutes twenty-six per cent of the mineral wealth created annually in the United States.

Uses of Petroleum. Although the use of petroleum is comparatively recent in history, petroleum has already found a place in our commercial and industrial life that makes it a necessity of the first importance. Petroleum and natural gas are the sources of about forty per cent of our power in


OIL AND GAS FIELDS IN THE UNITED STATES
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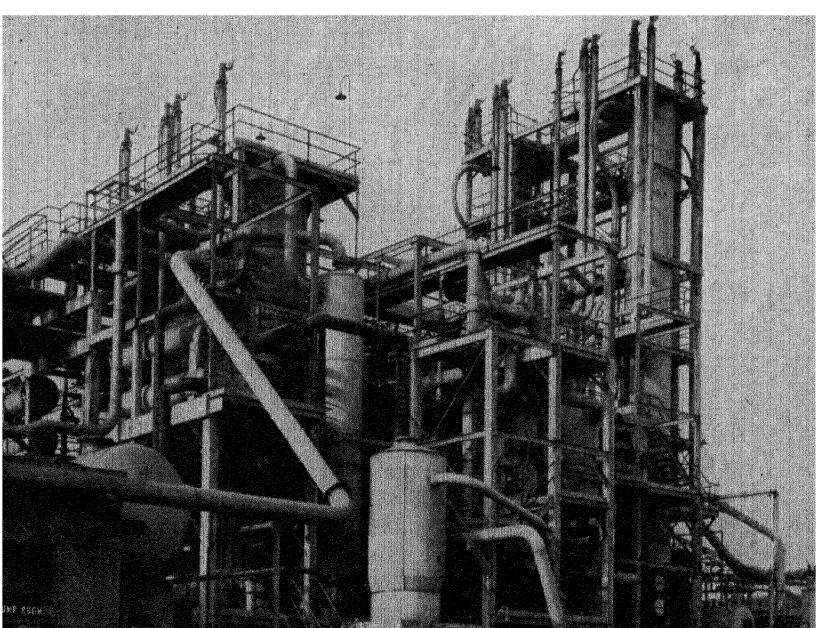
this country. Petroleum finds an important place on our farms where it is used to run tractors and other power machines, and lights. Petroleum supplies gasoline for internal-combustion engines, which run our many automobiles, motor boats, and industrial machinery. Petroleum supplies kerosene, which is the most important source of light in the absence of electricity and gas. The high-speed machinery of the present day depends almost wholly upon the various oils and greases derived from petroleum. As a source of fuel it is fast becoming popular and, in some cases, a real necessity to industrial life. Many of the important by-products of petroleum are used a great deal in industry. Asphalt, a product of petroleum, is used extensively in the building of roads and also for roofing material.

Use of Gasoline. The internal-combustion engine, when it was invented, found in gasoline an excellent source of power because of its energy, cheapness, and availability. Without

A modern petroleum refinery. The complex refining process gives commercial value to every part of the crude petroleum.

Underwood and Underwood



the presence of plenty of cheap gasoline, the automobile industry would have had a slow growth. Today the automobile industry, with its investment of many millions of dollars, depends on this supply of gasoline for its support and continued growth. Up to this time, no sufficient substitute source of power has been discovered although several possibilities have appeared. Denatured alcohol probably presents the most attractive possibility as a substitute for gasoline, but the problem of producing it cheaply and in sufficient quantities still remains for chemists and producers to solve.

Unfortunately the internal-combustion engine now used in automobiles is very wasteful of gasoline power. Less than five per cent of the energy of gasoline, it is estimated, is used in the operation of our present type of automobile engine, ninety-five per cent of the energy being entirely wasted. Improvements will eventually reduce this waste. If the energy now wasted in a gallon of gasoline could be used, our cars would run more than three hundred miles a gallon, instead of at the low mileage we now get. From this, it appears that the very machines that depend most upon the supply of cheap gasoline are the worst offenders against conservation. It is estimated that more than one million horse power, with the same percentage of waste in gasoline, is developed in this country by small gasoline engines in industrial plants and on farms.

Use of Kerosene. Although emphasis in the refining of petroleum has shifted from kerosene to gasoline, the extraction and the distribution of kerosene still occupy an important place. Relatively little kerosene is now used to produce power, the great bulk of the supply being used for lighting. People in large centers of population, where electricity and gas provide lighting, find it difficult to realize the size of the kerosene trade in regions where kerosene is the only available form of lighting. This trade assumes large proportions in our petroleum exports.

American kerosene, together with candles made from paraffin, a waxlike by-product of petroleum, goes over all the world and is found in many regions almost unknown to the

ordinary course of trade. The kerosene trade is highly organized, especially by the Standard Oil Company, which has distributing agencies wherever this form of lighting is principally used.

The use of kerosene as a fuel in oil stoves forms no small part in the consumption of petroleum, especially where kerosene is necessary because other fuels are lacking.

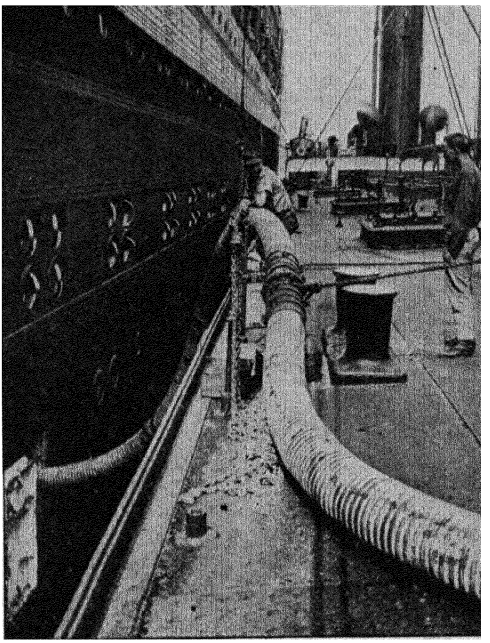
Use of Petroleum Lubricants. Modern invention has produced machines of high speed that depend wholly for their lubrication upon petroleum-extracted oils. Certain oil fields produce petroleum better adapted to the making of these oils, whereas other oil fields produce petroleum better adapted for use as fuel. Crude oils, rich in paraffin, are refined to make various grades of motor and machine oils and greases. The demand of the automobile industry for these specialized oils and greases is tremendous. Unless the wheels of industry are properly lubricated, loss will follow.

Probably one of the greatest sources of loss in the operation of automobiles is the use of poor oil: oil thinned with gasoline, or oil dirtied and filled with tiny bits of steel by the wear and tear of operation.

Some vegetable and animals oils can be used, under certain conditions, as substitutes for petroleum oils, but as yet no substitutes have been discovered that can fill the demands in quantity and for quality now made upon petroleum oils. The proper conservation of our petroleum resources is absolutely imperative to keep the supply of proper lubricants up to the constantly increasing demands of industry and transportation.

Use of Petroleum as a Fuel. The use of petroleum as a fuel is fast becoming more and more popular, especially in regions where coal is either lacking or difficult to obtain. Thus we find that the locomotives of our Southwest burn oil to generate steam, and the industries of California depend upon petroleum for their fuel supply. Our ships are using fuel oil more and more, because it is convenient to store and easy to load and handle. This is particularly true of warships, be-

cause of the necessity of loading under all kinds of extraordinary conditions. Petroleum supplies fuel also for the oil burners that are used to heat houses.



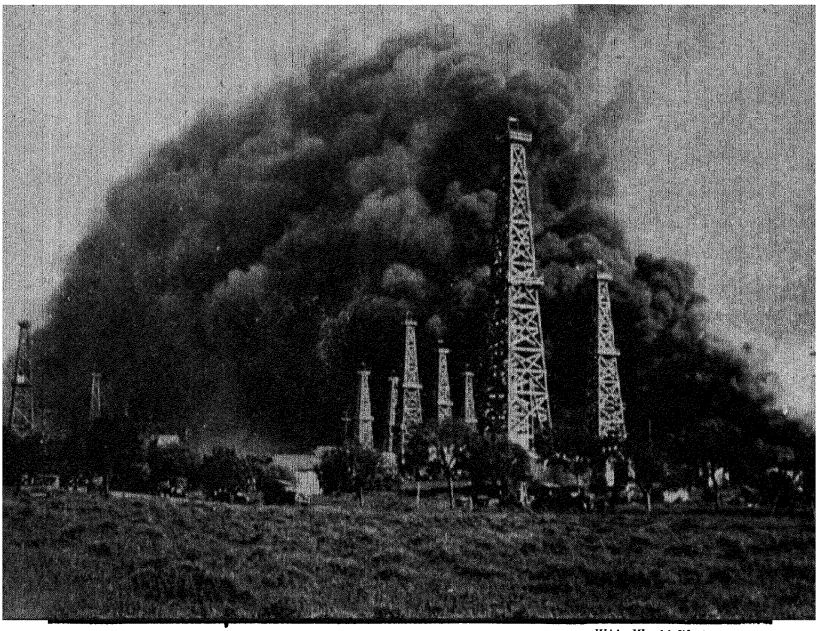
Ewing Galloway

Fueling an ocean liner from an oil tankship.

By-Products of Petroleum. The process of refining petroleum yields many by-products, some of which are important articles in industry and commerce, such as rubber solvents; asphalt; cleaning fluids; road oil; paraffin products, like wax, coated paper, and candles; various drugs; electric carbons; and vaseline products. These articles are by-products of the general processes of extracting the more desired gasoline, kerosene, and oils, and, in a way, are a form of conservation of our petroleum resources. This by-product industry has a great future, and chemists are already utilizing every part of the crude petroleum as it passes through the refineries.

Conservation of Our Petroleum Resources. Much present waste of our petroleum resources can be stopped, and our limited supply can be conserved. The present system of production, which is discussed more in detail in another chapter, can be vastly improved. The proper control of the sinking of wells would do away with many unnecessary wells. The eager rush of oil prospectors results in badly organized and highly competitive extraction of oils. To gain profits quickly, owners hasten to sink more wells than are necessary; and, in their desire to obtain as much of the oil as possible while it lasts, they take out too much oil and thus flood the market.

Poor methods have often resulted in flooding underground reservoirs with subsurface water, in this way ruining not only the well being sunk, but also others that are tapping the same



Wide World Photos

Wasteful oil fire near Los Angeles.

underground supply of oil. Scientific methods of drilling now stop this waste. Much natural gas, which is also commercially valuable, is allowed to escape while wells are being drilled. This is true particularly when gas hinders the extraction of oil. This gas could likewise be conserved and used as a source of power.

Many times, thousands of barrels of oil are wasted in bringing in a *gusher*, a well in which the gas pressure underneath the ground forces the oil high into the air, because suitable appliances to control the output are lacking. One such gusher in Mexico caught fire, and more than three million dollars' worth of oil was burned before the fire was extinguished. By the use of more scientific reservoirs and covered tanks, much evaporation is being eliminated after the petroleum reaches the surface. Leakage from pipe lines, which convey oil to the refineries, is another important item of waste. More scientific use of these pipes now results in large savings. As the price increases, more attention is being paid to petroleum conservation.

TEXT QUESTIONS

1. What discovery led to the wide use of petroleum for lighting purposes?
2. Show how the invention of the automobile increased petroleum production. Prove your answer.
3. Discuss briefly petroleum production of the United States, and its economic importance to our country.
4. Outline briefly the chief uses of petroleum for power.
5. Discuss the use of gasoline in automobile engines; in gasoline engines in general. What are the possibilities of a substitute for gasoline?
6. Discuss the use of kerosene for lighting purposes in the United States; in the world in general.
7. Show how the demands for oils and greases have affected the importance of petroleum. Explain.
8. Where is petroleum especially popular as a fuel? Why?
9. Make a list of the principal by-products of petroleum in use today.
10. Explain how oil is wasted under present conditions of production and distribution.
11. What is a gusher? a by-product? a lubricant? denatured alcohol? a pipe line? a refinery?
12. What is the difference between petroleum and gasoline?
13. Show why the automobile industry should be particularly interested in the conservation of petroleum.
14. In what forms does petroleum reach our foreign markets?
15. How can some of the waste of petroleum be stopped?

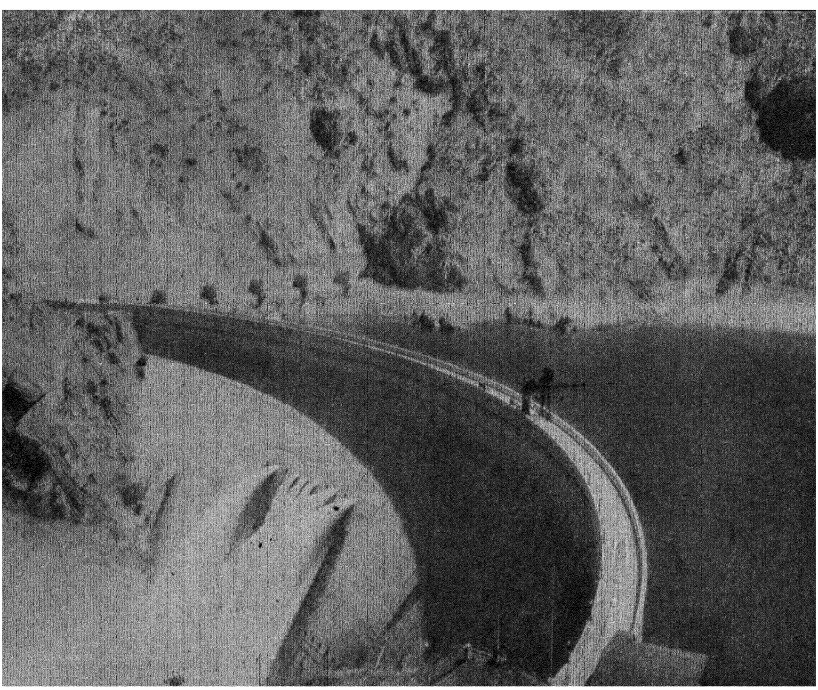
SECTION 3—WATER AS A POWER RESOURCE

Extent of Water-Power Resources. Potential water power includes water power that is not now used but could be used under certain conditions. Developed water power includes water power in actual use. An exact estimate of our potential water-power resources is impossible because of the large number of varying factors that enter into computations, such as the volume of the water at different times, storage facilities, the distance the water falls, and the location in regard to markets and industries. The actual development of water-power resources, however, can be ascertained with a fair degree of accuracy.

Although the United States uses about one third of the developed water power of the world, she uses only about one fifth of her estimated water-power resources. The Pacific States have the largest amount of undeveloped water power in

Arrowrock Dam in Idaho has a capacity of 340,000,000 tons of water.

U. S. Department of the Interior



this country, whereas the manufacturing states of the East and the South have developed the greatest percentage of their available water power. New England leads in the use of water power, availing herself of eighty-six per cent of her possible supply. Some states in the United States that are lacking in coal are, fortunately, best equipped with water-power resources.

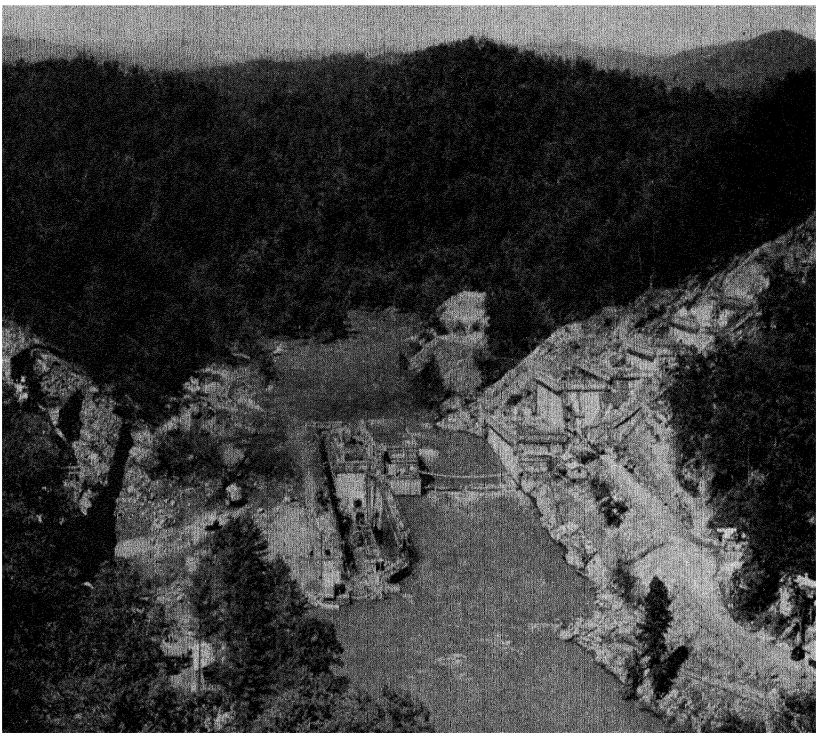
Western Europe ranks next to North America in amount of water-power resources and percentage utilized. Italy, Norway, Sweden, and Switzerland have great sources of water power and use large percentages of them.

Africa leads the continents in the amount of possible water power but has the smallest amount developed.

Recent Advance in the Use of Water Power. In this country we have developed our water-power resources to a point where they contribute only about nine per cent of our power supply.

Many of our water-power resources have been made available for power purposes comparatively recently by the improvements made in transmitting electricity. Previously water power could be used only at its source. As a result the location of factories, mills, and other users was restricted to places that, in many cases, were poorly adapted to manufacturing because of the difficulty of bringing raw materials to the factories and of carrying manufactured articles to the markets. The direct use of water power was uncertain because of the fluctuation in the water supply, the mills frequently having to close in dry seasons. Naturally, under these conditions, cheap steam power from coal was superior to water power, as factories could be better located and as there was a regular and steady supply of power.

The making of electric current and its improved transmission from water-power sites to manufacturing centers have changed this situation somewhat and freed water power from some of its previous handicaps, the water supply being made more regular by dams that hold back water to maintain a regular flow at all times. Since we have succeeded in transmitting electric current over long distances, sometimes as far as four



Tennessee Valley Authority

Hiwassee Dam under construction. This project will help to control seasonal floods on the Tennessee River and will aid navigation in months of low flow.

hundred miles, developed water power has increased in amount and in relative percentage to our general power supply.

Large Investment of Capital Necessary. Large water-power electric plants may be operated more economically than steam-power electric plants; but the large amount of money necessary to obtain a site, to erect dams to hold the water, to purchase land for reservoirs, and to install machinery and transmission lines discouraged men from extensive investments, which, although the power supply was cheap, involved interest charges on the invested capital. Men preferred the cheaper first investment, even though a larger annual maintaining charge for power was to be found in steam-power plants. Thus, only the more profitable sites have been developed for water-power electric plants.

The future use of many of our less desirable water-power sites will be delayed until the cost of coal has reached a point where it exceeds, to a marked degree, the interest charges on the large first investments necessary to develop those water-power sites. Then, too, water-power plants must compete with old, established steam-power plants, investments in which have already been made. It would be unwise to scrap these plants, especially as the coal used forms a comparatively small percentage of the annual expense of operating.

Competition with Coal Power. As long as competition governs the business world, the power that is the cheapest and best for the money at the time will prevail. How the use of power from coal displaced the early direct use of water power has already been noted. Having obtained the lead, coal still maintains it as a power supply, even in competition with the more modern use of water power in the production of electricity. With the increased use of electricity in industry came direct competition between electricity made by the use of coal and electricity made by water power, with the former leading. It is true that we are consuming our best and most easily obtained grades of coal. It is also true that in the competition of the power resources the best and most easily operated water-power sites have been developed. As coal becomes more costly, so too will the development and use of our undeveloped water power increase in cost. Probably at some time in the distant future, water power and its use through electricity will lead, but the victory will be postponed until our coal deposits are so exhausted that coal will be too costly to buy in large quantities. The use of fuel oil will affect this situation, but the reserve of this resource probably does not compare in amount with either of the two chief supplies of power.

Location of Water-Power Sites. One reason why only about one fifth of our available water power is being used is that much of it is located in the Far West and the Rocky Mountains. Power generated there must be transmitted long distances for use. Such transmission requires costly construction and installation.

California, Washington, and Oregon have developed some of their water power for manufacturing, but much of the undeveloped water power remains unavailable because of its remote location. It is true that many of the water-power sites situated near the manufacturing centers of the East and the South have been developed; but this amount of developed water power is small in comparison to the great possible water power of the Pacific and Rocky Mountain regions, some of which must remain undeveloped for many years until development will be worth while from a commercial standpoint and until the demand for power has increased to a point where operation will be profitable.

Government Development of Water Power. Certain great water-power sites in the United States have long been idle, largely for two reasons. In most cases a sufficient supply of power was already available to satisfy local needs, both home and industrial. In all cases these great natural power locations needed such costly engineering works that private capital was unable to undertake the work of development at a profit.

For many years there have been two theories of power use in this country. The older belief was that water-power sites should be developed by private capital and the electricity sold to users, giving the company a reasonable profit. The second theory was that natural power sites belonged to the nation and should be developed for the benefit of everyone, rather than for private profit.

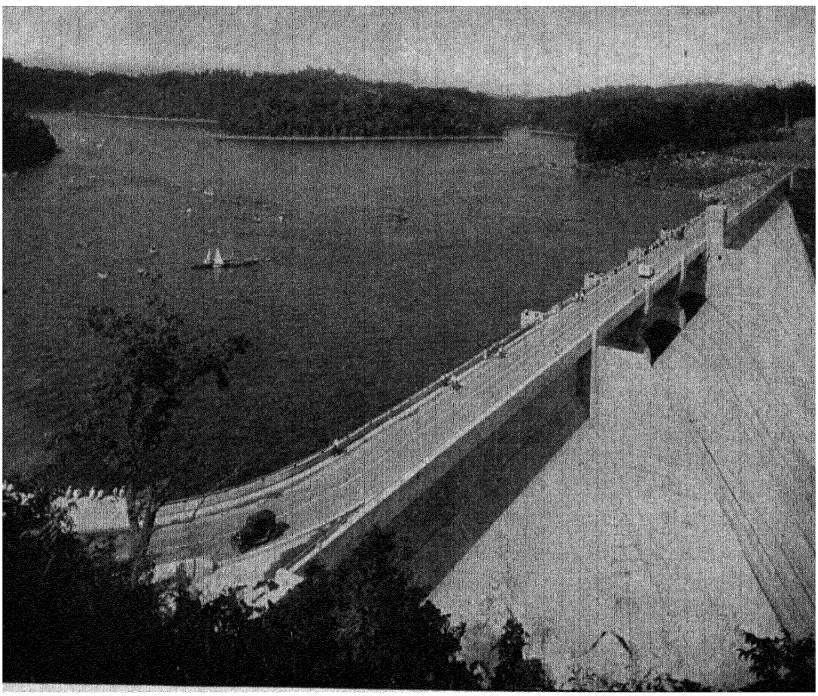
In accordance with the second theory the Government has recently begun to construct at national expense a number of great hydroelectric projects in different parts of the country. Boulder Dam on the Colorado River, the Bonneville and Grand Coulee dams on the Columbia River, and the great series of dams on the Tennessee River are examples of these new government projects. They are so costly that they could not have been built at present by private companies, but they are magnificent proof of man's modern skill in engineering. They have already provided vast new supplies of electric current for use of farm, mine, and factory, perhaps more than

can be used for many years to come. The question of public versus private ownership of water power has not been finally settled; we now have both systems and in time must work out a satisfactory solution to this great national problem.

Water-Power Projects. Niagara Falls is an outstanding example of a water-power site that has been developed by private companies for the generation of power exclusively. In most water-power projects, however, other factors are taken into consideration, such as flood control, navigation facilities, and irrigation. Thus the Great Lakes–St. Lawrence Waterways Project, to be constructed jointly with Canada, plans not only to supply large amounts of electric power to adjacent areas, but also to provide for a twenty-seven-foot channel to enable ocean-going vessels to ply between the Great Lakes and the Sea.

Boulder Dam serves to control flood and silt conditions on the Colorado River, supplies vast stretches of arid land with irrigation, and, in addition, produces an immense amount of electric power to large cities within transmission distance of it. The Grand Coulee Dam has been designed to aid in flood control of the Columbia River, to create a large amount of cheap electricity, and to increase immensely the productivity of thousands of acres by affording irrigation to dry regions nearby. Throughout the United States we find that most of the larger developed water-power sites provide a combination of services, thereby diminishing the relative cost of each service.

In 1933 Congress created what is known as the Tennessee Valley Authority (TVA) for the planned development of the Tennessee River Basin. The purposes of this act are flood control; national defense; soil conservation; reforestation; generation of electric power; manufacture of fertilizers; improvement of navigation, agricultural, and industrial facilities; and the general improvement of living conditions of the inhabitants. Thus was started one of the greatest experiments in governmental planning, the success or failure of which will be watched with much interest by all of us because of the tremendous problems and costs involved.



Tennessee Valley Authority

The first regatta on Norris Lake, September 6, 1937. The Norris Dam project is one of the important units in the Tennessee Valley Authority program.

Improvement in navigation facilities to provide a channel nine feet deep from the mouth of the Tennessee River to Knoxville, Tennessee, calls for ten great dams. These dams, by holding back the excess water, can control flood conditions and insure a regular and steady flow of water at all seasons. Some of the larger dams, such as the Wilson Dam, the Norris Dam, and the Wheeler Dam, are used also to generate electricity for use in neighboring communities at rates so low that the private electric companies could not successfully compete with these government-owned plants. The great dam at Muscle Shoals, started during the World War to supply munitions, can now be operated for the manufacture of cheap fertilizer and for the production of large quantities of power.

The important water-power projects in the United States are discussed fully in Chapter XIX.

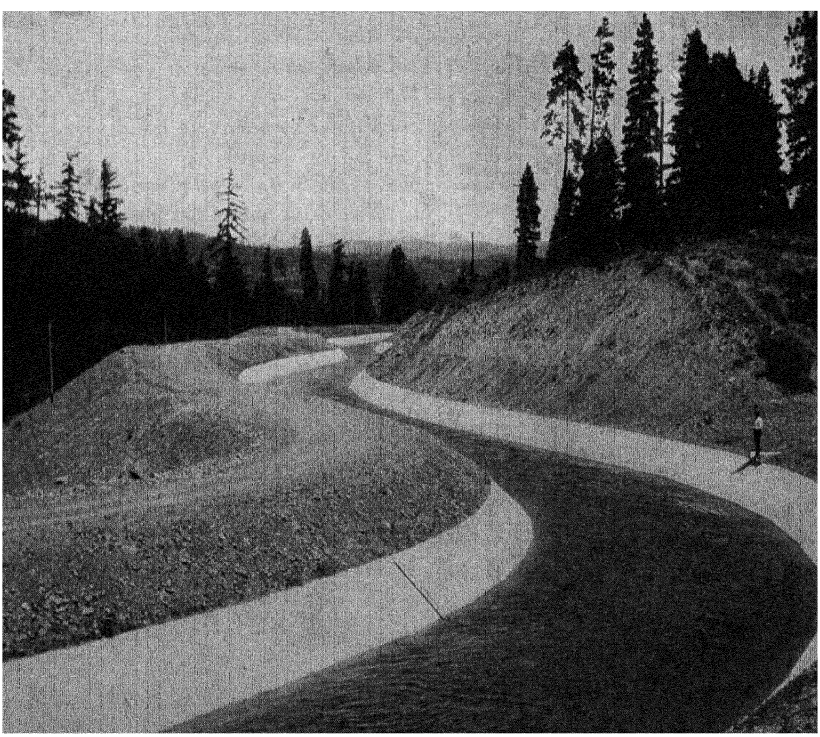
Irrigation Projects. In connection with the use of water power, there is another factor—irrigation. At some water-

power sites, water can be used not only for power to generate electricity, but also for irrigation of what would otherwise be barren land. This combination of power and irrigation diminishes the relative cost of each and makes practicable what would otherwise be doubtful ventures. Many of our Western lands are being reclaimed through irrigation and made to produce heavily. As mentioned before, where power sites and dry areas are found together, the combination works well for both. Detailed discussions of the irrigation projects in our country are given in Chapter XIX.

Water Supply for Large Cities. One of the great problems confronting every large city is that of an adequate pure-water supply. Many times, this necessitates the taking of hundreds of acres of land for reservoirs to hold the dammed-up waters.

An irrigation canal built in the state of Washington as a part of the Yakima Federal Reclamation Project.

U. S. Bureau of Reclamation



Great care must be used to protect the water stored in these reservoirs from pollution. The water is brought many miles through aqueducts, at great cost, and is then pumped through smaller pipes to thousands of homes. The amount of water used by even a small city is enormous. As our cities grow, so also does the problem of the water supply become more difficult to solve; and plans must be laid, far in advance of expected demands, to supply the needs of an ever-increasing city population.

TEXT QUESTIONS

1. Why is it difficult to estimate our potential water power?
2. Where are the least-used water-power resources in the world today?
3. Why do we not use more of our water-power resources? Explain.
4. What section of the United States uses the greatest percentage of its available water power? What section uses the lowest percentage? Why?
5. What has led to the increased use of water power in the United States?
6. Why is a large investment of capital necessary in the development of water power?
7. Explain why, at present, some of the water-power resources of our western areas are unavailable for industrial purposes.
8. Discuss the competition between coal power and water power.
9. Suggest, giving reasons for your answer, when water power will outrank coal power in use.
10. Explain the two theories of water-power development. How do they differ?
11. Describe the activities of the Tennessee Valley Authority.
12. Name and locate several of the great water-power projects in this country.

PROBLEMS AND PROJECTS

1. Collect pictures of all kinds of power plants.
2. On an outline map, indicate the present coal resources of the world.

3. On an outline map, indicate the known petroleum fields of the world, including those of the United States.
4. Draw up a list of all the kinds of power used by man.
5. What kinds of power are used in your community?
6. Is electricity available in your community? Where does it originate? What kind of power furnishes it?
7. Where does your drinking-water supply come from? Trace its journey from the source to your house.
8. How can some of the waste in the mining of coal be stopped? Explain.
9. List the advantages and the disadvantages of coal, of petroleum, and of water as sources of power.
10. Where do railroads use the most electricity?
11. Discuss the coal supply of the future.
12. List the advantages and the disadvantages of super-power plants.
13. Discuss the future supply of gasoline.
14. Show the influence of water power on early New England.
15. Explain what would happen if our power supply was suddenly stopped.
16. Make a list of magazine articles, pamphlets, and books dealing with the subject matter in this chapter.
17. List all the water-power projects now under government ownership.

TOPICS

1. Ways in which to save coal in heating houses.
2. The history of oil production in the United States.
3. Irrigation projects in the United States.
4. Government power projects now under construction.
5. Heating by oil.
6. Petroleum as a source of power.
7. The history of electricity.
8. The water supply of some large city.
9. The conservation of power resources.
10. Coal strikes and their effects on commerce.
11. The power supply of the future.
12. Super-power plants.

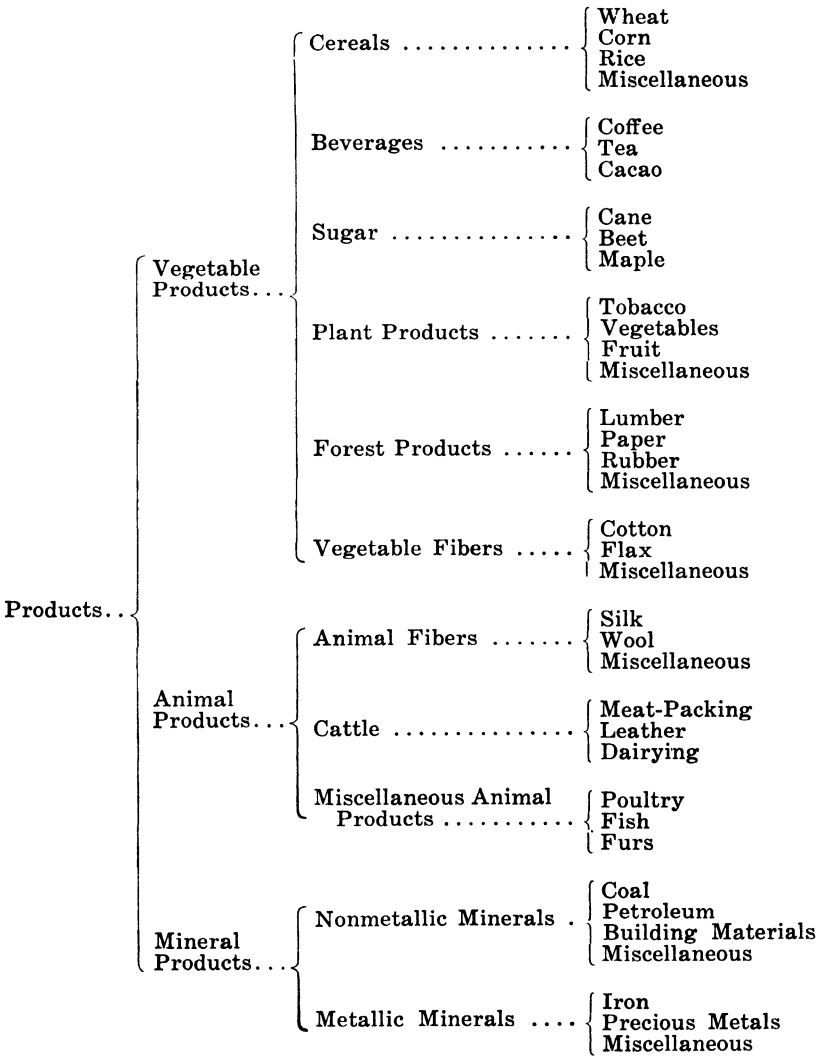
13. Diesel engines.
14. The Tennessee Valley Authority.
15. The Bonneville Dam.
16. Boulder Dam.
17. The Grand Coulee Dam.
18. The Great Lakes–St. Lawrence Waterways Project.
19. The dam at Muscle Shoals.

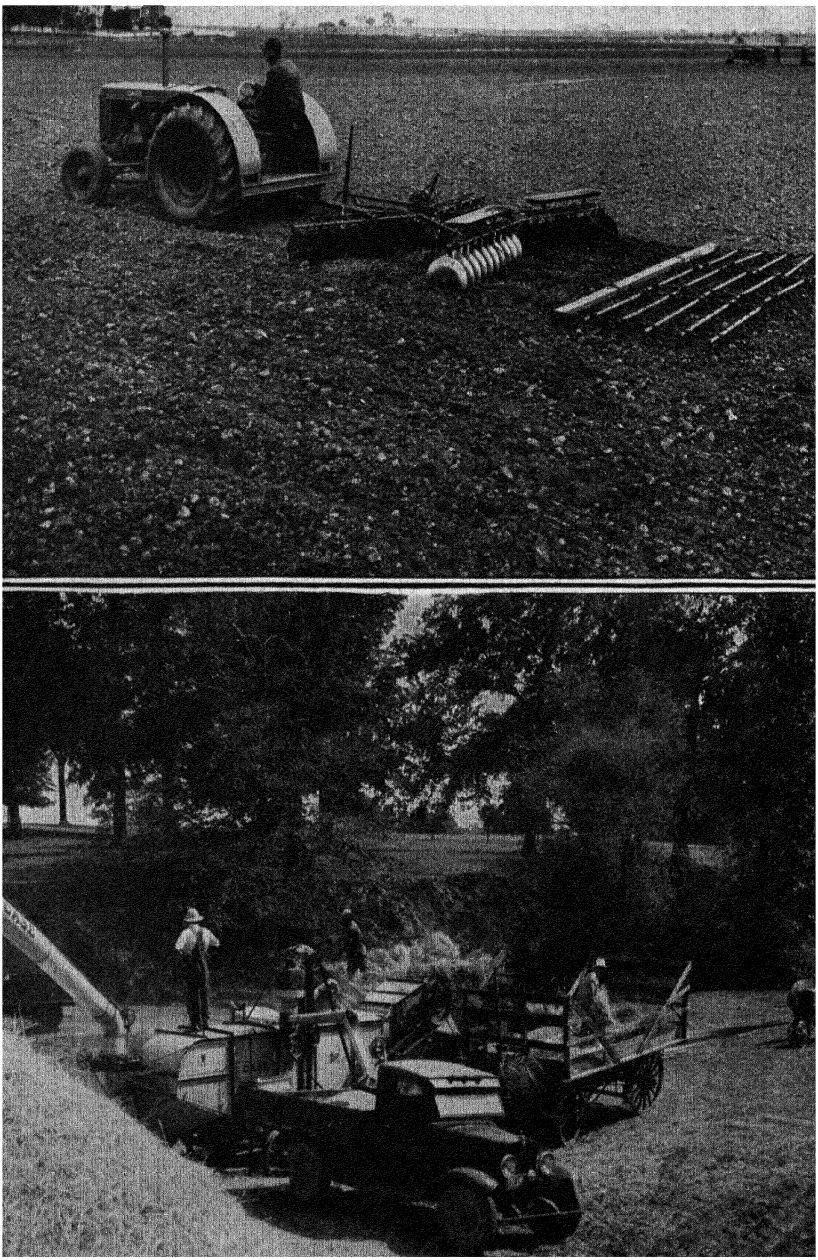
FOR CLASS DISCUSSION

1. Water power is more economical than steam power.
2. Petroleum will eventually displace coal as a house-heating agency.
3. The Government should own the coal mines and control the production of coal.
4. Development of power resources by the Federal Government is not justified.
5. Petroleum is a source of international friction.
6. The exportation of petroleum products from our country should be stopped.
7. When irrigation and water power can be combined, power projects are more likely to be worth the expenditures involved.
8. The automobile interests should own and control the petroleum industry.
9. Coal will outlast petroleum as a power resource.
10. The Government should own all power resources and should control their distribution.

PART II

PRODUCTS OF COMMERCE AND INDUSTRY





Machinery is used extensively both in the cultivation and in the harvesting of wheat.

CHAPTER VIII

CEREALS

SECTION 1—WHEAT

History of Wheat. The use of wheat as a human food goes back far beyond written history, but it is generally agreed that wheat was first known in western Asia. We know that wheat was cultivated in China at least three thousand years before Christ, and records in the pyramids tell us that it was popular as a food among the ancient Egyptians. The Bible constantly refers to wheat, its first reference occurring in Genesis, the first book of the Bible. In translations of ancient writings, the word "corn" is taken to mean "grain," and most of the grain referred to as "corn" was wheat.

There seems to be no reason for believing that wheat was known in the Americas before the coming of the Europeans.

Up to the Revolutionary War, cultivation of wheat in the United States was confined to the original thirteen colonies. After the Revolution, its cultivation began a westward march; and at the completion of the Erie Canal, the center of the wheat industry was in western New York and Pennsylvania. As pioneers pressed westward, the center of wheat production followed them and, in 1880, crossed the Mississippi River.

The increase in diversified farming in the East has cut down the amount of land available for large wheat crops. More attention has been given to dairying and truck farming, and farms have become smaller. Then, too, the soil of some eastern farms is not so fertile as it was formerly, because it has been used for many years.

As land becomes more expensive, the western wheat lands that are suitable will gradually be used more in intense and diversified agriculture, and large areas now under wheat cultivation will be divided into small farms raising small crops of various kinds. Until that time cheap land and extensive cultivation will hold the wheat center west of the Mississippi River.

Growing Conditions of Wheat. Wheat thrives best in a loamy, well-drained soil. It requires, at the beginning of growth, a cool, moist period in which to sprout the seeds and start healthy stalks. Moisture increases the number of stalks and hence the final yield. Later, after the seeds have sprouted and the stalks have a good start, warm, dry weather is best. This kind of weather causes the grain to ripen and prevents such wheat diseases as rust and mold.

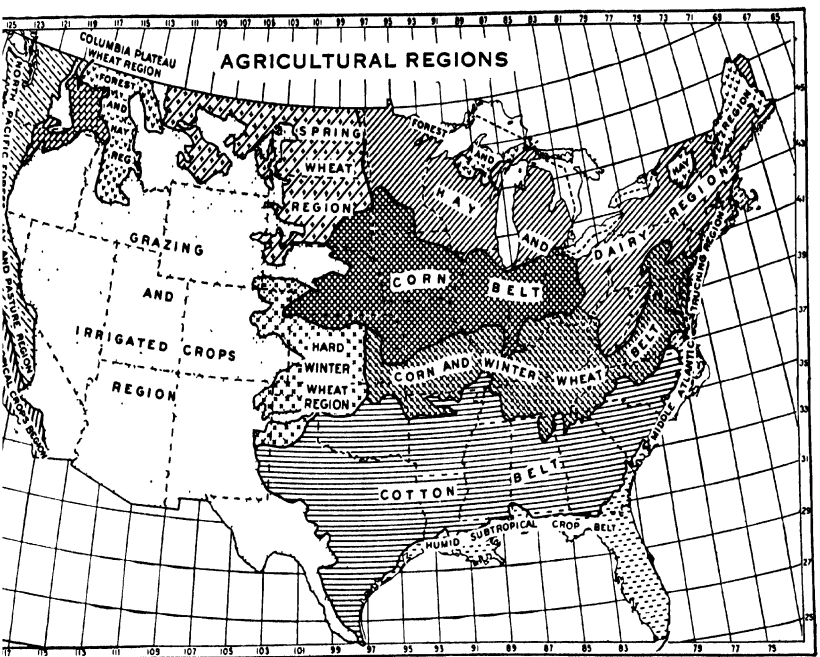
The wheat of Egypt, the Mediterranean countries, and the United States, especially California and the Columbia Plateau region, because of a sunny ripening period, is much brighter in appearance than that of the central and northern European countries. A long, wet winter without too much frost, followed by a cool, moist spring and by a warm, dry summer, makes the ideal combination of weather for wheat.

Classifications of Wheat. The United States Department of Agriculture divides wheat into five commercial classes: (1) hard red spring wheat, (2) durum wheat, (3) hard red winter wheat, (4) soft red winter wheat, and (5) white wheat. In general, most spring wheat is hard wheat, and most winter wheat is soft wheat.

Spring wheat is planted in the spring and is harvested in July and August. It is rich in gluten, a sticky substance, and makes the best bread flour. It is planted in regions in which severe winters make fall planting undesirable. It is raised chiefly throughout most of the northern part of our wheat belt.

Durum wheat is a very hard wheat used much in macaroni making because it has a high percentage of gluten. It is a very hardy kind of wheat and can be grown in regions of small rainfall. Its yield is greater than that of any other kind, and it is becoming very popular in our country.

Winter wheat is planted in the fall and is reaped in June and July. Although it is not so rich in gluten as spring wheat, it is richer in starch, and is used much for pastry flour. It is raised chiefly in the central and southern parts of our wheat belt, where there is less danger of the crop being killed by



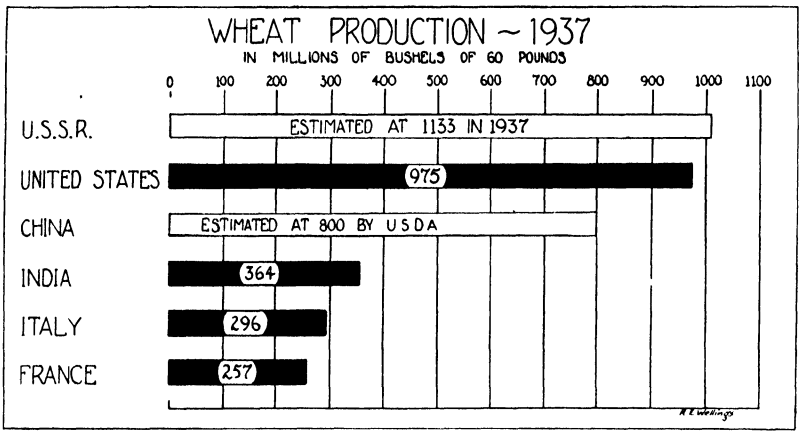
U. S. Department of Agriculture

cultural regions. Note especially the regions devoted to spring wheat and winter wheat.

the cold during the winter. This wheat forms about two thirds of the wheat crop in this country.

Wheat in Russia. Since the year 1932, Russia has led the world in wheat production and has been a leading wheat exporter. With modern machinery and intelligent methods, Russia can remain the greatest wheatgrower in the world. She is increasing her yield per acre, which has been the lowest in the world. She has plenty of cheap labor. The establishment of better transportation facilities would greatly help in moving her immense crop.

The loss of the Russian wheat supply, during the World War and after, was met principally by the United States, Canada, and Argentina. Now that Russia has regained her former place in wheatgrowing, there is a large overproduction of wheat throughout the world in general, notwithstanding the fact that the demand for wheat has increased. This



overproduction has caused lower prices, resulting in losses to many wheatgrowers. Cheaper methods of production, increased consumption of wheat, or a cutting down of wheat production must result.

Wheat in China. In the absence of any exact figures from China, the amount of wheat raised there can only be estimated. The United States Department of Agriculture estimates China's wheat crop in normal times to be 800,000,000 bushels annually. Most of this is winter wheat. None of it is exported because of the great population there, which consumes the entire crop. The demand for wheat in the Orient is increasing, and wheat is becoming an important competitor of rice there.

Wheat in India. India ranks high as a wheatgrower. Most of India's wheat is grown in the northwestern part, much of it under irrigation. It is grown on small areas of land by farmers using primitive methods of cultivation and harvesting. As a result the wheat is in bad condition, full of chaff and dirt, and poorly graded, when it reaches the European markets, where it naturally brings a much lower price than the wheat of competing countries.

The amount of the crop produced varies from year to year, being determined somewhat by the amount of the other cereal

crops and somewhat by climatic conditions. The quantity exported varies also. In times of abundant crops, the amount exported is larger than normally; in times of crop failures, especially those of other cereals, it is smaller. It averages about one sixth of the quantity produced. England imports most of this wheat.

Wheat in Canada. Because her supply exceeds her demands, Canada has become one of the leading wheat-exporting countries. Her great wheat regions in the provinces of Saskatchewan, Manitoba, and Alberta lie just north of the wheat regions of the United States. The climatic conditions are favorable; the soil and topography lend themselves to the extended use of machinery; and the long summer days, due to the more northerly latitude, cause rapid growth.

Canada's people are of the same type as those of the United States and employ the same methods used in our own wheat regions. Railroad facilities in Canada are well planned and operated, and water transportation, via the Great Lakes, is also available. Some wheat is now being moved north to Hudson Bay, and much goes westward to Vancouver, for export.

Since 1932 Canada's wheat production and exports have declined because of world market conditions and other economic factors. Canada, however, remains the leading exporter of wheat in the world. Recent trade treaties between the United States and Canada will probably result in much more of Canada's surplus wheat passing to and through our country.

Wheat in Europe. The European countries, especially France, Italy, and Germany, are large wheat producers; but, because of their dense populations and large industrial centers, they are also large consumers of wheat. When they cannot produce enough wheat to satisfy their demands, they import wheat from other countries to make up the difference. Since 1932 France and Italy have steadily decreased their wheat imports, mostly by increased domestic production. Hungary, however, ranks high as a wheat exporter, having



Underwood and Underwood

Harvesting time in northern France. Note the high, even stacks in which the bundles of wheat are kept until they are threshed.

more than doubled her wheat exports since 1932. Russia sends her enormous wheat surplus to supply part of the European market.

In Europe there is a very intensive system of wheat cultivation because of the scarcity and the high value of farm lands. The highest average yield per acre is found in northwestern Europe. France, with an area smaller than that of Texas, and with only one eighth of that area planted in wheat, is one of the leading wheat producers of the world.

Wheat in Argentina. In the southern temperate zone, Argentina ranks well up in the list as a producer and an exporter of wheat. Both her soil and climate are well adapted to wheat-growing. Because of her relatively small population, Argentina has a large wheat surplus for export. She has been held back because of the absence of adequate transportation facilities and lack of capital, but she possesses an advantage in the nearness of her wheat-producing areas to the ocean.

Wheat in Australia. Australia, while unimportant as a wheat producer in comparison with many other countries, ranks high as an exporter because of her small population and limited local consumption.

Wheat in the United States. Conditions in the United States are ideal for extensive wheatgrowing. Vast prairies of com-

paratively cheap land, free from rocks and trees, and in but little need of fertilizers, encourage the operation of large farms by machinery.

Because of several reasons, such as extensive droughts and the crop restriction policy of the Federal Government, the wheat production in the United States dropped exceedingly from 1932 to 1937. Up to 1934 our country was an important exporter of wheat, but from then to 1937 our imports of wheat were larger than our exports, primarily because of low prices in the world market, domestic demand, and reduced crops.

What the future of wheat production in the United States will be is difficult to foretell because of the many economic factors involved. Our country has all the natural factors necessary for a tremendous wheat production, provided the economic factors are favorable. Because of present economic conditions, farmers are turning more and more to other crops and to diversified farming in general.

The long haul from our western wheat farms to ocean ports is a distinct disadvantage to us; but the wonderful facilities of transportation, together with the ingenious devices for handling wheat in bulk at the terminals, greatly lessen the costs. Our western ports form an outlet to the Orient, where increasing demands for wheat are encouraging, especially when Oriental production of wheat falls short.

Wheat Belts in the United States. Wheat is grown in all the states of this country, but only in certain areas does large-scale production occur. Between northern Texas and Canada lies the chief region of production. There, the growing conditions for wheat are excellent. The rainfall, generally, is satisfactory and well timed; the soil is right; and the character of the surface is favorable to operations on a large scale.

The states of the northern section of this belt, North Dakota, Montana, South Dakota, and Minnesota, grow spring wheat because the severity of the winters there discourages fall planting. Kansas, Nebraska, Oklahoma, and Texas, in the southern section of the belt, grow winter wheat because the

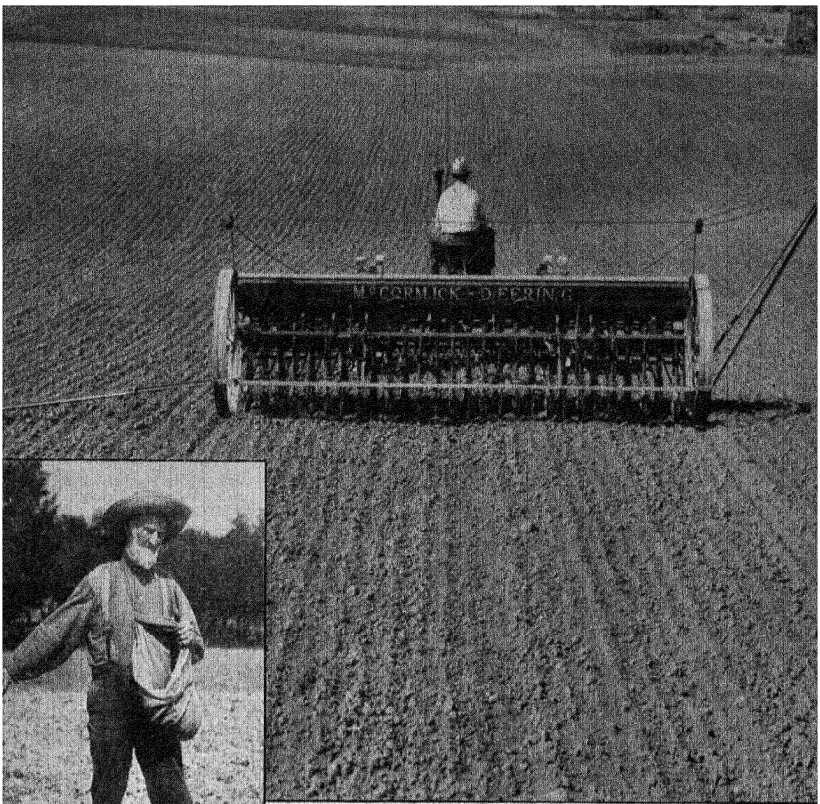
winters are mild and allow the fall planting and early growth of seeds in the spring.

Another wheat belt of the United States is eastern Oregon, eastern Washington, and Idaho—the region known as the Columbia Plateau. There, both spring wheat and winter wheat are successful. A special kind of soft white wheat, rich in starch, and in demand for export trade, has been developed for this region by the Washington State College. Although the rainfall is limited, it is sufficient and comes at the right time. Irrigation for some of this area is planned upon the completion of the Grand Coulee Dam Project. There, as in California, the climate is favorable to the growing of a bright wheat. So dry is the wheat in this region at harvest time that the grain can be cut and threshed, without delay, directly from the stalks.

The eastern states, while growing wheat to some extent for local use, do not enter into wheat production on a large scale.

Wheat Planting. In wheat planting, all kinds of methods are used, ranging from the most primitive in backward countries to the most modern in the United States. In backward countries the soil is broken up by crude wooden plows drawn by different kinds of animals. The seed is scattered broadcast by hand and then is covered with soil by dragging old trees or brush over it. This method is wasteful because many of the seeds are not well covered and therefore are eaten by birds or die from exposure.

The most up-to-date methods are used in our country. The soil is broken up by steel plows drawn by horses or tractors. On the larger wheat farms, tractors are used to draw great gang plows, which consist of from six to twelve plows, all making furrows at the same time. After plowing, the soil is generally broken up into smaller pieces by harrowing, which is done by tooth-harrows (large frames with spikes in them) or by disc harrows, which resemble steel pie plates set on edge a small distance apart. The seed is planted by seeders, or drills, which make a shallow furrow, or hole, into which they drop the seed, and then cover it up with earth. This method



International Harvester Company

The sower in the illustration at the left is slowly broadcasting seed by hand. He can plant only a few acres in a day, and that planting is done inefficiently and wastefully. By means of the tractor drill illustrated above, the grain farmer is able to plant from forty to fifty acres of wheat in a day. Because the wheat is planted evenly, a uniform growth of the grain is insured.

of planting gives more assurance of a successful crop, saves much time, and avoids much waste.

Wheat Harvesting. For centuries the sickle was the only reaping tool in the world, and it is still used extensively in backward regions. In the early 1800's, in America, the cradle scythe with long fingers parallel to the blade was invented. On the majority of the wheat farms in the United States, harvesting is done by the reaper-binder type of machine, which cuts the wheat and binds it into bundles, which are then stacked up to dry. These machines may be either

horse- or tractor-drawn. Wheat is also harvested by machines, called *combines*, which cut off the heads of the wheat, thresh the wheat, weigh it, and pack it into bags ready for shipment. The use of combines is especially common in the great wheat fields of the Far West and on the Columbia Plateau, where the wheat ripens and dries on the stalk.

Threshing. *Threshing*, the separation of wheat from its stalks, is carried on in backward regions in the same way in which it was in ancient times. The wheat is spread over hard earth or stone floors, and then animals are driven over it so that their hoofs will separate the kernels from the stalks. For centuries wheat has been threshed by hand also, a tool called a *flail*, two stout sticks fastened together by straps, being used. After threshing, the wheat is winnowed or cleaned by being thrown into the air with scoops in order that the wind may carry away the chaff, bits of straw, and dust. The wheat kernels, being heavier, fall to the earth more quickly.

In the United States, great machines, called *threshing machines*, move from farm to farm threshing the wheat crop as they go. Sometimes these machines are run by steam power and sometimes by gasoline engines. The wheat is thrown into the threshing machine, which threshes it, separates the straw from the wheat, cleans the wheat, weighs and measures it, and pours it into the waiting wagons.

Wheat Storage. From the thresher, wheat is generally taken to the grain elevator, near the railroad. Here it is stored until transportation. Upon arrival at the local elevator, the wheat is graded, and a receipt is given to the farmer. The receipt will be cashed at any time by the elevator company, its value depending upon the market price of wheat on the day it is cashed.

Large wheat companies then take the wheat from the local elevators to centralized shipping points. At the great shipping centers, we again find grain elevators, this time with immense capacity. The wheat is stored in these until it is ready for shipment; it is then loaded into ships by the force of gravity. Ships are unloaded by the use of the vacuum prin-



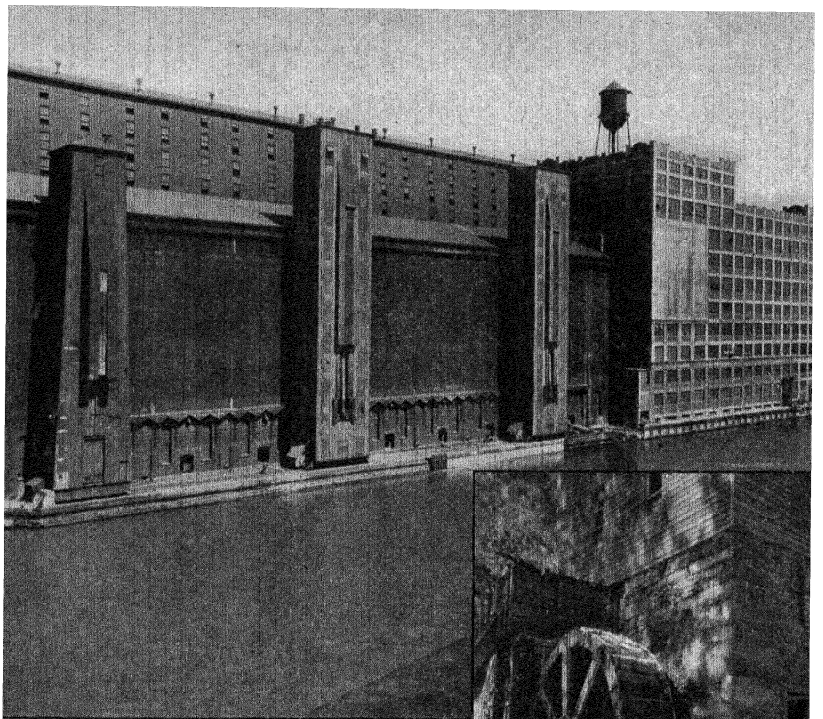
International Harvester Company

Contrast the harvesting of wheat by means of a modern combine with the harvesting of wheat by means of a primitive cradle scythe.

ciple, the wheat being sucked up through large tubes. Sometimes moving belts are used in unloading the grain.

Milling. Prehistoric man first ground wheat into small particles with his teeth, but soon other ways of grinding grain were invented. The simplest device known is a hollowed stone in which the grains of wheat are placed and then pounded or ground by another stone. An improvement on this is a device, called a *mortar* and *pestle,* that consists of a bowl (the mortar) either of rock or wood, and a pounder or grinder (the pestle) with a handle.

In many parts of the world, a *quern* is still used. This consists of two stones and is so constructed that the upper stone revolves on the lower one. A hole is cut through the center of the upper stone down to the lower stone. The worker moves the upper stone in a semicircular motion by a handle attached to it, at the same time feeding the wheat through



Pillsbury Flour Mills Co.

A modern flour mill, powered by water and by steam, and an old water-powered grist mill, which ground meal for Washington's troops in Virginia.

Virginia State Chamber of Commerce

the hole. The wheat thus ground comes out as coarse flour between the two stones at the edges. The *millstone* works on the same principle as the quern, but is much superior because it is larger and is grooved so that it grinds the wheat into smaller pieces. As a result of both of these methods, the flour contains much bran and many impurities. Neither method is suitable for grinding hard wheats well.

By the modern roller method of grinding wheat, the grain is gradually reduced by a series of iron rollers. After each succession of rollers, the results are sifted, or bolted, through silk screens. This gives a much finer, purer, and better flour, which is whitened at the mill by a simple chemical process that does no harm. The roller method permits the miller to use either soft or hard wheat.

Milling Centers. When western New York was the center of wheat production, Rochester, and later Buffalo, became great flour-milling cities, and have retained their importance, even with the westward march of wheatgrowing.

At present Buffalo is the leading flour-milling city of the world. She has abundant water power, good transportation facilities from the wheat fields by way of the Great Lakes and the Erie Canal, and ready access to the great markets of the East.

When spring wheat became popular because of the inventions that made its reduction into flour commercially advantageous, Minneapolis began to grow in importance and for many years was the leading flour-milling city of the world. Its water power, nearness to the spring-wheat fields, and fine transportation facilities were important factors in its growth and leadership.

Other milling centers of importance in the United States are New York City, St. Louis, Milwaukee, Wichita, and Seattle.

In Europe, Budapest is, by far, the largest flour-milling city and is noted for the excellence of its product.

TEXT QUESTIONS

1. Prove that wheat was an important food in early times.
2. Before the discovery of America, what was the importance of wheat in the Old World? in the New World?
3. Explain the movement of wheatgrowing toward the west in the United States.
4. Discuss the growing conditions of wheat. Give the effect of climate (1) in the beginning period; (2) in the ripening period; (3) on the kinds of wheat grown in the different regions.
5. Name two kinds of wheat. By listing their characteristics, indicate the ways in which they differ.
6. Why is durum wheat popular in some regions?
7. Contrast wheatgrowing in densely populated regions with that in sparsely populated regions.
8. Explain the increasing demand for wheat in the world.

9. Give reasons why the United States is a large producer of wheat.
10. Explain our decreasing wheat production in the United States; our decreasing export trade in wheat.
11. Why is Canada a great wheat producer? Why is it a great wheat exporter?
12. What influences wheat production in India? India's export of wheat? the prices at which her exported wheat is sold?
13. Discuss wheat production in Russia.
14. Explain the wheat situation in European countries.
15. What hinders wheat production in Argentina? Why is Argentina a large exporter of wheat?
16. Why does Australia rank high as an exporter of wheat?
17. Locate the spring-wheat belt of the United States; the winter-wheat belt.
18. Why can wheat be threshed immediately upon being harvested in eastern Oregon and eastern Washington?
19. Name and locate the leading milling centers of the United States and Europe.
20. Why are some of these centers prominent in flour making?
21. Define the following terms: sickle; cradle scythe; reaper-binder; combine; gang plow; flail.
22. Define the following terms: mortar and pestle; quern; millstone.
23. What kind of wheat is used for pastry? for bread? for macaroni?
24. How is flour bleached white?

SECTION 2—CORN

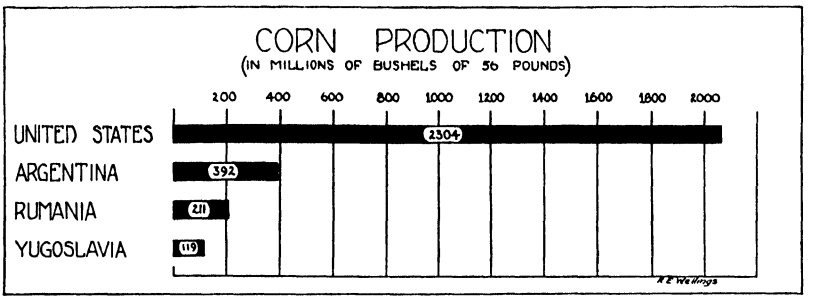
History of Corn. Long before Columbus discovered America, the Indians grew a cereal that was unknown to Europeans. In America we call this cereal corn; but in other parts of the world it is called different names, such as Indian corn, maize, Egyptian corn, Turkish corn, and mealies.

The word *corn* means grain of any kind. It was natural, however, that the early American colonists should gradually narrow its meaning to their principal cereal; hence, in America it has lost its original meaning and is restricted to one class of corn—Indian corn, which the English call maize. Recent findings among ancient ruins in America prove that corn was in use for centuries before the coming of the Europeans. In fact, it was the principal cereal of the Indians.

To the early colonists, corn was particularly valuable and tided them over what otherwise would have been serious food shortages. From the Indians, the colonists learned how to plant and cultivate this new cereal, which could easily be grown in half-cleared fields. The yield of corn was, in proportion to the labor involved, also much greater than that of the other grains. Its cultivation spread to Europe and then over the rest of the world wherever growing conditions were favorable.

Growing Conditions of Corn. Corn grows best in temperate climates. It requires a long growing period, varying from four to five months, during which there must be no frost. Ideal conditions call for warm nights, sunny weather, and intermittent showers. The soil should be a well-drained loam. Argentina, the Danube Valley in Europe, and the corn belt of the United States, possessing all the necessary factors, furnish the best natural locations for the growing of corn.

Regions of Corn Production. The production of corn in the United States exceeds, by a large amount, the combined production of all the other corn-growing regions of the world. Corn is an important crop also in Argentina, the Danube Valley, Russia, Mexico, Egypt, and southern Europe.

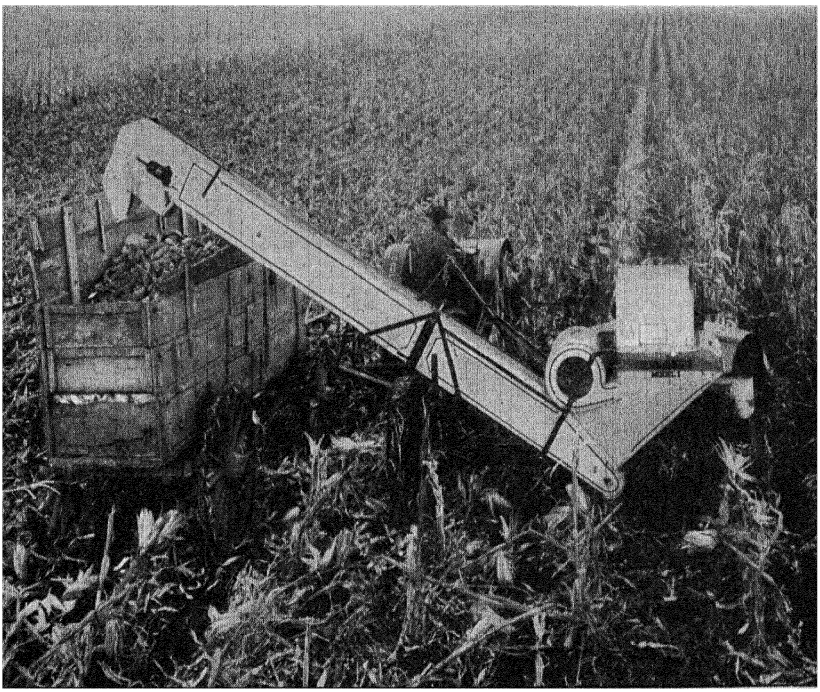


The corn belt in the United States extends northward from the Gulf of Mexico to Canada. The leading corn-producing states in this belt are Iowa, Illinois, Indiana, Minnesota, Ohio, Nebraska, and Missouri. There the growing conditions favor large commercial crops. Conditions for growing corn are favorable in the South, and much is now being raised there, although cotton is the more common crop.

The corn grown in the corn states of our country exceeds in value all our other cereals combined and is worth more than the yearly products of our gold and silver mines. As most of the tremendous crop is marketed in the form of fattened livestock, the corn states are also the great livestock states.

Cultivation of Corn. Land selected for a corn crop is usually plowed in the spring and is planted as soon as danger of frost is past. The seed corn is drilled into the ground by a *drill*, or checkrow planter, which makes a small furrow, drops in the seed, and presses the earth over it. Rows are straight and from three to four feet apart. This permits a machine, called a *cultivator*, to be drawn between the rows later, when it becomes necessary to hoe out the many weeds without injury to the small corn plants.

Corn grows rapidly and soon reaches a height of from six to fourteen feet, depending upon the kind of corn and the growing conditions. Great care is taken to select the best seed from previous harvests. This careful selection insures steady improvement in the quality of the crops.



Husking corn by machinery.

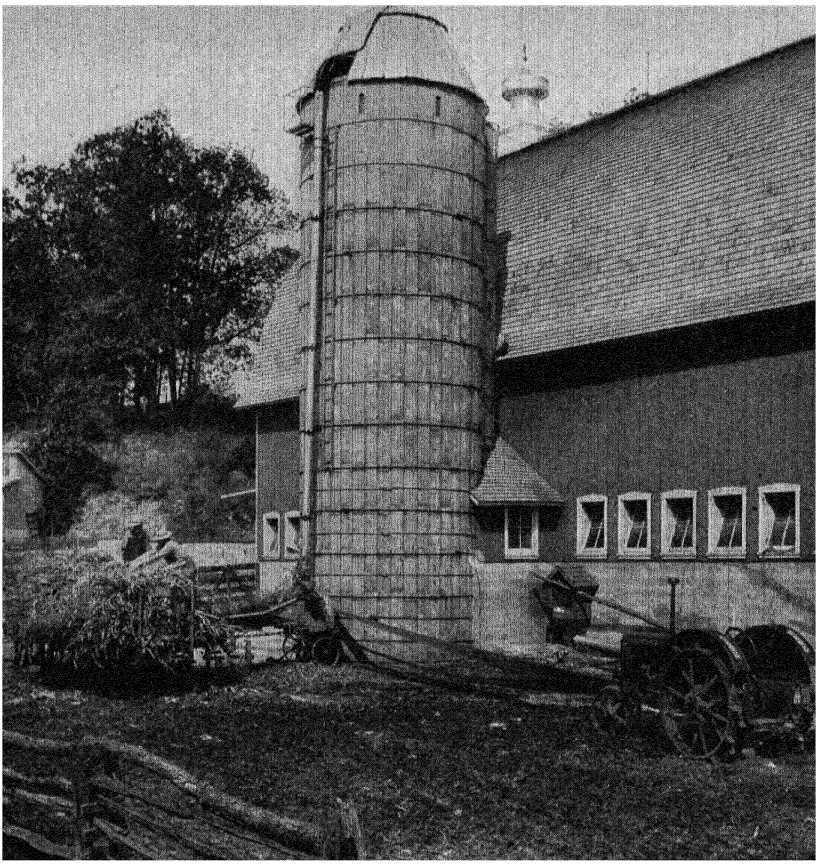
Harvesting Corn. Corn is usually harvested by hand. The laborer may first cut the stalks and stack them together to afford protection from the wind and rain, and later strip off and husk the ears; or he may strip off the ears while the corn is standing in the field.

There are, however, corn cutters in use, some of which cut and break the stalks by power, while others pick off the ears and husk them. The use of these machines is increasing.

Green corn, including the stalks, leaves, and ears, is frequently cut into small pieces and hoisted into large circular buildings called *silos*, where it is stored as winter fodder for livestock. This mixture is called *silage*, or *ensilage*.

By-Products of Corn. Practically every part of the corn plant is used, either as silage or in some by-product industry.

The cob is used as fuel and in the manufacture of certain chemicals. From the seed or kernel come breakfast foods, corn meal, poultry feed, hominy, alcohol, starch, glucose, grape sugar, syrups, cooking oils, a fine grade of machinery oil, and synthetic rubber from which most of our pencil



The green corn stalks are cut into small pieces and are then raised through the pipe to the top of the silo.

erasers are made. From the stalk and the leaves, we get cellulose, photographic film, smokeless gunpowder, paper stock, fertilizers, chemicals, and soundproofing materials.

The principal by-product of corn, however, is the livestock that fatten on it. About eighty per cent of our corn crop is fed to animals and therefore reaches the market in the form of meat.

One kind of corn is sweet corn, which is a favorite market commodity during the short season in which the kernels have reached their normal size, but have not yet become hard. Much of this sweet corn is canned and forms an important dish throughout the year. Popcorn is another corn, this particular kind catering to a special confectionery market.

Commerce in Corn. Our country produces over one half of the world's crop of corn, growing about 2,500,000,000 bushels annually. Since 1933 the production of corn has been somewhat decreased by droughts and crop restrictions. The greater part of this great corn crop is used in the United States, less than one per cent being exported to other countries in the form of corn. The great commercial value of corn is in its food value for farm animals. Only in the Southern States is it important as a table food.

The Mexican and Central American corn crops and the southern European crop are used locally. Argentina is the world's leading corn exporter. This large export is due to the fact that her grazing facilities for livestock are almost unlimited. Her corn crop is exported principally as animal feed to European nations.

Russia, South Africa, Indo-China, and the countries of the Danube Valley export a considerable percentage of their corn crops, which are small in comparison with the world crop.

Corn does not constitute an important article in international commerce because most of it is consumed near the place where it is raised. It is rather bulky for its food value and has a tendency to spoil easily. It is also subject to post-harvest pests like corn weevils, which may spoil it after it has been marketed.

The exportation of corn from the present corn-growing countries will decrease as density of population and the meat demand increase. Because of the requirements of corn growing, few available fields remain; and increased production is possible mainly through more intensive cultivation and the use of hardier kinds of corn.

TEXT QUESTIONS

1. Explain the use of the word *corn* in ancient historical writings. To what does the word apply in England? in America?
2. Where did Indian corn first become known to the civilized world?
3. List some of the other names by which corn is known.

4. Show how corn was particularly valuable to the natives of America; to the early colonists.
5. Point out five regions outside the United States that are important corn growers.
6. Locate the corn belt of the United States. Name the leading corn-growing states.
7. Compare the value of the corn crop with the value of some of our other products.
8. Outside the corn belt, where in the United States can corn be grown successfully? Why is more not grown there?
9. Give the ideal conditions for growing corn. Where are these conditions found?
10. Discuss the method of planting corn. How is corn weeded?
11. Describe the harvesting of corn; the preparation of corn for use.
12. What is silage? How is it stored?
13. Make a list of common by-products of corn, telling from what part of the plant each comes.
14. In what form does most of our corn reach the market? Why?
15. Give the reasons why corn does not enter largely into international commerce. Name some exporting countries. Why are they exporters?
16. Define the following terms: drill; cultivator; silo; weevils.
17. Why do we not export more of our corn?
18. Where is corn used largely as a table food in the United States?
19. In general, why will corn decrease as an export from corn-growing countries?

SECTION 3—RICE

History of Rice. The origin of rice stretches into the dim past before written history. Southeastern Asia was probably its first home. Ancient records show that it was being cultivated in China in 3000 B.C. The Greeks under Alexander the Great, in their expeditions into India, found it under cultivation there and brought seeds home. We know that it was grown in Egypt and other parts of northern Africa in early times, although it was so little used as a cereal that the Bible makes no reference to it. It was cultivated at Pisa, in Italy, soon after 1468, and its cultivation spread to other European countries wherever growing conditions were favorable.

The general cultivation of rice in America started in 1694, when a sea captain left rice seeds with the governor of South Carolina. The success of this tiny rice crop led to the local cultivation of rice in the lowlands of South Carolina and Georgia. During the last three decades rice culture has become important in several states.

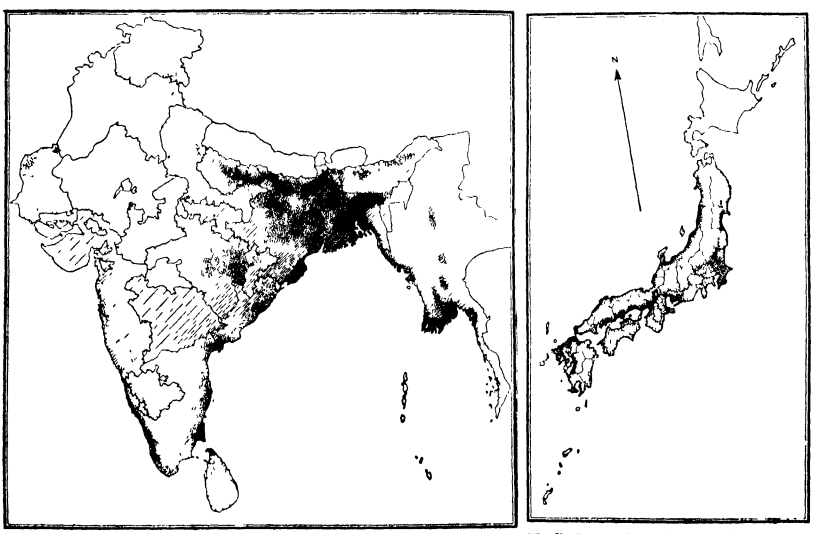
Growing Conditions of Rice. What wheat, as a food, is to the temperate zone, rice is to the tropical and subtropical zones. The cereals of the temperate zone, wheat, corn, and the other grains, quickly spoil in the humid atmosphere of the tropics. Fortunately, rice thrives in the tropics and also keeps well after the harvest because of its covering, which is a protection against dampness.

Although there are thousands of varieties of rice, for our purposes we shall divide rice roughly into two kinds: the upland, or hill, rice, grown like any other cereal, but found only in thinly settled regions; and the lowland, or wet, rice, which requires peculiar growing conditions and is cultivated principally in thickly populated areas. We shall discuss here lowland rice, the kind that figures in commerce.

Rice is a cereal of only tropical or subtropical growth. In addition to sunshine and warmth, it requires a large amount of moisture. During the growing season of ninety days, it needs at least forty-five inches of water. Underneath the top

soil should be a layer of clay, which will keep the water near the surface of the ground. This makes possible, at certain periods, the necessary covering of the fields with inches of water. The warm countries of southeastern Asia are well adapted to rice culture because of the presence of abundant rainfall during the rainy season, and because of the river *deltas,* regions where rivers divide into several mouths. These deltas make excellent sites for rice fields, being level and easily flooded, and having proper subsoils, with an abundance of water at hand.

Rice-Growing Countries. Because of the density of population and consequent large domestic consumption, countries



U. S. Department of Agriculture

Rice growing in India and Japan. Each dot represents ten thousand acres. Much rise is exported from India, but that grown in Japan is largely for local consumption.

that lead in cereal production are frequently only small exporters; in fact, they may be importers from countries in which small populations permit exportation. These conditions are especially true in countries producing rice.

India, China, and Japan stand out as the leaders in rice production. China and Japan, because of their great local

demands, are not leading exporters. Although the East Indies, the Po River Valley in Italy, the Nile Valley in Egypt, small areas in southern Europe, and the Philippine Islands do not figure as exporters, because of their heavy domestic consumption, they do produce considerable rice. India, French Indo-China, and Siam are the leading rice exporters.

As the world demand for rice grows, new areas are opened; rice culture has spread into tropical and subtropical America and the West Indies.

Cultivation of Rice. The rice of commerce is cultivated in the Far East in a very intensive way. Because of the enormous populations there, land is very valuable and must therefore be worked to its limit. The rice fields are carefully laid out in level plots and surrounded with embankments to re-

In parts of the Orient great hillsides are terraced to provide for the growing of rice. The terraces are masterpieces of engineering by the natives and convert every possible inch of hillside into fertile, tillable land.

Underwood and Underwood



tain the water. The fields are planned so that a slow flow of water can be maintained from higher to lower levels. This prevents stagnation of the water and enables the rice growers to use the water several times. The construction of rice fields is easier in comparatively level lowlands than in hilly countries, where great toil and skill have to be used in terracing the slopes to make small patches of level land.

After the fields have been leveled and diked, a water supply is necessary. In the lowlands, valleys, and river deltas, the water supply, found in the streams and rivers near at hand, can, by proper engineering, be conveyed to the rice fields. This water is raised to a sufficient height to flow over the fields. Among the crude devices operated by man power to raise the level of the water are water wheels, pumps, and even water pails.

To supply the terraces on the hillsides, the water is often raised to the necessary high level by hard and arduous human labor, but sometimes a stream higher up may be made to flow to the highest terrace and then, by careful tending, led down through the lower levels. Only cheap and abundant labor makes this kind of rice culture possible.

After the field has been laid out and a water supply assured, planting may be started. The soil is stirred up by a plow, animal drawn, or is spaded up by men with heavy, crude tools. Because of the small size of the fields, the latter method is more common. Water is then allowed to flow onto the field, where it is mixed with dirt into fluid mud.

The seed is sometimes sowed broadcast; but in regions of intense cultivation, small rice plants about six inches high, obtained from carefully tended nurseries, are transplanted by women and children. These plants are set out, under water, about ten inches apart.

During the early growth of the plant, the water covering the ground is frequently drawn off during the daytime to allow the warm air to reach the plants, and is then run on again at night to keep the ground and the plants warm. After the plants have been well started, water is kept on the land. The fields are carefully weeded by hand.



Vitaphone

Rice fields are sometimes called paddy fields. The rice harvesters in this illustration are cutting rice by hand. Notice the swampy condition of the land here in Ceylon.

As the plant grows, it sprouts from one hundred to four hundred rice seeds and begins to turn yellow. When the rice is fully ripe, the water is drawn off, the land is allowed to dry, and the harvest begins.

Harvesting Rice. In the Orient rice is still cut by hand with the old-fashioned sickle. Several small bunches of stalks are cut, bound together with rice straw, and placed in a large pile to dry. Sometimes it is necessary to build the large bunches on stick foundations to keep them from the damp or wet ground.

Much hand labor is necessary at harvest time; everybody—man, woman, and child—turns out into the fields. Meals are eaten in picnic form, and everyone works. After the rice has dried sufficiently, it is threshed, principally by drawing the rice stalks over saw-tooth edges or nails, which pull the rice kernels from the stalks. The rice kernels are winnowed

by throwing a scoopful into the air and thus allowing the breeze to blow away the chaff and straw, while the rice, which is heavier, drops into a pile by itself.

Rice kernels are covered with a brown substance, which clings very tightly. In the tropics the brown covering is left on the rice until the rice is to be eaten or prepared for export. Rice, before the covering is removed, is called *paddy*.

Preparation of Rice for the Market. Rice is prepared for local consumption as food by placing the paddy in large mortars and pounding it until the brown covering is worn off. After the rice has been winnowed by the breeze, it is ready to be cooked.

Rice for export is taken to exporting cities, like Bangkok, Saigon, and Rangoon, where it is prepared for the foreign market, which demands a white polished kernel. Since unpolished rice, as used by natives, is superior to polished rice as food, it is gaining favor in our country.

By-Products of Rice. Rice straw is extensively used. From it are made sandals, hats, coverings for tea chests, and mats. Various drinks are made from fermented rice, the principal one being sake.

Rice Cultivation in the United States. For many years rice culture in the United States was limited to the low, swampy lands of the southern states bordering on the Atlantic Ocean. Here the same methods used in the Orient were employed, negroes supplying the necessary labor.

Recently rice culture has received a great impetus in Texas, Louisiana, Arkansas, and California, where the almost level lands are utilized. These lands have a top soil of good loam, under which is a hard clay. Water from below the surface is supplied by artesian wells. The warm climate is suitable for rice. Hence, all the necessary growing conditions are present.

In the above-mentioned states, unlike the Orient, the methods of the wheat field are employed. The soil is broken up by gang plows drawn by tractors, and the seed is drilled by machine drillers; later, artesian wells supply plenty of water



U. S. Department of Agriculture

Harvesting rice in the United States.

for flooding the fields. When harvest time arrives, the water is drawn off and the ground is dried so that it will support the harvesting machines, which reap the rice like wheat. The rice is then threshed by machine threshers and placed in bags, ready for the market. Our total crop, however, is only a small fraction of the rice produced in the Orient.

Although American labor costs much more than Oriental labor, and although the yield per acre is much less than it is in the Orient, the cost per bushel is much lower than in the Oriental countries because of the use of machinery. This lower cost has made possible the profitable exportation of rice from the United States to countries with much lower wage scales.

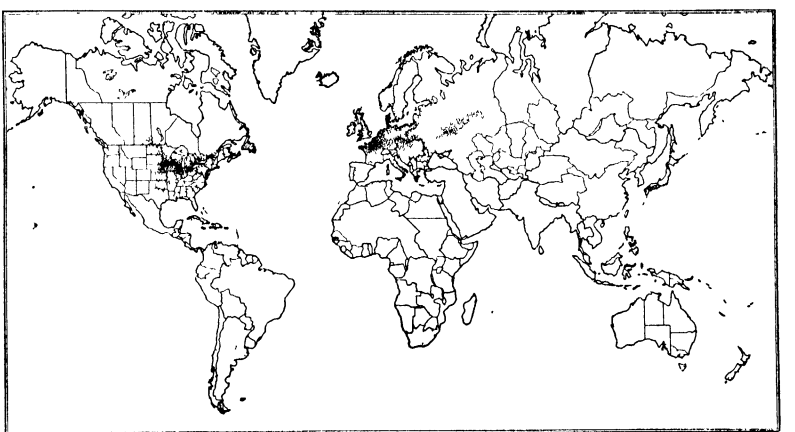
In general, our exports are greater than our imports, because we, as a nation, are not great rice eaters, and also because we have a large export market nearby in the West Indies and tropical America.

TEXT QUESTIONS

1. Tell what you can about the history of rice in the Old World; in the New World.
2. Give the growing conditions of rice. Why is rice production especially well adapted to tropical countries?
3. In what countries is rice the most important food cereal? Why?
4. Name the countries that lead in producing rice; in exporting rice.
5. Explain why some of the large producers of rice export but little.
6. Where in the United States is rice grown?
7. Describe methods of planting rice in the Far East.
8. Show how the importance of water in rice culture has led to very intensive cultivation.
9. Tell how rice is harvested and threshed in the Orient.
10. How is rice prepared for local use in the Orient? for export?
11. Define (a) paddy, (b) sake, (c) unpolished rice.
12. Name some of the by-products of rice.
13. Contrast the methods of rice cultivation and harvesting in the United States with those in the Orient.
14. Why does the United States usually export more rice than it imports? Explain.
15. Define (a) delta, (b) artesian well, (c) upland rice, (d) subsoil, (e) terraces.
16. What states now lead in rice culture in the United States?
17. What cities in the Orient are the leading rice exporters?
18. Why are the cereals of the temperate zone not raised more in the tropics?

SECTION 4—MISCELLANEOUS CEREALS

Oats. The world crop of oats exceeds that of any other cereal in volume, but is lower than many others in value. Oats are used near the places where they are grown and enter very little into international commerce, because they are grown principally as stock food rather than as human food, and because they are large and bulky in proportion to their weight. The use of oats as a breakfast cereal is growing, however, and their use as food in certain countries is common.



U. S. Department of Agriculture

The production of oats. Oats are used principally as a stock food near the places where they are grown.

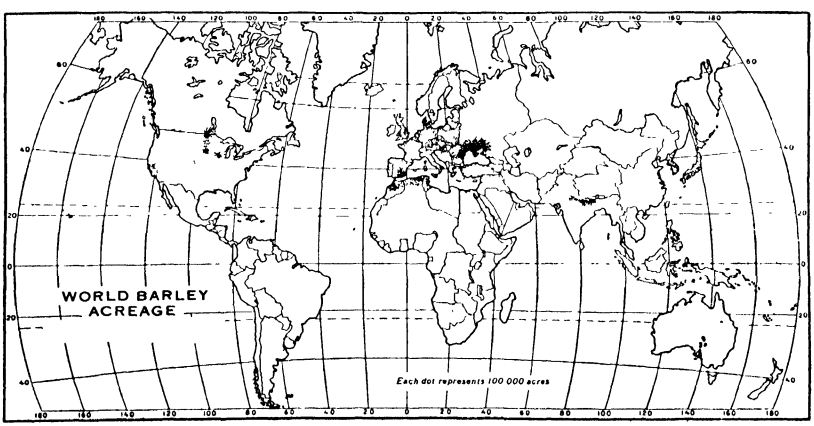
Oats can stand much more cold and much more moisture than wheat; in fact, oats require more moisture. Comparatively, they are a quick-growing crop. Oats can endure the heat and thrive on the moisture of the corn belt. They can be planted early in the spring and reaped between the planting and harvesting of corn. In this way, the farmer is enabled to work his crew continuously. Oats are grown also in winter-wheat areas, where they are planted when failure of the fall-sown wheat seems certain. In all these areas oats are valuable as food for animals.

Because of the short growing season, oats are found farther north than spring wheat. Oats do not need so good a soil as

wheat and, therefore, can be grown in areas where the soil would make a financial failure of wheatgrowing.

In the United States, our leading growers of oats are the North Central States, principally Iowa, Minnesota, Illinois, and Wisconsin. In Europe, the largest crops of oats are grown in Russia, Germany, and France. Canada's oat crop is also large.

Barley. Barley, in appearance, is very much like wheat, but, because it lacks the gluten of wheat, is not so popular for breadmaking. Barley is one of the oldest, if not the most ancient, of known cereals. It was found in the ruins left by prehistoric man and is constantly referred to in the Bible and



U. S. Department of Agriculture

The production of barley. This cereal has the widest range of latitude of all cereals.

other ancient writings. It is the hardiest of all cereals and has the widest range of latitude climatically. It is found in the Arctic Circle and on mountain slopes in the tropics. It resists cold and drought, and is prolific in its yield. Because of these facts, it was the most commonly used cereal in antiquity. Its drought-resisting quality made it a crop of importance in the ancient lands bordering the Mediterranean Sea.

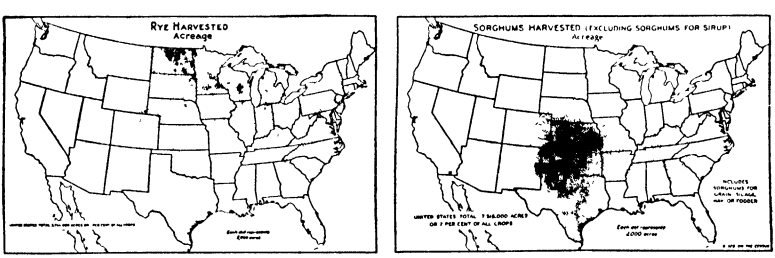
Barley is a quick-growing crop and is therefore popular in cold, dry regions. In some countries of poor living conditions,

it is the principal cereal and is made into barley cakes and bread. Its health value is well known; barley broth is a favorite dish for invalids, and barley mixtures are fed to babies.

Barley is particularly rich in fats and salts. It is much used as a stock food and as the basis of beer. It is especially valuable as a stock food in parts of the United States and in northern Europe, where climatic conditions discourage the growing of corn.

In California, barley is grown as a forage crop, being cut for its forage before it is ripe. It is grown there also for its grain. The fact that it can be dovetailed into the wheatgrowing period makes it a good crop for the farmer, as it enables him to keep his help working in the off seasons. It is therefore a supplementary crop in the wheat belts, especially in the North Central States. It is grown in central and northern Europe. Russia leads all other European nations in barley production. Large crops of barley are found in India, Japan, and northern China. Its future possibilities in the semiarid regions of our West are great.

Rye. Rye, as a breadstuff among the European peoples, ranks next to wheat. It resembles wheat in appearance, but



U. S. Department of Agriculture

The production of rye and sorghum in the United States. Rye is grown chiefly in the North; sorghums, in the Southwest.

is inferior in quality as a breadmaker. Rye was used by prehistoric man, but appears to have been unknown to the Mediterranean peoples of history, probably because, as was the case with oats, the climate was unsuitable for its production.

Rye can grow in colder climates, on less moisture, and in poorer soils than wheat, and can withstand poorer methods of

cultivation. We find it growing in Russia just north of the wheat belt, and in the spring-wheat states of our country. Being hardy, it will get an earlier start than wheat, is subject to fewer pests and diseases, and forms a good alternate crop with wheat. Its ability to grow under poor conditions makes it popular in hilly regions. The early colonists in America found it a friend because it could stand rough treatment in poorly cleared fields.

Rye is used in Europe, in large part, as a breadmaker, although, because it lacks gluten, it makes poorer bread than wheat. In many regions the only bread the people have is made of rye. Most European-grown rye is raised in the northern part, around the Baltic Sea, principally in Russia and Germany. Rye is grown in the United States in the northern Atlantic and Central States, where it is used as stock food. As a cereal crop in this country, rye is unimportant, although the amount being grown is now increasing.

Buckwheat. Buckwheat is a hardy plant supplying a seed that is used as a poultry food and that is ground into buckwheat flour, from which the popular buckwheat cakes are made. Buckwheat grows and ripens quickly. It can be planted late in the season and harvested before frost time. For this reason farmers often plant buckwheat if their regular cereal crop has failed. In the United States, most of the buckwheat crop is raised in two states, New York and Pennsylvania.

Millet and Sorghum. Millet and sorghum are cereal plants that are very important in the food supply of millions of natives in Africa and Asia. Because of local demands, these cereals do not enter very much into world commerce. These plants can grow where ordinary cereals will perish, because they are hardy, grow quickly, and require very little moisture. Under various names, such as Kafir corn, durra corn, millo maize, and Chinese sorghum, these cereals have been introduced into certain sections of the United States where lack of sufficient moisture is fatal to the ordinary cereal. In some sections of the Southwest where the rainfall is too slight for cereals in general, these imported cereals have been very suc-



Underwood and Underwood

Peasants cutting millet in Japan. Millet is an important item in the food supply of millions of Orientals.

cessfully grown, and the acreage devoted to them has rapidly increased. The seeds and stalks are used, almost wholly, for cattle food in this country.

TEXT QUESTIONS

1. Why is the oats crop the largest cereal crop?
2. What is the importance of oats as animal food? as human food?
3. Give the climatic requirements of oats as a crop.
4. Explain the importance of oats as a supplementary crop to other cereals.
5. Why was barley early grown by man as a cereal? Prove your answer.
6. Give some of the leading characteristics of barley.
7. Discuss barley as a human food; as an animal food.

8. Give the leading barley regions of the world; of the United States. Why do these regions lead?
9. Why is barley often grown by wheat farmers?
10. Why do we not find rye being cultivated in countries bordering on the Mediterranean Sea?
11. Explain how the hardiness of rye, under adverse conditions, makes it a popular crop.
12. Tell why rye is used in some sections of Europe as a human food; in our country as a stock food.
13. Where is rye grown chiefly?
14. Compare rye and wheat as breadmakers. Compare barley and wheat as breadmakers.
15. What are millets? Why are they raised in the United States?

PROBLEMS AND PROJECTS

1. On an outline map, indicate the sections of the United States that lead in cereal farming. Show which cereal leads in each section.
2. On an outline map of the world, indicate where wheat is being harvested in each month of the year.
3. On an outline map, indicate the chief cereal-growing regions of the world. Show which cereal leads in each region.
4. Collect pictures of machines and tools used in cereal production.
5. Draw up a list of breakfast foods made of cereals and tell which cereal forms the base of each.
6. Draw up a list of corn products that are used in your home.
7. Draw up a list of articles made from corn.
8. In what countries are primitive methods of planting and harvesting wheat still used? Why are they used there?
9. Why are the countries of western Europe large importers of wheat? Explain.
10. What is "black bread"? Why is much eaten in Europe and little in the United States?
11. Explain why rye is called the poor man's crop.
12. Prove that barley was known to the ancients.
13. What are the present prices of the different cereals in the nearest large market?
14. Make a list of the cereal exports of the United States; of the cereal imports.
15. Make a list of the various kinds of wheat and obtain, if possible, a sample of each.

16. Make a list of magazine articles, pamphlets, and books describing cereal production and distribution.
17. How can the wheat yield be increased in the United States?
18. Why do not the rice growers of China use our machinery? Explain fully.
19. Compare the wheat yield per acre in exporting countries with that in importing countries. Explain the difference.

TOPICS

1. A comparison of farming methods in Europe and in America.
2. Modern agricultural machinery.
3. The effect of the World War on the food supply of the world.
4. The value of cereals as food.
5. Corn and meat production in the United States.
6. The labor supply in the Middle West during the harvest season.
7. How wheat is bought and sold in large quantities.
8. The future of wheat raising in the United States.
9. The future food supply of the world.
10. Crop restriction policy in the United States.
11. The effects of the A.A.A. on cereal farming.

FOR CLASS DISCUSSION

1. A diet composed principally of cereals is better than one in which meats predominate.
2. Cereal farming in our West offers a good investment for surplus capital.
3. Eventually there will not be enough food for the rapidly increasing population of the world.
4. The Government of the United States should regulate the price of wheat in this country.
5. The law of supply and demand is the best way of regulating the production of foodstuffs.

CHAPTER IX

BEVERAGES

SECTION 1—COFFEE

History of Coffee. The true story of the discovery of coffee as a beverage is hidden in the past. It is generally agreed that the coffee tree, a native of Abyssinia, was carried to Arabia in about the thirteenth century. At that time, coffee became a popular drink among the Arabs and other Mohammedans. Its use and cultivation were spread by pilgrims to Mecca; and about the middle of the sixteenth century, coffee became a popular drink in Constantinople.

Coffee appeared in France in 1669. As demands for it grew, Louis XIV encouraged the cultivation of coffee; and from the French plantations in Martinique, the great coffee plantations of South America have developed. During the seventeenth and eighteenth centuries, London coffeehouses acquired a great popularity and were the meeting places of many famous men. In this country, coffeehouses were favorite gathering places for the patriots preceding and during the Revolutionary War.

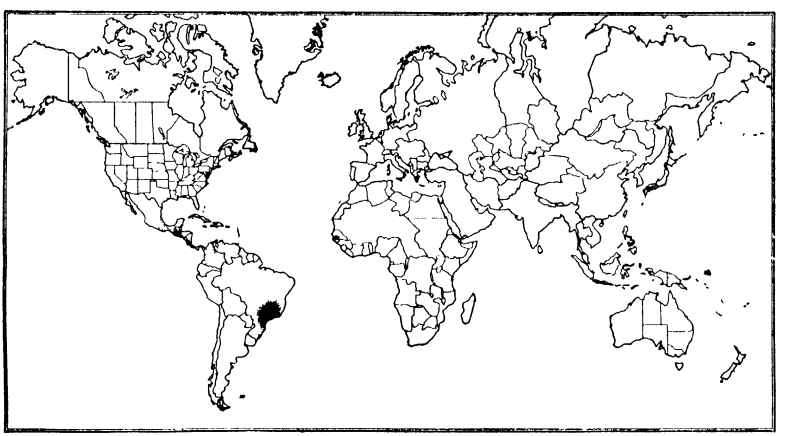
Coffee has now become one of the leading beverages of the world. It is estimated that over three million pounds of coffee are consumed every day throughout the world.

Varieties of Coffee. Although there are many varieties of coffee trees, two stand out as leaders and furnish most of the coffee of commerce. The Arabian coffee plant, or tree, grows to a height of about sixteen feet, though often it is kept pruned down to eight feet to make picking easier.

The Liberian coffee tree originated on the west coast of Africa. It grows to a greater height, when allowed to do so, than does the Arabian tree. It is more hardy, more capable of resisting drought and heat, and is less subject to disease than the Arabian tree. Its berry, while larger, is inferior in

quality. Liberian coffee was introduced into Ceylon and the East Indies at the time of the great coffee-tree blight, in the hope that it might save these districts for coffee cultivation. It still remains in Java. Most of the coffee grown in the Americas is from the Arabian trees. Local climatic and soil conditions affect the character of the coffee grown on either kind of tree.

There are several local varieties of coffee, each with its merits, but they exert little influence on the general market. As coffee was originally graded by its place of origin, there



U. S. Department of Agriculture

World coffee production. Ninety per cent of the coffee of the world is grown in the Western Hemisphere.

are three classifications in the trade. Originally, Mocha coffee came from Arabia, through the seaport of Mocha; Java coffee came from the island of that name and its neighboring islands of the East Indies; Rio coffee came from Brazil. These names have become trade names; and, because of trade usage, coffee is sometimes classified, not by its place of origin, but by its similarity to coffee from one of these places—Arabia, the East Indies, or Brazil.

Growing Conditions. Coffee is a tropical and subtropical commodity. Frost is deadly to it, yet it cannot stand too much direct sun. Hillsides and low mountainsides, especially on the fringes of the temperate zone, are favored places for its



Keystone View Company

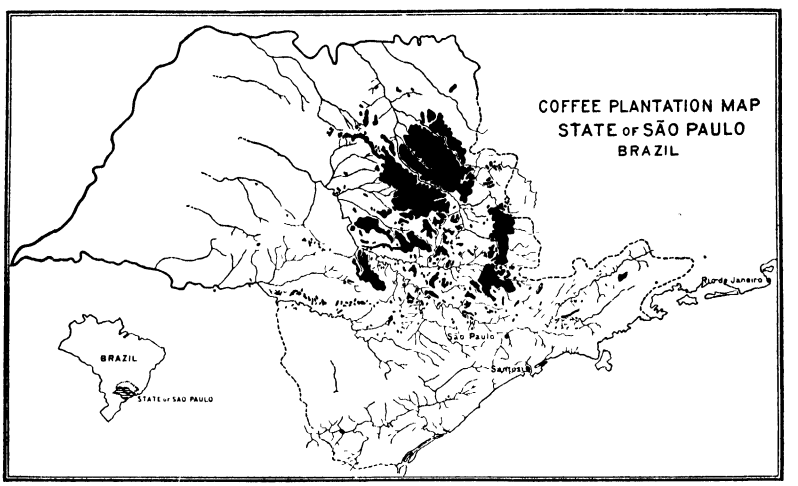
Harvesting coffee. Observe the banana trees, which, with their large leaves, protect the coffee trees from too much sun and wind.

cultivation, because they furnish the proper temperature and afford quick drainage for the necessary rainfall. From seventy-five inches to more than one hundred inches of annual rainfall, well distributed, are best for coffeegrowing. In locations where high winds occur, windbreaks are necessary; and in some places shade trees are required to lessen the heat from the too direct rays of the sun. The best soil for growing coffee appears to be a red volcanic earth that is rich and well drained. Brazil is highly favored with all these conditions.

The world area suitable for coffee culture is greater than that required to supply the needs of the world. Because of this, unsteadiness of the market has resulted.

Countries of Production. The lead in coffee production was held at the start by Arabia, then by the East Indies (especially Java), and finally by Brazil, which alone now produces about two thirds of the coffee crop of the entire world. About ninety per cent of the coffee of the world is grown in the Western Hemisphere.

Beginning in Mexico and going southward through Central America to Venezuela and Colombia, and then on to Brazil, we find many coffee plantations. The immense coffee-producing area of Brazil is located in four provinces. In the center of the area are São Paulo and its port of Santos, with its long water front lined with boats waiting for coffee cargoes.



U. S. Department of Agriculture

Coffee plantation map of the state of São Paulo, Brazil. Santos is the largest coffee-shipping port in the world.

The coffee of the East Indies is of high grade and is in great demand. Governmental control of coffee raising in Java maintains a high standard of excellence. Some coffee is exported from Arabia, although most of the Arabian coffee is consumed near its source. India raises some coffee in the northern part, near the Ghats Mountains. Because of the disastrous scourge that visited Ceylon's coffee trees a number of years ago, that island has turned its attention to tea culture. In recent years a new coffee region has been developed in the highlands of British East Africa.

Coffee Cultivation. There are two methods of growing coffee plants. One is to plant the seeds in well-prepared ground, two or three seeds being planted to ensure one good plant. Later the poorer plants are pulled up, and the better

plants are allowed to grow. The plants are spaced far enough apart so that when they mature there will be enough soil to nourish them well. Another way is to grow the plants in a special nursery until they are large enough to transplant. In both methods great care is taken in weeding and in protecting the young plants from too much sun and wind.

Sometimes banana trees are grown between the rows of coffee trees to afford protection from both sun and wind. Oftentimes, for this purpose, trees of more permanent growth are planted. The amount of protection needed from wind and sun varies with different locations. From three to five years after planting, the coffee trees begin to bear and will continue to bear thereafter for many years.

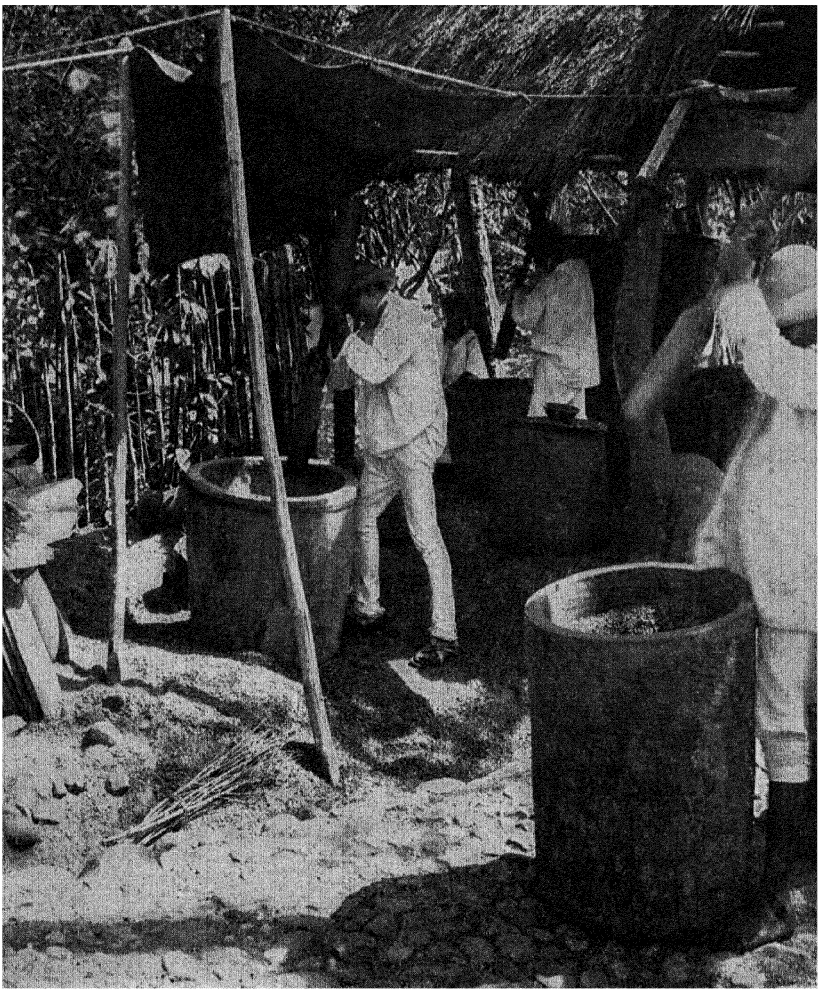
Harvesting Coffee. In Arabia, coffee berries are not picked but are allowed to ripen and fall to the ground.

In Brazil, the coffee pickers strip the berries from the tree. Berries that fall to the ground are also gathered. Sometimes a cloth is placed around the tree to catch the berries that fall. This wholesale method of picking the berries results in a mixture of ripe, unripe, and overripe berries, together with leaves and twigs, requiring much sorting and cleaning later.

In Java, great care is used in picking, and only ripe berries are gathered. This results in three distinct pickings. Java excels in picking coffee berries, while Brazil surpasses in the preparation of the berries for the market. Java has a large labor supply, while Brazil uses the best machinery in handling the berries after they have been picked.

Preparation of Coffee for the Market. Two methods are used to extract the little coffee beans from the coffee berries. In the dry method the berries are first dried in the sun, then pounded to loosen the beans, or seeds, from their coverings, and then cleaned by air so that only the beans remain. In the wet method the berries are first soaked in water; then the pulp is removed from the beans by friction machines; and finally the beans are dried in the sun.

In order to preserve the aroma and oils in the green coffee beans, the beans are roasted near the consumers by brand

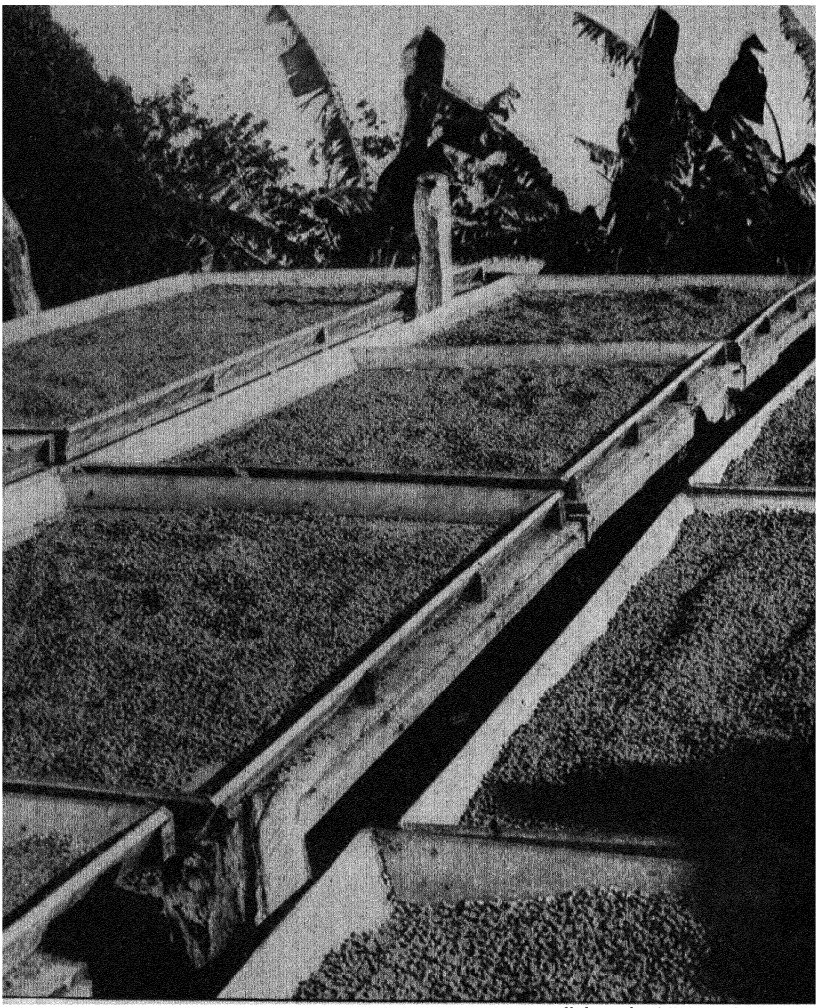


Keystone View Company

Crude native method of husking coffee in Cordoba, Mexico.

owners or wholesale dealers, and are often ground at the store of the retailer.

Countries of Consumption. Coffee is primarily a commercial product. Most countries that lead in coffee consumption do not produce it and must depend on commerce to bring it to them. The United States, requiring almost one half of the coffee crop of the world, is the largest consumer. Germany, Brazil, France, and the smaller European countries follow.



Underwood and Underwood

Drying coffee in Puerto Rico.

The Scandinavians are the greatest per capita coffee drinkers, averaging over sixteen pounds of coffee a person a year. The annual per capita consumption of coffee in Denmark is over fifteen pounds. In the United States, we use over thirteen pounds a person a year. Belgium uses over twelve pounds a person a year. The British are not great coffee drinkers, averaging in a year less than a pound a person.

Substitutes. Other substances, the most common being chicory, are sometimes mixed with coffee to make it cheaper.

There are several substitutes that may be offered to those who find coffee injurious. Almost all these substitutes are made from cereals that are roasted and blended and made to taste like coffee, yet lack any injurious qualities.

On the market in the United States are some brands of real coffee from which the caffeine has been extracted.

TEXT QUESTIONS

1. Who were probably the first coffee drinkers?
2. Name and describe the two principal varieties of coffee trees.
3. Give the principal trade names of coffee. Why are the various kinds of coffee so named?
4. Give the principal conditions for successful coffeegrowing.
5. Explain the rise and the fall of the prices of coffee.
6. List the principal regions of coffeegrowing. How has the leadership changed?
7. Where do we get most of our coffee?
8. Give two ways in which coffee trees are planted.
9. How are coffee trees sheltered from wind and sun?
10. Contrast the method of harvesting coffee in Java with that in Brazil.
11. Contrast the two methods of preparing coffee for export.
12. Why are the roasting and the grinding of coffee delayed until just before the coffee is used?
13. Show how coffee enters into world commerce. What countries are the greatest consumers?
14. What countries lead in per capita use of coffee?
15. From what are most substitutes for coffee made?

SECTION 2—TEA

History of Tea. It is now generally agreed that the tea plant originated in the province of Assam in India, whence, at an early period, it found its way into China. The discovery of its use is credited to the Chinese. In England, tea is still called "China tea." As early as 2700 B.C., a Chinese writer mentioned the tea plant; and we are told by a later Chinese writer, in 400 B.C., that the brew made from its leaves has medicinal value. This statement may be accounted for by the fact that tea calls for boiled water, a factor in areas infested with typhoid fever. Tea probably did not become popular as a beverage until about the sixth century after Christ.

Its introduction into England dates from the last of the sixteenth century.

Conditions of Growth. Tea is a subtropical plant, requiring steady warmth while growing; yet it is hardy enough to withstand occasional frosts. For this reason we find it growing at some distance from the equator. The soil should be fairly rich, preferably in iron, and should contain plenty of decomposed animal and vegetable matter. The red soil suitable for coffee is also excellent for tea. Plenty of rain is required; for this reason the monsoon district of southern Asia is the ideal region for growing tea. Tea is generally planted on hillsides, because hillsides provide good drainage and are less desirable for other crops necessary for the large populations found in tea-growing regions.

The picking of the leaves requires cheap hand labor with a certain manual skill; for this reason the tea industry is located in the Orient, where there is an abundance of such labor. Although tea culture could perhaps be carried on successfully in the United States throughout the cotton belt, the absence of cheap skilled labor would make it unprofitable in competition with the cheaper labor of the Orient.

Varieties of Tea. In commerce two chief classifications of tea are found: black tea and green tea. The various trade names of tea depend upon three factors: the way in which

the tea is cured, the grade of leaves used, and the region whence the leaves come. In general, black tea is produced by the fermentation of the leaves. Among the black teas we find Flowery Pekoe, Orange Pekoe, Souchong, Oolong, Pekoe, Congo, and Bohea. In the making of green tea, the leaves are not allowed to ferment but are dried quickly. In the green teas we have Gunpowder, Imperial Hyson, Hyson, Young Hyson, and Hyson Skin. Tea regions that give trade names to their products are China, Japan, Ceylon, and Formosa (Taiwan).

The most desired tea leaves are the young, tender buds of the first picking. Very little of this kind of tea reaches the markets of the world, most of it being saved by the growers for their own use or for presents. A great variety of tastes demands various kinds and grades of tea; for this reason a wide choice is made possible by the producers.

Countries of Production. Mention of tea naturally brings to our mind China. In the absence of reliable data from China, experts estimate that China probably produces more tea than any other region in the world. China's crop, while large, has little export value. India far surpasses China in the value of its tea exports.

If the value of the tea crops is taken as a measure, the regions of world production follow in this order: India, China, Ceylon, Dutch East Indies, Japan, and Formosa. It is only within the past century that tea culture in India and Ceylon has come to the front. Both India and Ceylon are favored in that picking can continue, at short intervals, practically the whole year round, because of climatic conditions.

Tea culture in China is extensive; but China has lost much of its export trade to the advantage of India, where machinery and modern sanitary methods prevail.

Japan specializes in the green teas for her principal export market in America. The tea of Formosa (Taiwan) is famous for its quality, but the tea crop is comparatively small, because of the relatively small area of the island.

Tea Cultivation. Tea is grown from seeds that form on bushes allowed to grow freely without being pruned. These

seeds are sprouted and planted in nurseries from which the young plants, after growing to a height of about a foot, are transplanted to the tea orchard in rows four feet apart each way. The plant, if left alone, would grow from sixteen to twenty feet high; but, because of greater strength in the leaves and the ease of picking, the plants are kept pruned to a height of from three to six feet.

The tea plant, or bush, is ready to be picked when about three years old. In some regions, like Ceylon, this plucking of the leaves can be continued the whole year round; while in other regions, like China, but three or four pickings a year are possible. This difference is due, in large part, to variations in climate and rain supply. In some regions in Japan where they are shaded, tea plants produce a larger leaf. In general, however, little protection from the sun and the wind is required in tea districts. For planting, pruning, picking, and weeding, a large supply of cheap labor is necessary.

A skilled tea picker. Observe how the tea basket is carried from the head while the tea is being picked.
McCormick & Co.



Tea Picking. The tea pickers are generally girls and women who are trained to pick the tea leaves from the plant in such a way that no injury to the plant results. As they are picked, the leaves are thrown into large wicker baskets; and later the laborers are paid according to the weight of the leaves picked.

In China, the choicest tea leaves are first picked about April. Soon after, when the second picking occurs, only the small, tender leaves are sought. Then follow a third and a fourth picking, the quality of the tea getting poorer with each picking. Successive pickings, spaced too closely to-



Ewing Galloway

Plucking tea. Skill is required in plucking tea leaves so that no injury results to the tea plant.

gether, would injure the plant too much. It must have time to recover its strength before it is picked again, or before the cold of winter arrives.

In Ceylon, the tea leaves are picked about every two weeks throughout the year. The quality of the tea varies with the climatic conditions, which, in that region, are especially favorable because of the moisture brought by the monsoons. After being picked about two years, the tea plant is pruned severely and then allowed to recuperate.

Preparation of Tea for the Market. In China, the leaves are first withered by constant stirring over a heated pan. This process makes the leaves limp and damp because of the juice that oozes from them. The leaves are then taken to bamboo tables, where they are kneaded into small tea balls, the kneading liberating the juice and moisture in the leaves. This is called rolling the leaves. The next process is for the purpose of drying the leaves gradually, in such a way that they will retain their juice and yet lose their excess moisture. If green tea is desired, the rolled leaves are placed in firing pans of iron and are dried by heat. An attendant constantly stirs the leaves to prevent them from burning or from drying too rapidly. This quick drying results in green tea.

If black tea is desired, fermentation is allowed to take place before the leaves are dried. The rolled leaves are put on trays and placed in the sun. Slow fermentation then takes place. When the fermentation has reached the proper point, the leaves are dried in pans in the same way in which the leaves of green tea are treated. This process not only completely dries the tea leaves but also stops the fermentation.

The final operation consists in packing the tea chests, which then go down to the ports, where the tea is repacked and graded for export.

Frequently, artificial, nonpoisonous dyes are used to color tea bright green or black to increase its selling quality.

In India and Ceylon, modern methods and machinery are employed in preparing the leaves for the market. The leaves are withered in iron trays, rolled in special machines, and dried or fired in other machines that correctly time the drying. In this way the tea leaves, after being picked, are not touched by human hands.

Japan uses hand methods in preparing tea for its own use, but machinery in preparing tea for export. All tea exported is packed in airtight packages, generally lined with aluminum foil. These airtight packages prevent moisture from spoiling the dried leaves and preserve the desired aroma and other qualities. On reaching the United States, the tea is repacked in sealed packages for the retail trade.

Countries of Tea Consumption. The amount of tea that is consumed in China and Japan cannot be estimated. It is the everyday drink in these countries and forms the principal beverage of the rest of the Orient as well.

Among the white nations, the United Kingdom leads in per capita tea consumption, averaging annually a little over nine pounds. The Australians average about seven pounds a person a year. In the United States, our annual per capita consumption is less than one pound, but our total consumption is large. The poorer Russians, contrary to popular belief, are not great tea drinkers. Since 1930 Russia's annual per capita consumption of tea has been less than one-half pound.

Substitutes. Leaves of many other plants or trees are mixed with tea leaves. Leaves from rose, ash, plum, buckthorn, and other plants or trees are used. Sometimes tea is scented by flowers from various plants. Minerals are used to make the tea weigh more and to improve its appearance.

Other Teas. A beverage product of South America is maté, or Paraguay tea, which comes from a small tree grown in Paraguay. This tree, with leaves about four inches long, is a member of the holly family. Small branches are cut from the trees and dried over a fire. The leaves and small twigs are then reduced to a powder by being pounded. This powder, mixed with hot water, gives a stimulating drink. Another form of tea, called yaupon, which was used by the Indians, is found in our southern states. Other types of tea are made from various leaves and grasses. Maté is the only one of these that has commercial importance.

TEXT QUESTIONS

1. Discuss the history of tea as a beverage.
2. What conditions are necessary for tea culture? Name some places where these are found.
3. What are the principal green teas? black teas?
4. Name, in the order of the amount of tea produced, the leading regions of production.
5. Name, in the order of the value of tea produced, the leading tea-growing regions.
6. In what kind of tea does Japan specialize? Where is the best market for the tea of Japan?
7. Explain the influence of cheap labor on tea growing in the Orient; in the United States.
8. Describe tea growing in India and Ceylon.
9. Describe how tea is picked in the different regions.
10. Contrast the methods of preparing black and green teas.
11. Describe how tea is prepared for the market in China, India, and Ceylon.
12. What Oriental peoples lead in tea drinking?
13. What nation of the white race leads in tea consumption?
14. What is sometimes mixed with tea?
15. Name some of the unusual kinds of tea beverages.

SECTION 3—CACAO

History of Cacao. There are three trees from which we obtain commercial products with names so nearly alike that they are often confused. From the coconut tree, we get *coconuts;* from the coca tree, we get *cocaine;* and from the cacao tree, we get *cocoa* and *chocolate.*

When the Spaniards landed on this continent, they found the natives drinking chocolate, a drink new to the explorers. How far back into history chocolate drinking goes, we are unable to learn exactly, but we do know that a long time ago the Incas, in Peru, and the Aztecs, in Mexico, drank it. Records indicate that cacao beans frequently passed as money; and even to this day, in some parts of Central America, cacao beans are used as a medium of exchange.

The Spanish introduced the drink into Spain and for many years controlled the cacao trade. The custom of drinking chocolate spread over all Europe and America. Today there is an enormous demand for the products of the cacao bean: cocoa and chocolate.

Cacao tree. The blossom and the fruit grow directly on the trunk and the larger limbs of the tree.

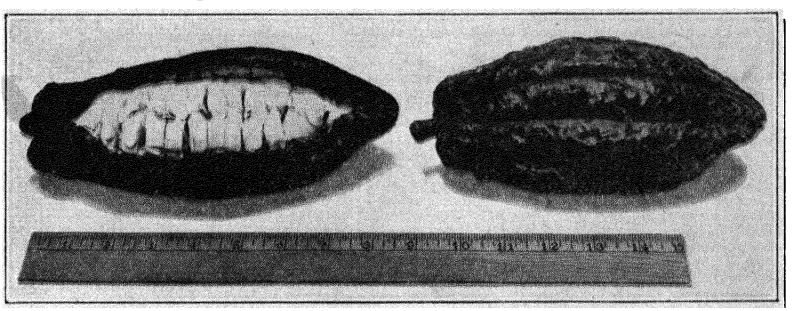


Underwood and Underwood

Conditions of Growth. The cacao tree thrives under certain very definite conditions. It requires much heat, but it can not stand much direct sun. This fact makes necessary either natural or artificial shade. The tree requires plenty of rain. The soil in which it grows must be deep and rich. As wind is fatal to the production of cacao beans, the tree must be grown in regions protected, either naturally or artificially, from the wind. For this reason, many of the islands of the

West Indies are unable to grow it, as they are exposed at times to high winds. The cacao tree is generally found on tropical lowlands where the heat and the moisture are of the right degrees. As these regions are unhealthful for human beings, it is difficult to obtain an adequate labor supply. The limits of the equatorial calms (thirteen degrees north and south of the equator) appear to mark the boundaries of most successful cacao culture.

The tree, which is an evergreen, normally grows to about twenty feet in height. The blossoms and the fruit grow directly on the trunk and the larger limbs of the tree. The fruit resembles a cucumber in shape, but is much larger. It contains from thirty to forty large seeds that resemble almonds but are greater in size.



Hershey Chocolate Co.

Cacao pods. The length of the pods is indicated by the ruler in the lower part of the illustration. Note the beans in the pod at the left.

A Cacao Plantation. Cacao trees are raised from seed in either nurseries or orchards. When they are planted directly in their permanent locations, they are spaced far enough apart (fifteen to twenty feet) to allow for the spread of the mature tree. Generally, two or three seeds are planted in one place. The inferior plants are pulled up, and the better ones are allowed to mature.

The method more commonly used is to raise the young plants in a special nursery, where better care can be given them. When about a foot high, the young trees are transplanted to the orchard. Great care is taken to protect them from too much sun and wind. Shade trees are planted between



Hershey Chocolate Co.

Cutting cacao pods from the tree.

rows. Sometimes banana trees, which furnish both shade and protection from the wind, are used.

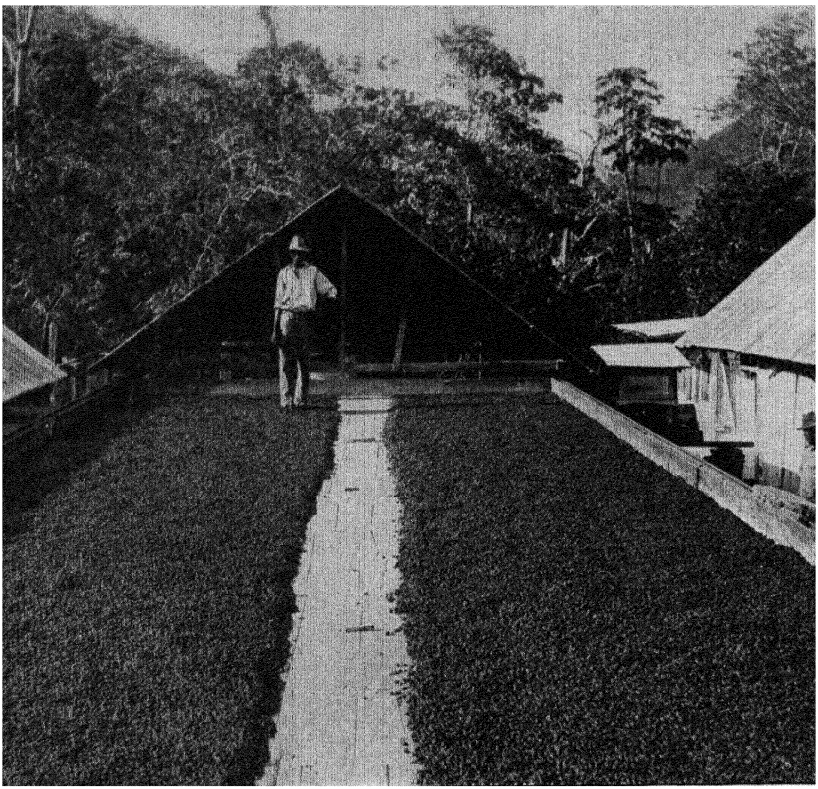
After about five years' growth, the trees begin to bear fruit. From blossoming to fruiting, the time is about four months; and, although the chief crop is gathered in the early part of the dry season, the blossoming and fruiting continue throughout the year. Some fruit can be picked by hand; that growing higher on the tree is cut by a special knife on a pole, and the fruit is caught as it falls. Great care must be used not to spoil the blossoms, which mean future fruit.

The pods, or fruit, are carried to a place where they are cut open, and the seeds are taken out. In order that their slimy covering will be removed, the seeds are piled in heaps and allowed to ferment. Special care must be taken not to leave them too long. Three days are usually enough to complete this process. The beans, or seeds, are then washed or rubbed to remove any pulp that may still cling to them, and are dried like coffee beans on stone floors or sliding trays.

After being polished, the beans are ready for the market and are shipped to Hamburg, Havre, London, and New York City, the leading cacao markets.

Distribution of Cacao. Although a native of the Americas, the cacao tree has been successfully transplanted to the Old World. The leading countries of production border on the Gulf of Guinea. Since 1900 two British West African colonies, Gold Coast and Nigeria, have expanded their plantations and now produce about three fifths of the world's crop. In South America, Brazil is the most important producer, followed by Ecuador and Venezuela. Some cacao is raised in the West Indies, notably in the Dominican Republic, and in the countries of Central America. The acreage devoted to the cacao tree in Ceylon and the East Indies is rapidly increasing.

In Europe, for a long time Spain led in the consumption of cacao and its products, especially chocolate; but England, Germany, Holland, and France have surpassed her. The demand of the United States for chocolate, both as a beverage and for candy, is enormous. It is a popular soda-fountain flavoring, and this use alone requires annually many hundred



Philip D. Gendreau

Cacao beans spread on the floor of a drying shed.

thousands of pounds of cacao beans. In total consumption of cacao the United States leads the rest of the world, using about two fifths of the world's supply.

TEXT QUESTIONS

1. What products do we obtain from the coconut tree, the coca tree, and the cacao tree?
2. Describe the discovery of chocolate as a drink.
3. Discuss the growing conditions of the cacao tree. Why is it difficult to get a labor supply for its cultivation?
4. Where is the cacao tree grown principally?
5. Describe a cacao tree; a cacao pod.
6. Tell how cacao trees are planted and cultivated.
7. How is cacao harvested?
8. How are cacao beans prepared for export?
9. Discuss the distribution of cacao production and consumption.

PROBLEMS AND PROJECTS

1. On an outline map of the world, indicate the regions of production and consumption of coffee, tea, and cacao.
2. Collect pictures showing the culture and manufacture of coffee, tea, and cacao.
3. Collect samples of different coffees. Compare them.
4. Collect samples of different teas. Compare them.
5. Why are not coffee, tea, and cacao produced in the United States?
6. What is the harmful ingredient in coffee? in tea? Explain fully.
7. Explain the popularity of chocolate in the United States.
8. Explain why coffee is popular among the Mohammedans.
9. Why is chocolate a good emergency food?
10. Explain the popularity of tea in the Orient.
11. Explain the large per capita consumption of tea by the English.
12. Why does cocoa retain heat longer than tea?
13. Contrast in quantity and quality the coffee consumed in Europe with that used in this country.
14. Make a list of magazine articles, pamphlets, and books dealing with the subject matter in this chapter.

TOPICS

1. Food values of coffee, tea, and chocolate.
2. The Boston Tea Party.
3. The old English coffeehouses.
4. Races and their beverages.
5. Handicaps of tropical agriculture.

FOR CLASS DISCUSSION

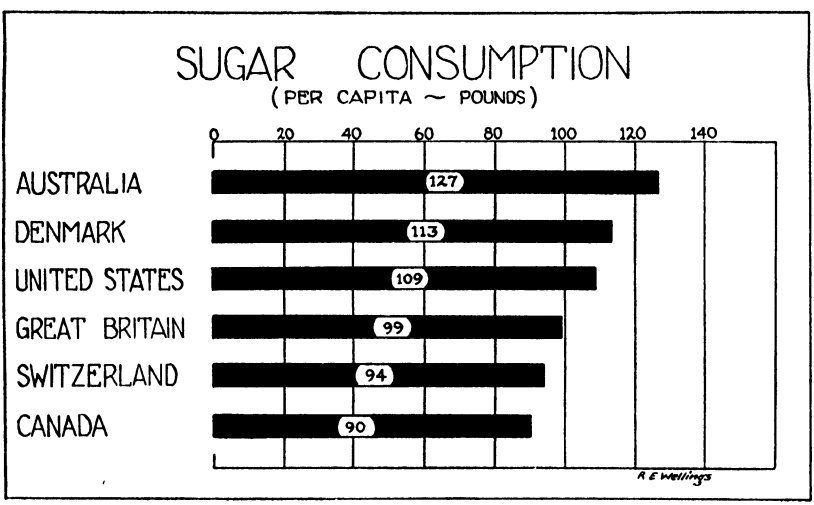
1. Coffee is more beneficial than tea to the human race.
2. The human race would be better off without coffee or tea.
3. Less chocolate should be eaten by students.

CHAPTER X

SUGAR

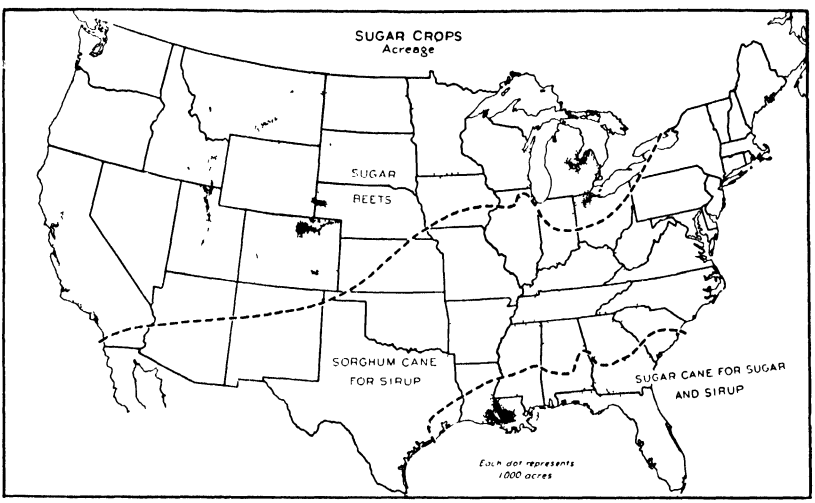
SECTION 1—CANE SUGAR

Introduction. Imagine eating your own weight in sugar every year! You probably do so if you weigh one hundred and five pounds or less, for this amount is about the annual per capita consumption of sugar in the United States. If it were possible to divide the world's annual crop of sugar equally among all persons in the world, it is roughly estimated that each would receive about twenty-five pounds. How fortunate we are to live in a country where we can afford to have so much sugar!



Sources of Sugar. Almost all plants store away, for future use, some form of sugar. Two plants, however, are particularly rich in sugar: the sugar cane and the sugar beet. These two are the principal sources of our commercial sugar. Maple sugar is extracted from the sap of the maple tree. The palm tree furnishes palm sugar. Corn contains a sugar, used

chiefly in the form of syrup for cooking. Sugar of milk, a by-product of cheese making, is used much in medicinal mixtures. Maple sugar, palm sugar, and sugar of milk do not, however, enter into world commerce to any great extent. Through our vegetables and fruit, all of which contain some sugar, nature supplies us with all the sugar we really need.



U. S. Department of Agriculture

Sugar crops in the United States. Sugar-cane raising in Continental United States is limited to a relatively small area because of the long frost-free season that is necessary.

History of Cane Sugar. The cultivation of sugar cane began in India, whence it was carried successively to Egypt, other parts of northern Africa, Madeira, the Canary Islands, and eventually to the West Indies and Brazil. The use of sugar in ancient times in India is indicated by the accounts of the expedition of Alexander the Great in India in which it is recorded that he "ate solid honey not made by bees." In the Old Testament there is one brief mention of it as "the sweet cane from a far land," indicating that it was not common in Biblical times. Greek physicians knew of it as "Indian salt" and used it in medicinal mixtures. Numerous references in ancient writings show that honey was the common sweet in those times.

Returning Crusaders brought back with them a knowledge of and a taste for sugar, which led to sugar-cane production in Madeira and the Canary Islands. Upon the discovery of the Americas, its cultivation spread rapidly to the West Indies and Brazil, where the climate and soil were very favorable.

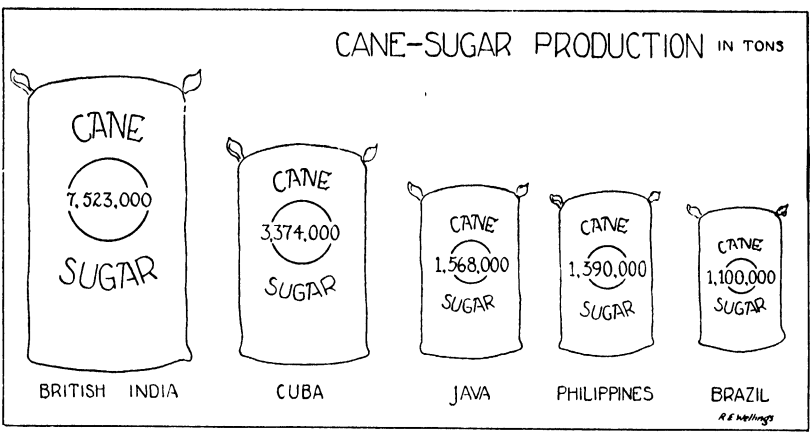
During the nineteenth century, sugar-cane production spread rapidly and was supplemented by an ever-increasing beet-sugar production, until sugar ceased to be a luxury in the prosperous countries.

Requirements of Sugar Cane. Sugar cane is a tropical and subtropical plant. In appearance it resembles a cornstalk with the rings of a bamboo, but has a solid, fibrous center. In some cases it grows as high as twenty feet, although it usually rises only six or eight feet. Sometimes it has a flower somewhat like a corn tassel. The stalk is full of juice, which, when boiled sufficiently, yields the desired sugar.

Sugar cane grows best in regions where the temperature is more than seventy-five degrees, although it will grow in places where the temperature drops below this point, provided it has an eight-month growing season free from frost. Plenty of sunshine is necessary to obtain cane yielding a large percentage of sugar. Frequent heavy showers are needed, unless irrigation supplies the required amount of water. Sunny irrigated regions make an ideal setting for a sugar-cane plantation. The soil should be rich in phosphates and preferably level, with proper drainage. Only extremely high winds are injurious to sugar cane.

Distribution of Sugar Cane. Sugar cane, like some other agricultural crops, during the past ten years, has shown a tendency to shift in the relative importance of its leading regions. Since 1932 British India has steadily increased its sugar-cane areas, until now it leads the countries of the world in amount of sugar cane planted and cane sugar produced. Its sugar, however, is an inferior grade, called *gur*, and is not refined into white sugar. India's sugar is consumed wholly within the borders of India, and enters the world trade not at all. In fact, much sugar is imported from nearby Java to supply local demands.

Cuba has been, and still is, the outstanding producer of the cane sugar that enters into world commerce. Cuba is peculiarly favored for sugar-cane growing. Its relatively small population makes possible large areas for cultivation.



More than half the island is of level land adaptable to machine methods. The soil is deep and rich, permitting several successive crops. The climate is frost-free. There is plenty of rainfall when the cane most needs it, followed by a dry sunny period, which increases the sugar content of the cane and also dries up the land in time for harvesting operations. The coast line is very irregular with many natural harbors, which make it possible for large ocean-going vessels to load at, or near, the sugar plantations. Cuba is, moreover, near the great sugar markets in the United States where it enjoys a special low tariff.

Java ranks high as a producer of cane sugar and also as an exporter. Much of the sugar of Java goes to India and nearby countries of the Orient. Java has ideal conditions for raising sugar cane, but, because of her large population, it is necessary to work the land intensively to feed her people. Only one crop of sugar is allowed from each annual planting, the land being immediately plowed after the cane harvest, for rice or some other food crop. Java succeeds in getting

high yields of sugar cane per acre, thereby overcoming the handicap of a costly annual planting.

Hawaii, the Philippines, and Puerto Rico make large annual contributions to the cane-sugar supply of the world, especially to the markets of the United States, where they do not have to pay duties. In continental United States, Louisiana and Florida raise some sugar cane, although the danger of frost is present. We are forced to import large amounts of sugar every year.

Other regions that make substantial contributions to the world's sugar bowl are Brazil, Australia, Peru, the West Indies, the East Indies, and Formosa (Taiwan), which is being developed to provide more and more for the sugar demands of Japan, to whom the island now belongs.

Raising of Sugar Cane. The cane sprouts from small cuttings of sugar cane planted in furrows. Until the cane is sufficiently high to stop the growing weeds, weeding is necessary and is done by machinery or by hoes. After about seven or eight months' growth, the cane is mature and ready for cutting. The cane is cut near the ground with long knives, called machetes, and is then gathered by bull carts or little trains on portable tracks and carried to the sugar mill.

Extraction and Crystallization. From the unloading platform, the cane moves along on an endless belt to big rollers, which crush it thoroughly. The fiber that is left is called *megasse,* or *bagasse,* and is used for fuel, or to make wall board.

The juice runs down into large vats, where it is purified by the addition of a milk of lime and by a skimming off of the impurities, which rise to the surface. It is then boiled in vacuum pans because liquids boil in a vacuum at a lower than ordinary temperature. This process is used because it saves fuel and conserves some of the sugar crystals.

When the juice has boiled down to a certain degree, it passes through pipes to a machine called the centrifugal. This resembles a large tub with a metal strainer inside it. The centrifugal is set in motion, and the mass of sugar is thrown



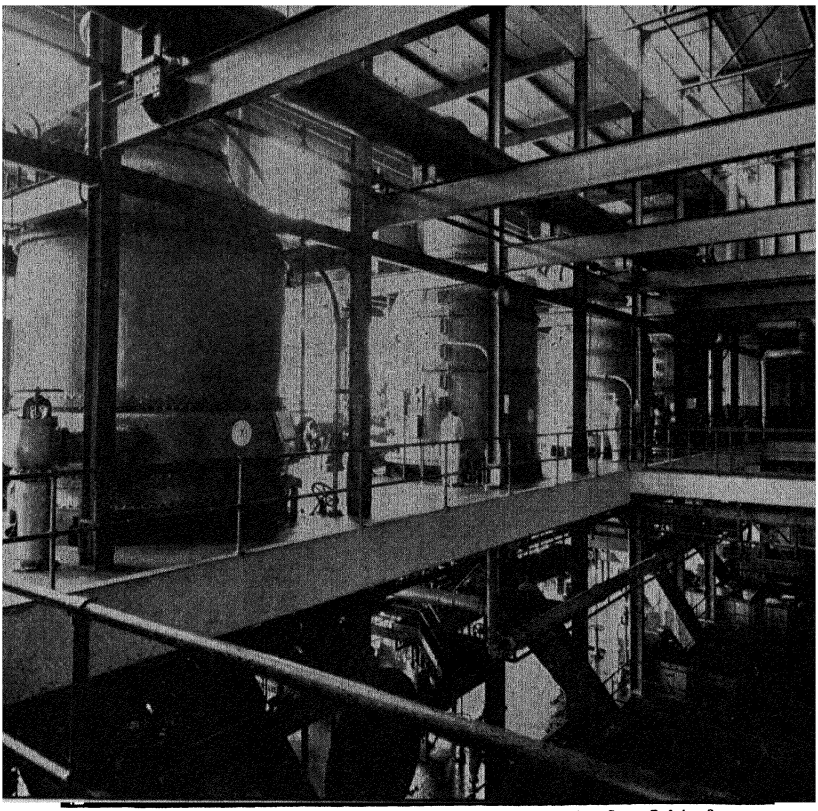
Keystone View Company

Cutting and loading sugar cane in the field.

against the metal strainer. The liquid passes out through the holes, while the sugar crystals, unable to get through, are retained inside. These furnish raw sugar and make up the brown sugar we buy at stores. The liquid that passes through the holes is later refined for molasses and cattle food or is distilled into alcohol.

Cane-Sugar Refineries. Raw cane sugar is refined into the desired white sugar of commerce at refineries, located at the large seaports of the great sugar-consuming countries in the temperate zone. These refineries are so located because they are easily reached by water transportation from the sugar mills, and so permit the concentration of the products of several mills; they are near power resources, such as coal and oil; they are near the skilled workers necessary; and they are close to the consumer market.

The leading cane-sugar refineries in this country are in New York, Boston, Philadelphia, Savannah, New Orleans, and San Francisco, the last being a refining center for much of the raw sugar from Hawaii and the Philippines. Montreal, Halifax,



American Sugar Refining Co.

Part of a sugar refinery. In these large vacuum pans the juice from the sugar cane is boiled until the proper state of crystallization is reached.

and St. Johns, in Canada, have large cane-sugar refineries. In England, cane-sugar refineries are located in London and Liverpool. Because Europe is a large beet-sugar producer, no large cane-sugar refineries are there.

TEXT QUESTIONS

1. Discuss the origin of sugar and its spread to other countries.
2. Prove that sugar was a rarity in olden times. What was the common sweet?
3. What historical events increased the planting of sugar?
4. Does the greater proportion of our sugar supply come from sugar cane or from sugar beets?
5. What is the annual per capital consumption of sugar in the United States?

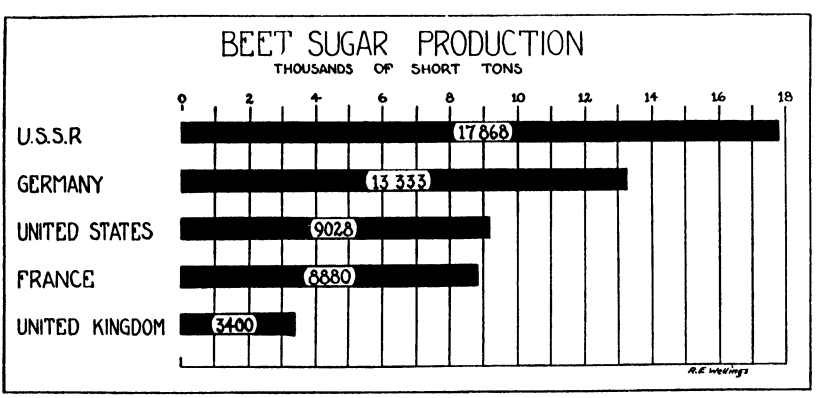
6. List the principal plant sources of sugars. Which are most important?
7. What are ideal conditions for growing sugar cane?
8. Discuss sugar-cane growing in India.
9. What geographical factors favor Cuba as a sugar-cane grower?
10. Why is Java limited to one crop of sugar cane a year?
11. In what ways are the Philippines, Puerto Rico, and Hawaii favored in the sugar markets of the United States?
12. What is the outstanding producer of the cane sugar that enters into world commerce?
13. List all the regions under the American flag that produce cane sugar.
14. Tell how sugar cane is planted and cultivated.
15. Explain how sugar is extracted from sugar cane.
16. Where are cane-sugar refineries located? Why?
17. Where are the leading cane-sugar refineries in the United States? in Canada? in England?
18. Why are there no large cane-sugar refineries in Europe?
19. Define the following terms: bagasse; machete; vacuum pan; centrifugal; raw sugar.

SECTION 2—BEET SUGAR AND MAPLE SUGAR

History of Beet Sugar. Sugar-beet culture began during the Napoleonic Wars when France, blockaded from cane-sugar supplies, offered prizes for a workable method of extracting sugar from beets. The result of this offering of prizes was that beets were so improved in sugar content that it became profitable to raise them for sugar. Beet growing spread rapidly until, about 1900, the quantity of sugar from beets exceeded that of sugar from cane.

During the World War, the production of beet sugar was seriously crippled because many of the regions devoted to sugar-beet culture were in the actual seat of war. From this setback, and also because of the fact that sugar can be extracted from cane more economically than from beets, beet sugar has never regained its leadership, although its production now is greater than ever before.

Distribution of Beet Sugar. Across the northern plain of Europe, the culture of sugar beets is a well-established and



important industry. Beet sugar is consumed almost wholly in, or near, the country of its origin. Russia and Germany are the outstanding producers of beet sugar in Europe; the United States is the leader in America. France, Italy, Belgium, the Netherlands, Sweden, Denmark, and Great Britain produce considerable crops, but consume them within their own bor-

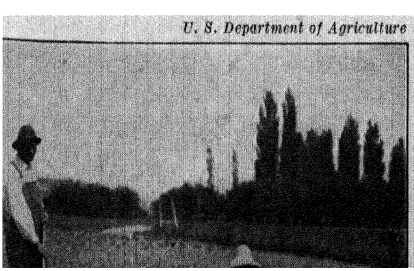
ders. Great Britain has doubled her production in the last five years.

In the United States, some of the irrigated lands, with their sunshine and abundance of water, are ideal locations. On the northern and western edges of the corn belt, beet culture is generally profitable, although the lack of sufficient rainfall sometimes results in a crop failure. Colorado, California, Nebraska, Michigan, and Utah are our leading sugar-beet states.

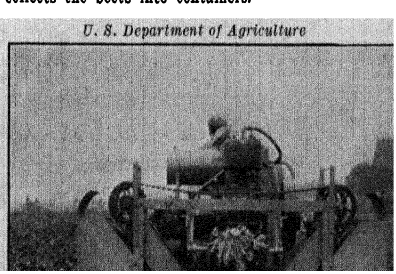
Sugar-Beet Culture. The sugar beet is a product of the temperate zone. Ideal conditions call for a moderate spring, followed by a warm summer with plenty of rain and then by a cool, dry autumn. Fertile, mellow loam, rich in lime, is the best kind of soil. Plenty of cheap labor is required. In Europe there is an abundance of cheap labor, but in this country the lack of it has been a serious handicap. The necessary cheap hand labor is obtained by contract between the farmers and immigrant families, who agree to care for a certain acreage and to do all the work necessary in raising the crop.

The seeds are planted in long rows in early spring. When the little beet plants appear, they must be carefully thinned. This process must be done by laborers on their hands and knees. No machine can do it. Later the ground must be continually weeded. This work may also be done by hand, although usually horse-drawn cultivators are used between the rows. When the beets are ready to be harvested, they are taken from the ground by forks, or plows, that turn the beets

Thinning sugar beets. This task is slow and tedious; it must be done wholly by hand labor.



Harvesting beets by machinery. On large farms machines are replacing other methods. The machine plows up the beets, cuts off the tops, and collects the beets into containers.

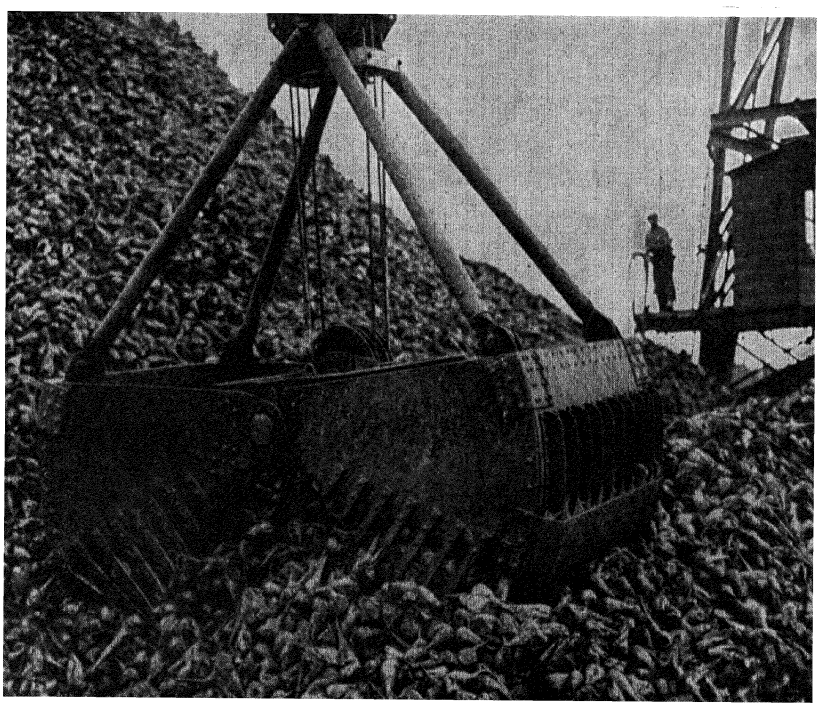


to one side. The tops are cut off, and the beets are piled and covered with straw until they are taken to the mill.

Extraction of Beet Sugar. After being thoroughly washed to remove the dirt and mud, the beets are cut by machinery into tiny slices. These slices are then placed in a series of twelve tanks, called diffusion tanks, through which warm water runs slowly, gradually washing away the beet juice. These tanks are constantly being emptied and refilled with new sliced beets in rotation. The juice washed out from the beets in the tanks comes out through pipes into a large tank where it is treated exactly as the juice of the sugar cane. Beet juice is extracted by *diffusion*, or soaking, whereas cane juice is extracted by *pressure*, or squeezing.

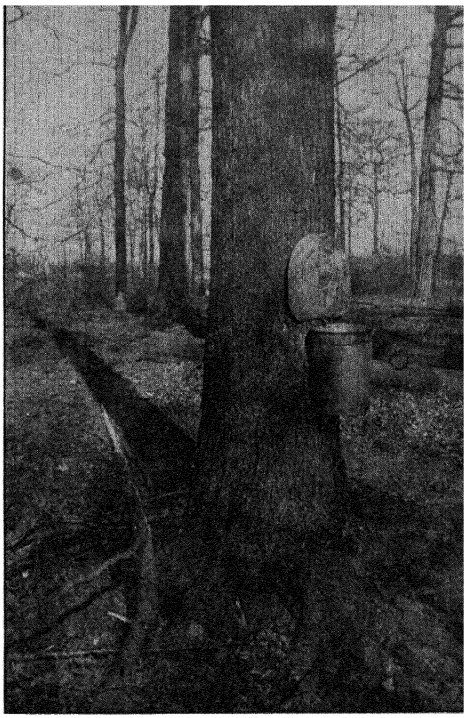
The refineries for beet sugar are located at, or near, the beet-sugar mills, and not at a distance as in the case of cane-

Scooping beets, at the beet-sugar mill, before slicing them.
Keystone View Company



sugar refineries. With the exception of water transportation, beet-sugar refineries enjoy the advantages noted under cane-sugar refineries, and, in addition, are nearer the large sugar markets of the interior of the country.

There is no waste to beet-sugar making. The tops and the leaves of the beets are used for cattle food. The beet pulp that is removed from the diffusion tanks is dried and pressed into cakes for cattle food.



U. S. Department of Agriculture

Obtaining sap from a maple tree by means of a bucket attached to the tree.

Maple Sugar. In the northern part of New England and New York, and in the southern part of eastern Canada, maple sugar, considered a great delicacy, is made from the sap of the sugar-maple tree. The sap is taken from the maple trees through holes bored into the trunk. It is boiled down, crystallized, and molded into forms suitable for sale. It is sold also as maple syrup. The production of maple sugar forms an important local industry, although this sugar does not enter, to any extent, into world commerce.

TEXT QUESTIONS

1. Why did sugar-beet culture begin? Why was it encouraged?
2. How is the juice extracted from beets?
3. Compare the extraction of juice from beets and that of juice from cane.
4. Contrast the locations of cane-sugar and beet-sugar refineries, and give reasons for the difference.
5. What is maple sugar? How is it obtained? Where is it obtained?
6. What is the importance of maple sugar?

PROBLEMS AND PROJECTS

1. On an outline map, indicate the leading sugar-cane producing regions of the world.
2. On an outline map, indicate the leading sugar-beet producing regions of the world.
3. On an outline map of the United States, indicate the cane-sugar, beet-sugar, and maple-sugar states. Show the location of the sugar refineries.
4. Prepare a list of magazine articles, pamphlets, and books dealing with the subject of sugar.
5. Draw up a list of the different kinds of sugar obtained from plants, and tell what each kind is used for.
6. The United States has a good climate and good soil for sugar production. Why do we import much sugar? Explain.
7. Discuss the use of by-products of sugar cane.
8. Explain the sugar-beet production of Michigan.
9. Explain how the discovery of America greatly stimulated the production of sugar.
10. How did the World War affect the sugar supply of the world?
11. What is glucose and what is it used for?
12. How does the canning industry affect the price of sugar? Why?

TOPICS

1. The history of sugar production.
2. The necessity of close co-operation between the sugar-beet growers and the sugar mills.
3. Sugar as a food.
4. The passing of sugar from a luxury to a necessity.
5. The increase in sugar demand and supply.
6. Sugar and the tariff.
7. Sugar as an article of world commerce.
8. The overproduction or underconsumption of sugar.

FOR CLASS DISCUSSION

1. Our Government should admit into this country tax free those articles that can be produced more cheaply elsewhere than at home.
2. The tariff on sugar should be abolished.
3. Beet sugar will eventually win in competition with cane sugar.
4. The Government should regulate the price of sugar.
5. Sugar is more detrimental than beneficial to the human race.

CHAPTER XI

PLANT PRODUCTS

SECTION 1—TOBACCO

History of Tobacco. Bhang, a kind of hemp, was being smoked by the Turks and other Eastern peoples long before the discovery of America. The sailors of Columbus found the natives of the New World smoking a new substance that they called tobacco, from *tobago,* the name of the Y-shaped pipe used. This new plant was carried to Spain, where, for its medicinal properties, its culture was encouraged.

A man named Nicot introduced it into France; and from his name, we get the word *nicotine,* which designates the active poison in tobacco. In spite of the opposition of the clergy and the ruling powers, the use of tobacco rapidly spread over all Europe during the seventeenth century.

During their early Colonial days, Virginia and Maryland found tobacco a great source of income and exported it heavily to the markets of Europe. So important was this product to the early colonists that it was used as money.

Importance of Tobacco. The area planted in tobacco in the United States has tripled in extent since the Civil War. Today tobacco ranks seventh in value among the farm crops. As an export, tobacco usually ranks third, being commonly outranked only by cotton and wheat. As a source of federal internal revenue, it ranks second only to the income tax.

Distribution of Tobacco. India and China rank highest in world tobacco production, followed by the United States in third place. Other leading regions are Russia, Brazil, Japan, Greece, Turkey, Italy, France, the East Indies, and the West Indies.

Only a small part of India's crop is exported. China is an importer. The United States is the largest exporter, followed by the East Indies. The largest importer is England,

followed by Germany. Europe takes three quarters of the tobacco exported.

Most of the tobacco exported from the United States goes to England, China, France, the Netherlands, Germany, Belgium, and Australia. We import cigar wrappers from Sumatra and Java; cigar fillers from Cuba and Puerto Rico; and cigarette tobacco from Turkey and Greece.

Nearly three quarters of our immense crop of tobacco is grown in four states: North Carolina, Kentucky, Virginia, and Tennessee. The remainder is grown mainly in South Carolina, Pennsylvania, Ohio, Georgia, Wisconsin, Connecticut, Maryland, and Florida. Some states, like Connecticut, Wisconsin, Florida, and Louisiana, while not producing large quantities, have an excellent reputation for special grades. Our principal tobacco markets are Louisville, Kentucky; Richmond, Virginia; Durham, North Carolina; Key West, Florida; and Winston-Salem, North Carolina.

The Tobacco Plant. Tobacco grows over a wide range of climate. Its growing season is comparatively short, only three

Tobacco plants.

U. S. Department of Agriculture





Homeyer-Clark Studio

Freshly picked tobacco drying in the sun.

months. If the weather is warm and moist, it thrives well in the temperate zone. The soil should be rich in potash; but, if fertilized, poor soils can be used. Soil and climate, especially soil, have a great influence on the kind of leaf produced.

There are many varieties and grades of tobacco. Skilled sorters can separate tobacco into hundreds of classes. Oftentimes leaves from the same plantation can be sorted into many different grades. These grades are determined by the type of leaf, the purpose for which it is intended, its odor, the way in which it has been cured, its freedom from large veins, its gumminess, its elasticity, its color, and its burning qualities.

How Tobacco Is Grown. Tobacco is grown annually from small seeds so tiny that several hundred thousand are contained in an ounce. The seeds are planted early in the spring in carefully prepared plant beds. It is customary, before planting, to mix the seeds with ashes to give them better scattering and fruiting qualities. When the plants are about six inches high, they are transplanted in long rows, about four thousand to the acre. This planting is done by hand generally; but on the larger farms, by machinery that makes a hole, places the plant in it, and presses the soil down. In the fall when harvest time comes, some farmers pick off the leaves separately, taking off the lower leaves first, because they ripen before the others. The leaves are then strung on string or wire. Other farmers cut down the whole plant, slit it up the main stalk, and hang it over a wooden pole.

Curing of Tobacco. The leaves are taken to drying barns, where they are dried by a natural circulation of air or by a heated draft. After being dried, the tobacco goes to the fermentation barns. There it is permitted to ferment under

carefully controlled conditions until the desired amount of fermentation has been obtained.

Tobacco is aged for a period of from two to four years, depending upon the purpose for which it is intended. After being carefully regraded, it is blended or mixed with other kinds, and is ready for manufacture into smoking tobacco, plug tobacco for chewing, cigarettes, cigars, and snuff.

Manufacture of Tobacco Products. Cigars are made by stripping out the midrib of the leaf and rolling a number of the pieces together. A binder leaf is then rolled round the filler, and the whole is encased in a wrapper. This work is done by machinery or by hand. Plug tobacco, for chewing, is prepared from tobacco that is tough and gummy. After chicle and various sauces are added to the tobacco, it is then pressed into molds in such a way that the outside is covered with a good-looking leaf. Cigarettes are made from finely cut tobacco. Snuff is tobacco dust. Pipe tobacco is carefully blended, pressed into cakes, and then ground to the degree desired for various brands.

Waste, in the form of sweepings, stems, and tobacco dust, is used as fertilizer and in the making of plant sprays.

TEXT QUESTIONS

1. Was tobacco a product of the Old or the New World?
2. What is the origin of the word *nicotine?*
3. Explain the importance of tobacco to Colonial Virginia.
4. What are the ideal growing conditions for tobacco?
5. How are the various grades of tobacco determined?
6. How is tobacco grown?
7. Describe the curing of tobacco.
8. Discuss the ways in which tobacco is prepared for the market.
9. Where is tobacco grown? Where is it consumed?
10. Name the chief tobacco markets of the United States.

SECTION 2—VEGETABLES

Importance of Vegetables. Vegetables are very important to us as food. They furnish our bodies with starch for fuel and energy; with proteins for muscle and tissue; with mineral salts for bones and teeth; with acids for digestion; with bulk and roughage for our intestinal tract; and with vitamins, without which we could not live. From vegetables we get food in the form of fruits like tomatoes; blossoms like cauliflower; leaves like cabbage; stems like celery; roots like beets; bulbs like onions; and tubers like potatoes.

The use of vegetables is almost universal, consumers ranging, in quantity used, from the Chinese, who live largely on vegetables and cereals, to the Americans, one quarter of whose daily food is composed of vegetables. As our country becomes more thickly populated, we shall probably increase the proportion of vegetables in our diet. Dense populations tend toward a vegetarian diet, because scarcity of land compels them to raise food that is very cheap to produce.

Intensive methods enable the farmer to raise more food per acre in the form of vegetables than in any other form. The fruit and vegetable industry in our country has risen to a place where its products comprise almost sixteen per cent of the farm crops in value. Because of the large domestic demand, the bulk in shipment, and the perishable quality, the chief value of vegetables lies in domestic consumption rather than in export trade.

History of Vegetable Growing. So far back does the use of vegetables by man extend, and so varied and scattered over the world is it, that it is impossible to trace the growth of the industry as a whole. The New World gave to Europe three important contributions in food vegetables—the potato, the sweet potato, and the tomato. The early colonists brought with them from the Old World seeds of the common vegetables. Learning many valuable lessons from the Indians, they soon found how to adapt the culture of the imported vegetables to local conditions, with the result that some vegetables remained the same in character, while others took on



U. S. Department of Agriculture

A field of celery.

different qualities, especially when crossed with native kinds of the same vegetable.

Distribution of Vegetable Growing. In regions of dense populations is found the greatest emphasis on vegetable growing. The great mass of people in Europe depend almost wholly upon vegetables for food. England, after raising much in the southern part of the island, calls every year on neighboring countries for millions of dollars' worth of vegetables. The early market of other parts of Europe is supplied with produce from the gardens of northern Africa, especially Algeria and Egypt.

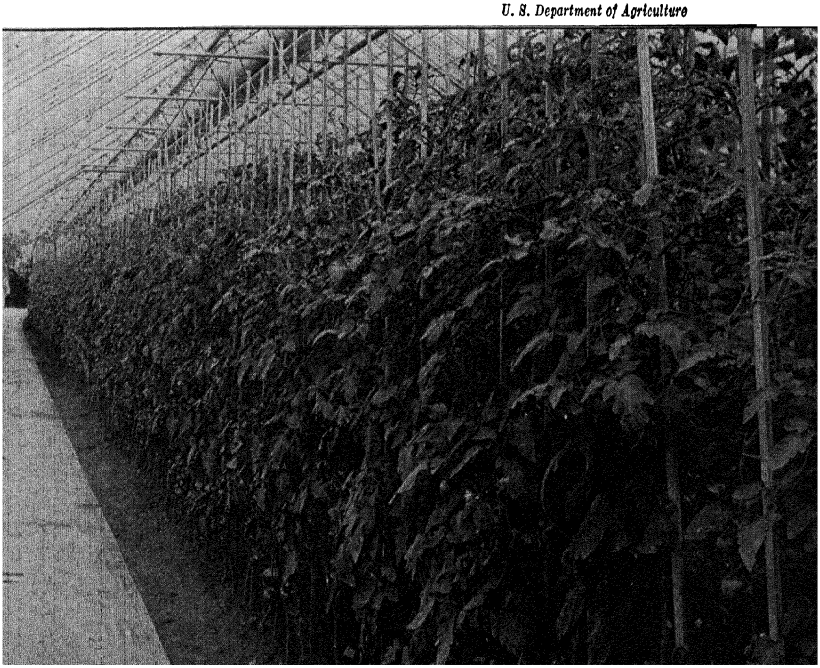
In the eastern part of our country, we find the people of the Atlantic coastal plain busy raising vegetables for the large cities found there. The soil, a light sandy loam, is excellent for quick and early growing. Early in December, green vegetables begin to pour into the northern cities from southern Florida; and then the area of production gradually moves northward with the season through northern Florida, Georgia, the Carolinas, Virginia, the southern part of New Jersey and Delaware,

until summer finds the green vegetables ripening in New York and New England.

Wilmington, Delaware, Philadelphia, Pennsylvania, Baltimore, Maryland, and Norfolk, Virginia, are natural shipping points to the large cities, and immense freights move from them. Chicago and the cities of the Mississippi Valley find a somewhat similar movement from regions on, and north of, the Gulf of Mexico. California, with her wonderful all-the-year-round facilities for growing vegetables, supplies the cities west of the Rocky Mountains. Her great surplus is canned. By means of modern transportation facilities, some of her produce is shipped eastward, in specially built cars, even as far as the Atlantic Coast.

Vegetable Culture. The vegetable farm must be so located that climate and soil conditions are right; there must be abundant cheap labor and good transportation facilities. The raising of vegetables requires plenty of fairly cheap hand

Tomatoes cultivated under glass for the early market.
U. S. Department of Agriculture



labor. Hand labor is needed for transplanting young plants from the nurseries, weeding, thinning, picking, packing, and shipping. The southern part of the Atlantic coastal plain depends almost wholly on negro labor. The truck farmer of California looks to Chinese, Japanese, and Mexican labor. Vegetable gardeners near our large cities find a source of cheap labor in the immigrants from Europe, who are especially good workers because they have been trained along this line in their native countries.

TEXT QUESTIONS

1. Why are vegetables important to us as food? What do they furnish us?
2. Show how we get vegetable foods from the various parts of plants.
3. Why are vegetables important in densely populated regions?
4. Why do vegetables not enter more into foreign commerce?
5. What vegetables did the New World give to the Old?
6. Where does Europe get vegetables for her early markets?
7. Explain the northward movement of vegetable farming in the United States as the summer advances.
8. Why is the Atlantic plain especially fitted for vegetable growing?
9. What are the leading vegetable-shipping centers?
10. What part does California play in the vegetable-growing industry?
11. Why is a supply of cheap labor necessary in vegetable growing?
12. Explain how this labor is obtained in the South; in California.

SECTION 3—THE POTATO

Importance of the Potato. The potato is a native of South America. It was carried by the Spanish explorers to Europe, where, after a slow start, it has become the most important food vegetable grown. Its slow start is explained by the poor quality of the primitive potato; but this hindrance has been overcome by crossbreeding, until now we have the present desirable product. In Europe, the potato is popular because it can be produced in large quantities in a comparatively small area and thus furnishes to the large populations the cheapest form of food. In regions outside of the European corn belt, the potato is very important also as a food for cattle and swine. Europe has learned to make starch, potato flour, and alcohol from its surplus potatoes.

In this country, because of the competition of other vegetables, there is a limited production of potatoes. The potato

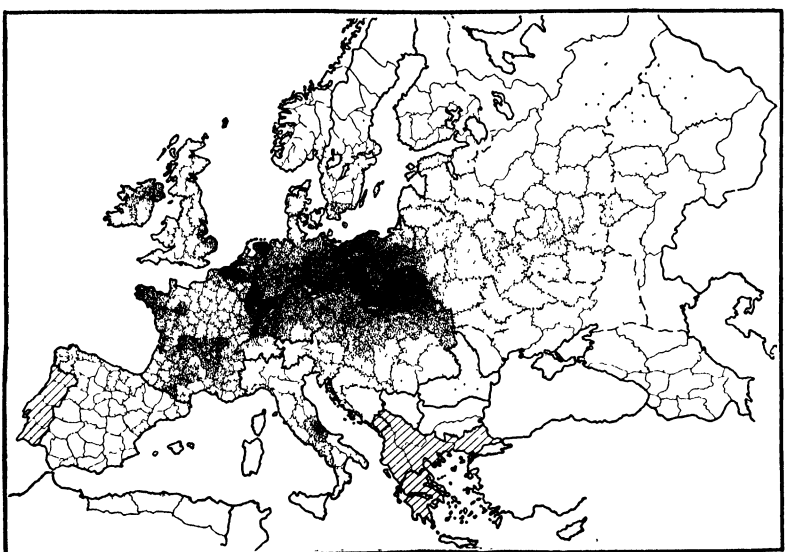
White-potato canning plant at Palatka, Florida. After years of experimenting, the process of canning the smaller No. 2 Irish potatoes, which formerly went to waste, has been perfected.

Keystone View Company



takes a relatively small place as a table vegetable here, although in value the potato crop outranks all other vegetable crops combined. Our great cornfields make the potato unnecessary as a stock food. We have not yet found it practicable to use our surplus much in the form of alcohol, dried flakes, or potato flour; and so the ever-present fear of overproduction limits, to some extent, our planting of potatoes.

Distribution of the Potato. Curiously enough, the potato in South America, its place of origin, is of very small importance. It grows better in the Northern Hemisphere, where



U. S. Department of Agriculture

Potato production in Europe. The large potato crop is an important part of the food supply of this continent.

it has been perfected. Europe produces over ninety per cent of the world crop. Germany leads in importance, followed by Russia and France. The great northern plain stretching back from the Baltic Sea is the potato patch of the world. The yield per acre in Europe is large because of the intensive method used. England imports many potatoes to supplement her production. Ireland is noted for her large per capita yield.


U. S. Department of Agriculture

Planting potatoes.

The great bulk of potatoes in this country is raised in the northern sections. The states that lead in potato growing are Maine, Idaho, Michigan, New York, Pennsylvania, Minnesota, and Wisconsin. While much of the early crop is grown farther south, the bulk of the supply comes from these states. Potatoes are grown in all sections of this country, except those in which, because of altitude or lack of water, they cannot be grown.

Potatoes in Commerce. The potato, because it is bulky and perishable, has a rather low place in world trade. It is rarely exported, except when countries are near at hand, as in Europe, or where transportation facilities make it possible to ship quickly and cheaply. It is essentially a product for domestic consumption. As a crop from which to make money, it requires a large market fairly near at hand.

In this country the potato farmer is continually haunted by the fear of overproduction. A year of plenty brings low prices; a year of scarcity, high ones. This makes it necessary to plan a season ahead, but forecasting is difficult. It also explains to some extent why we do not produce as much as we could in this country, where a surplus means ruinous prices to the producer. The perfection of methods of conserving the potato in times of abundance, by converting it into potato flour, alcohol, or dehydrated slices, would remove this ever-present danger to the farmer and greatly increase potato growing. Many more farmers would engage in potato culture if they could be assured of a steady market and a reasonable price for their product. Co-operative associations are tending to help to restrict production and to market the crop intelligently.

Sweet Potatoes. Next in importance to the potato comes the so-called sweet potato. It grows well in our Southern

States, where it forms one of the principal staples of food supply. It is very rich in starch and therefore is valuable as a food. It can grow in summer as far north as New York. Because it can do well in light sandy soils, it is also raised extensively in New Jersey, Virginia, and Maryland for the eastern and northern markets. Similar conditions are found in the North Central States, where it is grown for Chicago and other large cities of that region. China leads all other countries in its production.

Because of the perishable nature of the sweet potato and its rapid decay in warm temperatures, commerce in it is severely handicapped. The sweet potato can be easily dried and ground into powder or flour. A mixture of wheat flour and sweet-potato flour is very palatable. In this form the sweet potato could become a valuable addition to our food sources, should necessity demand it.

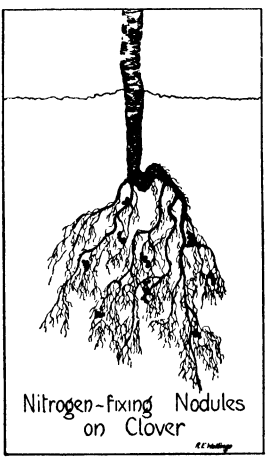
The yam, a product of tropical America, resembles the sweet potato in appearance. It is valuable as a food in those regions in which it is grown. Since it is consumed locally, it enters into commerce to only a small extent.

TEXT QUESTIONS

1. Explain the popularity of the potato in densely populated regions.
2. Why is the potato particularly popular outside of the corn belt of Europe?
3. Contrast its use in Europe with its use in America.
4. Discuss the distribution of potato raising in the world.
5. Where are commercial potato farms in the United States?
6. Why is not the potato an article of importance in our exports?
7. Why do we fear overproduction in the United States?
8. Where are sweet potatoes raised in this country? Why are they grown in these regions?
9. What handicaps commerce in sweet potatoes?

SECTION 4—THE LEGUMES

Introduction. Legumes are vegetables that are valuable to our food supply because they contribute proteins, or food that is a valuable source of nitrogen, and thus, in many cases, are substitutes for meat. They are called *pulse* in the Old World, where they are grown much more than in this country because of the lack of a large meat supply. Legumes have the power to gather nitrogen from the air and to store it in tiny sacs on their roots. They are particularly valuable to the soil because they enrich it with nitrogen.


Nitrogen-fixing Nodules on Clover

Beans and Peas. The principal legumes are beans and peas. Combined with starchy vegetables like potatoes, or starchy cereals like rice, they form a common diet, the mixture supplying both starch and proteins. The Chinese mix beans and rice for their principal food; while in Europe the combination of potatoes or starchy cereals and legumes constitutes the principal diet.

In this country five states lead in bean production. California raises beans on soil too dry for corn; Michigan and New York raise them in regions too cool for corn. Idaho and Colorado also raise large crops.

The soy bean is a legume containing about eighteen per cent oil. This bean is very important as a food in China and Japan, where meat is scarce. It supplies fats and proteins, thus serving as a substitute for meat. The oil, after being pressed out of the beans, is used as butter and lard. In industry, soy-bean oil is used in the manufacture of soap, varnishes, paints, rubber substitutes, waterproofing material, and printers' ink. The bean cake, which remains after the oil has been pressed out, is used as a cattle food and as a fertilizer. Like other legumes, the soy bean supplies nitrogen to the soil.

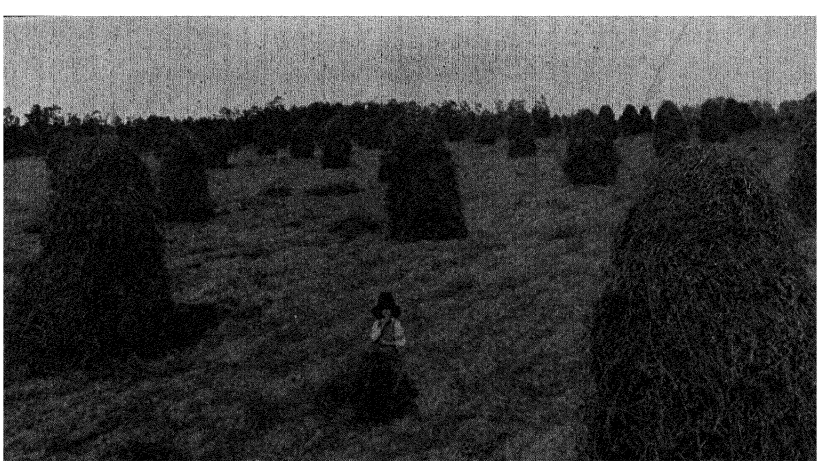
The largest part of the world's crop of soy beans is grown in China, Manchuria, the United States, Chosen, and Japan. From Manchuria, over ninety per cent of the world's trade in soy beans is exported chiefly to Germany, Japan, Denmark, the United Kingdom, and Holland. The cultivation of the soy bean is increasing in both Europe and the United States, where it is grown mainly for stock food, paint, plastics, and as a soil enricher. The states that lead in the production of soy beans are Illinois, which grows more than half our crop, Indiana, Iowa, Ohio, and South Carolina.

Peas, for years, especially before the advent of the potato, formed the principal vegetable of the common people in Europe. They are now widely used as a food in either a fresh or a canned state. Dried peas are used the world round. Peas and beans form important crops in the Mediterranean countries, which are too poor and crowded for the production of an adequate meat supply; in Asia Minor, legumes, especially beans, are the mainstay as a food.

Peanuts. The peanut comes under the heading of legumes and is fast being recognized as a valuable food. It is very rich in proteins; and, in the form of peanut butter, it finds a welcome as a meat substitute. Due in part to the laboratory discoveries of Dr. George W. Carver, the distinguished Negro

Harvested peanuts ready for threshing.

Southern Railway





Threshing peanuts.

scientist, peanut culture is expanding and is now found in various parts of the South, especially in Georgia, North Carolina, Alabama, Virginia, and Texas. It is well established in Texas, where its increase has been especially marked. In addition to the value of peanuts as a human food, the whole plant is an animal food, pigs and cows being particularly fond of it.

TEXT QUESTIONS

1. What are legumes? Why are they important as foods? Why are they soil enrichers?
2. Why do we not use legumes to a greater extent in this country? Why are they used more in China and in Europe?
3. Which states in the United States lead in bean cultivation? Where are beans and peas grown extensively outside of our country?
4. Discuss the importance of the soy bean.
5. Show how peas have been and are an important food.
6 In what states are peanuts grown? Why is the peanut good as a food?

SECTION 5—FRUIT

Introduction. Fruit today is no longer a luxury; it has become a necessity. Up to fifty years ago, almost every farmer raised enough fruit for his own supply and a small surplus for the neighboring markets. With improved means of transportation, the fruit industry has followed the example of the vegetable industry; it has become more or less localized in specially adapted areas that depend upon the railroads to ship the products to the markets of great centers of population. In this way fruit culture has spread into climatically favored localities and is able to supply us the year round with fruit, which can now be transported great distances by fast trains of specially designed cars.

Physical Factors in Fruit Culture. The principal physical factors that govern fruitgrowing are climate, water supply, and soil. The first is by far the most important, although its importance varies somewhat according to the fruit. Northern fruits, like the apple, the peach, and the pear, require a late spring to avoid the danger of too early budding and exposure to frosts, which kill the fruit. The summer following should be fairly clear and sunny to color and flavor the fruit. The autumn should be long and cool to allow the fruit to ripen well on the trees.

Sheltered places are sought for orchards. The windward shore of any large body of water (the shore toward which the wind blows) is protected from frost in that the cool wind off the water delays the spring budding of the trees until the danger of frost is past. Places that have a high altitude are less liable to frost because of *frost drainage;* that is, the cold air, with its frost, seeks the lower levels in the valley rather than the higher elevations. Sometimes the difference in temperature between the top of a hill and a neighboring valley is twenty degrees. Through New England, for this reason, peach orchards are invariably found on high land, and in West Virginia the ridges are used for apple orchards. The Ozark Plateau in southern Missouri and northern Arkansas is likewise used for orchards.



Canadian National Railways

Apple blossom time on the Niagara Peninsula. The winds from the Great Lakes delay the spring budding until danger of frost has passed.

Citrus fruits are very easily spoiled by frost. For this reason citrus groves must be located in semitropical climates, where the temperature only rarely falls below the freezing point.

The water supply should be adequate and well distributed, a condition generally found near large bodies of water and on the windward side of mountains. In the West, many fruit orchards depend wholly, for a water supply, on irrigation, which is highly desirable as long as it meets the requirements.

Fruit trees require a good top soil, with a well-drained subsoil, so that water will not stand around the roots. A hard clay bottom, or ledge, results in too much water at times and not enough at other times. The soil should be crumbly and capable of retaining sufficient moisture. In regions suitable for fruitgrowing, certain areas are found to possess the proper soil and are selected in preference to others. Hillsides are preferred to level lands because of better drainage.

Economic Factors of Fruitgrowing. In addition to the physical factors to be considered in selecting a location for successful fruit production, there are economic factors. Nearness to the market is very important. Places distant from the market cannot get their crops out profitably in competition with locations that are nearer. Good transportation facilities are absolutely essential. The automobile truck has done much to favor the more distant locations, but a large commercial orchard should have, or be near, a railroad connection with the large markets.

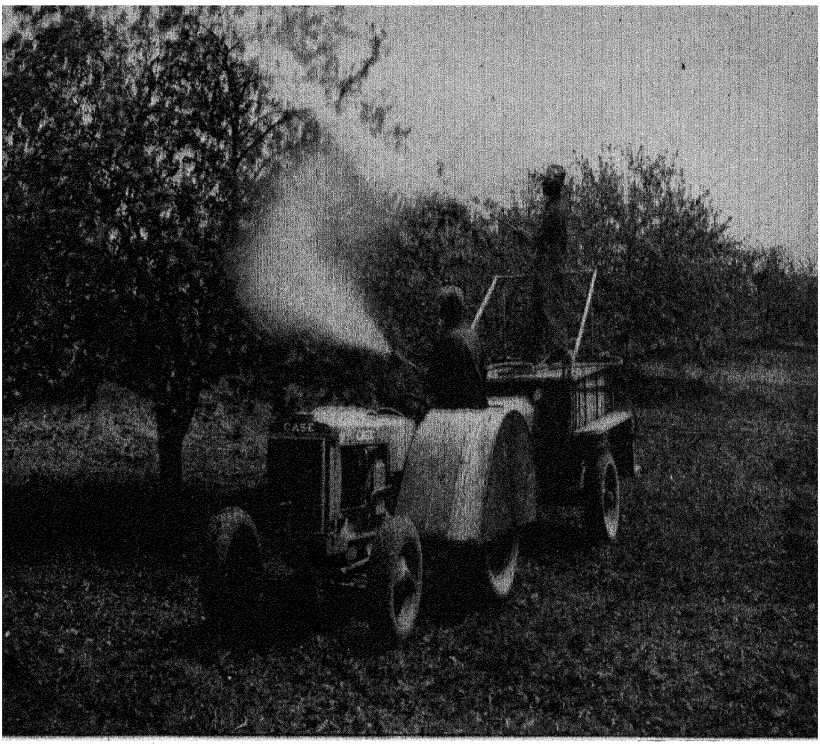
Sufficient labor must be present. Fruitgrowing requires much intelligent hand labor, especially in the harvest time, when the fruit must be carefully picked and handled to avoid injury and bruising. Packing requires careful handling and great attention to detail.

Co-operation among fruitgrowers has resulted in the formation of several co-operative associations that pick, pack, and market the crop of a whole fruit region, with the result that the product is standardized, well advertised, and intelligently marketed.

Another economic factor that enters into fruit culture is the time of harvest. Fruitgrowers, favored by being able to pick the fruit and to reach the market even a few days in advance of others, reap the benefit of a much better price.

The Apple. The apple is well known in history and is frequently referred to in classical and Biblical literature. Apples are now raised almost everywhere in the United States, although the commercial production is confined to the best-adapted regions. In this country the apple crop exceeds in value any of the other temperate-zone fruit crops. The value of the citrus-fruit harvest amounts to less than two thirds of the value of the apple crop.

The apple is by far the most popular fruit on the market. It ranks high because it keeps long without spoiling, has various uses, and is relatively cheap. A large apple area is located in West Virginia and Virginia, on the hills of the Great Valley and the eastern slope of the Blue Ridge section. Michigan and New York are favored with a suitable climate. A section in



Spraying fruit trees in order to kill pests.

southern Missouri and northern Arkansas, in the Ozark Mountains, is famous for its apples.

Idaho, Washington, Oregon, and California have large orchards under irrigation. The largest commercial apple production in North America, however, is found in eastern Washington. There the soil, topography, and climate combine to produce a highly colored apple, greatly desired in export trade.

Some apples are raised in Europe, especially in Germany, France, Russia, and England; but the United States exports annually great quantities to Europe to supply its deficiencies. Canada's apple crop is the only important commercial fruit crop of that country. British Columbia, a region near Lake Ontario, and Nova Scotia are the principal regions of apple culture in Canada.

The Peach. Peaches first grew in China and came by way of Europe to America. However, the principal source of peaches is now this country. The American peach surpasses

in every way its Chinese parent. Europe is unable to grow the peach commercially, except in Italy and southern France. In the countries farther north, it will grow, only with the greatest care, in hothouses or in warm, sheltered places. Peach culture has grown rapidly in the United States since the Civil War, and now ranks next to that of apples and citrus fruits in the value of its crop.

Although the peach thrives well in most of the apple districts, it is affected more by climate than is the apple. We find it being grown commercially in the apple regions of New York and Michigan because the tempered winds from the lakes hold back the budding time. It does well also on the ridges in Connecticut and the Virginias, and on the Ozarks, because of the same frost drainage that favors apple culture. The American peach still is an important crop in its original home in Delaware, New Jersey, and Maryland. It grows farther south than the apple; and our Southern States, especially Georgia, which ranks second only to California, find it a source of considerable income. The warm Southern States have the advantage of raising peaches that reach the market well in advance of the bulk of the crop from other regions. California raises about one third of our entire peach crop, sending many of her peaches eastward, even to England, and canning her immense surplus. Washington also produces peaches for export.

The peach industry has spread over these widely separated regions because of climatic conditions, but it is dependent, in getting its crop to market, upon the rapid and efficient transportation facilities now afforded. Because the American peach is widely scattered over the country and is harvested at many different times during the year, according to the climate of the locality, it is now possible to have fresh peaches from May until late fall.

Citrus Fruits. The principal citrus fruits that enter into commerce are the orange, the lemon, the grapefruit, and the lime. They lend themselves to commercial handling because they are well protected from injury by their tough skins. In this country the orange, the grapefruit, and the lemon are

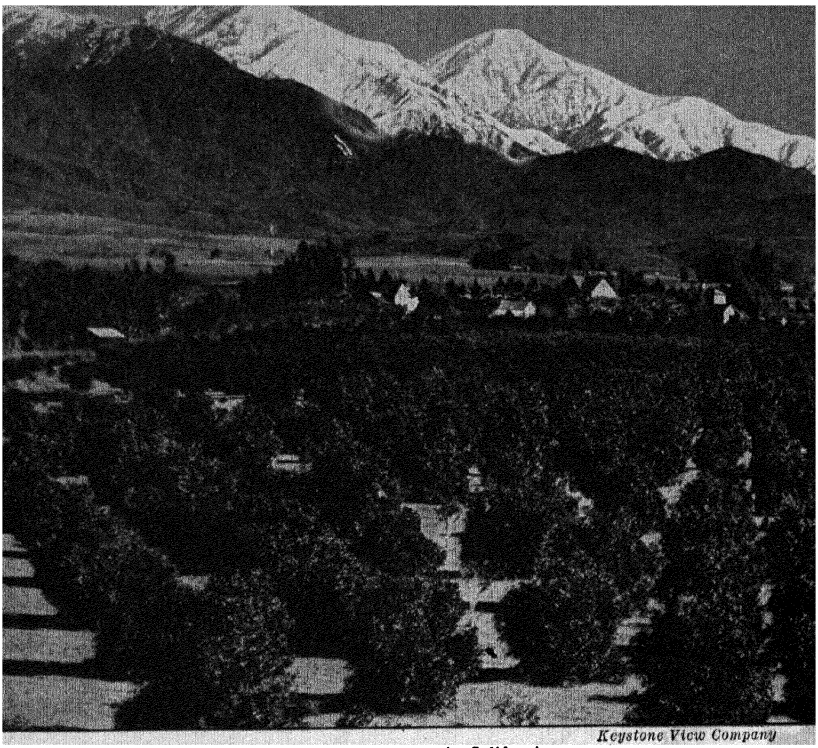


Heaters are used in orange groves when there is danger of frost.

the most important. Although not widely raised until lately, the orange has been well known for centuries.

The orange and the lemon are grown commercially for the European market in Italy, Sicily, Spain, and Portugal. Asia Minor also raises some excellent citrus fruits, especially oranges. In China and Japan, factors favor orange growing. Brazil and other semitropical countries of South America, and the West and East Indies are also producers of oranges. Almost everywhere throughout the tropical zone, oranges are grown. In this country we find two regions well adapted to the growing of citrus fruits: Florida and California. Both of these sections came into prominence as orange producers when rapid transportation to the northern and eastern markets became available.

Although Florida has the advantage of a plenteous rain supply and is nearer to the market, it is in greater danger of frost than is California. Florida oranges are noted for their juiciness and sweetness. California oranges are large; and the



An orange grove in California.

navel orange, which is produced there, is highly sought after because it can be easily peeled and has no seeds. In value, the citrus fruits are second only to apples.

Orange growers have organized into large co-operative associations that undertake the picking, packing, and marketing of the crop. These activities continue practically the whole year round. The co-operative associations have done much to eliminate waste and loss.

While we still import a large quantity of lemons from Sicily, California has extensive lemon groves and is fast assuming control of the domestic demands. The grapefruit is a product that, within recent years, has gained favor in our country. Florida, Texas, Arizona, and Puerto Rico are the greatest sources of supply.

TEXT QUESTIONS

1. What changes have taken place in the last fifty years in fruit-growing? Why?
2. Show how each of three physical factors affects fruit culture.

3. What are the ideal climatic conditions for growing apples and peaches?
4. What is frost drainage?
5. How do large bodies of water afford protection from frost to adjacent regions?
6. Why is irrigation preferable to a natural rain supply in the growing of fruit?
7. State the economic factors affecting fruitgrowing and show the effect of each.
8. Prove that the apple, the most popular fruit now, was also well known in former times.
9. How is the apple demand of Europe supplied?
10. What is the relative value of the apple crop compared with that of the other fruit crops in the United States? Why is the apple the most popular fruit on the market?
11. Where are apples grown in Canada?
12. Where are apples grown commercially in the United States? Why are they grown in these regions?
13. Where did the peach originate? In what country are most of the peaches of the world grown today? Where are peaches grown in Europe?
14. What are the leading peach-growing regions in the United States?
15. What does California do with her immense crop of peaches?
16. Show how transportation makes it possible to have peaches on the market during a long season.
17. What are the chief citrus fruits? Which is the most important?
18. Where, outside of the United States, are oranges grown? Where are they grown in the United States?
19. Contrast Florida and California as orange growers, giving the favorable and unfavorable points of each.
20. Where do most of our lemons come from? Where are most of our grapefruit grown?
21. How are orange growers organized? Why?

SECTION 6—FRUIT (Concluded)

Grapes. Grapes were known to man as far back as written history goes. We know the ancient Egyptians ate them. The Romans and the Greeks pressed them into wine. Since vineyards and grapes are frequently mentioned in the Bible, we know that they were common in the East during early Biblical times.

For centuries Europe has cultivated the vine for wine and raisins. France, Italy, Algeria, Spain, and the regions of central Europe now lead in the making of wine. In South America, Argentina leads in wine making. Asiatic people are not great wine drinkers. This is due, in part, to the Mohammedan religion, which forbids the use of alcoholic liquors.

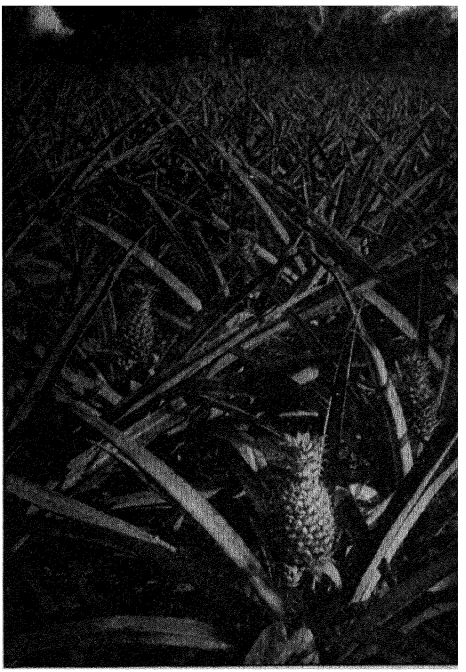
Our colonists brought European varieties of grapes with them; but, because of the damp climate of the Atlantic seaboard, which caused diseases in the vines, these varieties did not thrive, and the people turned to the native vines. By careful selection and cultivation, these native grapes soon became highly desirable, especially for table use. Grape culture has become important in two distinct regions in the United States: the region in New York, Michigan, and Ohio, near the Great Lakes, and the California region.

A California vineyard.

Chamber of Commerce, Los Angeles



In the eastern section only native grapes are raised. These are used for the table and also in a large grape-juice industry. California raises European varieties, because her climate is similar to that of the Mediterranean countries, where these varieties are found at their best. Many of our finest table grapes are raised in California. A wine industry that competes successfully with that of France also flourishes there.



Underwood and Underwood

A pineapple plantation in Florida.

The Pineapple. The pineapple is a native of the American tropics, but was early transplanted to Europe, where, under artificial conditions, its culture spread. It is now a favorite tropical fruit in the markets of the United States and, to a lesser degree, in European markets.

The principal sources of pineapples consumed in our country are Hawaii, Puerto Rico, Isle of Pines, Cuba, Florida, and California. Hawaii produces immense crops, shipping the fruit fresh and canning a large surplus.

Europe gets the largest part of her pineapple supply from the Azores and the West Indies, although she obtains some from northern Africa.

The Banana. One of the most remarkable facts in recent commerce and industry has been the rapid development of the banana trade. Bananas thrive in tropical climates wherever there is sufficient rainfall.

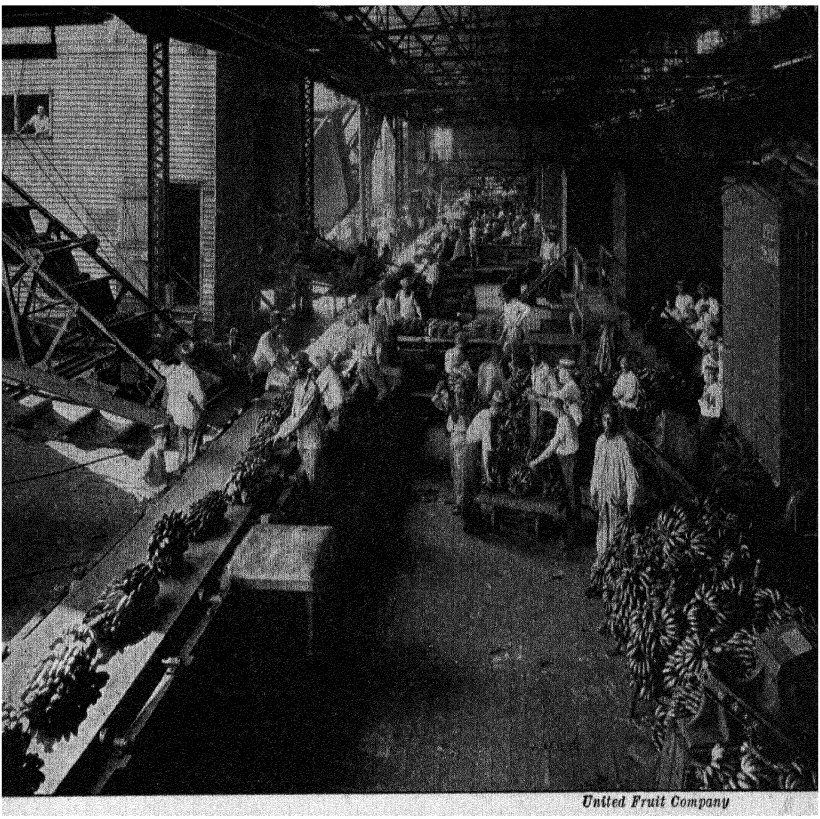
The banana is rich in starch and has been one of the chief food plants of the tropics for a long time; but, because of its perishable nature, it was a rarity in temperate-zone markets until within the last few decades.



Harvesting bananas to be shipped to the United States.

Within relatively recent years foreign capital has been active both in the production and in the distribution of bananas. Regions favorable to the growth of the banana have been laid out in large plantations. Railroads have been built to bring the fruit to the coast, where it is loaded into large, fast boats, which bring it to our markets. Bananas are sold at such low prices that oftentimes they are cheaper than fruits grown here at home. The growth of the banana trade provides an excellent illustration of the use of a tropical source of food supply by intelligent methods of temperate-zone initiative.

The principal sources of the banana supply of the United States, which is by far the greatest consumer in the temperate zone, are the countries of Central America and some of the West Indies, chiefly Jamaica. The European supply comes from islands off the west coast of Africa and from tropical America.



United Fruit Company

Unloading bananas at New Orleans. Notice the moving belts and the freight cars standing near at hand.

Canning Industry. The canning industry received a great impetus directly after the Civil War and by 1880 had become really important. This industry is still somewhat scattered because of the location of some of its factories near the sources of supply. Railroads, however, have a tendency to bring the canning industry into centers where large canning factories and a large labor supply are able to make the process cheaper.

During the past twenty-five years, great strides have been made in canning different varieties of vegetables and fruits; hence, almost any vegetable or fruit is now available in canned form. Corn, tomatoes, peas, and beans are the principal vegetables canned and are nearly equal in value. Tomatoes lead in quantity.

Baltimore is a leading canning center for vegetables and is favored by being able to draw its supply of raw materials from neighboring vegetable growers. It is close to the eastern markets and makes use of its canneries in winter to can oysters from the Chesapeake Bay oyster beds.

Some states, such as Maine, Wisconsin, and Minnesota, which lie outside of the great corn belt and have a short growing season, can raise sweet corn for canning purposes because the corn is canned before it is fully ripe. The leading corn-canning states are Illinois, Minnesota, Iowa, and Indiana.

The canning of baked beans is growing rapidly. This industry is not dependent upon local sources of supply because beans will not spoil. The North Central States lead in the canning of beans.

California is well ahead of all other states in fruit canning; she is far from the market for fresh fruit and has an immense surplus crop. She furnishes us almost all our canned apricots, peaches, and pears. California supplies canned asparagus also. Oregon and Washington excel in canning berries.

Great advances have been made in freezing meats, vegetables, and fruits to preserve them until they reach the consumer.

Dried Fruit. Most of the fruit drying is done in regions that have a sunny climate, like California and the countries around the Mediterranean Sea. Later this fruit is transported to less favored regions.

From the countries in southern Europe, we get dried figs, dried dates, and raisins. In California, the conditions for drying are ideal. There peaches, apricots, plums, and grapes may be dried on trays in the sunshine, without any resort to artificial means. This type of drying gives the fruit an inviting appearance as well as a complete drying. Almost all the dried fruit of this country, with the exception of dried apples, is prepared in California. New York leads in apple drying.

TEXT QUESTIONS

1. What proof can you give that the grape was well known in ancient times?
2. Why are native varieties of grapes popular in the eastern part of our country?
3. Why are European varieties raised extensively in California?
4. Where are grapes raised in Europe? Why?
5. Where are pineapples raised extensively? Where does Europe get her supply? Where does the United States get her supply?
6. How is the surplus pineapple crop cared for?
7. Explain the reason for the rapid expansion of the banana trade.
8. What are the principal regions of banana production?
9. Account for various locations of the canning industry. Give examples.
10. Where is the dried-fruit industry located? Why?
11. What state leads in apple drying? Why?
12. What city is a leading vegetable-canning center? Why is it prominent in the vegetable-canning industry?
13. How does Baltimore use her canneries the year round?
14. What states lead in canning corn?
15. Name other important canning regions and tell what they specialize in.
16. What are the principal kinds of canned vegetables? Which leads in quantity?
17. What dried fruits do we get from foreign countries?
18. What dried fruits do we get from within the borders of the United States?

SECTION 7—MISCELLANEOUS PLANT PRODUCTS

Spices. For centuries, man has flavored his food with certain vegetable products called spices. During the time when trade was confined to the exchange of luxuries, spices played a more important part in commerce than they do now, when the great bulk of the world trade is in necessities of life. Spices are used over all the civilized and semicivilized world. Some of the great discoveries of history were made, in part, during the search for an all-water route to India and other parts of the Far East, by means of which trade in oriental products, among which spices held a very important place, could be carried on. The competition to obtain this trade resulted later in the British domination of India. For this reason, it is said: "Pepper made India a part of the British Empire."

Black and white pepper come from the same plant. The difference in treatment results in the two peppers. Singapore is the great pepper-shipping port. Pepper is grown in the Malay Peninsula, Siam, the West Indies, and the Philippine Islands. Red pepper, sometimes called cayenne pepper, is from a wholly different plant, called capsicum, grown in Spain, Mexico, and Central and South America.

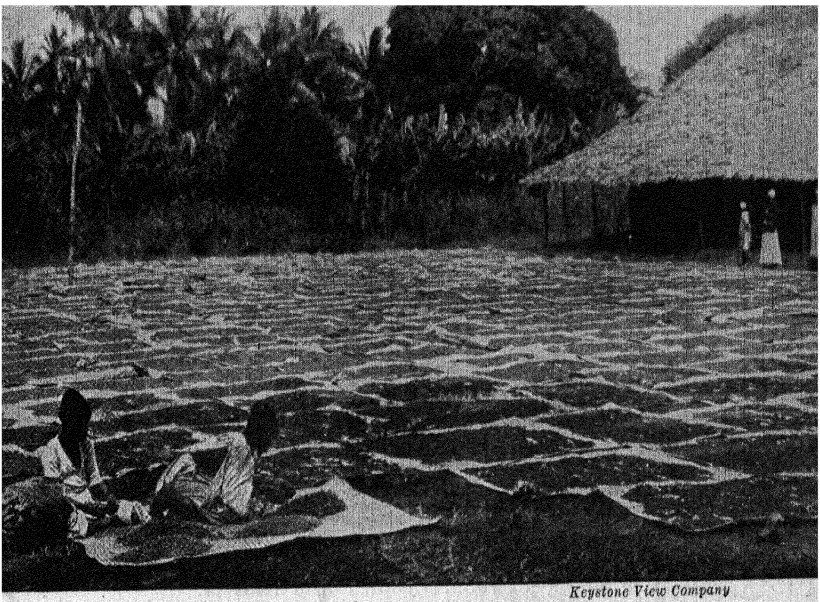
Ginger, found in most tropical countries, comes from the dried roots of a plant. This plant is extensively grown for commerce in China, Indo-China, India, Africa, and Jamaica.

Nutmegs are the kernels of fruit that grows in the Moluccas and other islands of the East Indies, Zanzibar, the West Indies, and South America. The covering of the kernel is dried to make mace, a very fragrant spice. The white appearance of nutmegs is due to a covering of lime.

Cinnamon is the bark of a small tree that thrives in Ceylon, the West Indies, South America, and southern Asia.

Allspice, sometimes called pimento, is the unripe berry of a plant that thrives best in the West Indies, particularly in Jamaica, and the East Indies. Its popularity is due, in part, to its cheapness.

Cloves are the dried flower buds of a tree that grows best in the Moluccas and other islands of the East Indies, the



Clove drying in Zanzibar.

West Indies, and Zanzibar (East Africa). They are used extensively in pickling and in confectionery. Oil of cloves is oil used in medicines.

Vanilla is extracted from the pods of a plant that grows in Mexico, Central America, and South America. The pods are allowed to dry slowly and to ferment slightly, and are then cured to permit the flavor to develop. The oil is extracted by either pressure or chemical processes. Vanilla is one of the popular flavorings in candy, ice cream, and soda drinks.

In the temperate zone, mustard is the principal spice grown. It finds favorable conditions in America, Europe, Asia, and the East Indies. It is made from tiny seeds of the mustard plant, which are ground into very fine powder.

Caraway seeds are grown largely in northern and central Europe and in the United States. They are used to flavor bread, cakes, and liquors.

Vegetable Medicines. From time immemorial, herbs and plants have furnished medicines. The more important ones provided are opium, quinine, cocaine, sarsaparilla, licorice, aconite, rhubarb, arnica, belladonna, castor oil, and ipecac.

Opium is the thickened juice of the poppy, and from it we get laudanum and morphine. All three are used as opiates—

pain deadeners. Their abuse, rather than their legitimate use, has been very harmful, especially to Oriental races.

There is now a concerted attempt by the nations to limit the growing of the opium poppy. Permitting the growing of poppies to supply opium to the slaves of this drug has been one of the disgraces of civilized nations. Opium is now produced in India, China, Persia, and Asia Minor, where it brings in large revenues through taxation.

Quinine comes from the bark of the cinchona tree, which is a native of Peru, in South America. For this reason, the bark is sometimes called Peruvian bark. The cinchona tree has been transplanted to the East Indies with success, and much of the commercial supply comes from these islands. Quinine is the most effective medicine for malaria.

Cocaine comes from the coca plant and is used in medicines and by dentists to deaden pain. It comes chiefly from South America.

Castor oil is the oil extracted from the castor bean, which grows well in Asia and North America.

TEXT QUESTIONS

1. Show how the demand for spices and other oriental products led to the discovery of America and to British rule in India.
2. Explain the decline of spices in relative importance in world commerce.
3. Name the various kinds of pepper. What do they come from? Where are they produced?
4. What is ginger? Where is it produced?
5. What are nutmegs? Where are they produced? Why are they white in appearance?
6. Name some of the more important medicinal plants.
7. From what is opium made?
8. Where is opium produced? Why is it a source of revenue?
9. From what does quinine come? Where is it produced?
10. Where does cocaine come from and what is it used for?
11. From what does vanilla come? Where is it produced?

PROBLEMS AND PROJECTS

1. On an outline map, indicate the principal tobacco-growing regions of the world. On the reverse side of the map, explain why these regions lead in growing tobacco.
2. What kind of grapes do you prefer? Why? Where do these grapes come from?
3. Make a list of spices used in the kitchen. Tell where each one comes from.
4. What vegetables raised in your locality are shipped to other localities? Why?
5. Draw up a list of all the vegetables used by man for food. Which ones are used as fresh vegetables in your neighborhood? Which ones are used as canned vegetables? What vegetables are never used in your neighborhood? Why?
6. Draw up a list of all the canned vegetables found on the shelves of your local grocery store. Find out where each vegetable is grown. Explain why it is raised there.
7. Draw up a list of all the fresh fruits found in your local market. Make a list of all the canned fruits in your local market. Tell where each fruit comes from.
8. Why do we get most of our sweet potatoes from the South and most of our white potatoes from the North?
9. Show how, through the canning and the drying of fruits, places at distances from the sources are able to have fruits for use.
10. Discuss the effect of canning on the vegetable diet of the people of today.
11. Discuss how legumes form an important part of the diet of people who have little meat to eat.
12. What fruits are cheaper to raise outside of the United States? Why?
13. Discuss the effects of climate on the dried-fruit industry.
14. How is the evenness of the various blends of tobacco maintained?
15. Describe the methods of packing and transporting our most important fruits that come from a distance.
16. Make a list of the common vegetable medicinal drugs. Where is each produced? For what is each used?
17. Why do not the Oriental peoples raise more potatoes than they do?
18. Make a list of magazine articles, pamphlets, and books dealing with the subject matter in this chapter.

TOPICS

1. The need of vegetables in our diet.
2. Potatoes as a food supply.
3. The effects of tobacco.
4. Pests that attack vegetables.
5. Pests that attack fruit trees.
6. Vegetables in the diet of people one hundred years ago, and those in the diet of people today.
7. The relation between potato raising and increased population in Europe.
8. Dried fruits.
9. Tropical fruits.
10. Fruitgrowers' associations and their results.
11. Spices.
12. The economic value of the soy bean.
13. Commission houses and their work.
14. The green-vegetable markets of our large cities.
15. Contrast of the attitudes of the government of this country with those of the governments of Europe in regard to the tobacco industry.
16. How trade in drugs is controlled in the United States.
17. The opium trade and its history in the Orient.
18. The international trade in opium.
19. Tobacco in American colonial history.
20. Frozen foods.

FOR CLASS DISCUSSION

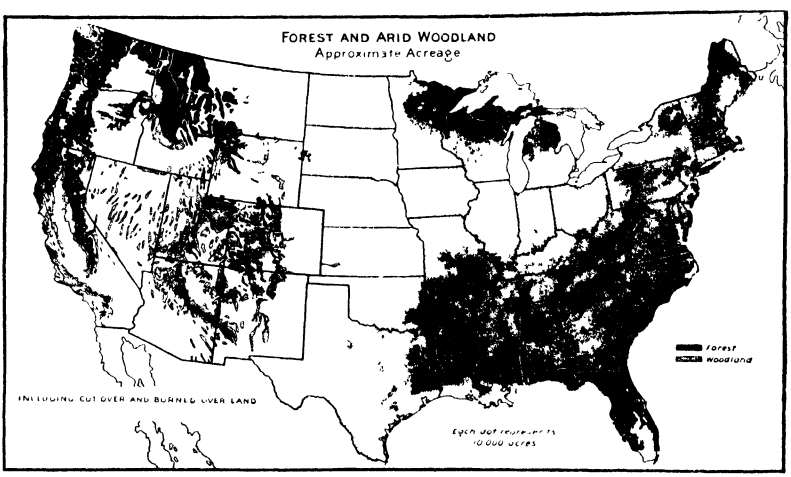
1. An all-vegetable diet is better than an all-meat diet.
2. The fruitgrowing industry offers a good opportunity for investment.
3. Truck farming, as a business, offers a good future.
4. The elimination of commission houses would benefit the fruit industry.
5. Destroying crops to prevent overproduction is economically justifiable.
6. The increased consumption of tobacco is a menace to health.
7. Opium is more of a curse than a benefit to the human race.
8. The prosperity of a country is measured by what it eats.

CHAPTER XII

FOREST PRODUCTS

SECTION 1—LUMBER

Importance of Wood. Wood is one of the most essential articles of commerce. Lumbering and the use of wood form one of the leading industries of the world and one that ranks very high in our country. Through the ages man has looked to wood for his shelter, his fuel, his implements of peace and war, and his vehicles of transportation, especially ships.



U. S. Department of Agriculture

With the invention of printing and the process of making wood-pulp paper, the forests have made possible the tremendous spread of the knowledge upon which modern society rests. The rapid and wonderful growth of our country would have been impossible without the forests, which supplied the enormous amounts of lumber needed. Wood enters into our lives every day in very necessary and vital ways.

Kinds of Wood. Wood is classified as soft and hard. Softwood comes from the cone-bearing evergreen trees and is

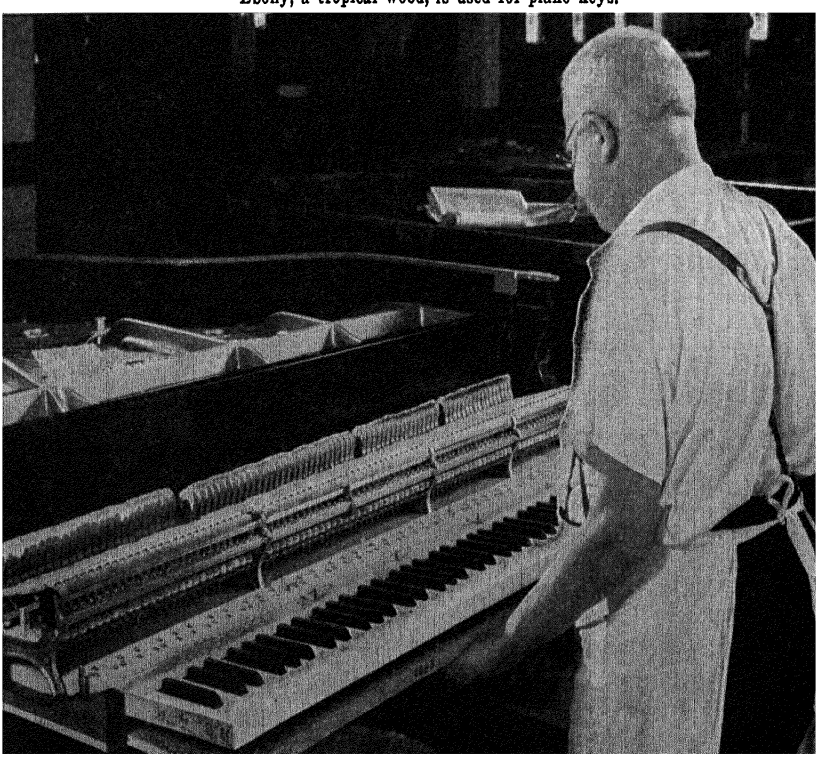
easily worked with tools. It is used principally in construction work, especially in the building of houses. Hardwood has a finer grain, takes a better polish, and is harder to fashion with tools. It is used for furniture and floors, and many other purposes.

Most softwoods grow in the northern latitudes, although we find some in the high altitudes of the southern part of our country. They form the principal lumber supply of the world.

Most tropical woods are classified as hard. Because of their beauty, they are used almost wholly in furniture, musical instruments, and cabinets.

Distribution of Lumbering. Trees grow in any region in the world where there is sufficient rainfall. Two general belts may be distinguished. The tropical trees form a belt around the world near the equator and supply us with the

Ebony, a tropical wood, is used for piano keys.

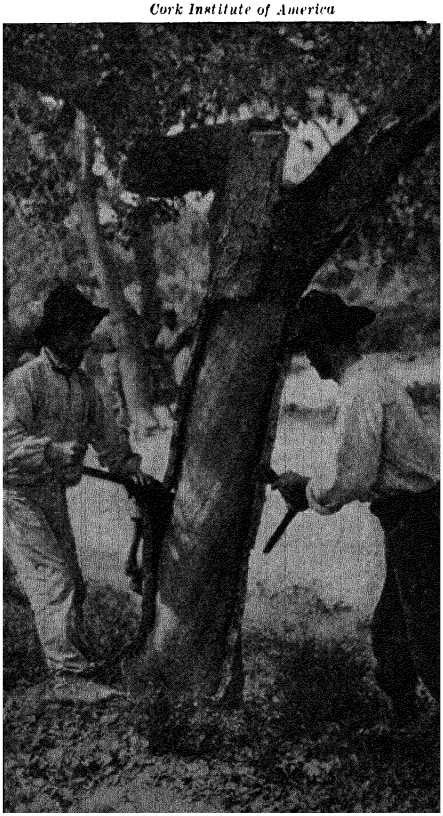


beautiful hardwoods of mahogany, rosewood, ebony, and sandalwood. In the north temperate zone, we find another great forest belt extending across Asia into Europe, and across the United States and Canada. It is from this belt that we get our famous softwoods like pine, spruce, redwood, hemlock, and Douglas fir, and our hardwoods like oak, maple, walnut, and birch.

The principal producer of lumber in the world is our own country, which furnishes over fifty per cent of the world supply, or more than all the other countries combined. Other lumber-producing countries of importance are Canada, Japan, Brazil, and the northern and central countries of Europe.

The countries of the Old World have drawn so heavily on their forests that most of them do not now produce enough lumber for their own use and are obliged to import largely, although Russia, Finland, and the Scandinavian countries, Norway and Sweden, still produce for export.

Peeling cork bark from a tree.
Cork Institute of America



Our own forests have been greatly depleted by wasteful methods and tremendous domestic demand. We still export large quantities to England, Japan, Argentina, Canada, Australia, and the Netherlands. Our hardwood export is taken chiefly by the British Isles, Canada, South America, and Mexico.

Most of our lumber imports come from Canada. Tropical woods like mahogany, Spanish cedar, ebony, and rosewood are still imported in the form of logs. Large quantities of pulpwood come from Canada, Sweden, and Norway. Cork

comes chiefly from Spain, Portugal, and other Mediterranean countries.

Forest Regions of the United States. We may classify the forest regions of the United States into seven areas: (1) the northeastern, which covers New England and New York; (2) the Great Lakes region, which takes in Michigan, Wisconsin, and Minnesota; (3) the Appalachian Highlands district, extending from New York southward; (4) the southern district, including the Atlantic Coast States and the lower Mississippi basin; (5) the hardwood district, stretching westward from the Appalachian Mountains to the Mississippi River and northward from Alabama to the Great Lakes; (6) the Rocky Mountains district; and (7) the Pacific Coast region, stretching westward from the Rocky Mountains and northward from California.

The lead in lumbering was first held by the northeastern district. It was later taken by the region around the Great Lakes. Next the southern district was ahead of all others. The lead passed to the Pacific Coast region in 1930.

Northeastern Section. Lumbering in the northeastern section today is confined principally to the cutting of pulp wood, which is, in most cases, second-growth timber on old locations that have been cut over previously. Lumbering in this region is now carried on by French-Canadian labor. Some of the biggest pulp mills of our country are located within this district; and at Holyoke, Massachusetts, is one of the greatest centers of paper manufacturing in the United States.

Bangor, Maine, situated at the falls where the Penobscot River meets the tidewater, was the leading lumber center of the northeastern district before the extensive cutting of the forests and the rising costs of transportation made the lumbering industry seek new fields. The principal woods produced by this district were white pine and spruce.

Great Lakes Region. The successor to the northeastern district was the district around the Great Lakes, which supplied practically the same kinds of wood: pine and spruce. Michigan became the leading lumber state, but later the

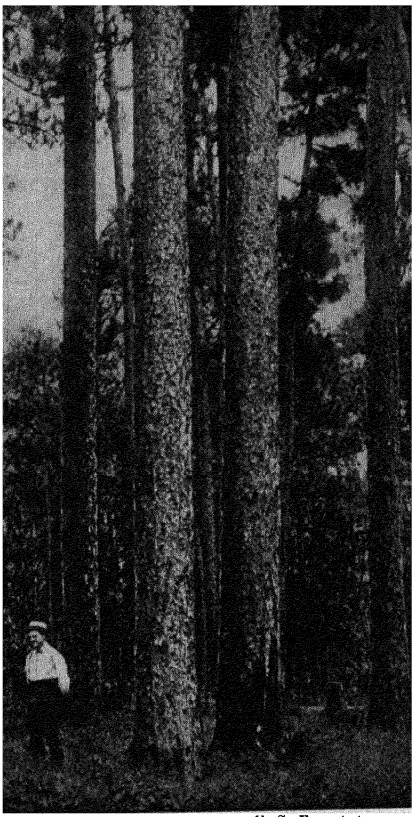
leadership shifted westward to Wisconsin and Minnesota. Chicago grew important as a lumber market. Minneapolis was well located as a lumber center because the Falls of Saint Anthony supplied the power to saw the lumber from the neighboring districts. As the lumber supply decreased, Minneapolis became one of the leading milling cities of the world.

It was during the leadership of the Great Lakes district that Grand Rapids, Michigan, became prominent in the manufacture of furniture. That city has held the lead, and it is today the recognized center of this industry.

Appalachian Highlands District. This district extends southward from Pennsylvania to northern Georgia. Because of the elevation of this region, we find several of the northern trees growing in it. The topography is rugged and unsuited to the lumbering methods commonly used on more level ground. This disadvantage makes the cost of getting out the lumber great, especially since practically all the lumber readily accessible has already been cut. Because of this situation, the Appalachian Mountains district does not contribute greatly to the lumber supply of our country at the present time.

Southern District. The southern district reaches from New Jersey, down the southern Atlantic Coast and around the Gulf of Mexico, to Texas. It now furnishes about one third of our lumber supply. Its most important trees are the yellow pine and the cypress. The long-leaf pines of this district are the source of our naval stores—tar, pitch, turpentine, and rosin. This district is fairly level and permits the building of temporary logging railroads through the forests. The lumber is shipped to the northern markets, principally by water, and to the foreign markets from the ports of Mobile, Pensacola, Savannah, Charleston, and Norfolk. A small town in Mississippi called Gulfport is one of the greatest lumber-shipping ports in the world. Railroads also haul large shipments to the northern cities.

This region seems likely to remain a great producer of softwoods. Trees grow rapidly there because of adequate moisture and excellent sunshine. The wood-pulp industry is rapidly expanding there.



U. S. Forest Service

Long-leaf yellow pine, Louisiana.

Hardwood District. As the pioneers pressed westward, they found extensive forests of hardwoods extending from the Appalachian Mountains to the Mississippi River. This belt of hardwood extends southward to Louisiana and northward to the Great Lakes. It was cut into heavily to make room for agriculture, much of the excellent hardwood, now so valuable, having been burned for that purpose.

Because of the abundance of hardwood, factories for the production of farm implements and wagons located in that section. The remaining hardwoods are being cut steadily; regrowth is slow; and lumber from this district is certain to decrease.

The principal centers and markets are Chattanooga, Tennessee, Evansville, Indiana, and Memphis, Tennessee, the last named being the largest hardwood market in the world.

Rocky Mountains District. Forests are found on the higher slopes of the Rocky Mountains, but in rather scattered locations. The number of trees increases quite noticeably in the northern end of the mountains because of the presence of more moisture. The trees are mostly pine, spruce, cedar, and Douglas fir. As it is difficult to get the logs to the mills, little lumbering as yet has been done. In this area fires have ruined large tracts of excellent trees.

Pacific Coast District. Beginning in California and extending northward through Oregon and Washington, the Pacific Coast district has the greatest supply of saw timber in the world. With its rainy marine climate and mild winters, this

district has excellent natural conditions for the growth of softwoods. Among the more valuable timber trees are the famous Douglas fir, the enduring red cedar, and the giant redwood of California. Ponderosa pine, spruce, and hemlock also help swell the cut. The two leading commercial woods today are Douglas fir and ponderosa pine.

The timber of the Pacific Coast has the advantage of being easily accessible for export by water. Washington became our leading lumber state in 1905 and has held that position almost without a break to the present. Oregon easily ranks second. Logging roads penetrate the interior valleys and skirt the mountain slopes, bringing trainloads of logs to the west coast sawmill towns of California and Oregon. Puget Sound offers even better access to the forested interior. Hundreds of American and foreign freighters load their cargoes of lumber, shingles, box shooks, lath, or squared logs, not only at Seattle

Lumbering scene near Kenny, Oregon.

Philip D. Gendreau



and Tacoma, but also at a dozen smaller mill towns around the Sound.

The Panama Canal has made it possible for the populous eastern United States to obtain Pacific Coast lumber easily and cheaply. Trainloads of lumber reach the agricultural Middle West. Europe, South America, and Asia are also steady buyers of the softwoods from the west coast.

Although lumbering has been going on steadily in this district for several decades, the Pacific Coast still has about one half of our remaining saw timber. Regrowth conditions are so favorable that our Forest Service hopes to make this district one of the perpetual softwood producers of the nation.

Deforestation. In this country we have been extremely wasteful of our wood supply, in marked contrast to the European nations, which have carefully conserved their lumber resources. In early times our forests were a check on agricultural expansion, and it was necessary to cut down and burn large numbers of trees in order to clear the land. This practice encouraged a habit of wastefulness, from which the country has not recovered.

The principal ways in which we have wasted our wood supply are: (1) the unnecessary use of good wood as fuel; (2) the lack of fire prevention, which has resulted in tremendous forest fires, many of which by proper means could have been prevented; (3) wasteful logging methods and careless tree slaughter; (4) the use of valuable trees for the production of naval stores only; (5) the destruction of thousands of trees for tanning bark; (6) the failure to destroy injurious tree pests; and (7) the nonuse of sawmill refuse. The results of this wasteful deforestation are: (1) growing scarcity of lumber and approaching exhaustion; (2) increased soil erosion; (3) annual floods; (4) frequent wind storms and sand storms; (5) frequent snowslides and landslides; and (6) growing scarcity of fur-bearing animals.

The lumber interests are now realizing more and more the need of eliminating these wastes and conserving the future supply. The Government, with an eye for the future, is beginning to guard our national forests. Scientific forestry,

including selective logging and sustained yield, is being practiced, not only in government forests but also in privately owned ones. State governments are encouraging tree planting. Sentiment against needless waste and toward intelligent conservation in this country is growing. Europe has had strict forestry laws for a long time to save what she can of her trees. As our great forest areas approach depletion, we, too, are beginning to awaken to the need of reforestation and careful, scientific methods of conservation.

TEXT QUESTIONS

1. Prove the importance of wood.
2. Classify wood. List examples of each class.
3. Give the characteristics of hardwoods and softwoods.
4. Discuss in general the distribution of lumbering.
5. What countries lead in lumbering? Why?
6. Explain the lumber situation in Europe.
7. To what regions do we export our hardwoods?
8. Of what do our lumber imports consist? Why?
9. Name and locate the forest regions of the United States.
10. Trace the leadership in these districts.
11. What are the lumber conditions in New England and New York?
12. What are the lumber conditions in the South?
13. What are the lumber conditions along the Pacific Coast?
14. What are the lumber conditions around the Great Lakes?
15. Name the ways in which the wood supply of the United States is wasted.
16. Give the results of deforestation.
17. What is meant by sustained-yield forestry?

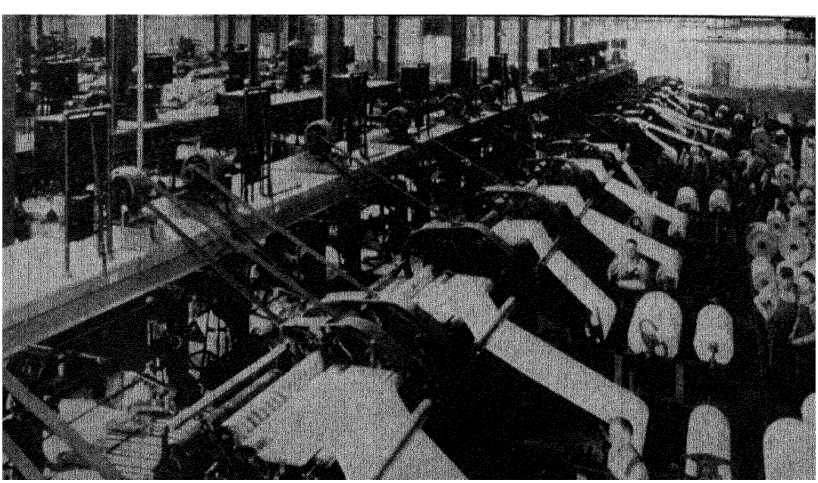
SECTION 2—PAPER

History of Papermaking. Prehistoric man cut crude pictures and figures on rocks. The ancient peoples made hieroglyphics, or symbols, on damp clay tablets and then baked these tablets to preserve them. In this way they left us many records. Early in history man found a way of preparing sheepskin so that it was white and smooth, and on this he wrote his messages and records. Down through the centuries this was called *parchment* and was one of the leading materials for writing; even today it is used for college diplomas. On the banks of the river Nile, the Egyptian people found growing a plant that they called *papyrus* and from which they made a paper called by the same name. This paper was a favorite material for writing, and on it many of our ancient manuscripts were written. The sacred writings of the ancients, including many books of the Bible, were inscribed on it, generally in the form of long scrolls.

The Chinese were the first to make paper from vegetable fibers, using, for this purpose, the leaves of the paper mulberry tree. Evidently the Arabs learned this process from the Chinese, because the Crusaders found them making paper from cotton fibers, and brought back with them to western

A battery of cutters and finishers in a large paper mill.

Underwood and Underwood



Europe the secrets of papermaking. During medieval times paper was made by hand from flax and rags; and the first books, printed on this early paper, show clearly that it was crude, poor material.

With the invention of printing, the demand for paper naturally grew; and with the increased output came better grades of paper. Rags were the chief source of paper material until 1857, when a method of making paper from a grass called *esparto* was invented. This grass became a very important source of paper stock. Not long after this it was discovered that wood pulp would make paper; and this source has outstripped all others, especially as a source of the poorer grades of paper. Paper from wood pulp now forms over ninety per cent of our paper supply.

Paper Fibers. Today, paper is made from many different vegetable fibers rich in cellulose. In this way are obtained the many grades of paper made necessary by the thousands of uses to which paper is put. Paper is made from rags, principally linen and cotton; from the wood pulp of many kinds of trees; from old paper; from esparto grass; from the straw of cereals, especially rye, wheat, and rice; from fiber plants, such as hemp and jute; from bamboo trees; and from paper mulberry trees.

Each one of these fibers has some distinctive characteristic that fits it for use in a special kind of paper. Linen and cotton rags make our finest bank notes, paper money, bonds, and high-grade record papers. The best papers used in correspondence are made largely from cotton rags. The best grades of wood pulp enter into the papers used for books and magazines of superior quality.

The cheaper grades of paper, used in newspapers, wrapping papers, and cheap magazines, are made from less expensive wood pulp. The heavier papers used in cartons are often made from cereal straws and old papers. Chinese and Japanese lanterns and beautiful papers of the Orient are made from the inner bark of the mulberry tree. Rice paper is made from the pith of a small tree found in Taiwan. Esparto grass makes fine paper for printing.

Rag Pulp. In collecting rags, the junkman carefully sorts out the cotton and linen rags, which he sells to paper mills. New rags come from clothing factories and textile mills. Upon arrival at the paper mill, the rags are placed in a machine called a thrasher. The rags are whipped and beaten, and the dirt and dust are sucked out by means of a vacuum system. The rags are then sorted; and women remove all bits of metal such as eyelets, buckles, and buttons, and cut the rags into small pieces about four inches square. These pieces are then carried to the duster, which beats them to remove any remaining loose dirt.

The rags are next dumped into a huge boiler, called the bleach boiler, which rotates slowly and mixes and washes the rags thoroughly, under steam pressure, in a solution of caustic soda. This process cleans the rags and partially bleaches them. They are then passed on to a washer, which washes them and completes the bleaching so that they come out pure white. After this, the rags are put into drainers, which draw off the surplus water and stop the bleaching process.

The next machine into which the rags are put is the beater, which beats, mixes, and reduces the rags to a milky-white solution full of tiny fibers. From this machine, the pulp is run into the stuff chest, where a slowly revolving paddle keeps it in motion. The stuff chest is large enough to be a reservoir of rag pulp; it feeds the pulp, as it is needed, into the papermaking machine.

Wood Pulp. Logs are prepared for the pulping process by being cut into short lengths, by having the bark cut off, and by having the knots removed. The wood is reduced to pulp in either of two general ways: mechanically or chemically. In the mechanical process the prepared pulp wood is fed into machines, where it is ground into fine powder by large grindstones revolving swiftly in water. So great is the friction of this grinding that cold water must be fed in continuously to prevent too great heat. The tiny bits of ground wood run into a huge tank. From this, they usually go directly to the papermaking machine, although sometimes they

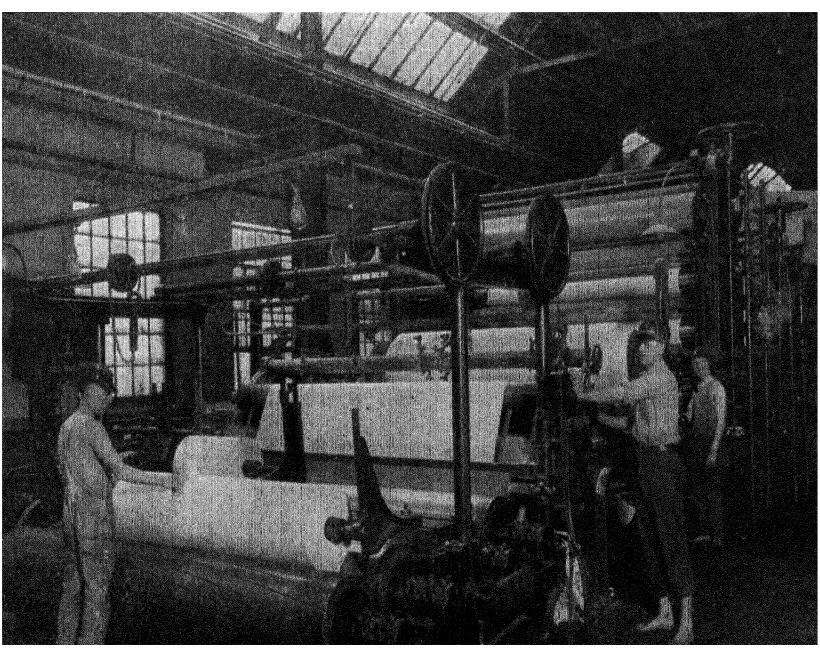
are taken out in layers and pressed to extract the water. This pressing results in pulp sheets, which are shipped to the paper mill.

By the chemical process the pulp is chipped into small pieces by machinery and placed in large tanks, called *digesters*, where strong chemicals reduce the wood to small fibers. The chemicals are removed, and the pulp is formed into large sheets and then sent to the paper mill.

In this condition the paper pulp resembles large sheets of coarse strawboard. This pulp is mixed with water at the paper mill and, when in liquid form, is ready for the paper-making machine. While in liquid form, it is held, like rag pulp, in large tanks called stuff chests.

Papermaking. All the work in papermaking is done by machinery. Two brothers, named Fourdrinier, helped perfect a wonderful machine that goes through the whole process from beginning to end. Some of these machines are three hundred feet long and sixty feet high.

A papermaking machine.
Champion Coated Paper Company

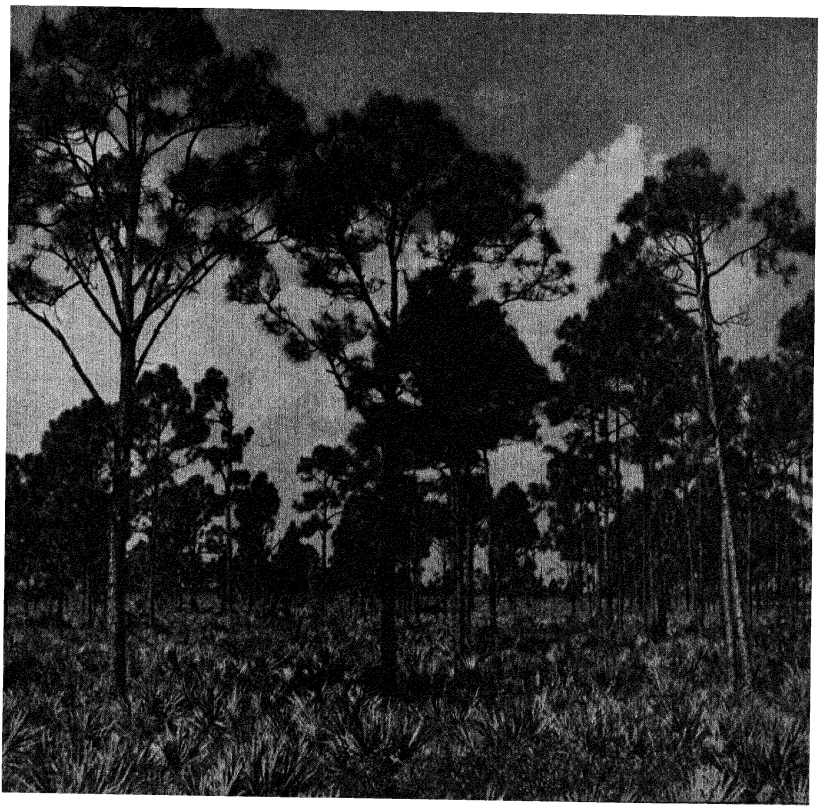


The pulp, which has been mixed from wood pulp, rag pulp, or other materials, is now ready to begin its journey from the stuff chest. It spreads itself evenly over a moving belt of copper screening. The speed of the moving screen belt is carefully adjusted so that the milky stream of pulp is spread on the belt to the desired thickness. A sidewise and up-and-down motion is given to the belt as it moves along in order to distribute the fibers more evenly. Water runs down through the holes in the screen belt; the pulp thus becomes drier as it moves along. The pulp is further dried by being passed through a suction box that sucks out additional water from the drying pulp, and by being passed through a series of rollers.

Sometimes a chemical solution called *sizing* is mixed with the pulp before it begins its trip. Paper of finer grades is given sizing while on its journey by being passed through a tub of sizing, made of glue, rosin, talc, and china clay. This mixture fills all the tiny spaces between the fibers and makes the paper smooth and capable of taking ink without blotting. When a glaze is desired, the pulp is passed through slightly heated polished rollers called calenders.

At the end of the rollers, the paper is wound onto large spools, or reels. After this, it is cut into strips by being passed between circular knives. Another knife cuts each strip into sheets. If the paper is intended for newspapers, it is left on the large spools and taken in this form to the presses. The cheaper grades of paper are artificially dried by heated rollers, near the end of the papermaking machine. The best grades of paper are slowly dried in lofts by air currents.

Location of the Paper Industry. When rags were the main source of papermaking materials, the mills were located where there was sufficient water power, and near the market for rags and paper. As wood pulp became more and more important, the mills shifted to points where, in addition to a good water supply, there was a good wood supply, the market factor becoming less and less important as transportation of pulp and paper became cheaper than that of the wood from which they were made. The result is that much of our wood



Philip D. Gendreau

A new and thriving industry in the Southern States is the extensive use of young pine trees in the manufacture of paper.

pulp is now manufactured near the wood supply, usually being made into paper there, though sometimes being shipped to the paper factories nearer the supply of skilled labor and the markets.

So great is our demand for wood pulp that our own resources supply only about one half of our needs. We import great quantities of wood for pulp and wood pulp itself from Canada, Norway, and Sweden. From Europe we import millions of pounds of rags and also some of the finest grades of paper.

In our domestic supply of wood for pulp these states lead: Maine, Washington, Wisconsin, Louisiana, and New York. As science finds the way to use more kinds of wood for pulp, there has been a trend toward the southern and Pacific Coast forests as a source of pulp. New processes in pulp making have

made possible a greater use of the forests of the South, resulting in a very rapid growth in the number of pulp and paper mills there. New York, Michigan, and Maine lead in paper production, followed by Ohio and Wisconsin.

We export only a small percentage of paper made in the United States because we use almost all of it for our newspapers, books, and magazines.

Effect of Paper Manufacturing on Our Wood Supply. At the beginning of our wood-pulp industry, great waste occurred; but now our mills are carefully guarding their supply because they foresee a shortage unless scientific methods are employed. The building and the maintenance of large pulp mills require an immense amount of capital.

TEXT QUESTIONS

1. What substances were used for paper in early times?
2. Who discovered the art of making paper from fibers?
3. Who brought this knowledge to Europe?
4. Explain the rapid improvements in papermaking.
5. From what fibers is paper now made? Give the characteristics of each kind.
6. Describe the making of paper pulp from rags.
7. Describe the two ways in which wood pulp is prepared.
8. Explain how paper is made from pulp.
9. What factors govern the location of the wood-pulp industry? the paper industry? Why?
10. Discuss the distribution of the supply of wood for pulp.
11. What is the effect of papermaking on our wood supply?

SECTION 3—RUBBER

History of Rubber. Although Columbus found natives of the islands on which he landed playing a game with balls made of rubber, not much attention was paid to the product from which the balls were made until the latter part of the eighteenth century, when crude rubber shoes were introduced into Europe. About this time it was discovered that rubber would erase pencil marks. The product, at that time, received its English name of India rubber, that is, a material from the Indies that would rub out marks.

In 1820 Charles Macintosh discovered that rubber could be dissolved in coal naphtha. He used this solution to waterproof textiles and thus gave rise to the making of rubber coats, which, for a long time, were called macintoshes. Unfortunately the rubber became sticky in hot weather and stiff in cold weather.

In 1839 Charles Goodyear discovered the process of mixing rubber with sulphur and other chemicals under heat. He called this process *vulcanizing*. This process made rubber products indifferent to heat or cold, and also made possible the using of rubber in the various forms now called hard rubber.

In 1876 an Englishman named Wickham smuggled rubber-tree seeds out of Brazil. From these seeds have come the great rubber plantations of the East Indian Islands, India, and the Malay Coast.

The Rubber Tree. Rubber is a thickened juice, called *latex*, that is extracted from more than three hundred kinds of trees, although only a few of these lend themselves well to commercial production. Latex is not the real sap of the tree, but is a white, milky fluid just inside the bark. The Hevea tree is the principal source of our best rubber, and is now grown extensively on the plantations of the Far East. It grows rapidly and in about five years yields latex.

In northern Mexico and southern United States, guayule rubber is receiving much attention. It is obtained from a plant, which is cut and treated chemically or by mechanical devices.

Various grades, due to the kinds of trees from which the rubber comes, the regions of origin of the rubber, and the method of curing, are recognized in the crude-rubber trade.

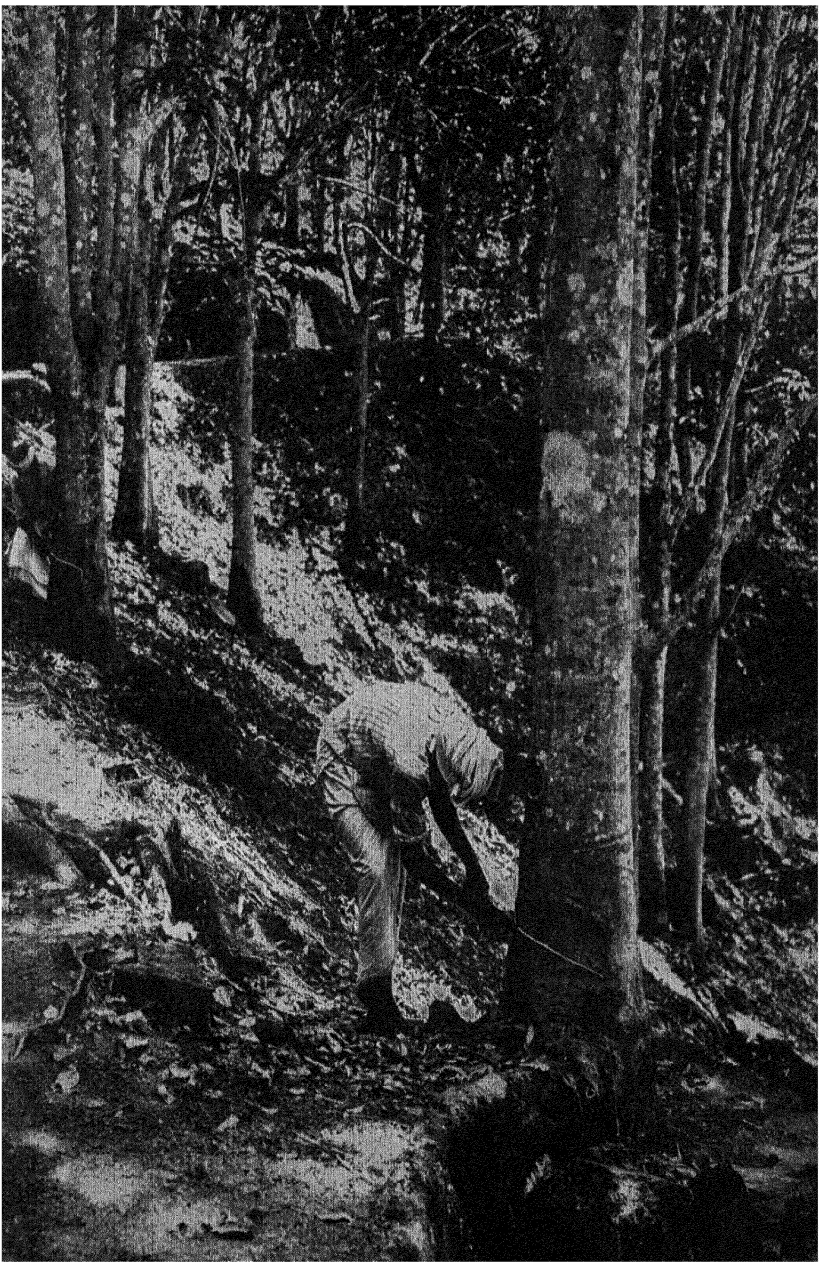
Plantation rubber now forms over ninety-five per cent of the world's supply and brings a much higher price than the dirtier and poorly cured wild rubber.

Location of Crude-Rubber Production. Until quite recently Brazil was the chief rubber-producing country; but the great bulk of the world's rubber supply now comes from the large plantations of the Straits Settlements and other parts of the Malay Peninsula, Ceylon, India, Borneo, and other islands of the East Indies. The greater part of rubber production at present is almost wholly in the hands of the British and the Dutch.

Rubber trees require an annual average temperature of seventy-five degrees or higher. From eighty to one hundred inches of rainfall a year are necessary. The natural home of rubber trees is within thirty degrees north and south of the equator, and the greatest region of production is a belt within about ten degrees of the equator.

The Amazon River Valley affords an ideal climate for rubber trees, but for white men, a very unhealthful one. For many years no commercial plantations were found in this region, production depending wholly on the tapping of wild trees by natives. During the last decade, however, American capital has established large plantations seven hundred miles up the river from Pará. In Africa, especially along the west coast and the Congo River, we find wild-rubber harvesting an important industry. Some plantation rubber is cultivated in Mexico and Central America, and some rubber is gathered from wild trees. Large rubber plantations are now being developed in Liberia, Africa, and in the Philippines.

So varied are the sources of rubber, and so increasing is the demand for it, that this industry will undoubtedly find, for some years to come, many changes in its location. It has already passed from the wild-rubber stage into the planted-tree stage. As improvement in the different trees advances, new areas will be opened up and older regions will lose their leader-



Salada Tea Company

Tapping wild rubber trees in the East Indies.



B. F. Goodrich Co.

A rubber plantation in the East Indies.

ship. So important to the world is rubber that no one region will be permitted to monopolize its production very long.

Methods of Wild-Rubber Production. In gathering wild rubber, the native laborer taps the tree with a long-handled axe, or knife, so that the latex runs out from the gashes in the bark into little cups. These he later empties into a bucket. The milky latex is then coagulated, or thickened, by smoke from a fire made of bark or nuts rich in creosote. The native dips a wooden paddle into the latex and holds it over the smoke, which hardens the latex. This process is repeated until he has built up a large lump, called a *biscuit,* weighing from fifteen to thirty pounds. The paddle is removed, and the biscuit is ready for the market.

Methods of Plantation-Rubber Production. On large commercial plantations, trees from nurseries are set out in rows

and carefully tended until they reach the age of yielding latex, generally about the fifth year. Several methods are used to tap the bark. The cut must penetrate the bark, but not the tree. Cutting into the tree would injure it and also permit the sap to mix with the latex. This mixture would result in inferior rubber. The latex is caught in small cups.



Keystone View Company

Tapping a rubber tree on a rubber plantation.

The cups of latex are emptied into buckets; and the latex is carried to the coagulation house, where it is strained and placed in large shallow tanks. After acid has coagulated it, the rubber is pressed into large sheets and dried. Sometimes it is sprayed into the top of a very hot room, where heat evaporates the water from it, and the pure rubber falls in flakes to the floor. Because of the great care used and the scientific methods employed, plantation rubber is free from the impurities and dirt that characterize wild rubber.

Plantation rubber is pressed into bales weighing from one hundred and fifty to two hundred pounds, is covered with cloth, and then shipped to the markets. The great rubber markets of the world are Singapore (Malay Straits), Pará (Brazil), London, and New York. Some rubber is shipped in the form of latex in tank steamers to the factories.

Rubber Manufacture. The great variety of goods manufactured from rubber requires many processes in the factory. The description of these processes must therefore be limited to those that are used to prepare the rubber for the detailed processes.

Crude rubber, upon arrival at the mill, is cut open and inspected for foreign substances like dirt. It is then cut, ground into small pieces, and washed by running water until it is

clean. It is then rolled into sheets and thoroughly dried. After this, it is mixed with various chemicals, the ingredients of the mixture depending upon the article to be manufactured. Soft-rubber goods, requiring elasticity, use but a small proportion of these chemicals; whereas in hard-rubber goods, chemicals make up as high as one third of the total composition. Sulphur, litharge, and whiting are the principal materials used. After mixing, the rubber is handled in various ways, the processes from this point changing with the nature of the finished articles.

Consumption of Rubber. The United States is the largest consumer of rubber products in the world, taking over three quarters of the world's supply of rubber. Over eighty per cent of this rubber is used to make automobile tires. Much is used in belting, hose, steam- and machine-packing, and footwear, including boots, rubbers, heels, and soles. The electrical industry, including radio, draws on rubber for insulation material and storage batteries. The value of our rubber products runs annually into many millions of dollars.

TEXT QUESTIONS

1. Explain the origin of the word *rubber*.
2. What men improved the making of rubber goods, and how did the processes that they introduced help the rubber industry?
3. How did Wickham aid the rubber industry?
4. What is rubber? What is latex?
5. Why is the Amazon River Valley an ideal location for rubber? Why is this region not developed to a greater extent?
6. Name and locate the principal rubber regions of the world.
7. How does the United States rank as a rubber producer? Why?
8. What factors affect the location of rubber production?
9. Can rubber production be monopolized? Why?
10. Describe the various ways in which rubber is produced.
11. Contrast the primitive and the plantation ways of coagulating the latex.
12. How is crude rubber prepared for manufacture into finished articles?
13. Discuss the consumption of rubber at present.

SECTION 4—MISCELLANEOUS FOREST PRODUCTS

Naval Stores. Tar, turpentine, rosin, and pitch, all products of the pine tree, are called naval stores because of their use on ships. Their importance has declined with the displacement of wooden ships by those made of steel.

Tar is obtained by distilling pine wood. It is used to weatherproof ropes, roofs, and boat hulls; it is used also in medicines and in road making.

Turpentine is made by distilling the sap of the pine tree. After the distillation process, rosin is the solid material remaining; pitch is the heavy, sticky liquid left. Turpentine is used extensively as a solvent for paints and varnishes. Rosin is used in soaps and also in paper as a sizing agent. Pitch is used in making ships watertight.

Methods formerly used in the naval-stores industry were extremely wasteful, resulting in the killing of many valuable trees in order to obtain their sap alone. Present-day methods seek to conserve the trees and to delay their destruction. The southeastern section of the United States produces over ninety per cent of the world's supply, exporting much from the ports of the Carolinas and Georgia. France and Russia produce most of the remaining supply of the world.

Collecting sap from pine trees for turpentine.
U. S. Forest Service



Gums. True gums, substances exuded by plants or extracted from them by solvents, when mixed with water, form mucilage, but they will not dissolve in alcohol or turpentine. Gums are used in stiffening textile fabrics, in printing calico, in printers' ink, in candy, in medicine, in cordials, and in making mucilage.

Practically all our commercial gums are the hardened juice of various kinds of acacia trees. Gum arabic comes from Asia Minor; gum Senegal, from northwestern Africa; Cape gum, from southern Africa; and wattle gum, from Australia.

Resins. Resins are the various solid or semisolid organic substances, produced by or exuded from plants or trees, yellowish to brown in color, and soluble in alcohol, ether, or turpentine, but not in water. Hard resins, after being melted and dissolved in spirits, are used for varnishes. The principal classifications of hard resins are shellac, mastic, gamboge, and dammar. The last named is called a gum for trade purposes.

The most important hard resins are: Zanzibar copal, which comes from Mozambique, a Portuguese colony in Africa, and is the hardened juice of a living tree found there; kauri copal, which comes from New Zealand and is the fossilized gum of the kauri tree; amber, which is found along the shores of the Baltic Sea and is the fossilized sap of a tree. This last resin is used in pipe making and also for ornaments such as necklaces and beads.

Other hard resins come principally from southern Asia and neighboring islands, and are chiefly the hardened juices of trees.

Oleoresins, that is, resins produced as mixtures with essential oils, are liquid resins such as turpentine, lacquer, and Peru and Canada balsam. They are used in paints and varnishes. The balsams are used also in medicines.

Gum resins, that is, resins produced as mixtures with gums, are used in medicines, perfumes, and incense. Almost all of them come from the tropics. They are aloes, myrrh, frankincense, asafetida, and benzoin.

Dyestuffs. Vegetable dyes formerly occupied a much more important place in commerce and industry than they do at

present; but modern science has given us mineral dyes, principally from coal tar, that surpass them in cheapness, brilliance, and permanence. There are some industries, especially in the Oriental countries, that still cling to the use of vegetable dyes. The oriental rug industry depends largely upon vegetables for its dyes.

Indigo comes from India, Java, and Natal. It is the product of a bush that is broken up, soaked in water, and allowed to ferment, whereupon it gradually drops a blue powder. This dye is extensively used in the Orient to dye the cheap cotton fabrics of the poor.

There are several woods that yield dyes. Brazilwood and logwood, trees that grow well in tropical America and the West Indies, are the chief sources of tree dyes. Red is the principal color extracted from them; black also is obtained.

Madder comes from the ground-up roots of a plant and yields, depending upon the root and the method of preparation, various colors—pink, red, and purple. Black also is obtained from it.

Fustic, which gives a yellow dye, comes from a tree found in tropical America and in the West Indies.

Tanning Materials. To change hides into leather, solutions rich in tannin or tannic acid are required. For centuries the vegetable kingdom has supplied materials for tanning. The principal source of these materials has been the barks of certain trees: the hemlock, the oak, the larch, the willow, the quebracho, the wattle, and the birch.

Other sources of tannin are the acorn cups from the valonia oak, grown in Asia Minor and on the Balkan Peninsula; divi-divi, which is the dried pods of a tree that grows in tropical America, the East Indies, southern Asia, and Australia; the leaves of the sumac tree, which grows in America and in Sicily; myrobalans, the dried fruit of a tree that grows in southern Asia; and the root of a plant called canaigre, found in southern United States and northern Mexico.

Tanning material in the form of oak and hemlock bark was plentiful in colonial times, and small tanneries abounded everywhere. As the supply of tanning materials became more

difficult to get, it was found advisable to centralize this industry into larger plants; to extract the tannin at its sources; and to ship it in highly concentrated form to the tanneries. This concentration permitted the use of various woods from which extracts could be made.

Our present supply of tanning materials comes from the Appalachian district, from the northern forests extending from Maine to Wisconsin, and from certain trees in our Pacific Coast district. Tanning extracts now come from the various regions of the world best adapted to their production. In the past the tanning-materials industry wasted millions of good lumber trees for their bark alone. Present-day methods are also using great quantities of mineral chemicals instead of vegetable tannin.

Oils. Oils of vegetable origin may be classified into two groups: fixed oils and volatile oils. The fixed oils do not evaporate upon exposure to the air. They are generally obtained by mechanical means, especially by pressure, from the wood, seeds, fruit, and leaves of trees and shrubs. Some are drying oils, like linseed oil; and some are nondrying oils, like olive oil.

Fixed oils are used in paints, varnishes, and medicines; in cooking and soapmaking; and for lubrication, illumination, and table use. Among the principal fixed oils are olive oil, cottonseed oil, corn oil, linseed oil, tung oil, coconut oil, cocoa butter, castor oil, peanut oil, almond oil, and palm oil.

Tung oil, the most powerful drying oil known, is extracted from the seeds in the nuts grown on the tung tree, a native of China, whence has come most of the supply of this oil. So great is the demand for tung oil in our American industries, however, that during the last ten years hundreds of thousands of tung trees have been planted in our southern states, especially in Mississippi and Florida where climatic conditions are favorable, and extraction mills have been built near these locations.

It is interesting to note that, because of the superiority of machine methods, it is possible for an extraction mill at Gainesville, Florida, to extract more oil in a given time than could hundreds of Chinese coolies using old hand methods.

It is apparent that while we shall continue to import great amounts of tung oil from China, additional quantities demanded by our industries will increasingly be supplied by the rapidly expanding domestic production in our own southern states.

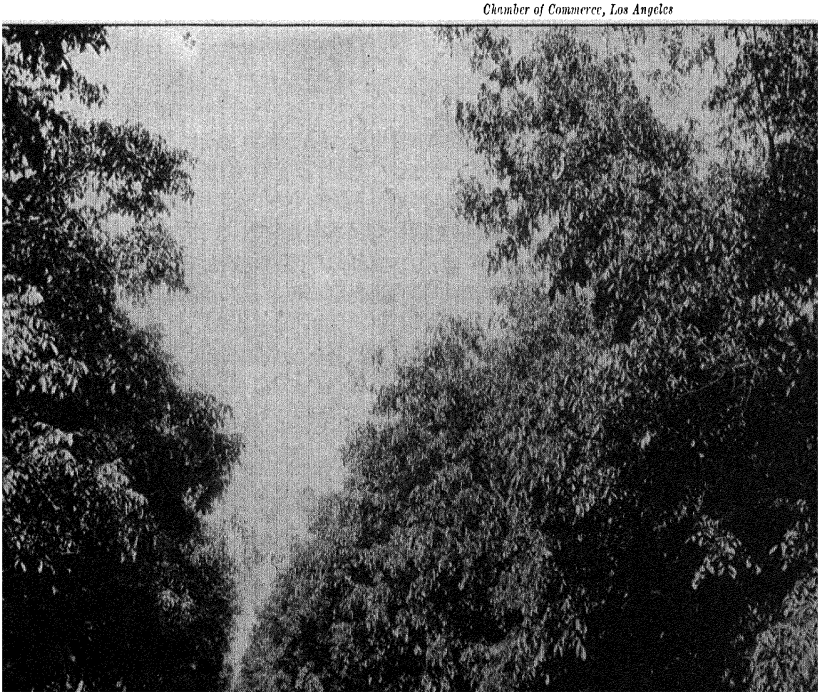
Tung oil is used in industry in the making of paints, varnishes, linoleum, inks, insulating materials, and for waterproofing. It dries quickly, resists heat, and repels water.

Volatile oils, because they are essences extracted from their various sources by distillation, are sometimes called essential oils. They evaporate quickly and will not change into soap. They are used in perfumery, flavoring, medicines, and paints. Their sources are flowers, fruits, spices, and sap. Turpentine and camphor are classified as volatile oils.

Nuts. Nuts, as a food supply, enter annually into commerce to the value of several million dollars. Among the commercial

A walnut grove in California. Our domestic production, which is increasing, forms a valuable contribution to our food supply.

Chamber of Commerce, Los Angeles



nuts, we find coconuts, walnuts, almonds, chestnuts, acorns, pecans, Brazil nuts, peanuts, hickory nuts, filberts, and hazelnuts. Coconuts form the principal item of nuts imported into this country, as we have no available areas suitable for extensive cultivation of them.

Almonds, filberts, and Persian (English) walnuts take a leading part in our nut import, although our domestic production is increasing. The chestnut forms an important part of the food supply of southern France and other Latin countries. From the Orient, where their production is cheap, we import large quantities of peanuts.

TEXT QUESTIONS

1. What are naval stores and why are they so called?
2. How are tar, turpentine, and rosin obtained?
3. Why has the obtaining of naval stores resulted in the wasting of much wood?
4. For what are naval stores used?
5. Where are naval stores produced?
6. What are gums? Where are they obtained? What are they used for?
7. What are resins? Where are they obtained? For what are they used?
8. What are gum resins? What are they used for? Where are they obtained?
9. What kind of dyes has displaced vegetable dyes in importance?
10. Where are vegetable dyes still used? Why?
11. What is indigo? How it is produced? Where is it produced?
12. Name some of the principal vegetable dyes and tell where they come from.
13. Explain why tanning extracts are now made near the sources of supply.
14. Show how the obtaining of tanning materials resulted in waste in the past.
15. Name the chief tanning materials. Where does each come from?
16. What are fixed oils? Name some. For what are they used?
17. What are volatile oils? From what are they obtained? In what are they used?
18. Name some principal nuts. Where are they grown? How are they used?

PROBLEMS AND PROJECTS

1. On an outline map, indicate the principal lumber regions of the world, including those of the United States.
2. On an outline map, indicate the principal rubber-growing regions of the world.
3. Make a collection of pictures showing lumbering and milling methods.
4. Collect pictures showing wasteful methods of lumbering.
5. Draw up a list of all the common uses to which wood is put.
6. Make a list of the substitutes now being used for wood and explain how they are used.
7. Draw up a list of the principal tanning materials now used, and tell where each comes from.
8. Make a list of all the various kinds of wood that you find in your home, including those in furniture. Where does each kind come from?
9. Obtain samples of various grades of paper and compare them. What makes the difference in quality? Explain.
10. Mention ways in which many forest fires are started. How can the number of these fires be reduced?
11. Which is the best material to use in building a house—stone, brick, cement, or wood? Give reasons for your answer.
12. Draw up a list of common articles made from paper.
13. If you were a mill-saw salesman, where would you expect to find your best markets? Indicate locations on an outline map of the United States.
14. If you were going into the business of growing rubber, where would you locate? Why?
15. If you were going into the furniture-making business, where would you locate? Why?
16. How have forests helped us? hindered us?
17. Explain why it is sometimes cheaper to import wood pulp than to use domestic wood pulp. Where does the imported pulp come from? Why?
18. What efforts are American manufacturers now making to grow their own supply of rubber?
19. By asking people who know, find out how much common lumber has risen in price in your community in the last twenty-five years. Explain this rise in price.
20. Show how mineral dyes are displacing vegetable dyes.
21. Explain why prairies have no trees.
22. What is synthetic rubber? For what is it used?

23. Explain how science has found a way to reduce the waste that formerly occurred in the tanning-materials industry.
24. What encouragement does your state give to the planting of trees?
25. Why do not more large concerns in the United States establish extensive rubber plantations in the Philippine Islands?
26. Make a list of magazine articles, pamphlets, and books dealing with the subject matter in this chapter.

TOPICS

1. Modern plantation methods of growing rubber.
2. Creosote as a wood preserver.
3. The work of our Government in forest preservation.
4. Forest control in Europe and America.
5. The future of lumber in the United States.
6. Composition shingles.
7. The Amazon River Valley and rubber-tree growing.
8. The English control of the rubber market.
9. The Firestone rubber plantation in Liberia.

FOR CLASS DISCUSSION

1. Stricter governmental control of our timber supply is justifiable.
2. To protect its supply of crude rubber, the United States would be justified in acquiring regions where rubber can be grown.

CHAPTER XIII

VEGETABLE FIBERS

SECTION 1—COTTON

History of Cotton. The growing of cotton began in India, far back in history. We know that cotton fibers had reached a high degree of perfection in that country by 600 B.C., when Hindu priests used cotton cloth as an emblem of holiness. Nearchus, admiral of Alexander the Great, in his expedition to India in 330 B.C., related: "There are in India trees bearing, as it were, great bunches of wool from which the natives make garments whiter than any other."

Cotton was known also to the ancient Egyptians. Its cultivation spread slowly into northern Africa; and about A.D. 1000 the Moors brought it into Spain. The Romans used cotton. Caesar's tent was made of it, and cotton awnings kept aristocrats cool in the Coliseum. For centuries India was the only source of cotton cloth. Calico, a cloth made of cotton, gets its name from Calicut, in India. The extraction of the seeds made the cloth very costly, and for this reason its use was greatly restricted.

Cotton was in use in the Americas long before Columbus sailed from Spain. Cortez described its use in Mexico, and Magellan found it in Brazil. The Peruvians used it for centuries before the advent of the Spaniards.

Until 1794, when the cotton gin was invented in the United States by Eli Whitney, the production of cotton was limited in this country, because of the amount of labor and time needed to extract the seeds. The invention of the cotton gin made it possible to put cleaned cotton on the market at a low cost, thus stimulating its use. Cotton became the leading textile for clothing. This change in the textile industry, coming at almost the same time as the invention of steam-power machines, had a great influence on the commerce and industry of the world.



Philip D. Gendreau

Weighing bales of cotton for shipment in India.

Kinds of Cotton. Sea-island cotton is grown in the United States in very small amounts along the sea coast of the Carolinas, Georgia, and Florida. Of all cotton plants, sea island has the longest fibers. They are about two and one-half inches long.

Egyptian cotton has long fibers, averaging about one and one-half inches in length. Imported into the United States, this cotton has been planted in Arizona and California, where it grows well and yields several thousand bales annually. Egyptian cotton is used much in the manufacture of underwear, hosiery, and automobile tires.

American upland cotton furnishes most of our raw cotton. Its fibers average about three fourths to one inch in length. They are separated from the seeds with difficulty. Texas leads in the growing of this kind of cotton.

Brazilian cotton was formerly poor in quality and length of fiber, but has been improved so that it resembles American Upland. Chinese and Indian cottons are short-fibered. We

use very little of them in this country. Most Peruvian cotton is very coarse and is chiefly mixed with wool.

Distribution of Cotton. The United States annually produces about two fifths of the world's supply of cotton and is therefore a very important factor in cotton production. Texas, Mississippi, Alabama, Georgia, and Arkansas are our leading cotton-producing states. India produces about one sixth and is followed in importance by Russia, China, and Egypt. Almost all the rest of the cotton supply of the world is grown in Brazil, Peru, Mexico, Argentina, Uganda, and the Sudan.

The exporting countries of raw cotton are the United States, India, Egypt, Brazil, and Argentina. Russia, China, and India absorb the bulk of their crops for domestic use. Most of our exports of raw cotton now go to England, Japan, Germany, France, and Italy.

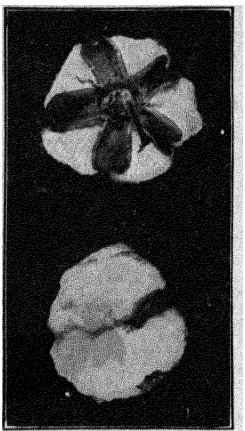
The countries that lead in cotton manufacturing are England, the United States, Japan, Germany, Russia, France, and India. The principal export markets for American cotton piece goods are the Latin-American countries, the Philippine Islands, and Canada. Our commerce with India and Japan is declining because of the increase in manufacturing in those countries. We import some of the best grades of raw cotton from Egypt and the finer grades of piece goods from England and other countries of Europe.

In recent years there has been a marked decrease in the percentage of the United States cotton crop in the total world production. Crop limitation in the United States has helped stimulate rival cotton areas to increased production and export.

The Cotton Plant. Cotton will grow forty degrees north or south of the equator, but it thrives best within thirty-five degrees of the equator. In the United States, it is planted every year and grows to a height of from two to four feet.

The cotton plant varies in character because of different factors, such as the nature of the locality where it is grown, the methods of cultivation, the choice of seed, the soil, and the climate. The fibers come from a pod, which bursts open and discloses a boll of cotton full of seeds.

Conditions of Growth. Cotton thrives best in a warm climate that has plenty of rainfall or irrigation during the growing season. Rain in the early growing season is helpful, but later, when the crop is ripening, it is liable to be harmful. The cotton plant is very sensitive to frost.



U. S. Dept. of Agriculture
Cotton bolls.

Conditions in our southern states are very favorable, especially because of the gradual rise in temperature during the season when the cotton is growing. Egypt, because of its warm climate and ample irrigation, is favorable to cotton growing. In India and China, poor seed and climatic conditions result in an inferior and short fiber.

Planting of Cotton. The seeds are sown in rows about four feet apart. In the United States, planting is usually done in late March or April. After the seeds have sprouted, the chopping-out process is begun. Surplus plants are cut with a hoe, and the other plants, which are to mature, are left a short distance apart. As the process is carried on by hand, it is very expensive.

Fear of frost and the constant fight against the boll weevil keep the cotton growers worried. Their worst enemy is the boll weevil, an insect that attacks the cotton boll and destroys the inside fibers before they are ripe. Although the Department of Agriculture has kept up a constant warfare against this pest, it has spread over all the cotton area of the South. Long winters, crop rotation, and the use of poison help to destroy it.

Cotton Picking. The crop begins to ripen late in July and continues to do so until late autumn. As soon as the bolls begin to open and to show ripe cotton, picking begins.

The picking of cotton, especially the low-priced cotton, is a large item in the cost of cotton production. Despite the invention of many machines, cotton is still largely picked by hand. A machine, which promises to become successful in



Philip D. Gendreau

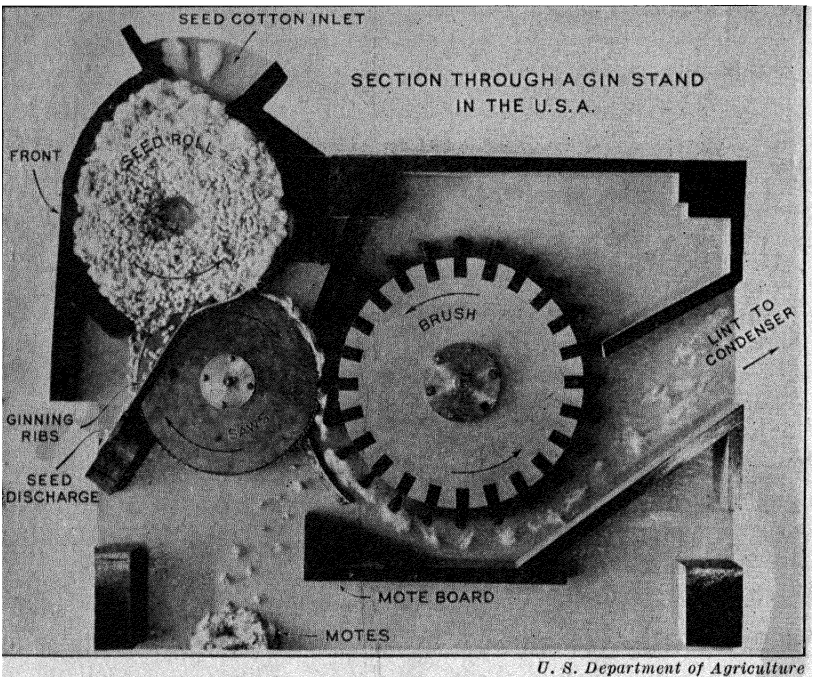
Picking cotton on the Mississippi delta.

operation, has recently been developed to pick cotton but will probably prove too costly for the average cotton grower.

Ginning Cotton. The object of ginning cotton is to remove the fibers from the seeds, to which they cling. Each cotton boll contains about forty or fifty seeds, hidden among the fibers. The crude cotton gin invented by Eli Whitney at the end of the eighteenth century has been improved, and today, under the name of the saw gin, it is capable of cleaning thousands of pounds of cotton a day. The cotton, sucked from the wagons by air, is ginned and labeled within an hour.

After the first ginning, the little linters, which still cling to the seeds, are removed by a second gin. These linters are used for batting, wadding, the poorer grades of cloth, and in the making of explosives.

Baling Cotton. Clean cotton represents about one third of the weight of unginned cotton, the other two thirds being composed principally of seeds. Baling is usually done at the ginnery. Although the quantity in the American bale varies, a bale is usually about five hundred pounds in weight.



Section through a saw gin stand.

If the cotton is destined for export, it is rebaled by the Morse lever press. This machine subjects the cotton to terrific pressure, which reduces the bale in size. Later the bale is covered with bagging and bound with steel bands. As in the case of exporters of many other commodities, the exporters of cotton have been guilty of carelessness in shipping and have thus invited criticism by foreign buyers.

By-Products of Cottonseed. Cottonseed was once considered worthless, but it now forms a valuable part of the cotton crop. It is pressed for its oil, from which are made lard substitutes, table oils, soaps, and candles. The cottonseed cake, which is left after the oil has been pressed out, is ground into meal and used for cattle food and as a fertilizer.

Manufacture of Cotton. The general process of manufacturing cotton may be divided into three steps: cleaning and

combing the fibers; pulling and twisting the fibers into threads; and weaving the thread into cloth.

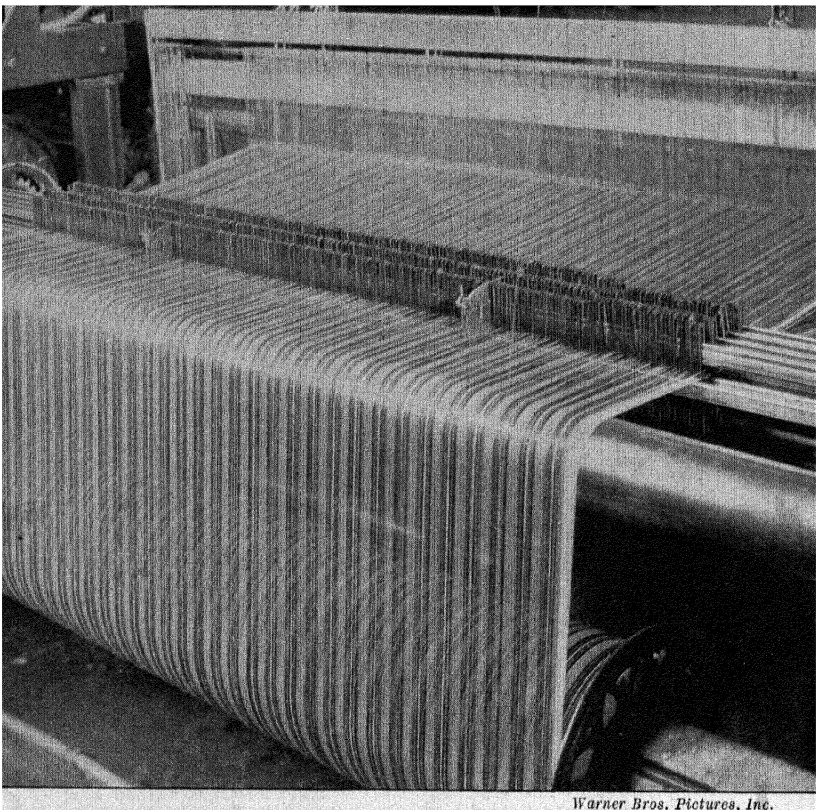
When the bales arrive at the mill, they are cut open. The cotton is then loosened, and fluffed up and cleaned by a series of machines. The fibers then pass, in the form of a large roll, or lap, to machines where they are carded and cleaned by rollers with tiny teeth. These small teeth brush the fibers into a thin sheet. This sheet is then wound into a loose cotton rope about an inch thick, called a sliver. A number of slivers are brushed and drawn out, being united into one draw sliver. The draw slivers then pass through a process called roving, which further draws and slightly twists several draw slivers into a coarse yarn.

The cotton is now ready to be made into thread by a spinning machine. Two methods are used to spin cotton thread: the ring spinner, which is more common, and the mule spinner. In the first machine, the cotton is twisted and drawn by a rapidly revolving device. In the second, the cotton is twisted rapidly and, at the same time, drawn out by a frame that moves away from the revolving spindle.

After the spinning, the thread is drawn off onto spools in a process called winding. At this stage, the thread is sometimes shrunk and strengthened by immersion in proper solutions of various chemicals. If dyed threads are desired in the weaving process, the thread may also be dyed.

From these spools, the thread is drawn onto immense spools, called beams, in such a way that hundreds of parallel threads are wound around the beam for the later weaving process. These threads will later compose the warp, or the lengthwise threads, of the cloth. Others, called filling threads, are wound on bobbins to form the woof, or the cross threads, of the cloth.

The warp threads from the beam are now drawn through harnesses, so arranged that some lengthwise threads may be raised and others lowered, as desired. The process of weaving consists of raising and lowering certain lengthwise threads and causing a shuttle full of thread, which unwinds as it goes, to cross between them in the open space between the higher



Modern power loom.

and the lower threads. The machine that does the weaving is called a loom.

After the cloth has been woven, it is bleached pure white by chemical processes, or dyed, and sometimes printed by huge color presses, which stamp each color separately. It is then starched or sized, smoothed, pressed, and wound in large rolls ready for the market.

Cotton-Manufacturing Countries. England has held the front rank in cotton manufacturing since the advent of machinery. The European wars gave that country a good start about the year 1800. Iron and coal, near at hand in England, were used in making machinery and in producing power. Raw cotton from overseas, carried in British merchant ships, was cheap. England gradually built up a labor supply skilled in manufacture of textiles. The combination of these factors enabled England to become a world leader both in cotton

manufacture and in overseas export to her less skilled neighbors.

In time other European countries managed to develop cotton industries of their own. Some of them, particularly France, Germany, Belgium, and Italy, have grown almost as skilled as England, although none of them have equalled her in export trade. Today Russia has extensive cotton-spinning and weaving plants, and most of the more advanced European countries have similar plants, large or small.

Japan imported cotton machinery from England in the 1870's and quietly developed a cotton industry of her own. Japanese labor was patient, skillful, and low paid; the efficiency of the Japanese mills increased steadily and soon Japan entered the world market as an exporter. At the present time Japan is a rival of England in the total amount of yardage sold, although England is still selling the more expensive types of goods while her Oriental competitor sells the cheaper.

In the United States, the East, especially New England and the Middle Atlantic States, early began the manufacturing of cotton goods. There the presence of power resources, water power at first and coal power later, and the fact that the land was unfit for general agriculture combined to make manufacturing profitable. The climate also was favorable, and the population, chiefly of English stock, followed the example of the mother country. New England obtained the lead and, despite growing competition, held it for many years.

More recently, cotton manufacturing has become well established in the Southern States, where conditions are even more favorable. The milder climate and longer growing season of the southern Piedmont make fuel and food costs lower than in New England. Lower living costs have been reflected in lower wage costs to the mills. Rates for electric current from nearby water-power plants are also lower than in the North. Raw cotton is grown almost at the doors of the mills, giving them another cost advantage. As a result cotton manufacture has expanded in the South, which now has more cotton spindles than New England and is turning out more goods. The

North still claims the leadership in making the finer grades of cotton piece goods.

It seems quite clear at present that cotton manufacturing will remain in the states along the Atlantic Coast because it is well established there; skilled labor has settled there and does not wish to move; and the transportation of raw materials by water is cheap. Also, the great cotton markets are located there, and the Atlantic Ocean is the highway for exports to many foreign markets.

TEXT QUESTIONS

1. Discuss the history of cotton up to 1800.
2. What invention in the eighteenth century greatly increased cotton production? Why?
3. Describe the principal kinds of cotton.
4. What are the principal cotton-producing countries? Which ones export?
5. What are the leading cotton-manufacturing countries? Why are these important in cotton manufacturing?
6. What regions import cotton goods from the United States? Why?
7. Why does England export a large percentage of cotton goods?
8. Describe the cotton plant.
9. What conditions are favorable to cotton growing? Contrast the climatic differences in the various cotton-growing countries.
10. How is cotton planted in the United States? How is the boll weevil fought?
11. Why is cotton picking a large item in the expense of cotton cultivation? Are machines practicable? Why?
12. What does the cotton gin do? Explain.
13. Discuss the baling of cotton.
14. What do we get as by-products of cottonseed?
15. Discuss fully the methods used in manufacturing cotton thread.
16. How is cotton thread woven into cloth?
17. Why does England occupy so important a place in cotton manufacturing?
18. What factors early encouraged manufacturing in New England?
19. What factors are favorable to manufacturing in the South? in New England?

SECTION 2—FLAX

History of Flax. The use of flax extends far back into prehistoric times. Frequent reference to linen is made throughout the Bible; hence it is clear that linen was in common use among ancient peoples in early Biblical times.

Down through the centuries linen was the principal cloth used by civilized peoples until the cotton gin made possible cheap cotton cloth and gave cotton cloth the popularity and supremacy it now has. Even now, linen is held in high esteem for certain uses, such as table linen, collars, shirts, and surgical bandages.

Because of its great tensile strength, linen is a favorite in the manufacture of twines and ropes that require this quality. The invention of the detachable collar (stiff or soft) created a great demand for linen because of its peculiar adaptibility to this purpose. In colonial times in this country, linen occupied a very important part in the making of clothing; flax was grown throughout the colonies and spun at home for finer grades of shirts, dresses, and clothing in general. Cloth made from both linen and woolen fibers was the linsey-woolsey of colonial fame.

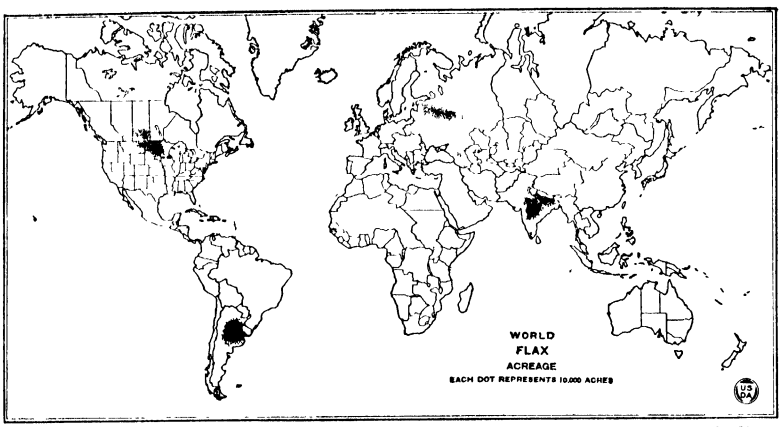
After the beginning of the nineteenth century, the general use of linen declined, and flax spinning and linen manufacturing gradually gave place to the cotton mills, until today the United States makes very little linen.

Distribution of Flax. In a discussion of the distribution of flax cultivation, distinction must be made between flax growing for seed and flax growing for fiber. When grown for fiber, flax must be harvested before the seeds are ripe in order to conserve the toughness of the fiber. When flax is grown for seed, however, the fiber is worthless and is generally burned.

Countries that grow flax for its fiber usually have a large supply of cheap hand labor, which is necessary for the successful cultivation of flax. Russia has led all other countries in flax-fiber cultivation, producing as high as four fifths of the world's supply. Flax is grown for its fiber also in central Europe, Belgium, Holland, France, and the British Isles, prin-

cipally in Ireland. In all these countries there is plenty of cheap labor, and whole families are available for the necessary handwork.

Flax is grown for seed in Argentina, central Russia, the United States, and India. From the seeds, linseed oil, so necessary to paints, is extracted.



U. S. Department of Agriculture

World flax acreage.

The manufacture of the fiber into linen cloth is centered in western Europe—Belgium, France, Holland, England, and Ireland—where skilled workers are found to make the flax into the very fine linens that we import. As previously stated, we in the United States manufacture very little linen, and that is used principally for collars, shirts, and toweling. We manufacture linen cordage also.

The leading cities in the linen industry are Brussels, Belgium, excelling in fine linen laces, and Belfast, Ireland, specializing in table linens of all kinds.

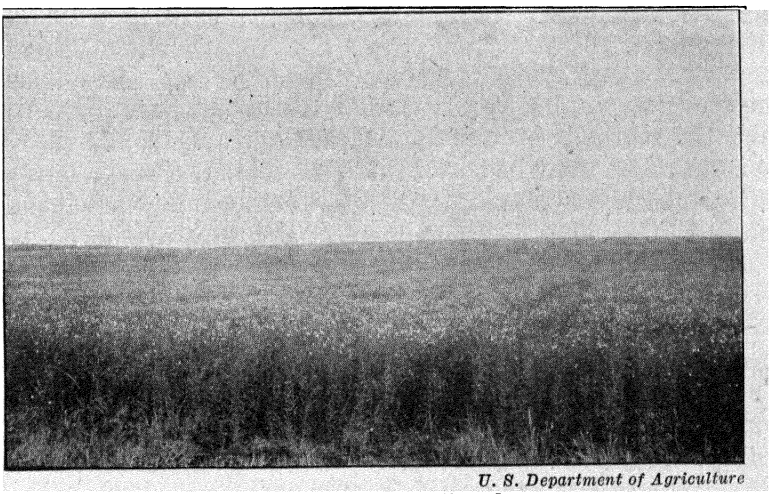
Preparation of Flax and Manufacture of Linen. When cultivated for its seeds only, flax is planted, reaped, and threshed like wheat, the seeds being later pressed for oil in a manner similar to that used with cottonseed.

If planted for its fiber, flax requires much care. When the stalk begins to turn yellow at the base, the flax plants are

pulled up by the roots and tied into small bundles. These are piled into stacks to dry.

The seed is separated from the stalk by drawing the plants through spikes. This process is called *rippling.*

Next comes the *retting* process, which consists of placing the stalks in large bundles under water until the vegetable matter



U. S. Department of Agriculture

A field of standing flax.

between the fibers and the outside woody bark have rotted sufficiently to be separated. Care must be used not to ret, or rot, the flax too much, as this would injure and weaken the fibers themselves. In Ireland, flax is retted in shallow ponds. In Belgium, in the Courtrai district, it is placed in large wooden tanks and sunk below the surface of small rivers. The river Lys in Belgium is famous for its retting qualities because of the chemical make-up of the water, which causes the flax to ret quickly and well. After the retting, the flax is dried. Sometimes, after being dried, it is again retted two or three times.

When properly retted and dried, the flax is *scutched;* that is, the fibers are pounded to free them from the rest of the plant.

After the scutching the fibers are hackled by being drawn over spikes that extract any remaining foreign matter from

the fibers and leave them straight and clean. In this process the short flax fibers, or *tow,* are combed out so that they can be spun separately from the longer flax fibers, which average from twelve to eighteen inches in length.

Because of the brittleness of the flax, dampness is essential in the spinning. Sometimes the fibers are passed through hot-water baths before spinning; sometimes the first spinning is done under water.

Except that more dampness is necessary, the general method of spinning flax is similar to that of spinning cotton; and the methods of weaving, bleaching, and dyeing also resemble those used in cotton manufacturing. Fine linens are often bleached by exposing them to the dew and the sunshine; but when speed is desired, chemical solutions are used.

TEXT QUESTIONS

1. Prove that linen was well known in ancient times.
2. For what is linen now used? Why?
3. Why has linen declined as a material for clothing?
4. Where is flax raised for fiber? Where is flax raised for seed? Why is flax produced in these regions?
5. Where is linen manufacturing carried on? Why is the industry centered in these regions?
6. Describe the growing of flax for fiber.
7. How is flax reaped?
8. Describe the various processes necessary to convert flax into linen thread.
9. How is linen thread made into cloth? How is linen cloth bleached?

SECTION 3—MISCELLANEOUS VEGETABLE FIBERS

Minor Vegetable Fibers. Vegetable fibers may be classified into general groups: bast fibers and structural fibers. *Bast fibers,* like flax, jute, true hemp, and ramie, are those taken from the stems or stalks of plants. *Structural fibers,* like Manila hemp, sisal hemp, pineapple fiber, and coir, are found in leaves, leaf stalks or stems, or fruits. Bast fibers are generally extracted by rotting. Structural fibers are usually extracted by scraping.

Jute. Jute is a bast fiber and the poorest of all fibers. It is used where cheapness rather than strength is desired. The plant grows to a height of about fourteen feet. It is cut by hand and then treated very much like flax. The resulting fiber is long and soft but has little strength. It dyes easily but does not hold color well. It is used only in bagging, covers for cotton bales, and in the cheaper grades of upholstery, carpets and rugs, linoleums, twine, and rope.

Jute is grown to some extent in China and Taiwan, but India is the largest producer of jute in the world and exports it to countries requiring bagging for grains, sugar, and cotton bales.

Hemp. True hemp is a bast fiber resembling flax. It was well known to ancient peoples; and, until the coming of cheap cotton, cloth made from hemp ranked next to linen as an important textile. The plant grows from three to ten feet high. The extraction of the fiber is accomplished by practically the same methods as those used with flax. True hemp grows well in the temperate zone, where there are sufficient rain and a three-month growing period.

Russia is the greatest producer of hemp, but Italian hemp is noted for its high quality. American hemp is grown in small quantities, principally in Kentucky. All the central European countries produce some hemp.

Hemp is used as a substitute for flax in the manufacture of rope, twine, carpets, and rugs. An extract of hemp is used in the Orient as a narcotic under the name of bhang.

Ramie. Ramie (rhea) and China grass are classed as one in trade, although there is a slight difference in their origin and preparation. Ramie is raised in China, Japan, and India, and will do well in a subtropical climate. It grows year after year, spreading rapidly and reaching a height of fifteen feet. It is cut by hand.

Extracting the fibers is difficult because they are held together by a gummy substance. The fibers are freed from this gummy substance and the wood by being soaked first in water and caustic soda, and later in acid solutions. When freed, the fibers are fine and silky. The use of ramie fibers is increasing and will grow faster as the process of extraction is improved. The invention of a machine for successfully removing the gum from ramie will make ramie a competitor of both flax and cotton.

We find ramie already used in making lace, upholstery, table cloths, toweling, ropes, sails, underwear, and dress goods. It has many of the qualities of linen; it is tough, yet soft, and, when woven into cloth, wears well. The raw material comes from the Far East and India, and is manufactured in France, England, and the United States.

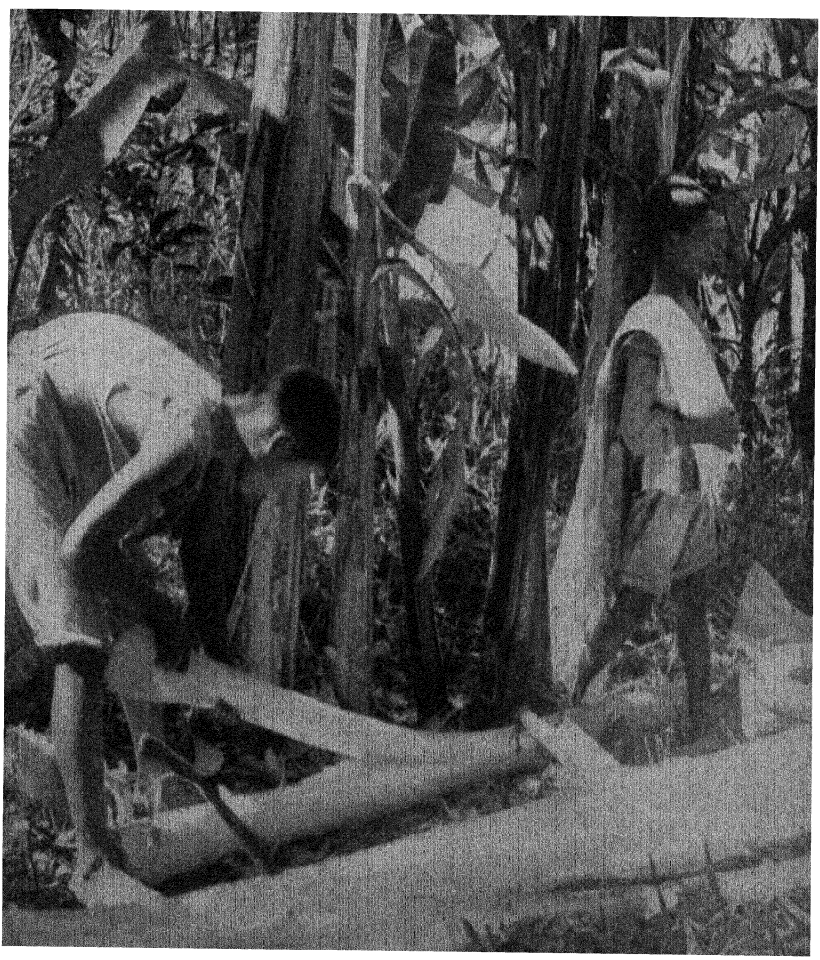
Piña, or Pineapple, Fiber. The leaves of the pineapple plant are the source of pineapple fiber. The plant thrives well in a tropical or semitropical climate and is generally raised for its fruit. The workers of the Philippine Islands excel in the extraction of this fiber. The pineapple spine, or leaf, is cut, and the fiber is scraped by machines or drawn through knives that separate the vegetable matter from the silky fibers. The fibers are later dried and made into very soft and silky cloth, which finds its way into our stores and is sold as pineapple cloth.

Coir. The outer husk of the coconut is composed of coarse fibers. After the nut has been taken from the husk, the husk is allowed to rot in water until the woody substances are soft. The fibers are then easily extracted by being pounded and combed. These fibers, called coir, are short, but can be twisted into strong, solid ropes. Coir ropes are used at sea because

they float and are little affected by salt water. Some coir is made into coarse mats, especially door mats. Some is used for stuffing and for packing in upholstery.

Manila Hemp. Manila hemp, or abacá, comes principally from the Philippines, where the kind of nonfruiting banana tree from which it is taken thrives well. The leaf stalks around the central stalk provide the fiber. They are cut into

Gathering Manila hemp, Philippine Islands.
Keystone View Company



strips, scraped by machines or knives to remove the pulp, and when dried are ready for use.

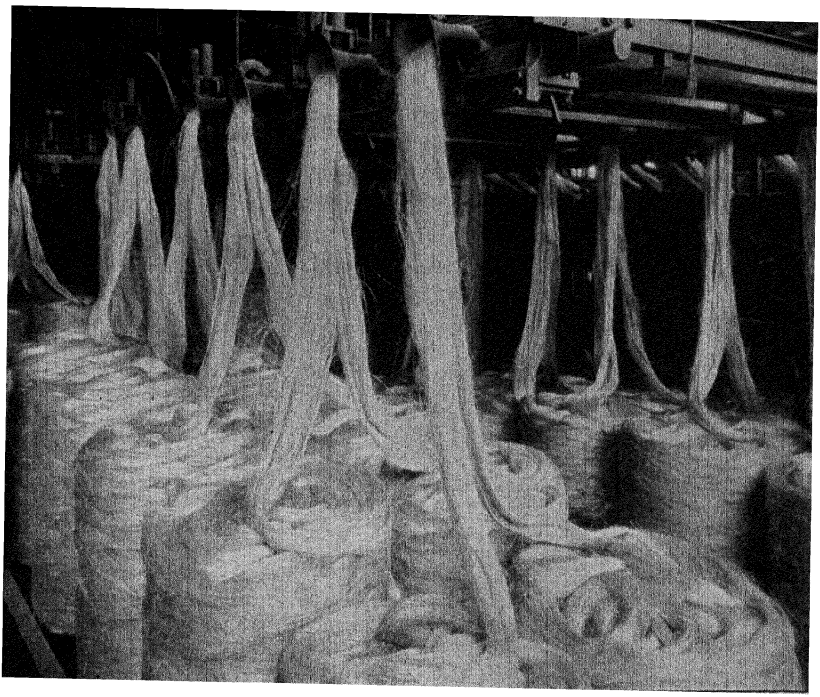
Manila hemp, because of its great strength, is used principally in the making of twine and rope. Much of it is used on our western farms as binder twine for grain. Europe also buys a large amount for rope and twine. The fibers, especially the softer and finer ones, are sometimes used in the making of cloth. Old rope made of this fiber is the principal source of cheap Manila paper.

Sisal Hemp. Sisal hemp is called *henequen.* This fiber comes from a species of Agave plant, which thrives well in Yucatan, Mexico, its native home, whence the greater part of this fiber comes. This sisal-hemp fiber has been known for several hundred years and was used by the Spaniards on their ships. The invention of the self-binder-reaper increased the demand for twine, and this demand resulted in increased attention to sisal hemp.

The long spiny leaves are cut and put through a machine that scrapes off the pulp and leaves the fibers, which are later

A field of drying sisal hemp in Yucatan, Mexico.
Underwood and Underwood





International Harvester Company

Sisal hemp being made into binder twine for use in the grain fields of America.

dried. The fibers are used in making twine, bagging, and cordage. The natives use it also in making hammocks and mats. It forms an important item of export for Mexico and is exported principally to the United States and Europe.

Rayon. Within the past few years there has sprung up a new industry—the making of rayon. Although rayon has been known for almost fifty years, it was not until after 1912 that its manufacture became important.

A Frenchman named Chardonnet made a study of silk and finally worked out a process by which a textile resembling silk could be made from vegetable substances rich in cellulose. Wood pulp or cotton is reduced to a thick, sticky substance, which is pressed through tiny holes. In this way a fragile filament is made. Several of these filaments, twisted together, form a thread of rayon.

Rayon looks and feels like silk and is fast becoming known, not as artificial silk, but as a textile in its own right. It is used extensively to weave with other textiles to give them a silk-like finish. It is used also in making underwear and light-

weight garments. Since 1925, when our annual output reached about 52,000,000 pounds, the increase in the use of rayon has been remarkable, our production in 1936 amounting to 277,630,000 pounds. Large amounts of capital are required to build and equip factories for its manufacture. The successful production of it requires a high degree of technical knowledge.

The countries that lead in rayon production are Japan, the United States, Great Britain, Germany, and Italy.

In the production of rayon in the United States, these states lead: Pennsylvania, Maryland, Virginia, West Virginia, and Tennessee.

TEXT QUESTIONS

1. What is the difference between bast and structural vegetable fibers? Contrast methods of extracting the fibers.
2. Describe jute and its production.
3. Where is hemp grown? What is it used for? What is bhang?
4. Discuss ramie and China grass.
5. What is pineapple cloth? How is pineapple fiber obtained? Where is it produced?
6. What is coir? How is it obtained? For what is it used?
7. What is Manila hemp? How is it obtained? Where is it produced? For what is it used?
8. What is another name for sisal hemp? Where is sisal hemp produced? For what is it used? How is it obtained?
9. What is rayon? How is it made? What is it used for? Discuss its use in recent years. What is its probable future?
10. Name the leading countries and states in rayon production.

PROBLEMS AND PROJECTS

1. Make an outline map of the world showing regions where each vegetable fiber is grown extensively.
2. Collect pictures showing cotton being grown, picked, ginned, baled, shipped, and manufactured.
3. Make a collection of pictures showing the minor vegetable fibers in various stages of growth and manufacture.
4. Collect samples of various grades and kinds of cotton.
5. Make a list of all the by-products of cottonseed. Obtain some samples if possible.

6. Gather strings and ropes made from vegetable fibers. Which is strongest? cheapest?
7. Indicate on an outline map where flax is raised in this country for its seed.
8. Explain how cotton thread is spun on a large scale in factories.
9. On a simple hand loom, show how weaving is done.
10. Why are Buffalo and Cleveland great paint-producing cities?
11. Plant some cotton seeds and watch the plants grow.
12. Make a list of magazine articles, pamphlets, and books dealing with the subject matter in this chapter.

TOPICS

1. Inventors of textile machinery.
2. The competition in cotton manufacturing between the North and the South.
3. Rayon: its history and future.
4. The competition among minor vegetable fibers.
5. The boll weevil.
6. The future of ramie.
7. The clothing of medieval times.
8. England as a textile maker.
9. England's interest in the Civil War.
10. The cotton-cloth trade rivalry of England and Japan.
11. The effects of cheap string.
12. Industrial expansion in the South.

FOR CLASS DISCUSSION

1. Free trade in textiles would be beneficial to the United States.
2. A child-labor amendment to the Constitution should be passed.
3. The South is well equipped for industrial expansion.
4. Japan needs the raw cotton of China.

CHAPTER XIV

ANIMAL FIBERS

SECTION 1—SILK

History of Silk. More than forty-five hundred years ago, a Chinese queen discovered that the tiny strands of the silkworm cocoon could be reeled, made into thread, and woven into cloth. The Chinese guarded their secret well and succeeded in retaining complete control over the silk industry for more than two thousand years. The people of Japan, India, and Persia finally learned the secrets of the industry. Europe's first knowledge of this textile came from the records of Alexander the Great's invasion of the East.

It was not until the sixth century, however, that silk culture began in Europe. Up to that time whatever silk was found in Europe had been imported from the Eastern countries. Silk culture in Europe was started by two Nestorian monks, who brought back with them from the East some silkworm eggs in the hollow of bamboo staffs. From this small beginning the silk industry spread into Greece and Asia Minor, and later into Italy, Spain, and France, where the climate is ideal for both the silkworm and the mulberry tree, upon the leaves of which the worms feed.

Silk culture was carried on in the American colonies up to the time of the Revolutionary War. It did not become important again until about 1830, when a craze for silk culture swept the country, leading to speculation and consequent financial loss. The crash came about 1838, and silk culture has never been revived here.

Although climatic conditions are excellent for silkworms and their food supply, labor in this country cannot compete with the supply of cheap labor in the Orient and Europe. The raising of silkworms is almost wholly a matter of hand labor. Silk culture is now experiencing a decline in Europe because of the cheaper labor available in the Orient.

Regions of Production. Most raw silk is produced in Japan, China, Italy, Russia, Greece, and Asia Minor. Japan and China are the leading countries, chiefly because of the abundance of cheap hand labor available there. Practically all our silk imports come from these two countries. The province of Shantung, China, produces tussah silk, which is silk produced by worms fed on a certain kind of oak leaf.

Because the cost of transportation of raw silk is a relatively small item in the total cost of silk cloth, the manufacture of silk is located in the great industrial nations of Europe and in the United States, whereas the raw material is produced chiefly in the Orient, where cheap labor abounds. The best silk cloth comes from Europe, principally from Lyon, in France; Krefeld, in Germany; Milan, in Italy; and Zurich, in Switzerland. In the manufacture of silk, the United States exceeds all other countries combined; it also consumes eighty per cent of the raw silk that enters into world commerce. In Paterson, New Jersey, our leading silk-manufacturing city, an interesting combination of industries is found, the silk industry employing hundreds of women and girls and the iron foundries employing hundreds of men.

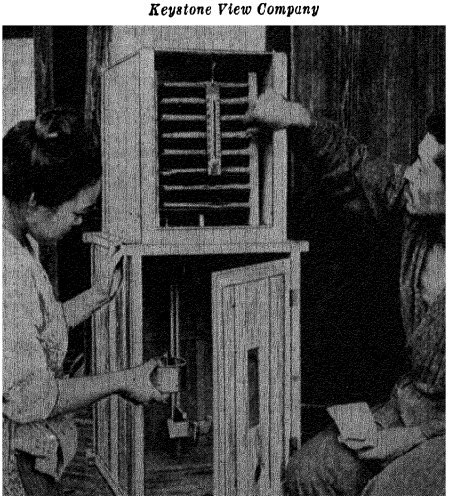
Silk Culture. The silkworm is hatched from the tiny eggs of a moth. The moths lay the eggs on prepared paper sheets. The papers are kept in a cool, dry place until the time for hatching arrives, when mulberry tree leaves are at their best. The eggs are then artificially hatched in incubators.

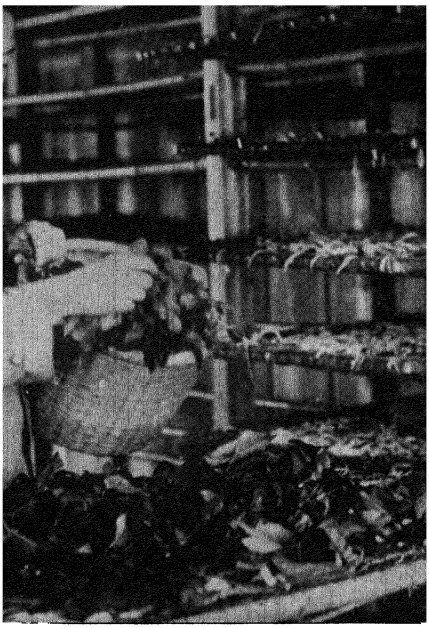
The silkworm, when it breaks open its small shell, crawls up through the holes in a screen, placed just above the hatching sheet, on which have been placed bits of mulberry leaves.

Great care is exercised to keep the temperature of the

Hatching silkworms in an incubator in Japan.

Keystone View Company





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Feeding mulberry leaves to young silkworms.

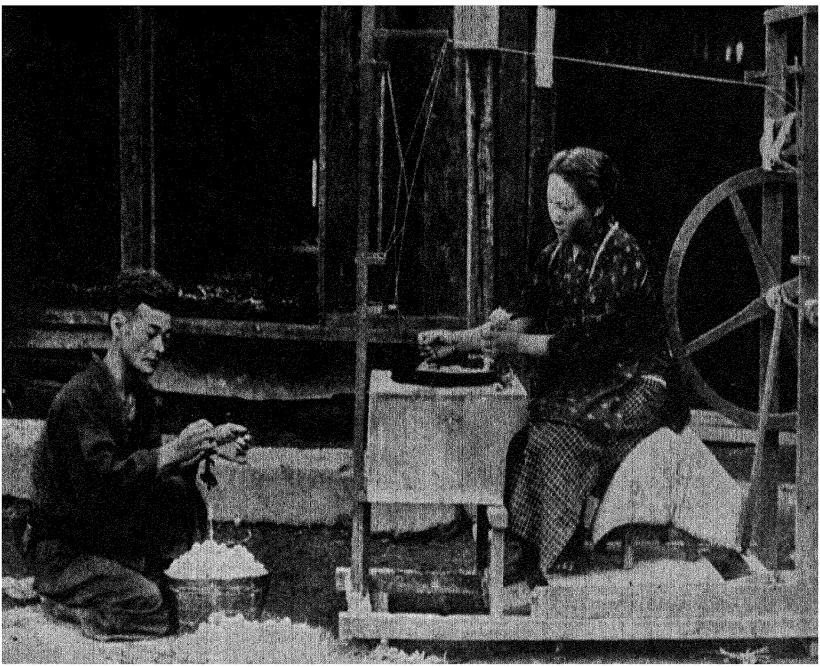
room, where the silkworms are, even and warm, and to eliminate drafts. The worms require absolute cleanliness and good air, being very quick to sense perfumes or tobacco smoke. Great loads of mulberry leaves are required to feed the worms, which eat mostly at night.

When about a month old, the silkworm begins to seek a place on which to spin its cocoon. At this time bamboo sticks or tree branches are placed where the worm can find them.

After finding a good place, the silkworm begins to anchor its web and spin its cocoon. After about three days, the worm has spun its cocoon. In about two weeks, under ordinary conditions, the worm has become a moth. If the moth is not desired for an egg supply, the cocoon, shortly after it has been completed, is heated to a degree that kills the moth. The moth is thus prevented from breaking out and destroying the silk strands. The cocoons are dried and can be kept in this condition for long periods of time. For the future supply of worms, some cocoons are not heated, and the moths are allowed to break out and lay eggs.

Preparation of Raw Silk. When it is time to remove the silk, the cocoons are placed in warm water. This loosens the outside covering and makes it possible to pick up, with the aid of a small brush, the end of the filament, or tiny strand, with which the cocoon was spun. The ends of at least five of these filaments are then passed through a small eye, similar to the eye of a needle. There they join into one strand, which is wound on a reel. This reeling is done either by hand or by machinery.

When sufficient silk has been reeled to make a skein, it is taken from the reel and secured to prevent raveling. In this



Keystone View Company

Reeling silk in Japan. The silk is first reeled onto small reels and is then re-reeled into skeins.

condition, after becoming dry, the skein of silk is packed with others into bundles called *books*, weighing from five to ten pounds each. These books are then packed into bales weighing from one hundred thirty-three pounds to one hundred forty-three pounds for the market.

Manufacture of Silk. Several processes are necessary to prepare the raw silk for weaving and dyeing. These processes combined are called *throwing silk*, and the men who perform them are called *throwsters*. First, the raw silk is soaked in lukewarm water into which oil and soap have been mixed. This mixture loosens the gum that naturally clings to the raw silk. After this bath, the silk is artificially dried. It is then wound from the skeins onto bobbins. During this process the silk is stretched and smoothed to a uniform thickness.

Next, several threads from as many bobbins are drawn through an eye into one thread and wound on one bobbin. The next process twists one, two, or three threads together. Sometimes one strand is twisted by itself and then twisted with another strand or perhaps with more than one other

strand. The number of threads and the number of twists depend upon the special use to which the thread is to be put.

Then the thread is boiled to remove any remaining gum. During the removal of the gum, the silk loses much weight. It is at this stage that weighting materials in the form of mineral solutions that give weight to the silk, but, of course, cheapen it, are frequently added. Pure-silk cloth contains no mineral weighting and wears longer than cloth that does have it. The thread is then bleached, dyed, stretched, and made shiny by special processes. Sometimes dyeing is postponed until after the thread has been woven into cloth.

After these processes, the silk thread is again wound on bobbins, or spools, and is ready for weaving. The processes of weaving and finishing are so complicated that their description belongs to a special discussion in a book on textiles. The various silk cloths are named from their weave, their finish, their patterns, and the raw silk that enters into their manufacture.

Other Silks. From broken and left-over pieces of silk filaments comes what is called *spun silk.* After being washed, the broken pieces are dried. They are then pulled apart, and from this waste silk is spun a thread in much the same way that cotton thread is spun. This spun silk is woven together with real silk into cloth; it is sometimes used by itself. The resulting cloth is called spun-silk cloth.

Cotton is made to resemble silk cloth by a process called *mercerizing,* which consists of treating the cloth with chemicals that give it the feel and luster of silk. Silk gut, used much in making leaders for fishing lines, is extracted from the silkworm by a special process that draws out the sack of silk in the worm to a length of three or four feet and causes a heavy, strong strand to form.

TEXT QUESTIONS

1. Give the origin and the history of silk.
2. How did silk spread into southern Europe? Why was the silk industry successful there?

3. What is the history of silk culture in the United States?
4. Why is silk culture not profitable here? Why is it profitable in the Orient and the Mediterranean countries?
5. What regions lead in silk culture? Why?
6. Why do we lead in silk manufacturing? What other countries are important in this industry?
7. Name the leading silk-manufacturing cities of the world.
8. What is one reason why the silk-manufacturing industry has centered at Paterson, New Jersey?
9. Why do some countries produce raw silk and other countries manufacture silk?
10. Describe fully the raising of silkworms.
11. What is done to prevent the moth from spoiling the silk by emerging from the cocoon?
12. How is raw silk reeled?
13. What is a skein of raw silk? a book of raw silk? a bale of raw silk?
14. Describe the methods used in silk manufacture.
15. What is the meaning of the term *throwing* silk?
16. How is silk made to weigh more?
17. How much weighting does pure-silk cloth contain?
18. From what do the various silk cloths get their names?
19. What is spun silk? How is it prepared?
20. What is mercerizing?
21. What is silk gut? How is it made? For what is it used?

SECTION 2—WOOL AND MISCELLANEOUS ANIMAL FIBERS

History of Wool. Just when man began using wool for making garments, we do not know, but that its use was general from early times is evident from the many records that ancient peoples have left. Even in the earliest chapters of the Bible, sheep are frequently mentioned; and the founders of the Hebrew race are pictured as leading, with their flocks, a pastoral life. Ancient Greek writings describe the spinning and weaving of wool, and many of the beautiful carvings left by the early Greeks show the importance of wool in the lives of these people.

Records as far back as 200 B.C. tell us of the care with which sheep were bred to increase their wool value. Shortly after our era began, Spain became famous for the quality of wool obtained, by intelligent crossbreeding, from the sheep raised there. These sheep were ancestors of the noted *merino* sheep, famous for their wool.

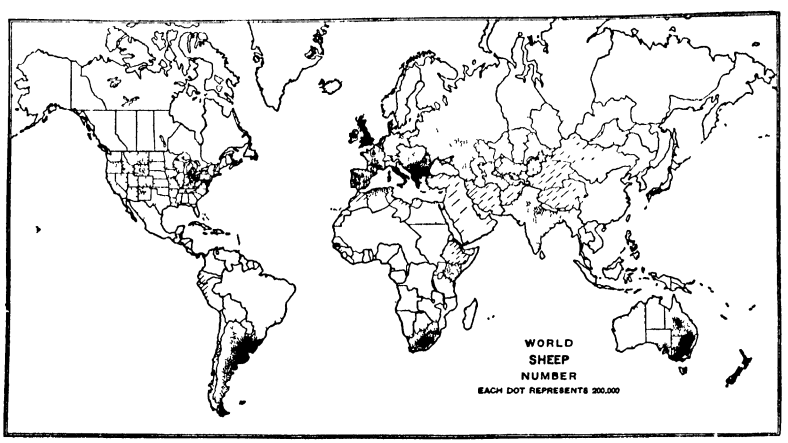
The early colonists in America brought sheep with them, and sheep raising has been important in this country ever since.

Changes in Sheep Raising. One of the many changes of the last hundred years in sheep raising should be noted. For centuries sheep were raised locally in comparatively small flocks, and the domestic demand for wool was supplied near home. With the coming of cheap and efficient transportation, sheep raising has become the great industry of the semiarid borderlands of civilization, where climatic and pasture conditions are favorable. As the world population has become denser, agriculture has displaced pastoral life near the large centers of population and has pushed grazing into lands farther away and, as yet, unsettled.

Although sheep are still raised in agricultural regions, emphasis is placed on their mutton rather than on their wool. We look to the open spaces for our great supply of wool. If the population of these regions increases and agriculture becomes more important, the number of flocks will become

smaller and the wool supply will therefore decrease unless more attention is given to the improvement of wool and the increase of the amount of wool obtained from each sheep.

Another factor that enters into the future wool supply is the demand for mutton, which is naturally opposed to that for wool. Many sheep-raising regions are now turning their attention to increasing the mutton content, whereas formerly they were interested in the wool supply. South America is gradually changing the breeds of her sheep to those that are producers of fine mutton rather than of fine wool. The breeding of a kind of sheep that produces mutton and wool equally well is now the goal of sheep raisers.



U. S. Department of Agriculture

World distribution of sheep. It will be noted that there are six world centers of sheep raising. Four of these, the South American countries, South Africa, Australia, and New Zealand, are recently settled lands with sparse populations and are located in the Southern Hemisphere. The two centers in the Northern Hemisphere are the Balkan States and Great Britain. In Asia Minor and in the Balkan States topography, climate, and the nomadic habits of the people in the recent past have caused sheep to become important farm animals. In Great Britain many factors combine to make sheep raising a prominent industry in spite of high land values and extreme industrial concentration of population. Russia and the United States, although they rank high in total number of sheep, are, because of their large areas, far down the list in number per square mile.

Distribution of Wool. Although the south temperate zone leads in wool production, wool manufacturing is located almost wholly in the north temperate zone. In the amount of

wool produced, Australia leads the rest of the world, followed by the United States, Argentina, New Zealand, and South Africa. Other leading regions are Russia, Uruguay, and England. Throughout the temperate zone sheep are being raised. Much of the wool is used locally. In our country Texas leads in the production of wool, followed by Wyoming, California, and Montana. Although not ranking as a leader in quantity of wool produced, Ohio supplies our finest wool.

The United States and England compete for leadership in wool manufacturing. At present we lead. France also is an important manufacturer. Japan is fast coming into an important place as a manufacturer, although she has to import nearly all her raw material.

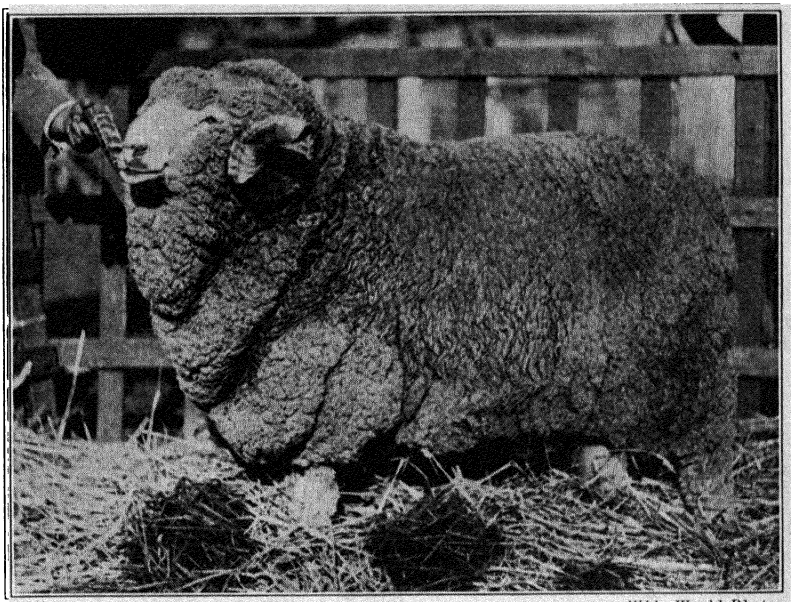
Our domestic supply of wool is equal to only about one half of the demand of our mills; and we import heavily from the wool-exporting regions of the world, principally from Australia and South America. Our carpet wool comes from India, China, and the Near East. We import manufactured wool in the form of woolens and worsteds from England, and also in the form of rugs and carpets from the Orient and the Near East.

Recent estimates give the following rankings to the continents in volume of wool produced: Australia, Europe, South America, North America, Africa, and Asia.

Kinds of Sheep. The merino breed of sheep was taken from Spain to other places and interbred with other kinds. This interbreeding resulted in various subclasses of merino, like the Rambouillet of France. From the merino sheep we get our finest grade of wool. This class of sheep, however, produces a poorer grade of mutton.

Efforts are being made, by interbreeding merino sheep with English types famous for mutton, to get a breed that will produce both good wool and good mutton, but they have, up to this time, been unsuccessful. Either one breed or the other predominates. Progress along this line is, however, being made.

Sheep in Asia and Africa, except in South Africa, have not been scientifically bred for either wool or mutton, with the



Wide World Photos

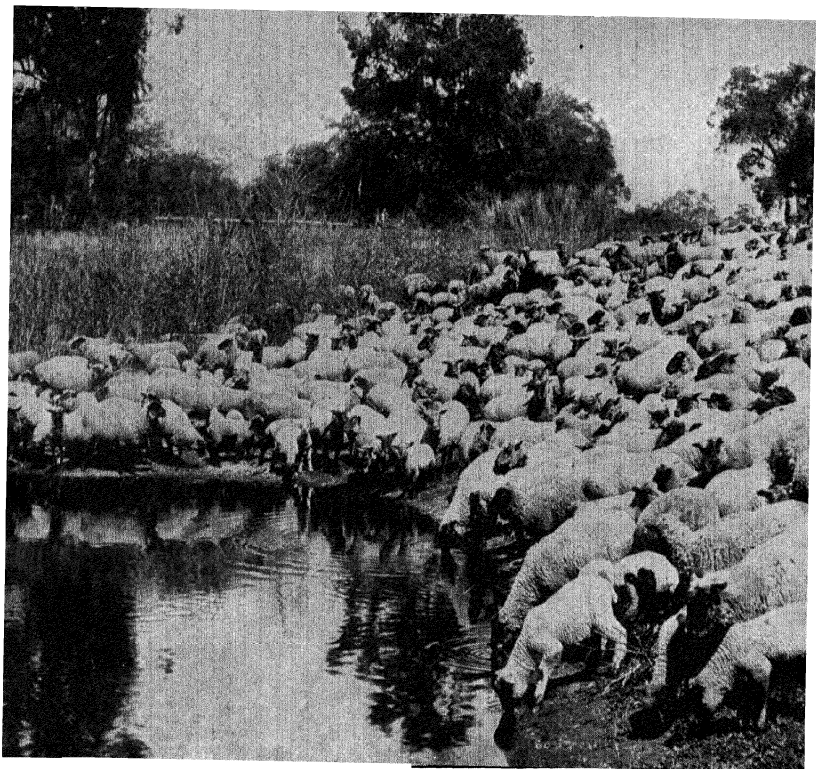
The champion wool bearer of Australia.

result that they produce a very coarse and rough wool used almost wholly in carpetmaking.

Poor care and breeding sometimes result in the decline of wool and the increase of hair on the sheep. In Brazil, there are sheep that have no wool and are covered only with hair. These are valuable mostly for their skins.

Merino wool is the standard of fineness, and all wools are classed by it. So general has become this custom, that wool is graded in the fleece as fullblood merino, one-half blood merino, and so on, the fiber being classified as if it came from the various cross-bloods of the merino sheep, although the sheep from which the wool came may have in them no merino blood at all.

Sheep Raising. Sheep are often herded in large flocks of from a thousand to two thousand animals. One man is hired to tend the flock. With his intelligent dogs, he can see that the sheep are protected from wild beasts, given sufficient water, and led to good pasturage. The life of a shepherd is a



U. S. Department of Agriculture

Sheep in California.

lonely one. The owner sends supplies to him at intervals, but between visits the shepherd is alone with his sheep.

Sheep often crop grass so close to the ground that the land cannot be pastured again for a long time. If very hungry, they bite so close as to kill the grass. After cattle have grazed on a tract, it is soon green again. The fact that cattle cannot be pastured on land that sheep have recently been over causes feuds between the cattlemen and the sheepmen. Sheep in the West are now pastured mostly on large prairies, and near water holes, if possible, or under government permit in the national reservations.

Shearing. In most countries, sheep are sheared once a year in the late spring. Shearing is done by both hand and machinery. The latter way is more rapid and is used on the larger sheep ranches. The sheep are held while the shears are run over them, and the wool is clipped close to the skin. The fleece comes off in one piece and is wrapped in a bundle.



U. S. Department of Agriculture
Shearing sheep by machinery.

At the slaughterhouses the wool is pulled from the skin of the dead animal after the skin has been sweated, or chemically treated. This class of wool is called *pulled wool* and comprises about one sixth of the wool supply of the United States. Pulled wool is generally sent for manufacture to a special factory located near the slaughterhouse.

The chief wool-pulling center in Europe is Mazamet, France. There are several wool-pulling establishments in Chicago and the other meat-packing cities of the United States. This wool is inferior to the sheared wool that comes from live sheep.

Wool Selling. The sheep rancher may deal with traveling representatives of wool merchants, who go through the sheep regions for the purpose of buying wool, or he may sell it directly to the agents of the large mills, which also send their buyers through the sheep country. Again, he may send it to a commission merchant to be sold on consignment. If he is located near a mill, he can trade directly with it. He may find a buyer in some local merchant, or he may sell the wool through one of the wool growers' co-operative societies. If he is near a wool auction-center, he may sell at auction.

The great wool auction-markets of the world, where buyers and sellers meet, are Sydney, London, Liverpool, Bremen, Marseille, and Hamburg. The chief American wool markets are Boston, New York, Philadelphia, Chicago, and St. Louis. Most of our American wool is sold by the ranchers to traveling buyers, rather than sold at auction.

Preparation of Wool for Manufacture. When the wool arrives at the mill in the form of bales, it is ungraded, very dirty, and full of grease. After the bale has been broken,



American Woolen Company

Sorting wool.

sorters take the wool and carefully grade it as to fineness and length of fiber by tearing it into pieces and throwing similar kinds into large baskets near at hand.

Because of the dirt and dust, wool is usually sorted on slatted tables through which the air is constantly being sucked downward. This keeps the dirt out of the air and prevents sickness.

After sorting, the wool is washed in soapy water and is thoroughly rinsed. This washing removes the dirt and grease. Seventy-five per cent of the weight of wool before washing is composed of dirt and grease. After the washing, the wool is sprinkled with oil to prevent it from becoming too dry and brittle.

Manufacture of Wool. Wool fiber is used in two different ways. The longer fibers are combed and, by special processes, spun into threads and woven into cloth. Goods made from this cloth are known by their hard, straight threads and well-marked patterns. They are called *worsteds.*

The shorter fibers are used to make goods called *woolens,* which are recognized by their softness and loosely woven patterns. The short fibers, after being carded, are spun into woolen yarn and woven on looms. After the pieces of goods have been shrunk in baths, they are *teasled;* that is, the fuzzy woolen nap is drawn up so that the cloth, like that in blankets, becomes woolly in appearance. The nap is then shaved off to a uniform, smooth surface.

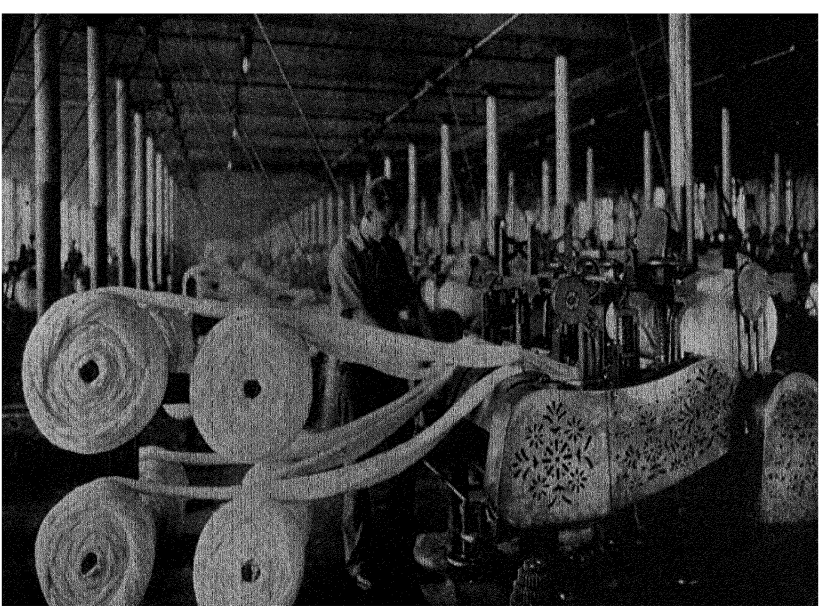
Wool is used also in knitting. For this purpose special knitting machines that interlace the threads without weaving are used. Sweaters, stockings, and underwear are knitted on these machines.

Wool fibers may be pressed and pounded together so closely that their scalelike formation will hold them more compactly than weaving would. A layer of wool or fur so formed is *felt*, with which we are familiar.

Remanufactured Wool. If we depended upon the annual supply of wool from sheep alone, wool clothing would be much more costly, because the annual supply of fresh wool is not large enough to satisfy the demand. Woolen rags, cuttings from tailors, and waste wool from mills are used in making what is called *shoddy wool.*

From this supply of shoddy, mixed with good wool, many of our suitings are made. It is a great saving to use this reclaimed wool and, from an economic viewpoint, entirely justifiable. People buying woolen goods should, however, know whether the goods are made with some proportion of shoddy

A scene in a woolen factory.
American Woolen Company



wool, for the wearing qualities of the goods are weakened because of the short fibers of the shoddy. *Mungo* is similar to shoddy but is made from hard yarns and worsted fabrics.

Many fabrics combine wool fibers with other fibers. Such cloth is made by mixing cotton threads among the woolen threads. Silk also is used to supplement wool. In manufacturing carpets, it is a common practice to use, for cross threads and backings, some of the minor vegetable fibers, like jute and hemp.

Miscellaneous Animal Fibers. Although silk and wool form the principal animal fibers of commerce, there are others. On the shores of the Mediterranean Sea, that is, in southern Europe, Asia Minor, and northern Africa, large numbers of goats furnish goat's hair and wool.

The wool of the Angora goat, called *mohair,* noted for its luster, length, and fineness, brings a high price. These goats have been imported into South Africa and our country, where they are now being raised, principally in Texas. Another, called the Tibetan goat, furnishes a very fine wool called *cashmere,* from which are made the famous cashmere shawls. Because of the small amount of wool grown on each animal and the large amount of hand skill necessary, cashmere shawls are very costly. This wool is used also in other fine textiles.

The yak is used as a beast of burden in the Himalaya Mountains. From it are obtained very fine hair and wool. The hair is used to make rope and tent cloth; and the wool, to make fine cloth.

The hair of tropical camels is used in making paint brushes and tents. In colder climates in Asia, camels have long, soft wool. This wool is woven into soft, warm cloth, used much in making winter clothing.

The llama of South America, a beast of burden in the Andes Mountains, furnishes a wool that is used locally to make clothing. A similar but smaller animal, the alpaca, furnishes a soft wool that is shipped to England and America, and made into dress goods called alpaca. Many small animals like the beaver and the rabbit furnish fibers that, when treated, make the felt of our hats.

TEXT QUESTIONS

1. How do we know that wool has been in common use since early times?
2. What changes have been taking place in sheep raising in late years?
3. What regions lead in wool production? What states lead in our country?
4. What countries lead in wool manufacturing?
5. From what regions do we import wool?
6. What kind of sheep is the best wool producer?
7. Describe sheep raising.
8. What is pulled wool? Where are the principal wool-pulling factories located?
9. How is wool sold? Which is the best way? What are the largest wool markets of the world? Locate them.
10. How is wool prepared for manufacture?
11. Describe how wool is made into cloth.
12. Distinguish between woolens, worsteds, felt, shoddy, and mungo.

PROBLEMS AND PROJECTS

1. Make an outline map showing the wool-producing regions of the world and the location of the great wool-manufacturing centers.
2. On an outline map, indicate the countries of silk production and silk manufacturing.
3. Collect pictures of wool production and wool manufacture.
4. Collect samples of silk thread and cloth. Compare them.
5. Collect pictures of silk in all its stages.
6. Explain why we do not produce more silk in the United States.
7. Collect samples of wool.
8. Contrast samples of artificial silk with samples of real silk.
9. Collect samples of animal fibers and state where each fiber is obtained and how it is used commercially.
10. If you were a ragman, how would you sort rags to sell? Which rags would be worth most? Why? What would each kind of rag be used for?

11. What are the current prices of silk? of wool? Are they higher or lower than last year's? Why?
12. Find out how to distinguish woolen from cotton cloth.
13. Make a list of magazine articles, pamphlets, and books dealing with the subject matter in this chapter.
14. Explain the position of your state as a sheep raiser.

TOPICS

1. Wool production in our West.
2. The silk industry of Paterson, New Jersey.
3. Silk culture in the United States.
4. The transportation of silk.
5. Wool production in Australia.
6. The supply of wool and the demand for it.
7. The increased use of silk in the last twenty-five years.
8. The factors that determine the price of wool.
9. Artificial silks.
10. How to detect real silk from artificial silk in cloth.
11. Comparison of the qualities of the various textiles.

FOR CLASS DISCUSSION

1. Silk is a necessity.
2. Wool production offers a good opportunity for investment.
3. The Government should compel manufacturers to label all textiles to indicate their exact composition.
4. Artificial fibers will largely displace natural fibers for clothing.

CHAPTER XV

CATTLE

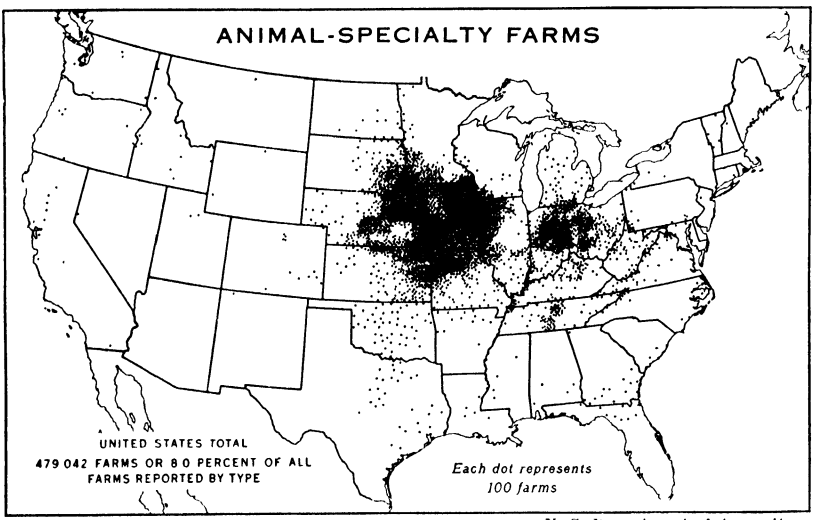
SECTION 1—THE MEAT-PACKING INDUSTRY

The Meat Supply. In densely populated regions like Europe, the meat supply has been maintained by intensive farming and dairying. On the frontiers, where grazing is of primary importance, meat is still plentiful.

The Orient cannot afford to raise animals for meat, because the population is so dense that land is needed to raise crops to support the people. Consequently, the people of China and Japan live mainly on vegetables, fish, and cereals. In India, where twenty-five per cent of the cattle of the world are raised, little meat is eaten, not only because of the religious beliefs of the majority of the people but also because of the extreme poverty of countless inhabitants. Cattle are used principally for work. The proportion of meat in the daily diet of a people is likely to be an indication of their relative prosperity.

Distribution of Meat Production. While India leads the other countries in the number of cattle raised, her contribution to the meat supply of the world is not large because the religious beliefs of the Hindus do not allow the killing of animals. The United States leads all other countries in beef production, although her beef exports have decreased greatly because of the increasing demands at home, decreased demands abroad, and the competition of other beef-producing areas.

Europe raises more cattle than does the United States; but her countries are relatively smaller than our country, and hence no one country except Russia ranks high. In Europe also, local demand prevents a large export trade in beef, although there is considerable trade between adjacent countries. The regions that lead in beef exports are Argentina,



U. S. Department of Agriculture

Notice the concentration in the corn belt.

Australia, and Uruguay. These, because of their small populations, can export their large surplus.

In our country the cattle-raising regions are the western plains, the corn belt, and the eastern dairy farms. Our great meat-packing centers are Chicago, Omaha, St. Louis, St. Joseph, Kansas City, Indianapolis, St. Paul, and Sioux City. There are large slaughterhouses also in New York City, Buffalo, Boston, Jersey City, Fort Worth, Portland (Oregon), and Denver.

Some hogs are raised almost everywhere, but local demands generally prevent much exportation. We raise more hogs than any other part of the world except China, and not only produce enough pork for our own demands but also export great quantities over all the rest of the world. There is no other region in the world that can compare with our corn belt in the size and extent of its swine-raising industry. Our pork-packing centers are located near the corn belt. Chicago is the largest of these. Other important pork-packing cities are Omaha, Kansas City, and St. Louis.

Mutton is raised in large quantities in the temperate-zone countries. New Zealand, Australia, and Argentina are the

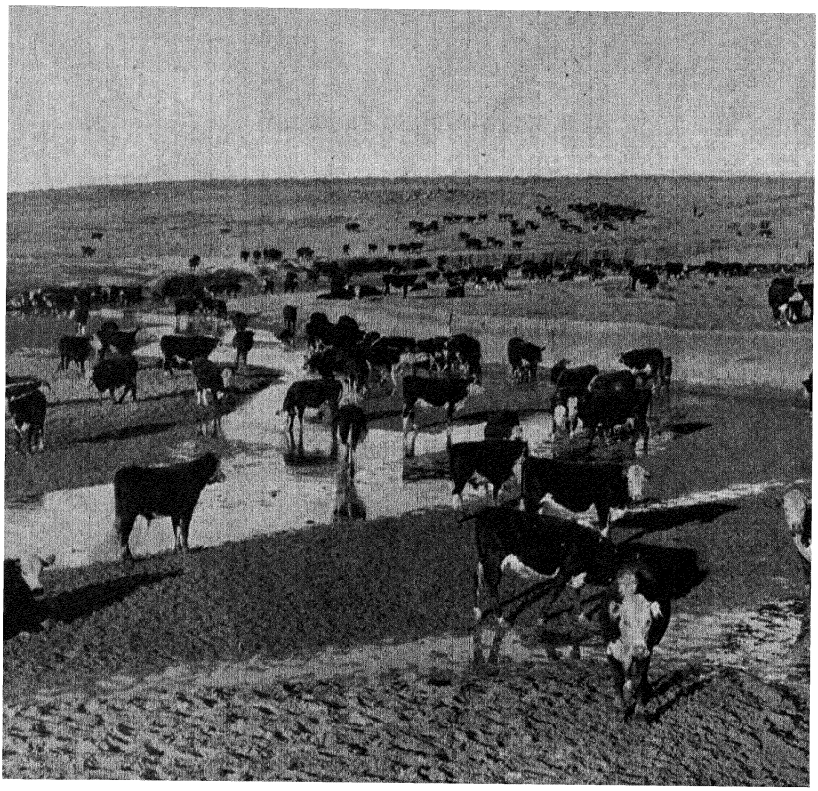
great mutton exporters; other regions, as a rule, consume their own supplies locally.

Domestic Animals in America. The American Indians raised no domesticated animals for a food supply. All our domestic animals were brought from Europe. Settlers along the coast imported domestic animals from their home lands. Eventually, these increased in numbers and became an important source of food.

As the increasing population caused the amount of land available for our animal industries to decrease and caused the demand for meat to increase, more attention was paid to increasing the meat-producing qualities of the various animals. The old Texas long-horned cattle of the range have been displaced by the short-horned cattle noted for their beef. Our swine also have been improved, and new types of hogs superior for pork have driven out the inferior kinds. Our sheep also, as we have already noted, have been given attention.

Cattle in the West. For many years the unfenced grasslands of the Great Plains and the Intermountain States were the main source of our beef cattle. The owners let their great herds of longhorns roam freely, only rounding them up twice a year to brand the calves and to sort out the mature animals for market. Millions of lean two- and three-year-old cattle were driven from the grasslands to the Middle West where they were fed on corn for several months. Then they were ready to be shipped to slaughtering and meat-packing centers, such as Chicago.

The free range gradually passed into private ownership and was fenced. By 1900 the open range cattleman had practically disappeared, and cattle grazed on great private ranches. As homesteaders and farmers invaded the West in great numbers, the ranches were cut up and made smaller. This caused a change in their methods. The western cattleman of today does not depend entirely on grass for his cattle, but grows some alfalfa under irrigation; he often fattens his animals on cottonseed cake, or sugar-beet pulp. He may graze them part of the year in the national forests. His cattle, now generally sold as yearlings, are smaller and plumper and

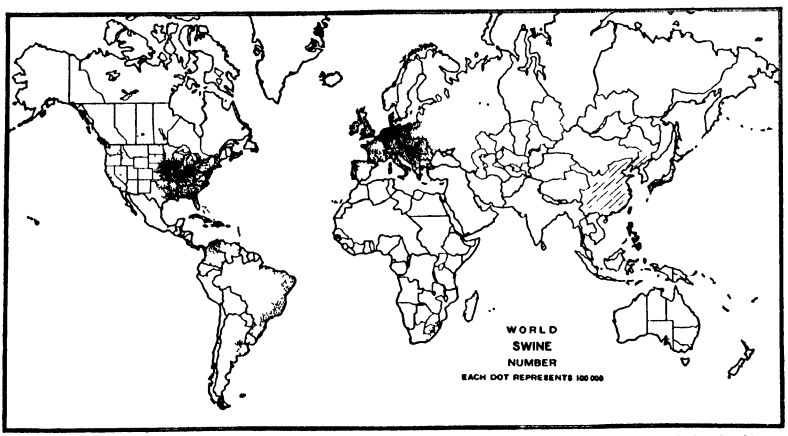


U. S. Department of Agriculture

Two-year-old steers in the Great Plains area.

bring better prices. Many of them are ready for slaughter without further fattening, but the leaner animals are still shipped to the corn belt for several months in the feed lot. Two thirds of our beef cattle are now grown as well as fattened in the Middle West.

Swine Raising in the United States. Along with other domestic animals, swine were imported from Europe. In the beginning of the last century, attention began to be paid to the improvement of hogs, with the result that several famous breeds, such as the Berkshire, Duroc, and Poland-China, have come to the front. These breeds, noted for their superior quality and quantity of pork, are known as lard hogs. Canada, England, and Denmark breed hogs in order to obtain lean bacon, and in those countries we naturally find the so-called *bacon hog.*



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World distribution of swine (hogs). In total number of swine the United States ranks high among the nations of the world, but in number per square mile it falls behind many European countries. Swine are known to be numerous in China, but their number and distribution can only be estimated.

Although swine have always been raised locally for domestic consumption, the swine-raising industry is now centered in the corn belt of the United States, where more hogs are raised than in any other section of our country.

Hogs are great meat producers as they fatten and mature quickly and breed rapidly. When corn is cheap, it is good business to raise hogs, because the returns from them are better than those from corn. The turnover is quick, and the natural increase is rapid. Within a year after birth, the hog is ready for the pork packer.

Mutton Production. In this country our mutton sheep are raised chiefly in the eastern sections. Our wool sheep from the western plains, however, are also a big factor in the supply of mutton.

We import small quantities of mutton from South America and Australia, where the mutton is frozen and kept chilled on its long sea voyage to the markets. Great quantities of this mutton go to England and other parts of Europe. In our country the sheep-slaughtering industry is located in the great meat-packing centers.



Ewing Galloway

Union Stockyards, Chicago.

Beef Packing. The cattle to be sold by farmers are sent to the stockyards and are kept in pens until they have been purchased by a packing house. After the sale has been completed, they are driven from their pens to the packing house. From the runway, they are shut into small open stalls, where they are killed. They are then attached to an overhead trolley.

From that point on, the entire process of butchering is conducted in a very highly organized and sanitary way. So highly organized is the work that an animal often passes through the various processes and arrives at the cooler in about half an hour.

In the Chicago packing plants two hundred and fifty cattle can be handled every hour because the work is subdivided into several skilled operations, each done by a man trained to do that one job. During the process four different inspections

are made by government inspectors, who place the government stamp of approval on accepted meat and cause all other meat to be condemned.

After being in the cooler for three days, where the temperature is kept just above freezing, the meat is dressed into the various cuts and is shipped to the market in refrigerator cars. Upon arrival at its destination, the meat is stored in cool rooms until it is called for by the retailer and customer. In this way meat is kept good for long periods of time. It is possible to ship meat long distances, even to Europe, by the use of refrigerator ships.

One of the things for which American packers are famous is the wonderful economy and efficiency displayed by their making use of all parts of the animal. About fifty-seven per cent of the weight of a live animal represents meat. The entire remainder of the animal is used in making various by-products. Hence, in our large establishments, no waste occurs. This economy reduces the cost of our meats and also furnishes us with many valuable by-products.

Pork Packing. In this country pork packing has reached a very important place, not only in our own meat supply but also in the world supply. Our products go everywhere. The same wonderful organization and subdivision of labor found in the beef-packing establishments are present in the pork-packing industry, although the processes differ somewhat.

Fresh pork goes at once to the market. Some pork is salted; some is packed in tins. Hams are cured in pickle and then smoked. Bacon also is cured in large rooms especially built for this process. The trimmings are mixed with beef trimmings and spices, packed into sausage casings, and shipped to the market as all kinds of sausage, from frankfurters to bologna. Some parts of the hog are melted into fine lard.

In this industry, as in the beef industry, great attention is paid to the use of all parts of the hog; and "everything but the squeal" enters into some form of by-product.

TEXT QUESTIONS

1. Contrast the meat supply of Europe with that of America. Why is there a difference?
2. Contrast the meat supply of Australia with that of China. What is the reason for the difference?
3. Why is the meat consumption of India low, although that country leads in cattle raising?
4. What condition prevents a large export of beef from the United States? from Europe?
5. What regions lead in beef exportation? Why?
6. What three general regions of cattle raising are found in the United States?
7. What cities are our great meat-packing centers?
8. What cities are our leading pork-packing centers?
9. What changes in cattle-raising methods have been made in the West?
10. Why is there a large cattle industry in the corn belt?
11. Describe swine raising in the United States.
12. Why are hogs well suited to dense populations?
13. Where does our imported mutton come from? How is it shipped?
14. In what sections of our country are our mutton sheep raised?
15. Describe the various steps in the beef-packing process from the time the cattle are sent to the stockyards until the meat is shipped to the market.
16. How many cattle can be handled in the Chicago packing plants every hour?
17. How much of a live animal represents meat?
18. Name some of the forms in which pork is put on the market.

SECTION 2—THE LEATHER INDUSTRY

Importance of Leather. The process of removing the hair of animals and tanning the skins into leather was well known before written history began. The earliest records we have show that man had used leather for many years. Ancient Egyptian inscriptions and Chinese records thousands of years old tell us that leather was much used in those countries. Old Greek and Roman writings constantly refer to skins and leather. The Bible mentions Simon the Tanner.

Throughout olden times, and down through the centuries until the coming of cheap cotton, leather was one of the most important sources of clothing. At the present time an inventory of our clothing and other useful articles will disclose how important a part it still plays in our everyday life. Among the more important articles made of leather are shoes, gloves, caps, luggage, machine belts, purses, belts, and automobile accessories. More than eighty-five per cent of our leather is used in the shoe industry. The tanning of leather and its manufacture into useful commercial articles are among the leading industries of the world today. The United States ranks well ahead of any other country in the tanning of leather.

Distribution of Leather. The great livestock-raising countries of the world are the principal sources of hides and skins. The tanning industry was generally located near the source of tanning materials, although this requirement is not now so essential as it was formerly. The abundance of tanning materials in this country has given us advantages that have helped us to gain the leadership in the tanning industry.

Notwithstanding our large domestic supply of hides and skins, we are obliged to keep our tanneries supplied by importing heavily from countries having a surplus. The principal imports in this line are as follows: hides from Argentina and Canada; calfskins from Canada and Sweden; sheepskins from New Zealand, Argentina, and Brazil; and goatskins from India and China.

Our exports of leather, however, greatly exceed our imports of this product. The latter are principally special leathers

that come from the other leading tanning countries of the world: Canada, the United Kingdom, Germany, and France.

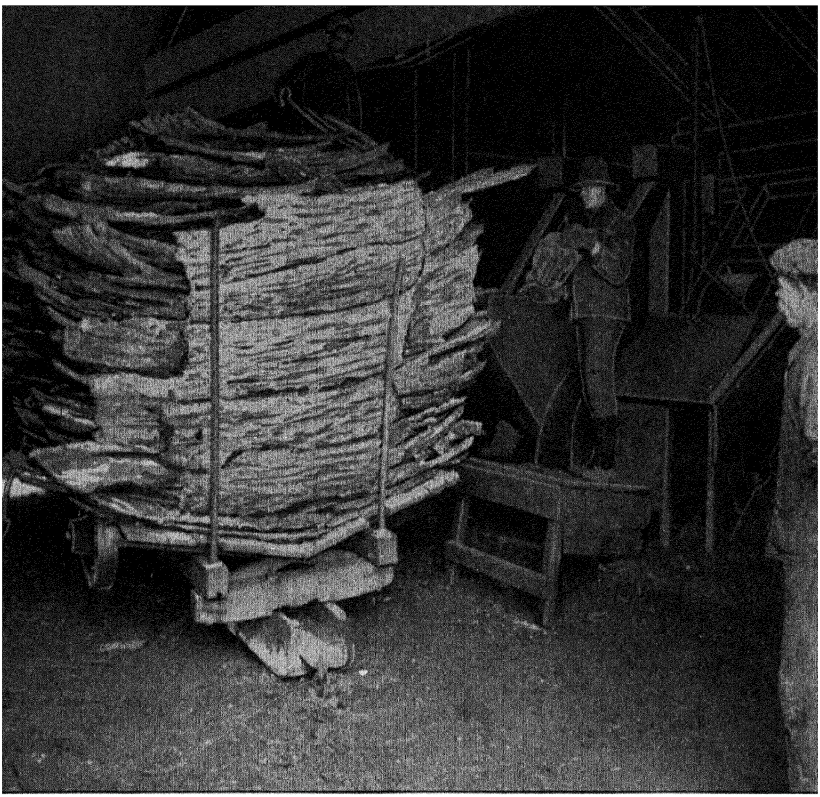
During colonial days the tanning industry was located wherever tanning material was at hand throughout the thirteen colonies. With the cutting away of the forests, the small tanneries disappeared and concentration of the industry resulted. Pennsylvania has large hemlock forests and leads in tanning in the United States. Several factors, such as new methods of tanning, the concentration of tanning materials into extracts near their source, making it possible to ship them in small bulk, and the advantages of organizations with large amounts of capital have brought about the concentration of the tanning industry into large centers. Our leading tanning centers are Philadelphia, Chicago, Milwaukee, Newark, and Boston.

Classification of Skins. The skins of fur-bearing animals are called *pelts* and, after being tanned with the fur still on, are referred to as *furs*. The skins of large animals like cattle and horses are called *hides*. The skins of animals like deer and calves are called *kips*. The skins of smaller animals like sheep, pigs, and goats are called *skins*. The skins of various other animals like elephants, kangaroos, alligators, snakes, sharks, and porpoises may be placed in some of the preceding classifications. All these skins except pelts are tanned without the hair. After being tanned, they are called leather.

Hides are classified as raw, or green, hides when fresh from the animal; salted, or dried, hides when prepared for keeping and transportation; and tanned, or cured, hides when made into leather.

Every class of skins is adapted especially to some particular use; and experience and skill have enabled man to procure the various kinds of skins and to make them into those articles for which they are best suited.

The greatest source of leather is the skins of domestic animals, although there is a commerce of much importance in the rarer skins of animals that have not been domesticated. Methods employed in tanning and curing produce leathers of varying qualities and uses, and a detailed knowl-



Keystone View Company

Grinding hemlock bark, from which tannic acid is obtained.

edge of the leather business requires much study and experience. We shall take only a brief look at the industry as a whole in its relation to commerce and industry.

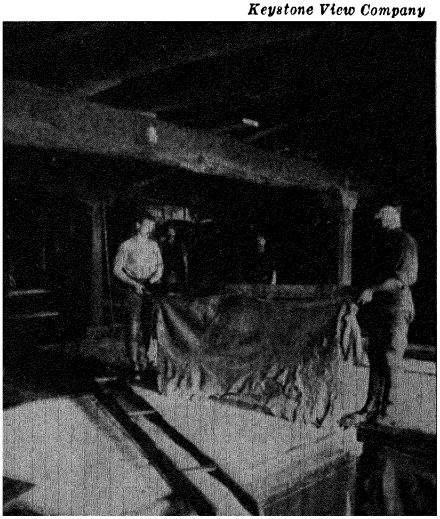
Tanning Materials. The bark and fruits of certain trees, rich in tannic acid, are used as tanning materials. By present-day methods, extracts are made from these materials; and the extracts, rather than the materials themselves, are shipped to the tannery to save transportation costs. The principal trees that supply bark for tanning are the oak, willow, hemlock, birch, and chestnut. Other sources of tanning materials are sumac leaves, valonia acorns, quebracho chips, myrobalans, dried fruits, divi-divi pods, and oak galls. Solutions of chromic acid, a mineral substance, can tan lightweight skins quickly. Now, large amounts of this substance are used. Mixtures of eggs, flour, and oil are also used to cure some of the lighter skins.

The Tanning Process. Several methods are used to preserve hides until they are ready for tanning. Some hides are dried in the sun; some are salted and then dried; some are kept in brine; while still others are smoke-dried.

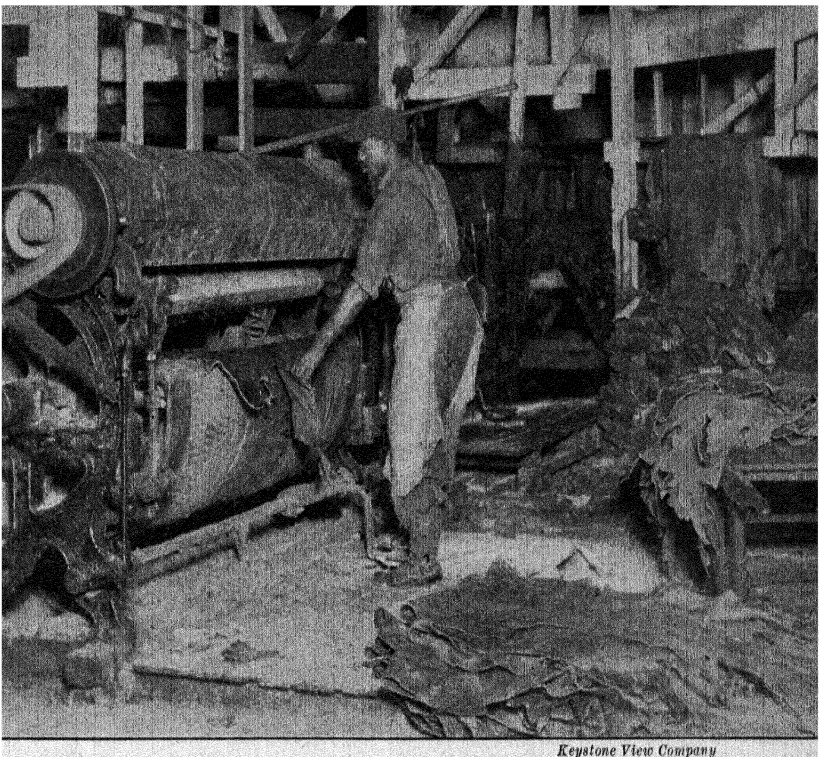
Upon arrival at the tannery, the hides are soaked in water to be softened and washed of any loose dirt. They are then placed in pits full of lime solution, which loosens the hair. From the lime pits, they pass through machines that scrape off all the hair. After this, pieces of loose flesh are shaved off the flesh side. The hides are then soaked again in a weak acid solution to be rid of any lime and to open the pores of the skins. This process is called *deliming,* or swelling. The hides are then placed in tanning pits containing solutions of tanning materials. From time to time the hides are moved around, and the solutions are made stronger. The hides stay in these tanning pits for varying lengths of time, depending upon the weight of the skins, the strength of the solution, and the purpose for which the hides are intended. It takes from six months to a year by this process to tan good sole leather.

In the chrome method of tanning, the skins, after the swelling process, are placed in huge horizontal cylinders containing the chrome solution. The cylinders revolve over and over, and the skins are kept constantly in motion, like clothes in a washing machine. In about eight hours the skins have become tanned. The advantages of this process are its cheapness and speed. It is not successful for heavy leathers or those intended for hard wear.

Tanning American leather.
Keystone View Company



Skins are sometimes cured by a process called tawing. After the skins have been stripped of the hair and soaked in a solution of bran and water, and alum and water, they are coated with a mixture of water, flour,



Removing hair from hides.

and eggs. By this process, the skins are cured by the action of the eggs in the pores, and a soft, flexible leather is produced.

Chamois skin is made into a soft leather by almost the same process, except that oil is used in place of eggs. Russian leather is tanned by a solution of birch bark, which gives it an odor offensive to insects. For this reason it is used in bookbinding. Our patent leather is leather that has been stretched, painted with enamel and varnish, and then baked. Cordovan leather was originally made in Cordova, Spain, from horsehides. Most of it is now made from horsehides shipped from South America.

Leather, after tanning, is finished by several different processes. Machines with sharp knives split it into sheets of uniform thickness. Other machines work oil into the pores and soften the leather. Heated rollers iron it so that it is smooth, while still others polish it. Some machines emboss it with designs. Ingeniously made machines measure the number of square inches in every piece.

When the leather is finally finished, it is wholly different from the original hide or skin, not only in appearance but also in its physical properties. It will not decay and, under proper conditions, will last a long time.

TEXT QUESTIONS

1. Discuss the importance of leather in former times. Discuss its importance at present.
2. What is the difference between hides and skins? From what animals do we get hides? skins?
3. From what countries do we import hides? calfskins? sheepskins? goatskins? special leathers?
4. Why does the United States lead in tanning? What are the other leading leather-manufacturing countries?
5. What factors led to the concentration of the tanning industry of the United States?
6. Where are our leading tanneries located?
7. How are skins classified? How are hides classified? Name some of the animals that contribute leather.
8. Name some of the principal tanning materials.
9. How are hides preserved until they are ready for the tanning process?
10. Describe the tanning of heavy hides.
11. Describe the chrome method of tanning skins.
12. What is tawing? chamois skin? Russian leather? Cordovan leather? patent leather?
13. How is leather finished after it has been tanned?
14. Give some of the principal uses of leather today.

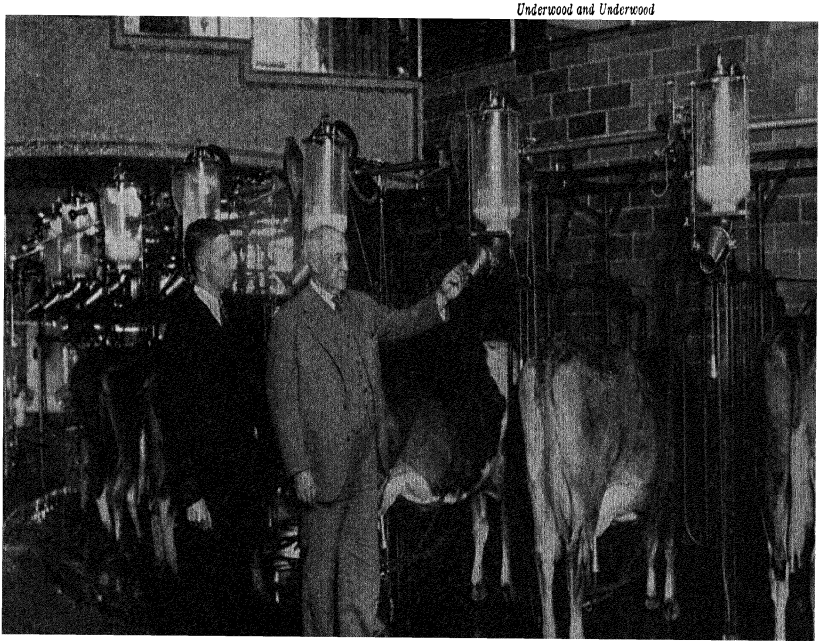
SECTION 3—THE DAIRY INDUSTRY

Growth of Dairying. In addition to meat for our food supply, animals provide us with dairy products: milk, butter, and cheese. In general, cows are the source of these supplies, but in some lands goats and sheep are the source. Up to the middle of the last century, dairying was wholly a local industry, carried on by the farmers near towns and cities.

As the population became more dense and our cities grew larger, this method of supplying milk became more difficult to adjust. The coming of rapid and efficient railroad transportation made a change possible. Now, large companies collect the milk from the farmers, sometimes located at considerable distances from the cities. The milk is brought to various shipping points, where it is pasteurized and bottled and then distributed in the early hours of the morning. In this way a mighty river of milk daily flows cityward from widely scattered sections.

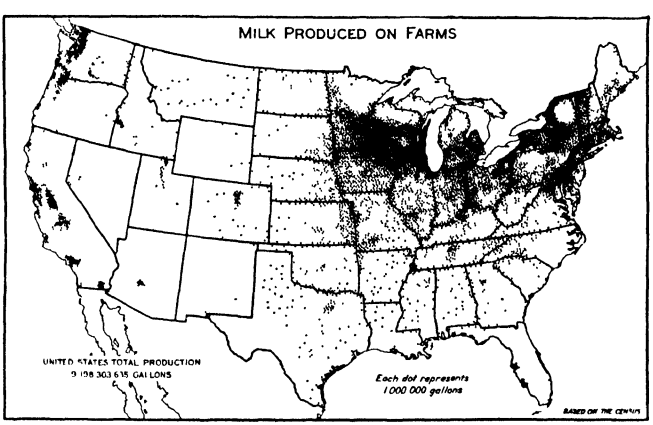
The rotolactor. An apparatus on a rotating platform that washes, dries, and milks cows. One cow goes on and one cow comes off the platform every fifteen seconds.

Underwood and Underwood



So important has the milk supply of our large cities become that every precaution is taken to insure a daily supply of pure, fresh milk. The old-fashioned, haphazard, inefficient system has given place to one that is highly organized and scientifically supervised. Pureblood cows, famous for their milk, are now raised and kept under the most sanitary conditions. The milk is carefully tested and graded, and is given utmost care at every point. Although this change has resulted in increased cost, it has resulted also in improved health for our city populations.

Distribution of Dairying. Among the factors that enter into the location of the dairying industry are nearness to market, climate, and a supply of cattle food. A cool climate aids not only in keeping the milk sweet but also in manufacturing butter and cheese. Good grazing facilities in summer and an abundance of winter food in the form of grain, hay, and corn silage are found from the Atlantic westward to the states of North Dakota and South Dakota. There is also a well-defined area on the Pacific Coast.



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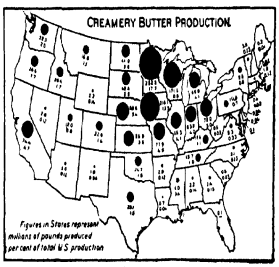
Because of these factors, our northern states lead in the dairying industry, Wisconsin ranking first in the production of cheese, Minnesota first in butter production, and New York leading all others in milk. Our dairy products are valued at

over a billion dollars a year, and we produce more than any other country. Because of our large domestic consumption, we export little.



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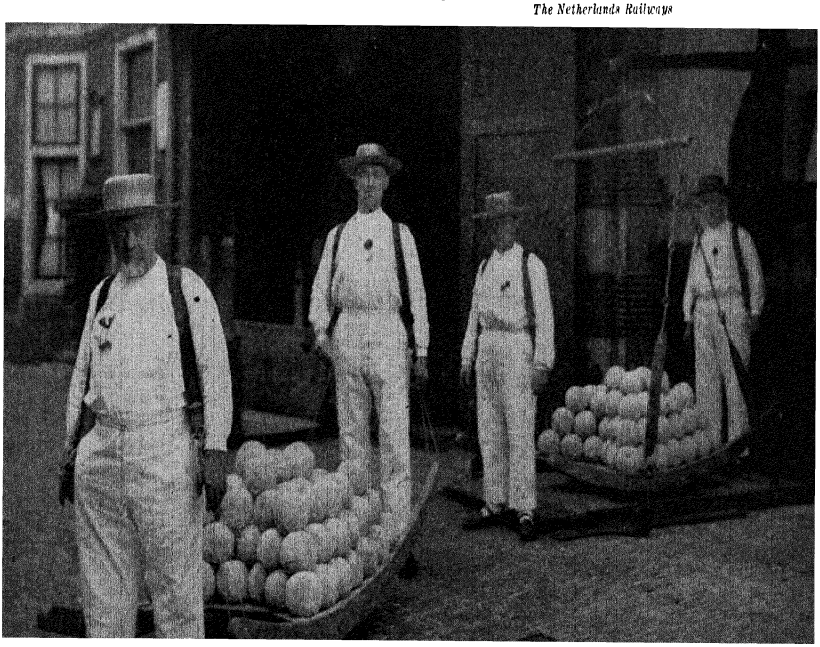
Almost all the northern European countries are engaged in the dairying industry. Denmark, Sweden, and Norway, as well as Holland, excel particularly in buttermaking. France, Holland, Italy, and Switzerland lead in the making of cheese products. Canada has built up a large dairying industry and specializes in cheese, which she exports in large quantities to England. Australia and New Zealand export butter and cheese to Europe in the same refrigerator ships that carry their mutton.

The more densely populated regions of Europe use much more cheese than we do, since they eat it as a substitute for

Cheese bearers leaving the weighhouse in Holland after the cheese has been weighed.

The Netherlands Railways



meats. We eat more butter per capita than do the people of any other country in the world.

Buttermaking and Cheese Making. With the change in the method of supplying and distributing milk came corresponding changes in the making of butter and cheese. Formerly, butter and cheese were made in the home of the farmer and exchanged at the country store for necessary articles. Now, butter and cheese are factory-made. The farmer separates the cream from his milk by the use of a centrifugal cream-separator, feeds the skimmed milk to his livestock, and carries the cream to a local creamery company. This company, after testing the cream for butter fat, buys it to make butter. Sometimes the farmer sends whole milk to the creamery. The whole milk may be used to make cheese, or the cream may be separated and made into butter. This change in making butter and cheese, from a home industry to a factory industry, was started in New York and has spread so widely that practically all our butter and cheese are now factory-made.

Great quantities of milk are preserved for future use by modern processes that convert the milk into the condensed, evaporated, and dehydrated, or powdered, milks of commerce. In this way milk is made available for use anywhere and at any time. Commerce in these kinds of milk, especially in those parts of the world where fresh milk is not available, is constantly increasing.

TEXT QUESTIONS

1. What change has occurred in the dairy industry since the middle of the last century? What has made this change necessary? What has made it possible?
2. How is the milk supply of our large cities organized?
3. What factors enter into the location of the dairy industry?
4. Where is the dairy industry centered in our country? in Europe?
5. What other countries are important producers of dairy products?
6. Describe the organization of the butter and cheese industry in our country.

PROBLEMS AND PROJECTS

1. Indicate, on an outline map, the leading dairying states of the United States. On the reverse side of the map, give reasons why these states lead.
2. On an outline map, indicate the cattle-raising regions of the United States.
3. Make a list of leather articles that we use in everyday life. Why are these made from leather?
4. Collect a number of samples of leather and compare them.
5. Why are hogs the best food animals to raise in thickly populated regions?
6. Make a trip to a shoe factory and describe your visit.
7. Compare, as to weight and wearing qualities, tannic-acid-tanned leather and chrome-tanned leather.
8. Why does Denmark specialize in dairy products? Where is her principal market?
9. Where would you locate if you were to begin in the cattle-raising industry? Why? in the swine-raising industry? Why? in the sheep-raising industry? Why?
10. Learn the source of the milk supply of your community and describe its organization.
11. What dairy associations exist in your community? What do they do?
12. How is meat shipped from Australia and South America to Europe?
13. Explain why Wisconsin is a prominent dairying state.
14. Explain why Iowa has many beef cattle.
15. Make a list of the various cuts of meat found in a meat market. Which are the most costly? Why?
16. Make a list of all the different kinds of cheese and tell where each is produced.
17. Corn in the form of pork is more profitable than corn meal. Why?
18. Why does the United States export much pork?
19. Why are our meat exports decreasing? Explain.
20. The average annual consumption of meat in the world is about forty pounds a person. Name two countries in which more is eaten per capita and two in which less is eaten per capita. Explain why in each case.
21. What are the various breeds of cattle? What distinctive quality does each have?

22. Explain the rising cost of meat.
23. Compare shoemaking by hand and by machinery.
24. Discuss the breeds of cattle that are used in dairying.
25. Make a list of magazine articles, pamphlets, and books dealing with the subject matter in this chapter.

TOPICS

1. Meat as a food.
2. A description of a meat-packing plant.
3. By-products of meat-packing plants.
4. Cattle raising in Argentina.
5. Swine raising in the corn belt.
6. The tanning of leather—past and present.
7. A description of a round-up on the western plains.
8. The rapid and efficient transportation of meat products.
9. Butter making in Denmark.
10. Our mutton supply.
11. Milk products as food.
12. The milk supply of our large cities.
13. Automatic machinery in shoe factories.
14. The Goodyear welt process of shoemaking.
15. The decreasing meat supply and consequent higher prices.
16. The co-operative dairy associations and creameries.
17. Governmental inspection of the milk supply.
18. Governmental inspection of meat products.

FOR CLASS DISCUSSION

1. Payment based on piecework is fairer to laborers in shoe factories than a daily wage.
2. The large meat-packing companies have benefited the public.
3. Dairying offers a good opportunity for investment.
4. Cold storage lowers the cost of meat.
5. As a nation, we eat too much meat.

CHAPTER XVI

MISCELLANEOUS ANIMAL PRODUCTS

Poultry. The meat and eggs of poultry are important items of our daily food supply. They are found almost everywhere outside the frigid zones, but are most abundant in the densely populated regions of the north temperate zone. Because fowls multiply rapidly, grow to maturity quickly, yield many eggs, produce delicious meat, and can be raised in a small space on relatively cheap or waste food, they are particularly desirable in these regions as a food supply.

The average farm has at least a small flock of chickens. As a result some trade in poultry and eggs is local in its nature, is somewhat irregular as to standards of quality, and lacks the efficiency of a country-wide organization. In the last three decades there has been a tendency toward larger chicken farms.

More and more attention is being given to improving conditions in the poultry industry. The introduction of better types of hens is resulting in a better quality of eggs and more eggs per hen. A large part of our commercial egg and poultry business is now in the hands of co-operative associations.

Commercial hatching.

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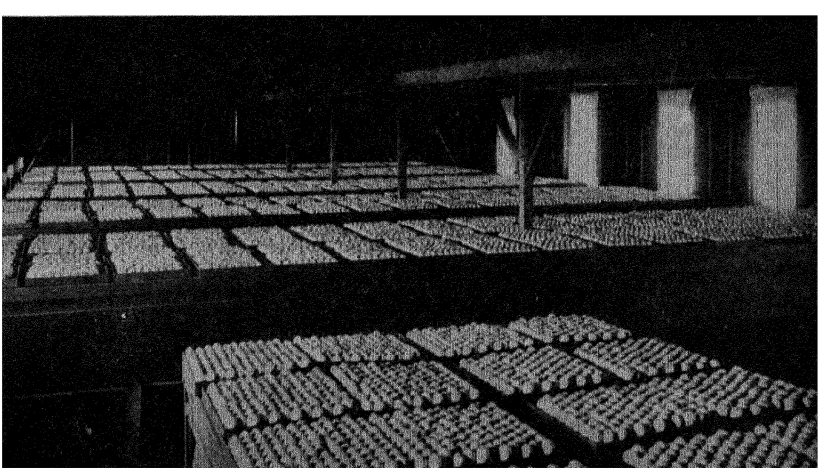

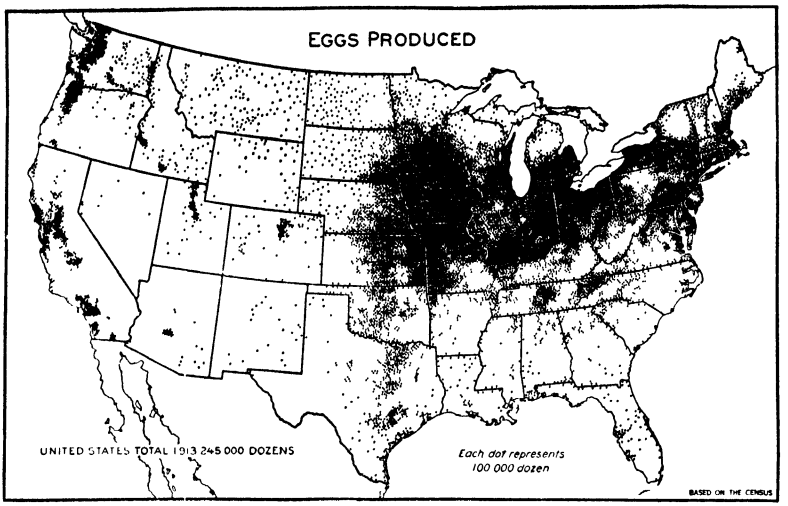

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Our production of chickens and eggs in the United States runs into tremendous numbers. We export very few eggs, but we import them from Canada, sometimes from Europe, and even from China. Russia, China, Denmark, and the Netherlands are large exporters of eggs. China alone normally exports almost one fifth of the world's export of eggs in the shell, besides great quantities of dried eggs, of which the United States takes a large share. Great Britain imports almost one half of the world's export in eggs. Other heavy importers of eggs are Germany, France, Spain, and Switzerland.

Fishing Industry. The Phoenicians, perhaps the greatest commercial nation of ancient times, made their start as fishermen, later extending their voyages and trading until their commerce covered all the known world of their time. Like the Phoenecians, every great maritime nation of history has looked to its fishing industry to furnish sailors. All nations that today lead in ocean trade have a thriving fishing industry, which trains and supplies men for their commercial and naval fleets.

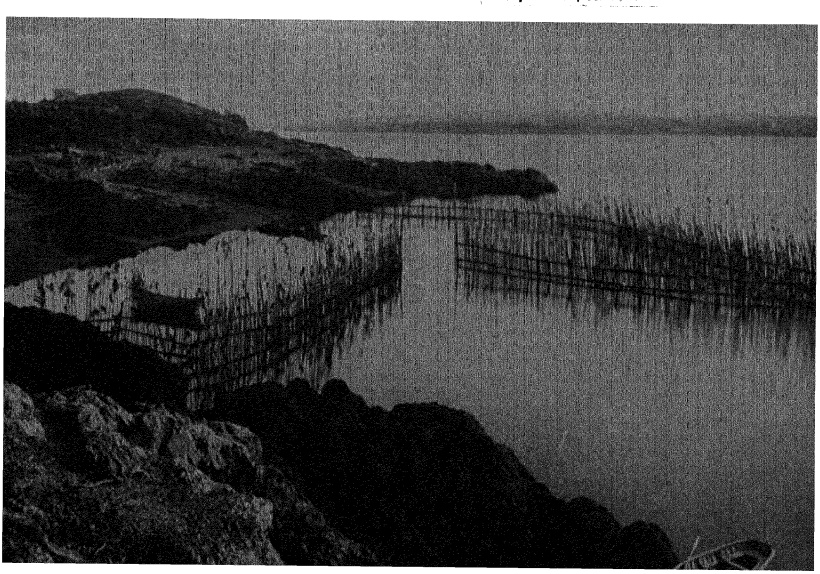
The fishing industry has had an important influence on the settlement and the history of our country. The excellent

fishing grounds near the coasts of New England were known to Europeans before the colonization of New England was undertaken, and fishing became the leading industry of the early settlers of that section. Later, New England became interested in the whaling industry, and, because of the need for fishing boats and the nearness of excellent wood for construction, in shipbuilding also. For many years New England's ships were prominent in the carrying trade of the world. The development of the iron steamship during and after the Civil War in the United States gave the lead in shipbuilding to England. New England sailors, schooled to sea life aboard fishing fleets, have played an important part in our commercial and naval history.

Importance of Fish as Food. As a source of food, the fishing industry is relatively unimportant to us, recent estimates placing its contribution to our total food supply very low. The number of men engaged in it is comparatively small. The total value of its products annually ranks far down the list, these products being lower in value than many of the minor cereals and being worth less than one twentieth of our corn

Herring weir, Eastport, Maine.

U. S. Department of Commerce



crop alone. Among the reasons for the lack of importance of the fishing industry are that it entails a dangerous life, full of hardships; that it requires long absences from home; and that it yields irregular and small returns.

The popular demand for fish in the United States is relatively small, as we are well supplied with other food products of a more desirable nature. The costs of catching fish and getting them to market leave but little margin of profit in a market where the demand drops when prices reach too high a level. As the population increases and our other sources of food become scarcer, fish will undoubtedly come more and more into demand and importance in this country. The large populations of China, Japan, and northwestern Europe look to the fishing industry for a much larger portion of their food than we do.

Location of the Fishing Industry. A number of factors enter into the location of the fishing industry. Of these, the principal ones are climate, topography of the sea bottom, and habits of the fish. All the great fishing regions lie in the north temperate zone, where the coolness of the water is favorable to large numbers of edible fish.

The topography of the sea bottom has had a great effect on the locations of the fishing industry. All great fishing regions are in waters over coastal shelves or banks, where fish like cod, halibut, and haddock can lay eggs and feed in the shallow waters. In the Atlantic Ocean the principal fishing waters are the Grand Banks, off the shores of Newfoundland; the West Banks, off the shores of Nova Scotia; and Jeffrey's Banks, off the coast of Massachusetts. In the North Sea, between England and Denmark, lies the Dogger Bank. The Japan Bank, off the northeastern coast of Asia, and the waters of the north Pacific Coast from Washington, along Canada, to Alaska, are the most important fishing regions in the Pacific Ocean.

The habits of different kinds of fish also help to determine the locations of the fishing industry. Some fish, like the shad, herring, and salmon, during certain times of the year ascend large rivers to lay their eggs. At these times they are caught in great quantities. This characteristic of the salmon deter-

mined the location of the great salmon-packing industry of Alaska and our North Pacific coast. Other fish, like mackerel, menhaden, and bluefish, run in large schools on the surface of the water, where their presence gives rise to a specialized fish industry in certain places, especially along the eastern coast of our country.

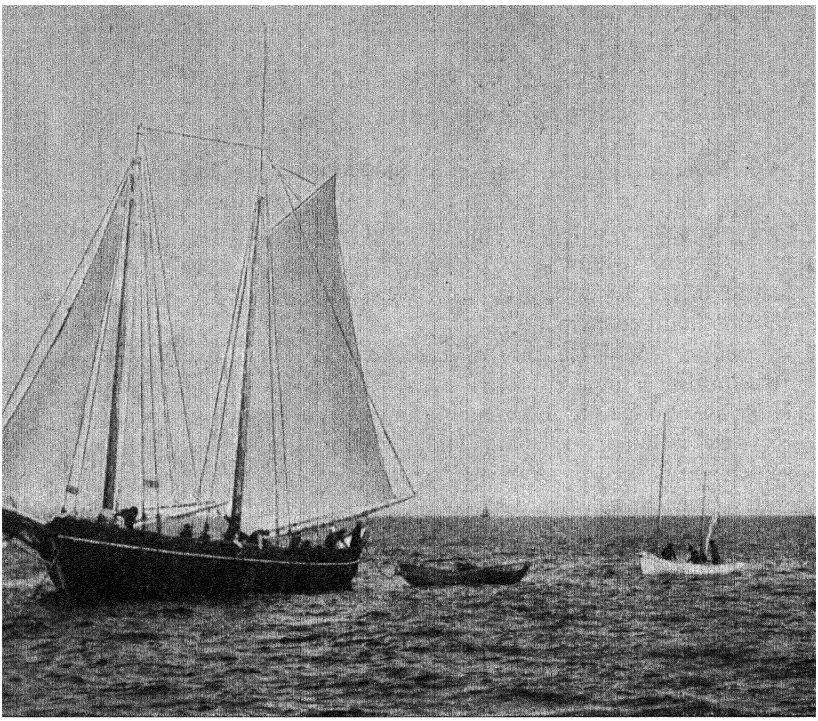
Leading countries in the fish industry are Japan, Great Britain, the United States, Russia, France, Canada, Portugal, Norway, and China. Fish is not, however, an important article in world commerce. Spain, Italy, Portugal, and the Catholic countries of South America are importers, principally of salted and canned fish. Although we rank high in the value and quantity of fish products, we import more than we export. Our exports are chiefly in the form of salted or canned fish.

Fisheries on the Atlantic Coast and the Gulf of Mexico. New England has always been noted for her fish products, especially cod. The fish that she supplies are mostly cod, haddock, halibut, mackerel, and hake. Herring are also found in large numbers, the small ones being canned as sardines.

Boston, followed by Portland and Provincetown, is the leading fresh-fish market of New England. Gloucester is famous everywhere for her salt-codfish industry. Along our eastern coast, from Connecticut to North Carolina, fishing has grown in importance as the population has increased. At the present time the value of the fish products taken from this area approaches that of New England's fish products. Squeteague, bluefish, shad, sea bass, butterfish, and mullet are caught in great numbers for the markets of the large adjacent cities.

Chesapeake Bay is noted for its oysters, which are sent fresh or canned from Baltimore to the markets. Crabs, fresh and canned, also form a valuable product. The menhaden caught along these shores are used chiefly in making oil, fertilizer, glue, and by-products.

As yet, fishing has not been very highly organized along our Gulf Coast, although there is an increasing interest in fishing because of the presence of rapid transportation and refrigeration. The canning of shrimp is becoming an important industry in this region.



U. S. Department of Commerce

Cod fishing.

The sponge-fishing industry is located along the coast of Florida, with its center at Tarpon Springs.

Inland Fisheries. Our Great Lakes supply trout, whitefish, and sturgeon to the neighboring markets of the cities on or near their shores. This industry is largely local and relatively unimportant commercially. Our inland lakes and rivers also are sources of the fish supply, but these are fished primarily by sportsmen rather than by professional fishermen in the industry.

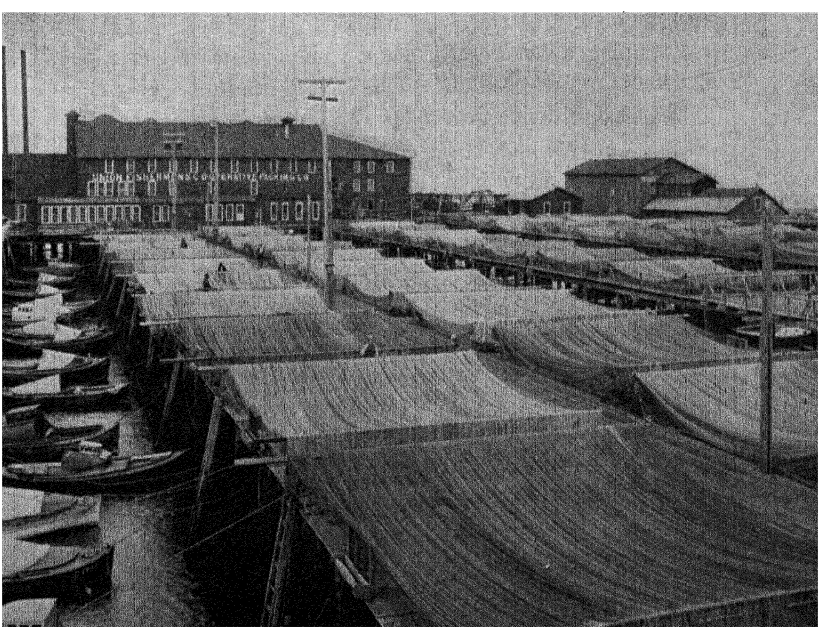
The Mississippi and its tributaries furnish some fish for the people along their banks, but their fisheries do not enter largely into commerce. In these regions the gathering of fresh-water clams for their shells, which are made into pearl buttons, is a local industry. Valuable pearls are sometimes found inside the shells.

Pacific Coast Fisheries. The Pacific Coast is famous for several varieties of fish, especially the salmon and halibut of

the Northwest and Alaska, and the tuna and pilchard (sardines) of California waters. Most of the salmon, tuna, and pilchard are canned. Halibut is iced or frozen and shipped all over the United States; Pacific halibut now exceed Atlantic halibut in the ratio of twelve to one. Among the other Coast fisheries of greatest commercial value are mackerel, flounder, herring, crabs, and oysters.

The most important fish of the northern Pacific Coast of the United States, and of Alaska to the north, is salmon. This fish ascends the rivers in enormous numbers during the spring and the summer to spawn. The Columbia River, in Washington, the Fraser River in British Columbia, and many rivers in Alaska have great annual salmon runs. Overfishing in Northwest waters has cut into salmon runs so heavily that the leadership in salmon canning has now passed to Alaska. Fortunately the Alaskan fisheries are carefully regulated to insure a permanent supply, and conservation measures are now being applied to other salmon waters.

Fishing nets and boats at a Columbia River cannery in Oregon.





Seining salmon in the lower Columbia River, Oregon.

Salmon are caught in various ways, from the spears and fishwheels of the Indians to the modern methods of trolling, gill nets, seines, and traps. Alaska uses mainly traps. Salmon are taken immediately to the canning factory where machinery does most of the work of cleaning, cutting into sections, packing in cans, and cooking by steam. Seattle has been for many years the center of the canned-salmon trade.

Government Aid in Fisheries. The Bureau of Fisheries of the National Government greatly aids the fishing industry by maintaining hatcheries that supply millions of tiny fish for distribution in places best adapted for them. Bulletins of this Bureau help fishermen in many ways; they describe the best methods of catching, preserving, and marketing fish. Studies are continually being made by this Bureau to aid and conserve the industry in every way possible.

States aid fishing by passing laws that forbid fishing during seasons when the fish are spawning or laying eggs, and that limit the amount and the kinds of fish that may be caught. Treaties between the principal fishing nations allow deep-sea fishing outside a three-mile limit from shore, and in other ways help in maintaining the industry without international friction.

The Fur Seal. The fur of the seal is much sought after for coats. This demand has resulted in the slaughter, almost to extinction, of fur-bearing seals. The Pribilof Islands, a pos-

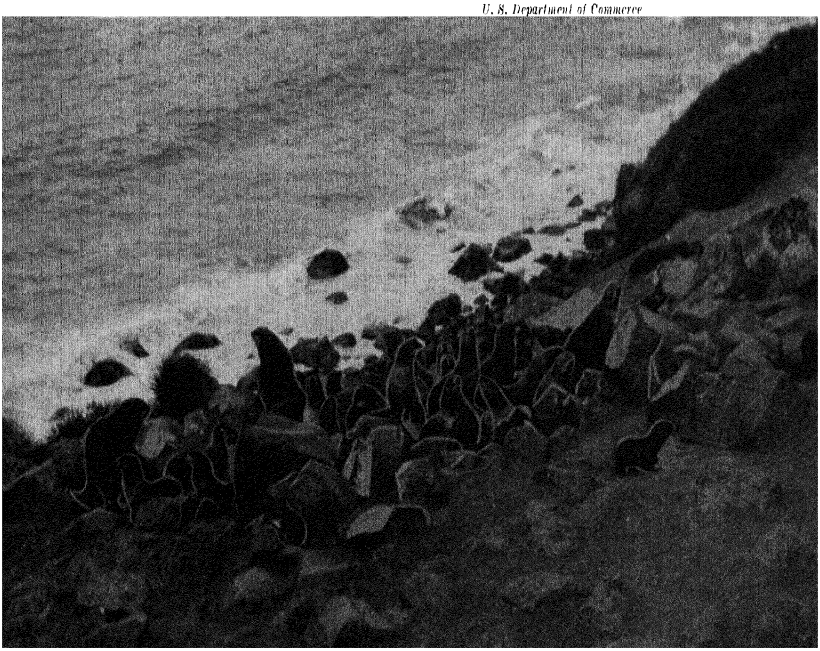
session of the United States west of Alaska in the Bering Sea, are famous as the chosen place for seals to raise their young, for which purpose they swim great distances.

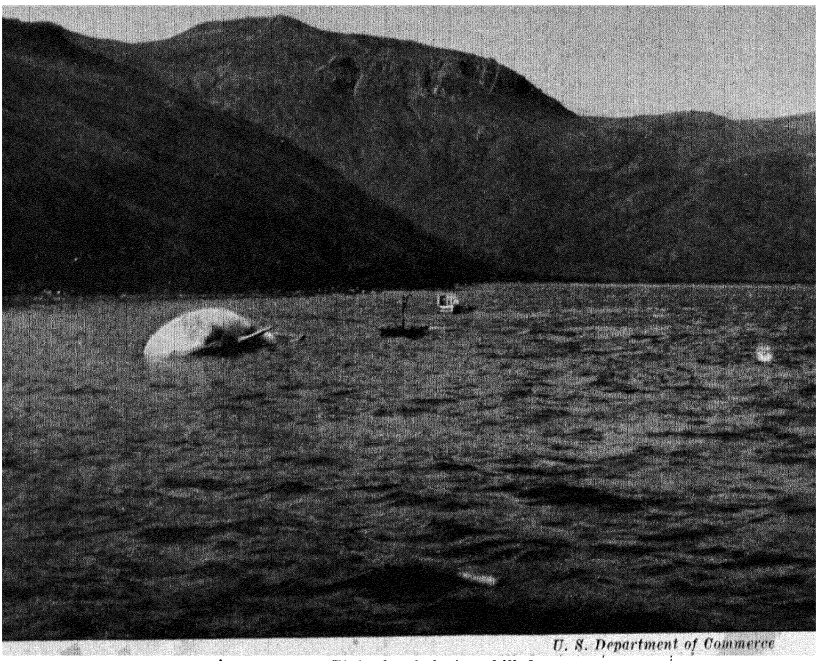
As the seal seeks its food in the ocean and swims miles for it, seal hunters can shoot the swimming seals beyond the three-mile limit. Within this limit, however, the Government controls the hunting of seals. Formerly, seal hunters lay in wait in their ships just outside the three-mile limit and killed all the seals in sight. This resulted in the slaughter of the mothers and the consequent death of the young seals from starvation. Through international treaties with England, Russia, Japan, and Canada, our Government has stopped much of this ruthless slaughter of seals away from land. It is hoped that the seal industry will survive for many years under the protection of the United States and its watchful coast guard fleet.

The Whaling Industry. The whaling industry reached its highest point of importance during the first half of the nine-

Seals on one of the Pribilof Islands, Bering Sea.

U. S. Department of Commerce





Finback whale just killed.

teenth century, when hundreds of ships and thousands of men were engaged in it. New Bedford, Massachusetts, was the center of this industry in the United States, and from this port the whalers outfitted their vessels and sailed to the arctic seas on long voyages in search of whales. Great fortunes were made in this industry. Although whales are still hunted, their scarcity, the use of substitutes for whalebone, and the development of petroleum for lighting and lubrication have brought about a rapid decline in whaling.

In place of the old wooden whaling ships, steamships with modern equipment for killing the whales and rendering the oil from them are now employed. A few of these sail now from Seattle and go north to Bering Sea. Most of the world's whaling is now done in Ross Sea in the Antartic by means of floating factory ships from Norway, Japan, and Great Britain.

Furs. From the beginning of time, man has used the skins of animals for protection against cold and wind. In cold climates fur has always been the most common article of clothing. Even when furs are not needed for warmth, they are often used for ornament.

Although the tropics contribute some furs, such as those of the leopard, tiger, and monkey, it is the cold regions of the Northern Hemisphere that produce our commercial furs. It is in those regions that nature provides the animals with finer and warmer coats; there, also, is found much unoccupied land, where wild fur-bearing animals can survive. Because of the large demand and decreased supply, many kinds of furs are now very expensive. As a result of this condition, there is in the United States and Canada the so-called *fur farm*, where men specialize in the breeding of fur-bearing animals, especially the silver fox.

Canada, Russia, and Siberia lead in the production of the more valuable furs, such as those that come from the sable, the mink, the seal, the ermine, and the black and silver foxes. The United States contributes a large amount of the less valuable furs. From South America come the fur of the nutria and that of the chinchilla. Australia contributes a large amount of rabbit skin and sends kangaroo, wallaby, and wombat fur also to the market. Among the animals that furnish the greatest amount of furs to commerce are the squirrel, the rabbit, the muskrat, and the beaver.

Valuable silver fox skins produced in Russia.

Sovfoto



The leading fur markets are London; New York; Leipzig, Germany; Gorki, Russia; and St. Louis.

The fur industry furnishes work not only to many trappers but also to many skilled workers, who finish pelts after they reach the market and, from the finished furs, make very attractive and useful garments.

TEXT QUESTIONS

1. Why is poultry valuable in dense populations?
2. What countries enter into the commercial production of poultry and eggs?
3. What is the relative importance, as a source of food, of the fishing industry in the United States? Why?
4. In what countries is the fishing industry more important as a source of food than it is in the United States? Why?
5. List and discuss the factors that enter into the location of the fishing industry.
6. Locate the principal ocean-fishing regions of the world.
7. What countries lead in fisheries?
8. What can you say about our exports and imports of fish?
9. Discuss the fisheries on the Atlantic Coast.
10. What are the leading fish markets of New England?
11. In what product does Chesapeake Bay excel?
12. What does the Gulf Coast produce?
13. Discuss inland fisheries.
14. Describe fully the salmon fishing and canning industry.
15. What other fish are found along the Pacific Coast?
16. How does our Government aid fisheries?
17. Describe the fur-seal industry.
18. Why did whaling decline in importance? Explain.
19. Where is the present location of the whaling industry?

PROBLEMS AND PROJECTS

1. Collect pictures of the fishing industry. Locate the particular kind of fishing industry represented by each picture.
2. Collect pictures showing the different kinds of poultry. Which kind is best for eggs? for meat? Why?

3. Make a list of all the articles that come from animals.
4. Draw up a list of all the fish found in your local fish market, classifying them as fresh, canned, dried, smoked, or salted. Where does each come from?
5. Make a list of all the fresh-water fish you know of. Which are found near your home?
6. Gather some statistics and compare, in point of volume and value, the poultry industry with some of the other industries concerned with animal products.
7. What kinds of fish are canned? Gather labels showing as many different kinds of canned fish as you can.
8. What problems occur in the codfish industry?
9. What problems occur in the fur-seal industry?
10. Where would you locate if you were starting in the poultry-raising industry? Why?
11. Why is the Middle West popular for large henneries?
12. What have the state government and the National Government done to aid fisheries in your locality?
13. Where is fur-trapping now carried on? How?
14. Make a list of magazine articles, pamphlets, and books dealing with the subject matter in this chapter.

TOPICS

1. Codfishing—a description.
2. Salmon fishing—a description.
3. Trappers of today.
4. The important furs on the market today.
5. The fishing industry of the Great Lakes.
6. The old-time whaling ship.
7. Fur as clothing.
8. The importance of fish in the food supply of Japan.
9. The importance of poultry in the United States.
10. The Pribilof Islands.
11. Present-day methods of raising poultry for the market.
12. The fish supply of tropical waters.
13. The relation between the fisheries of a country and its merchant marine.
14. The Hudson Bay Company.
15. The modern whale "factory" ship.

FOR CLASS DISCUSSION

1. Congress should pass laws that will eliminate cruel methods of trapping wild animals.
2. Fishing yields good returns for the labor expended.
3. Lobsters are worth the price charged for them.
4. Poultry offers a good opportunity for investment.
5. Fishing laws violate personal liberty rights.
6. A diet consisting largely of fish is more healthful than a diet containing a large amount of meat.
7. Fish hatcheries should be supported by private capital rather than by government funds.
8. The wearing of furs for ornament should be discouraged.
9. All furs should be tagged in order to enable buyers to identify the animals from which they come.
10. Fur farms offer good opportunities for investment.
11. Wheat farmers would be more successful if they changed to the poultry business.
12. Canned herring should not be labeled as sardines.
13. The Pacific Coast offers a better opportunity for financial return to one engaged in the fishing industry than does the Atlantic Coast.

CHAPTER XVII

NONMETALLIC MINERALS

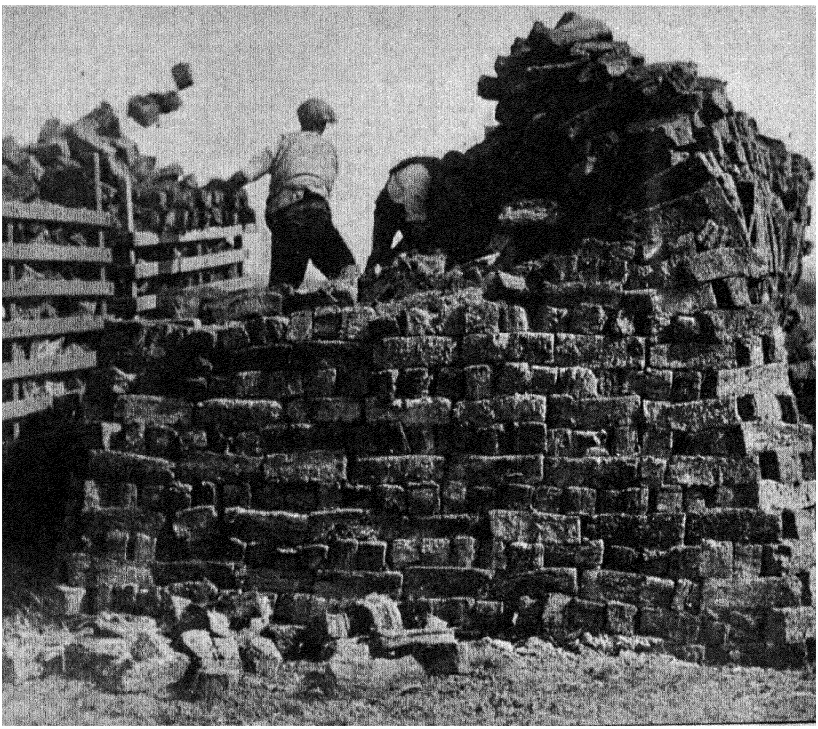
SECTION 1—COAL

History of Coal. Coal was known to the ancient Greeks, as several of their written records testify. Remains of the Roman camps in England show that the Romans used coal for heating. Travelers during the Middle Ages tell us of the use of coal in China. Monks in England were using coal in the ninth century.

It was not until the utilization of steam, in the eighteenth century, and the need for a special fuel for use in making steam, that coal came into commercial importance. From that time its importance has constantly increased; today the commerce and industry of the world are dependent upon it. Coal found prominence first in England as a fuel for use in making steam; hence England, because of its coal deposits and early industrialization, soon excelled all other nations in manufacturing.

In our country it was not until the nineteenth century that coal became important. This delay was due to the presence of great quantities of wood near at hand for use as fuel in heating and in steam making. As our population increased, our cities began to grow larger, our forests to recede farther and farther, and coal to become more important. Today, coal is one of the most valuable power resources and furnishes not only the largest part of our power but also fuel for heating, coke, and illuminating gas, besides the many by-products that come from coal tar.

Kinds of Coal. *Peat* is the fuel that represents the first stage in coal formation. It is composed of vegetable matter that has piled up in marshes or on low, damp ground and that, because of lack of air, has decayed but little. When other sources of heat are not available in those regions in which peat is found, the peat is dried and used as heating fuel. It



Keystone View Company

The peat industry, western Ireland.

occurs principally in Canada, Ireland, Russia, Germany, and Norway.

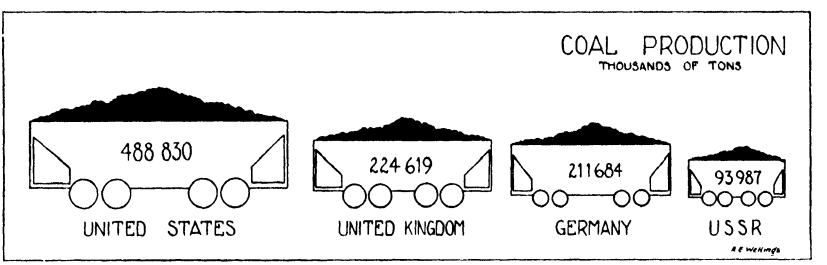
Lignite, which represents the second stage in coal formation, is a kind of link between peat and real coal. It is brown or red in color and crumbles easily. It is found in Australasia, central Europe, Canada, and in large deposits in our western and southern states. In the absence of better grades of coal, it is used for household heating, but, as yet, has not become important in commerce.

Bituminous coal is often called soft coal. The name *bituminous coal* is given to all real coal not classified as anthracite, or hard coal. Bituminous coal is the chief coal of industry and commerce, and the deposits of it are the most widely scattered of all types. This coal provides fuel for steam making and heating; it is used in making coke; it furnishes power for manufacturing; and it is a source of gas.

Anthracite is the hard coal frequently used in heating homes. It occurs in only a few places, principally in Penn-

sylvania, Colorado, and China. It burns with an intense heat and with little flame and smoke.

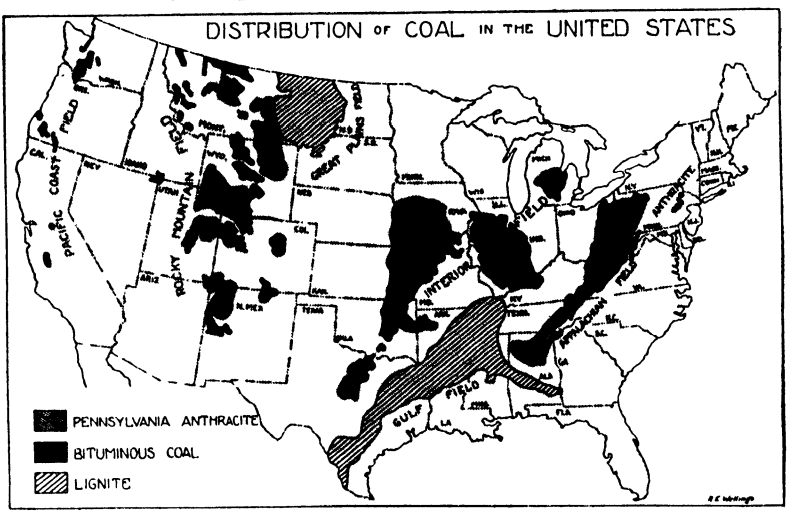
Distribution of Coal. Because adequate surveys have not been made outside of Europe and North America, the coal reserves of the world have not yet been fully determined. It appears that the great bulk of the known coal reserves of the world is found in the north temperate zone. It is estimated that one half of the world's coal is in the United States. Great Britain, Germany, Canada, China, and Australia also have large deposits.



The extent of the coal reserves of the various regions does not necessarily determine the coal production of those regions. Among the factors that enter into coal production are: (1) the quality of the coal; (2) its nearness to markets and industrial centers; (3) the ease with which it can be mined; and (4) the character of the people of the country in which the coal is found.

The United States is well favored in all these respects and produces yearly almost one third of the world's supply. The United Kingdom, with less than three per cent of the known coal reserves, and Germany, with about five per cent of the coal reserves, are large contributors to the coal production of the world. Russia in recent years has become one of the leading coal producers. Although the estimated coal resources of China are great, she produces very little because the mines have not yet been developed. Japan, with very small reserves, produces more coal than China—about two per cent of the production of the world.

Coal Fields of the United States. The United States Geological Survey lists six main coal fields in our country. (1) The eastern, generally called the Appalachian field, extends from Ohio and Pennsylvania southward to Alabama. (2) The interior field is composed of three distinct sections: the northern, which consists of Michigan; the eastern, which covers Illinois, Indiana, and western Kentucky; and the western, which begins in central Iowa and runs southwestward to central Texas. (3) The Gulf field takes in those southern states that have large deposits of lignite. (4) The northern Great



Plains field, composed largely of lignite, begins in Montana and extends across North Dakota. (5) The Rocky Mountains field includes a number of disconnected deposits, mostly of low-grade bituminous coal, beginning in Montana and extending southward to New Mexico. (6) The Pacific Coast field includes deposits that are practically all in the state of Washington.

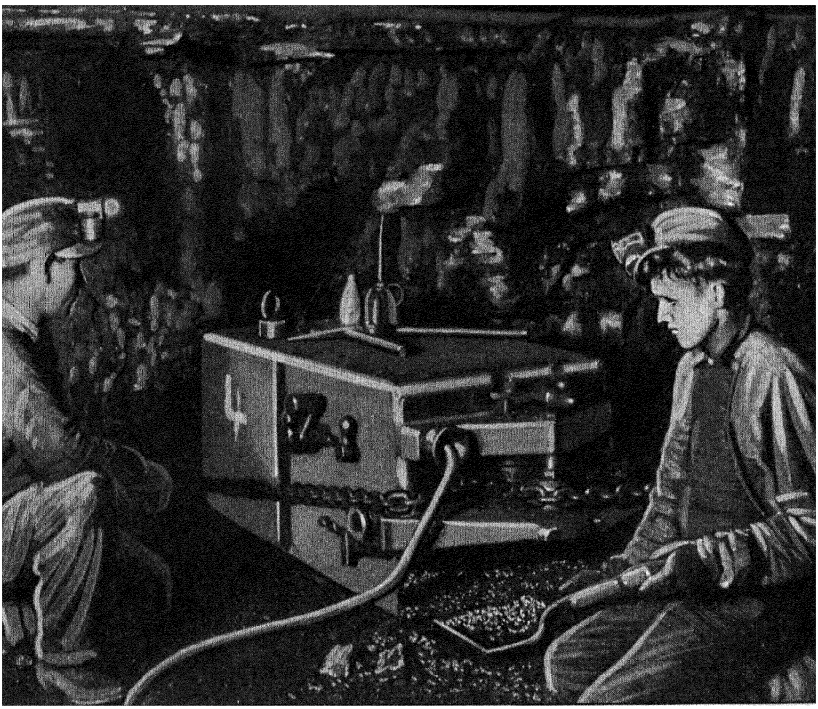
The best coal, including anthracite and high-grade coal used in generating steam, is found in the Appalachian field. Moreover, with few exceptions, the quality of coal decreases as one goes westward, while the quantity increases. As the eastern deposits become depleted and the price of their coal increases, the immense low-grade bituminous and lignite deposits of the

western regions will become more important, not only for heating purposes but also for gas production. At present their commercial value is confined, almost wholly, to the use of this coal in household heating. Just now Pennsylvania, West Virginia, Illinois, Kentucky, and Ohio are our leading coal-producing states.

The Appalachian Field. The Appalachian coal field has all the factors necessary in coal production on a large scale. In some parts of its northern section, principally in Pennsylvania, is found bituminous coal famous for its coking qualities. This coal is very essential to the neighboring iron and steel industry. In eastern Pennsylvania occur the only important deposits of anthracite in the United States. The high-grade coal in the Appalachian field is particularly valuable because of its nearness to the great industrial centers of the eastern and central sections of our country. The transportation agencies and power plants of these regions depend largely upon the Appalachian field to furnish coal for use in the generation of steam.

In the central section of this field, some difficulty is experienced in getting the coal to the market because of the ruggedness of the topography. In the southern section, great quantities of coal are used in the iron and steel industry centered at Birmingham, Alabama. The comparative ease with which coal in this field can be mined has led to hurried and wasteful mining methods. The ingenuity of the American people is well illustrated in the Appalachian field by the wide use made of mining machinery. The use of machinery and the nearness of the coal to the surface make the per capita production large and the coal relatively cheap. The great industries that have made our country famous were possible principally because of these conveniently located and easily mined deposits of excellent coal. The anthracite from this district heats houses of New England, of the Middle Atlantic States, and of most of the North Central States.

The Interior Field. The bituminous coal of the interior field is inferior to that of the Appalachian field, but it is superior to much of the coal of Europe. Because of its nearness, the



Keystone View Company
Electric cutting machine in a coal mine.

coal from this region is of great importance to the large industrial centers.

Because they are near the market, and the quality of coal produced is high, the northern and eastern sections of this field are the most important. The coal seams in this field are almost level and can be reached easily. The western section is not extensively mined because its coal is of low grade and far from industrial centers. Some of the coal is used locally, chiefly for heating houses, and some is used by the railroads. The presence of petroleum near the coal deposits of this field tends to postpone coal-mining here until low-grade coal comes into greater demand.

Coal Mining. There are three general ways in which coal is mined. One method, called *drift mining,* is used where the coal seams come to the surface. The coal in these seams is mined as stone is quarried. If the outcrop is on the side of a hill, the seam is followed by tunnels into the side of the hill.

The second method, called *strip mining,* is used where the coal seams are very near the surface of the earth. In this

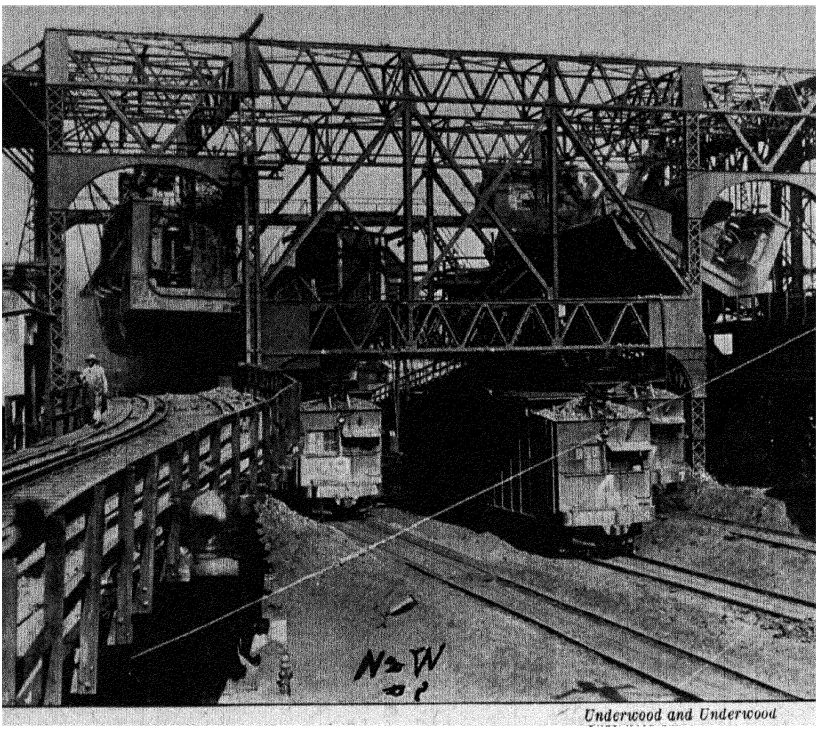
case the top covering of earth is removed by huge steam shovels, and the coal underneath is scooped up and dumped into cars, which run into the cut on temporary tracks.

By far, the most coal is obtained in the third way. This method, called *shaft mining,* is used where the coal seams are some distance down in the earth. A vertical shaft is sunk to the coal seam, which is worked from the bottom of the shaft. After the coal is blasted or dislodged from the seam, it is loaded into small cars, taken to the bottom of the shaft, and raised to the surface by elevators.

Commerce in Coal. The three greatest coal-exporting countries are England, Germany, and the United States, although Russia is also an important exporter of coal. Japan and Australia export small quantities to neighboring seaports and countries. Our export of bituminous coal forms less than four per cent of our production; but, because our production is so large, coal is a valuable item of our export trade in spite of this low percentage. Much of our exported coal goes to Canada.

In competing with England and Germany for the European markets, we are handicapped by transportation costs to the coast and by ocean transportation to the country of destination. Coal is a bulky freight in comparison to its value, and the countries nearer the European market can ship coal to that market much more cheaply than we can. Our outgoing freights to Europe are largely bulky raw materials like grain and cotton, whereas our incoming freights are chiefly manufactured goods, which occupy smaller space. The difficulty of getting sufficiently large return cargoes from Europe is increased when coal is added to European-bound cargoes.

On the other hand, coal shipments to Central America, the West Indies, and South America are more easily accommodated in outbound steamers, because the return cargoes from these regions consist principally of bulky raw materials. The demand for coal is not large there, however, because these regions are not industrial and lie mostly in warm climates. Aside from our exports to Canada, it is doubtful whether our foreign trade in coal will increase.



Unloading coal at a pier, Norfolk, Virginia. The coal cars are run up the incline at the left into a cradle. The cradle containing a loaded car is then tilted until the entire contents of the car have been emptied.

England, because of her dense population and great manufacturing industries, must import food supplies and raw materials. This condition creates an inbound freightage composed chiefly of bulky materials. To furnish the outbound cargoes for her ships, she has built up a large export trade in coal, not only to the nearby countries in Europe but also to distant lands where she has established stations for the coaling of war vessels and merchant steamers. Consequently, coal is a valuable asset to England, furnishing power for her many factories and outbound cargoes for her merchant ships.

Germany is in somewhat the same position, importing raw materials and exporting small manufactured articles and coal to fill cargo space. Germany is favored also by being in the center of a great industrial region and by being near the manufacturing countries of western Europe, all of which need coal for power.

In the United States, coal moves, as a rule, westward. This westward movement is due primarily to the superi-

ority of eastern coal and also to the fact that the railroads, after hauling the great crops of the West to the eastern seaboard, can haul coal westward on their return trip. A similar situation is found on the Great Lakes. Coal supplies the return cargo for the large vessels that transport iron ore and grain from the Lake Superior ports to the eastern terminals. Water transportation on the Ohio River is also easier when freight is moving westward. For these reasons much coal from the Appalachian field makes its way to the industrial centers of the Middle West. It is estimated that the railroads of our country use about one-quarter of our coal in their locomotives and that about one third of their freight consists of coal.

TEXT QUESTIONS

1. What are the various stages in coal formation?
2. Discuss the history of coal briefly.
3. What are the different kinds of coal?
4. Where are the principal coal reserves located?
5. What factors enter into coal production?
6. What countries lead in coal production? Why?
7. Where are our principal coal fields?
8. Compare the quality of coal in the East and in the West of our country.
9. Where is the largest anthracite field in the United States?
10. Discuss the coal of the Appalachian field in regard to quantity and quality.
11. Why is the output of coal per capita greater in this field than in any other?
12. Discuss the interior coal field.
13. In what three ways is coal mined?
14. How does the industrial system of England favor her in the export of coal?
15. Why is it better for us to ship coal to South America than to Europe?
16. Explain the westward movement of coal in the United States.

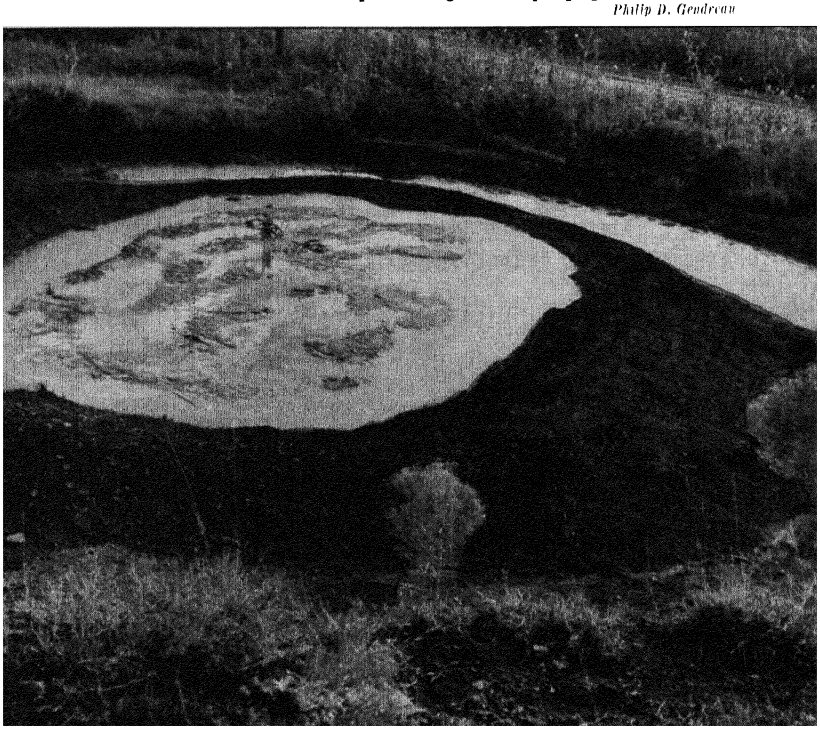
SECTION 2—PETROLEUM

History of Petroleum. Just when petroleum was first known can not be stated accurately, but we do know that it was discovered in very early times. In the Bible, Job refers to it as the "oil from the rock," and several other references to pitch and slime undoubtedly point to petroleum. We have found asphaltic mortar from petroleum in the ruins of Babylon, the ancient capital of Babylonia, and Nineveh, the ancient capital of Assyria.

Petroleum was used in the wrapping of mummies in Egypt; as a source of light in Burma; in the ancient fire worship around the Caspian Sea; and as a medicine not only in ancient times but also during the Middle Ages in Europe.

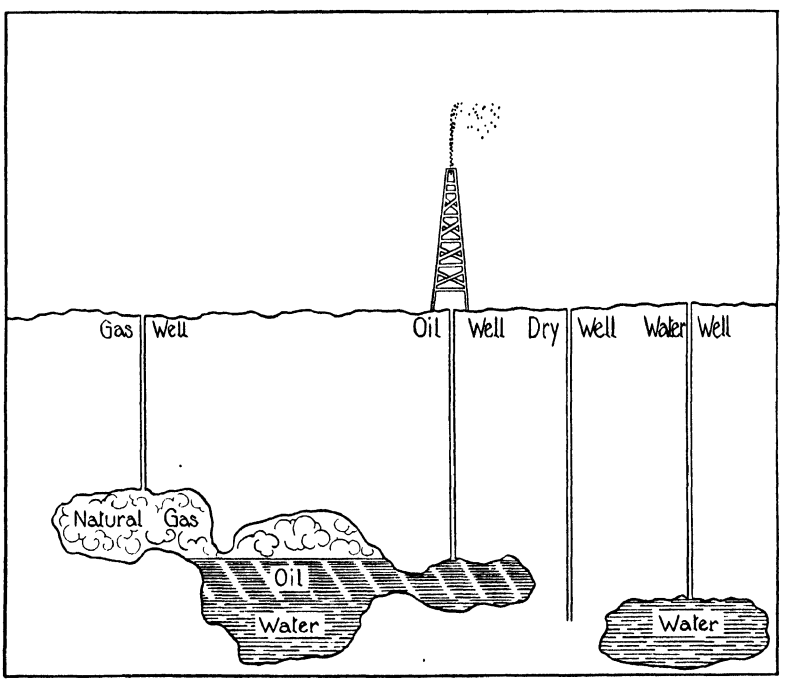
In America there is ample evidence that it was used by the Mound Builders several hundred years ago, and that the

A natural oil pool flowing without pumping.
Philip D. Gendreau



Indians used it as a medicine long before the coming of the Europeans. The early settlers copied the Indians in its use, and petroleum became a popular medicine in those regions where it was found on the surface.

In 1859 Colonel Drake sank the first oil well, near Titusville, Pennsylvania, in an endeavor to obtain a greater quantity of this oil. About the same time it was found that, after distillation into kerosene, petroleum furnished a very satisfactory light. Its popularity for lighting grew rapidly, and the drilling of oil wells soon became a booming industry. The oil industry, from 1860 on, spread rapidly; new fields were discovered; and a great business and industry came into being.



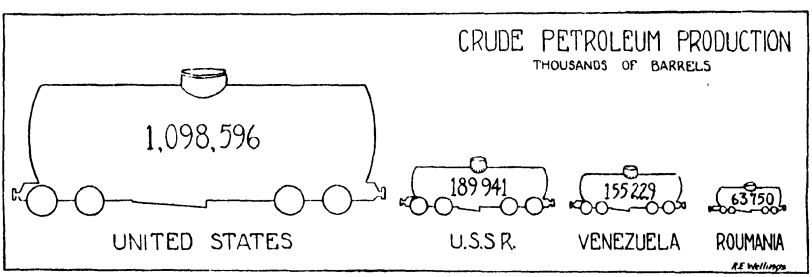
The formation deep under the surface of the earth determines the kind of well.

The invention of the gasoline engine and the automobile, about 1900, increased the demand for gasoline, a by-product of petroleum. Petroleum became a very important industrial

product, until today it ranks well up towards the top of our leading products in value.

Like coal, petroleum has lain under the earth awaiting the coming of the machine age for its large-scale exploitation. From 1927 to 1937 more petroleum was used than during all the hundreds of years of the world's history up to that decade.

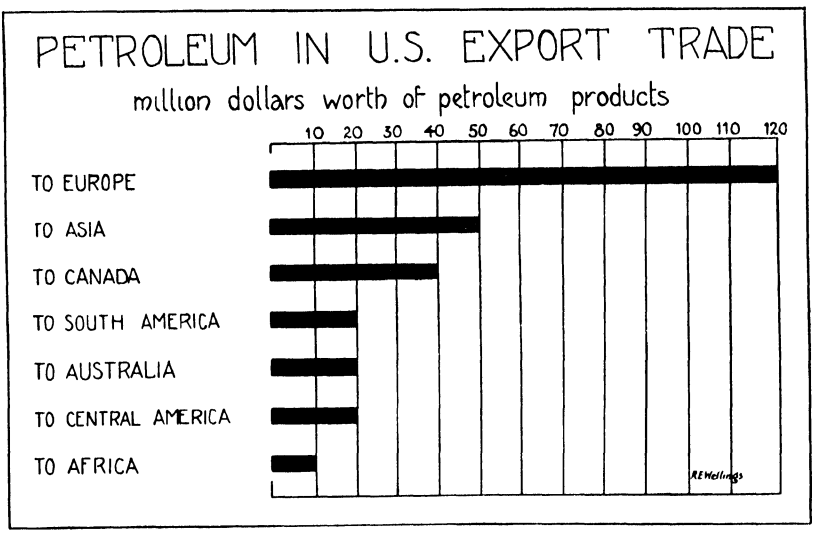
Distribution of Petroleum. The petroleum reserves of the world are widely scattered and have not yet been fully determined. It is highly probable that, for many years to come, the discovery of new fields will greatly affect the world's supply. At this time, however, only rough estimates can be given of known and probable reserves.



It is estimated by the best authorities that our country has about one fifth of the known petroleum reserves of the world and that Russia, Iran, Rumania, Mexico, South America, and the Dutch East Indies have most of the remainder. Many other regions have oil fields of considerable extent, but small in comparison with those of the regions named.

The regions that lead in petroleum production are the United States, which produces more than sixty per cent of the world's supply, and, in order of importance, Russia, Venezuela, Rumania, Iran, and the Dutch East Indies. Russia has been forging rapidly upward in relative rank; in 1931 it reached second place, followed closely by Venezuela. The order of importance in world production of oil will shift among the various regions as present oil wells decline in output and new regions are opened up; but it appears that for several years the United States will probably lead in production.

Notwithstanding our large domestic use of petroleum and its products, we export more than we import. Most of our exports go to Europe. South America takes some of our ex-



ported fuel oils to generate power. Asia is a good customer for kerosene, a valuable source of light in regions far from other sources of light. The bulk of our imported crude oil comes from Venezuela.

Oil Fields of the United States. The various oil fields of the United States differ not only in their location but also in the quality of petroleum produced.

The Appalachian field, including New York, Pennsylvania, Ohio, West Virginia, Kentucky, and Tennessee, is the oldest field and for many years furnished almost all the oil produced in this country. The oil from this field, which ranks fifth in quantity produced, is the best in quality, having a paraffin base and being free from objectionable asphalt and sulphur.

The Lima-Indiana field includes northwestern Ohio and Indiana. This is one of the oldest fields and reached its maximum output about 1896, when it was a very important field. At present its production is relatively small.

The Illinois field reached a high point of production about 1908. For a period of more than twenty years, ending about 1935, its production was relatively small. From 1935 to 1940 its production increased more rapidly than that of any other field and it is again one of the largest producers.

The mid-continent field includes Oklahoma, Texas, Kansas, northern Louisiana, and Arkansas. This field is now producing more than all the other fields in the United States combined.

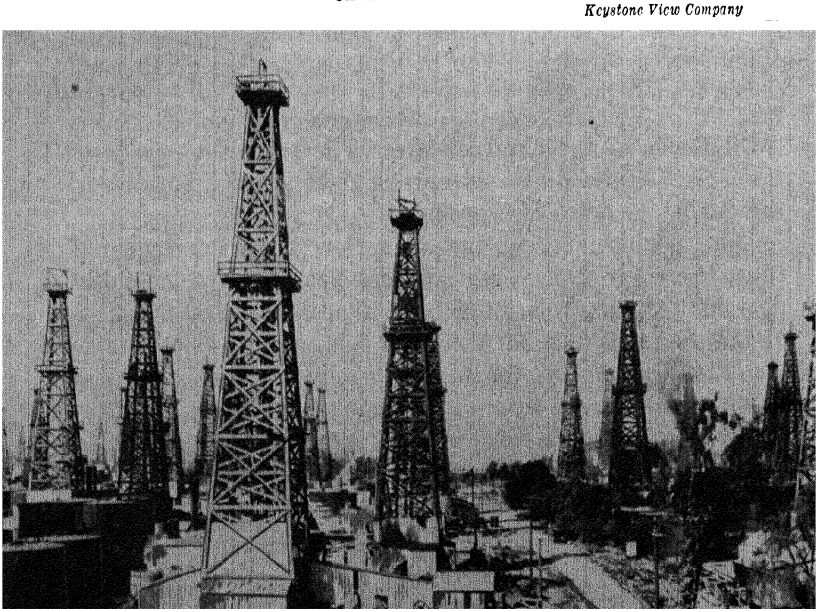
The Gulf Coast field includes the regions along the coasts of Texas and Louisiana. It now ranks third in quantity of production.

The Rocky Mountain field includes Wyoming, Montana, and Colorado. Its present position in quantity of production is sixth.

The California field reached its maximum output in 1929, and it now ranks second only to the mid-continent field. Its oil is of such a quality that it is used chiefly for fuel and lubricants, and as a source of asphalt. This field is especially important to the industries of the Pacific Coast, because it furnishes a power resource.

Oil wells in California.

Keystone View Company



In some classifications the Appalachian field, the Lima-Indiana field, and the Illinois field are grouped together as the eastern fields. The leading states in petroleum production at present are Texas, California, and Oklahoma.

Transportation of Petroleum. Petroleum, upon reaching the surface, is run or pumped into large settling tanks, where the dirt and water sink to the bottom. When the oil is cleared of these, it is stored in large storage tanks until it is ready for transportation.

The transportation of petroleum is unique in that it is handled largely by means of pipe lines. Trunk lines reach from the mid-continent field to Chicago and to the Atlantic Coast. California has considerable mileage of pipe lines centering at Los Angeles and at San Francisco. In Russia there is a long pipe line reaching from the Baku oil fields to the Black Sea. Two pipe lines connect Iraq with the Mediterranean Sea.

Tankers, vessels built especially to carry crude or refined oil, carry their loads to distant ports. This traffic annually amounts to over one billion tons. Railroad tank cars are used mostly to transport refined oils, such as gasoline and kerosene, from refineries to the markets. Tank trucks are used to transport gasoline, fuel oils, and kerosene directly to retailers, service stations, and customers.

Kerosene for the foreign trade is put in five-gallon square tins, which prevent excessive evaporation. In the distant lands to which they are shipped, these tins serve various purposes after the kerosene has been used.

Refining of Petroleum. Crude petroleum, as it comes from the wells to the refineries, is a heavy liquid, generally dark in color, and with a very disagreeable odor. It contains many impurities. At refineries the impurities are separated from the crude oil by distillation, which also accomplishes the separation of the oil into the various substances demanded by industry. Refineries are located near oil fields, near large industrial centers that form a ready market, and on the seacoast where shipping facilities are available.

In *straight-run refining* the petroleum is put into large iron tanks and slowly heated. The various substances pass off

in the form of vapor, the most volatile, or those that most readily change into gas, going first under the least heat. These vapors pass through pipes lying in cold water. Because this process cools them, they are changed into liquid form again. After distillation these liquids are treated chemically to remove the impurities that they still contain.

Rhigolene, naphtha, gasoline, benzene, kerosene, and distillate result from the refining process, passing off as vapor in this order as the crude petroleum is heated. The degree of heat that causes the substance to vaporize determines its character; kerosene, being the least volatile, passes off last. The degrees of heat necessary to vaporize these substances are now fixed by law so that these products may be safely used within certain limits.

If kerosene contained some parts of the more easily vaporized gasoline or naphtha, its use in ordinary lamps would be dangerous. To be safe, kerosene should not evaporate at less than 100 degrees Fahrenheit or burst into flame at less than 125 degrees.

Gasoline is distilled at certain degrees of temperature, depending upon the use to which it is to be put. Naphtha is very dangerous because it explodes and ignites at low temperatures. Because it is very volatile, it should never be used in a closed room. Because rhigolene vaporizes quickly, it is used by doctors as a local anaesthetic in operations; it is used also in freezing mixtures.

In the *cracking process* of refining used at the more modern refineries, the heavy oil is further distilled under very high pressures and at higher temperatures. This process results in a much greater yield of products, especially in gasoline. It is estimated that the cracking process conserves over one billion barrels of oil yearly.

A process whereby natural gas can be reduced to what is known as *casing-head gasoline,* has made natural gas an important factor in gasoline production. Gasoline may be obtained from oil shales and coal, although at present the process is costly and cannot compete successfully with gasoline distilled from petroleum.

By-Products of Petroleum. Besides the use of petroleum for fuel and power, petroleum is particularly remarkable for the scope and number of its by-products. What remains in the still after the volatile products have been distilled is used to make hundreds of important petroleum by-products. These important by-products include cleaning fluids; road oils; paraffin products, such as candles and some waxes; various drugs; electric carbons; vaseline products; lubricating oils; and aniline dyes.

These articles are by-products of the general processes of extracting the more desired gasoline, kerosene, and oils, and, in a way, are a conservation of our great petroleum resources.

This by-product industry has a big future; indeed, chemists are already utilizing every part of the crude petroleum as it passes through the refineries. A further discussion of the conservation of our petroleum resources will be found in Section 2 of Chapter VII, "Use of Power Resources."

Natural Gas. Natural gas generally occurs with petroleum, but sometimes it is found separately. It is one of our most valuable natural resources, yet none has been so carelessly wasted. Formerly, much of the natural gas in the oil fields was allowed to escape into the air. Almost anyone could drill a gas well and either use or waste the flow from it. The gas from some wells was permitted to burn for years, and the annual waste in natural gas ran into millions of dollars. More attention, however, is now being paid to its conservation.

Much of the gas found in oil wells has been piped to industrial concerns, which find it to be a cheap source of power and an excellent fuel for use in making steam. Natural gas is a source of about eight per cent of our power energy. The iron and glass industries are often located near a supply of natural gas, because it forms, for them, an ideal fuel, being cheap and free from sulphur, besides giving a very intense heat. Natural gas produces more heat than manufactured gas, but it furnishes a poorer light.

Another important industry that uses considerable natural gas is the carbon-black industry, which reduces natural gas to carbon black, a material used extensively by the rubber,

ink, and paint industries. Carbon black also forms an important export commodity. Casing-head gasoline is also obtained from natural gas, being condensed from casing-head gas, or natural gas, rich in gasoline, produced by an oil well.

Like oil fields, gas fields are widely distributed over the United States; and as the supply becomes diminished in various fields, there is a change in the amount produced and in the relative importance of the different fields.

In the East, West Virginia, Pennsylvania, and Ohio are important producers, though, at present, California, Oklahoma, and Louisiana lead in the quantity produced.

TEXT QUESTIONS

1. Discuss the early history of petroleum up to the time of the invention of the kerosene lamp.
2. What events increased the production of petroleum in the world?
3. Discuss our imports and exports of oil and its products.
4. Name, in order of their importance, the leading petroleum reserves of the world; of the United States.
5. Explain the different ways in which petroleum and its products are transported.
6. How is petroleum refined into its products?
7. List some of the by-products of petroleum.
8. What waste occurs in the production of petroleum? How can conservation be made more effective?
9. What is the "cracking" process in the refining of petroleum?
10. How is natural gas used? How is it transported?
11. What is casing-head gasoline? How is it produced?
12. What is carbon black? What is it used for?

SECTION 3—BUILDING MATERIALS

Cement. Since the time that man began to build his own house, he has used some kind of material as cement to bind rocks and bricks together. In early times this substance was probably burnt gypsum, a mineral that is used in making plaster of Paris. The Romans used a cement similar to our Portland cement, but the secret of making it was lost. It was not until 1824 that an Englishman discovered that limestone and shale when ground up fine, heated, and then reground would make a cement that, when hardened, resembled the rock formations found in Portland, England. He called his discovery Portland cement. At the present time some Portland cement is made also from the slag waste of blast furnaces.

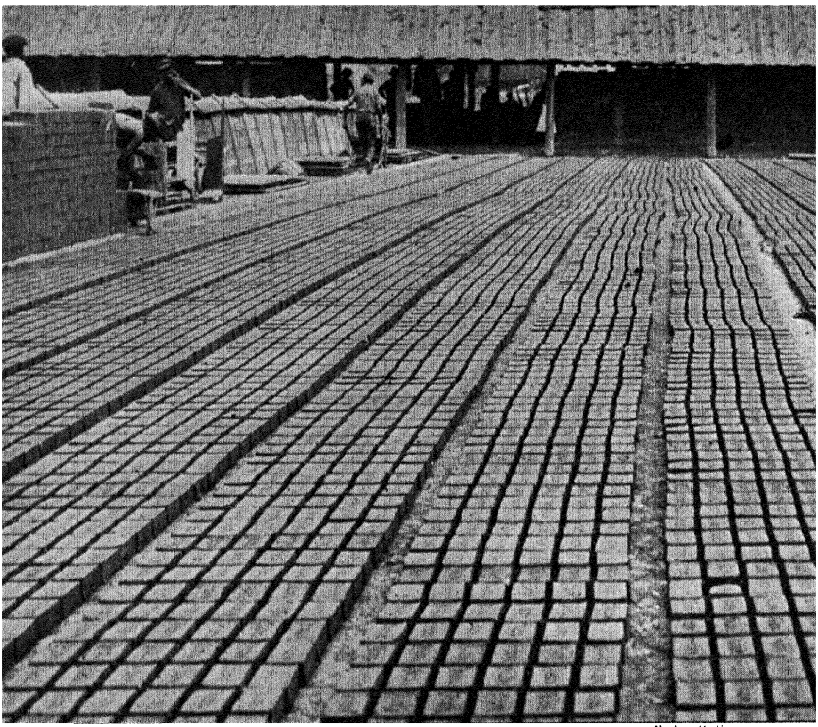
It is only within the last fifty years that this cement has come into wide use. At the present time the demand for it is increasing at a very rapid rate. When this cement is mixed with gravel, sand, and small rocks, and is allowed to harden, it makes what is called *concrete*. This composition is becoming the most practical material for foundation work in buildings and for roads.

Cement works are generally located as near the markets as possible to avoid excessive freight costs. Eastern Pennsylvania, including the Lehigh Valley, leads in the production of cement in this country.

Clay Products. Primitive man soon learned to mold clay into shapes and to allow it to harden in the heat of the sun. Later, using finer grades of clay and more intense heat produced by artificial means, he succeeded in making many beautiful and useful things. That the art of the potter was well known among ancient people is proved by the wonderful examples found in ruins. In fact, some of our earliest written records were inscribed on baked clay tablets.

We might classify clay products into two general classes: building materials, such as bricks, terra cotta, tiles, and drain pipes; and dishes and art objects.

Porcelain, a fine white pottery, has come into wide use because it is especially valuable as a nonconductor in electrical



Ewing Galloway

Drying brick in the sun.

equipment. Most of our bathroom fixtures are made of iron coated with porcelain, and many of our kitchen utensils are made in the same way.

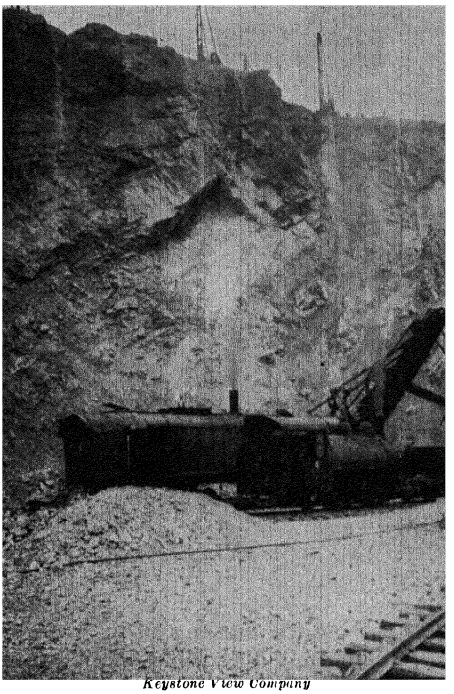
Building materials, because of the heavy freight costs incurred in their shipment, are generally made as near the market as the location of clay permits. The large clay beds of New Jersey and the Hudson Valley furnish enormous amounts of clay for making building materials for New York City.

The quality of the clay plays a very important part in the making of fine dishes. Clay of good quality is sometimes imported from great distances. Trenton, New Jersey, and East Liverpool, Ohio, are the leading pottery centers in the United States.

Building Stone. From earliest times man has used stone chiefly as a material to build dwellings. In the countries of Europe, almost all buildings are made of stone, because of the lack of cheap wood. In this country most of our constructions have been made of wood because of the bountiful supply of

cheap lumber. With the rapidly advancing costs of wood, however, we are gradually using more stone, which is more lasting and durable. Stone also has the advantage of being fireproof. In our large cities structures of certain types are required by law to be built of stone or other fireproof materials.

More than half of the stone now used in this country is used in the form of crushed rock. In large construction jobs crushed rock is mixed with cement to make concrete. It is used also in road making, which has increased rapidly; as foundation for railroad tracks; and in the chemical industry. This enormous demand for crushed rock results in the use of many of the smaller rocks that formerly were wasted.



Keystone View Company

Quarrying broken rock for road beds.

The principal stones used as building materials are granite, sandstone, limestone, marble, and slate. Granite occurs in widely scattered places over the country; but, when possible, it is quarried near the place where it will be used so that freight costs will be saved. Because granite is hard and weather-resisting, and takes a high polish, it is much used not only as a building material but also for monuments. New England leads in the production of granite. Some quarries, especially those of Maine and Massachusetts, are located near waterways so that transportation costs are greatly reduced. California also is a large producer of granite, principally in the form of crushed stone.

Sandstone is widely distributed. This stone is made up of tiny particles of sand, cemented together centuries ago. Because of its color combinations, it is sometimes a very pretty stone. The main supply of this stone comes from the north-

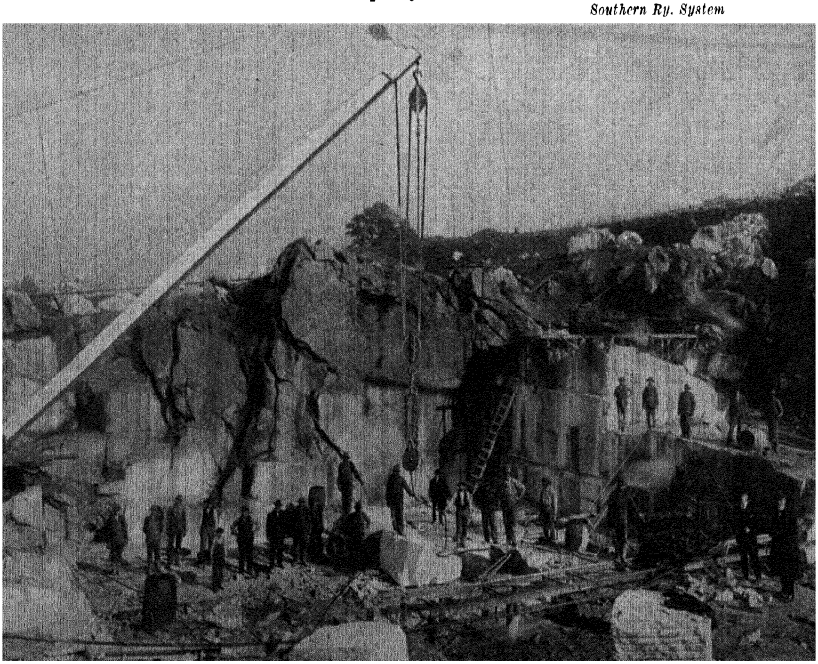
eastern part of the United States. The Berea sandstone of Ohio is in great demand. Some New York sandstone is very hard and makes an excellent paving stone.

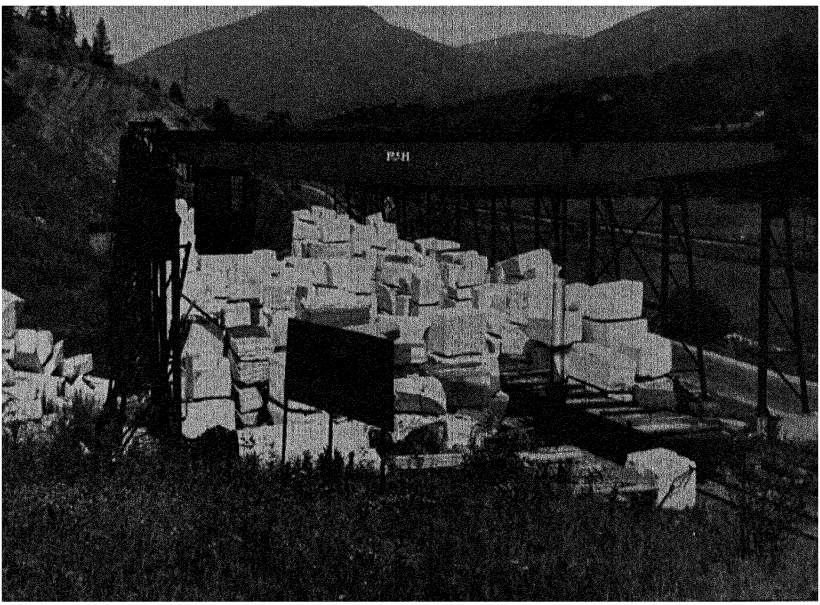
Limestone is the most widely used of all building stones. The quality of limestone varies with its composition, some of the stone being too soft for good construction purposes. Although there are limestone quarries in various parts of the country, the Bedford limestone of Indiana is that most desired for building. Much of our limestone is used as crushed rock and in iron-smelting. The amount of limestone used is greater than that of all other stones combined.

Marble is used in construction, particularly because of its beauty. It is the favorite stone of the sculptor and the monument worker. Ages ago, when it was formed, other materials were mixed with it, a fact that accounts for the beautiful colors and varied patterns sometimes found in it. A thin sheet of marble often covers the walls of buildings, giving them the appearance of solid marble. Vermont, Massachusetts, New

A marble quarry in Tennessee.

Southern Ry. System





Philip D. Gendreau

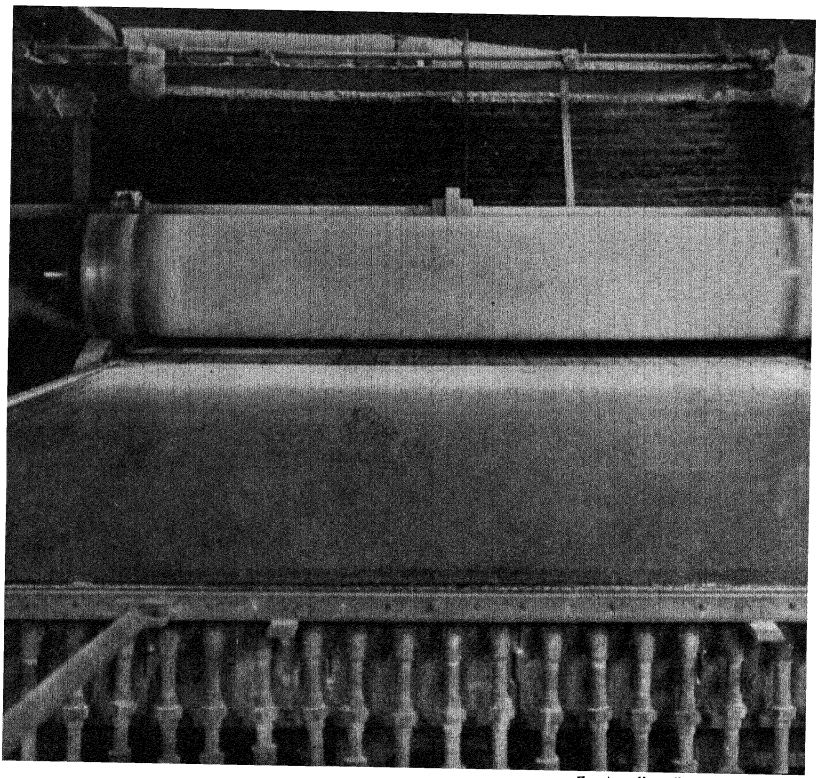
Block marble, which has been taken down from the mountains in Vermont and is now ready for shipment.

York, Georgia, and Tennessee are the leading producers of marble in the East; California and Colorado, in the West. The finest marble in the world comes from Carrara, Italy.

Slate is clay, hardened by heat and pressure in early geological periods. It splits into big sheets and is easily shaped to the desired size. Sometimes, so that it will be even in color, the slate is dyed. Most of the blackboards used in schools are made of slate. Slate is used also in making sinks, roofs, mantels, and floors, and for numerous other building purposes. It is quarried along the eastern coast, from Maine southward to Georgia. The greater part of our commercial slate comes from Maine and Pennsylvania.

Glass. The ancient Egyptians left behind them enough samples and records to prove that early in history glass-making was a well-known art. Later the Greeks and the Romans used glass. During the Dark Ages the Venetians gained the leadership in glassmaking and held it for centuries.

In this country, although there were in Colonial times a few scattered glass factories, it was not until after the Revolution that factories were permanently established. The East retained its leadership for some time; but with the introduction



Keystone View Company

Plate glass cooling after being rolled.

of coal, natural gas, and later petroleum as heating agents, the industry spread westward. At present the leading city is Pittsburgh.

Glass is made by heating sand with flux materials like soda, potash, and salt. The sand and other substances, when heated at high temperatures, turn into a molten mass, which, when hardened, becomes glass. Ordinary window glass is made by blowing molten glass into large cylindrical forms, which are then cut, flattened, and reduced to window-glass sizes. Plate glass is formed in large flat molds from the melted glass, then smoothed by large rollers, ground into the right thickness by rough wheels, and finally polished. In the making of bottles, the glass, while still soft, is blown or pressed into molds by machines. Cut glass is a specially mixed glass on which designs have been cut with special devices. Imitation cut glass is made by pressing soft glass into molds. Specialized forms and costly items are still done by professional glass blowers.

TEXT QUESTIONS

1. Why was not cement used more in Colonial times?
2. Why is it called Portland cement?
3. From what materials is our common cement made? How is it made?
4. Why is it desirable to make cement near large cities?
5. Prove that the art of making clay vessels was well known in ancient times.
6. Why is porcelain in great demand?
7. Where are clay building-materials usually made? Why?
8. Locate our most important pottery centers.
9. Explain the growing use of stone in buildings in the United States.
10. For what purposes are the greatest amounts of stone used?
11. Name the principal building stones.
12. Locate the leading centers of stone production.
13. How is most of the limestone in our country used?
14. Why is limestone important to the iron and steel industry?
15. For what is marble used? Where is the best marble quarried?
16. Why is it desirable to transport stone by water when possible?
17. What is slate? How is it used?
18. Show that glassmaking is an ancient art.
19. Describe the various kinds of glass, their uses, and the methods of their manufacture.

SECTION 4—MISCELLANEOUS NONMETALLIC MINERALS

Fertilizers. The most important plant foods of which the soil is robbed by growing crops are phosphorus, nitrogen, and potassium. In one form or another, these appear in all fertilizers prepared for restoring richness to the soil. The United States, rich only in the phosphates, which supply phosphorus, is obliged to import nitrates, which give us nitrogen, and potash, which furnishes potassium.

The fertilizer industry, which is located on our eastern coast, can easily obtain the bulky raw materials from their sources, either domestic or foreign. The eastern farm lands, being older and more impoverished than those of the West, need fertilizer more than do those of the West and consequently form the principal market for it.

Nitrates. The nitrogen of commercial fertilizers is obtained from the large beds of nitrates in Chile; from the refuse of meat-packing and fish-canning factories; from garbage; from ammonia, a by-product of the coke industry; and from the air itself. Although there are a few scattered deposits of nitrates in some of our dry western states, most of our mineral nitrate supply comes from South America.

Great amounts of nitrates are obtained artificially from the air. The process of obtaining nitrogen from the air requires a large amount of cheap electrical power. One function of the great Muscle Shoals Power Plant in Alabama is to give us cheap nitrates from the air.

Potash. The potassium of commercial fertilizers comes mostly from deposits of potash. The largest of these deposits is in Germany, which now furnishes over eighty per cent of the potash supply of the world. There is a deposit in Alsace also.

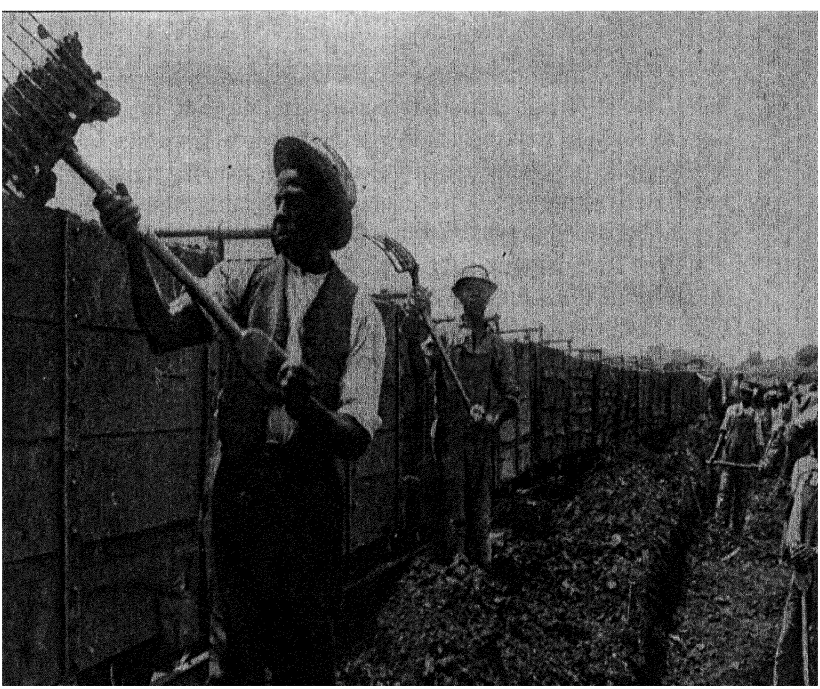
During the World War our supply of German potash was cut off, and in this emergency we were forced to develop the production of potash in this country. Potash was obtained from the salt lakes in Utah, California, and Nebraska. It was also made from the kelp, or seaweed, found along our sea

shores. A large deposit of potash was found in Texas, deep under the surface of the ground. After the war, however, Germany again gained practically a monopoly on the production of this product, because she could supply it more cheaply than any other country.

Recently, large deposits of potash have been found in southeastern New Mexico and in the salts of the Dead Sea, in Palestine.

Phosphates. The phosphorus of commercial fertilizers comes from the various mineral phosphates. These occur in fossil rock formations, in the bones of slaughtered animals, and in the basic slag from blast furnaces. By far, the greater amount comes from the phosphate rocks found in Florida, Tennessee, and in some western states. Florida supplies over forty per cent of all the phosphates used in the world, and more than twice as much as do all the other states of this country together.

Loading phosphate on freight cars.
Keystone View Company



Europe obtains some of her phosphates from deposits in Africa and also from basic slag, a by-product of the iron industry. So rich are we in phosphates that we have sufficient for our domestic demands and also for large exports to Europe.

Salt. Because salt is a necessity of life, it has always been a valuable mineral. Down through the centuries it has been an article of commerce. Fortunately for the human race, it occurs in abundance and is comparatively easy to obtain. Some is mined under the ground. Large deposits of rock salt are found in Germany, Spain, England, and India. In some places salt is procured by evaporating sea water.

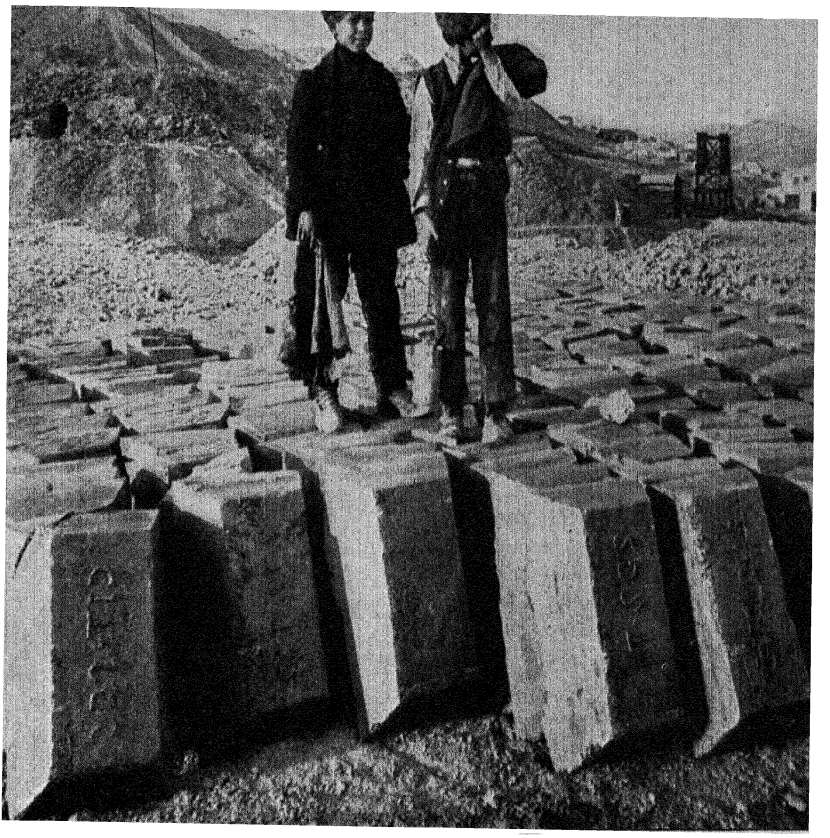
In our country a large part of the supply is obtained by sinking pipes, similar to those used in oil wells. Fresh water is poured down these wells; and after the salt has dissolved, the water is pumped up. The water is then evaporated so that the salt can be obtained from it. Salt is valuable not only as a food product but also for extensive use in manufacturing, in dairying, and as a preservative. Large salt works are located in New York, Michigan, Ohio, California, and Utah.

Graphite. Graphite is known also as plumbago and black lead. It is a form of carbon. It is used as a lubricant, in making crucibles, in stove polish, in glazing powders, in paints, in lead pencils, for electrical purposes, and for foundry linings.

Formerly, lead pencils were made from lead, but graphite has displaced it. Graphite for use in lead pencils must be not only free from impurities and grit but also soft. It is mixed with clay and baked to give it the proper degree of hardness. Crucibles are made in the same way.

Graphite occurs in widely scattered areas of the earth. A large amount of the ordinary grade of graphite comes from Ceylon. New York and Pennsylvania lead in production in this country. Graphite of high grade and suitable for use in lead pencils comes from Siberia. Artificial graphite of a very high grade is made at Niagara Falls, New York.

Sulphur. Sulphur occurs in a natural state in Europe, Japan, South America, and the United States. For many



Keystone View Company

Sulphur partially refined in Sicily.

years Sicily was the chief sulphur producer of the world, but the leadership has passed to the United States. At present Louisiana and Texas furnish more than eighty per cent of the supply of the world.

In Sicily, the sulphur ore is heated to a point at which the pure sulphur runs out. The sulphur then hardens into lumps as it cools. In Louisiana and Texas the underground deposits are reached by sunken wells, into which are pumped hot water and steam, which melt the sulphur. The sulphur is forced by pressure to the surface and is then reduced once more to a solid by evaporation and cooling.

Sulphur is used as a disinfectant, for matches, for gunpowder, as a bleaching agent, in the rubber industry, and in the paper-making industry, which uses the greatest amount of sulphur produced.

TEXT QUESTIONS

1. Of what plant foods is the soil often robbed by agricultural processes?
2. In what plant food is the United States rich? Which plant foods does this country lack?
3. Why is the fertilizer business located near the eastern coast of our country?
4. What are the sources of nitrates?
5. What are our sources of potash?
6. From what states do we get our phosphates?
7. Discuss the United States' exports and imports of nitrates, potash, and phosphates.
8. How is salt obtained? Where is it found in sufficient quantities to be mined commercially?
9. What is graphite? What is it used for? Where is it found? Where is it manufactured?
10. Where is sulphur found? What is it used for? How is it obtained?
11. What industry depends heavily on sulphur?

PROBLEMS AND PROJECTS

1. Make an outline map of the United States showing the principal coal fields.
2. Make an outline map of the world showing the principal oil fields, and one of the United States showing its oil fields.
3. Collect pictures of coal in different stages.
4. Collect a number of pictures showing oil fields, oil wells, pipe lines, etc.
5. Estimate the number of square feet of glass used in your house; in your schoolhouse.
6. Obtain samples of the various grades and kinds of coal and be able to tell what each is used for.
7. Collect samples of various kinds of glass. What is each kind used for? How is it made?
8. Make a list of the sizes of anthracite, or hard coal. What is each size best suited for?
9. Why are the smallest pieces of hard coal the cheapest?
10. Where is the commercial coal field nearest your locality? Does your local supply of coal come from there? Why?
11. List as many by-products of coal as possible.

12. List as many by-products of petroleum as you can. What ones are in common use in your community?
13. What articles in common use about you are made of slate?
14. What stone is the most used in your vicinity for building purposes? Why?
15. How is crushed rock used in your vicinity? List its uses.
16. How can you help to conserve coal in the heating of your house?
17. Describe each of the principal building stones, and give its advantages and disadvantages.
18. Explain how roads are made of crushed stone.
19. Explain how bricks are made.
20. Why are most European buildings made of stone?
21. What kind of gasoline does your father use in his automobile? Why? What kind of lubricating oil is the best? Why?
22. How are coal briquettes made? Why are they used?
23. List the various ways in which coal is wasted, and suggest a remedy for each.
24. Collect stories of the early use of coal in the world; in the United States.
25. Compare coal and coke as heating agents.
26. Contrast the methods used in coal mining and the methods used in quarrying stone.
27. Explain how fine chinaware is made.
28. What is hydraulic cement?
29. Explain how the World War caused a shortage of potash.
30. Why are heavy building materials transported by water when that method is possible?
31. Explain how a gasoline engine works.
32. Explain how a Diesel engine works.
33. What commercial fertilizers are used most in your vicinity? Why?

TOPICS

1. Wastes in oil production.
2. The crushed-rock industry.
3. The building-stone industry.
4. The speculative features of oil production.
5. Social conditions in the coal-mining regions.
6. The miners' side of a coal strike.
7. The mine operators' side of a coal strike.

8. The need for cheap fertilizers.
9. Clay products of the past and the present.
10. Refineries and refining processes.
11. Petroleum fields in Asia Minor.
12. The coal-mining situation in England today.
13. The influence of the "good-roads" movement on the production of cement.
14. Mechanical coal-stokers and their operation.
15. England's interest in the oil fields of Iran and Iraq.

FOR CLASS DISCUSSION

1. The Government should own and control our coal mines and oil wells.
2. Good roads pay in the long run.
3. As a national resource, our coal reserves are more important than our petroleum reserves.
4. The last coal strike was justifiable.
5. Competition among gasoline filling stations is beneficial to the public.
6. The petroleum industry and the public would benefit if the petroleum industry were controlled by one big company.
7. Our supply of fertilizers should be conserved.
8. Price fixing in the petroleum industry is justified.
9. The Government should establish quotas in the various oil fields and thereby limit production.
10. In a few years the scarcity of gasoline will seriously cripple the automobile industry.
11. Coal is preferable to oil for the purpose of heating homes in the northern part of the United States.
12. We should stop exporting large quantities of petroleum in order to conserve petroleum for our future use.

CHAPTER XVIII

METALLIC MINERALS

SECTION 1—IRON

History of Iron. Few iron articles are found in the ruins of olden times, but their absence does not prove that the use of iron was unknown to the ancients. The fact that iron rusts away when exposed to the air, even in dry climates, probably accounts for the scarcity of iron articles in ruins. That iron was in common use in the period preceding written history is proved by the many references to it in our first written records. The Bible refers to iron often, pointing to its common use by the ancient Hebrews. Early in Genesis, reference is made to Tubal-cain, a worker in iron and brass.

Although the production of iron and steel has been carried on in limited quantities down through the centuries, it was not until the discovery of the power of steam and the invention of the steam engine by Watt that the production of iron and steel became of primary importance. The amount of iron produced during the last century makes the total production up to that time seem negligible in comparison. The prosperity of a region may often be measured by its demand for iron and iron products.

Growth of the Iron Industry in the United States. The Indians of America evidently did not understand the use of iron before the arrival of the Europeans. In 1585, records show, the colony of Sir Walter Raleigh discovered iron ore on Roanoke Island. As early as 1608 iron ore was shipped to England from Virginia.

The first iron works in America were established in 1643 by Governor Winthrop at Lynn, Massachusetts, the iron ore being obtained from the banks of neighboring ponds and rivers. This foundry prospered, and later others sprang up in other colonies. England, to aid her ironmasters at home, greatly hindered the manufacture of iron in America by pass-

ing restrictive laws that limited the output chiefly to pig iron. Only a few plants were permitted to manufacture finished products.

After the Revolutionary War the iron and steel industry in this country began to expand more rapidly; and many small local foundries, using principally charcoal as a heating agent, sprang into being. After 1844, because of the use of hard coal, a concentration of ironmaking developed in the anthracite fields of eastern Pennsylvania. In a short time, however, the industry became centered near the coke fields of western Pennsylvania, because of a change in the reducing agent from hard coal to coke. This district held the leadership in the manufacture of iron and steel for many years, even though ore of the Lake Superior region began to be the principal basis of iron and steel; it was cheaper to take the ore to the coal and coke fields of Pennsylvania than to carry the coal to the ore.

The iron industry has gradually spread westward and northward to cities on the Great Lakes, where the ore and the coal meet. Birmingham, Alabama, also has become a center for this industry, being especially favored by the presence of iron ore, coal, and limestone, the last of which is used in iron smelting.

Iron Ores. Pure iron is found only in meteorites, or "shooting stars," which have fallen from the skies. It occurs in many combinations with other minerals and rocks, and, wherever present, gives to the soil a red, yellow, or brown color. When found in combination with other minerals, it is called iron ore.

In some deposits of iron ore, the proportion of iron is as great as seventy per cent; in others, the quantity of iron is small. Most of our iron ores in this country run, in iron content, between forty per cent and sixty per cent. If there is less than twenty-five per cent of iron in a deposit, mining is unprofitable. To be profitable, an iron deposit should be characterized by the following qualities: A great proportion of iron in its ore; nearness to the market; nearness to coal and limestone, which are required to reduce the iron ore to iron; and not too great a portion of objectionable substances, such as

sulphur and phosphorus, which greatly add to the cost of reducing the ore.

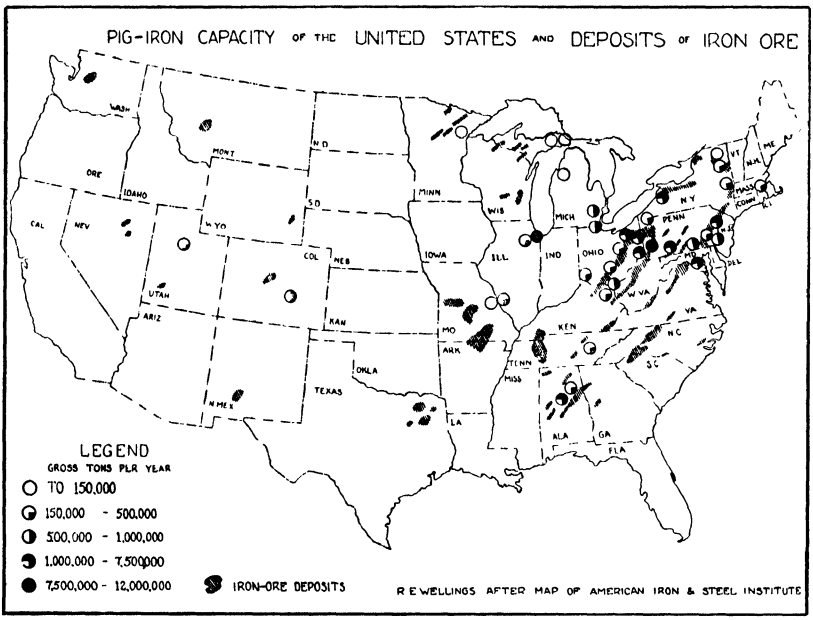
The principal iron ores of commerce are red hematite, which furnishes the largest proportion of our iron; magnetite, which ranks next and is interesting to students because of its magnetic qualities; brown hematite; the carbonates; and spiegeleisen. The quality of iron ore, based chiefly upon the iron content and the presence of certain other substances, determines, in large part, the method to be used in reducing it to iron and steel. Such great strides have been made in smelting methods that many kinds of iron ore that formerly were not commercially profitable are now available for use.

Distribution of Iron-Ore Production. Because of the lack of reliable information, it is very difficult to estimate the extent of the iron-ore reserves of the world. We know that iron ore is widely distributed and that there are vast deposits, but the extent of these deposits cannot be estimated with any degree of accuracy. Explorers constantly discover new supplies.

Conservative estimates of our known deposits tell us that, at the present rate of consumption, there is enough iron ore to last for hundreds of years. According to the best authorities, the leading ore deposits now lie in the United States.

The regions that lead in actual ore production are the United States, with over half of the entire world's supply, France, the United Kingdom, Russia, Sweden, and Spain. The last two countries are chiefly exporters to countries with a more liberal supply of coal.

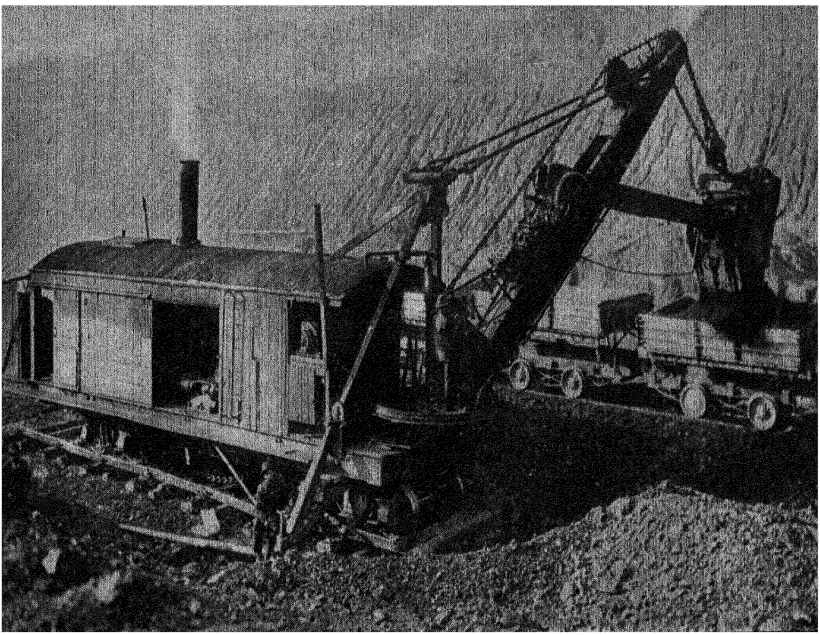
In the United States, there are two important iron-ore regions. The first is the Lake Superior region, which includes parts of the states of Minnesota, Michigan, and Wisconsin, and is the leading ore section not only of our country but also of the entire world. The Minnesota deposit is known as the Mesabi Range, and the Wisconsin-Michigan deposit, as the Gogebic Range. This section produces more than eighty per cent of the iron ore mined in this country. Minnesota alone, which produces more than sixty per cent of our whole supply, leads all other states combined and is followed by Michigan, which holds second place in the quantity mined.



The second region, located in the Appalachian Mountains, runs northward from Alabama, which produces over eight per cent of our supply and ranks third among the states, to Pennsylvania, New Jersey, and New York. New York and New Jersey now furnish comparatively small percentages of the national production.

Methods of Mining Iron Ore. Iron ore is mined in three ways. In Europe and in some parts of this country where the iron ore is deep underground, the *shaft method* is used. This method resembles the shaft mining of coal except that there is not, as in coal mining, any danger from gas. Some of the mines in the Gogebic Range in Wisconsin and Michigan are of this kind.

In the Lake Superior region, where the ore lies near the surface, the *open-pit method* is generally used. By this process the surface earth is removed by steam shovels and loaded into cars, which carry it away to be dumped. Large shelves are then cut into the ore bed, and the same steam shovels



Ewing Galloway

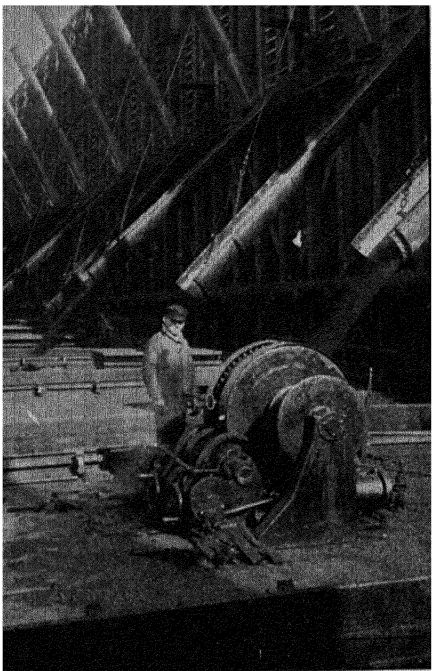
Mining iron ore with a steam shovel in northern Minnesota.

scoop up the iron ore in huge clamshell buckets and drop it into waiting cars, which run on temporary tracks down to the shovels. The work continues during the day and the night; and cars containing huge loads of ore daily move from the open pits to the shore of Lake Superior.

The third method is called *milling*. The top layer of earth is removed, and tunnels are run in under the ore beds. The miners shovel the ore through large openings into the tunnels. Waiting ore cars haul the ore through the tunnels to the grade of the railroad.

Transportation of Iron Ore. Efficient and relatively cheap transportation is necessary in successful iron-ore production. In the United States, we are fortunate in that our best iron-ore deposits (those of the Lake Superior region) are so located that the Great Lakes form a natural highway for carrying the ore to the coal.

At the port of Duluth, Minnesota, are built great ore piers that stretch far out into Lake Superior. On these piers are set up the most modern devices for handling the ore by machinery. The ore is dumped into large pockets. From these



Keystone View Company

Loading an ore ship at Duluth.

pockets, the ore is drawn, by means of gravity, down chutes into boats built especially for carrying ore. In a short time an ore boat capable of carrying thousands of tons of ore is filled. These boats carry the ore down through the Soo Canals to lake ports in Wisconsin, Indiana, Illinois, Ohio, and Pennsylvania. At these ports the boats are emptied by giant cranes.

The ore is put into canal boats or ore cars and is taken inland to the cities where it is to be smelted into iron. Often the iron and steel plants are located on the lake shore, and the coal is brought to them. Loading and unloading are done by machinery, human labor being almost eliminated. Water transportation, because of its relative cheapness, is preferred to transportation by railroad. This accounts for the large volume of ore and coal traffic on our Great Lakes, connecting canals, and the Ohio River.

Location of the Iron and Steel Industry. The iron and steel industry is located in the countries in which the following factors favor production: (1) abundance of smelting materials, such as coal and limestone; (2) abundance of labor; (3) nearness to markets; (4) good and cheap transportation facilities; (5) presence of sufficient capital to maintain large plants; and (6) easy access to iron ore.

Since 1894 the United States has held the lead in iron and steel production, now furnishing one third of the pig iron of all the world. The other leading regions in iron production are Germany, Russia, the United Kingdom, France, Belgium, and Luxemburg. The combined production of these regions makes up about eighty-five per cent of the world's production, the remaining fifteen per cent being scattered among several

other countries. The combined iron and steel production of Asia, Africa, Australia, and South America is less in quantity than that of the city of Pittsburgh.

In the United States, iron and steel plants are found chiefly in Pennsylvania, in other states that border the Great Lakes, and in Alabama. For years Pennsylvania has led all the other states because of her wealth in good bituminous coal for coking and the presence of limestone close by. In recent years there has been a tendency to locate new iron and steel foundries along the shores of the Great Lakes, where the ore from the Lake Superior region is unloaded. The coal and limestone are brought to these plants. The iron and steel industry has recently been growing rapidly around Birmingham, Alabama, because there iron ore, limestone, and coal are all near by.

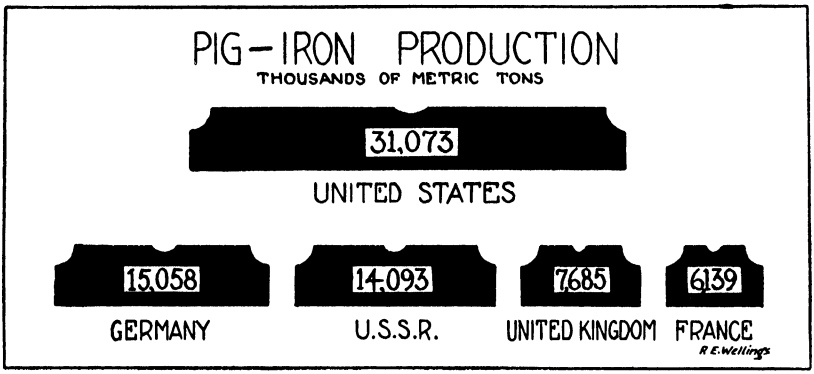
Iron Smelting. All iron ore is smelted, or reduced to iron, in blast furnaces. These blast furnaces are huge vertical cylinders, lined with several feet of fire bricks and bound with iron plates. At the top, eighty to one hundred feet from the ground, are devices that make it possible not only to feed into the furnace coke, iron ore, and limestone, the materials used in smelting, but also to prevent the gases from escaping.

At the bottom of the furnace is the hearth, on which the molten iron collects. A few feet up are placed large pipes that provide a forced draft of superheated air to make the coke burn at a high temperature.

Coke is used to generate heat under a forced draft of air; limestone fluxes the impurities; and together they form a slag, which floats on the heavier molten iron at the bottom.

When sufficient iron has accumulated in the hearth, the slag is first drawn off through a special opening and run into ladles mounted on wheels. It is cooled and later broken up, crushed, and used in cement, as road-making material, and in fertilizer.

The iron is drawn off through a special opening at the bottom of the furnace after the clay plug has been broken. It runs down through a sand channel to molds made in sand. These molds branch off the main channels; and the iron, when cooled, is called *pig iron* because the mold pattern looks like a litter of pigs.



In larger plants the white-hot liquid iron is run into large ladles on wheels, and is then poured from them into molds moving on an endless chain. In these molds the iron is cooled by a shower bath of water.

The blast furnaces are kept in operation during the day and the night until they are burnt out, need repairing, or possibly rebuilding. About five casts a day are generally drawn from a blast furnace.

Pig iron is the basis of the iron industry. From it are made other kinds of iron. *Cast iron* is pig iron remelted to a liquid state and then cast into molds of the desired shapes. It breaks easily and cannot be worked by forging, welding, or bending. It is used because it molds easily, is hard, and costs little.

Wrought iron is pig iron from which some impurities have been taken. Because of its quality, it can be bent, forged, welded, drawn out into wire, rolled into bars, and made into other desirable forms.

Steel is purified pig iron from which certain impurities have been taken and to which other substances have been added. It lends itself to all forms of treatment. Because of its strength and its quality of being easily rolled and milled, it is the most used form of iron. *Alloys* are mixtures of steel and other metals.

Commerce in Iron and Steel. We may divide the regions importing iron and steel into three general groups: (1) regions like South America and the East Indies, where there

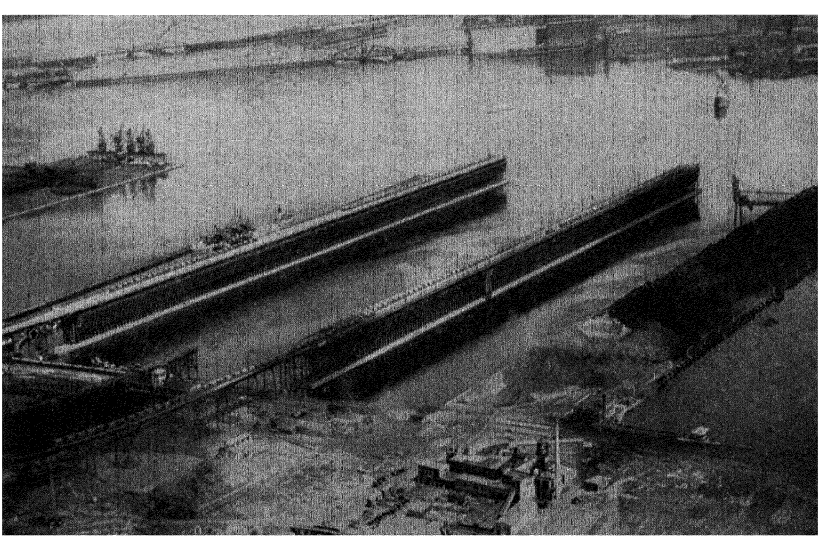
is almost no local production; (2) countries like Canada and Japan, where the growing demands are not met by the domestic supply; and (3) countries like Germany and the United Kingdom, which are also great producers.

The United States ranks fifth among the countries that export iron and steel, although she furnishes more than half of the entire world production. This export trade of the United States forms only about five per cent of our entire production. This small figure is due to a large demand at home, transportation costs, and the competition of European producers. By far, the larger portion of our exports go to regions in North and South America, Canada alone taking about one third of them. Our trade with Cuba, Mexico, and the South American countries is increasing. Our trade with European countries is large in volume although low in percentage of production. Italy has recently increased her trade with us. Japan also imports from the United States.

At present France is the greatest iron-exporting country of the world, but is followed closely by England and Germany. Belgium and Luxemburg, in proportion to their production, are important exporters.

Coal and ore docks at Duluth, Minnesota.

Chamber of Commerce, Duluth



We import some iron ore from Newfoundland, Sweden, Cuba, and Brazil. Most of our imports of iron and steel are composed of pig iron, alloys, and crude steel.

TEXT QUESTIONS

1. Why are there not more iron relics of the past?
2. Prove that iron did exist in ancient times.
3. What invention greatly increased iron manufacturing? Why?
4. Discuss the growth of the iron industry in the United States.
5. Name the different iron ores.
6. What qualities make iron ore good or bad?
7. What regions lead in iron-ore production in the world? in the United States?
8. Describe the methods of mining iron ores.
9. Describe the ways in which iron ore is transported.
10. What factors enter into the location of iron and steel foundries?
11. Where are the leading regions of ironmaking and steelmaking in the world? in the United States? Why are they the leading regions?
12. Why are new steel plants being located near the Great Lakes?
13. Discuss the Birmingham region. What are its favorable points?
14. Discuss the world commerce in iron and steel.

SECTION 2—THE PRECIOUS METALS

Platinum. Although in recent years platinum has become the most costly of commercial metals, it was for many years treated as an inferior metal. Its name, platinum, which means in Spanish "little silver," was given to it when it was discovered in Colombia, South America, more than two hundred years ago. Its rise to its present economic status is due not only to the discovery of its fine qualities but also to its scarcity. It is superior to gold in durability and, because it is scarcer, commands a higher price.

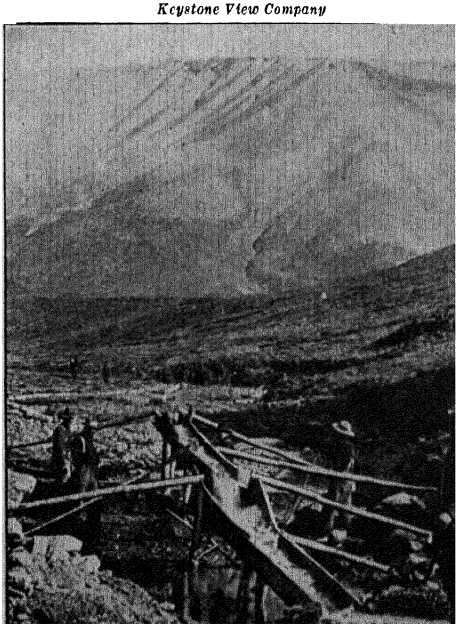
To meet the growing demand for platinum, several explorations to find new deposits have been made, but they were without much success. Platinum does occur in a few sections of our country but in no great amounts. The Ural Mountains in Russia held practically a monopoly on the production of platinum until the World War, when Colombia, where it was first discovered, advanced to the leadership.

Platinum is usually found, in the form of small nuggets and scales, in the gravel of river beds. It is occasionally mined from veins in the same manner as other minerals.

Gold. Ancient records and ruins show us that gold was sought for and used, either as money or for ornamental purposes, in very early times. Down through the centuries there has been a demand for gold, because of its scarcity and properties, and a corresponding effort to supply this demand. The great gold strikes that occurred about the middle of the last century in America and Australia, and later in Africa, were

Gold mining in Alaska in former days.

Keystone View Company



particularly timely in that they supplied the necessary gold for the large amount of money needed to carry on the rapidly increasing world trade.

The leading regions in gold production are the Transvaal (in Africa), Canada, the United States, Russia, and Mexico, although many other countries produce large amounts of gold. The United States produces considerably less than one tenth of the world's supply of gold. Our leading gold-producing regions are California, South Dakota, Colorado, Arizona, Nevada, and Alaska. The annual world production of gold is not great in comparison with that of other commercial products. The gold produced in all the world in a year is less valuable than the anthracite mined in Pennsylvania in the same period. Other factors remaining the same, a constantly increasing store of gold in the world would cause a rise in prices.

Gold mining with electrically driven machines.

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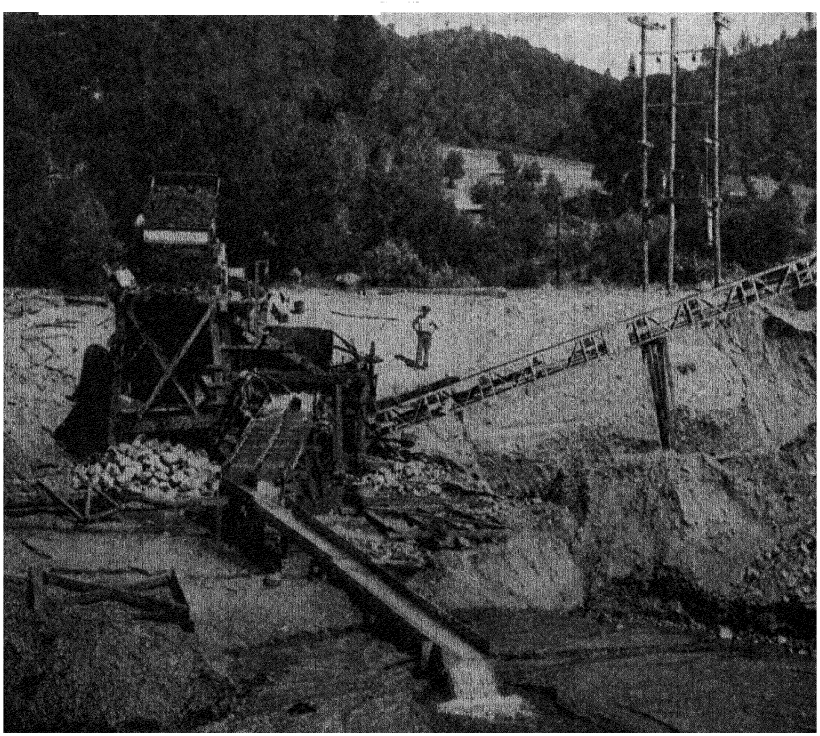
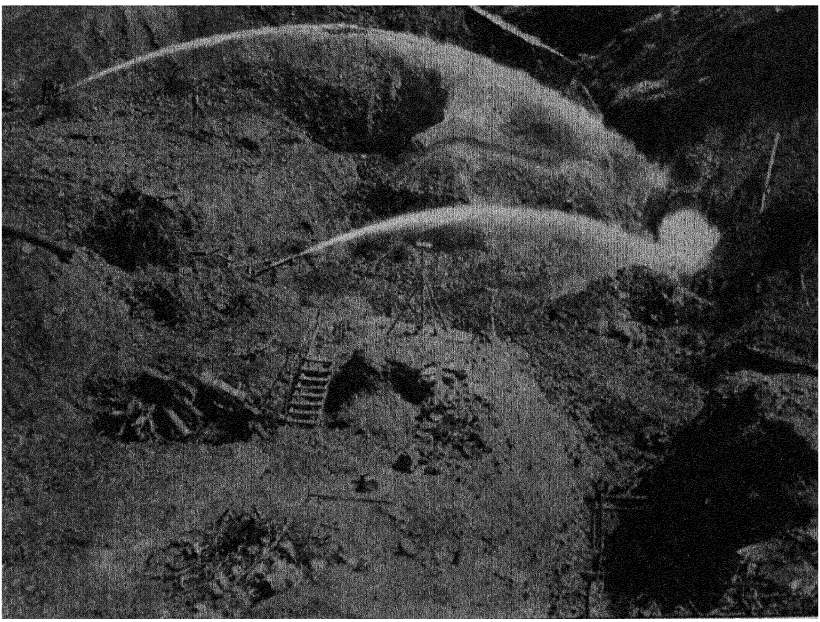




Underwood and Underwood

A gold mine where the gold is washed out by great streams of water.

The annual demand for gold to be made into money takes almost the whole production. Gold is usually used for money because it is valuable, is easy to mint, can be easily carried, serves as a convenient medium of exchange with other types of money, is readily recognized, and furnishes a standard for storing up value for the future. In gold coins some copper is generally used as an alloy because of the softness of pure gold.

Silver. The value of silver in ancient times was equal to that of gold. Because the method of extraction was difficult, it was as rare as gold. That it was well known in the Americas is proved by the quantities taken from the South American tribes by treasure-hunting Spaniards in the sixteenth and seventeenth centuries.

During Colonial times, although its presence here was known, little was mined because of the difficulty of extracting it. It was not until 1859 that silver in large quantities was discovered in the Sierra Nevada Mountains. This discovery led to a rapid expansion of silver mining, especially in Nevada. The most famous deposit was the Comstock lode, which has produced millions of dollars' worth of silver.

The leading silver-producing countries in the world are Mexico, the United States, Canada, and Peru. The states that lead in the production of silver are Idaho, Utah, Montana, Arizona, Colorado, and Nevada. Most of the silver produced today comes from ores containing other metals. Much of the silver of Montana is found in copper ores. In Idaho, lead ores yield most of the silver.

Silver is used in coins, in plating ornaments, in tableware, and in jewelry. Silver was not a standard of value in most of the countries of the world, except in the Orient, until very recently; gold, which is more stable and rare, was much preferred.

TEXT QUESTIONS

1. Explain the high cost of platinum.
2. Where is platinum mined? How is it mined?
3. Has platinum always been a precious metal?
4. Has gold always been in demand?
5. What are the leading regions in gold production?
6. How does the annual world production of gold compare in value with that of the anthracite mined in Pennsylvania in a single year?
7. What characteristics of gold make it a convenient form for use as money?
8. Explain the equality of value of silver and gold in ancient times.
9. How does silver occur? Where is silver mined principally?
10. How does silver compare with gold as a standard of value?
11. Why are these metals called the precious metals?

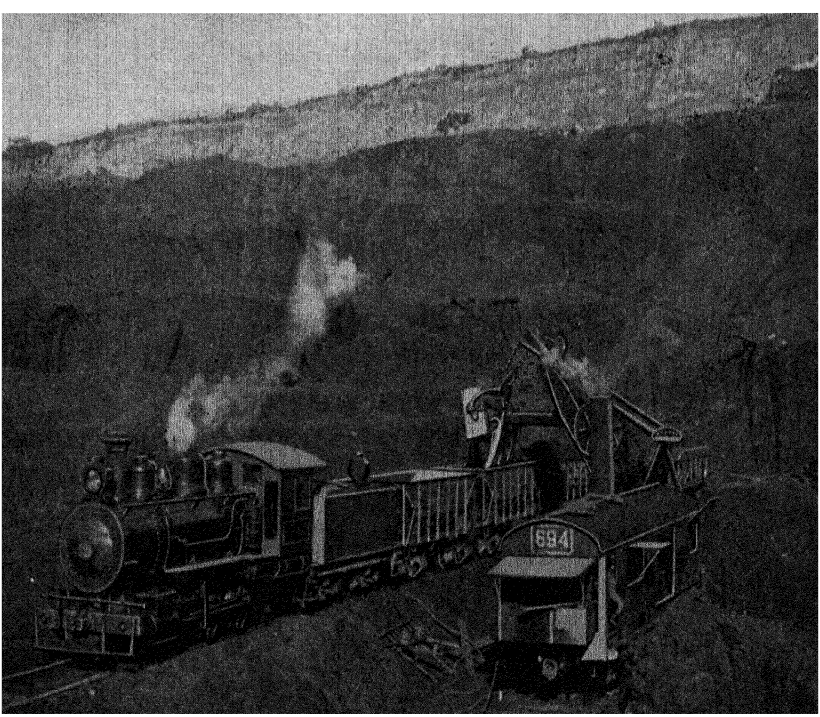
SECTION 3—MISCELLANEOUS METALS

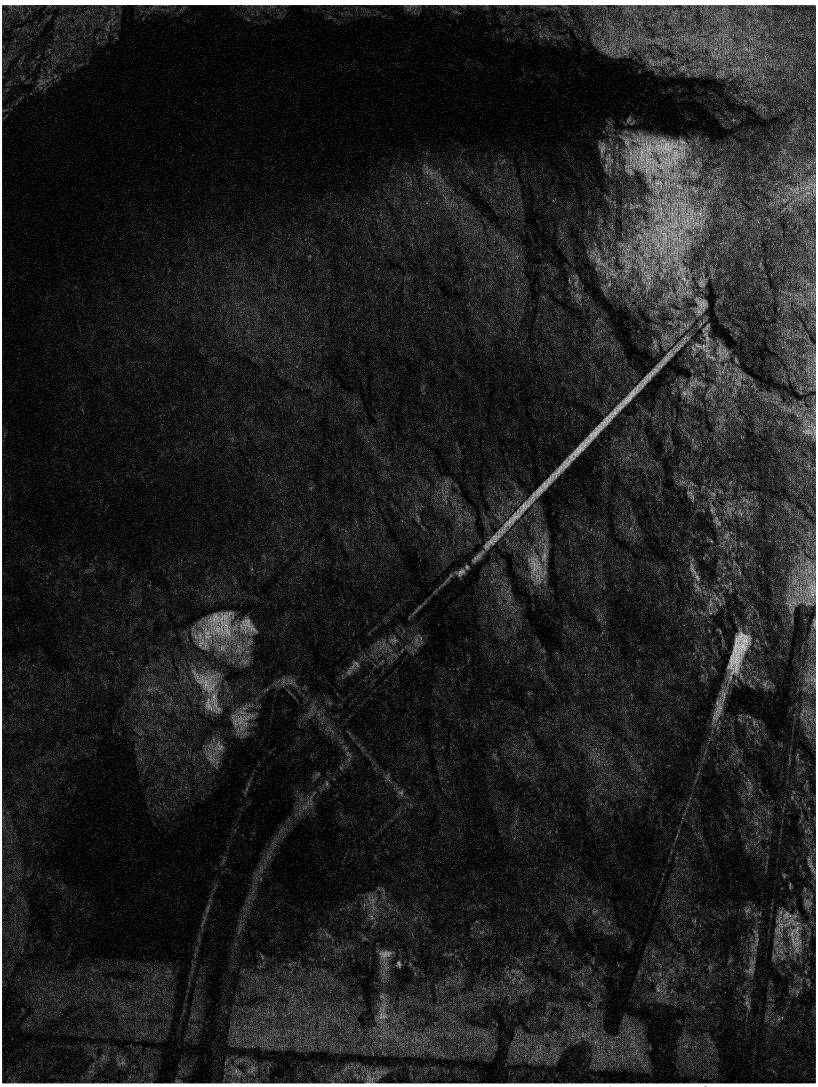
Copper. Copper was one of the first metals known to man. Numerous relics of copper and of bronze, the latter an alloy of copper and tin, were found in ancient ruins in Europe and in America. Practically all the tools used in building the Egyptian pyramids were of copper or bronze. Utensils and weapons found in the dwellings of early mound builders of North America were made of copper. The Indians, as is shown by their arrowheads, were acquainted with the use of copper.

Early man used copper before any other metal because, when found in a pure state, it needs no refining and, without even being heated, can be hammered and easily shaped.

An open-pit copper mine.

Keystone View Company





Anaconda Copper Mining Company

A miner using a drill in a deep mine in Montana.

About the middle of the nineteenth century, discoveries of great copper deposits in Michigan greatly spurred copper production. Later, discoveries near Butte, Montana, resulted in the lead passing to this region. Arizona then took the lead and has held it since. Utah has come into prominence, because new methods of working her low-grade ores have met with success. The states that now lead in order of impor-

tance in the production of copper are Arizona, Utah, Montana, Nevada, and Michigan.

The United States leads the world in copper production, supplying about one third of the world supply. Copper forms one of our most valuable contributions to world trade. In value it ranks next to iron among the metals, being greater in value than our production of both gold and silver combined.

Other countries that are important in copper production are Chile, Northern Rhodesia, Canada, Belgian Congo, and Japan. In Europe, Russia now leads in copper production.

We import much copper, principally in the form of copper ore, from countries that have little or no coal for smelting purposes. Near the city of Tacoma, Washington, is located the famous "Tacoma Smelter" to which ships bring copper ore from Alaska, Chile, and other lands bordering on the Pacific Ocean. The imports are encouraged by the demand for bulk freights on returning steamers from these countries.

Nearness to the ocean ports and the coal supply are among the reasons why so many of our copper refineries are located in the eastern section of our country.

Our principal customers, to whom we export, are Germany, England, and France, in order of importance.

The increased use of electricity greatly stimulated the production of copper, because copper seems to be the most practical metal for electrical use. The use of copper in automobile construction and in building construction also has created a large demand for copper.

Science is constantly finding new uses for copper, in boilers, electric refrigerators, radio accessories, and washing machines. The mixing of copper with zinc to make brass, with tin to make bronze, and with aluminum to make aluminum bronze also creates a constantly enlarging demand that must be met by increased and cheaper production. For centuries copper has been used for small coins, such as the English penny and the American cent.

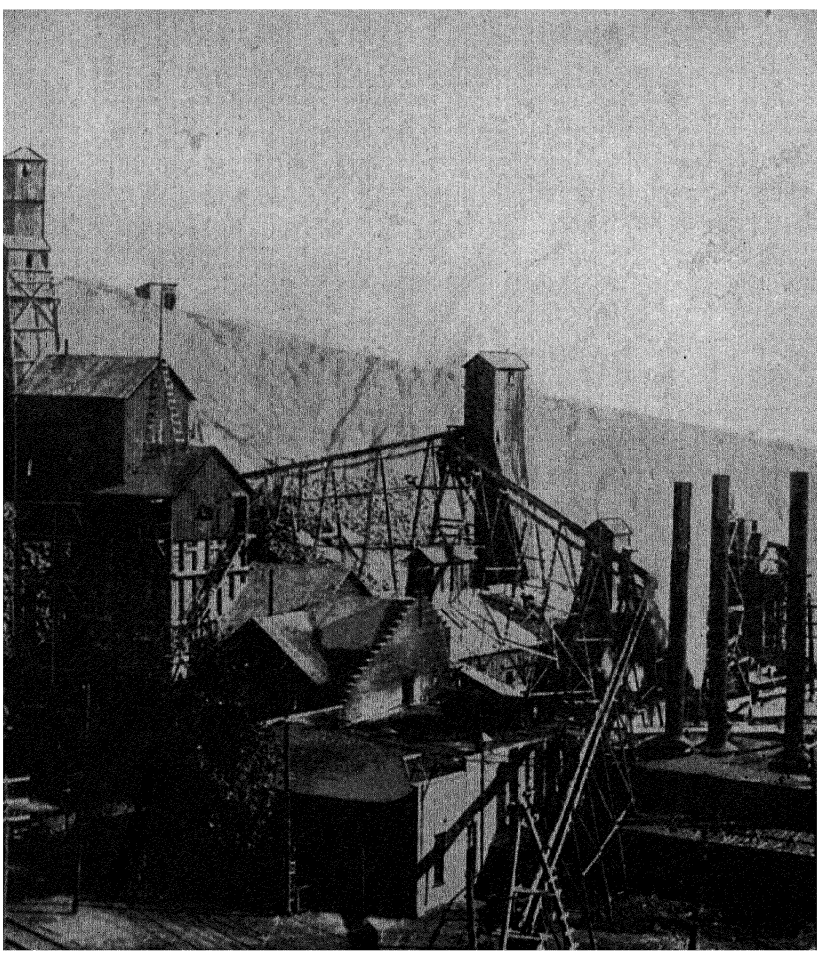
Lead. Early records make it clear that lead was used by the ancients in covering the bottom of ships and in making money, water pipes, and paint. Some lead mining was carried

on among the early colonists in this country, because lead was particularly valuable to them for molding bullets and making pewter dishes.

Great deposits of ore containing large quantities of lead were found along the Mississippi Valley, and soon Missouri took first place in lead mining and has held it ever since. Other important lead-producing states are Idaho, Utah, and

A zinc and lead mine, Joplin, Missouri.

Keystone View Company



Oklahoma. The important lead-producing countries are the United States, Australia, Mexico, and Canada.

Lead rarely occurs in a pure state, generally being extracted from an ore called *galena*. It is used much in the making of paint; by plumbers, in the form of pipes and fittings; and in weights, shot, bullets, and printers' type.

Zinc. Zinc, as a separate metal, was probably not generally known, except possibly in China, until the eighteenth century. The brass of ancient times was probably made from copper and ores containing zinc. The systematic production of zinc in this country dates from the latter part of the nineteenth century.

The United States produces about one third of the world's supply. Oklahoma is the leading state in zinc production, followed in order by New Jersey, Kansas, Montana, and Idaho. Several European countries, principally Belgium and Germany, produce zinc. Canada also ranks high as a zinc producer. England and France are our best customers, England taking almost fifty per cent of our export. We import zinc from Mexico.

Zinc can be combined with copper to make brass. It is much used also in making galvanized iron, which is iron coated with zinc by electricity. Zinc plates are used in making illustrations for books and newspapers. Zinc is also an important base for zinc paints.

Tin. Remains of tin utensils have been found in the ruins left by the Swiss Lake Dwellers, who lived thousands of years ago. The Phoenicians sought out and brought back with them tin from the mines in Cornwall, England. Tin, probably from the same source, found its way into Rome.

Tin occurs in only a few regions. It is found, like gold, in placer mines and also in rock and ore veins.

The mines of England furnished tin for centuries, but at present most of the world's supply now comes from southeastern Asia and the Straits Settlements.

Tin is valuable because it can be plated over iron and thus forms a rustproof covering. In the form of tin plate, which

is tin-plated iron, it is the basis of our so-called tin dishes and utensils, tin roofing plates, and tin cans. The supply of tin is limited, and great ingenuity and skill are necessary to use it economically by spreading it as thinly as possible on the iron base.

The United States is almost wholly dependent upon imported tin, as our domestic supply is very small. Since we use more tin than any other country, we are forced to import almost fifty per cent of the entire world production, principally in the form of tin bars, which we later make into tin plate. Most of this tin comes from the Straits Settlements and England.

Aluminum. Aluminum is one of the newest metals in commercial use. Although it is found almost everywhere in the earth, the high cost of extracting it has limited its common use. It is now being extracted from an ore called *bauxite.* In this country bauxite is found in four principal states: Arkansas, Alabama, Georgia, and Tennessee. Arkansas furnishes over eighty per cent of our supply.

As the extraction of aluminum from bauxite requires much power, electricity is used. Aluminum is therefore produced near large water-power sites, principally Niagara Falls, New York; Badin, North Carolina; Alcoa, Tennessee; and Massena, New York. Aluminum is being extracted near water-power sites also in France, Germany, Italy, Norway, and Switzerland.

The processes of extracting aluminum are being constantly improved and cheapened; and with this decrease in cost come more demands for this metal. Aluminum is used extensively in electrical work, especially for high transmission wires, in which its light weight and toughness are desirable. It is being used more and more in automobile construction. It is valuable in airplane and dirigible construction. Railroads are using it to reduce the weight of their equipment. The Navy is finding increasing use for it. Kitchen utensils of aluminum are becoming more and more popular. New alloys of aluminum and other metals increase the demand for aluminum. Certain aluminum salts are used in paints. Aluminum is also

making inroads into the furniture industry. The invention of a process that would enable us to extract aluminum at lesser cost would greatly increase its use and render a real service to industry.

TEXT QUESTIONS

1. Prove that copper was well known in ancient times.
2. Where is copper now mined principally?
3. Why is the United States a large exporter of copper?
4. For what is copper used?
5. For what was lead used in olden times?
6. What is it used for now?
7. Where is lead mined?
8. Where is zinc found? What percentage of the world's production do we supply?
9. For what is zinc used?
10. Where are the chief deposits of tin?
11. Explain the importance of tin to industry.
12. How does the United States rank as a producer of tin?
13. How does our country rank in tin consumption?
14. What has retarded the use of aluminum?
15. Where is aluminum manufactured? Why is it made there?
16. For what is aluminum used? Why?

PROBLEMS AND PROJECTS

1. Make a map of the United States and show where our principal iron deposits are. Locate also the leading iron and steel centers.
2. On an outline map of the world, indicate the regions that produce the various metals.
3. On an outline map of the United States, indicate the regions that produce the various metals.
4. Make a list of all the metals and their principal regions of supply.
5. List the articles made of iron with which you come into contact daily.
6. Collect pictures of the various metals in different stages of production.
7. Collect pictures of the iron industry.
8. Collect as many samples of iron ore as you can and label them.

9. Explain why more iron articles have not come down to us from early times.
10. Make a list of the silver articles in your home.
11. What articles do you use that are made of aluminum?
12. Discuss the different ways in which iron is mined.
13. Draw up a list of articles made of platinum.
14. In what ways do we use lead? zinc? tin?
15. How is iron formed in large deposits? Illustrate.
16. Make a list of iron articles exported.
17. Why did the iron industry spread westward after Revolutionary times?
18. Discuss the advantage of an iron center being near the market.
19. Why has copper become important in industry?
20. Why is platinum not used for money? Why is silver used for this purpose? gold?
21. What is galvanized iron? Describe galvanizing.
22. Draw a diagram of a blast furnace and explain how the furnace operates.
23. Find out what special qualities alloys add to steel.

TOPICS

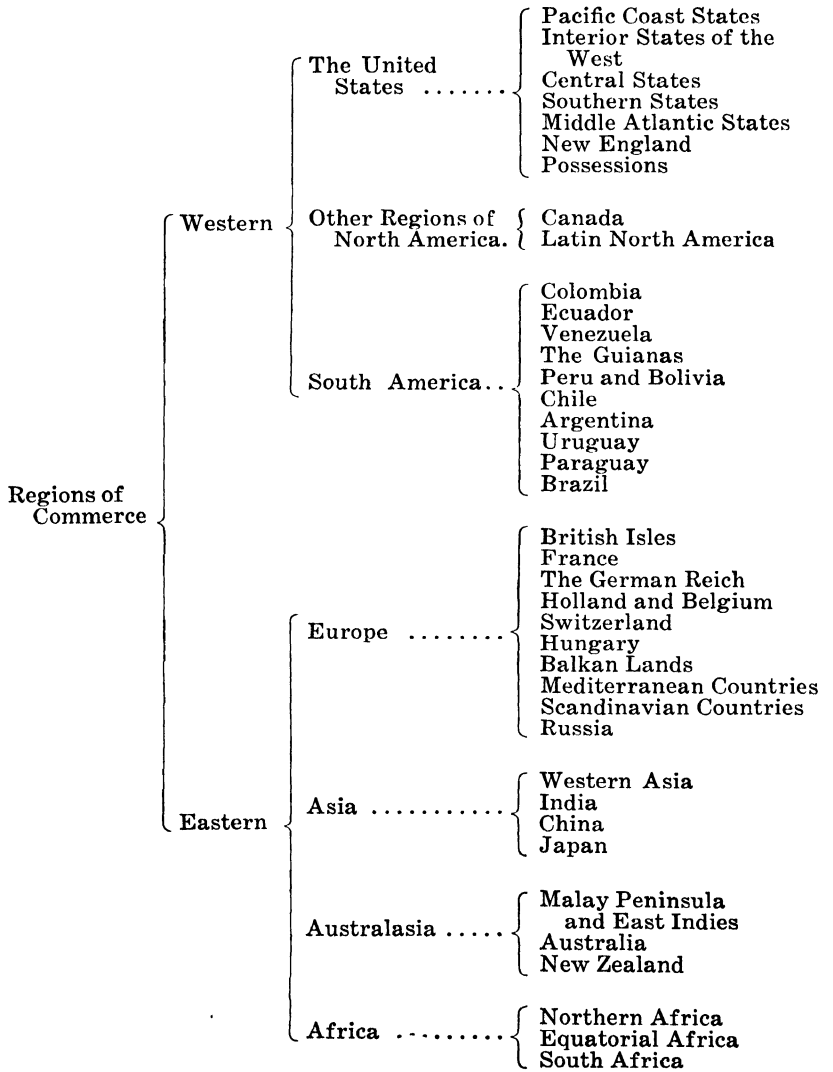
1. Steelmaking in the United States.
2. The history of iron and steel.
3. Copper.
4. Gold.
5. Silver.
6. Platinum.
7. The paint metals.
8. Automobile steels.
9. The South African gold supply.
10. How a steel rail is made.
11. The future of aluminum.
12. The gold rush of 1849.

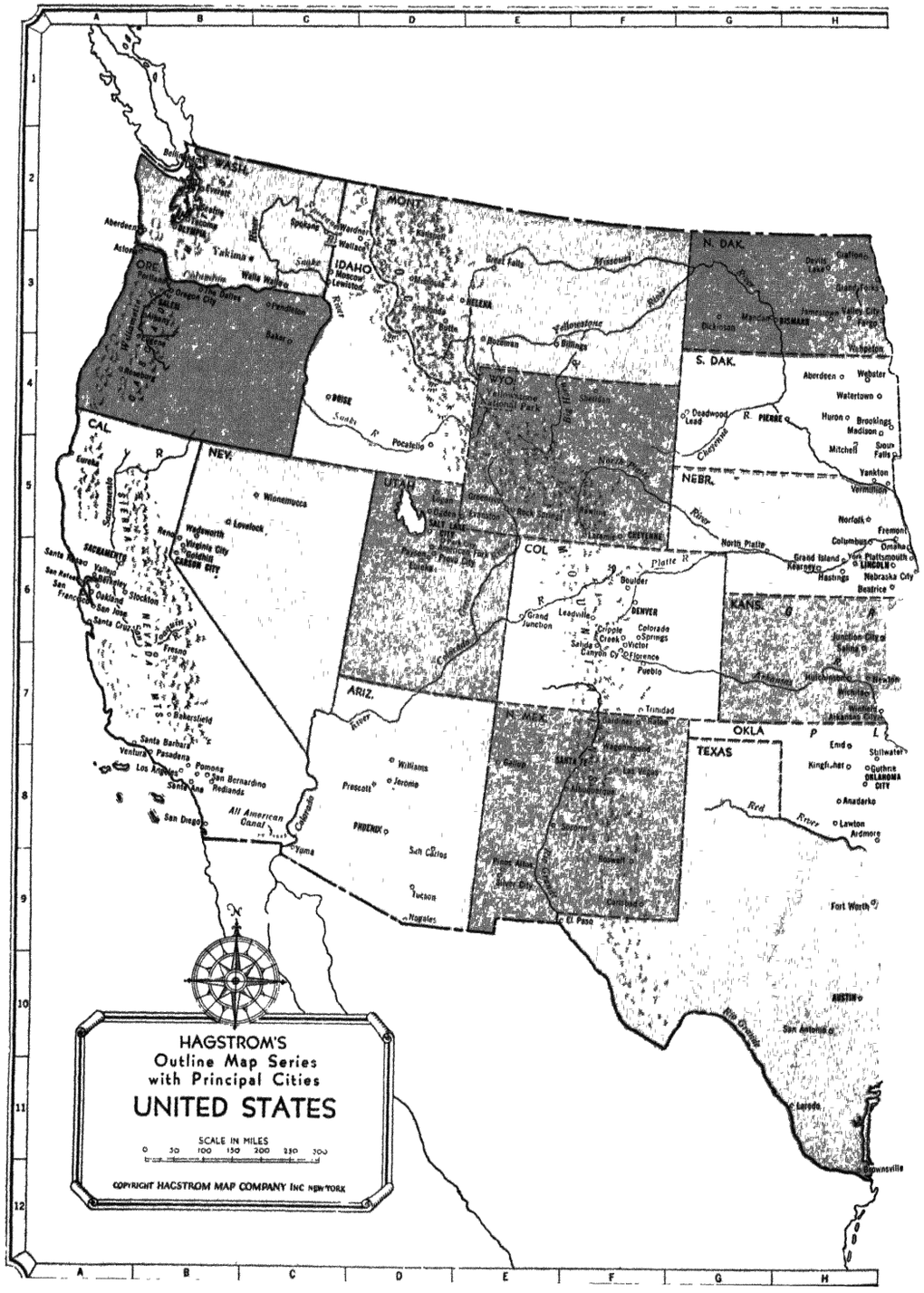
FOR CLASS DISCUSSION

1. Labor conditions in the steel industry should be improved.
2. Copper is more valuable than aluminum.
3. Zinc paints are better than lead paints.

PART III

REGIONS OF COMMERCE

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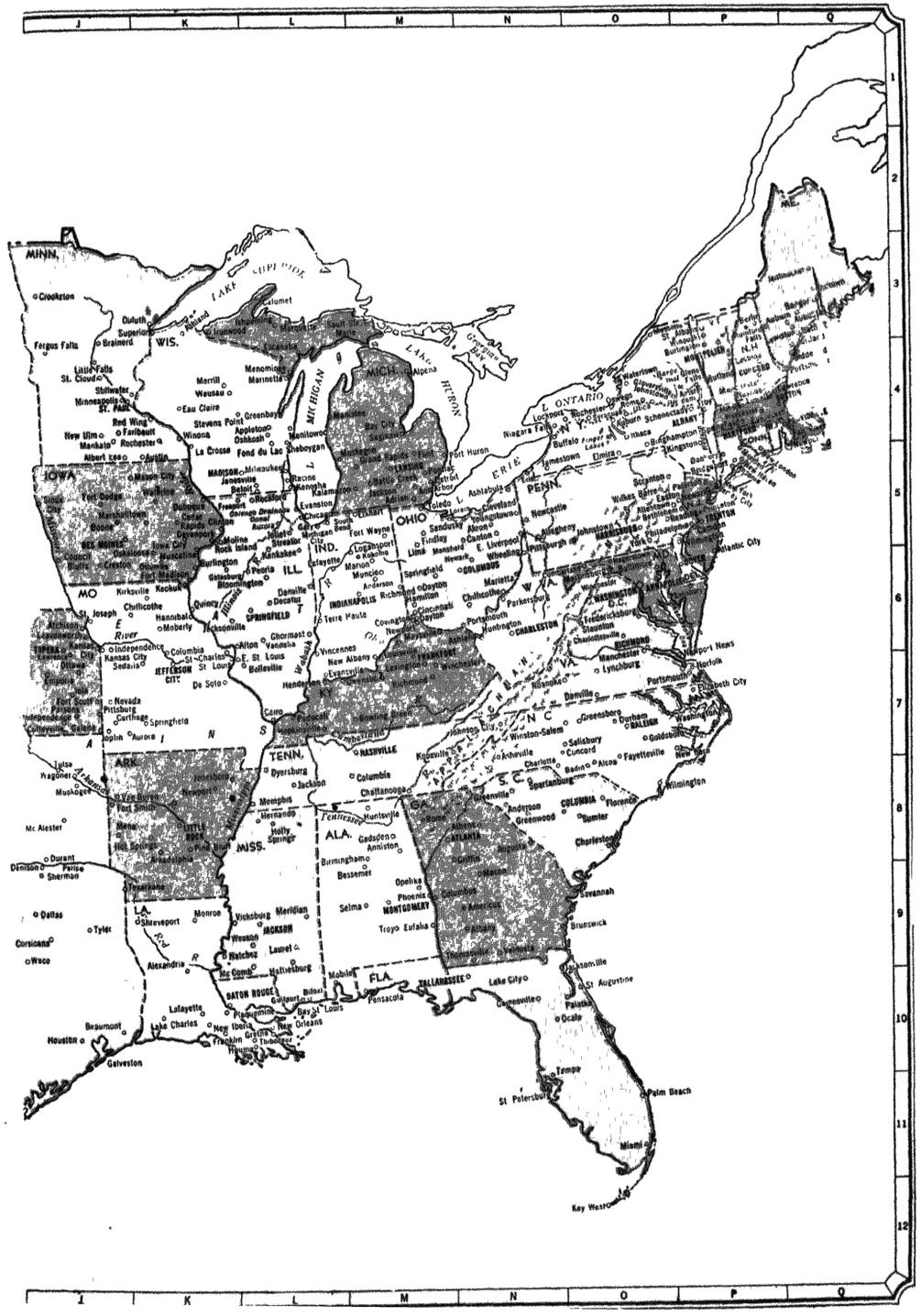
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MASS.
VT.
N. H.
ME.
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
L. ONTARIO
D. C.

CHAPTER XIX

THE UNITED STATES

INTRODUCTION

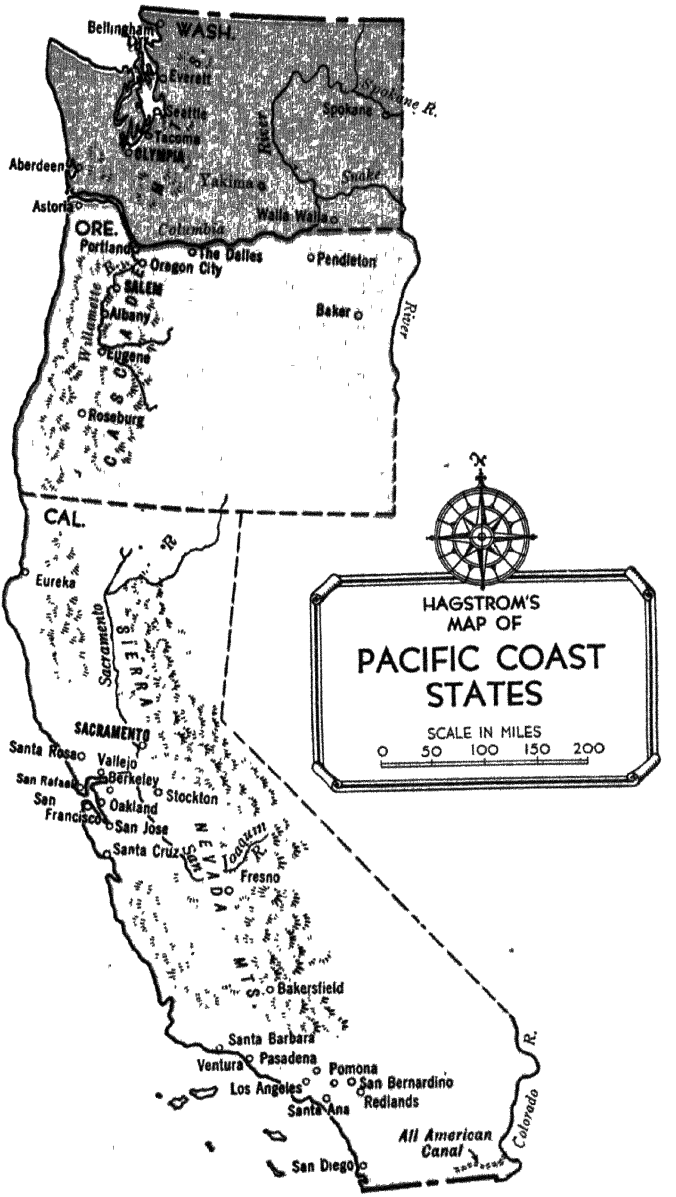
Man is the most important factor in commerce and industry, for he is the cause of all commerce and industry. As he has sought to better his living conditions, he has used the resources of nature to help bring about the satisfaction of his ever-increasing wants.

The raw materials of forests, mines, and farms, and the products of lakes, rivers, and oceans are being turned more and more to man's use. The different regions of the world, with their varied climates, produce many different kinds of raw materials. This difference in products of the various regions is the reason for commerce; the surplus products of one region often help to supply the needs of another region.

In this division of the text we shall study the various commercial regions of the world and the geographic factors that influence man and his ability to produce commodities. We shall begin with a study of the main commercial regions of North America, not only because this continent is the one on which we live, but also because it is one of the most active continents in the production of commodities and in the development of trade.

SECTION 1—THE PACIFIC COAST STATES

In General. Although differing greatly in climate and natural resources, the three Pacific Coast states, Washington, Oregon, and California, may be studied as a single region. Their access to the Pacific Ocean, together with their varied but favorable climates, is an important factor in making them more highly developed than interior western states. Furthermore, these states have two chains of mountains, the Cascades in Washington and Oregon and the Sierra Nevadas in California, valuable for water power, timber, and scenic resources.



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These ranges cause the west slopes to differ greatly from the semiarid portions to the east.

Climate. The various parts of the three Pacific Coast states have widely differing types of climate. Between cool western Washington and Oregon and the hot Imperial Valley in southern California are found several types of temperate, subtropical, and tropical climate.

The Cascade Ranges, running north and south just west of central Washington and central Oregon, join the Sierra Nevadas, running generally north and south near the eastern boundary of California, to divide the three states into two different climatic areas. The moisture-bearing winds blowing eastward from the ocean create, especially in Washington, Oregon, and northern California, an area of heavy and well-distributed rainfall as far east as the crests of these two great mountain ranges. In rising to pass over the mountains, the winds lose most of their moisture on the windward, or western, slopes. As a result the interior country east of the mountains is a semiarid basin, part of it virtually desert. To the southward, in California, the rainfall is mainly of the dry subtropical type, coming in winter and so limited that irrigation is necessary for the successful growing of crops in most of central and southern California.

In the extreme northwest the winters are comparatively warm and the summers cool. The climate there is called marine, and it more nearly duplicates the climate of Great Britain than does that of any other part of Continental United States. In the western part of Washington rain falls during more than one half of the days in the winter months.

The temperature of the interior section of Washington and Oregon shows greater variation than does that of the coastal slope. The summers are warmer and the winters are colder than they are on the coast, although the variations are not so great as they are throughout the Middle West.

Northwestern California, because of the frequent rains brought by the moisture-bearing westerlies, is very wet during a large part of the year. In contrast, the southeastern part of the state, including the famous and fertile Imperial Valley,

was a desert until the beginning of irrigation several decades ago. West of the Sierra Nevadas the state has the Mediterranean type of climate, with mild, rainy winters and sunny, almost rainless summers. Although the northern part of central California is in the same latitude as New York, it is almost as warm as the southern part of the state because the Sierra Nevadas protect it from the winter cold of the interior and because the prevailing winds from the Pacific are warm.

Forests. Extensive and valuable forests are located in the northern section of the Pacific Coast States, because the heavy rainfall in the northwest encourages the growth of forests. These forests cover nearly one third of the area of the Pacific Coast States. Washington and Oregon each cut between three and four billion board feet of lumber annually, leading all other states in lumber production. Washington, Oregon, and California together normally produce over forty per cent of the nation's timber supply. Washington and Oregon also rank high among the states as a source of our domestic supply of wood for pulp. The principal types of trees in this district are Douglas fir, hemlock, cedar, white pine, ponderosa or yellow pine, and spruce. Groves of gigantic redwood trees are found in northwestern California. The Pacific Coast should become, by careful cutting and reforestation, one of our permanent sources of timber products.

Fisheries. The Pacific Coast is one of our most important fishing regions. In a recent year the value of the fish obtained from this region was more than $24,000,000, or two thirds of the value of the fish obtained from the Atlantic Coast. California is our leading state in fishery products, its fish industry being valued at more than $18,000,000 annually.

The fish also are the basis of important canning industries. The canning of sardines is an $8,500,000 industry in California, and the canning of salmon is an $8,000,000 industry in Washington and Oregon, the amount being divided about equally between the two states. The Los Angeles-Long Beach Harbor district is the leading United States fish-canning area.

In addition to the sardines and salmon, other fish caught in large quantities on the coast are tuna, mainly in California

waters, and halibut, mainly in the northwest. Washington leads the coast in oyster production, growing oysters extensively in sheltered bays and inlets such as Willipa Harbor.

Bonneville Dam, on the lower Columbia River, which might have been an unsurmountable barrier to the salmon in their journey up river to their spawning grounds, has fish ladders and elevators to enable the fish to go beyond the dam. If this had not been done, the salmon would have been shut out of the upper Columbia and Snake rivers, and the salmon industry would have suffered a great loss.

Minerals. Gold is one of the principal minerals of the Pacific slope, and California is more closely associated with this metal than is any other state in the country. Gold was the magnet that drew thousands of settlers to this region in the middle of the last century. In a recent year the gold mines of California produced more than thirty-six million dollars' worth of this metal, or nearly one fourth of the total gold mined in the whole country. Gold is found also in eastern Oregon. Valuable deposits of copper are worked in the Cascade Mountains of Washington.

Important fields of petroleum are located in southern California. These fields are among the most productive in the world. Because of the lack of coal, petroleum serves as the chief fuel for railroads and factories. The output of this fuel in California is now of far greater value than the production of gold from the same region. In a recent year the petroleum produced was worth more than six times as much as the gold produced in the same period.

Mention should be made of other important minerals: namely, asphalt from beds in California; salt from Salton Sink, a dried lake region of southern California; borax from Death Valley in the Mojave Desert; coal from Washington; and silver in small amounts from all three states. Important reserves of manganese ore occur in the Olympic Peninsula of Washington. Mercury is found in Oregon and is growing in importance as a mineral product there.

Agriculture. Because of the great variety of climate in the Pacific Coast States, the farmers of this region are able to



Northern Pacific Ry.

Fruit trees in Yakima Valley, Washington.

cultivate many different kinds of temperate-zone and subtropical crops.

Western Washington and Oregon, with their abundant rainfall, produce many fruits, including peaches, pears, prunes, apricots, berries, and plums. Market gardens and small fruit ranches abound. By means of modern methods of refrigeration, these fruits are shipped to markets in all parts of the country. With its excellent rainfall and fine pastures, the Northwest is an expanding dairy region, marketing much butter and cheese.

Central Washington and northern Oregon have one of the most important irrigated apple-growing districts in the country; this district includes such famous centers as Hood River, Wenatchee, and Yakima. Of the entire apple crop of the United States, approximately one third comes from this section. Much of this crop goes to northern Europe by refrigerator ship. Hops and walnuts are also important products of these states.

In eastern Washington and Oregon is one of the most famous dry-farming regions in the country. Wheat is grown there extensively. The dryness of the summer climate enables the farmer to cut, thresh, and sack his grain on the same day. In recent years the yield has declined somewhat because of erosion and depletion of soil caused by the continual use of the land for the growing of grain. Hence, new crops such as alfalfa, peas, clover, and sugar beets are being introduced.

California is noted especially for her production of fruit. The mild winters, long summers, abundant sunshine, and plentiful irrigation are very favorable to the growing of citrus fruits, grapes, pears, peaches, plums, strawberries, cantaloupes, watermelons, apricots, figs, dates, walnuts, and almonds. This state is the greatest prune-producing area in the world.

California is also important as a winter truck-farming region, growing about one fifth of the commercial vegetable crop of the country. Many vegetables are grown in the Sacramento and San Joaquin valleys. The Imperial Valley, because of the fertility of its soil, high temperatures, and ample supply of irrigation, is a famous truck-garden area. The coastal region of southern California, especially around Los Angeles, has developed a very intensive system of agriculture.

Barley, wheat, and sugar beets are produced on a large scale. Cotton, grown under irrigation, is a smaller but valuable crop.

Irrigated Regions and Power Projects in the Pacific Coast States. Irrigation is practiced to a greater or less extent in all three Pacific Coast states. Although the Columbia River has a superabundance of water, the land through which it flows east of the Cascades is dry and semidesert. During the irrigation season, that is, from April to October, the days are hot and the nights cool. Annual rainfall runs from 8 to 15 inches; but during the irrigation season it averages only 3 or 4 inches, far less than the amount required for the successful cultivation of crops. The soil is extremely rich and is quite productive when properly irrigated. It is suited to the cultivation of temperate-zone crops such as hay, grain, beans, peas, and fruits.

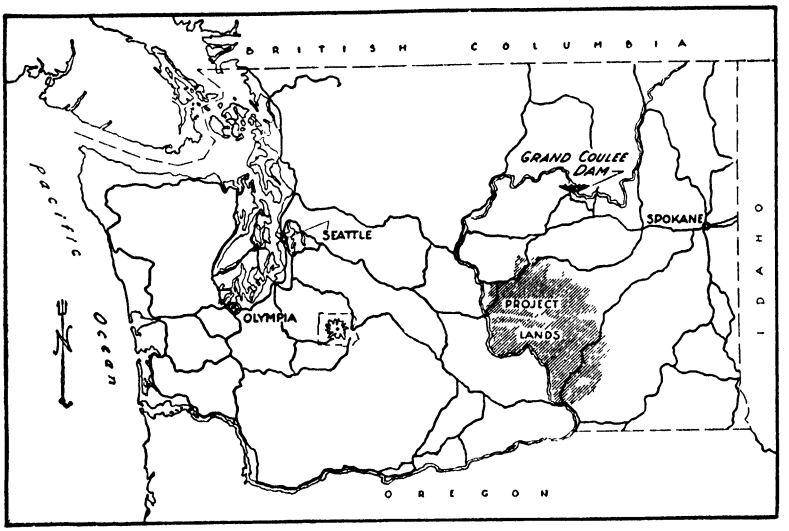
Irrigated farms comprise about 25 per cent of the value of all the farms in the state of Washington; and out of the 36 counties of the state of Oregon, 25 have irrigation operations, a little more than one fourth of the crop land being irrigated.

Although water for irrigation may be obtained from almost every stream east of the Cascades, only a major undertaking would be capable of providing the enormous amount of irrigation necessary to this rich but dry land. To provide this necessary irrigation for the arid lands in the Columbia River region, to open this vast, rich territory, and to provide a source of water power that can be used in the development of electricity, several great dams are being built on the Columbia River. These dams will be built between the Canadian border and the mouth of the Columbia and will use 92 per cent of the fall of the river within this country.

Of all the potential water power of the country, 68 per cent is west of the Rocky Mountains, and 41 per cent is in the watershed of the Columbia River, which is the greatest source of energy on the North American Continent. California has much available hydroelectric power also.

Bonneville Dam, located 42 miles upstream from Portland, is the first of the proposed Federal projects to be completed. One of the main purposes of this dam is to eliminate the Cascade Rapids, which were for many years the main obstacle to navigation on the lower river. To eliminate these rapids, the largest single-lift lock in the world was built. This lock will raise ocean-going vessels 66 feet upward on their way up the Columbia to the interior of Washington and Oregon. The dam backs the river upstream approximately 50 miles and increases navigation up the river to 188 miles from the Pacific Ocean. The Bonneville Project is intended to supply electricity to thousands of farms and to towns in Oregon, Washington, and Idaho. One-half million horse power of energy is available as the demand increases.

Three hundred miles upstream from Bonneville Dam is the Grand Coulee Dam, which, when completed, will be the largest man-made structure in the world, three times larger than the largest Egyptian pyramid. The Grand Coulee will reclaim

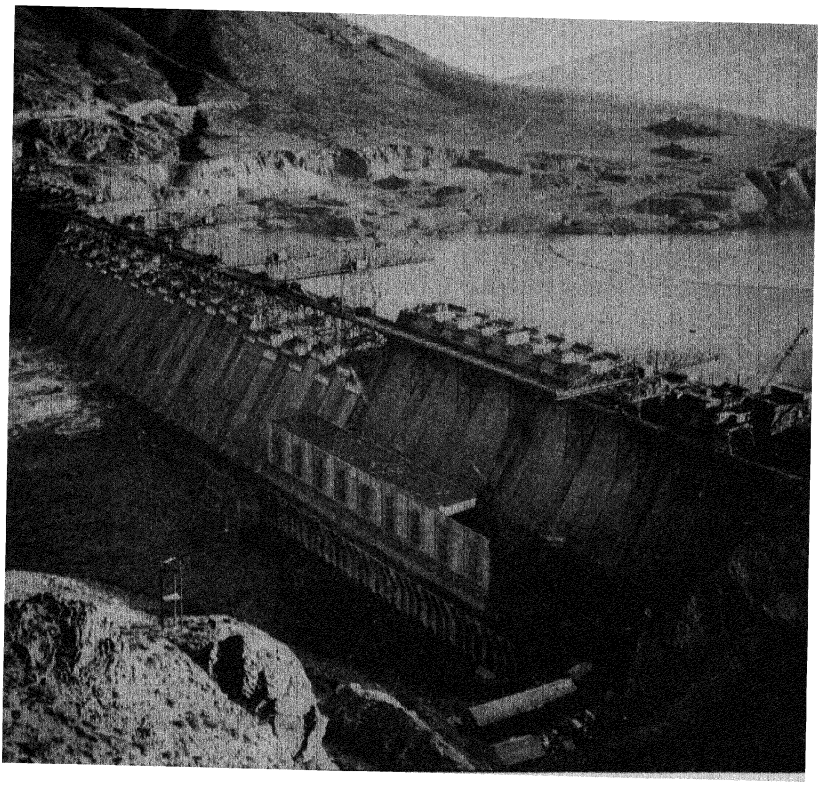


Land to be reclaimed by the Grand Coulee.

1,200,000 acres of land in the Big Bend country, located north of the Snake River and east of the Columbia River before that river turns its course west toward the Pacific; will regulate the flow of the mighty Columbia; and will generate electricity to be used for industrial purposes, in pumping the water for irrigation, and in pumping the water for storage into the reservoir high above the present river bed. This dam and the Bonneville Dam together will generate more electric energy than is produced in the entire state of New York.

Of the 1,200,000 acres of land to be irrigated, 980,000 acres will be irrigated by the force of gravity by means of a system of canals. About 220,000 acres will have to be irrigated by means of pumping plants because these lands lie about 70 feet higher than the level of the canal system.

The water of the upper Columbia will be impounded in a storage reservoir 151 miles long by a massive concrete dam near the Grand Coulee, the gorge that was formerly the temporary bed of the Columbia. Ages ago a glacial ice sheet blocked the Columbia River so that the river was forced to cut a new canyon through the basalt and granite plateau. When the ice sheet receded thousands of years later, the



Authenticated News Photo

The west wing of Grand Coulee under construction.

Columbia returned to its old course. What had been the temporary gorge was then left stranded and empty—a corridor of cliffs and bluffs, 50 miles long, 1,000 feet deep, and from 1 to 5 miles wide. Its floor now is 600 feet above the water level of the Columbia River because, since the time the Columbia returned to its original course, it has not been subjected to the wearing-down process caused by the constant flowing of the water.

Grand Coulee itself will be used as a balancing reservoir, into which water will be pumped during the high-water season (which coincides with the irrigating season) by means of part of the power produced at the dam.

A main canal will carry the irrigation waters to the east and west canals near Coulee City, and a system of lateral canals will then distribute the water to the land. This new agricultural land, after irrigation, will be used for the growing

of fruit, nuts, celery, tomatoes, alfalfa, dairy products, and livestock.

The Bonneville and Grand Coulee projects, and the other projects to be built in the Columbia Basin, will aid in navigation, provide water for irrigation, and generate power for the states of Washington, Oregon, and parts of Idaho.

The state of California presents a somewhat different problem. That state has no navigable rivers, with the exception of the Sacramento and the San Joaquin, but it does have many smaller streams that provide an abundance of water for irrigation of areas that would be virtually useless if it were not for irrigation.

The Central Valley of California includes the valley of the Sacramento River in the north and the valley of the San Joaquin in the south. The rainfall in the region is not uniform; it averages about 25 inches a year in the northern part, but decreases as one goes southward until it averages only about 5 inches a year in the southern part. The upper Sacramento Valley is therefore the area that has the greatest water supply, and the southern portion of the San Joaquin Valley is the area that has the greatest need for water.

Although the Sacramento is subject to disastrous spring floods, the large amount of water taken from the river for purposes of irrigation made the river so low in summer as to stop navigation. To overcome this situation, the Contra Costa Canal Project was started in 1937. This project will include the building of Shasta Dam (originally called Kennett Reservoir) on the upper Sacramento and the Friant Reservoir on the San Joaquin.

Water will be pumped from Shasta Dam, by a series of pumping plants, to the Friant Reservoir for use in irrigating the San Joaquin Valley. Shasta Dam will not only regulate and store the winter floodwaters, but, by providing a flow of water during the dry months, will keep in check the salt water that has been seeping in from the Pacific Ocean and ruining the rich farm lands of the delta of the Sacramento. Friant Dam will hold back the waters of the San Joaquin to supplement the diminishing supply in the southern areas of the valley.

The rainfall in the region of Los Angeles averages only about 15 inches a year, and most of it is concentrated in three or four winter months. Originally Los Angeles obtained its water supply from the Los Angeles River and from artesian wells. In 1913, however, the construction of the Los Angeles Aqueduct was completed. This aqueduct consists of a 238-mile system of conduits beginning at the Owens River, northeast of Los Angeles, which has tributaries that receive their water from the abundant winter snowfall of the Sierra Nevadas. This water is transferred to Los Angeles by gravity and now forms about 80 per cent of the water supply of that city.

A future source of supply of water for this city will come from Parker Dam, situated 155 miles below Boulder Dam, on the Colorado River. The Colorado River Aqueduct, 242 miles in length, will extend from Parker Dam to the Cajalco Reservoir, near Riverside. When completed, it is expected to furnish a billion gallons of water daily to Los Angeles and other cities.

Although Imperial Valley, in the southeastern corner of California, is frost-free and has fertile soil and high temperatures, it was useless for agricultural purposes until irrigation was begun. Its climate and soil, coupled with a plentiful supply of water, are ideal for the production of crops. Since the use of irrigation, this section of the Pacific Coast has been supplying green vegetables to the market during the cold winter months. The first canal to be built from the Colorado River to Imperial Valley was the Imperial Canal. Part of this canal goes through Mexican territory, and the Mexican farmers are therefore entitled to use one half of the water flowing through the canal. The project proved to be unsatisfactory because the large quantities of silt in the Colorado have gradually filled up the Imperial Canal until today the canal can carry only about one fifth of the amount of water it originally carried.

In 1928, when Boulder Dam was approved, the construction of the All-American Canal was authorized. This canal is being built from Imperial Dam, near the Mexican border, as part of the Boulder Dam Project, and will go through American territory only. This canal, although incomplete, already provides water for the rich Imperial Valley. A branch canal may

extend to the Coachella Valley north of Imperial Valley. The All-American Canal is 80 miles long and has already brought a new prosperity and wealth into the Imperial and Coachella Valleys.

Manufactures. Most of the products manufactured in the Pacific Coast States are based on local supplies of raw materials. Oregon, Washington, and northern California have many mills engaged in the manufacture of wood products, including lumber, plywood, shingles, furniture, wood pulp, and paper. Flour from the Inland Empire (eastern Washington and Oregon) is milled in a number of Northwest cities, and many food, fish, and dairy products are processed.

Among the industrial specialties are boat building and airplane manufacturing in Seattle; copper refining near Tacoma; fruit and vegetable canning in California and in the Willamette Valley of Oregon; shipbuilding in San Francisco and the Puget Sound cities; the refining of Hawaiian cane and California beet sugar on the shores of San Francisco Bay; petroleum refining, the assembling of motor vehicles and the manufacture of automobile tires, meat packing and the processing of other agricultural products, and the manufacture of machinery and aircraft in Los Angeles; and the motion-picture industry in southern California. The operations of the motion-picture industry have grown to major proportions. Today this industry, which ranks high among the industries of the country, provides employment to thousands of people and has a yearly pay roll of many millions of dollars.

Transportation Facilities. The commercial development of the West is due, to a great measure, to the railroads that were built from the interior through the passes and over the mountains to the Pacific Coast. A number of transcontinental lines now connect the Mississippi Valley with the coast. Much of the freight moving north and south is carried by sea. The harbors of Los Angeles, San Francisco, and the Puget Sound region afford excellent facilities for ocean transportation. The only important navigable river is the Columbia, which has a deep channel that is being extended by the Columbia Basin

Reclamation Project. The Sacramento River is navigable for only a short distance.

Cities. In this section, at the time of the last census, there were nine cities having a population of more than 100,000: Los Angeles, San Francisco, Seattle, Portland, Oakland, San Diego, Long Beach, Spokane, and Tacoma. The metropolis of the Pacific Coast is the city of Los Angeles. This city grew remarkably during the first quarter of the twentieth century, and in 1937 had an estimated population of more than 1,489,000. Its rapid growth has extended the city limits to the coast; by dredging and building a breakwater, a harbor has been developed, called San Pedro, and Los Angeles has thus become a seaport. It is the fruit center of southern California, and is located in one of our greatest petroleum regions. The pleasant and favorable climate of the region has made it a favorite residential city and is also the most prominent reason for the concentration of the motion-picture industry in its suburbs.

San Francisco, the second city in size in this region, with an estimated population of about 687,000 in 1937, is located on an excellent harbor. Its hinterland includes the Great Valley of California, an exceedingly rich and productive agricultural district. Ten railway lines reach the Bay, and from here steamship lines carry American exports to many foreign ports, particularly across the Pacific. The commercial possibilities of this city will become still greater if the peoples of the Far East ever develop in a commercial way to the degree attained by the Europeans, who are opposite our Atlantic shore.

Farther north, there is a rapidly developing section around Puget Sound. The metropolis of this section is Seattle, a rival of San Francisco in the struggle for trade supremacy with the Orient. Seattle has the advantage of being nearer the ports of the Orient than is its rival farther south. Because of its more northern location, it is in a more direct line with the steamship routes, which take a northerly course to Asia. Seattle has the additional advantage of being located nearer Alaska. The chief industries of Seattle are flour milling and



Northwest Airways

Seattle, the metropolis of the section around Puget Sound.

the processing of other products of the farm into foodstuffs, lumber, boat making, wood products, and the manufacture of airplanes.

Tacoma, also located on Puget Sound, shares with Seattle some of the advantages just mentioned. It is the center of a great lumber and furniture industry and nearby has the largest copper smelter on the coast.

Portland, the largest city in Oregon, located on the Willamette River and near the Columbia River, has important transcontinental connections with the East. It is the commercial center for the Oregon forests, the Columbia River fisheries, and the Inland Empire of eastern Oregon and Washington. It is also a great food-processing center and a smaller manufacturer of woolens and knit goods.

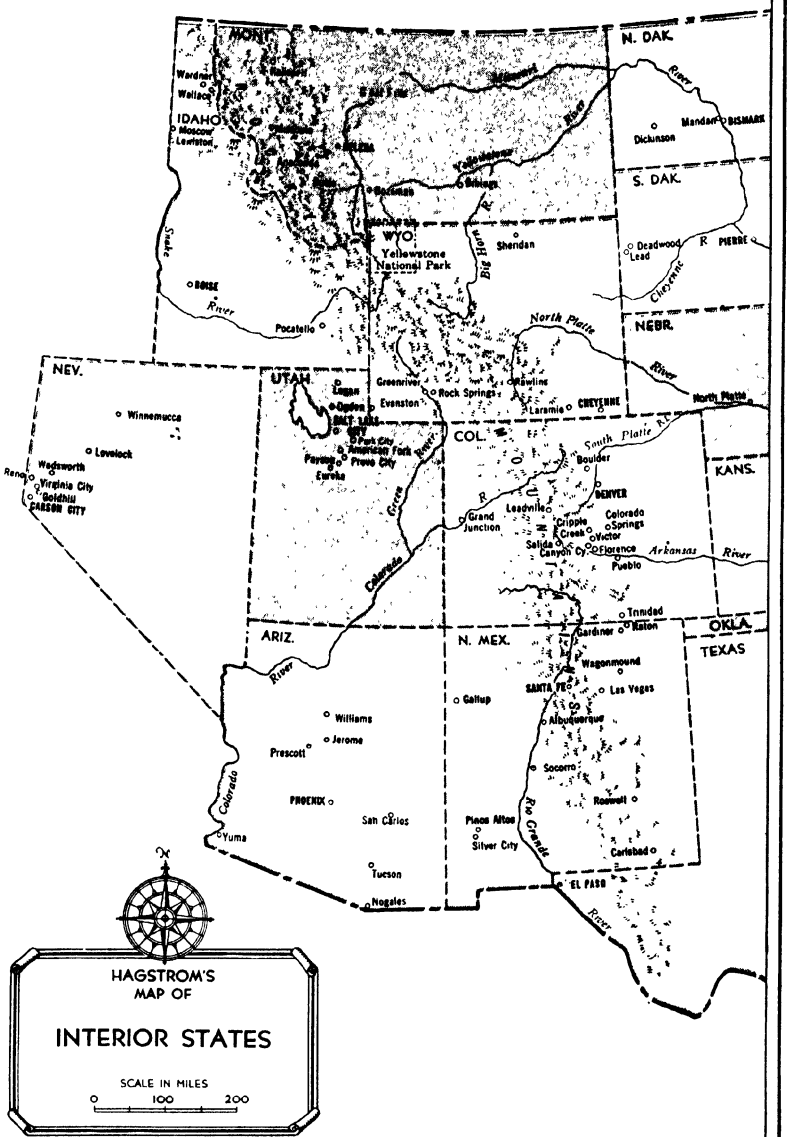
Spokane, an inland city, is in the region of grain growing, lumbering, and mining known as the Inland Empire. Three great transcontinental lines (the Chicago, Milwaukee, St. Paul, and Pacific; the Northern Pacific; and the Great Northern) converge at this city and thus give it excellent transportation facilities.

Foreign Commerce. Only a small portion of the foreign commerce of the United States passes through the Pacific

Coast ports. According to statistics recently available, only about six per cent of the nation's foreign commerce is present in the western side of the country, and of that about one half goes through the city of San Francisco. The tonnage of the Puget Sound ports is greater than that of the southern port, but it is less in value. Trade, however, is certain to increase in this region, as the Pacific Coast faces an ocean around which at least half of the people of the world live. As Asia adopts Western ideas of trade and as the wants of the Oriental peoples increase, the commerce of the Pacific Coast will not continue to be so far below that of the eastern seaboard.

TEXT QUESTIONS

1. Why is the Pacific Coast more highly developed than the interior states to the east of it?
2. Describe several types of climate found in the Pacific Coast States.
3. How does climate aid wheatgrowers in the Northwest?
4. Which states lead in the production of lumber? gold? prunes? petroleum?
5. Why is the Northwest densely covered with forests?
6. Locate and describe the following cities: Spokane, Seattle, Tacoma, Oakland, Portland.
7. What advantages does Seattle have as a seaport?
8. What is the character of the products manufactured on the Pacific slope?
9. How does the climate of the region around Los Angeles favor the motion-picture industry?
10. What three transcontinental railway lines meet in Spokane?
11. What purposes will the Coulee Dam Project serve?
12. In what way does the Bonneville Dam aid commerce?
13. In what way has irrigation influenced agriculture in Imperial Valley?
14. What are the main sources of water for irrigation in the various sections of California?
15. Contrast San Francisco and Los Angeles in as many ways as you can.



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SECTION 2—THE INTERIOR STATES OF THE WEST

Introduction. The Interior States of the West lie directly east of the Pacific Coast States and west of the one hundredth meridian of longitude, that is, west of central Texas, Kansas, Nebraska, and the Dakotas. This region consists of a gradually rising plain in the eastern section, the Rocky Mountains in the central section, and the plateau region between the Rockies and the Pacific Coast States. It may well be called "a land of little rain," for most of it has an annual rainfall of less than twenty inches, and a considerable portion receives less than ten inches a year. This part of our country has no sea coast, no large navigable river, and, except in the mountainous sections, no large forests. High altitude and small amounts of rainfall, coupled with high winds, cause portions of this region to resemble a desert.

A characteristic of this section is its remarkable contrasts: its great plains and its lofty mountains; its irrigated, thickly populated areas and its vast, dry, thinly populated regions; its sections of monotonous, unattractive country and its mountainous regions of magnificent scenery. Many thousands of tourists are attracted each year by the scenic wonders of this area, especially by those in Yellowstone National Park, in Wyoming, Montana, and Idaho; Glacier National Park, in Montana; Rocky Mountain National Park, in Colorado; and Grand Canyon, in Arizona.

Climate. The climate of this region is principally of the continental type, hot in summer and cold in winter. Because the moisture-bearing winds from the Pacific lose most of their moisture as they rise over the Cascades and the Sierra Nevadas, the section between the Pacific Coast States and the Rockies, especially in the central and southern districts, has the smallest amount of rainfall of any region in the United States. The plains east of the Rockies receive annually fifteen to twenty inches of rain because of the cyclonic storms, with their moisture-bearing winds, that originate many hundreds of miles away. Because the rainfall is irregular in both amount and distribution, extremes prevail and agricultural success is uncertain. Much of this area is used most satisfactorily for

grazing purposes. When an effort is made to cultivate it, and the protection given to the land by the grass is thereby lost, long periods of drought may result in dust storms. During these storms strong winds blow away the good topsoil, leaving fields that are of but little value for agriculture. The topsoil is either lost entirely or is piled in great drifts, which cover fences and even buildings at times.

Although the amount of rainfall is small, it is, in most parts, sufficient for the growing of grass. On the plateau section of this region are the great sheep and cattle ranges of the country.

When the prevailing winds strike the mountains, they are forced upward and are cooled. As a result they drop their moisture in the form of rain and snow and thus provide water for the growth of forests on the mountains and for the irrigation of many of the plain areas.

Minerals. This region abounds in minerals; in fact, the presence of minerals was the reason for its first settlement. Coal is scattered throughout this section, but it is found principally in Colorado. Lead and zinc are mined to a considerable extent in Idaho. Copper is found in abundance in the states of Arizona, Utah, Montana, and Nevada. Iron ore is widely distributed in Colorado, which is the leading state in the smelting of iron ore west of the Mississippi.

Petroleum is found mainly in Wyoming. New Mexico has large deposits of potash. Colorado ranks first in the production of molybdenum, a metal used in making high-grade steels; in fact, this state furnishes about ninety per cent of the world's supply. Extensive deposits of phosphate rock occur in southeastern Idaho. Gold and silver are mined in Colorado, Nevada, Arizona, Montana, and Utah.

Irrigation. The climatic conditions in this section of the country have been a serious drawback to the development of agriculture; most of this region was long considered too dry for raising crops of any kind. The attraction that originally drew the early settlers to these states was the mineral resources. Then, as the population began to increase, the necessity of producing more food became increasingly imperative.

The factor most needed to make agriculture possible was water; hence, irrigation has been developed extensively in this entire region. Colorado, which is the leading state in irrigation, is second only to California in the extent of its irrigation areas; but, unlike California, it contains the headwaters of many important rivers that cross into adjoining states. These states, in turn, expect Colorado to allow a reasonable supply of water to flow into their thirsty lands. One of the largest irrigation projects in the world, Boulder Dam, is located in the southwestern part of this section, on the Colorado River, at the Nevada-Arizona boundary line. The states that derive the principal benefit from this project are California and Arizona, with California receiving the major share.

Irrigated Regions. The important irrigated regions, classified according to drainage basins, are as follows:

(1) The northern half of the Great Plains, extending from the Rocky Mountains toward the Mississippi River, is drained by the Missouri River and its tributaries. The irrigated land is confined almost exclusively to the valleys. In most of this area, however, large-scale dry farming is carried on more or less successfully.

Included in this basin is the Shoshone Project in northwestern Wyoming. The water supplying this project is furnished by the Shoshone River, which runs into the Big Horn River, a tributary of the Yellowstone River. Here is constructed a huge dam of masonry, 328 feet high. The project serves about 100,000 acres of land.

Another notable development is located on the Cheyenne River and its tributaries, including the Belle Fourche River. This project irrigates more than 100,000 acres of land in western South Dakota. Its location is favorable in regard to markets, since it is near the mining towns of the Black Hills, as well as within the trading area of the great cities of Omaha, Minneapolis, St. Paul, and Chicago.

(2) Large areas of Wyoming and Nebraska are supplied with water by the North Platte River. The valley of this river has its water supply increased by the Pathfinder Reservoir in Wyoming.

(3) The central part of the Great Plains is drained by the Arkansas River and its tributaries. The Arkansas River waters a large area in Colorado and a small area in Kansas. The enterprises in this section are capable of irrigating about 1,000,000 acres. Of the total possible irrigable acreage, approximately 900,000 acres are irrigated.

(4) The Continental Divide in Colorado forms a distinct separation between the eastern two thirds and the western one third of the state. The eastern slope is very deficient in water supply, but the western slope has a surplus of water. The Colorado-Big Thompson Project in the northern part of the state was begun in 1937 in order to divert water from the western slope of the Divide to the eastern slope for purposes of irrigation, as well as development of power. This project is the largest government project ever proposed in the state.

(5) South central Colorado, most of central and eastern New Mexico, and the southwestern part of Texas are drained by the Rio Grande and its tributaries. The Rio Grande is subject to heavy floods; but, since at times this river is nearly dry, water storage is necessary for permanently successful irrigation. The river has therefore been dammed in New Mexico to form the Elephant Butte Reservoir, which has sufficient capacity to store the floodwaters and to regulate the flow of the stream. Water from this reservoir supplies about 180,000 acres of land in a strip 40 miles wide on both sides of the river not only in the states of New Mexico and Texas but also in Mexico.

(6) The Gunnison Project is in western Colorado. A large water supply to feed the Uncompahgre Valley was obtained by tunneling under a mountain range 2,000 feet high. This project opened up more than 140,000 acres for productive agriculture.

(7) Arizona, southern Nevada, southern Utah, and western Colorado are drained by the Colorado River and its tributaries. Although vast quantities of water flow through the mighty Colorado, much of the area through which the river winds its way is arid. Other sections of this territory were, until the construction of Boulder Dam, ravaged by the floods of

the river at certain seasons of the year. In 1934 alone, floodwaters caused crop losses totaling nearly ten million dollars.

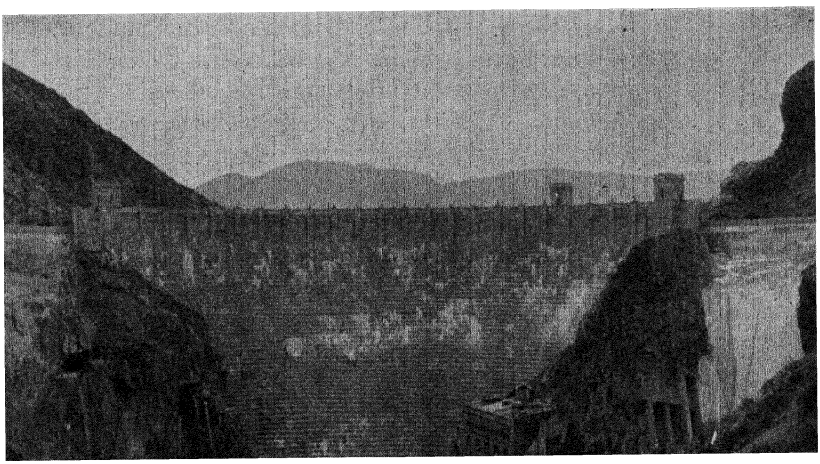
To protect this area from the destruction and loss caused by the floods and to provide irrigation for the arid lands, Boulder Dam was built. The dam, which is one of the greatest irrigation projects in the world, is located in Black Canyon on the Colorado River, about 30 miles southeast of Las Vegas, on the Arizona-Nevada boundary line. The dam holds back the water to form a storage reservoir, known as Lake Mead, which is 115 miles long.

The most important area irrigated by means of the Boulder Dam Project lies, not in the Interior States of the West, but in the Pacific Coast States. This area is the extremely rich, but dry, Imperial Valley in southern California. Irrigation waters for this district are obtained from Imperial Dam, below Boulder Dam, and are transported to the valley by the All-American Canal. The valley depends upon the Boulder Dam Project for flood protection, irrigation, and control of silt accumulation in the Colorado.

Boulder Dam is the highest dam in the world and one of the most famous in this country. It provides water for irrigation, protects the surrounding territory from floods, controls the silt in the river, generates electric power, improves naviga-

Roosevelt Dam, Arizona. The water stored by this dam irrigates approximately three hundred thousand acres and, in addition, provides a valuable source of power.

Ewing Galloway



tion, and regulates the river. Its electric capacity is four times that of Niagara, while its water-storage capacity is the greatest of any dam in America.

(8) Just a little south of the central part of Arizona is Roosevelt Dam, located on the Salt River. This dam is 284 feet high, 1,080 feet long, and 170 feet thick at the base. The water is easily distributed over the entire region, which comprises between 250,000 and 300,000 acres.

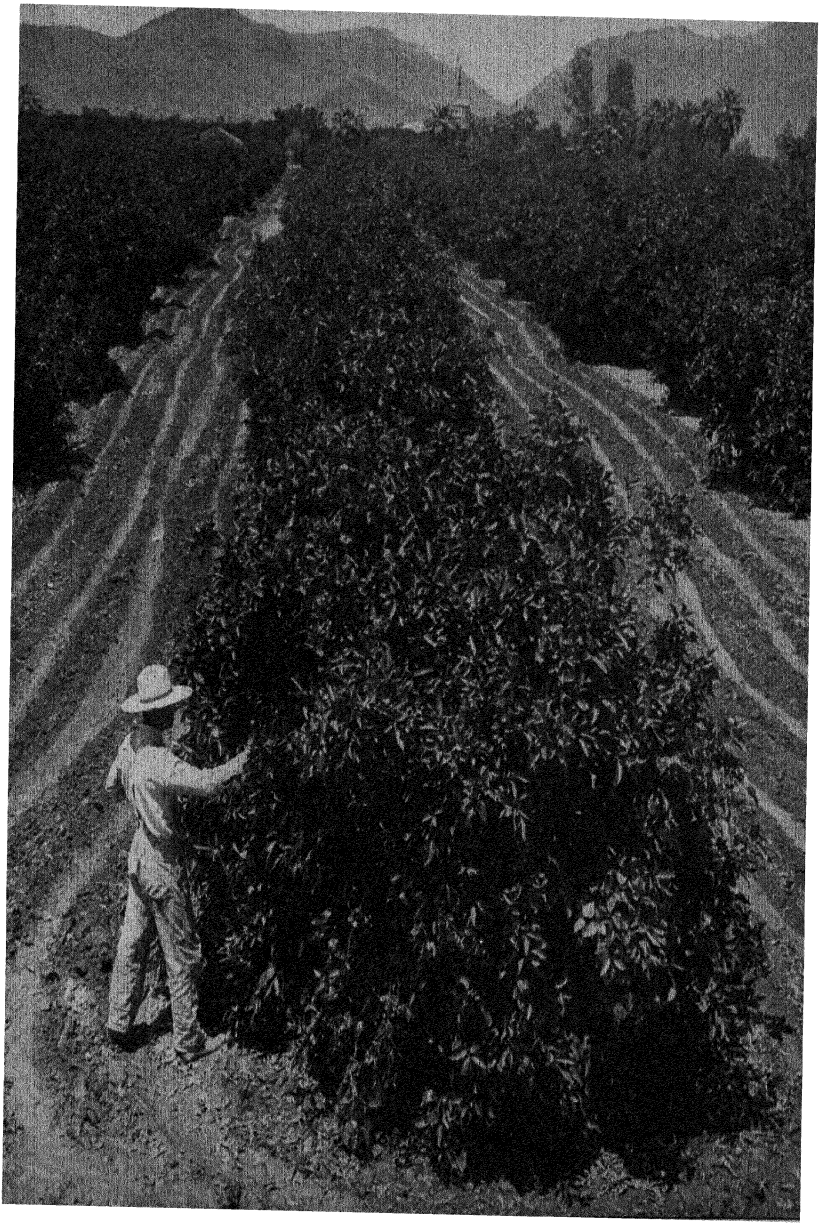
(9) On the border between California and Nevada lies Lake Tahoe, the outlet of which is Truckee River. Plans for using Lake Tahoe for a storage reservoir have been made. Water from both Truckee River and Carson River is stored in the Lahontan Reservoir in Nevada.

The future extension of irrigation will depend upon whether crops of sufficient value can be produced to justify the expense of storing floodwaters. In many places water can be obtained from wells when the expense of pumping is justified, but little is known of actual ground-water resources.

Agriculture in Irrigated Regions. The many different crops grown in these irrigated lands illustrate the varied climate of the United States. For example, hay, grain, sugar beets, and vegetables are the staple crops in the northern section; farther south the principal crops are apples, peaches, pears, and plums. Colorado is especially noted for head lettuce, cantaloupes, and celery. In the warmer southwest subtropical fruits, winter vegetables, and cotton are grown profitably.

The high value of the land encourages intensive tillage; the ever-present problem of labor tends to keep most of these farms small enough for one man to work, except at harvest time when migratory workers are available. In the fruit-growing sections the holding of an individual does not run over 5 or 10 acres. These small farms tend to increase the density of population in the richer rural areas.

Dry Farming. In many places where irrigation is impossible or too costly but where rainfall is at least ten inches a year, *dry farming* has been developed. This type of farming is carried on by storing the rains and snows of two winters in the soil. In the region west of the Rocky Mountains, the rain



Ewing Galloway

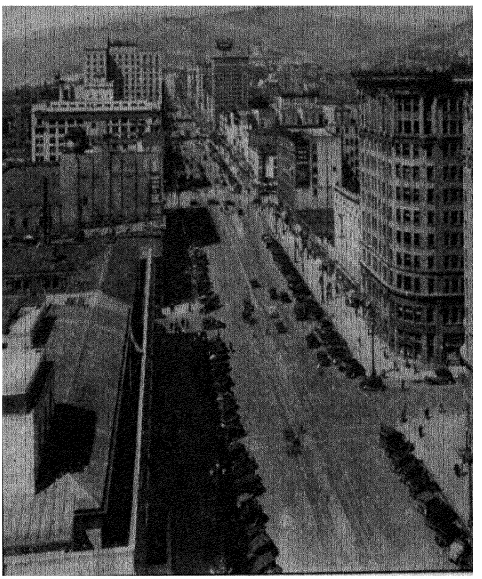
Irrigated grapefruit orchard, Arizona.

falls chiefly during the winter months. The topsoil is underlaid by a clay subsoil, which is almost impervious to water. After the rains of one winter have fallen on the land, the surface of the ground is thoroughly cultivated. The finely pulverized soil forms a blanket of dust on the surface, thus decreasing evaporation. During the following winter more rain is absorbed. Thus, the land, at the beginning of the second spring contains much of the rainfall of two winters and is ready to grow a crop.

Various crops are cultivated under this type of agriculture; drought-resistant species, such as Kafir corn, sorghum, millet, or durum wheat do best. The last-named crop is of special importance and forms a considerable part of our western wheat crop. For this type of agriculture ranches must be of large size since at least half of the acreage lies fallow each year.

Transportation Facilities. As stated previously, the commercial development of the West has been greatly aided by the railroads, which have connected it with the more populous East. Much credit is due to the pioneer railway builders, who helped to speed up the settlement of these interior states. Seven transcontinental railroads now connect the Mississippi Valley with the Pacific Coast. The first line was the Union Pacific, built in the sixties, from Omaha, Nebraska, to Sacramento, California; since then, it has been extended to Portland, Oregon. The Missouri Pacific, joining the Denver and Rio Grande Western Railroad and the Western Pacific Railroad, offers a continuous route from St. Louis to San Francisco. The longest line to the West is the Santa Fe, which follows the old Santa Fe trail to the Southwest, thence to Los Angeles, and to San Francisco. The Southern Pacific connects New Orleans and Galveston with the same California cities. The Chicago, Milwaukee, St. Paul, and Pacific; the Northern Pacific; and the Great Northern, which almost parallel one another across the northern part of the United States, have their termini in the Puget Sound region. These three great railroads connect the cities of the Great Lakes with the Pacific Northwest.

The Chicago, Burlington and Quincy System, with twelve thousand miles of lines in fourteen states, has Chicago and Denver as its termini.



Salt Lake City, the largest and most important city in the state of Utah.

Cities. Natural conditions in these interior states are unfavorable to the growth of large cities. In two of the states, Nevada and Wyoming, there is no city with a population of more than twenty-five thousand. Small distributing and shipping centers are sufficient to serve the needs of areas where the density of population is often less than two persons per square mile. Only a few large cities have so far arisen.

Denver, the highest large city in the United States, is the most prominent center in these interior states. Originating as a placer-mining camp, it is now the commercial center of the entire Rocky Mountains region, with a population of 300,000. Nine railways enter it, three of which are transcontinentals. It specializes in slaughtering and meat packing, the smelting and refining of ore, and the manufacture of mining machinery.

Among interior cities, Salt Lake City, capital of the Mormon state of Utah, has a unique location in the Great Basin, once considered a desert. With the Great Salt Lake on the west and the Wasatch Mountains on the east, this thrifty city of 140,000 is the center of one of the oldest irrigation projects in America. It is the distributing center for a wide radius of well-tilled beet, fruit, vegetable, berry, alfalfa, and sheep ranches.

El Paso, the largest city in the southern part of this section, is located one hundred and twenty-five miles downstream from the Elephant Butte Reservoir, to which it owes much of its growth. The city is a wholesale center for a large portion

of this region. Its industries include copper refining and smelting.

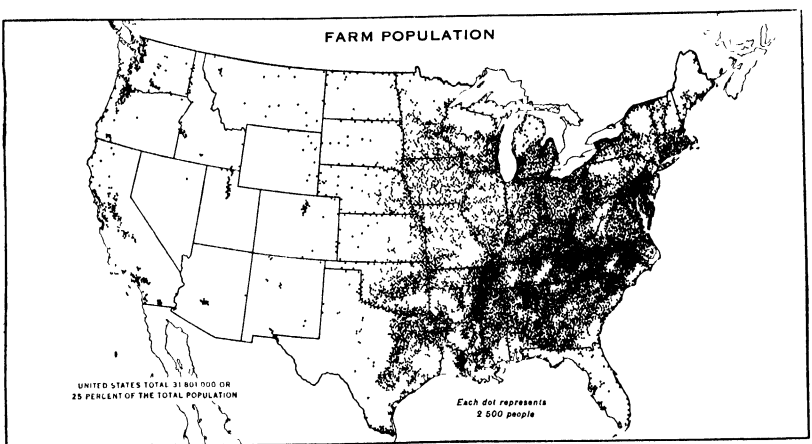
Butte, Montana, owes its prominence to an enormous reserve of copper ore, which for over half a century has made it one of the most famous mining camps and smelter cities in the Rockies.

TEXT QUESTIONS

1. What is the significance of the one hundredth meridian of longitude?
2. What has been the effect of extensive sheep raising in this region?
3. Discuss the climate of this region.
4. Which state is the leading state in irrigation? Which state leads in the extent of its irrigation areas?
5. Locate five irrigation projects.
6. Why are irrigated lands valuable?
7. Explain the term *dry farming.*
8. Explain the causes for the small number of large cities in this region.
9. Name four transcontinental railways connecting the Mississippi Valley with the Pacific Coast. Name the terminal of each.
10. What western states are important producers of copper? of petroleum? of gold and silver?
11. Explain the main purposes of the Boulder Dam Project; of the All-American Canal.
12. Contrast the following cities in as many ways as you can: Denver, Butte, Salt Lake City.
13. List some of the scenic wonders for which this section of our country is famous.

SECTION 3—THE CENTRAL STATES

Introduction. The Central States, which include the territory north of the Ohio River and east of the central portion of the Dakotas, Nebraska, and Kansas, are also known as the Middle West. They comprise about twenty-five per cent of the area of the country, contain about one third of the population, and produce nearly sixty per cent of the agricultural crops. The



U. S. Department of Agriculture

states of Kansas, Missouri, Iowa, and Illinois contain more acres of improved land than does any other section of the country.

Soil and Climate. The level or slightly rolling prairies with their deep rich soils are splendidly adapted to general farming. The climate of this region, which is largely of the continental type with hot summers and cold winters, is also suitable for a wide range of crops. The greatest variations in temperature are found in the western states where the difference between the hottest and the coldest day during the year is often as much as one hundred and twenty degrees. The rainfall averages from twenty to forty inches a year, the amount decreasing from east to west.

Forests. The western portion of this region was almost treeless when the white man came to this country, but there

were also sections where timber was abundant. Today, in the eastern and southern sections, some hardwood trees, principally oak, ash, walnut, and maple, remain. The lake states, Michigan, Minnesota, and Wisconsin, formerly had great forests of white pine that were our most important source of lumber. Because of the depletion of the supply, the lumber industry in this section is now relatively unimportant. Much wood is still cut in this region, however, for use in the manufacture of wood pulp, from which paper is made.

Minerals. The principal minerals of this region are iron, coal, and petroleum. Michigan has some copper. From the industrial standpoint the iron of the Central States is probably the most significant of these. It is not only present in huge quantities but is also relatively easy to mine. The ore in the Mesabi Region, west of Lake Superior in Minnesota, is of very high grade, containing as high as sixty-five per cent pure metal.

The principal deposits of iron ore are in northern Michigan along the shores of Lake Superior, in northern Wisconsin, and in Minnesota. Here are located the largest beds of iron ore in the world. A characteristic of the mining in this region is open-pit mining, in which the earth is cleared off the ore and then the ore is scooped with enormous electric shovels directly into freight cars. Near Hibbing, Minnesota, are the world's largest open-pit iron mines. This Lake Superior district furnishes over eighty per cent of the iron ore produced in this country. Minnesota alone produces more ore in a year than is produced in any one foreign country.

The great supplies of iron ore naturally gave rise to an iron and steel industry in this section. In such cities as Gary, Chicago, Toledo, Detroit, Cleveland, and Youngstown, the manufacture of iron and steel forms an important part of the economic activities.

A number of oil pools with many producing wells underlie the Central States from Lima, Ohio, to Kansas. The abundance of salt in Michigan is one of the factors that have favored the growth of a large chemical industry. In East Liverpool and Cincinnati, near the large clay deposits of southern Ohio,

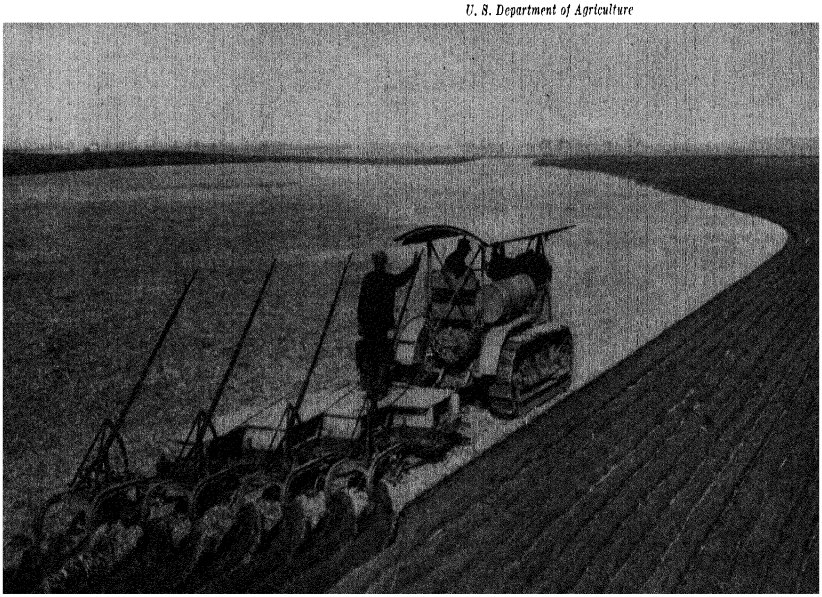
are extensive pottery works. Excellent sand has given Ohio a flourishing glass industry.

Agricultural Products. It is in agriculture that this section holds first place in the nation. The level prairies offer a fine opportunity for the use of the most improved types of farm machinery. Because of the climate and the soil, grain is the principal staple crop of this section, as are cotton and tobacco in the South. Both corn and wheat grow better in the Central States than in any other section of our country.

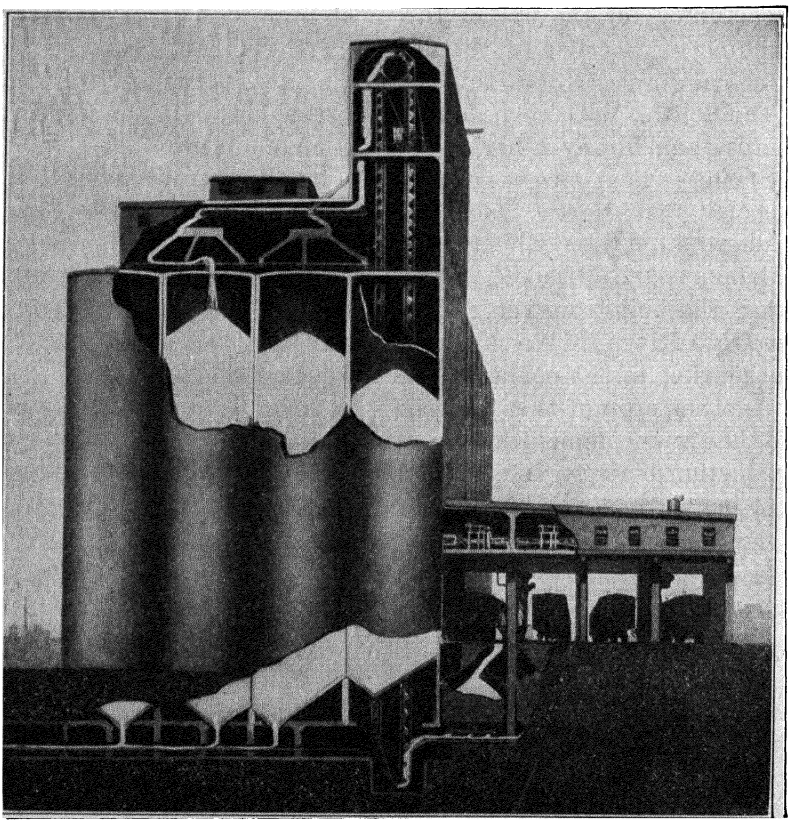
Spring wheat grows principally in the northern section, especially in North Dakota, Montana, South Dakota, and Minnesota. Winter wheat grows chiefly in Kansas, Nebraska, Oklahoma, and Missouri. The principal region for corn growing is the belt from central Ohio to central Kansas and from the Ohio River to Wisconsin. Corn from this section goes to the market in the condensed form of beef and pork.

Another crop of this region is the sugar beet. Sugar is one of the few commodities in which there is competition in production between temperate and tropic regions. The sugar-beet belt is just north of the corn belt and extends somewhat

Breaking prairie sod with an eight-bottom tractor plow.
U. S. Department of Agriculture



into the spring wheat belt. The sugar beet rarely competes with corn, for it requires a great amount of hand labor; hence, in those regions where corn will ripen, the farmer gets a greater profit per acre from corn than from the sugar beet.



Washburn Crosby Co.

A diagram showing how a grain elevator operates. The grain flows downward from the freight car, is lifted by buckets on an endless chain, and then flows by gravity to the proper bin.

Sugar beets are therefore usually cultivated in those regions that are too cool for corn to mature.

The cattle-fattening, hog-raising, and meat-packing industries play an enormous part in the economic life of this section. Before the days of the railroad and the refrigerator car, the

extent of these industries was limited and markets had to be near. Today, with the development of transportation and refrigeration, the animal industries, even though often situated a long distance from the markets, are under little handicap. Although considerable cattle raising is carried on in the range states farther west, the corn-growing states are the leading fattening areas for hogs and cattle. Iowa exceeds all other states in the value of both hogs and cattle fattened for market. Chicago leads in meat packing, partly because of the excellent transportation and terminal facilities, but more because it is the center of the richest fattening belt. More than one half of our meat comes from the Central States. This industry is important also in Kansas City, Omaha, St. Joseph, St. Paul, Indianapolis, St. Louis, and Cincinnati.

Meat packing is a splendid example of an industry in which modern methods and invention have evolved a large number of by-products. These by-products, like those in many other lines of industry, provide the major portion of the profits. What was formerly thrown away and wasted is now utilized for the benefit of both manufacturer and consumer. In the early days the chief products of the meat-packing industry were beef, hides, and tallow. Today, in addition to the three items mentioned, there are a great number of products, including foods, fertilizers, and raw materials.

Manufactures. The center of general manufactures in the United States is a little west of central Ohio. According to value, about one third of the manufactured products of the United States come from the Central States. This region has all of the requirements for manufacturing: a great market, an adequate and capable supply of labor, abundant raw materials, coal as a source of power, and unexcelled rail and water transportation facilities. In no other section of the country is there such a complete network of railways. These railways are supplemented not only by five great inland lakes, which reach far into the interior of the country and have an outlet into the ocean through either the St. Lawrence River or the New York State Barge Canal, but also by the Mississippi and Ohio rivers. All of these factors have made the Central States

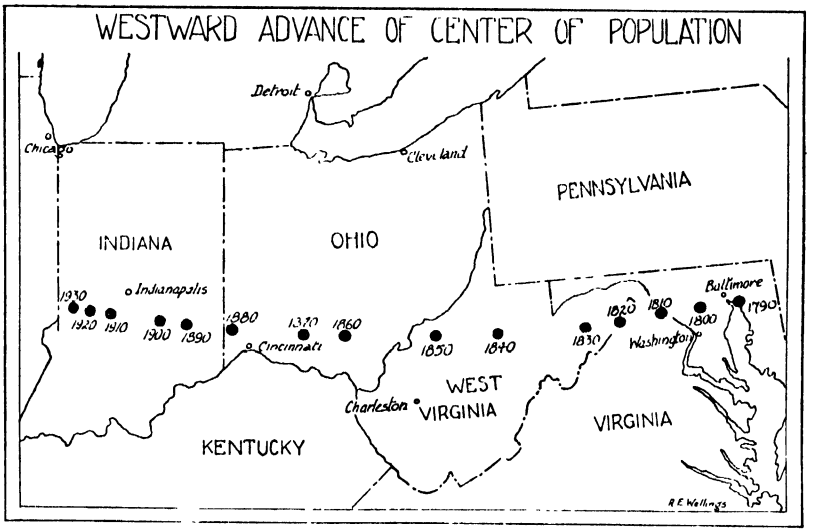
one of the greatest manufacturing districts on the North American Continent.

Automobile and agricultural implements are, in order, the two great manufacturing industries of the Middle West. The making of farm machinery near the great farm lands of the nation is not surprising. In the main, it has followed the westward movement of agriculture. In the early days there was a small industry in New England; later it was in New York State. The center of this industry is now Chicago, but Moline, Illinois; Springfield, Ohio; St. Louis, Missouri; Racine, Wisconsin; and Peoria, Illinois, also are large manufacturers of farm equipment.

Since the beginning of the twentieth century, the manufacture of automobiles has grown more rapidly than any other industry, with the possible exception of motion pictures. This industry has centered largely around the Great Lakes, chiefly because it first developed in this region, especially in such cities as Detroit, Flint, and Lansing, in Michigan, and Cleveland and Toledo, in Ohio. Several of these cities have grown large and prosperous through the making of motor cars and trucks. The Middle West, with its gently rolling or level surface, has built good roads everywhere, which have stimulated the general use of motor cars. In addition, Detroit and its sister cities now build automobiles for most of the car-using United States, as well as many foreign markets.

Other industries that are large in the Middle West are the tanning of leather in Milwaukee and the manufacture of rubber goods in Akron, Ohio; cash registers in Dayton, Ohio; leather goods in St. Louis; clothing, meat packing, and steel-making in Chicago; steel products in Cleveland; flour in Minneapolis; soap and machine tools in Cincinnati.

Transportation Facilities. In its wealth of natural water routes, the Middle West has a distinct advantage in commerce. In fact, the rapid development of this section during the first half of the nineteenth century was greatly aided by waterways. The Ohio River, with its headwaters in the Appalachian Mountains, provided a route westward to the Mississippi and Missouri rivers, thus encouraging the pioneers to push farther

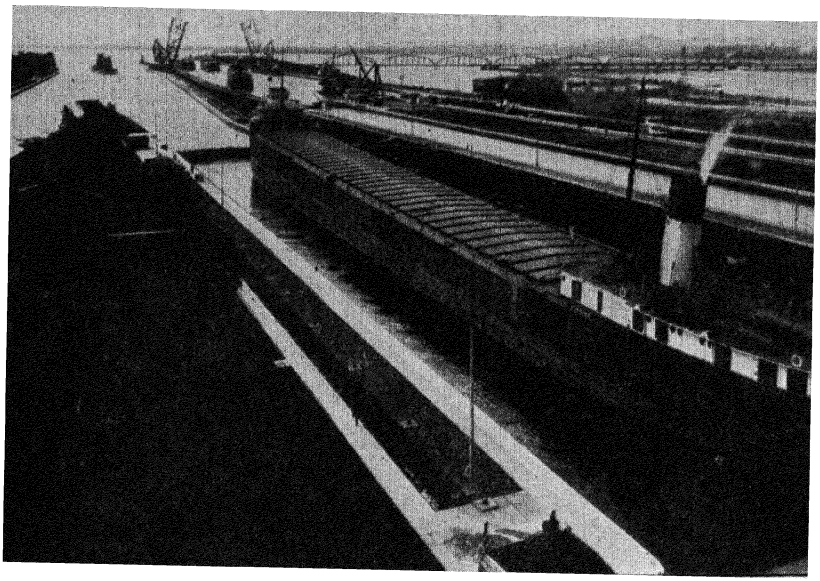


The westward march of the center of population of the United States is slowing up as our western states become more populated.

and farther into this section. The wealth of waterways made Middle West settlement possible at a very early date.

During the early part of the nineteenth century, steamboat traffic started on the Ohio and the Mississippi rivers. This mode of transportation continued to develop to a remarkable extent until the railroads cut into the revenue of these boats. The Missouri was never used to the same extent as the other great rivers of this system, first, because the territory bordering it was not so suitable for settlement as the lands along the Ohio and the Mississippi, and second, because the river itself was shallow and unreliable during much of the year. Although American rivers do not have the pre-eminent place in commerce that they had before the coming of railroads, the Mississippi River and its tributaries, especially the Ohio and the Monongahela, carry over ninety million tons of freight per year, or about three fifths of the total freight carried on all the rivers of the country.

The most important water route of this section is that formed by the Great Lakes. These five inland lakes accommodate vessels of all types and facilitate the handling of many



Ewing Galloway

The Soo locks. The Soo Canals are the gateway between Lake Superior and the East. They accommodate more freight in annual tonnage than that which crosses the Atlantic Ocean.

kinds of freight, especially those of large bulk and relatively low value such as iron ore and coal. The tonnage of freight handled between different ports on the Great Lakes is approximately equal to the tonnage of freight handled in the coastwise trade between all of our ports on the Atlantic, Pacific, and Gulf coasts. In total receipts and shipments the Duluth-Superior harbor, on Lake Superior, is second only to the New York harbor.

The New York Barge Canal provides shallow draft transportation between Lake Erie and the Hudson River. By means of the Chicago Drainage Canal, it is possible for barges to pass from Lake Michigan to the Illinois River and thence to the Mississippi. When all of the projected river improvements have been completed in the Central States, these inland waterways will be of great value for the movement of freight.

The recent Middle Western demand for a St. Lawrence Canal is actuated by a desire to find a shorter and cheaper route from the Great Lakes to the ocean. Farmers and manufacturers hope to make many of the inland cities virtual seaports, thus obtaining a great reduction in freight rates.

No other region in the United States has so extensive a network of railroads as the Central States. During the second


N. DAK.
MINN.
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IND.
OHIO
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KANS.
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
Grafton
Devils Lake
Grand Forks
Crookston
Jamestown
Valley City
Fargo
Duluth
Superior
Ashland
Ironwood
Marquette
Sault Ste. Marie
Calumet
Fergus Falls
Brainerd
Wahpeton
Aberdeen
Watertown
Huron
Brookings
Madison
Mitchell
Yankton
Vermilion
Little Falls
St Cloud
Stillwater
Minneapolis
ST PAUL
Menominee
Marinette
Escanaba
Manistique
Alpena
Bay City
Saginaw
Muskegon
Grand Rapids
Flint
Port Huron
Detroit
Toledo
Cleveland
Youngstown
Akron
Canton
Sandusky
Findlay
Lima
Mansfield
Springfield
Dayton
Cincinnati
Portsmouth
Marietta
Chillicothe
COLUMBUS
Newark
Zanesville
Wheeling
Parkersburg
Huntington
Ashtabula
Erie
Meadville
Oil City
Franklin
Johnstown
Altoona
Harrisburg
Pittsburgh
Uniontown
Morgantown
Clarksburg
Fairmont
Connellsville
Greensburg
Washington
Steubenville
Wheeling
Mansfield
Zanesville
Cambridge
Marietta
Chillicothe
Portsmouth
Ashland
Ironton
Huntington
Logansport
Kokomo
Fort Wayne
Elkhart
South Bend
Michigan City
Gary
Chicago
Evanston
Kenosha
Racine
Milwaukee
Sheboygan
Manitowoc
Green Bay
Appleton
Oshkosh
Fond du Lac
Menominee
Marinette
Wausau
Eau Claire
Stevens Point
Red Wing
Winona
La Crosse
Rochester
Mankato
New Ulm
Faribault
Albert Lea
Austin
Mason City
Waterloo
Fort Dodge
Sioux City
Marshalltown
Boone
Norfolk
Fremont
Columbus
Omaha
Council Bluffs
Creston
Oskaloosa
DES MOINES
Iowa City
Davenport
Clinton
Cedar Rapids
Dubuque
Freeport
Rockford
Janesville
Beloit
MADISON
Milwaukee
Chicago Drainage Canal
Aurora
Joliet
Streator
Kankakee
Rock Island
Mohne
Muscatine
Burlington
Galesburg
Bloomington
Peoria
Pekin
Lafayette
Danville
Decatur
Springfield
Jacksonville
Quincy
Hannibal
Moberly
Columbia
Alton
Ghormast
Vandalia
St Charles
St Louis
Belleville
JEFFERSON CITY
St. Louis
De Soto
Cairo
Vincennes
New Albany
Evansville
Terre Haute
Indianapolis
Richmond
Anderson
Muncie
Marion
Kokomo
Lafayette
Logansport

half of the nineteenth century railways became dominant in this area. The topography is especially favorable for railroad construction and operation. Expensive grading, sharp curves, and long bridges over deep cuts are seldom necessary. About one third of the total railway mileage in the United States has been built in this section of the country.

Nearly all the large cities are railroad centers, but Chicago and St. Louis are especially noted. Chicago is the greatest railroad center in the United States, being the terminus of the leading lines from the East, as well as most of the lines running to the West.

Cities. One of the most striking changes in the United States in the last thirty years has been the great growth of cities. According to the latest census, more than half of the people live in towns and villages with a population of 2,500 or more. In no other part of the country has the growth of cities been more striking than in the Middle West.

There are five cities in this section with a population of more than 500,000—Chicago, Detroit, Cleveland, St. Louis, and Milwaukee; and three with a population between 400,000 and 500,000—Minneapolis, Cincinnati, and Kansas City, Missouri. In all, there are thirty cities in the Middle West that have a population of more than 100,000.

In studying the cities of this region, it is better to take into account the metropolitan districts, or economic centers. These include all the organized towns that lie near the main cities. There are eight districts of high rank, especially from the standpoint of their manufactures. These are Chicago, Detroit, Cleveland, St. Louis, Minneapolis and St. Paul, Kansas City, Indianapolis, and Cincinnati. In each case accessibility is a most important factor favoring growth.

Chicago, the largest city in this region, with an estimated population of more than 3,600,000 is the second city in size in the United States. Although it is situated nearly a thousand miles from the seacoast, it is virtually a seaport because of its location on one of the Great Lakes. Wherever people are compelled to pass, or wherever there is a break in transportation facilities, a town or city is likely to develop. The south-

ward extension of Lake Michigan compels all east-and-west traffic to go around the south end of the lake, gives Chicago an unrivaled opportunity for commerce, and therefore helped it to become a great city.

Another important cause of the growth of Chicago is the fact that the city is located not only in the midst of a rich grain center and near the livestock belt of the United States, but also where supplies of coal and iron are within easy reach. Chicago has therefore a good industrial as well as a good commercial location.

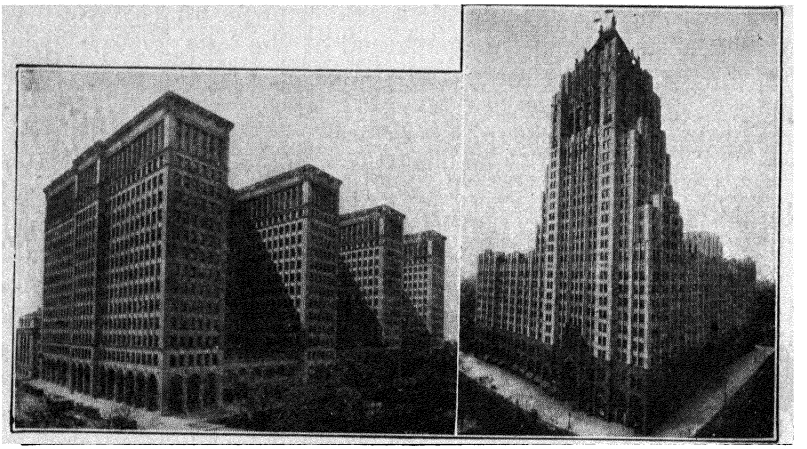
The city has expanded until it now borders the lake shore for about forty miles. Although it has an artificial harbor, it is one of the largest shipping ports in the world. It has been said that Chicago is the western terminus of the New York State Barge Canal.

As a railway center, Chicago is second to no other city in the world. A glance at a railway map shows a meeting of many lines at this city. This advantage, together with its lake-port facilities, enables Chicago to be a great distributor of commodities and, in part, accounts for its being the greatest grain and meat market in the world.

The leading industry, slaughtering and meat packing, yields nearly one fourth of the total value of the manufactured products of the Chicago district. Manufactures include clothing, foundry and machine-shop products, printed matter, iron and steel cars, and agricultural implements. The rolling mills in South Chicago and the blast furnaces and steel mills in Gary are among the largest in the whole country.

Detroit is the second city of the Middle West. Its growth has been remarkable during the last three decades. Today, with an estimated population of more than 1,780,000, Detroit ranks as our fourth American city.

Detroit is a lake port with a favorable location where railroads connecting the Middle West with Canada intersect traffic through the Great Lakes. Its early growth was the commercial result of this location, but its rapid growth since 1910 has been almost entirely based on the rise of one industrial specialty—automobiles. The main industry is the manu-



Buildings in Detroit made possible by the concentration of the automobile industry in that city.

facture of motor vehicles and accessories, in which Detroit surpasses any other city in the world.

Cleveland has developed into the leading industrial center on the south shore of Lake Erie. A glance at a map will show that this city is located on a direct line between Pittsburgh and the great ore mines of the Lake Superior district, a fact that makes it a natural transfer point. By dredging the Cuyahoga River and building great breakwaters, a commodious lake port has been made. The importance of Cleveland as a shipping port is shown by the fact that its lake trade amounts to many millions of dollars annually.

Cleveland is the chief manufacturing city in Ohio. The availability of large quantities of coal and iron ore turned it toward the heavy industries, including iron and steel, steel bridges, metal-working machinery, and stoves. The refining of petroleum is based on the nearness of oil fields, with pipe-line transportation of crude oil and water transportation of the refined products. Five railroads run through this city and make it a prominent railway center.

Toledo, located at the mouth of the Maumee River, is a lake port with an excellent harbor; the river gradually widens out into Maumee Bay, giving abundant room for shipping and

wharfage. Toledo has the disadvantage of being off the main railway routes between the East and the West. It is a favorable point, however, for trade between Detroit, Lake Erie, and the Ohio River.

The principal products of Toledo are petroleum, flour, automobiles, glass, and the manufactures of many machine shops and foundries. Some of the finest cut glass is made in Toledo.

Located at the west end of Lake Superior, and in the midst of an extensive grain, ore, and lumber region, Duluth is in a superior position to handle materials consigned to the manufacturing cities along the Lower Lakes. Its water front is lined with great elevators and ore docks; it is the shipping point for thousands of tons of iron ore and wheat, as well as inbound cargoes of coal and general freight. Lumber, flour, and steel are manufactured.

Milwaukee, on the western shore of Lake Michigan, industrial rather than commercial, is an outlet for the state of Wisconsin. Its chief industries are the tanning of leather and the manufacture of iron.

St. Louis, near the junction of the Mississippi and the Missouri, is a natural meeting place for traffic from the east, the west, and the north. This point was a center for early exploration and trade, as it can be reached easily by water routes from the Appalachians, the Great Lakes, the Gulf of Mexico, and the Rocky Mountains. As a result St. Louis became the metropolis of the upper Mississippi River basin in the early 1800's. When the bulk of trade in this region was carried by boat on the Mississippi River, this city rivaled Chicago. But, with the shift to railroads, river traffic decreased and St. Louis lost some of its early importance. The extension of the railways to the Pacific Coast, however, made St. Louis a railroad center second only to Chicago. It has therefore become a great distributing point for the West and the Southwest. From St. Louis are shipped not only its own products, which include packed meats, leather, boots and shoes, hardware, and furs, but also grain, livestock, and agricultural implements.

Minneapolis and its twin, St. Paul, located across the Mississippi River, were founded at this point because of the

Falls of Saint Anthony and rapids in the Mississippi River. Later, railroad connections and the settlement of the wheat lands to the north and west led to the commercial and industrial growth of these two cities. Numerous railroads connect these cities with Chicago and St. Louis, Lake Superior, the Pacific Coast, and Canada.

Minneapolis is second only to Buffalo, New York, as a center of flour manufacturing. The tremendous horsepower of the Falls of Saint Anthony, in the Mississippi River, and of Taylor Falls, in the St. Croix River, affords power for the mills, which have a daily capacity of from eighty to ninety thousand barrels. This city, with its wheat-growing hinterland and its power from the rivers, is another example of how geographic environment affects economic development.

Kansas City, at the great southwest bend of the Missouri River, is a city that began where river traffic met a major land route. In early pioneer days this was the eastern terminus of the Santa Fe Trail. The growth of this city, however, is due largely to the subsequent development of railroads. Kansas City is second only to Chicago in meat packing and in the value of its meat products. It is important also as a market for winter wheat and as a center for the distribution of farming implements, seeds, and other agricultural products.



Keystone View Company

Fourth Street, Cincinnati.

Other cities located on rivers are Omaha, on the Missouri, and Cincinnati, on the Ohio. The former is noted particularly as a meat-packing center. The latter has a wide variety of manufactures, such as clothing, soap, machine tools, artistic pottery, and paper products.

Of the cities that are strictly inland, the most important is Indianapolis, the capital of Indiana. The site, selected for political reasons, marked the center of population of the state. In the midst of a very rich agricultural region, Indianapolis is not only a state capital but a large and prosperous distribution center as well.

TEXT QUESTIONS

1. How has the topography of the Middle West aided agriculture and commerce?
2. Where is the spring wheat belt? the winter wheat belt? the corn belt?
3. Name and locate two lake ports, two large river ports, and an inland city in this region.
4. Name a city noted for the manufacture of each of the following commodities: agricultural machinery, rubber goods, cash registers, furniture, boots and shoes, and steel.
5. Name the cities in this region noted for the manufacture of automobiles.
6. What are the reasons for the predominance of the meat-packing industry in this region?
7. Where are the principal iron-ore mines of the Central States? What is the value of their location?
8. Locate the following cities and explain the importance of each: Dayton, Milwaukee, Indianapolis, Duluth, Gary, Cincinnati, St. Louis.
9. What cities other than Chicago are important as meat-packing centers?
10. How many cities in this region have a population of more than one hundred thousand inhabitants?
11. On an outline map of the United States, draw a line representing the approximate location of the one hundredth meridian of longitude. Why are the eastern portions of the states through which the line passes more densely populated than the western portions?
12. What city is especially noted for its blast furnaces?
13. Discuss the likelihood of Chicago becoming the largest city in the United States.
14. How would the proposed St. Lawrence waterway benefit this entire region?

SECTION 4—THE SOUTHERN STATES

Introduction. The states south of the Potomac and Ohio rivers and westward, to and including Texas and Oklahoma, make up the region called the South. There are five physiographic regions, each with its own characteristics: (1) the coastal plain; (2) the Piedmont; (3) the Appalachian Mountains; (4) the Ozark Mountains; and (5) the plateau of central and western Texas.

South of the Potomac River the coastal plain grows broader, occupying part or all of the Atlantic and Gulf Coast states, and including about half of the state of Texas. This is an area low in elevation with level to gently rolling topography and subtropical climate. Also included in the coastal plain is the fertile flood-plain of the Mississippi River.

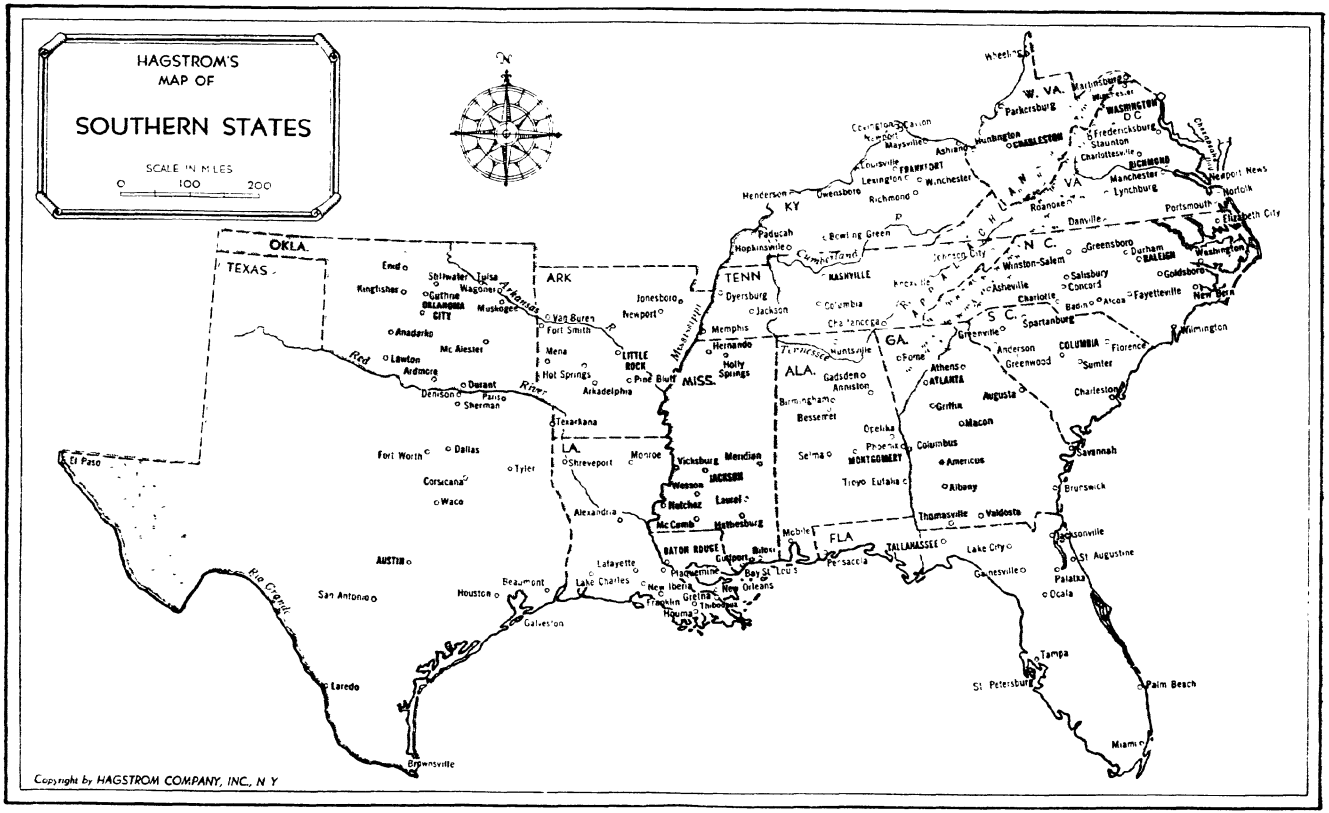
The Piedmont Plateau, lying between the coastal plain and the Appalachian Mountains, varies in elevation from approximately 1,000 to 1,500 feet. The Southern Piedmont is growing industrially; it is noted especially for the manufacture of cotton textiles.

The Ozark Mountains, in Arkansas and Missouri, support a sparse population chiefly by mountain agriculture. It is a rugged area in which transportation is difficult.

The plateau of central and western Texas is higher in elevation than the adjoining coastal plain; it is also deficient in rainfall. Grazing is a major occupation over large areas; in a few better-watered sections, crops such as cotton and wheat are produced.

The soil of the coastal plain is sandy and, although not naturally fertile, is made productive by the use of fertilizers; the alluvial soils of the Mississippi Valley are excellent. The clay loams of the Piedmont Plateau are rich, and there are highly productive soils in central Alabama and certain parts of Texas. One of the great problems in the Southern States is soil erosion, caused by unwise methods of cultivation plus heavy rainfall. The depletion of soil fertility is another problem.

Climate. The Southern States have a humid, subtropical type of climate. In the Piedmont Plateau and Appalachian


HAGSTROM'S
MAP OF
SOUTHERN STATES
SCALE IN MILES
0 100 200
N
OKLA.
TEXAS
ARK
TENN
KY
W. VA.
VA
N. C.
S. C.
GA.
ALA.
MISS.
LA.
FLA
Wheeling
Parkersburg
Huntington
CHARLESTON
WASHINGTON D.C.
Fredericksburg
Staunton
Charlottesville
RICHMOND
Manchester
Newport News
Norfolk
Portsmouth
Elizabeth City
Lynchburg
Roanoke
Danville
Winston-Salem
Greensboro
Durham
RALEIGH
Goldsboro
New Bern
Wilmington
Salisbury
Concord
Asheville
Charlotte
Fayetteville
Spartanburg
Greenville
Anderson
Greenwood
COLUMBIA
Florence
Sumter
Charleston
Savannah
Brunswick
Jacksonville
St Augustine
Palatka
Ocala
Gainesville
Lake City
TALLAHASSEE
Tampa
St Petersburg
Palm Beach
Miami
Pensacola
Mobile
Thomasville
Valdosta
Albany
Americus
Macon
Griffin
ATLANTA
Athens
Augusta
Columbus
MONTGOMERY
Tuskegee
Eufaula
Selma
Opelika
Phenix
Birmingham
Bessemer
Gadsden
Anniston
Huntsville
Florence
Tuscumbia
Corinth
Jackson
Dyersburg
NASHVILLE
Columbia
Chattanooga
Knoxville
Cumberland
Paducah
Hopkinsville
Bowling Green
Owensboro
Henderson
Lexington
Frankfort
Louisville
Ashland
Maysville
Newport
Covington
Clarksville
Memphis
Hernando
Holly Springs
Vicksburg
Meridian
JACKSON
Natchez
Laurel
Hattiesburg
McComb
BATON ROUGE
Gulfport
Biloxi
Bay St. Louis
New Orleans
Houma
Thibodaux
Morgan City
Franklin
New Iberia
Lafayette
Lake Charles
Alexandria
Shreveport
Monroe
Texarkana
Fort Smith
Van Buren
Newport
Jonesboro
Mena
Hot Springs
LITTLE ROCK
Pine Bluff
Arkadelphia
Russellville
Searcy
Batesville
Blytheville
Paragould
Wynne
Forrest City
Helena
West Memphis
Osceola
Marianna
Dothan
Eufaula
Ardmore
Durant
Denison
Sherman
Paris
Lawton
Mc Alester
Muskogee
Wagoner
Tulsa
Stillwater
Guthrie
OKLAHOMA CITY
Kingfisher
Enid
Anadarko
Fort Worth
Dallas
Tyler
Corsicana
Waco
Austin
San Antonio
Houston
Beaumont
Galveston
Laredo
Brownsville
El Paso
Rio Grande
Red River
Arkansas
Mississippi
Tennessee
Cumberland
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Mountains climatic conditions are modified by elevation; temperatures are usually lower in the winter months, and there is greater seasonal contrast than in the lowlands. Except for these highland areas, the climate is mild. Winters are cool to cold; frost occurs frequently, but snowfall is rare. Summers are hot and humid, and the maximum precipitation comes during the summer months. Sunny skies attract many winter visitors to Florida and Louisiana.

Forests. In the rugged Appalachian Mountains is the largest body of merchantable hardwood in the United States, including oak, sycamore, hickory, and black walnut. On the plains yellow pine is common, and cypress grows in the swampy lands. Naval stores are obtained from the sap of the long-leaf pine trees—tar, pitch, turpentine, and resin. The South produces over sixty per cent of the world's supply of turpentine.

The forests of the Gulf Coast States have, within recent years, become an important source of wood pulp for paper. Louisiana was first to become prominent as a source of supply. The growth of the trees in the South is rapid and, with reasonable and scientific cutting of the timber, this area can be made to produce a permanent supply of wood pulp.

Minerals. Large bituminous-coal deposits are located in the Appalachian Mountains. Iron ore is mined and smelted at Birmingham, Alabama. This city has an advantage over other smelting centers in that it is located near both coal and iron, as well as limestone.

Phosphate, one of the three minerals most essential to agriculture, is found in the South. The best deposits of phosphate rock are in Florida, South Carolina, Arkansas, and Tennessee; Florida is the leading producer. Because of the importance of phosphate in agriculture, these deposits are highly valued. Over fifty per cent of the production of the entire world comes from the Southern States.

Louisiana contains sulphur deposits, which have enabled the United States to produce more than eighty per cent of the world's supply.

The greatest oil-producing fields in the United States are found in Texas, Oklahoma, Kansas, Louisiana, and Arkansas.

Texas, the leading state, is followed by California and Oklahoma. Texas, however, produces as much petroleum as California and Oklahoma combined.

Agriculture. Cotton has long been the dominant crop in southern United States. Since Colonial times it has been a cash crop, and cotton still holds first rank in acreage cultivated. Next in acreage is corn, everywhere important for subsistence. Wheat and oats are also widely grown for local use. The sweet potato is commonly used all through the South, as well as a variety of vegetables. Two specialized types of agriculture, which are of increasing value, are, first, the fruits—citrus fruits, peaches, apples—and, second, the market gardening or truck farming, which has developed especially in Texas and from Florida northward in the coastal plain.

Cotton cultivation began in the Colonial Period. In order to export large quantities, cotton growing was encouraged. Increasing production soon created a demand for labor, which was met by the importation of slaves. As a result the large plantation system of agriculture using slave labor became firmly established in the South. After the abolition of slavery the plantation system declined, and smaller farms became common. The dependence upon cotton as a cash crop, however, remained until the invasion of the boll weevil, which practically destroyed the crop over wide areas before effective methods to combat it could be devised. Poor harvests for some years caused farmers to turn to other crops, especially grains and hay. Diversified agriculture has brought success to so many farmers that it is likely to be adopted as a permanent plan.

Cotton requires much hand labor. Planting and early cultivation are generally done with the aid of machinery, but picking must still be done by hand. Many attempts have been made to invent a cotton-picking machine. None of the machines have been successful, chiefly because the cotton bolls ripen at different times and the machine is unable to select and pick the ripe bolls and also leave the green ones untouched.

Prior to the development of machinery, it was necessary to separate the fiber or lint from the cottonseed by hand.

This process was both slow and expensive. The invention of the cotton gin was a great stimulus to cotton production, and mechanical spinning and weaving increased the output and lowered the cost of cotton cloth. The demand for cotton has grown until it is now one of the most commonly used fabrics. The Southern States rank first in world production of cotton.

The seeds are the most valuable by-product of cotton. They are ground and pressed to extract the oil, which is used in the making of soap, as a cooking fat, and sometimes as an edible oil. Europeans buy it as a substitute for olive oil. The residue, after the oil has been pressed out, is called *cake*. This is used mainly for cattle feed.

Tobacco, one of the agricultural products America has given the world, was a valuable money crop that the early colonists exported to England in return for other goods. At one time it was used as a medium of exchange in Virginia, taxes and wages being paid in tobacco.

Tobacco is greatly influenced by both soil and climate. Since each district seems to grow a distinct type, the various tobaccos are identified by the producing regions, as Virginia leaf and Kentucky leaf. The United States ranks first in

A tobacco market.

U. S. Department of Agriculture



world production of tobacco; the leading states are North Carolina, Kentucky, and Virginia. Louisville, Kentucky, located near the fields, is the greatest tobacco market in the world. Farther east, Richmond, Virginia, and Winston-Salem, North Carolina, are outstanding markets.

Citrus fruits grow well in the Southern States, especially in Florida and Texas. Florida is our leading producer of limes, grapefruit, and tangerines, and ranks second in orange production. In addition to supplying domestic demands, Florida exports citrus fruits to various European countries. Texas also produces and ships grapefruit of excellent quality. Peaches and apples are widely distributed through this region, but Georgia is the chief commercial peach grower. Large apple orchards are found in the Piedmont section of Virginia and in the Shenandoah Valley.

The low-lying coastal plain, with its sandy soils that warm up early in the season, provides an excellent location for a market-gardening or truck-farming development. Vegetables and small fruits of many types are grown for the winter and early spring markets. Early potatoes, celery, tomatoes, beans, and strawberries from Florida are sold in the New York markets in midwinter. As the season advances, crops in other states ripen and are shipped to the northern markets. Texas also supplies part of the winter and early spring demand for vegetables.

Sugar cane, a subtropical plant, is grown largely in Louisiana. Sugar cane is a major crop in Louisiana; this state grows about ninety per cent of the American crop.

Rice grows naturally along the low and swampy Gulf Coast of Louisiana and Texas, and along the lower Mississippi River where it is too wet for cotton or corn. In total production, however, it is insignificant in comparison with the Orient and is even a minor crop in the South.

Peanuts are a valuable forage crop in some parts of the South; Virginia is the leading producer.

A new and important industry is the production of tung oil. The tung tree, which was native to China, was successfully transplanted to the Southern States, where Mississippi and Florida are the largest producers. These states cannot

supply the American demand, however, and tung oil is imported from China. It is used chiefly in the manufacture of paints and varnishes.

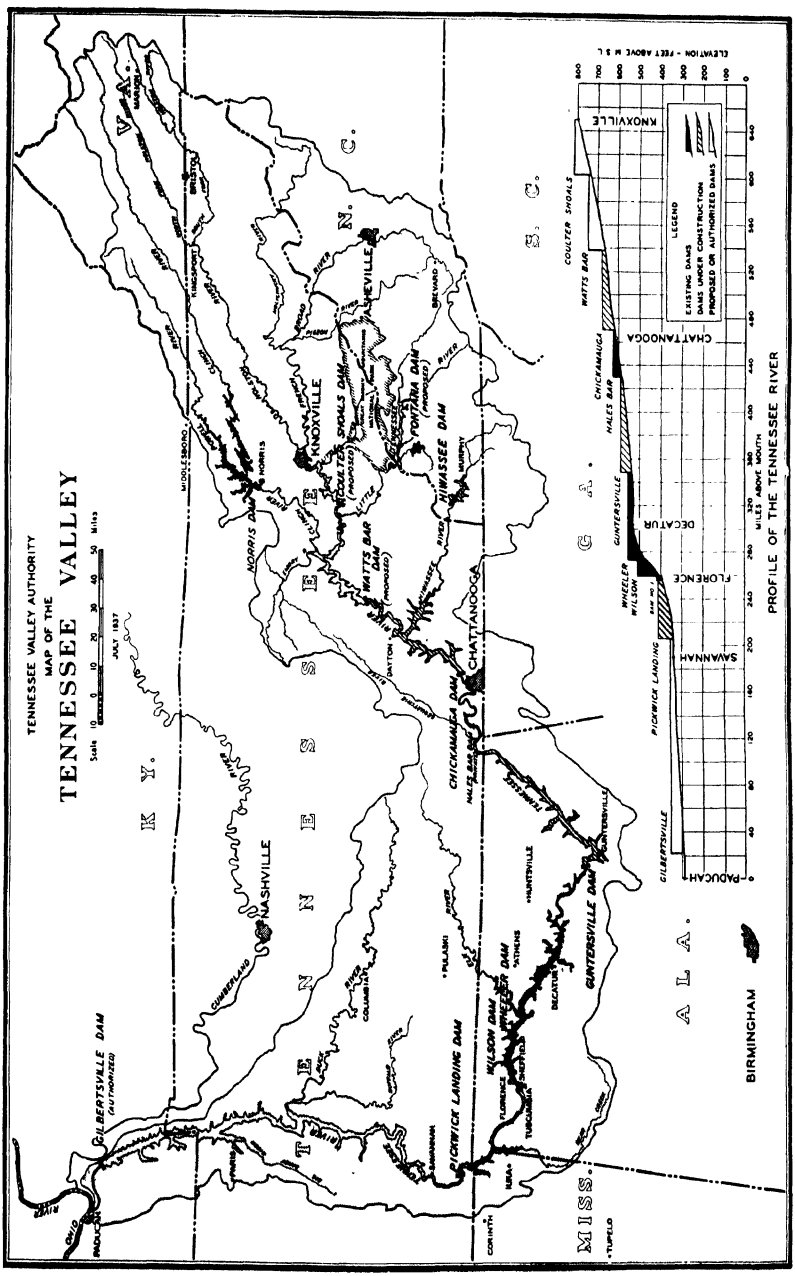
Two areas are important in the animal industries. The first area includes the upland valleys of Tennessee and Kentucky, in which many cattle are raised. The Lexington Basin in Kentucky—the bluegrass region—has long been famous for its race horses. The second area includes the semiarid plains of Texas, where there is adequate pasturage. Cattle keeping is the main occupation here. Local packing houses prepare the meats and by-products for market.

The Tennessee Valley Project. The Tennessee River is the longest and most important tributary of the Ohio River. The area it drains includes widely different regions: the fertile, well-kept valleys and the steep, wooded mountainsides of southwestern Virginia; the mountainous regions of eastern Tennessee; the industrial and commercial cities of Knoxville and Chattanooga; northern Alabama with its cotton fields; the Cumberland Plateau in Tennessee, with its coal, phosphate, iron, and timber; and the bluegrass regions of Kentucky. The area comprises about 42,000 square miles, about the size of Ohio, or about four fifths of the size of England; the population is about 2,000,000.

The Tennessee, in its natural state, is a river of extremes. At times it has violent floods that cause erosion, threaten towns and cities, and increase the high-water crests of the Ohio and the Mississippi rivers, which usually experience floods at the same time. In periods of drought the water is so low that navigation is stopped.

The Tennessee Valley Authority (TVA) was established by the Government in 1933 for the purpose of planning and inaugurating, under Federal control, (1) improved navigation on the Tennessee River, (2) control of floodwaters, (3) development of the agricultural and industrial resources of the valley, and (4) creation of a reservoir of hydroelectric power sufficient to operate locks and to supply a wide territory with electricity.

In the unified system of dams there are projects of two types: dams on tributaries of the Tennessee and dams on the



Tennessee Valley Authority

Tennessee itself. In times of flood the operation of a tributary storage dam is different from the operation of a main river dam. For example, Norris Dam, a tributary storage dam on the Clinch River, a tributary of the Tennessee in the state of Tennessee, is the first unit in the system of dams for the control of floods. In time of flood this dam can be closed tight, holding all the water and generating no power. The main river dams, on the Tennessee, are, in time of flood, unable to take care of all the floodwaters of the river; they can therefore generate power, while Norris Dam is closed, on the water that must be allowed to continue on its course. During the summer, when the river is low, Norris Dam will be emptied not only to prepare for the winter floods but also to add its supply of storage water to the flow of the Tennessee. The dams to be constructed on the Tennessee will therefore be operated according to the flow of the river and the control exercised by Norris Dam and the other dams in the tributary system.

The complete system of main and tributary dams will include at least eight projects, and possibly twelve, which will maintain a nine-foot channel throughout the length of the river so that navigation will be possible during all seasons of the year.

Rain upon denuded hillsides carries away millions of tons of fertile topsoil. Other millions of tons are lost through sheet erosion on the plains. The silt in a river does not settle until the flow of the river ceases, as, for example, behind a dam. Then it accumulates on the bottom. If it were not controlled, this accumulation would, in time, destroy the storage capacity of the reservoir and convert the dam into a useless artificial waterfall. To prevent this possibility and to aid the farmers in this region to improve their land, the Tennessee Valley Authority, in co-operation with several states, is engaged in a demonstration of erosion control and reforestation. It is making experiments in the production of phosphates and other plant foods and is testing the benefits of these plant foods on actual farms.

The TVA has an aspect that has to do with national defense also. The plants will be able to produce nitrates for war

purposes and to develop the power necessary for the large-scale operation of war industries.

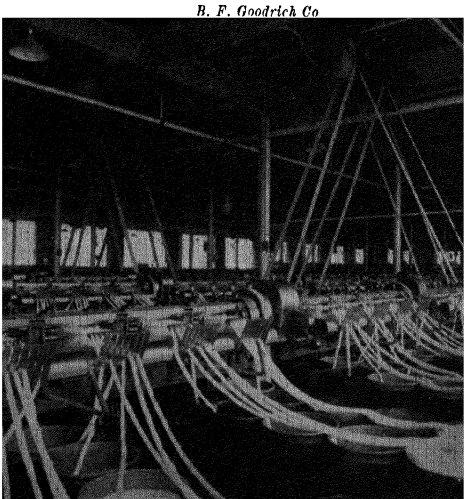
Manufactures. Although late in starting large-scale manufacturing, industrial progress in the South has been rapid. The cotton textile industry, formerly concentrated in the New England States, gradually shifted southward; and the Southern Piedmont has for some years exceeded New England in cotton manufactures. The South's advantages included: (1) nearness to raw materials; (2) an available labor supply; (3) hydroelectric power; (4) a lower cost of living than that in New England because of the milder climate; (5) good railway transportation; and (6) the southern market for cottons.

Cotton textile and hosiery mills and, more recently, rayon mills have been established in the Piedmont and along the fall line. With the long-distance transmission of electricity, small mill towns became more widely distributed. Their high-quality textiles and novelty goods find ready markets. North and South Carolina lead in cotton manufactures.

There are other industries of importance also. Furniture is manufactured in High Point (North Carolina); leather goods are manufactured in Waco (Texas); packing-house products are prepared in Fort Worth and Dallas, near the great pasture lands of Texas; sugar refining is located in New Orleans; the iron and steel industry is best developed in Wheeling (West Virginia); and Birmingham (Alabama); and the tobacco industry is concentrated in Richmond (Virginia) and Winston-Salem (North Carolina), while cigars are made from Cuban tobacco in Key West and Tampa (Florida).

A cotton mill in Georgia.

B. F. Goodrich Co.



Transportation Facilities. The greatest railroad system in the South is the Southern Railway,

which reaches nearly every important town east of the Mississippi River. A second important line is the Illinois Central, running from Chicago to New Orleans. This railway taps the Middle West and brings trade to New Orleans.

The Louisville and Nashville Railroad connects St. Louis with Cincinnati, Memphis, Atlanta, Mobile, and New Orleans. Two picturesque roads are the Atlantic Coast Line, following the shortest route south via the coastal plain to Jacksonville, and the Florida East Coast Railway, which goes from Jacksonville to Miami.

Cities. Historically the South has been an agricultural region, and the urban population has, therefore, been relatively small. Since about 1910 there has been an increasing movement toward the cities, part of a nation-wide trend in urbanization. The growth of the textile industry in the Southern Piedmont, the steel industry in Birmingham, and oil fields in Texas and Oklahoma have also contributed to the development of cities.

The metropolis of the South is New Orleans, with a population of about 500,000. Located on the Mississippi River at a point where the river is about one mile wide, New Orleans is the natural outlet of the Mississippi Valley. Both a river port and a seaport, it is accessible to the largest steamships. New Orleans ranks third among our customs ports. The leading commodity exported is cotton, but other agricultural products such as wheat, corn, and tobacco also go through this port. Most of the bananas imported from the Caribbean area come through the Port of New Orleans. Refrigerator ships discharge their cargo to refrigerated cars, and trainloads of bananas go by fast freight to all sections of the United States.

Atlanta, Georgia, is located near the south end of the Appalachians. Because of its location Atlanta has grown to be an important railway junction; it is also the dominant trade and financial center in southeastern United States.

Birmingham, Alabama, located at the south end of the Piedmont Plateau, where it has access to nearby deposits of coal, iron ore, and limestone, is important in heavy industries.



New Orleans Association of Commerce

New Canal Street in New Orleans. The large buildings of modern commercial New Orleans can be seen in the background.

Birmingham's economic development is concerned chiefly with mining, blast furnaces, and steel mills.

Louisville, Kentucky, is noted as a tobacco center; more leaf tobacco is handled here than in any other city in the world.

Dallas, Texas, a thriving city of 260,000 population, is the dominant trade center of eastern Texas. It has an important meat-packing business.

Tulsa, Oklahoma, owes its rapid growth to the development of petroleum resources.

Miami, Florida, has grown to be one of the most popular winter resorts. It maintains yacht basins, luxurious hotels, and recreation facilities for wealthy winter vacationists.

After New Orleans, Norfolk and Newport News, Virginia, rank second as important ports. Railroads bring freight from the Appalachian Mountains and some areas to the West for export. Savannah, Georgia, the third port, ships cotton, timber, and naval stores. Other leading ports are Charleston, South Carolina, which has an excellent natural harbor; Jacksonville, Florida, terminus of railroads; Houston, Texas, which

has a fifty-mile ship canal to the Gulf of Mexico; Galveston and Port Arthur, exporters of cotton and grains. Memphis, Tennessee, on the Mississippi, engages in river trade and is important locally.

TEXT QUESTIONS

1. What states are included in the Southern States?
2. Describe the five physiographic regions of the South.
3. What different types of trees grow in the Southern States? What tree has recently been transplanted to the Southern States from China?
4. Why is the Appalachian forest of great value?
5. What are the chief minerals of the South, and where are they found?
6. Name three important agricultural products of the South.
7. What is the most valuable by-product of cotton?
8. For what purpose is cottonseed used?
9. How are the various tobaccos identified?
10. What is meant by crop rotation?
11. What two Southern areas are important in the animal industries?
12. Explain what is meant by the term *Tennessee Valley Authority.*
13. What two types of projects are included in the system of dams for control of the Tennessee River?
14. Describe several purposes of the Tennessee projects in addition to that of control of floodwaters.
15. What advantages for the development of manufacturing do the Southern States possess?
16. Why has New Orleans become the metropolis of the South?
17. What Southern city is pre-eminent as a tobacco center?

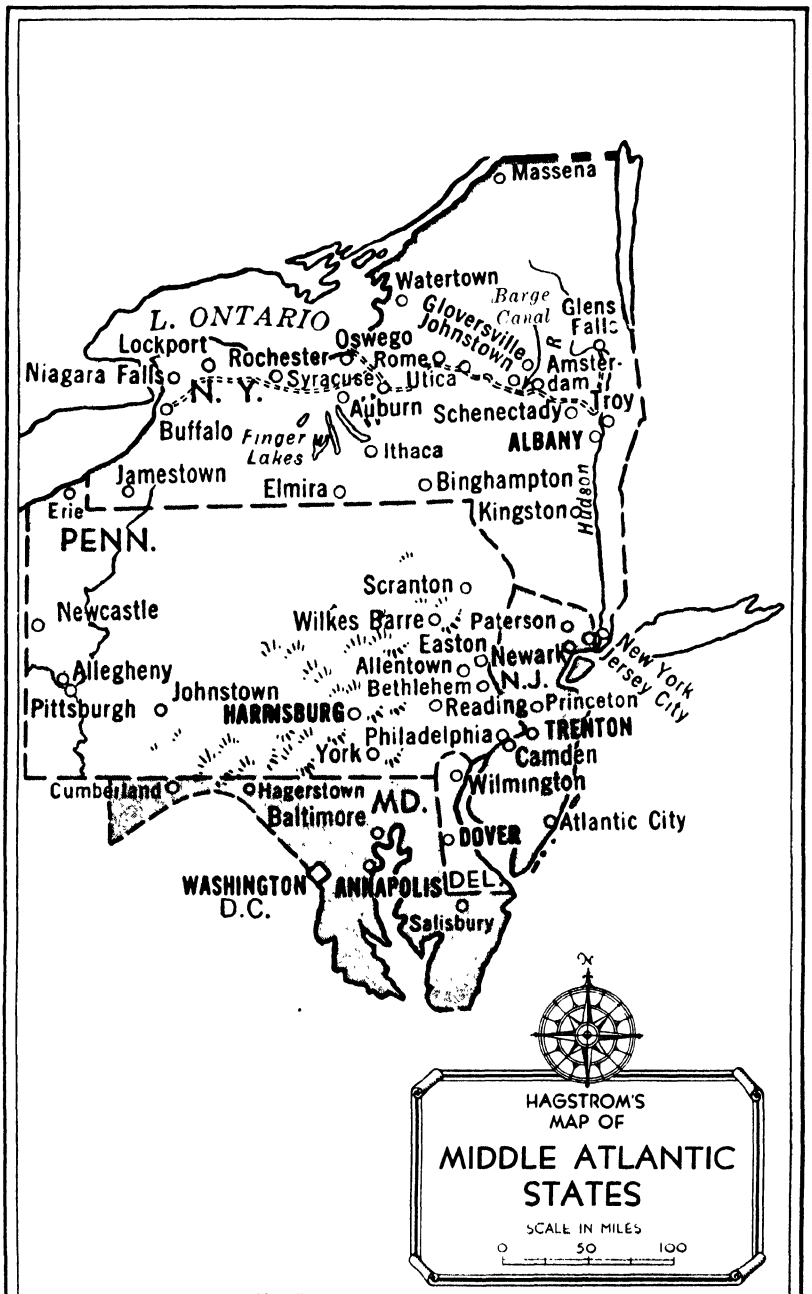
SECTION 5—THE MIDDLE ATLANTIC STATES

Introduction. The Middle Atlantic States are New York, New Jersey, Pennsylvania, Delaware, and Maryland. From a commercial and industrial point of view, they make up one of the most active and important regions in the United States. The coastal location and excellent harbors, the valleys opening toward the interior of the continent, and the wealth of natural resources have played a significant part in the development of the large number of cities and industrial areas. The main trade routes on both land and sea converge at the principal ports.

Climate. The climate of this region is generally favorable, with seasonal changes and ample rainfall. No other region in eastern United States has a better climate throughout the year for agriculture, manufacturing, and trade. Although the southern part is somewhat warm, it has, for the most part, an invigorating temperature during the major portion of the year. The successive summer, autumn, winter, and spring seasons, with their changes in rainfall, sunshine, and temperature, are no small factor in making these states the abode of a thriving, energetic people.

Fishing. The harvest of the sea, although not so rich as that of the New England waters, is abundant. The continental shelf extends down the entire coast and, with shallow bays such as Chesapeake and Delaware, forms an excellent fishing ground. The leading fishery product of this region is the oyster, the most productive beds being located in Chesapeake Bay. Other sea foods of this region are clams, crabs, shad, and herring.

Minerals. One of the principal coal fields of the world is in this section of our country. All along the western flank of the Allegheny Plateau, the best grade of bituminous coal is found. It is widely used throughout the entire East for steam-power plants, transportation fuel, and coke making. This coal has had much to do with making Pittsburgh and the surrounding country a great manufacturing district. In eastern Pennsylvania, around Scranton, Wilkes-Barre, and Pottsville, is prac-



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tically all of our best anthracite. This small area supplies the anthracite used in the United States, as well as in eastern Canada.

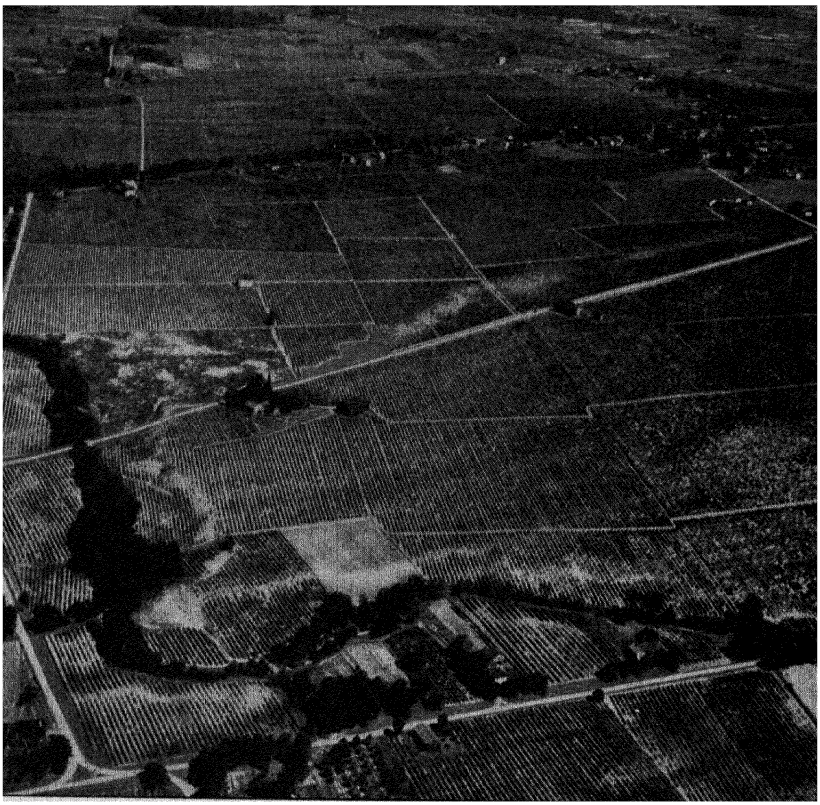
In addition to coal, the Appalachian Plateau contains petroleum and natural gas. Western Pennsylvania had the first oil wells drilled in America. After eighty years of operation, the output of the Appalachian oil field is greatly reduced, but Pennsylvania and West Virginia are still recognized oil states. The flow of natural gas has also declined from its former peak.

Building stone is quarried extensively, Pennsylvania holding first place in slate and limestone, and New York in sandstone. The large clay deposits of the Hudson Valley and the region around Trenton, New Jersey, gave rise to brickmaking and potterymaking. Valuable salt beds near Syracuse provide the material for chemical plants in that city. Some iron ore is found in the Appalachian Plateau, but it is now less profitable to work than the richer ore of the Lake Superior district. Eastern Pennsylvania leads in cement production in our country.

Agriculture. Although this region is not noted primarily for its agriculture, there are a few sections that are particularly favored for special types of farming.

The plain around Lakes Ontario and Erie, the Finger Lakes region, and the Hudson Valley are important fruit districts. No better apples are to be found than those from the Lake Ontario region; while grapes, peaches, pears, prunes, other small fruits, and vegetables grow in abundance in the Finger Lakes region and the Hudson Valley. The presence of large bodies of water, which delay the early autumn frosts, makes these districts well adapted to fruitgrowing.

Another region favorable to agriculture is the sandy loam section on the coastal plain in Delaware, Maryland, and southern New Jersey. Because of the markets offered by the adjacent large cities, this region is excellently located for truck farming. The main products of this area are berries, melons, tomatoes, celery, peas, potatoes, beans, and corn. Large acreages of tomatoes, corn, and other vegetables and fruits are grown for commercial canning.



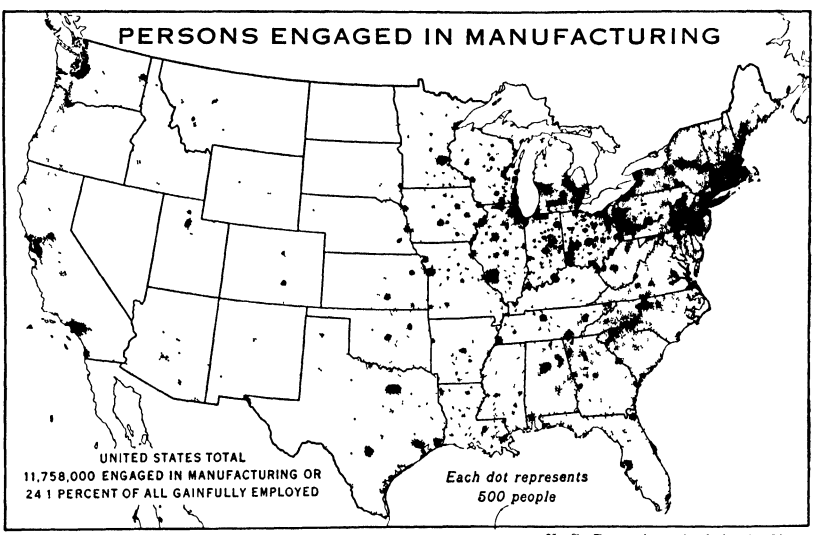
Welch Grape Juice Co.

Several hundred acres of vineyards in New York.

The abundant rainfall and the hilly land of the plateau regions of this section, which afford excellent pasturage, cause dairying to be a very important branch of agriculture. Railways or motor trucks take the milk to market; in some districts milk is made into butter, cheese, or condensed milk. New York is the chief dairy state in the Middle Atlantic States; Pennsylvania is second. The return from the land is usually much greater when the emphasis is on dairying than when food crops are grown. Because of the prevalence of dairying, hay is a leading field crop.

New York and Pennsylvania are two of our leading states in the production of potatoes. In the richer valleys crops like hops, tobacco, beans, cabbages, onions, and sugar beets are cultivated intensively on limited areas. This region does not attempt to compete with the richer Middle West in cereals.

Manufactures. Abundant coal and water power, good transportation facilities, and numerous large cities, which afford markets, are the principal factors that have made possible so large a concentration of manufacturing in the Middle Atlantic States. In addition to the great Appalachian fields of bituminous and anthracite coal, there is much petroleum and water power. This entire section is an excellent example of the organization of physical, economic, and human resources for the satisfaction of the requirements of modern life.



U. S. Department of Agriculture

Manufacturing is of great importance in the Middle Atlantic States.

Characteristic manufactures of the Middle Atlantic States are textiles in Amsterdam, Utica, Paterson, and Philadelphia; gloves in Johnstown and Gloversville; shirts and collars in Troy; clothing in New York and Rochester; cameras and optical goods in Rochester; shoes in New York and Binghamton; typewriters in Ilion and Syracuse; rifles and library supplies in Ilion; furniture in Jamestown; iron and steel in Pittsburgh, Philadelphia, and Baltimore; electric machinery in Schenectady; locomotives in Philadelphia; chinaware in Trenton; and canned goods in Baltimore. Printing and publishing are typical of New York and Philadelphia.

Certain industries have grown because of an early start. An example is the collar and shirt industry of Troy, New York. There is no geographic reason why this industry should have been located here, but detachable collars and cuffs were invented in Troy. On a house in that city is a tablet bearing this legend: "In this house, probably before 1827, detachable shirt collars were first made and the collar industry was originated by Hannah Lord Montague, 1794-1878" Thus an early start was the main factor in the establishment and growth of the collar and cuff industry in Troy, and the city has been able to retain this advantage.

Transportation Facilities. The railroad mileage in this area is not so great as that in the Middle West, but in no other section of the country is there so great a volume of passenger and freight traffic. The two most important railroad systems are the New York Central and the Pennsylvania, both of which connect New York City with Chicago and other western cities. The New York Central goes north from New York City to Albany and then west through the Mohawk Valley. The Pennsylvania Railroad runs south from New York City and goes westward through Pennsylvania. Other important lines in this region are the Baltimore and Ohio; the Delaware, Lackawanna and Western; the Lehigh Valley; the New York, Ontario and Western; the Delaware and Hudson; and the Erie.

The only inland waterways of importance are the Hudson River and the New York State Barge Canal, formerly known as the Erie Canal. This canal runs from Troy to Buffalo, a distance of 355 miles, of which 215 miles are natural waterways like the Mohawk River and Oneida Lake. The volume of shipping now carried by this canal is relatively small.

Cities. The Middle Atlantic States are favored by nature as a site for commercial centers. The valleys running east and west from the seacoast provide access to the interior and form natural trade routes that stimulate the growth of great cities. For this reason New York, Philadelphia, and Baltimore are of greater commercial importance than Boston, Portland, Providence, or Fall River in New England, or Charleston or Savannah in the South.

The Mohawk-Hudson Valley affords a superior location for large cities. This depression between mountains, leading into the heart of the continent, gives New York state the best natural connections with the interior. The mouth of the Hudson River is therefore the natural focusing point of commerce on both land and sea. It was natural, then, that a great commercial metropolis should grow up at this point. The supremacy of New York City in commerce is due to its excellent harbor, large wharf facilities, rich hinterland, and a location that keeps shipping costs low.

New York City is our largest center of general industry. Because of its varied interests it is also the leading financial and banking center of the entire country. Its manufactures are many and varied, although clothing is the leading one. This industry has centered here principally because of the presence of labor skilled in that particular trade. Printing and publishing hold an important place; in fact, no other city approaches New York in this respect. One of New York's main functions is that of a great wholesaling market, to which retail buyers come from all over the United States and Canada

New York City.

American Airways, Inc.



to select their stocks of merchandise. The metropolitan district includes all the urban population of northeastern New Jersey, Long Island, and Westchester County on the north. The prime importance of New York is well illustrated by the fact that approximately fifty per cent of the foreign commerce of the United States passes through its port each year.

The second seaport of importance in this region is Philadelphia, located on the deep and wide Delaware River. In Colonial times Philadelphia was the metropolis of the country, but the coming of the railway era and the settlement of the West cost this city its commercial pre-eminence. The interests of Philadelphia are now industrial rather than commercial. This city is one of the greatest textile-manufacturing cities in the country. The iron and steel trades, the refining of sugar and petroleum, printing and publishing, the manufacturing of locomotives, and shipbuilding hold important places. Camden, New Jersey, with its shipbuilding and canning is part of the greater Philadelphia district.

Baltimore has the advantage of deep anchorage inside protected Chesapeake Bay. Although it is the seaport nearest the upper part of the Ohio Valley, the mountains between have prevented cheap and rapid railway connections with the Middle West. Its hinterland is therefore limited to portions of southern Pennsylvania, and the states of Maryland, Virginia, and West Virginia. Typical industries of Baltimore are tobacco manufacturing and the canning of fruit, vegetables, and oysters. It has a great steel plant at Sparrows Point just outside the city on deep water.

Pittsburgh, located at the junction of the Allegheny and the Monongahela rivers, is a favorable site for the location of a trading city. The presence of high-grade coal also has made Pittsburgh a natural manufacturing site. Its position in steel making is due both to abundance of coking coal and to its excellent position in relation to major routes of transportation. Pittsburgh leads in blast furnaces, iron and heavy steel products, and glass.

Buffalo, located at the northeastern end of Lake Erie, holds a position of great commercial advantage. Its district also includes the manufacturing plants at Niagara Falls and the

steel mills at Lackawanna. The great falls of the Niagara River furnish the city with cheap and abundant water power. This power has been, and will continue to be, an important factor in the industrial development of this district, as well as of the western parts of New York State and Pennsylvania. Buffalo is the lake terminus of the New York State Barge Canal. It is a great distributing center for the manufactures of the eastern states, as well as for the foodstuffs and the raw materials of the Middle West. This city now has the lead in flour manufacturing. Other products are meats, foundry manufactures, automobiles, and lumber.

Other cities of importance in this region are Newark, Rochester, Jersey City, Albany, Syracuse, Utica, Schenectady, Binghamton, Scranton, Wilkes-Barre, Bethlehem, Trenton, and Erie.

TEXT QUESTIONS

1. What states are usually included in the Middle Atlantic States?
2. How does the topography of this region affect the commerce and industry of the people?
3. Where are the fruitgrowing and truck-farming regions of the Middle Atlantic States? Why are these regions important in agriculture?
4. Name a city in which each of the following commodities is manufactured: typewriters, silk, chinaware, locomotives, cameras, shoes, furniture, clothing, textiles.
5. Which minerals have had the greatest effect on the development of manufacture in the Middle Atlantic States? Why?
6. What advantages for industrial development has Buffalo?
7. Between what points does the New York State Barge Canal extend?
8. Name five railway systems in the Middle Atlantic States that connect the Atlantic Ocean with the Great Lakes.
9. Why is the New York Central Railway system called the "water-level route"?
10. Locate the following cities: Pittsburgh, Baltimore, Scranton, Trenton, Erie, Rochester, Syracuse.
11. What is each of the following cities noted for in the field of industry: Schenectady, Troy, Rochester, Trenton, Philadelphia?
12. Contrast Baltimore and New York in access to a productive hinterland.


ME.
Millinocket
Oldtown
VT.
St. Albans
Winooski
Burlington
Berlin
Bangor
Auburn
AUGUSTA
Rumford Falls
MONTPELIER
N.H.
Lewiston
Bath
Portland
Laconia
Rutland
CONCORD
Biddeford
Portsmouth
Manchester
Nashua
Lawrence
MASS.
Lowell
BOSTON
Worcester
Springfield
Pawtucket
HARTFORD
R.I.
PROVIDENCE
CONN.
Fall River
Danbury
Bridgeport
Meriden
New Haven
Ansonia
New London
Newport
HAGSTROM'S
MAP OF
NEW ENGLAND
STATES
SCALE IN MILES
0
50
100
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SECTION 6—NEW ENGLAND

Topography and Climate. New England is, for the most part, a very hilly and rugged region. Much of the soil is thin and infertile, gravelly, or stony, and, except in limited areas, is not sufficiently productive for agriculture. The mountain systems, because of their north-and-south trend, made it difficult for transportation to reach westward into the interior of the continent. The coast line is rough and broken and therefore affords many excellent harbors. The favorable coast line has played no small part in the development of fishing, shipbuilding, and commerce.

With no minerals of consequence except granite and marble, a limited farm area, and a severe climate, the New Englanders have had to adjust their activities to a few resources and turn to the sea and to manufacture.

The winters in most sections are long and relatively cold, but rainfall is adequate for crops. In the southern sections, however, the climate is less severe. The cool and pleasant summers, the White and Green Mountains, the many beautiful lakes, and the rugged sea coast have come to make New England a summer vacation land. The great cities near at hand supply the visitors. Providing recreation is an undertaking that brings the people of this region many thousands of dollars in the course of a season.

Forests. The northeastern forest region, which includes New England and New York, originally held the lead in lumbering in the United States. Today it is no longer so important in this industry. There is still some small-scale lumbering, but the forests are important chiefly as a source of wood for use in making wood pulp, which is in turn used in making paper. Maine is our first state in the production of wood pulp. Newsprint is made in numerous places in this area.

Fishing. Along the coast of New England the continental shelf reaches out for several miles under the ocean and affords an excellent fishing ground. Here the cod, haddock, herring, halibut, and mackerel, together with the lobster, thrive in relative abundance. The presence of a rich fishing ground near

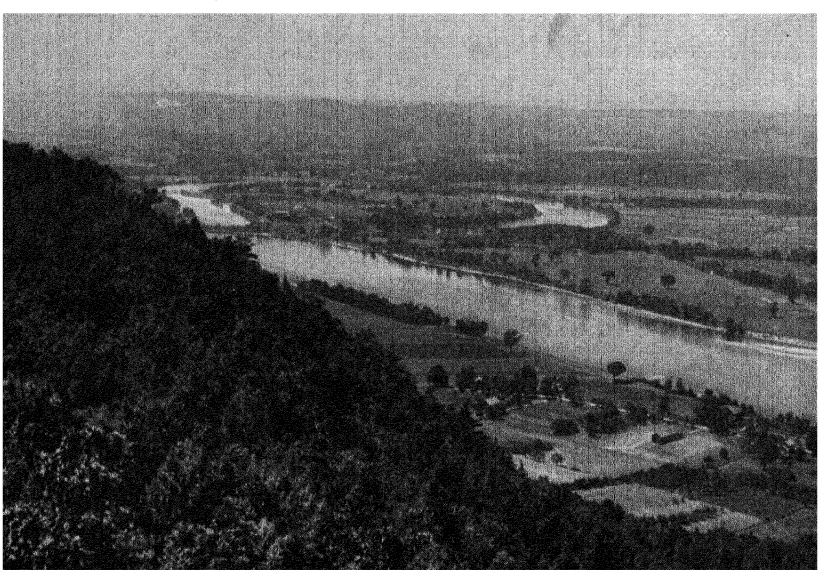
at hand early turned the attention of the people to fishing. Part of the fish are salted or smoked, but large quantities are marketed fresh. Some are canned in oil. The cities leading in the fishing industry are Boston and Gloucester.

Agriculture. Despite the relatively thin soil and harsh climate of New England, certain sections have profitable farming. Grain farming and cattle raising are not so profitable as in the Middle West. Many general farms in New England have been abandoned or have been changed to dairy, fruit, poultry, or market gardening. Many areas have one or more specialty crops. In northeastern Maine, where there is considerable sandy loam, the soil and the cool, moist climate make an ideal combination for the growing of potatoes. Aroostook potatoes are favorites in all the eastern markets. Special crops, such as tobacco and onions, are cultivated in limited areas in the Connecticut Valley. Cranberries are grown in bogs around Cape Cod.

The abundance of pasturage gives many parts of this region an advantage in dairying. Many farms in Vermont, New Hampshire, and Maine that are too hilly for the plow are used

The Connecticut River Valley near Holyoke, Massachusetts.

Ewing Galloway

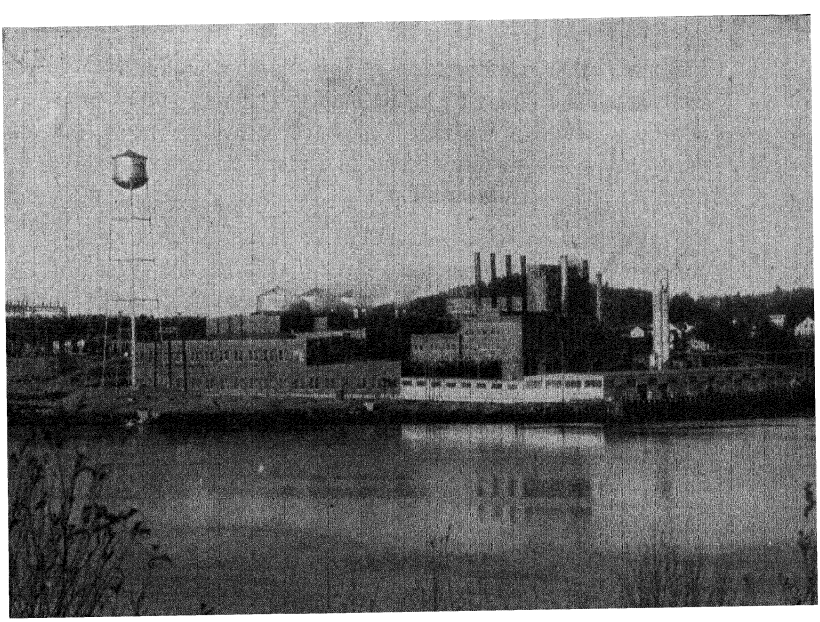


in dairying. This is now by far the most important branch of agriculture in New England.

The excellent market for dairy products in the many large cities, together with fast railways and trucks, has caused a tremendous growth in this industry during the last three decades. Each night milk is picked up from many remote stations in western and northern New England and is hauled into Boston, New York, and other cities. Thus the farmer near Bristol or Rutland, Vermont, finds a ready market for his commodity—thanks to modern methods of refrigeration and transportation. Poultry raising is a specialty in southern New England.

Manufacturing. In order for manufacturing to develop in any region, four things are necessary: (1) raw materials; (2) mechanical power; (3) a labor supply; and (4) a market to which the finished goods can be sold. New England rivers with their waterfalls afford a supply of cheap power for the operation of many mills. Water power has also been supplemented by coal imported from Appalachia.

A newsprint mill on the Penobscot River at Bucksport, Maine. This mill is a large producer of paper for newspapers.



The fact that agriculture was not too productive also impelled the people to turn to some activity other than farming. A large group of skilled workers is now available for factory work in this region. In addition, the numerous cities afford excellent markets for the finished products of the various mills and factories. Most raw materials must be shipped in, however.

Types of Manufacturing. The early cotton and woolen mills were begun along the line of New England waterfalls. Water power was the most important factor in determining their location here. The cities of special importance in the manufacture of cotton and woolen goods are Fall River, Manchester, Fitchburg, Lowell, Lawrence, Lewiston, Pawtucket, and Providence. Fall River has become one of the greatest cotton spinning and weaving cities of the United States.

In the middle of the eighteenth century, a Welsh shoemaker settled in Lynn and began the manufacture of shoes. From this humble beginning another characteristic industry of this region developed. Other cities leading in shoe manufacturing are Brockton, Haverhill, Boston, Manchester, and Salem.

Leather tanning began in the early Colonial days. Massachusetts still has a large number of tanneries, and Boston is the largest leather market in America.

Among other manufactures of this region are silverware in Providence and Meriden; men's hats in Danbury; brass products in Waterbury and Bridgeport; firearms in Springfield; hardware in New Britain; machine tools in Worcester; and paper in Holyoke, Massachusetts.

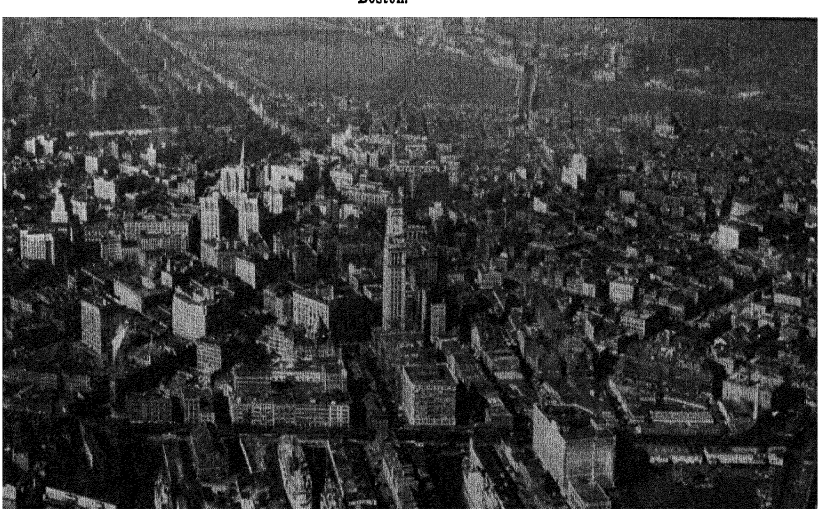
Transportation Facilities. Although New England has many good harbors, there is no large river that is navigable for any great distance into the interior. The Penobscot River, in Maine, though navigable for some distance, comes through a distinctly rural region. It does not open a rich hinterland, as does the Hudson, the Mohawk, or even the St. Lawrence. For this reason river transportation in New England has never been developed to any great extent. Much freight is carried by sea between New England ports and New York, and lesser amounts to other American ports.

Four railroad systems serve most of New England: the Bangor and Aroostook; the Boston and Maine; the New York, New Haven, and Hartford; and the Boston and Albany, which is part of the New York Central system. The New York, New Haven, and Hartford Railroad, which connects Boston and New York and serves all the large cities of southern New England, is one of the greatest passenger-carrying railroads in the United States.

Cities. In general, New England has developed along industrial rather than agricultural lines, and hence has become a region of cities. Nearly eighty per cent of the population of New England lives in towns and cities of more than twenty-five hundred inhabitants.

Frequently called The Hub, Boston is indeed the economic and cultural center of New England life; nearly all railways and roads converge in Boston. It is also the principal seaport for the region. As the terminus of most railways from the west, it has become the general distributor and wholesaler for trade with the rest of America. Boston is a great wool and leather market, a recognized tanning center for fine leather, and a general manufacturer of high-quality metal goods, including tools and fine hardware, watches, silverware, and jewelry. It serves as both the financial center and the

Boston.



printing and publishing center for most of New England. Many smaller cities and towns lying close by, such as Somerville, Cambridge, Quincy, and Everett, are regarded as part of greater Boston.

The other leading cities in New England are more important industrially than commercially. Providence, Fall River, New Haven, Bridgeport, Springfield, Hartford, Worcester, Manchester, Portsmouth, and Portland (Maine) all have from two or three to a score of industrial plants. With the exception of Worcester, all are located on excellent ocean harbors or on large streams. Because of the small size of their hinterlands, or tributary areas, and the north-and-south direction of the valleys, their growth in economic importance has been much slower than that of the more favored cities west of the Berkshire Hills. The cities of northern New England are small, and they have but little significance outside their own local districts.

General Outlook. The limited areas suitable for farming in New England make it impossible for New England agriculture to compete with the richer lands of the West. New England is primarily a manufacturing region, and is now obliged to import most of her raw materials, as well as large supplies of foodstuffs to feed her factory workers. While many of her industries owe their start to water power, their continued success is due principally to the supply of skilled labor now available and the ability of the manufacturers to supply high-grade products at a moderate price. This region no longer has a monopoly on mechanical power. The center of manufacturing has been moving steadily west as the use of coal and electricity has developed. In addition, the South has gone into the manufacture of cotton goods, and New England no longer has a monopoly in this type of textiles.

New England has the great advantage of being close to a large market. The entire North Atlantic region contains a greater number of cities of more than one hundred thousand inhabitants than any other region in the United States. These cities, therefore, afford large markets for the manufactured products of New England.

TEXT QUESTIONS

1. Name and describe the dominant surface features of New England.
2. Explain why many general farms in New England have been abandoned.
3. Explain the change in types of New England agriculture.
4. Why are certain specialty crops now profitable in the New England states?
5. Why is dairying an important industry in both Maine and Vermont?
6. What geographic and economic factors favor fishing along the coast of New England?
7. What are the four main things necessary for manufacturing in any region? Of these four, how many are present in New England? How many are lacking?
8. Name a commodity manufactured in each of the following cities: Meriden, Providence, New Britain, Brockton, Danbury, Lawrence, Winooski.
9. What factor has made New England predominantly a manufacturing region?
10. Name and locate two cities in New England noted for their fisheries.
11. Name three important railway systems of New England.
12. What percentage of the people of New England live in towns and cities of more than twenty-five hundred inhabitants?
13. Explain why Boston is frequently called "The Hub."
14. Are the other leading cities of New England more important industrially or commercially?

SECTION 7—POSSESSIONS OF THE UNITED STATES

Alaska. The territory of Alaska, in the northwestern portion of the North American Continent, was purchased from Russia in 1867. Alaska is in about the same latitude as Scandinavia and has about the same types of climate. The coastal areas, west of the mountain ranges, have a mild equable climate which is tempered by the warm winds from the Pacific Ocean. The interior has greater extremes in temperature and definite contrasts between winter and summer. In winter a temperature of sixty degrees below zero is not unusual, and in summer the temperature may rise to ninety degrees.

The long hours of sunshine during the summer in this northern country compensate for the short growing season. Because the sun shines from sixteen to twenty hours a day, crops mature in a short time. In the more favored areas barley, potatoes, cabbage, and turnips are grown, but there is always the fear of frost damage.

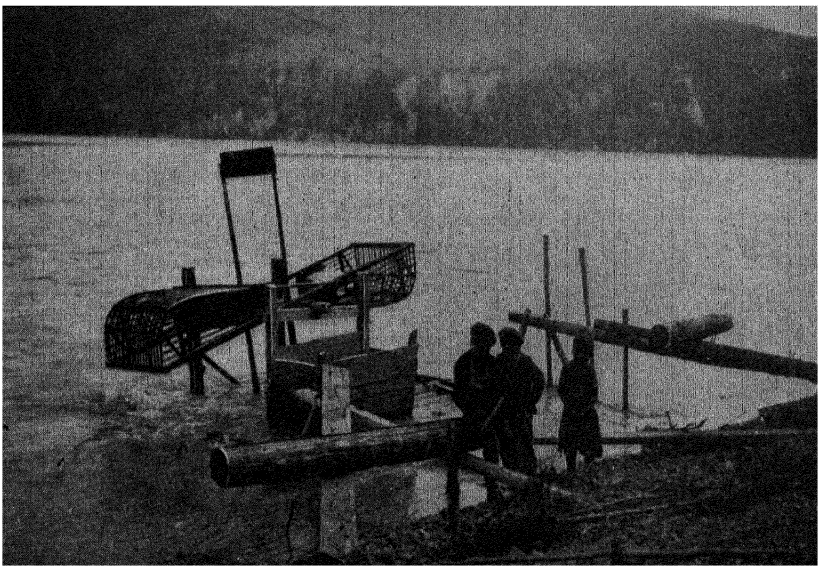
At the time of purchase Alaska was noted for its supply of furs, especially seal skins from the Pribilof Islands. Fur-bearing animals are still hunted and trapped on the mainland, but fur farming along scientific lines is increasing. Black and silver fox, mink, and marten are now raised in captivity.

As in western United States, gold attracted thousands of people, most of whom remained only until the placer deposits declined. The rush to the Klondike and Alaskan fields from 1897 to 1899 was similar to the rush of gold seekers to California in 1849. Gold is now principally produced from placer deposits in the Yukon Valley and in deep mines of the interior.

There are also large deposits of copper on the Prince of Wales Island and in the region north of Cook inlet. These rich deposits are accessible and commercially valuable. The total value of the gold and copper output has been many times as great as the original price paid for Alaska.

Alaska has valuable deposits of both coal and iron ore, neither of which are extensively worked.

Alaska is rich in minerals, but fisheries are now several times as valuable as mineral production. The salmon catch



Keystone View Company

A native's fishing wheel in Alaska.

alone was valued at about 37 million dollars in 1938. Along the coasts are many canneries, which pack for the foreign markets. Canned salmon is the leading export. Halibut, cod, and shell fish are brought to Seattle for sale throughout America as fresh fish. Salted and pickled fish, as well as fish meal and fish oil, are also prepared.

The best forests in Alaska, located in the southeast, are mainly coniferous. In the interior some timber is found along the watercourses; this timber is, however, too small for lumber and is used for pulp making.

An unusual type of animal industry has been developed in Alaska—the reindeer. A number of reindeer were placed on the plains by the Government some years ago for subsistence purposes. Reindeer serve the native peoples as a beast of burden as well as a food supply. Later a commercial reindeer industry developed, packing plants were built, and quantities of frozen reindeer meat were exported. The market for this meat is, however, a limited one, since many people are not familiar with it.

Because of the high-latitude location and short growing season, agriculture in Alaska is restricted to the hardier vegetables and certain cereals. Vegetables grow rapidly under

the long sunny days; peas, beans, parsnips, turnips, potatoes, radishes, and strawberries thrive. It is possible to grow small grains such as wheat, rye, and barley. Hay is also an important crop, providing feed for dairy cattle. Future agricultural developments will be limited to the local demand, with perhaps greater emphasis upon dairying. The United States Government has, for the past several years, been encouraging settlement and agricultural development of the Matanuska Valley.

Alaska's communication with the United States is entirely by water. Transportation within the territory is greatly influenced by the seasons. In winter, when the ground is frozen and snow covered, sleds drawn by dogs or reindeer are used. In summer, when the ground has thawed and there is much swampy land, transportation has to be by means of the waterways. The Yukon is navigable for a short time during the summer, as are also other streams. The unfavorable climatic and topographic features make road and railway building difficult, but progress is being made. Plans are now being drawn for the construction of a motor highway from the United States through British Columbia to Alaska.

Since Alaska has a population of only 59,000, there are no really large cities. Juneau, the capital and largest city, has about 4,000 people. Ketchikan, Anchorage, and Fairbanks rank next in size. Fairbanks is the terminus of the Alaska Government Railway, which gives access to the sea and serves the rich mineral area of the Copper River. Fairbanks is also in an area favored for future agricultural development. Nome is the principal town on the Seward peninsula; it serves the copper- and gold-mining areas nearby.

Puerto Rico. Puerto Rico is an island about ninety-five miles long and about thirty-five miles wide, somewhat smaller than our state of Connecticut. Because of its rich, fertile soil and well-developed agriculture, it is one of the most densely populated islands in the West Indies. The climate is tropical, although the elevation in certain parts makes these portions of the island excellent dwelling places for those accustomed to temperate zones.



Underwood and Underwood

Plowing with oxen on a Puerto Rican plantation.

The chief commercial products of this island are coffee, sugar cane, tobacco, and fruits. For a long time coffee was the principal crop, but lately there has been a tendency to grow more sugar cane under the plantation system. Sugar accounts for about one half of the total value of exports; it is followed by coffee and tobacco. Grapefruit, oranges, and pineapple are grown, chiefly for the American market. The principal industries are the refining of sugar and the manufacture of cigars, cigarettes, and Panama hats. Cotton, silk, and linen manufactures and embroideries rank second to sugar in export trade; in a recent year the United States imported twenty million dollars' worth of textiles and embroideries from Puerto Rico.

The Philippines. Several thousand islands, many of them small and unnamed, are included in the Philippines. Of the

dozen largest islands, Luzon and Mindanao are the most important.

In general, the climate is tropical, with alternate wet and dry seasons. In the interior of the islands, however, mountains and plateaus have the effect of modifying temperature and rainfall; climatic and vegetation zones are based on elevation. In the wet lowlands rice, bamboo, coconuts, and sugar cane grow; while at the higher elevations coffee, citrus fruits, corn, and sweet potatoes thrive.

The Philippine Islands are primarily agricultural; a large proportion of the thirteen million people depend upon farming for a livelihood. Rice, the chief food crop, makes up about seventy-five per cent of the diet. It is grown on the lowlands and terraced hillsides that can be irrigated; carabaos, or water buffaloes, are used as work animals in the wet rice fields. For years it has been necessary to import rice from Asia to supply the demand created by an increasing population having a higher standard of living. Corn is an important supplementary food crop; it is used by about one fifth of the people. Since it matures in a short season, it is often planted if there is a rice failure.

After rice and corn, sweet potatoes are a staple food. They are grown all over the islands, but especially where conditions do not permit the growth of rice. Yams, taros, millets, and beans are other subsistence crops.

The Philippine Islands grow four important export crops: Manila hemp, coconuts, sugar, and tobacco. Manila hemp, used for cordage, has been exported for years. It is cultivated both by small farmers and on large plantations, which are chiefly in the southern islands.

Coconuts are also grown under the plantation system. Copra (dried coconut meat) was formerly exported in quantity, but in recent years many crushing plants have been established in the islands and oil is exported. The islands now rank first in the export of coconut oil, which is edible and which has many industrial uses.

The modern development of the sugar industry dates from 1909, when Philippine sugar was first admitted to the United States duty free. Since that time output has increased, and

modern refineries prepare the sugar for market, chiefly in the United States.

The fourth cash crop is tobacco. Although domestic consumption of tobacco is large, leaf is exported to Europe and cigars are sent to the United States.

The Philippine Islands are rich in a number of minerals. The greatest mining development is in the gold fields of the northern islands. Production there has been increasing steadily until gold is now one of the major Philippine resources. There are also rich copper, iron ore, chrome, and coal deposits. Mining in the Philippines has been stimulated by the investment of foreign capital.

Approximately half the area of the islands is forested. There are many beautiful and valuable tropical woods. Other forest products are rubber, bamboo, resins, and gums.

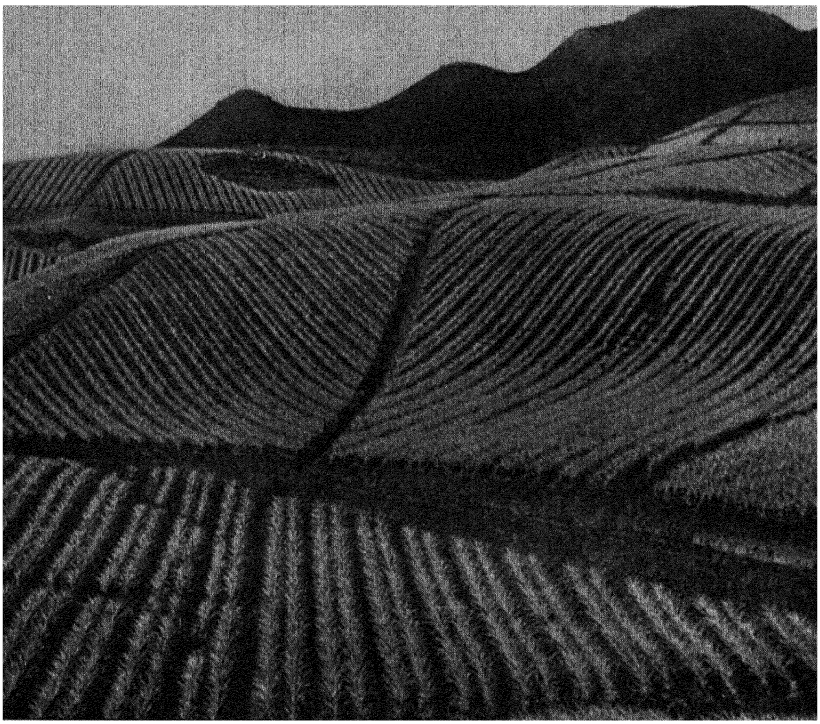
From time immemorial the people of the Philippines on their many islands have depended on boats, both between islands and around the coasts. Many of the islands have rugged and mountainous interiors where there is scant population and little need for expensive transportation lines. In the larger and more populous islands, modern transportation is increasing. There are now more than eight hundred miles of railway and ten thousand miles of highways.

Manila, with nearly 400,000 population, is the capital and leading port. Located on Manila Bay, it has one of the best harbors in the Orient and all modern port facilities.

Hawaiian Islands. The Hawaiian Islands are located in the mid-Pacific at the crossroads of ocean traffic. These islands are an important possession of the United States because of their strategic location and high productivity. The population of the islands is 384,000, more than half of whom are Asiatic in race.

The great commercial crop of the Hawaiian Islands is sugar cane, which is grown at the lower elevations. Sugar makes up the greatest percentage of the exports. Over fifty million dollars' worth of this commodity is exported to the United States annually.

Pineapples rank second in exports, millions of dollars' worth of canned pineapples being exported each year. Some of the



Underwood and Underwood

A Hawaiian pineapple plantation.

largest canneries in the world, consuming hundreds of tons of fruit each day, are located on these islands.

Coffee and tobacco are cash crops of lesser value. There is some subsistence agriculture, with rice as the leading crop. Corn, taros, vegetables, and fruits are also grown for local consumption; but, because of the emphasis on export crops, Hawaii regularly imports foodstuffs.

Honolulu, with a fine, spectacular harbor, is the capital and largest city. It is served by trans-Pacific airways and many steamship lines.

Other Possessions of the United States. American Samoa, Guam, and Midway Islands in the Pacific Ocean are controlled by the United States Navy and are highly valued for their strategic location. They are also important stations in cable service and in air transportation.

The Virgin Islands, lying east of Puerto Rico in the Caribbean Sea, were purchased from Denmark in 1917. They, too,

are important chiefly because of their location, guarding the eastern gateway to the Panama Canal.

The Canal Zone, which is owned by the United States, includes a strip of land five miles wide on each side of the Panama Canal. The opening of the Canal in 1914 provided for the first time easy and cheap ocean transportation between the east and west coasts of the United States. International trade routes have also been shortened thousands of miles by this short passage between the two great oceans of commerce.

TEXT QUESTIONS

1. What agricultural crops are grown in Alaska?
2. Compare the mineral output of Alaska with its fisheries.
3. How does climate influence transportation in Alaska?
4. Why is meat packing developing in Alaska?
5. What are the three important exports of Puerto Rico?
6. Name the principal commercial products of the Philippines.
7. Why are the Hawaiian Islands important to the United States?
8. Where is Guam? Where are the Samoa Islands? the Virgin Islands?
9. What is the importance of the Panama Canal to the United States?

PROBLEMS AND PROJECTS

1. How does the shape of the earth give Seattle an advantage in trading with the Orient?
2. Give at least three reasons why the meat supply of the United States is not increasing in proportion to the population.
3. On an outline map of the United States, place in each state the figure representing the population per square mile of that state.
4. On an outline map of the United States, trace the routes of the following railroads: the Santa Fe, the Southern Pacific, the Northern Pacific, the Union Pacific.
5. Write a report on irrigation in the West, touching on (a) the location of the arid and semiarid regions, (b) the reasons for lack of sufficient rainfall, (c) the way in which irrigation is changing living conditions in the dry west, (d) the important crops raised under irrigation.

6. Are the forest preserves of the Rockies of greater importance for water conservation or for timber?
7. Why have the Great Plains had an agricultural history marked by great extremes of prosperity and depression? Will the future merely repeat this history?
8. Using the following headings, compare the production of cane sugar with that of beet sugar: (a) growing the crops, (b) harvesting the crops, (c) refining the sugar, (d) marketing the product.
9. Make a table showing the cities in the Central States having a population of more than one hundred thousand. How many are situated on the Great Lakes? on the Mississippi River system? How many are inland cities?
10. On an outline map of the United States, show the location of (a) the corn belt, (b) the sugar-beet belt, (c) the spring-wheat region, (d) the winter-wheat region.
11. Compare the type of farm labor and the treatment accorded it in the wheat belt and in the corn belt. How does this affect social conditions of the farmers themselves?
12. The silkworm and the mulberry tree upon which it feeds do well in the state of Indiana. Why is this state, then, not a good place for the production of silk?
13. What are the economic and geographic factors that determine the boundaries of the corn belt?
14. Duluth, Minnesota, is near the head of Lake Superior, holding a position somewhat like that of Chicago, on Lake Michigan. Why is Duluth of less commercial importance than Chicago?
15. What factors have caused the manufacture of farm machinery to be located near the corn belt?
16. Find out the percentage of improved land in each state in the United States. Make a bar graph illustrating your findings. Which state has the greatest percentage of improved land? Why?
17. What is the importance of the fall line?
18. Why are legumes becoming increasingly important as a crop in the cotton belt?
19. Why is the population of the Southern States mainly rural?
20. On an outline map of the state of Mississippi, locate all the villages and towns having a population of three thousand or more. What is the reason for the rural nature of this state? Where are the larger towns located? Why?
21. What are the geographic and economic advantages for cotton manufacturing in the South? Which of these are permanent and which are temporary?

22. On an outline map of the United States, trace the railroad route of goods shipped from your city to New Orleans.
23. Name several reasons why the North Atlantic coastal plain is more thickly settled than the South Atlantic coastal plain.
24. What is the cause of the decline of wheatgrowing in New York State?
25. List the transportation facilities of your state under the following headings: (a) good automobile roads, (b) internal waterways, (c) harbors, (d) railroads.
26. Why is New Jersey a great manufacturing state in spite of the fact that it has a small amount of fuel and only meager water-power resources, and that it produces very little of the raw material used in its factories?
27. What geographic advantages does the location of the city of Norfolk have? What disadvantages?
28. From the table of the United States Census, or from other sources, make a table showing the cities of the Middle Atlantic States having a population of (a) more than 500,000, (b) 200,000 to 500,000, (c) 100,000 to 200,000. How many of each group are in New York State? in Pennsylvania? in New Jersey? in Maryland? in Delaware? What is your conclusion as to the important effects of these large cities on the industry of this region?
29. New England lacks coal and iron. Why, then, does the manufacture of light metalwares predominate in this region?
30. Why are the maritime provinces of Canada agricultural while the New England States are industrial?
31. Why are cities like Providence, Fall River, and Bridgeport smaller than New York, Philadelphia, and Baltimore?
32. What were the chief causes that determined the location of cities in New England? Name one city to illustrate each cause.
33. Boston is nearer Liverpool than is New York City. What prevents Boston from having as much foreign commerce as New York City? On an outline map of the world, show the direction of a steamship route from Boston to Liverpool, and that of one from New York City to Liverpool.
34. On an outline map of New England, locate a city prominent in the manufacture of each of the following: shoes, silverware, firearms, clocks, brassware, machine tools, jewelry, hardware.
35. On an outline map of the United States, show the principal airways between New York and San Francisco.
36. Why are little coal and lumber exported from Alaska to the United States?

37. Determine approximately the number of miles from New York City, via the Panama Canal, to each of the following cities: San Francisco, Hong Kong, Yokohama, Manila, Melbourne, Lima, Valparaíso. Compare these distances with those via the Cape Horn route.

TOPICS

1. Hydroelectric power as a substitute for coal.
2. The manufacture of iron and steel.
3. Milk for Boston and New York City.
4. The growth of the cotton-manufacturing industry in the South.
5. The economic value of the Great Lakes to the following industries: lumber, coal, iron.
6. Wheat production: (a) regions of growth, (b) methods of harvesting, (c) marketing, (d) milling centers.
7. The motion-picture industry of southern California.
8. The TVA project.
9. The by-products of corn.
10. Soil conservation.
11. Agricultural possibilities of Alaska.
12. Boulder Dam.
13. Co-operative marketing of agricultural products in California.

FOR CLASS DISCUSSION

1. Diversified farming has made southern agriculture more profitable.
2. The South has become as great a manufacturing region as New England.
3. Exhaustion of the forests will vitally affect every industry in the Central States.
4. Los Angeles will eventually become a larger city than New York.
5. The economic and social conditions of the Southern States are different from those in the Corn Belt.
6. Government help to people who are living on marginal or submarginal land is desirable.
7. The ability of Alaska to maintain a population as large as that of the state of California is doubtful.
8. The more highly developed a given region is, the less likely it is to utilize its rougher lands.

CHAPTER XX

OTHER REGIONS OF NORTH AMERICA

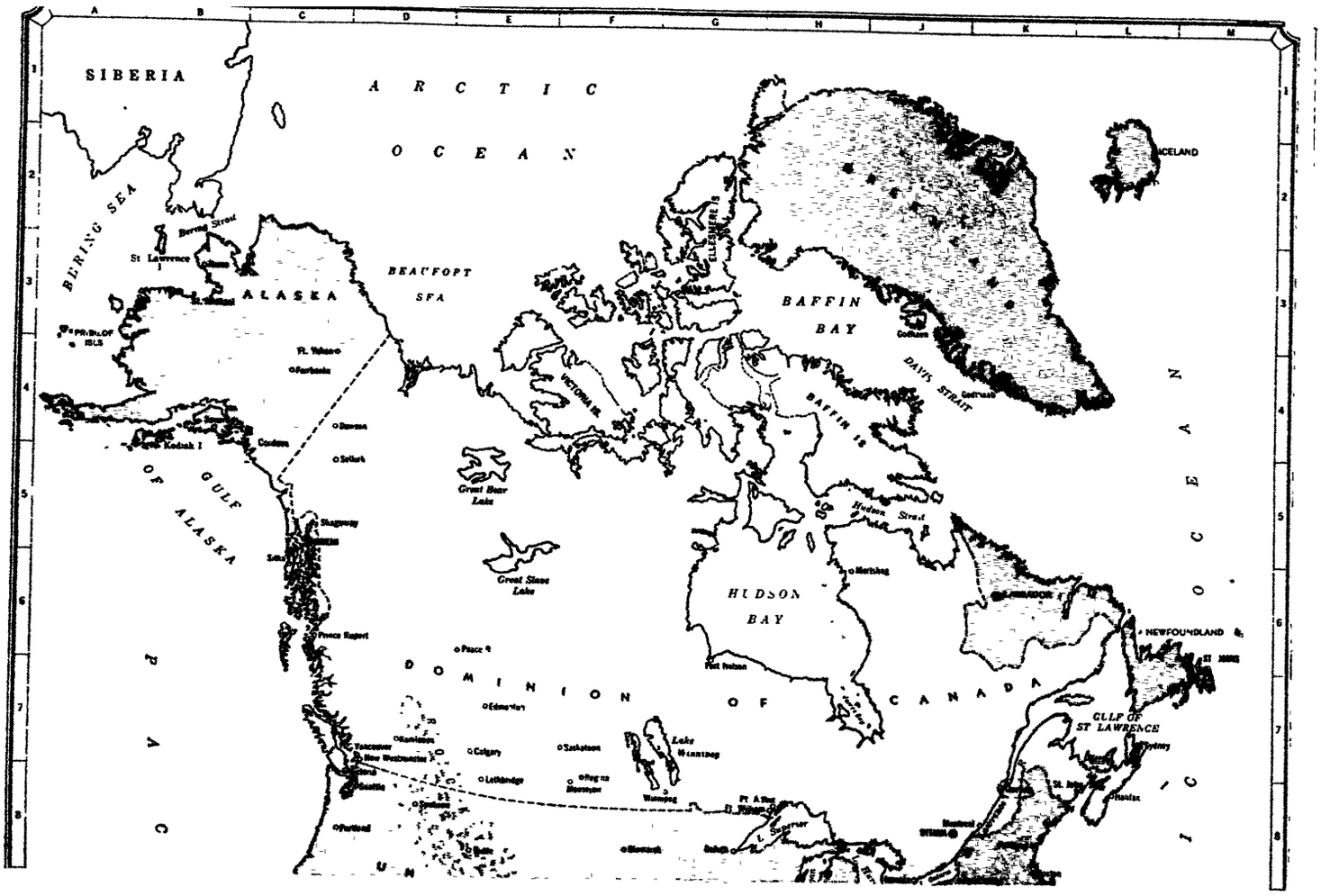
SECTION 1—CANADA

Area, Topography, and Population. The Dominion of Canada extends from the North Pole to the same latitude as that of Rome, Italy. It is about thirty times the size of the British Isles, and even exceeds the total area of the United States, Alaska, Hawaii, Puerto Rico, and the Virgin Islands combined. This great country covers 3,694,863 square miles.

Canada has an extremely varied topography, including mountains, foothills, plains, and many interior lakes in addition to the Great Lakes on the United States border. The scenic wonders attract many tourists every year.

The population of Canada was officially estimated in 1938 to be somewhat over eleven millions. The density of population based on the land area of the entire country, exclusive of the almost vacant Northwest Territories, is five persons per square mile, which is just about one eighth of the density of population of Continental United States. Canada consists of nine provinces and two territories, the population of which in 1938 was estimated to be:

Alberta	783,000
British Columbia	761,000
Manitoba	720,000
New Brunswick	445,000
Northwest Territories	10,000
Nova Scotia	548,000
Ontario	3,731,000
Prince Edward Island	94,000
Quebec	3,172,000
Saskatchewan	941,000
Yukon Territory	4,000
Total Population	11,209,000


SIBERIA
ARCTIC OCEAN
BERING SEA
Bering Strait
St. Lawrence
ALASKA
BEAUFORT SEA
PRIBILOF ISLS
Ft. Yukon
Fairbanks
Kodiak I.
Juneau
Skagway
Sitka
GULF OF ALASKA
Prince Rupert
Edmonton
Vancouver
New Westminster
Calgary
Saskatoon
Lethbridge
Regina
Winnipeg
Lake Winnipeg
Portland
Seattle
Spokane
Minneapolis
Duluth
Sault Ste. Marie
Toronto
Montreal
Ottawa
Quebec
Boston
Albany
Buffalo
Detroit
Chicago
Milwaukee
Great Bear Lake
Great Slave Lake
VICTORIA IS.
ELLESMERE I.
BAFFIN BAY
DAVIS STRAIT
BAFFIN IS.
Hudson Strait
Nottingham
Port Nelson
HUDSON BAY
Churchill
Moosonee
Moose Factory
Cochrane
Timmins
Sudbury
North Bay
Kingston
DOMINION OF CANADA
GULF OF ST LAWRENCE
Sydney
St. John
Halifax
NEWFOUNDLAND
ST. JOHNS
ICELAND
PACIFIC OCEAN
ATLANTIC OCEAN


UNITED STATES
GREAT PLAINS
APPALACHIAN MTS.
Salt Lake City
Cheyenne
Omaha
Des Moines
Indianapolis
Columbus
Kansas City
St. Louis
Louisville
Cincinnati
Pittsburgh
Richmond
Norfolk
Pueblo
Santa Fe
Oklahoma
Memphis
Nashville
Atlanta
Charleston
Savannah
Los Angeles
San Diego
Phoenix
Fort Worth
Dallas
El Paso
Houston
Galveston
San Antonio
Mobile
New Orleans
Tampa
Key West
Gulf of California
MEXICO
GULF OF MEXICO
Bahama Islands
WEST INDIES
CUBA
ISLE OF PINES
Santiago de Cuba
HAITI
PUERTO RICO
JAMAICA
Gulf of Campeche
BRITISH HONDURAS
GUATEMALA
HONDURAS
NICARAGUA
EL SALVADOR
COSTA RICA
PANAMA
Panama Canal
CARIBBEAN SEA
SOUTH AMERICA
PACIFIC OCEAN
ATLANTIC OCEAN
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with Principal Cities
NORTH AMERICA
SCALE OF MILES
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Climate and Location of Population. In general, the climate of southern Canada is similar to that of whatever portion of the United States is directly south. British Columbia duplicates the Pacific Northwest in climate; the Prairie Provinces resemble the American Dakotas; southern Ontario is similar climatically to western New York State; and the St. Lawrence Valley is not greatly different from interior New England. New Brunswick, Nova Scotia, and coastal New England are often described as one climatic region.

The present population of Canada is largely concentrated in this most favorable southern one third of the country. Farther north the wind-swept plains and coniferous forests, with their more severe climate of continental interiors, are sparsely populated. The tundras of the far north have only a few natives and trading posts. It is improbable that the northern two thirds of Canada will ever have a large population, although there will be many scattered work centers for the exploitation of timber, minerals, and water power. Southern Canada is far from being filled; and it is estimated that the country has sufficient natural resources, including its soil, minerals, forests, and fisheries, to support at least fifty million people. Many farmers from America have been attracted to the rich lands of the Canadian west and have emigrated to the Prairie Province wheat belt to become loyal Canadians.

Forests. With agricultural lands as the leading resource, forests are probably second in Canada. The total area covered by forests is estimated to be nearly eight hundred million acres. About one third of this area is covered with merchantable timber; one third is covered with young growth; and the remaining one third is unproductive.

From the standpoint of lumber resources, Canada ranks third in the world. The chief varieties of trees are spruce, cedar, Douglas fir, white pine, tamarack, balsam, and hardwoods such as birch, oak, ash, hickory, and several varieties of maple. The supply of valuable hardwoods, however, is being rapidly exhausted. In addition to these, there is also an abundance of hemlock. The bark of this tree gave rise to the tanning industry, which is especially prominent in Ontario.

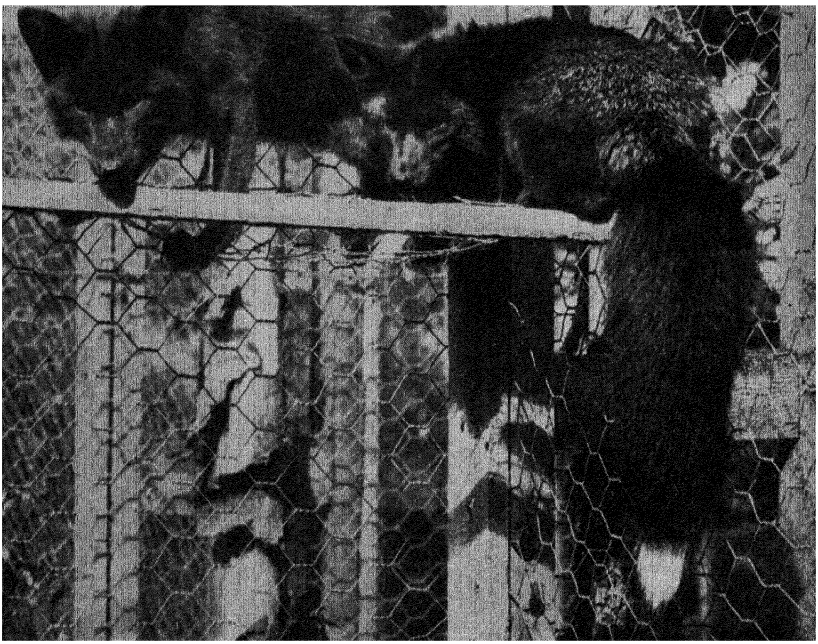


Underwood and Underwood

Logs on the Gatineau River, Canada.

Fisheries. · Canada possesses some of the most extensive fishing waters in the world. Nearly four fifths of the fishing waters of the North Atlantic region belong to Canada; and the Pacific Ocean, Hudson Bay, and the inland lakes also are valuable fishing grounds. The fishing industry, which is of great commercial importance, furnishes both fresh and canned varieties of fish for a large export trade. As in the case of the fishing industry of the United States, the principal varieties of fish are lobsters, cod, herring, whitefish, haddock, halibut, and sardines on the Atlantic Coast and salmon on the Pacific Coast.

Furs. Fur-bearing animals exist in considerable numbers in the vast sub-Arctic forests of Canada. Fur trading has been an important part of Canadian activities since the earliest days of the French régime, when that trade was monopolized by large proprietary companies. In Canada are furs of great value, including beaver, muskrat, otter, ermine, marten, fisher, mink, and fox.



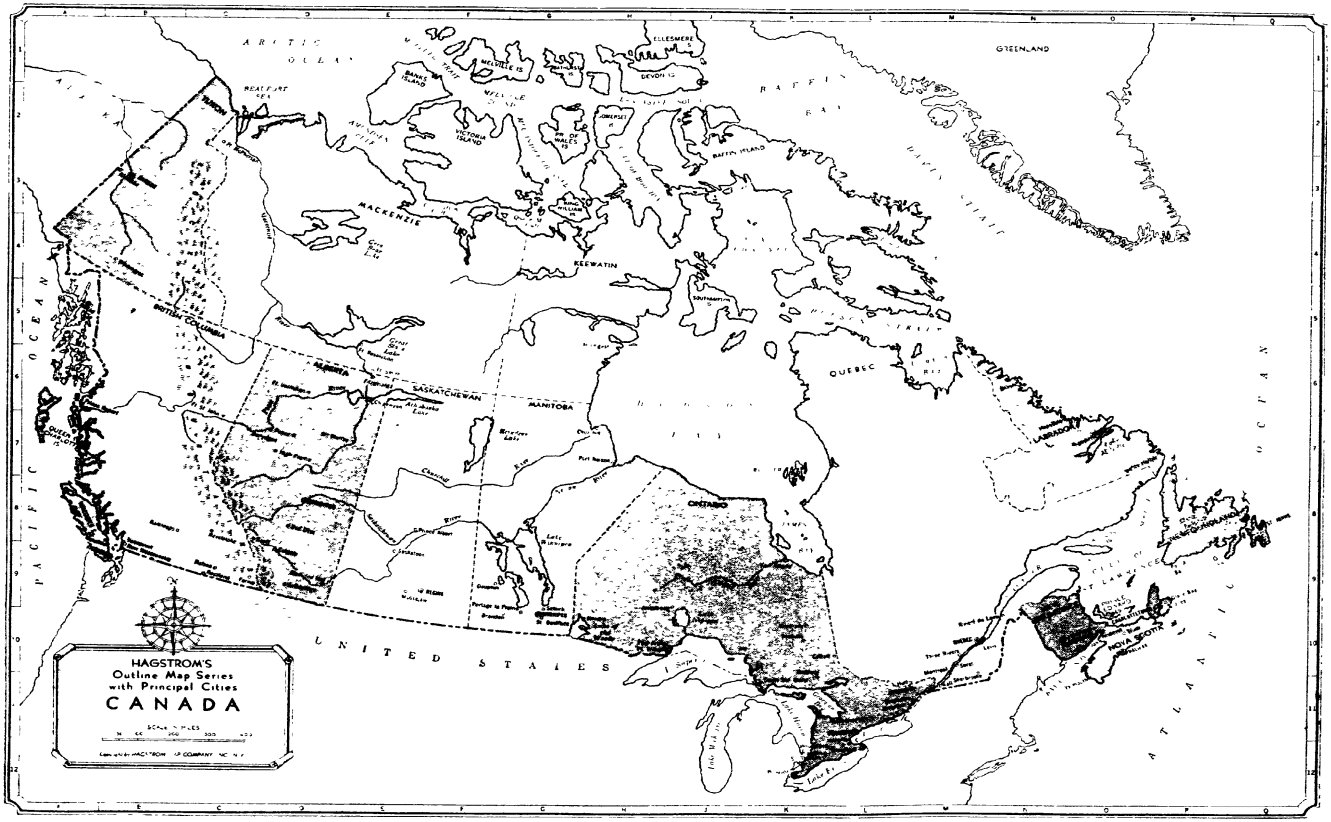
Ewing Galloway

Silver black foxes.

Canada no longer depends for its supply of skins entirely upon the trapping of wild animals. Various fur-bearing animals are now being raised commercially on large farms. These are given over to the raising of the fox, the raccoon, the mink, the marten, the skunk, the fisher, and the fitch. The province of Prince Edward Island led the way in fur farming, but Quebec now has more than twice as many fur farms as any other province. The value of furs exported from Canada in the year 1937 amounted to about $18,500,000.

Mineral Resources. Canada is rich in minerals, particularly gold, which leads all others. It also has commercial deposits of copper, nickel, lead, zinc, silver, platinum, asbestos, coal, natural gas, and petroleum.

Comparatively little is known of the possibilities of the practically unexploited Northwest Territories. Deposits of gold, copper, and silver have been found in considerable quantities, and oil has been found in the far north. This section of Canada gives promise of having a much larger supply of minerals than is now known. The main problem of exploitation of the


ARCTIC OCEAN
GREENLAND
ELLESMERE I.
DEVON I.
MELVILLE I.
BANKS ISLAND
VICTORIA ISLAND
PRINCE OF WALES I.
BAFFIN ISLAND
BAFFIN BAY
DAVIS STRAIT
REAL PART SEA
YUKON
MACKENZIE
KEEWATIN
HUDSON BAY
SOUTHAMPTON I.
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
LABRADOR
NEWFOUNDLAND
NOVA SCOTIA
PRINCE EDWARD I.
ST. LAWRENCE R.
GULF OF ST. LAWRENCE
PACIFIC OCEAN
ATLANTIC OCEAN
UNITED STATES
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CANADA

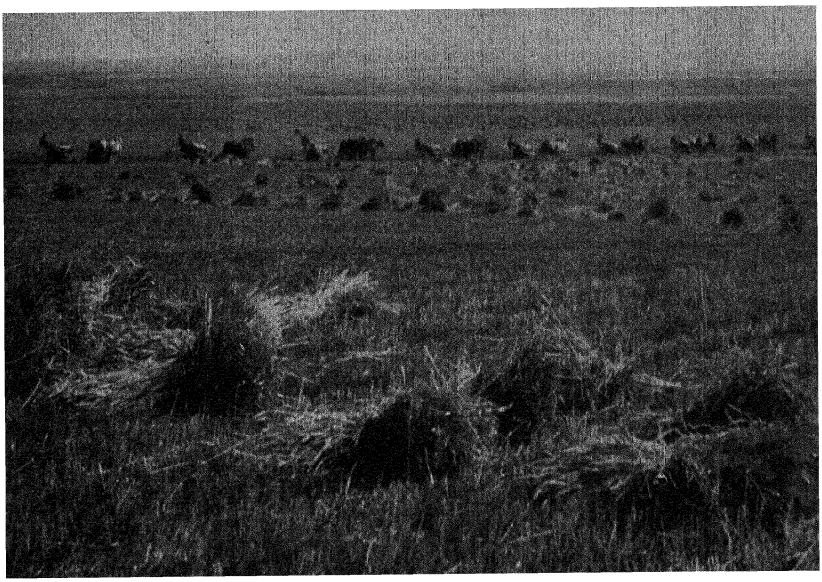
Northwest Territories is transportation, now partly solved by the airplane.

Ontario, Quebec, and British Columbia produced over ninety per cent of all the gold mined in Canada in 1937. Over half of the Dominion's production of copper and practically all her nickel come from the mines of the Sudbury district in Ontario, where eighty-seven per cent of the nickel supply of the world is produced. British Columbia leads the other provinces in the production of silver and lead. Zinc is produced chiefly in British Columbia and Manitoba, and iron in Ontario and Nova Scotia.

Large deposits of mica are found in Ontario and Quebec; these regions furnish the market of the United States with practically the entire amount of mica consumed in this country. Canada produces also more than half of the world's entire supply of asbestos. The principal mines of this mineral are located in the province of Quebec.

Canada has large fields of coal, the second most valuable mineral, but their location is such that the best use cannot be made of them. The great, populous St. Lawrence Valley is almost devoid of coal and has to import much of this mineral from the United States. The coal mines of Canada are known to extend over an area of more than 111,000 square miles. These fields may be conveniently divided into the bituminous coal fields of Nova Scotia and New Brunswick, the lignite fields in Manitoba and Saskatchewan, and the anthracite and bituminous coal fields in Alberta and British Colombia. The cost of railroad transportation of coal from the immense Alberta field to the eastern provinces is prohibitive and accounts for the fact that Canada's annual average imports of coal from the United States are more than 13,000,000 tons.

Agriculture. Canada is largely agricultural, although manufacturing industries now play a significant part in her economic life. Agricultural products represent the largest share of Canadian exports. Wheat is the chief money crop of Canadian farms, although hay and clover, oats, barley, tobacco, potatoes, and alfalfa are also of considerable importance. The highest wheat yield in Canadian history was in 1928 when more than 566,700,000 bushels were produced. According to recent sta-



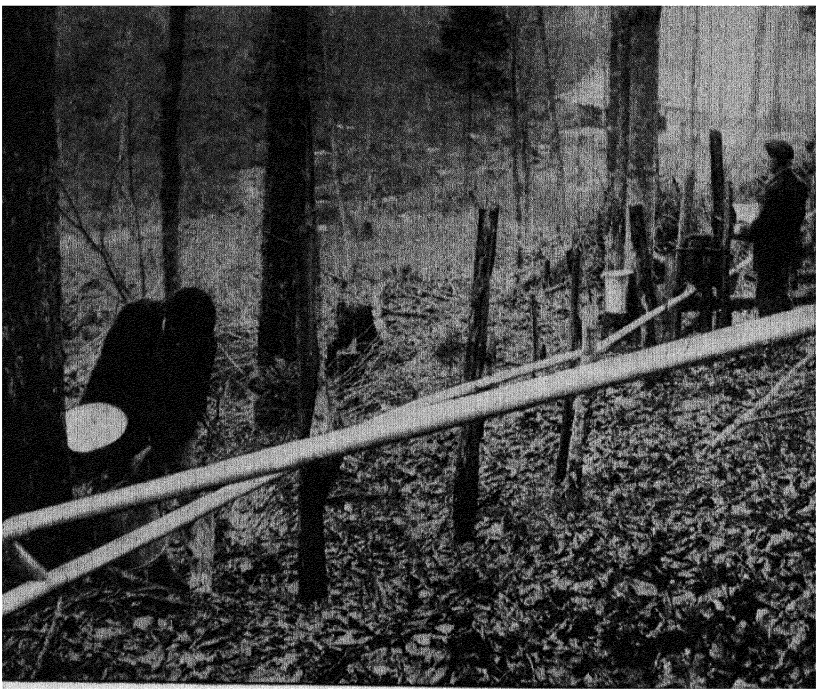
Canadian National Railways

Harvesting grain in western Canada.

tistics the yield in 1939 amounted to almost 500,000,000 bushels. Most of these crops are grown on the great plains in the West, where both climate and soil are favorable. The abundance of sunshine, which lasts from sixteen to nineteen hours a day in midsummer, has enabled the Canadian grain grower to push his farming northward more than a thousand miles from the American border. Rain is sometimes scanty in these plains, but the lessened evaporation of the far north leaves more moisture for the use of the growing crop. Canada ranks high in the list of wheat-producing countries of the world.

In the St. Lawrence Valley, whose growing season compares with that of the upper New England states, the most important crops are hay, oats, wheat, and potatoes. Southern Ontario, where the climate and the soil of Michigan are duplicated to a large extent, is the principal region for the growing of apples and small fruits. Some of the most productive apple orchards in the British dominions are in the Annapolis Valley, the Evangeline country of Nova Scotia.

From southern Ontario and Quebec come most of the dairy products of Canada. Canada is one of the greatest cheese-making and cheese-exporting countries in the world; it is exceeded by only New Zealand and Holland. The export of cheese



Underwood and Underwood

Gathering sap from sugar maples for use in making maple sugar. Note the pipe line through which the sap runs to a central point. The production of maple sugar is an important industry in Canada.

alone in 1938 amounted to 87,947,500 pounds, nearly all of which went to the United Kingdom.

Manufactures. For many years the industrial development of this country was not comparable to the resources that were available. This was partly due to the fact that Canada is a country that has been settled within relatively recent times. In the past, three important factors hindered manufacturing in this country: the lack of a supply of labor; the lack of adequate transportation facilities; and the small market for manufactured products. In wealth of raw materials and power resources, however, Canada is well equipped for many types of manufacture. Since about 1910 there has been a distinct movement to build up the industries of the country so that the demands for manufactured products can be supplied at home and large surpluses exported to other parts of the British Empire.

Iron and steel are made in Nova Scotia. The city of Sydney is the principal center, as it is located near supplies of coal, iron, and limestone. There are important steel works also along the shores of the Great Lakes, especially at Toronto, Hamilton, and Sault Ste. Marie.

The most important manufactures, according to value, are vegetable products, wood and paper products, iron, animal products, textiles, nonferrous metals, nonmetallic minerals, and chemicals. The airplane industry now promises to become important. Many famous American and English firms have branch plants in Canada.

The chief exports are newsprint paper, wheat, gold bullion, nickel, copper, planks and boards, meat products, and wood pulp. Of these, the United States takes about forty per cent.

Transportation Facilities. Canada has many great rivers. The most important are the Mackenzie, St. Lawrence, Yukon, Nelson, Saskatchewan, Peace, Churchill, and Fraser. All these rivers reach far into the interior but, with the exception of the St. Lawrence, none of them tap regions of commercial importance. All except the Fraser are icebound during a considerable portion of the year. In winter St. Lawrence Valley traffic must seek an ocean port that is ice-free, such as Halifax, Saint John, or nearby American ports.

In the matter of railways, Canada has a greater mileage in proportion to population than any other country. According to figures for 1937, the total mileage of Canadian railways was 42,727, or about one mile of railway for each 263 inhabitants. Two transcontinental roads connect the Atlantic and the Pacific; namely, the Canadian Pacific and the Canadian National.

Cities. Montreal, with a population of somewhat more than 800,000, is the metropolis and the commercial capital of Canada. Although this city is a thousand miles inland, it functions as a seaport. This port is nearly three hundred miles nearer Liverpool than is New York, but it is closed by ice four months or more during the winter. This city has one of the greatest grain-exporting harbors on the continent.

Quebec is the oldest city in Canada and is one of the two fortified cities in North America, the other being Halifax. Quebec, which is the capital of the province of Quebec, was formerly the most important city in Canada, but now it ranks sixth in size. It has become prominent as a manufacturing rather than as a commercial center. The building of a railroad bridge at Quebec has helped this city considerably by connecting it with Atlantic ports. Two other cities of importance in eastern Canada should be mentioned: Halifax, the capital of Nova Scotia; and Saint John, in New Brunswick. Both of these cities are located on ice-free harbors and are railroad termini for trunk lines to the west.

The second city in Canada is Toronto, the capital of Ontario, with a population of over 630,000. It has a rich hinterland on the Ontario Peninsula. Other cities of importance on this peninsula are Hamilton and London.

Ottawa, the capital of the Dominion, is located a short distance south and west of Montreal. It is known chiefly because of its political importance, but it is also a commercial and railway center.

There are no cities of size on the Canadian side of Lakes Huron and Superior; but some three hundred miles to the west of Lake Superior, at the entrance to the prairie country, is the city of Winnipeg, the capital of the province of Manitoba. Located on the eastern margin of one of the world's richest grain regions, Winnipeg has become the assembly point for trainloads of eastbound wheat and carloads of sheep and cattle from the ranches. It is the great railway center of western Canada. In Saskatchewan, Regina and Saskatoon are the distribution centers for a vast wheatgrowing area.

Calgary and Edmonton are supply cities for the ranch lands of the province of Alberta. Calgary is the center of a great stock-grazing region; while Edmonton, the capital of the province, farther north serves a wheatgrowing area. It was originally a fur depot and center for outfitting hunters, trappers, and miners; it is now an important manufacturing city.

The metropolis of western Canada is Vancouver, the third city in size in the Dominion, with a population of approxi-

mately 247,000. Located in British Columbia, not far from the American border, Vancouver has excellent railroad connections with the East, as well as close commercial relations with the American cities of the Pacific Coast. Its harbor is a deep arm of Puget Sound; steamship lines connect it with all parts of the world. Canadian wheat, lumber, and minerals are exported through Vancouver.

Relationship to the United States. The Dominion of Canada is commercially the best foreign market for the United States; it has the highest per capita consumption of American goods. More than sixty per cent of the imports of Canada are from the United States. Canada is also the chief source of supplies for the United States. In 1938, for example, it sent over to our country $423,000,000 worth of Canadian goods. We need Canadian products, and Canada needs ours. The fact that people of the same race, language, and culture are on both sides of the boundary does much for easy commercial relations.

TEXT QUESTIONS

1. Name the nine provinces of Canada. Which ones have the most population?
2. Of what do the natural resources of Canada consist?
3. How does Canada rank as a wheat-producing country?
4. What minerals does Canada produce in abundance?
5. Name two transcontinental railroads in Canada.
6. What provinces lead in fur farming? in dairying? in manufacturing?
7. Why has Canada been slower than the United States in developing manufacturing?
8. Locate the following cities: Halifax, Toronto, Edmonton, Winnipeg, Vancouver, Montreal, Quebec. What is the principal significance of each?
9. What Canadian products do we need most? What American products does Canada need?


San Diego
Phoenix
Fort Worth
Dallas
Birmingham
Charleston
Savannah
El Paso
Juarez
Gulf of California
Hermosillo
Chihuahua
Guaymas
Mobile
Jacksonville
Houston
New Orleans
San Antonio
Galveston
Tampa
MEXICO
Laredo
GULF OF MEXICO
Miami
Bahama Islands
NASSAU
Key West
Saltillo
Monterrey
Torreón
Alfalfa
La Paz
HABANA (Havana)
WEST INDIES
CUBA
Mazatlán
Zacatecas
San Blas
S. Luis Potosi
Tampico
Isla de Pinos
Manzanillo
Santiago de Cuba
REPUBLIC OF HAITI
DOMINICAN REPUBLIC
SAN JUAN
PUERTO RICO
Gulf of Campeche
Progreso
Mérida
Guadalajara
MEXICO CITY
Puebla
Vera Cruz
Grand Cayman
JAMAICA
PORT-AU-PRINCE
SANTO DOMINGO
ISLAND OF HAITI
Manzanillo
BELIZE
BRITISH HONDURAS
Acapulco
Salina Cruz
GUATEMALA
HONDURAS
CARIBBEAN SEA
GUATEMALA
TEGUCIGALPA
SAN SALVADOR
EL SALVADOR
NICARAGUA
Leon
Lake Nicaragua
MANAGUA
CENTRAL AMERICA
COSTA RICA
SAN JOSÉ
Panama Canal
Colón
PANAMA
PANAMA
SOUTH AMERICA
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CENTRAL AMERICA
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SECTION 2—LATIN NORTH AMERICA

MEXICO AND CENTRAL AMERICA

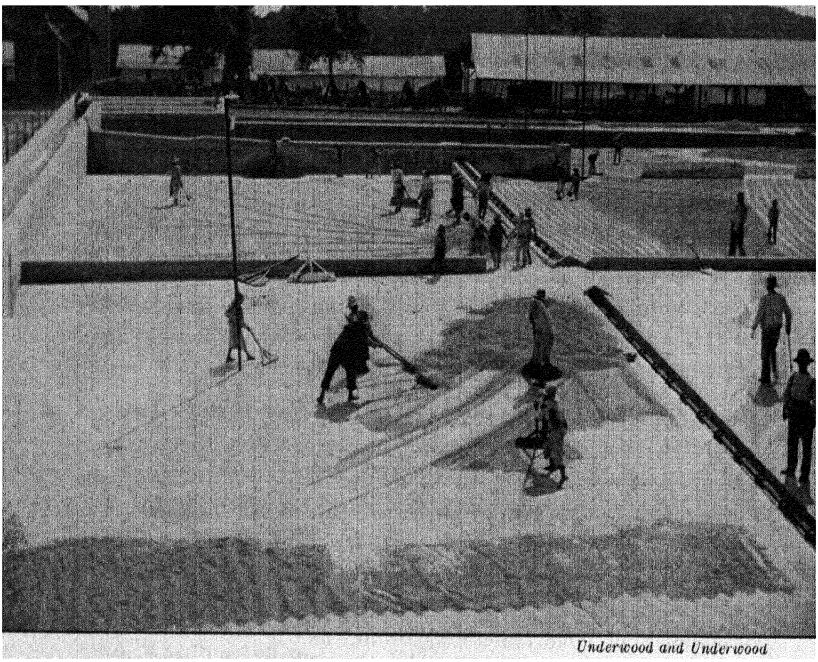
Introduction. Mexico and the small states comprising the section of the North American Continent called Central America are similar geographically and climatically. The coast is low and unhealthful; toward the interior the land rises to a high plateau, which is more habitable for man.

Natural Resources. These countries are rich in natural resources. One of the important oil districts in the world is near Tampico, Mexico, on the Gulf of Mexico. Mexico has some of the richest silver mines in the world and also large quantities of zinc and lead. This country also possesses a few deposits of coal and iron. Gold and silver are found in paying quantities in several of the small states of Central America, particularly in Nicaragua and Honduras.

Most of the natural resources of this region are poorly developed because of the meager transportation facilities as well as the backwardness of the people. Here we find a mixture of the white, the Indian, and the Negro races, with the Indian in predominance.

One of the resources of this region is the forests. Along the Caribbean Sea are dense forests producing mahogany, rosewood, tropical cedar, and logwood.

Agriculture. Agriculture, stock raising, and mineral exploitation are the chief occupations of Mexico. The country is rich, but primitive methods are used. The cultivated products of Mexico and Central America are of every variety from tropical to temperate, according to the elevation on which the crop is cultivated. The leading Mexican crops are as follows: corn, beans, wheat, sugar, coffee, cotton, and henequen. The most distinctive product of this area is coffee, which is a highland crop grown along the Pacific slope of southern Mexico and Central America. The Yucatan Peninsula of Mexico is an important source of sisal hemp, derived from the henequen plant. Sisal is imported into the United States and is used in the manufacture of binder twine. Bananas are an important



Underwood and Underwood

Great concrete drying floors at El Pacayal, the largest coffee farm in Guatemala. This plantation has more than seven thousand acres in coffee trees.

product of Central America, grown as a local food supply everywhere, as well as on huge American-owned plantations for export to the United States.

Manufacturing. The manufacturing of this entire region consists largely of handwork. As in the Orient, we find here the making of hand-woven fabrics, carved woods, pottery, jewelry, and leather articles. The backwardness of the people has had a marked influence on manufacturing, and the lack of fuel has hindered the development of factories. Although this region is rich in precious metals, iron, and petroleum, it is deficient in coal. There are, however, a few blast furnaces in the vicinity of Monterey, which is located near coal fields of some value, and a cotton-spinning industry at Puebla on the Mexican Plateau.

Cities. Mexico City, with its million people living on the cool and healthful plateau, is the dominant urban center of the entire region. The principal commercial centers are located

along the eastern coast. Vera Cruz is the chief commercial port and the natural outlet for most of the plateau region of Mexico. The fact that it is connected with the interior by rail has helped this city to keep its primary place as a commercial center. Tampico, a little farther north, has, however, a better harbor and an easier entrance to the plateau; it is a petroleum-shipping center. Guadalajara, on the plateau west of the capital, is the second largest city.



A banana tree in Costa Rica.

On the Pacific side mountain ranges come close to the coast, forming a barrier difficult to overcome. For this reason commercial Mexico faces toward the Atlantic, and all the Pacific ports are small, with Mazatlan as the leader.

Commercial Position. Although this entire region is rich in natural resources, such as precious metals, tropical fruits, forest products, and petroleum, the people are comparatively poor. Unstable governments, a lack of education among the common people, poor transportation facilities, and a high concentration of wealth in the hands of a relatively few have done much to retard the commercial development of this region.

To many Americans the most interesting part of Central America is Panama, where the great Panama Canal was completed in 1914. Here a constant procession of vessels, carrying the commerce of the world, go through the locks from ocean to ocean.

THE WEST INDIES

Introduction. Extending from the southern tip of Florida and forming a curve east and south to Continental South

America, are two groups of islands known as the West Indies. The larger islands, Cuba, Puerto Rico, Haiti, and Jamaica, are called the Greater Antilles, while the many smaller island groups to the east and south are called the Lesser Antilles. All the West Indies are inside the tropics and have a rainy trade-wind climate, with abundant rainfall and warmth.

Cuba. The largest island of the West Indies is Cuba. The surface of the island is fairly level, and soils are fertile; a low range of hills runs through the center.

This island is largely agricultural, centered around two crops, sugar cane and tobacco. Nearly one half of the cultivated land of Cuba is planted in sugar cane. The climate and the soil are extremely favorable to sugar; the island is the leading world exporter of cane sugar. Besides cane and tobacco, Cuba raises bananas, corn, cacao, citrus fruits, and pineapples.

The forests of Cuba are around Santiago, in the eastern end of the island. They provide a wealth of products, especially mahogany, Spanish cedar, and dyewoods. The cedar is used in the manufacture of cigar boxes. Iron ore and copper are the leading minerals.

The manufacturing of Cuba is simple; it consists mainly of sugar refining and the making of cigars and plaited straw hats. Havana, built by money earned in sugar growing, is a large and attractive city.

Haiti. Two republics make up the island of Haiti: the western end of the island, called Haiti, and the eastern end of the island, known as the Dominican Republic. Both republics are inhabited largely by French- and Spanish-speaking Negroes.

From the point of view of commerce, this island is of importance mainly because of its agricultural products, sugar, coffee, cacao, cotton, and bananas. The forests contain cabinet woods, dyewoods, and ebony.

Jamaica. The island of Jamaica belongs to the British Empire. Here are produced the characteristic crops of the tropics, including bananas, sugar cane, coffee, and coconuts.



Keystone View Company

Market day, Kingston, Jamaica.

Rum is made from molasses. Most of the trade of Jamaica is with Great Britain.

The Lesser Antilles. The hundreds of smaller islands in the eastern part of the Caribbean Sea are owned by various nations, principally Great Britain, France, and Holland. Most of these islands specialize in sugar cane, cacao, and tobacco; raise some cotton and citrus fruits; and distill molasses into rum.

British-owned Trinidad, largest and most important island commercially, also has large, producing oil wells; it exports crude petroleum, gasoline, and other petroleum products. A natural pitch or asphalt lake is mined for paving material.

TEXT QUESTIONS

1. What are the principal commercial commodities produced in Mexico?
2. In what ways do the Central American countries resemble Mexico?
3. How do they differ from Mexico?
4. What islands are included in the Greater Antilles?
5. Explain Cuba's agricultural significance.
6. Of what commercial importance is the island of Haiti? Trinidad?

PROBLEMS AND PROJECTS

1. Why are the cities on the northern shores of the Great Lakes much smaller than those on the southern shores?
2. Why are the provinces of New Brunswick and Nova Scotia agricultural, while the New England States to the south of them are industrial?
3. Where are the best forests in Canada? Is the wood hard or soft? For what is the wood used?
4. In what provinces of Canada has water power been developed? For what is it used?
5. What industries of importance have been developed, or could be developed, around Hudson Bay? Can agriculture be carried on extensively there? Why?
6. What conditions, natural or economic, have increased the production of wheat in Canada?
7. By what routes does Canadian wheat from the Prairie Provinces reach Europe?
8. Compare Montreal with New York City as to (a) nearness to Europe, (b) harbor, (c) hinterland, (d) transportation facilities, (e) foreign commerce.
9. Explain in what ways free trade with Canada would be (a) beneficial to the United States? (b) detrimental to the United States?
10. Account for the difference in the development and the prosperity of Cuba and Haiti.
11. Why is Mexico less developed commercially and industrially than Canada or the United States?
12. In what part of Mexico is the petroleum industry carried on? How does Mexico rank in petroleum production?

TOPICS

1. The importance of fur farming on Prince Edward Island and in Quebec.
2. The hinterland of Winnipeg.
3. The dairy industry in Canada.
4. The need for tariff reciprocity between the United States and Canada.
5. Governments in Latin North America.
6. Need for better trade relations between the United States and Latin North America.
7. The advisability of the interference of the United States in Haitian affairs.
8. Banana growing in Costa Rica.
9. Advantages of Nicaragua as a site for an interoceanic canal.

FOR CLASS DISCUSSION

1. There should be a closer industrial and commercial union between Canada and the United States.
2. Mexico's problem is one of agricultural education.
3. The islands of the West Indies are natural markets for American goods.
4. The countries of Central America should form a single state or a federation of states.

CHAPTER XXI

SOUTH AMERICA

SECTION 1—IN GENERAL

Introduction. From an economic point of view the development of South America has been very slow; and, with the exception of certain coastal regions, it is still sparsely inhabited. This is a continent with a large extent of navigable streams, an abundance of fertile land, and mountains containing large stores of minerals. It is still partially undeveloped, despite the fact that Europeans settled here many years before they did in North America.

Economic Conditions. Some of the regions in South America are rich and productive and are noted for their large cities, fertile farms, and valuable minerals. While some of the developed territory is still in the extractive stage of industry, and dependent upon mine or forest, agriculture of several different types is gradually becoming the basic occupation of all the more settled regions. Much of the continent, however, is of relatively little economic importance at the present time. Among the causes for this condition are:

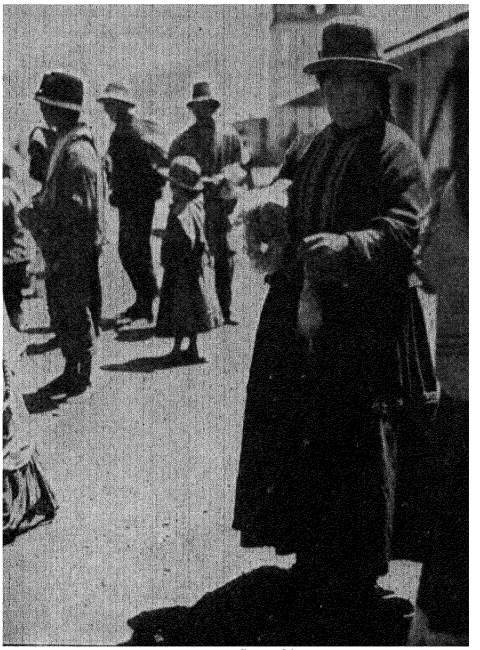
(1) About three fourths of South America lies in the wet tropics. The hot climate and heavy rainfall in this zone, which cause jungle growth as well as lower human energy and vitality, make a large part of this continent unsuitable for habitation by emigrants from temperate regions. Hence, industry cannot develop there as in the temperate sections of the world.

(2) The continent of South America has few deep indentations on its coast line. There are but few good natural harbors on the whole continent. This lack of harbors makes coastal commerce very difficult.

(3) The lofty mountains of western South America, together with the tropical vegetation in the interior, make the cost of roads and railways excessive.

(4) South America has many inhabitants whose wants are so simple that there is little demand for modern conveniences and manufactured products.

The inhabitants of this continent, with the exception of those living in the basin of the Paraná and the Plata Rivers and the valleys of Chile, are a mixture of the Indian, the Negro, and the white races. Probably not more than twenty-five per cent of the population of tropical South America is pure white. Many of the descendants of the early Spanish and Portuguese settlers lack the energy of their forefathers because of the enervating effect of the climate.



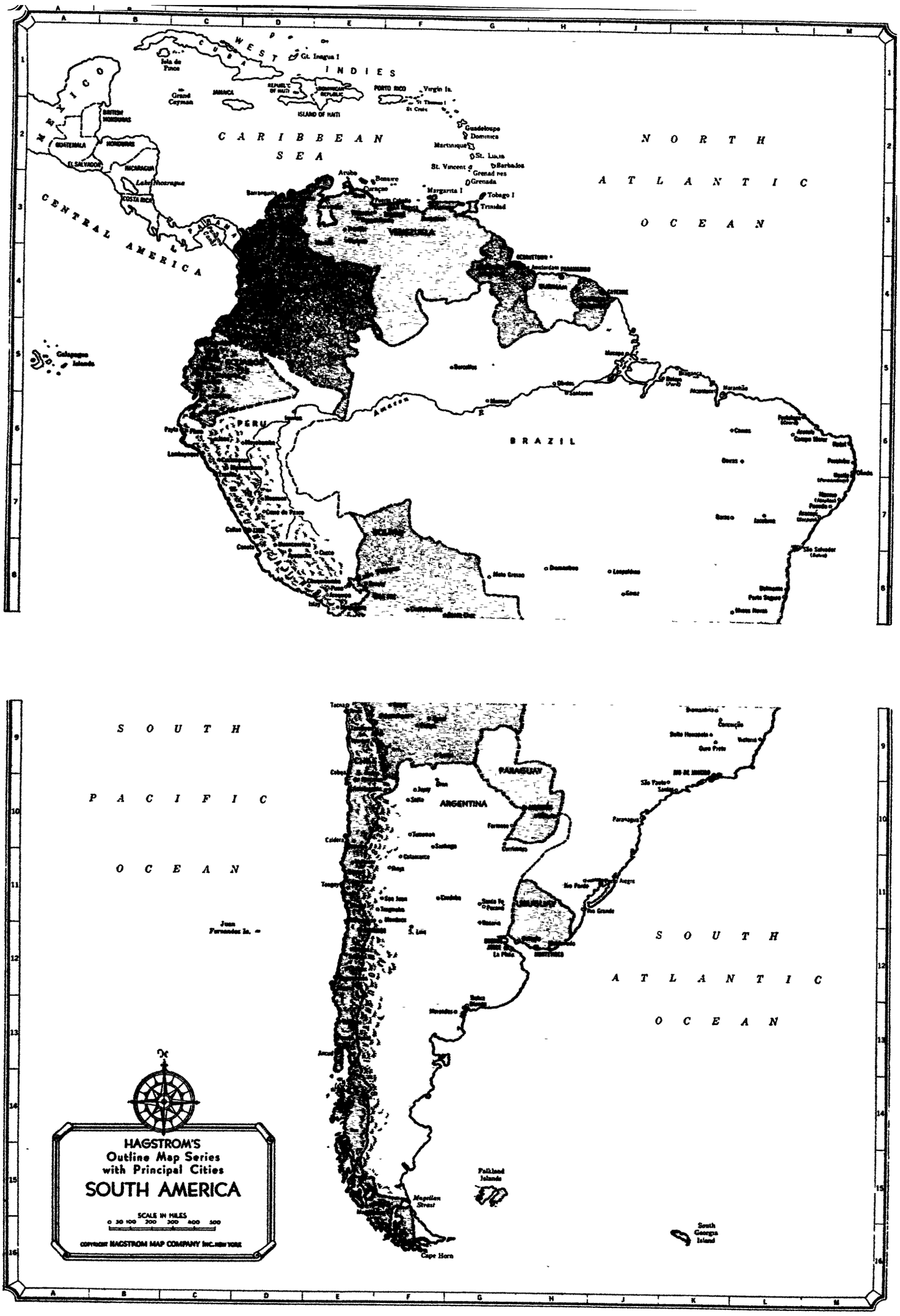
Grace Line

An Indian spinning near Cuzco, Peru.

Natural Regions. The plains of South America are among the largest in the world; they extend north and south through the interior over a distance of four thousand miles. They may be divided into three main sections, called the plains of the Orinoco River, the plains of the Amazon River system, and the plains of the Plata River system.

The plains of the Orinoco River are, for the most part, in Venezuela, not far north of the equator. They are generally low and hot, with a wet-and-dry type of climate. Most of this region is savannah pasture land with coarse grasses.

A little farther to the south are the plains of the Amazon River basin. These plains, with a rainy tropical climate throughout the entire year, occupy about half of the area of Brazil, as well as portions of Colombia, Ecuador, Peru, and Bolivia. The equator runs almost the length of this lowland. The high temperature and the heavy rainfall make this an area


WEST INDIES
CUBA
Gt. Inagua I
Isla de Pinos
MEXICO
Grand Cayman
JAMAICA
REPUBLIC OF HAITI
DOMINICAN REPUBLIC
ISLAND OF HAITI
PUERTO RICO
Virgin Is.
St. Croix
St. Thomas I
Guadeloupe
Dominica
Martinique
St. Lucia
St. Vincent
Barbados
Grenadines
Grenada
Tobago I
Trinidad
CARIBBEAN SEA
NORTH ATLANTIC OCEAN
BRITISH HONDURAS
GUATEMALA
HONDURAS
EL SALVADOR
NICARAGUA
Lake Nicaragua
COSTA RICA
PANAMA
Panama Canal
CENTRAL AMERICA
Aruba
Bonaire
Curaçao
Maracaibo
Barranquilla
Margarita I
VENEZUELA
Caracas
Valencia
Maracay
Barquisimeto
Maracaibo
Cumaná
Barcelona
Puerto La Cruz
Cabimas
Coro
Maturín
Ciudad Bolívar
Orinoco R.
Amazon R.
Manaus
Belém
Pará
Marabá
Tocantins R.
Galapagos Islands
PERU
Piura
Paita
Iquitos
Lambayeque
Chiclayo
Trujillo
Chimbote
Cerro de Pasco
Callao
Lima
Huancayo
Huancavelica
Ica
Arequipa
Nazca
Cuzco
Puno
Titicaca L.
Matto Grosso
Cuiabá
Corumbá
Santa Cruz
Sucre
Potosí
Oruro
La Paz
BOLIVIA
Guaporé R.
Porto Velho
Rio Branco
Acre R.
Cruzeiro do Sul
Juruá R.
Purus R.
Tefé
Madeira R.
Parnaíba
Fortaleza
Natal
Recife
Maceió
Aracaju
Salvador
Ilhéus
Vitória
Belo Horizonte
Rio de Janeiro
São Paulo
Santos
Campos
Niterói
Pôrto Alegre
Rio Grande
Florianópolis
Curitiba
Ponta Grossa
Paranaguá
Blumenau
Joinville
São Francisco R.
Juazeiro
Petrolina
Caicó
Mossoró
Areia Branca
Fernando de Noronha
BRAZIL
SOUTH PACIFIC OCEAN
SOUTH ATLANTIC OCEAN
Juan Fernandez Is.
Tocopilla
Antofagasta
Chañaral
Caldera
Copiapó
Vallenar
La Serena
Coquimbo
Tongoy
Ovalle
Illapel
Los Andes
San Felipe
Valparaíso
Viña del Mar
Santiago
Rancagua
Talca
Curicó
Linares
Chillán
Concepción
Talcahuano
Los Angeles
Temuco
Valdivia
Osorno
Puerto Montt
Ancud
Chiloé I.
Aysén
Puerto Aysén
Coyhaique
Puerto Natales
Punta Arenas
Magellan Strait
Tierra del Fuego
Cape Horn
Falkland Islands
South Georgia Island
ARGENTINA
Jujuy
Salta
Tucumán
Santiago del Estero
Formosa
Resistencia
Corrientes
PARAGUAY
Asunción
Encarnación
URUGUAY
Montevideo
Colonia
Paysandú
Salto
Fray Bentos
Mercedes
Rosario
Santa Fe
Paraná
Córdoba
San Juan
Mendoza
San Luis
La Rioja
Catamarca
Neuquén
Bahía Blanca
Buenos Aires
La Plata
Mar del Plata
Necochea
Tandil
Olavarría
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SOUTH AMERICA
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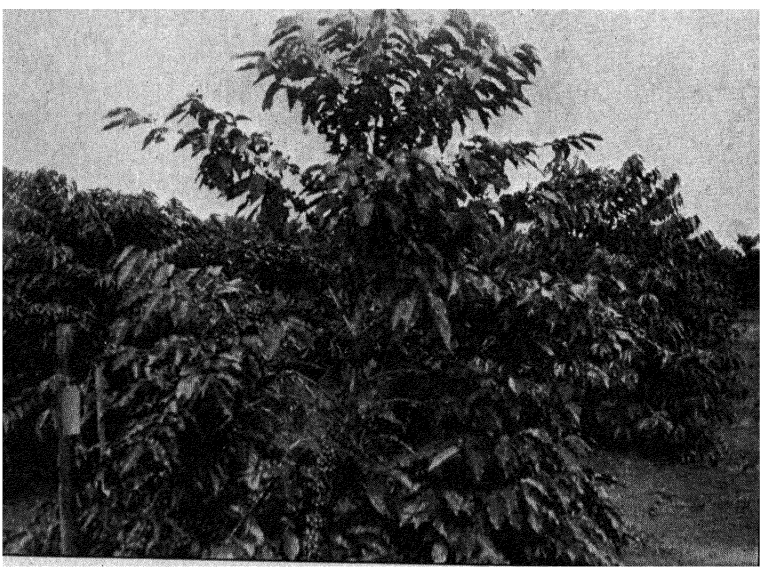
of jungle and forest, containing rubber, ebony, and other trees, but unsuitable for most types of agriculture.

South and east of the Amazon Basin is the great Brazilian Plateau, which rises gradually almost to the coast of Brazil, where there is a sharp drop to a narrow coastal plain. This plateau varies in climate; most of it receives less rain than the Amazon Basin, is not so hot or humid, and is more suitable for grazing and for tropical crops such as coffee, sugar cane, and cacao. Part of this highland drains north to the Amazon, and part west and south to the Plata River system.



U. S. Department of Agriculture

A coffee tree growing on a farm in São Paulo, Brazil.

The plains of the Plata system include parts of Brazil, eastern Bolivia, Paraguay, Uruguay, and eastern Argentina. The northern portion of the Plata basin has a hot, tropical climate, which gradually changes to subtropical near its estuary mouth between Argentina and Uruguay. This region of South America is perhaps the finest of all for human occupance, because of climate, richness of soil, smoothness and size of plains, and general agricultural productivity. It is more favorable than

the dry plain of Patagonia farther south, and has more available land than the great valley of Chile across the Andes to the west.

The Andes Mountains extend their lofty peaks and high plateaus along the entire western side of the continent. Here is a region, much of it in the tropics, which has every phase of climate from frigid to tropical. Parts of the Andean Chain have proved to be heavily mineralized. In the southern end between Argentina and central Chile few minerals have been discovered; the Colombian end in the north is also of minor significance. The great central portion, however, from northern Chile through Bolivia and Peru, is a region of mines and mining camps, with copper, lead, silver, zinc, tin, and iron among the metals in active production. Along the Peruvian-Chilean Coast is located the famous Atacama Desert, almost rainless, which has great deposits of nitrate of soda.

Manufacturing. In the hot lands of northern South America, the principal manufactures are articles made by hand, for local subsistence only. In these regions there is considerable work in hand-woven textiles, pottery, leather, and wood. There are a few cotton mills in the north, but most manufactures are imported.

In the more temperate lands of the south, manufacturing has made considerable progress. The three leading countries, Argentina, Brazil, and Chile, process many materials for export. This includes the making of flour, the refining of sugar, the tanning of leather, and the slaughter and packing of meat. They have also begun a number of the consumer's goods industries, including cotton and woolen textiles, shoes, clothing, furniture, household equipment, and other products. They have not yet reached the stage of highly skilled manufactures; most goods of the finer types are imported from Europe or the United States.

Water Transportation. As mentioned before, a serious drawback to the commercial and economic development of South America has been the lack of transportation facilities. The largest rivers are mainly in the tropical north and flow

through low jungle-bordered lands. As a result the ports along these rivers are usually small and concerned solely with nearby raw materials. While the Amazon and the Plata River systems carry as great a volume of water as the St. Lawrence and the Mississippi River systems of North America, the valleys of the former rivers, except the region near the mouth of the Plata River, are sparsely settled. Vast territories in the central and western part of Brazil are without human habitation.

The watersheds between the Orinoco, Amazon, and Plata River systems are very low; for this reason during the period of heavy rains the waters of these systems are mingled. A dream of many South American engineers is a continuous waterway from north to south with canals joining the headwaters of the various systems. This waterway would make a short route from Panama and the ports of North America to Buenos Aires. Because of the vast wilderness and the lack of cities en route, such a waterway would probably be too expensive to build and maintain.

Railroads. There has been considerable development of railroads in the republics of Argentina, Chile, Uruguay, and Brazil. The main interoceanic railroad runs from Buenos Aires to Valparaíso. A line that connects Montevideo and Rio de Janeiro will be extended up the coast to Bahia and Pernambuco. In this way the ports on the Plata River will be connected with all the main cities along the Brazilian coast.

A new line has been completed across Brazil, from Corumbá, a port on the Paraguay River, eastward to Rio de Janeiro. Chile has a railroad running from Tacna and Iquique south to Puerto Montt. This road is intersected by short lines running east and west and touching the coast at various points.

The topography of northern Argentina lends itself readily to the building of roads; hence, in this section we find a network of roads more dense than that in any other country of South America. There are also routes tapping the Bolivian plateau and a number of short lines running between Bahía Blanca and Buenos Aires, in Argentina.

Railroad building in Peru, Ecuador, and Colombia is an expensive operation. We find here only a few short routes from

the coast to inland capitals or mining areas. The same is true of the other northern republics, as the topography and the climate of these regions make the building of long railways unprofitable.

The highest railroad in the world is in Peru; it is built at an elevation of approximately fifteen thousand feet above sea level. The road is profitable only because it can handle the ores from the Cerro de Pasco copper mines. Another interesting road is the line from Quito to Guayaquil. This road climbs from sea level to the high Andean Plateau in less than three hundred miles.

Foreign Commerce. The bulk of imports of the countries in South America consists of manufactured products. These nations have been buying largely from Europe, because South America is nearer the ports of Europe and the people of this continent favor Europe as a source of finished products. The United States is now selling considerable goods to the South American countries, particularly automobiles, farm and other machinery, motion-picture films, and other manufactures in which America excels Europe.

The three great commercial nations of this continent are Argentina, Brazil, and Chile. According to figures last obtainable, the average annual exports of animal and meat products from Argentina amount to more than $187,000,000; the exports of coffee from Brazil amount to almost $146,000,000. The chief exports of Chile are mineral products, which amount to more than $83,000,000 a year. The combined yearly trade of all the South American nations amounts to more than four billion dollars. Of this amount, United States exports and imports total about one third.

TEXT QUESTIONS

1. Name and describe the main natural regions of South America.
2. Name and locate the three great river systems of South America.
3. Where is nitrate found? Why is it concentrated there?
4. In what does the wealth of the Amazon forests consist?
5. What are the characteristic manufactures of South America?
6. Why are there few railroads in South America?

SECTION 2—THE COUNTRIES OF SOUTH AMERICA

COLOMBIA

In General. Colombia is the only country in South America that has the advantage of facing both the Pacific Ocean and the Caribbean Sea. The lowlands, especially along the Atlantic, are tropical and unhealthful for settlement. Most of the population and the better cities are found in the cooler plateaus and high mountain valleys of the interior.

Forest Products. Colombia has a wealth of valuable forest products, mainly in the lowlands. The leading commercial trees and plants are the cinchona, from which quinine is obtained, balata, dyewoods, and nut trees. There are a number of good timber trees, but the intense heat of this tropical region, together with the heavy growth of the jungles, greatly hinders lumbering.

Minerals. Within recent years Colombia's oil resources have been developed so that now this country is one of the important producers of the world. Its output is small, however, compared to that of the United States.

Other minerals of importance are gold and platinum, found in the southwest. Colombia is the chief source of the world's supply of emeralds, found in veins of limestone near Bogotá. There are deposits of coal and iron sufficient for small blast furnaces, but the coal is of poor quality.

Agriculture. The soil of Colombia is fertile enough for successful agriculture. As in most of the other tropical countries, much of the farming is primitive and is carried on almost entirely on the uplands. The chief agricultural commodity is coffee; Colombia is second only to Brazil in world coffee export. The rainy trade wind coast also has great plantations where bananas are grown for the export trade. Other agricultural products are corn, potatoes, wheat, rice, beans, tobacco, cacao, and sugar cane. Two thirds of the export of Colombia consist of coffee.

Manufacturing, Transportation, and Cities. The manufacturing industries of Colombia consist of petroleum refining

for export, and sugar refining, flour milling, and some cotton spinning for local use.

The transportation facilities of this country are meager. The main artery of commerce is the Magdalena River, which runs north through the center of the republic and empties into the Caribbean Sea. This river is navigable for small steamers, but the unsatisfactory condition of its mouth prevents its full utilization. Railways to the highland interior connect with this river. In railroad facilities Colombia has only about two thousand miles in the entire country, with part of the roads of different gauges.

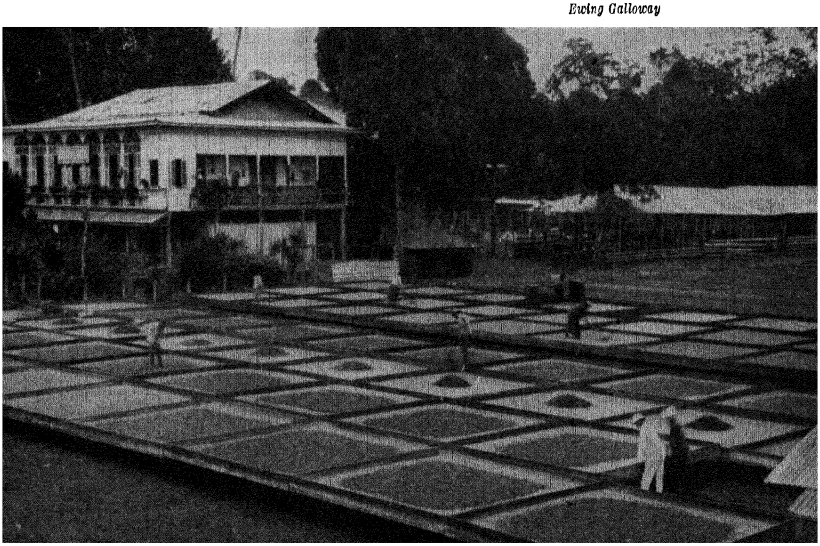
The chief city of Colombia is Bogotá, situated on the Andean Plateau at 8500 feet altitude. This is one of the highest capitals in the world. Cartagena and Barranquilla on the Atlantic Coast serve as the two main ports.

ECUADOR

In General. Ecuador is a small country and a rather poor one from a commercial point of view. The climatic conditions of Ecuador, which is situated in the belt of calms between the trade winds, are favorable to the growth and export of two

Drying cocoa beans in Ecuador. The trays are pushed inside the sheds at night.

Ewing Galloway



tree crops, cacao and coffee. Various forest products, such as vegetable ivory, are also found in the export list. This little country is famous also for one manufactured article: almost all the Panama hats come from here. Guayaquil on the lowland serves as the port and outlet for Quito, the capital, on the more healthful highlands.

VENEZUELA

In General. The location of Venezuela is excellent for commerce with the United States and the West Indies. The majority of the population live in the highland north, where the cool trade winds make living more comfortable. The best cities, Caracas on the highland, Maracaibo on the coast, are also found in the north. In the southern section are the great llanos, or grassy plains on the Orinoco Basin. Considerable cattle raising has been carried on here from early times.

Minerals. Venezuela has long had high rank in one valuable mineral—petroleum. The area around Lake Maracaibo on the north coast is one of the richest oil fields known; tankers carry Venezuelan petroleum everywhere. For some years the country has held third position in total world production, with some 150 million barrels per year, being exceeded only by the United States and Russia.

Agriculture. The chief crops of Venezuela are coffee, cacao, and sugar. Cattle raising has declined during the last twenty-five years. The coarse grasses along the Orinoco, together with drought, heat, and insect pests, make this a poor grazing region and produce inferior meat animals. Since the rise of the better grazing lands of Argentina and Uruguay, with their herds of pure-bred beef cattle, the Orinoco Basin is unable to compete in meat production.

THE GUIANAS

In General. The three Guianas, along the northern coast, are the only parts of South America where European powers

still control colonies. The coastal plain is hot, rainy, and forested, and much of it is still a tropical jungle. Small sections have been cleared for cultivation; rice, sugar cane, and cacao are the most common crops.

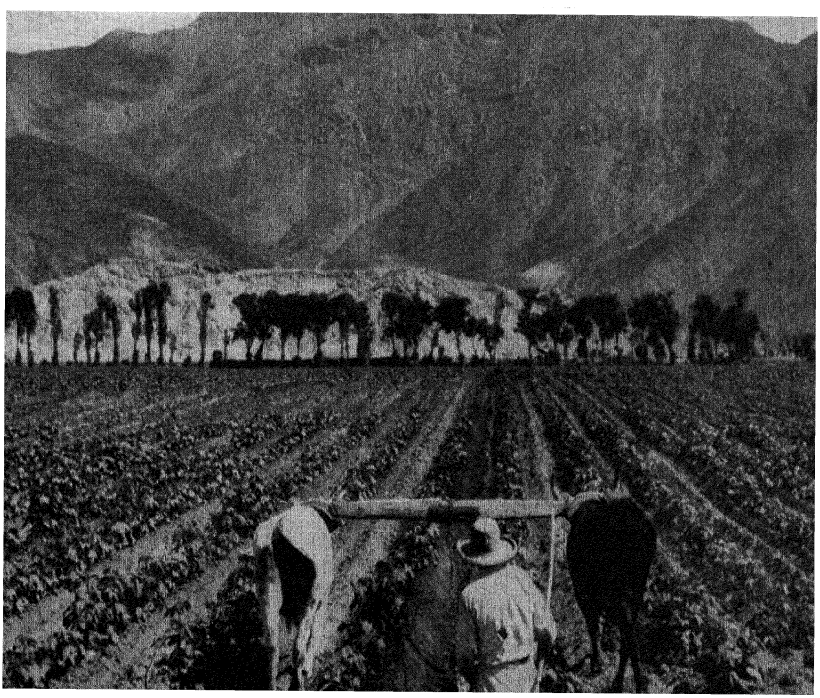
British Guiana is the best developed of the three colonies, largely because of rich deposits of bauxite in the interior. This ore, used for the making of aluminum, is brought down by river and shipped to the aluminum-manufacturing countries of the world. Dutch Guiana has also begun to export bauxite. Some diamonds are also found in British Guiana. French Guiana is still largely a jungle wilderness.

PERU AND BOLIVIA

Highland Countries. These two countries are regarded as highlands in the main, although both of them have lands, east of the Andes, sloping down into the hot Amazon Basin. These

A native of Peru plowing.

Grace Line



eastern lowlands are quite undeveloped. Peru has a narrow, semiarid coast along the Pacific. By the careful use of many westward-flowing streams from the Andes, this warm coastal strip is growing much good cotton under irrigation, with sugar cane as the secondary crop. Peru exports considerable cotton and a lesser amount of sugar. Alpaca and sheep's wool come largely from the colder highlands.

Minerals. It is in minerals that these two countries are rich. Peru ranks high as a producer of petroleum and copper, while about one quarter of the world's supply of tin comes from Bolivia. Lead, silver, and zinc ores, the three metals often found together, are worked in both countries, although Bolivia has the greater output of silver. Two valuable steel alloys, antimony and tungsten, are also shipped from Bolivia. Many of the mines are at such high altitudes that the hearts and lungs of the miners are affected; the transportation of supplies is also difficult and expensive. The cost of building railways and highways into the mountains has hindered the development of the mining industry.

CHILE

Three Main Geographical Regions. This country, more than twenty-six hundred miles long and, on the average, only one hundred ten miles wide, has differences of climate caused by its differences in latitude. Chile has three main geographic regions: a northern desert; a dry, subtropical central portion; and a southern region with marine conditions.

In the northern section the chief activity is mining. The great dry Atacama Desert has quantities of nitrate of soda. Copper, in the production of which Chile ranks second among the countries of the world, iron, and gold are also mined in the north. Iodine, a by-product obtained in the preparation of nitrates, is also exported. Eighty per cent of the exports of Chile are minerals.

Farming is carried on in the central portion of the country, which has good winter rainfall and sunny valleys that resemble those of southern California. The chief crops are wheat,

grapes, and other fruits. Great flocks of sheep pasture the drier hillsides and mountain slopes; wool is the chief agricultural export.

The southern third of Chile, reaching to the tip of the continent, is moderately cold, with a rainy marine climate. Much of the region is too cool and wet for good farming. As the forests are unfortunately not of superior timber woods, this region is the least productive of the three.

Cities and Transportation. Most of the commerce of Chile passes through the port of Valparaíso, which serves as the gateway for the capital, Santiago, in the central valley. Iquique and Antofagasta in the north serve almost entirely as nitrate ports. Landlocked Bolivia also uses Antofagasta as a shipping point for minerals.

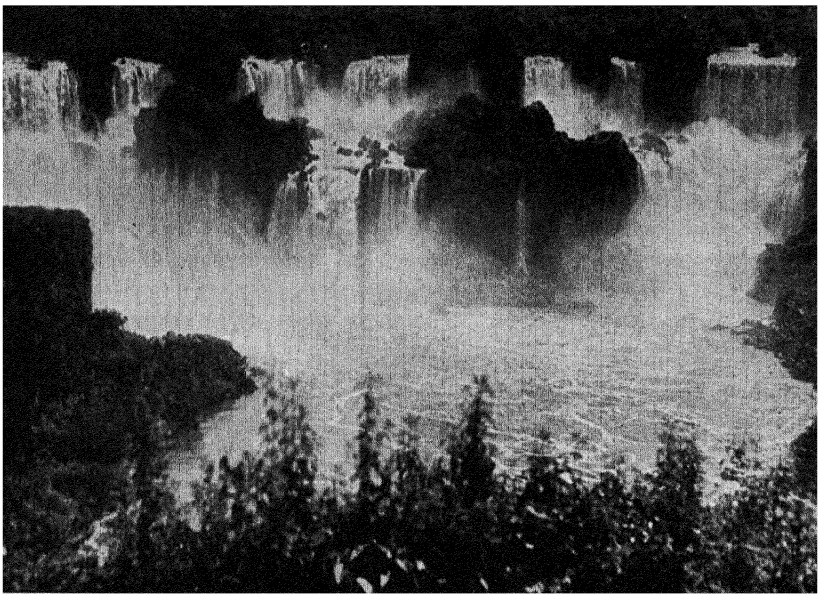
Manufacture in Chile is mainly for local use. It includes the making of shoes, woolen and cotton spinning, flour milling, and tanning.

Chile is well supplied with railways, having more than five thousand miles of tracks. The Trans-Andean Railway, connecting Santiago with Buenos Aires, gives Chile access to the Atlantic Seaboard. Because of the excessive cost of operating this road, the freight and passenger rates are very high. As a result little freight and relatively few passengers are carried across the Andes.

ARGENTINA

In General. Argentina is one of the three most progressive South American countries. Most of it has the advantage of being located in a temperate climate, and it has a larger percentage of inhabitants of European stock than any other South American country. Argentina contains a large proportion of the good farming area of South America. There are four distinct natural regions in the nation—the Gran Chaco in the north, the pampas in the east, the Patagonian Plateau in the south, and the semiarid region bordering the Andes in the west.

The Gran Chaco. The Gran Chaco contains both forest lands and grassy plains for cattle grazing. The temperature



Ewing Galloway

Iguassú Falls, Argentina, one of the most interesting natural wonders in South America.

is semitropical; the soil is good; and the climate is suitable for the raising of cotton, which requires a humid growing season and a drier harvesting season. As a result cotton growing has increased steadily, and raw cotton is an important item in the export trade. In the forested lands many valuable hardwoods are found. Perhaps the most interesting is the quebracho tree, with wood said to be so hard that it will break an ax. The logs can be sawed into lumber and railroad ties. By chopping the logs into fine pieces and boiling them, *quebracho extract* is obtained. This is used all over the world in tanning hides to make leather.

The Pampas. The Pampas or Great Plains, in the central part of Argentina, contain the most productive soils in the south temperate zone. The Pampas are level, free from stones, and virtually treeless; they are well adapted to farming on a large scale by the use of tractors and other farm machinery. This region, with a rainfall of from twenty to forty inches a year, affords a natural feeding ground, and the relatively mild climate makes it possible for cattle to remain in the pasture

during all the year. As a result livestock raising and meat packing play a greater part in the economic life of this country than that of any other country in the world. The value of these plains is increased also by their nearness to the sea. In no other country are such rich wheat and cattle-raising lands so close to good ocean ports.

Wheat, which is the chief cereal export of Argentina, is raised principally in the eastern section, where rainfall is more plentiful. Here too is a rich corn belt. Other crops, such as alfalfa and flax, from which linseed oil is obtained, are abundant. This region is one of the world's greatest producers of food products.

Patagonian Plateau. The Patagonian Plateau is located in the southern part of Argentina. In a zone of westerly winds, the high mountains on the west cut off most of the rainfall, and much of this area is too dry for general farming. Short grasses are about the only vegetation, and the region is suitable for little but sheep raising. It is one of the great sheep and wool areas of the world. It is sparsely settled; the chief town is Bahía Blanca, located on the northeastern edge of the plateau. This city functions as a port for the shipment of wool, hides, and meat.

Semiarid Region. In the west, close to the foothills of the Andes, the soil is rich, but rainfall is too scant for farming or grazing. A number of streams from the snow-capped Andes afford sufficient water for irrigation, and the land has been made so productive that some of the richest farms in Argentina are here. Sugar cane is produced in the warm northern area; and farther south grapes, peaches, plums, and other fruits abound. The eastern part of this region, close to the pampas, has sufficient dry browse to carry some sheep.

Minerals. Argentina has practically no minerals in commercial quantities except some petroleum, which is found in western Patagonia.

Manufacturing. The manufacturing of Argentina is, first, the processing of many local agricultural crops for export.

It includes slaughtering and meat packing, flour milling, tanning, oil seed pressing, and sugar refining. During the last decade, however, Argentina has made great progress in a number of the more skilled industries, including textiles of cotton, woolen, silk, and rayon, shoes and clothing, household equipment, furniture, printing and publishing, and various artistic crafts. While Argentina will probably never carry on the heavy industries requiring iron, steel, and coking coal as a base, it is industrially the most advanced of any of the South American countries.

Transportation. Argentina has the advantage of excellent river transportation in the northeast. The La Plata Estuary and the Paraná River afford a great highway for the cheap transportation of Argentina's exports. No other South American country has more miles of railways (25,000) than has Argentina. The great expanse of level land has greatly aided railroad building, and today lines reach out across the plains from Buenos Aires to all the surrounding territory. Two lines go through the Andes, one connecting Buenos Aires with La Paz in Bolivia, the other reaching Valparaíso in Chile. Argentina has more highways than any other South American country, but hard roads for automobiles are not so extensive; only near the large cities are there first-class roads. One difficulty encountered is the scarcity of road-building materials, but the next few years will probably see considerable improvement. Argentina also has several air lines.

Cities. The Argentinian capital, Buenos Aires, has grown to be the most important city in South America and the third largest in the Western Hemisphere, being exceeded only by New York and Chicago. With the best climate and the richest agricultural hinterland in South America, it has been attractive to European immigrants and has become a great commercial center. Most of the railways and the manufacturing plants of the country are centered here; its extensive wharves and docks are visited by ships of all nations.

Rosario, the second city in size, is the Paraná up-river port best located to handle the wheat trade. Bahía Blanca, the wool

and mutton shipper of Patagonia; Tucumán, the sugar-growing city on the flanks of the Andes; and Mendoza, famous for its grapes and wine, are three other cities with special regional functions.

URUGUAY

In General. Uruguay is the smallest republic on the continent of South America. It faces the Argentine pampas across the broad estuary of the Plata, and greatly resembles that productive area in surface, climate, and its devotion to pastoral pursuits. Cultivated crops are far less grown; but wheat, oats, corn, and linseed indicate a further resemblance to the pampas.

Sixty per cent of Uruguay's area is flat or rolling plains covered with grass suitable for grazing. Much of the land is still in great estates. Herds of cattle and bands of sheep are grazed over vast acreages. The largest item in the export trade is wool, followed by chilled and frozen beef and mutton, wheat and flour, and linseed. With its meat-packing plants, grain elevators, wool warehouses, and shipping docks, Montevideo is a smaller Buenos Aires.

PARAGUAY

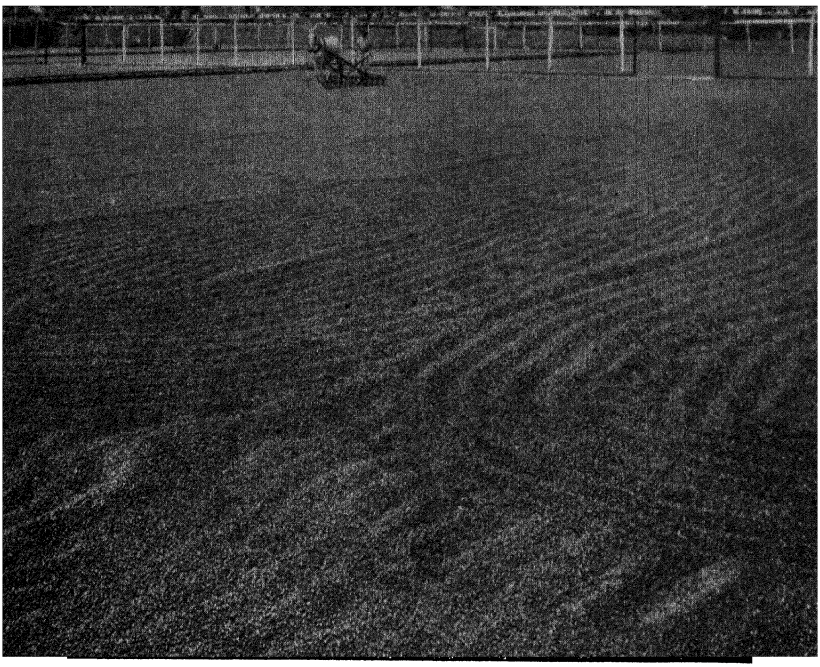
In General. Paraguay, like Bolivia, is an inland country. But unlike Bolivia, this country has a large navigable river, about which centers most of its economic life. Paraguay is more tropical than Uruguay, producing quantities of tobacco, corn, sugar cane, rice, oranges, and maté, or Paraguay tea. The leading occupation is cattle grazing on the wet savannahs; meat packing is of primary importance. The principal exports are meat products and hides, quebracho extract, cotton, and tobacco.

In 1938 Paraguay was more than doubled in size by a peace settlement, which awarded almost the entire Chaco country to Paraguay, ending a seventy-year dispute between Paraguay and Bolivia.

BRAZIL

In General. Brazil, which is the largest of all the countries in South America, includes more than half of the area of the entire continent. This country is larger than Continental United States, exclusive of Alaska. More than half of Brazil is made up of lowlands drained by the Amazon and the Plata River systems. It is a country of vast distances, much of it unknown and uninhabited except by a few Indians. The population of Brazil, somewhat more than 45,000,000, is greater than that of any other South American country. The great majority of the people are of Indian, Negro, or mixed blood; it is only in the eastern highlands that we find a larger white population and a greater economic development.

Southern and Eastern Highlands. The Brazilian highlands, which have been compared to the Appalachian Plateau in eastern United States, occupy much of the eastern and southern portions of Brazil. Their climate is affected by the southeast trade winds; thus, there is considerable rain on the coast, but areas back of the mountains are relatively dry. The southern part of the highlands is much cooler than the northern, though the lowlands are rather warm. This area is the most densely populated section in Brazil and is the world's greatest producer of coffee, most of it being grown in the two states of São Paulo and Minas Geraes. The rich, well-drained lands and the dry harvest time between July and September are factors that enable Brazil to be a leader in the production of the breakfast beverage of this continent. Other products of this highland region are cassava, beans, sugar, yerba maté, corn, cattle, cotton, and tobacco. Tobacco is grown throughout the entire highland region, but principally in the São Francisco Valley, and, next to coffee, is among the principal agricultural exports. The annual crop of cotton, which was grown and used in Brazil before the time of Magellan, is increasing and finding new markets. There is now a tendency for a greater variety of products and less dependency on coffee, tobacco, and sugar. In the western highlands there are great grass-growing areas that provide grazing for large herds of cattle and sheep.



U. S. Department of Agriculture

Drying coffee in São Paulo, Brazil. The coffee berries are allowed to dry for several days in the hot sun.

Meat, hides, skins, and wool are now important items of Brazilian export.

The Amazon Valley. The Amazon River, over 3,900 miles long, is the largest river in the world. Together with its tributaries, it drains over half the area of Brazil. Located as it is along the equator, most of this valley has no dry season. The whole region through which the river system courses is almost entirely covered by a thick jungle forest. This immense forest has a large variety of trees, but most of them are of limited commercial value. Even for the better ones, the intense heat and moisture, the thickness of the jungle, and the distance from markets hinder exploitation. Until recently the most valuable tree was the rubber tree. Before plantation rubber was developed in southern Asia, the wild rubber of Brazil was in great demand. Although the wild rubber of the Amazon is of good quality, it cannot be produced as cheaply as can plantation rubber; hence there has been a marked decline in the industry. There are other valuable trees in the Amazon Valley,

but they are scattered, entangled with jungle growth, or too far from either water or rail transportation. Typical of these woods are dyewoods, lignum vitae, rosewood, and ebony.

Minerals. Brazil has excellent deposits of certain minerals. It is one of the few countries in the world with large deposits of manganese; a small export of this commodity has begun. Brazil has large iron resources but, because of distance from the coast and the lack of present demand, they remain undeveloped. Good coal is lacking, and the former export of diamonds has declined greatly.

Manufactures. While manufacturing is not so well developed as in Argentina, it has grown steadily in Brazil during the last decade. Cotton textiles and clothing manufacture lead all others. Other characteristic industries of this region are clay products, wood products, leather, chemicals, and tobacco. For the future Brazil has great water power and large undeveloped iron mines that will, in all probability, be utilized on a much larger scale.

Transportation and Trade. No other region in the world has so magnificent a system of waterways as the Amazon basin. The Amazon River is navigable for many thousands of miles, serving as the great artery of trade and travel for that half of the country. With its present scant population, Amazonia will probably have little need for more in the way of transportation. It has practically no railway service.

Southern and eastern Brazil, with its greater population and lack of waterways, has developed a net work of some 20,000 miles of railway lines. This makes Brazil a close second to Argentina in total railway mileage; but the areas to be served are so large, and distances between major cities so great, that the country still feels undersupplied with train facilities.

The agricultural character of Brazil is well illustrated by its exports, most of which are produced in the southern part of the country. Coffee normally makes up half of the total. Cotton has recently become the second export and is still increasing in acreage. Cacao, meat products, cattle hides, oilseeds, oranges, and yerba maté are also from temperate or subtrop-

ical Brazil. Only the rubber export can be credited to the Amazon rainy tropics.

Cities. Rio de Janeiro, approaching two million in size, is the capital of Brazil and the second city of South America. With its fine natural harbor and populous hinterland, this city handles the largest part of the country's imports and many of its exports. Its interior rival, São Paulo, metropolis of the fertile plateau and center of the coffee country, is now well over a million in size; Santos serves as the out-port for São Paulo. Lesser centers along the trade-wind coast to the north are Bahia and Pernambuco. The old city of Pará at the mouth of the Amazon, now known as Belem, is still a shipper of rubber and the center for Amazon River trade.

TEXT QUESTIONS

1. Name the principal products of Colombia; of Venezuela.
2. Describe each of the three regions of Chile.
3. Why has cattle raising on the Orinoco plains declined?
4. Describe each of the four regions of Argentina.
5. Locate and explain the significance of Bogotá, Rio de Janeiro, Montevideo, Buenos Aires, Iquique, Pará.
6. What important crops are grown in Argentina?
7. Name two or three leading exports of each of the following countries: Brazil, Chile, Argentina, Colombia, Venezuela, Uruguay.
8. Why does the Amazon River play only a small part in the economic life of Brazil?
9. Chile, Bolivia, the Guianas, and Brazil each has a special mineral badly needed in the United States. Explain.

PROBLEMS AND PROJECTS

1. On an outline map of South America, indicate the following regions: (a) tropical forests; (b) grasslands; (c) deserts; (d) areas with an elevation of more than 10,000 feet. Indicate also the density of population of each country. Does your map help you to understand why South America is less active commercially and industrially than North America or Europe?
2. Compare the Amazon and the Mississippi River Basins. Note the factors that hinder the economic development of the Amazon Basin.

3. Determine which South American countries enjoy the most trade with the United States. Write a brief report on the character of this trade.
4. Plot on a map at least four routes by which you may travel from Buenos Aires to Valparaíso.
5. Compare Argentina with the United States in regard to (a) topography, (b) climate, (c) industries, (d) imports, (e) exports, (f) countries with which trade is carried on.
6. What are the chief geographic obstacles to the economic development of Bolivia?
7. Write a brief report on the climate and the products of Peru.
8. Why has Argentina developed much faster than any other South American country?

TOPICS

1. Coffee production in Brazil.
2. The proposed railway from New York to Buenos Aires.
3. The nature and distribution of population in South America.
4. The importance of the Lima Conference of 1938.
5. Sheep raising in Patagonia.
6. Difficulties of travel in Colombia.
7. Argentina—the future granary of the world.
8. Railroad building in South America.
9. The foreign trade of Brazil.
10. Yerba maté, the South American tea.

FOR CLASS DISCUSSION

1. The Panama Canal has greatly stimulated trade between Caribbean countries and the United States.
2. The economic and social interests of the South American countries are more closely allied to those of Europe than to those of the United States.
3. The tendency toward barter in international trade will seriously affect the commerce of the United States with South America.
4. Pan American airways will help to make South America more interested in the United States.
5. Brazil will become the leading manufacturing nation of South America.
6. Politics and government are the greatest obstacles to South American trade development.

CHAPTER XXII

EUROPE

In General. Europe has had a greater influence than any other continent on the development of art, education, history, trade, and government. Wherever Europeans have gone, they have carried their economic and social ideas with them. North America, South America, Australia, and New Zealand are governed largely by peoples of European blood and culture. Nearly the entire continent of Africa is controlled by Europeans. A considerable portion of Asia is under European domination, and China, Japan, and other Asiatic countries are said to be trying to "Europeanize" themselves. There is hardly a spot on the earth where European culture, business methods, and products are not to be found. This tendency of widely separated parts of the world to accept European methods and ideals seems sufficient proof that today Europeans and their descendants are the leaders of the world.

Many Separate Countries. The continent of Europe has an area of approximately 3,700,000 square miles; it is but little larger than Continental United States. In Europe, however, there are nearly as many separate political units as there are in all the rest of the world. The development of such a large number of independent countries has come about, to some extent, as the result of the geographic features of the continent. Europe was settled long before the development of modern transportation, communication, and educational methods. Geographic barriers like mountains, bays, inland waters, marsh lands, and dry areas were effective barriers between people and nations before the days of the railroad, telegraph, automobile, airplane, and radio. A study of a map of Europe will indicate how national boundaries have been established partly by geography. For example, Denmark, Italy, and Greece are each a peninsula; Norway and Sweden together make up the Scandinavian Peninsula; and Spain and Portugal make up the Iberian Peninsula. Moreover, the high barren mountain

range in the Scandinavian Peninsula is a partial cause for the separation of Norway and Sweden; and the arid lands of western Spain tend to separate that country from Portugal. The Pyrenees and the Alps have been effective in isolating Spain and Italy from the rest of Europe. The influence of marsh and swamp lands may be seen by studying the nature of the boundary between the Netherlands and Germany.

SECTION 1—THE BRITISH ISLES

In General. No other nation has profited more from its geographical location than England. During ancient times, and even until the discovery of America, the British Isles were on the very edge of the known world. Since the discovery of America and the development of oceanic commerce, they have enjoyed a central location, with trade routes coming to them from all parts of the world. The southern and eastern shores of Great Britain face the broad, open plain of Europe. This strategic position has helped to make the British Isles a great distributor of commodities and England a leading commercial nation.

For many years Great Britain has led the world in commerce and industry. The British have built an empire including more than five hundred million subjects and nearly a quarter of the land area of the earth.

Reasons for British Leadership. Many factors account for the leadership of England in world affairs. Among those most commonly accepted, however, are the insular position of Great Britain, its climate, the deep harbors, and the natural resources of the country.

(1) The insular character of Great Britain has served as a protection against invasion by enemies. Not since 1066 has a foreign army invaded her land, and few of her men have been withdrawn from productive occupations to serve in a standing army. Insularity has also been a vital factor in making Britain a great colonizer. In modern industrial development, an island country with limited resources needs access to areas from which it can obtain foodstuffs and raw materials



Travel & Industrial Development Association of Great Britain and Ireland

Potato planting in western England.

and to which it can sell manufactured goods. As overseas trade expanded, the British carried cargoes to all parts of the world, not only for themselves and their colonies, but also for others. The British are among the world's best seamen.

(2) The marine type of climate prevails in the British Isles. Because of the modifying influence of the ocean, there are no extremes of temperature. The average January temperature is about thirty-two degrees Fahrenheit, but many places are warmer than the average. Outdoor work on farms is possible during every month of the year. The average summer temperature is seldom above seventy degrees Fahrenheit.

The rainfall is abundant, but nearly three fourths of it comes during the winter months. The west coasts of Scotland and England receive about forty inches of rain annually; some of the highlands receive as much as eighty inches. The region around London has an annual rainfall of about twenty-four inches. The climate of the islands is fairly suitable for general agriculture. Both temperature and rainfall favor the growth of grass and hay; therefore the British Isles for centuries have been famous for their high-grade cattle and sheep.

(3) The many deep harbors of the British Isles furnish an excellent haven for fishing. fleets and have stimulated the development of a great navy and merchant marine. Most of the harbors afford ample docking facilities for the largest of steamships.

(4) The British Isles are fairly well supplied with natural resources. One of the greatest fishing grounds in the world is nearby. Timber is lacking, but two minerals—coal and iron —are relatively abundant. The working of coal and iron ore made industrialization possible. Coal not only served as fuel in local factories, but it was also exported to many different parts of the world, thus contributing to the development of trade. Iron ore, though decreased in quantity, still plays an important part in the industrial life of Great Britain. Tin is practically exhausted, but coal is still abundant.

Topography. At one time the British Isles were a part of the continent of Europe, but they became separated within relatively recent geological time. Evidences of that original union are the shallowness of the North Sea and the English Channel and the similarity of rock structure in France and in southern England. The highlands of Scotland and Wales are but the westward extension of the old Scandinavian ranges. Except for the Pennines and the hills of Cornwall, lowlands occupy nearly all of England. A very small, but important, lowland is in southern Scotland. Ireland is composed largely of an interior plain with more or less continuous hills rimming the coasts to the north and the east.

Fisheries. The Dogger Bank, which lies between England and Denmark in the North Sea, gives rise to an important fishing industry in Great Britain. British fishermen take about half of the total catch of fish from the North Sea. Approximately one million tons of fish are caught annually. The domestic consumption is so large, however, that only fifteen per cent of the catch is exported and about the same quantity is imported. A number of towns along the coast are fishing centers, but London is probably the largest fish market in the world.

Minerals. Great Britain is relatively rich in mineral resources. Its huge deposits of coal have been fundamental to the life and development of British industry. Prior to the Industrial Revolution England was an agricultural nation. With the introduction of machinery in industry and the use


HAGSTROM'S
MAP OF
BRITISH ISLES
SCALE IN MILES
0 50 100
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ATLANTIC OCEAN
NORTH SEA
IRISH SEA
English Channel
SHETLAND ISLANDS
Lerwick
ORKNEY IS.
Kirkwall
Thurso
The Minch
HEBRIDES
Dornoch
Dingwall
Fraserburgh
Elgin
Paterhead
Inverness
Kyle of Lochalsh
Aberdeen
Mallaig
Montrose
Dundee
Perth
St.Andrews
Greenock
Edinburgh
Berwick
Glasgow
Peebles
Ayr
Dumfries
GREAT BRITAIN
Moville
Glenties
Londonderry
Donegal
N. Larne
IRELAND
Belfast
Port Patrick
Carlisle
Newcastle
Sunderland
Durham
Stockton
Whitehaven
Kendal
Whitby
Scarborough
Killala
Sligo
Enniskillen
Achil
Downpatrick
Lancaster
Castlebar
Dundalk
Greenore
Heysham
Leeds
York
Bradford
Hull
Roscomon
Drogheda
Clifden
Galway
Mullingar
Halifax
Preston
Liverpool
Manchester
Immingham
DUBLIN
IRELAND
Birken-head
Chester
Sheffield
Lincoln
The Wash
Ennis
Caernarvon
Derby
Nottingham
Cromer
Kilrush
Carlow
Wicklow
Limerick
Peterborough
Tipperary
Tullow
Shrewsbury
Stafford
Leicester
Norwich
Yarmouth
Tralee
Clonmel
Wexford
Birmingham
Waterford
Rosslare
Aberystwith
Warwick
Cambridge
Lowestoft
Killarney
Kenmare
Cork
Kinsale
Queenstown (Cobh)
Bantry
Cardigan
Hereford
Cheltenham
Ipswich
Fishguard
Carmarthen
Oxford
Harwich
St.George's Channel
Merthyr
LONDON
Thames R.
Pembroke
Swansea
Cardiff
Bristol
Windsor
Greenwich
Canterbury
Bath
Salisbury
Dover
Barnstaple
Minehead
Southampton
Folkestone
Exeter
Dorchester
Newhaven
Calais
Padstow
Torquay
Brighton
Portsmouth
Strait of Dover
Penzance
Plymouth
Weymouth
Crecy
Falmouth
Abbeville
Le Havre
Diepoe
Amiens
Harfleur
Rouen
Cherbourg
CHANNEL ISLANDS (Br.)
Caen
Elbeuf
Louviers
Gisors
St.Lo
Evreux
Seine
Vire
Argentan
Versailles
Avranches
Alencon
Brest
St.Brieuc
St.Malo
Chartres
Etampe
Chateaulin
Fougeres
Mayenne
Chateau du Loire
Rennes
Quimper
Laval
Le Mans
Lorient

of coal in generating power, England, during the nineteenth century, became a leader in manufacturing.

The value of British coal production is around eight hundred million dollars annually. The principal fields are located in southern Scotland, Yorkshire, Nottingham, Derby, Lancashire, and southern Wales. The coal is largely bituminous and of excellent quality. Despite the continual mining of more than three hundred million tons annually for many years, it is estimated that there is enough coal remaining to last six hundred years at the present rate of production. British mines are, however, becoming deep; and because of the higher cost of production, other nations now compete with Great Britain in coal export. Britain has one important advantage over competitors in the nearness of the coal mines to the seacoast, an advantage that effects a considerable saving in freight charges.

Iron is found in Yorkshire near the mouth of the Tees River. British iron and steel production annually amounts to about twenty million tons. Coal and iron are the most valuable mineral products. Other minerals of industrial importance are slate, sandstone, salt, pottery clays, chalk, oil shale, and lead ore. The mines of Cornwall, which once contained an abundant supply of tin, are now almost exhausted.

Agriculture. In the Middle Ages enough agricultural products were grown in Great Britain to support the population. Farming was profitable until the middle of the nineteenth century, and a majority of the people were engaged in agriculture. Today less than seven per cent of the people are engaged in farming, and the entire group of islands is largely dependent upon other countries for food supplies. Only about one fourth of the area is under cultivation.

Farming has declined in England largely because other countries can produce foodstuffs more abundantly and more cheaply. The financial return from agriculture is less than that from factories. Great Britain now finds it necessary to import about four fifths of its breadstuffs and fruits; one half of the meat, eggs, and dairy products; and one third of the fish and vegetables. The chief crops are oats, potatoes, hay, flax, and barley; the first two are well adapted to a climate



An English farmyard.

that is cool and moist. The climate is generally too moist for wheat to be profitable, although some wheat is grown in the drier sections of the eastern part of the country.

Excellent pasture lands have long encouraged the raising of fine cattle, horses, sheep, and hogs. The British have exported high-grade livestock to all countries of the world. Today sheep are the most numerous of all animals on the farms. Animals and animal products account for about seventy-five per cent of the value of farm products in Great Britain.

Manufactures. At the beginning of the nineteenth century, Great Britain was able to outstrip all rivals in manufacturing. With plenty of fuel, and machinery that could be operated by cheap labor, she was able to remain one of the leaders in the industrial world. The industrial region of Great Britain extends from the London area northward through the Midlands to southern Scotland. Another industrial center is the Irish province of Ulster, which is well known for its linen manufactures and shipbuilding.

Iron and steel manufactures are important. England's own supply of iron ore is inadequate, and large quantities of pig iron and iron ore are now imported. The chief centers for iron and steel manufacturing are located near tidewater and coal in the Cleveland district near the mouth of the Tees River,

about Glasgow in Scotland, in northwest Cumberland, and in Swansea in southern Wales. One of the oldest steel-manufacturing centers is the Sheffield district. Special types of hardware and cutlery are made in Birmingham and Sheffield. Closely allied with the steel industry is shipbuilding, which is largely centered in Glasgow, Newcastle, and Belfast.

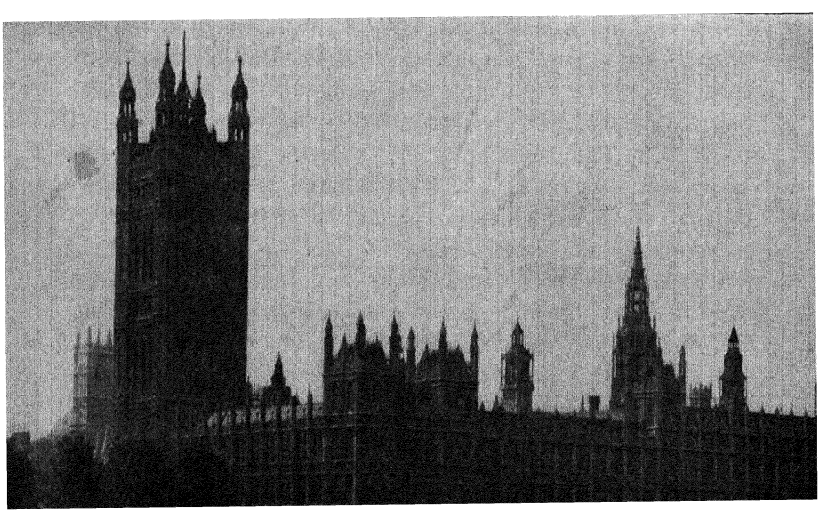
The spinning and weaving of wool has been an important industry since the Middle Ages. The chief manufacturing district is on the eastern side of the Pennine Chain, where Leeds, Bradford, Halifax, Huddersfield, and Leicestershire are noted for their woolens. Leeds is one of the greatest industrial cities of England and ranks first in the manufacture of clothing.

The cotton industry, which is located on the western slope of the Pennines, is centered largely in Manchester, Oldham, Bolton, Blackburn, Burnley, and Preston. Raw cotton is imported from the United States, Egypt, and India. Increasing competition of other countries, particularly the United States, Germany, Japan, and India, has made it difficult for Great Britain to hold her overseas markets. Since only about one fifth of the cotton goods is consumed in the home market, this is indeed a serious problem.

One of the most famous textiles in the world is Irish linen, which has long been the standard for fine linens. Northern

House of Parliament, London.

Keystone View Company



Ireland has developed a highly proficient method of manufacturing.

The key industries of Great Britain are food, drink, and tobacco; engineering, shipbuilding, and vehicles; textiles; public utilities; iron and steel; chemicals; building and contracting; paper and printing; and clothing. Textiles, iron and steel, machinery, vehicles, and coal normally comprise the bulk of the exports.

Cities. The largest city not only of the British Empire but also of the world is London. The geographical location of London was determined by the first crossing on the Thames River, used by armies in the days of the Roman Conquest. The Thames is an estuary for a considerable distance, and this invites commerce. With its superior location on the Thames, London became the gateway of England and grew into one of the world's principal distributing centers. The wares of many countries are brought to London and then transshipped

The docks at Liverpool.

Ewing Galloway



to other areas. London is today one of the world's great centers of finance, industry, and trade.

Liverpool is the principal city and port on the western coast of England. Situated on the estuary of the Mersey River, Liverpool has become the terminus for many shipping lines. Most of the British supply of cotton, wheat, meat, and tobacco are received through this port.

Other ports of importance are Cardiff, the chief outlet for coal mined in Wales; Manchester, which is reached by the Manchester Ship Canal and the Mersey River; Hull, located on the Humber River; Glasgow, in Scotland; and Belfast, in Ireland. Belfast is the center of the flax-growing region and the manufacture of linen. It is also noted for shipbuilding. Another city in Ireland that is of some commercial importance is Londonderry.

Ireland. Only Northern Ireland belongs to the United Kingdom politically, but all of Ireland is closely related to the United Kingdom economically. Ireland is predominantly agricultural, while England is predominantly industrial. The products of the one country therefore supplement the products of the other.

The central plain of Ireland is surrounded by mountains, which are relatively high near the sea and have long slopes toward the interior. Ireland has a marine type climate, which is even more mild and moist than that of England. Farm work can be carried on throughout the entire year, as freezing weather is rare. The rainfall is heavy, varying from eighty inches in the west to about thirty inches in the east.

Because of the heavy rainfall and unfavorable soil, Ireland is not important in the production of cereals. It is, however, ideal for growing grass and hay. Livestock, meat, butter, milk, and eggs are therefore produced advantageously and shipped to England. The climate also favors potatoes, which are raised in large quantities.

The leading industrial cities in Northern Ireland are Belfast and Londonderry; Dublin, the capital of Southern Ireland, is also of great commercial importance.

Economic Position of Great Britain. Although Great Britain is still the leading industrial and commercial country of Europe, her relative position has declined somewhat since the Great War. Among the factors contributing to Britain's high economic position was the use of steel, replacing wood, in shipbuilding. With a good supply of iron ore and a steel industry already established, shipbuilding grew rapidly; England soon developed a large merchant marine, which aided in colonial expansion and increased overseas markets.

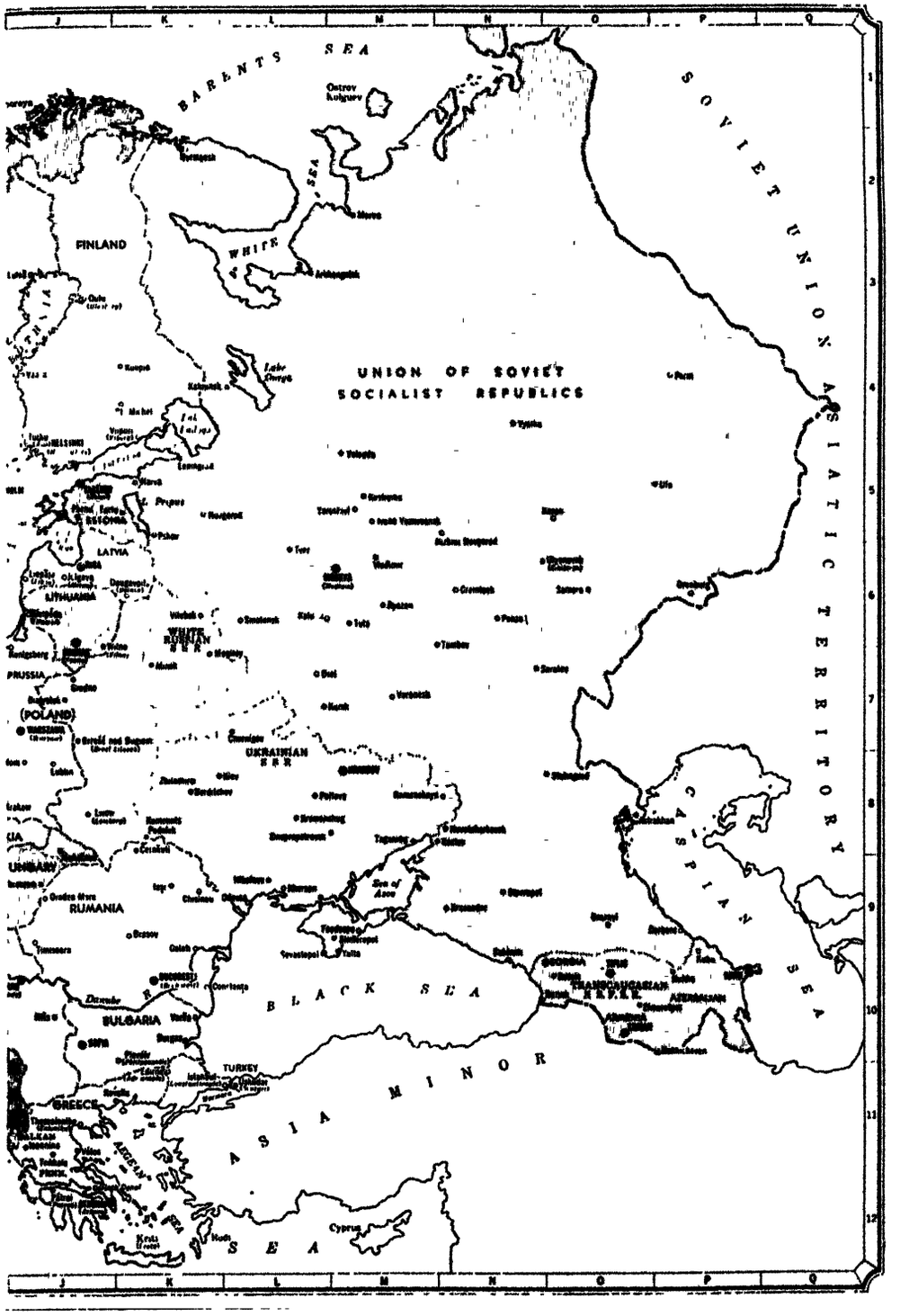
No other country is now so dependent upon foreign commerce as is Great Britain. A large proportion of her foodstuffs and nearly all the raw materials for industry must be imported. Since the home market cannot consume more than half of the goods manufactured, foreign markets are essential. Increasing competition in world trade makes it more difficult to hold markets now than during the nineteenth century.

With her large merchant marine and well-trained seamen, England engages in a profitable carrying trade, thereby greatly increasing her income. In addition, the earnings on British investments abroad have done much to offset the unfavorable balance caused by an excess of imports over exports.

TEXT QUESTIONS

1. In what European countries have the boundaries been determined by geographical features?
2. What advantages did Europe have for leadership in world affairs?
3. How have the British Isles profited from their geographical location?
4. What factors helped Great Britain to become a leader in commerce and industry?
5. Discuss the relative importance of agriculture and industry in Great Britain from the Middles Ages to the present time.
6. What important minerals are found in England?
7. Indicate the interrelationship between the minerals and the trade of England.
8. Name and locate cotton-manufacturing cities of England.
9. For what manufactured product is Ireland most famous?
10. What is the basis of trade between Northern Ireland and England?


HAGSTROM'S
Outline Map Series
with Principal Cities
EUROPE
SCALE IN MILES
COPYRIGHT HAGSTROM MAP COMPANY INC NEW YORK
ARCTIC OCEAN
NORWEGIAN SEA
NORTH SEA
BALTIC SEA
ATLANTIC OCEAN
BRITISH ISLES
SCOTLAND
IRELAND
WALES
ENGLAND
ENGLISH CHANNEL
BAY OF BISCAY
FRANCE
SPAIN
PORTUGAL
ANDORRA
GERMANY
NORWAY
SWEDEN
ITALY
YUGOSLAVIA
SLOVAKIA
TYRRHENIAN SEA
ADRIATIC SEA
IONIAN SEA
MEDITERRANEAN SEA
AFRICA
Balearic Islands
Lofoten Is.
Shetland Is.
Orkney Is.
Gotland
Oland I.
Corsica
Sardinia
Sicily
Malta
Gibraltar
Strait of Gibraltar


BARENTS SEA
WHITE SEA
FINLAND
UNION OF SOVIET SOCIALIST REPUBLICS
SOVIET UNION ASIATIC TERRITORY
LATVIA
LITHUANIA
WHITE RUSSIAN S.S.R.
PRUSSIA
(POLAND)
UKRAINIAN S.S.R.
RUMANIA
HUNGARY
BULGARIA
TURKEY
GREECE
BLACK SEA
CASPIAN SEA
ASIA MINOR
AEGEAN SEA
Cyprus
Ostrov Kolguev
Novaya Zemlya

SECTION 2—FRANCE

In General. France has the geographic advantage of fronting on two large bodies of water, the Atlantic Ocean and the Mediterranean Sea. This excellent position, together with ease of access to the interior by means of the plains and rivers, has done much to determine the political and commercial life of this country. The broad, level plains to the north and west, drained by navigable rivers, are the crossroads of many of Europe's busiest trade routes, which run toward England and the Americas. To the south through the narrow Rhone Valley is the best route to the Mediterranean Sea and the countries on its border. There France looks toward Africa and the Orient, where almost all of her colonial possessions are located.

Climate and Topography. The climate of France, though not the same over the entire country, is relatively mild. In general, the moist west winds that blow off the Atlantic Ocean give France a climate somewhat like that of the Pacific Coast of the United States. The climate of the northwest region is predominantly of the marine type, like that of Great Britain or the Pacific Northwest. To the south, in the lower Rhone Valley and along the Mediterranean, the climate, with its abundance of sunshine and the rainy season in winter, is similar to the climate of California. In the higher regions to the east near the German border, the temperature is somewhat lower and as a result there is more snowfall in winter. French winters are, however, usually short and mild, and nowhere are there long periods of freezing weather.

There is an abundance of rainfall, averaging approximately thirty inches a year—an amount that is satisfactory for agriculture. In Brittany, the central plateau, and the flanks of the Alps and the Pyrenees, however, the rainfall is somewhat greater.

Most of France consists of low plains near the sea and broken highland regions of moderate elevation, with valleys easily connected by canal or rail. The plains, with the exception of that between the Garonne River and the Atlantic

Ocean, are generally fertile. The mountains, the Pyrenees, Vosges, Jura, and Alps, are on or near the borders.

France can be divided into some six major regions, each of which is different in relief, climate, and agriculture. These regions are: (1) the central plateau and the highland peninsula of Brittany; (2) the Paris Basin; (3) Aquitaine, an ancient division of southwestern France; (4) the Mediterranean Coast and the Rhone Valley; (5) rugged northeast France; (6) the Pyrenees, Alps, and Jura Mountains.

The central plateau and Brittany are old worn-down, or eroded, mountain areas. In the central plateau the soils are poor, the winters are severe, agriculture is backward, and sheep and cattle are cared for by a sparse population. In Brittany better upland soils and milder climate enable farmers to raise many vegetables, apples, rye, and buckwheat.

The Paris Basin, with its flat or gently rolling lands, is the largest, richest, and most productive region of France. There is little waste land, and the thrifty French farmer is busily engaged in the growing of wheat and oats, sugar beets, and garden vegetables. The basin is also famous for its rich pastures, good livestock, and dairy products. Some grapes are grown, as in the famous Champagne wine district, but the great bulk of French grape and wine production occurs in the sunnier south of France. An extensive river system, the Seine and its tributaries, plus a network of modern railway lines, makes communication and transportation easy throughout this basin.

In Aquitaine the Valleys of the Garonne, Gironde, and Loire Rivers are excellent for agriculture. Cereals and wines are produced in abundance. A coastal area known as the Landes, which formerly was marshy and sandy, has been reforested and now furnishes considerable pine lumber.

The Mediterranean Plain, with its warmer climate and fertile soils, grows a great variety of products, such as olives, cherries, grapes, peaches, vegetables, and flowers. The sunny coast from Marseille to the Italian border is popular as a winter vacation land. The narrow but well-protected Rhone Valley is climatically similar to the Mediterranean Coast. This


NORTH SEA
IRISH SEA
English Channel
Bay of Biscay
Gulf of Lion
The Wash
Strait of Dover
HELGOLAND (Ger)
Port Patrick
Carlisle
Sunderland
Durham
Stockton
Whitehaven
Kendal
Whitby
Scarborough
Lancaster
Heysham
Leeds
York
Bradford
Hull
Preston
Halifax
Liverpool
Manchester
Immingham
Birkenhead
Chester
Sheffield
Lincoln
Caernarvon
Derby
Nottingham
Cromer
Peterborough
Shrewsbury
Stafford
Norwich
Yarmouth
Birmingham
Leicester
Aberystwith
Warwick
Cambridge
Lowestoft
Cardigan
Hereford
Carmarthen
Cheltenham
Ipswich
Merthyr
Oxford
Swansea
Harwich
Cardiff
LONDON
Bristol
Windsor
Greenwich
Barnstaple
Bath
Salisbury
Minehead
Southampton
Folkestone
Dover
Canterbury
Exeter
Dorchester
Newhaven
Torquay
Portsmouth
Brighton
Plymouth
Weymouth
Falmouth
Le Havre
Cherbourg
Harfleur
Rouen
Dieppe
Amiens
Peronne
Beauvais
Leon
Sedan
Mezieres
Thionville
Verdun
Reims
Caen
Elbeuf
Louviers
Gisors
Soissons
Evreux
St Denis
Meaux
Chalons
Metz
St Lo
Vire
Argentan
Versailles
PARIS
Sezanne
Nancy
Strasbourg
Avranches
Alencon
Melun
Bar de Duc
Toul
Brest
St Brieuc
St Malo
Chartres
Etampes
Fontainebleau
Domremy
Epinal
Chateaulin
Fougeres
Mayenne
Chateau du Loire
Troyes
Chaumont
Quimper
Rennes
Sens
Remiremont
Mulhouse
Lorient
Laval
Le Mans
Orleans
Joigny
Chatillon
Vesoul
Belfort
Vannes
Blois
Auxerre
Gray
Basle
Angers
Tours
Vierzon
Avallon
Dijon
Besancon
Nantes
Saumur
Nevers
Le Creusot
BERN
Bressuire
Bourges
Chalon
Lausanne
La Roche-sur Yon
Poitiers
Chateauroux
Moulins
Les Sables d Olonne
Niort
Montluçon
Vichy
Macon
Bourg
Geneva
Sion
Montmorillon
Gueret
Roanne
Chamonix
La Rochelle
Culoz
Annecy
Rochefort
Aubusson
Clermont Ferrand
Limoges
Lyons
Cognac
Angouleme
Montbrison
Vienne
Chambery
Tulle
St Etienne
Turin (Torino)
Pauillac
Perigueux
Brioude
Grenoble
St Jean
Coutras
Brive
Le Puy
Valence
Susa
Bordeaux
Libourne
Aurillac
Briancon
Pinerolo
Arcachon
Marmande
Cahors
Privas
Crest
Gap
Cuneo
Mende
Montelimar
Mont de Marsan
Agen
Rodez
Orange
Digne
Auch
Montauban
Beaucaire
Avignon
Nice
Dax
Alby
Lodeve
Nimes
Arles
Draguignan
San Sebastian
Biarritz
Bayonne
Toulouse
Castres
Montpellier
Aix
Marseille
Pau
Tarbes
Cazeres
Castelnaudary
Beziers
Sete
Bilbao
Carcassone
Narbonne
Toulon
Vittoria
Bagneres
St Girons
Foix
Miranda
Pamplona
Ille
Perpignan
Burgos
Logrono
Jaca
Olot
Allaro
Huesca
Tudela
Ebro
Vich
Gerona
Aranda
Soria
Saragossa (Zaragoza)
Manresa
Calatayud
Lerida
Granollers
Martorell
Mataro
Segovia
Daroca
Reus
Barcelona
Molina
Tortosa
Tarragona
MADRID
Guadalajara
Teruel
Vinaroz
Tonning
Emden
Groningen
Oldenburg
Leeuwarden
Clodenburg
Helder
NETHERLANDS
Zwolle
Meppen
Alkmaar
Amsterdam
Haarlem
Zutten
Osnabruck
Utrecht
THE HAGUE ('s Gravenhage)
Arnhem
Munster
Rotterdam
Dordrecht
Cleve
Wesel
Bochum
Hamm
Tilburg
Essen
Saarlohn
Flushing
Zeebrugge
Antwerp
Malines
Rhuydt
Cologne (Köln)
Ostend
Bruges
Maastricht
Aix la Chapelle (Aachen)
Calais
Ypres
Boulogne
BRUSSELS (Bruxelles)
Liege
Waterloo
Verviers
Malmedy
Lille
Mons
Coblenz
Crecy
Valenciennes
Namur
Maubeuge
Wiesbaden
Abbeville
Arras
Cambrai
Bastogne
LUX.
Trier (Treves)
Mainz
Albert
St Quentin
Luxemburg
Mannheim
Speyer
Saarbrucken
CHANNEL ISLANDS (Br)
Elbeuf
Louviers
Gisors
Soissons
Reims
Caen
Evreux
St Denis
Meaux
Chalons
Metz
St Lo
Vire
Argentan
Versailles
PARIS
Sezanne
Nancy
Strasbourg
Avranches
Alencon
Melun
Bar de Duc
Toul
Brest
St Brieuc
St Malo
Chartres
Etampes
Fontainebleau
Domremy
Epinal
Chateaulin
Fougeres
Mayenne
Chateau du Loire
Troyes
Chaumont
Quimper
Rennes
Sens
Remiremont
Mulhouse
Lorient
Laval
Le Mans
Orleans
Joigny
Chatillon
Vesoul
Belfort
Vannes
Blois
Auxerre
Gray
Basle
Angers
Tours
Vierzon
Avallon
Dijon
Besancon
Nantes
Saumur
Nevers
Le Creusot
BERN
Bressuire
Bourges
Chalon
Lausanne
La Roche-sur Yon
Poitiers
Chateauroux
Moulins
Les Sables d Olonne
Niort
Montluçon
Vichy
Macon
Bourg
Geneva
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Gueret
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La Rochelle
Culoz
Annecy
Rochefort
Aubusson
Clermont Ferrand
Limoges
Lyons
Cognac
Angouleme
Montbrison
Vienne
Chambery
Tulle
St Etienne
Turin (Torino)
Pauillac
Perigueux
Brioude
Grenoble
St Jean
Coutras
Brive
Le Puy
Valence
Susa
Bordeaux
Libourne
Aurillac
Briancon
Pinerolo
Arcachon
Marmande
Cahors
Privas
Crest
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Cuneo
Mende
Montelimar
Mont de Marsan
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Rodez
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Montauban
Beaucaire
Avignon
Nice
Dax
Alby
Lodeve
Nimes
Arles
Draguignan
San Sebastian
Biarritz
Bayonne
Toulouse
Castres
Montpellier
Aix
Marseille
Pau
Tarbes
Cazeres
Castelnaudary
Beziers
Sete
Bilbao
Carcassone
Narbonne
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St Girons
Foix
Miranda
Pamplona
Ille
Perpignan
Burgos
Logrono
Jaca
Olot
Allaro
Huesca
Tudela
Ebro
Vich
Gerona
Aranda
Soria
Saragossa (Zaragoza)
Manresa
Calatayud
Lerida
Granollers
Martorell
Mataro
Segovia
Daroca
Reus
Barcelona
Molina
Tortosa
Tarragona
MADRID
Guadalajara
Teruel
Vinaroz
FRANCE
HAGSTROM'S MAP OF FRANCE
SCALE IN MILES
0 50 100

is a rich agricultural region for such crops as peaches, grapes, the mulberry tree, melons, and small fruits. The swift-moving Rhone contributes to the production of hydroelectric power and the development of various textile and machine industries around Lyon.

In the rougher lands of northeastern France, including Alsace-Lorraine, agriculture is similar to that of the Paris Basin, but it is generally confined to a few better valleys such as the Moselle. There is much waste land. Spinning and weaving, and the iron and steel industry of Lorraine, tend to be more significant than farming.

The Alpine and Pyrenees Mountain slopes of France are important chiefly as grazing grounds for sheep and cattle and for the development of hydroelectricity. The ruggedness of the land, poor roads, and the colder climates make these areas more backward than the plain and plateau regions.

France also owns Corsica, a rugged forested island in the Mediterranean Sea. Here the warming influence of the waters permits the growth of olives, lemons, oranges, and winter vegetables. Algeria and Tunisia, rich colonies across the Mediterranean, are discussed with Africa.

Minerals. Compared with Great Britain and Germany, France is relatively poor in minerals. The principal coal region, which is in the northern provinces, is part of a district that extends into Belgium and Germany. Other coal fields are found in Lorraine and about Lyon, but the supply of coal is not adequate for the industrial demand. The great iron-ore deposits of Lorraine in northeast France, however, are the most extensive in all Europe. France now ranks next to the United States as a world producer of iron ore. Southern France has deposits of bauxite, the ore from which aluminum is made. The potash deposits of Alsace are valuable. Near Strasbourg are small deposits of petroleum, which yield a very small part of the French oil requirements.

Agriculture. As a result of excellent climate and fertile soil, France is able to grow a large amount of agricultural products. About sixty per cent of the total area is cultivated.



Ewing Galloway

A rural scene in France.

The various types of climate in France enable her to produce a wide variety of commodities, like cereals, sugar beets, fruits, nuts, olives, and animal and poultry products.

The crowded condition of the country has made intensive farming a necessity. Over half of the population is rural. The farms are medium to small in size, the average holding being twenty-four acres, but the yield from an acre is large. The important crops are wheat, rye, barley, oats, potatoes, and beets. Nearly every farmer has his field of wheat. As a wheat producer France ranks high. Her large domestic crop, plus an imported surplus from colonial Algeria, is nearly sufficient for her home flour requirements. The oat crop of France exceeds the wheat crop by some millions of bushels, but the wheat is more valuable. The average yield of wheat is twenty-three bushels an acre. This yield, compared with the yield of thirteen bushels an acre in the United States and in Canada, is an example of what intensive tillage would do towards increasing the food supply of the Western Hemisphere.

Next to cereals, the most characteristic French crop is the grape, although a great diversity of other fruits are grown,

including apples, pears, plums, peaches, apricots, and cherries. Because of the mild climate grapes can grow in nearly all sections of the country, but most of the commercial wine production is in the southern half. The crop is largely concentrated in river basins, like those of the Garonne and the Saône, and along the Mediterranean Sea. Because of superior natural conditions for grape culture, and careful attention to wine making, France has become the leading wine producer of the world.

Livestock raising is important in France, which ranks third in Europe in number of cattle. This country has almost sixteen million cattle, which produce meat for domestic consumption, dairy products for both home use and export, and hides and skins for the leather industry. France has many famous varieties of cheese made from both cow's milk and sheep's milk. The sheep supply wool for the manufacture of woolens, but the amount produced is insufficient and must be supplemented by imports of raw wool.

Manufactures. Manufactures reflect, in large measure, the skill and artistic ability of the French. Here manufacturing does not concern itself primarily with quantity or size, but rather with attractive design and high unit value. Appreciation of things beautiful and fine, a deep-rooted French characteristic, is expressed in silk fabrics, china, glassware, embroideries, toilet articles, shoes, kid gloves, and scientific instruments.

Iron and steel manufacturing, near the coal and iron fields, stands high in the list of French manufactures. Many iron industries are located in Lorraine, where the best ore is found. Iron and steel products form one of the chief exports of France. France also makes automobiles, ships, and electrical machinery. The scarcity of good coking coal is one of the chief handicaps in the full development of the iron and steel industries.

In textiles the French are second only to Great Britain among the countries of Europe. Some of the best fabrics, especially in cotton, are made in Alsace. Two other regions, Rouen and Lille in northern France, are prominent in textile manufacturing. These regions have the advantage of power

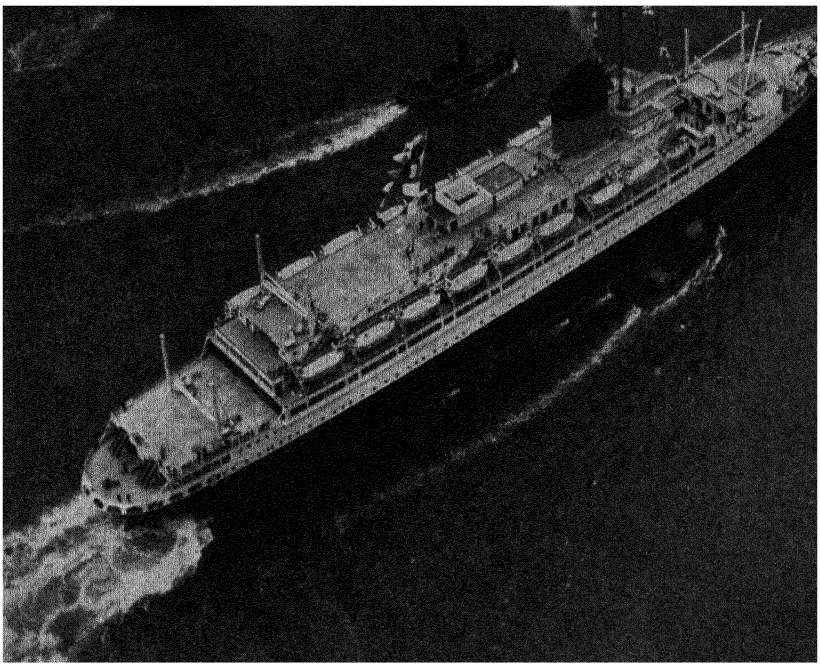
and market, together with ease in obtaining American cotton through Havre. In addition to the manufacture of woolen and cotton cloth, the making of linen is prominent in the city of Lille. Other types of manufacturing are silk in Lyon, the chief silk city in Europe; clothing in Paris; porcelain in Limoges, the chief seat of this industry in France; watches in Besançon, which is noted for its extensive manufactures of this product; perfumes along the Riviera; soaps in Marseille; rubber in Clermont-Ferrand; and gloves in Grenoble. Approximately one fourth of the manufactures of France come from Paris, where articles of luxury, such as elegant furniture, tapestries, shoes, dresses, millinery, drapes, rugs, and many other lines of finery are made. Hence, Paris has for many years been the style center for people who seek beauty and art in finished products.

French industry, as a whole, has never developed huge factories for large-scale production. Although there is some trend toward larger organizations, most factories are small and employ small numbers of workers.

Transportation and Commerce. France was one of the first nations to become a united country during the Middle Ages, and later became one of the leading commercial nations. A geographic factor that favored the political and commercial unity of this country is the splendid system of rivers, which makes all parts of the country accessible.

Almost all these rivers, which are navigable, are connected by a network of canals; thus it is possible to reach all points on the various rivers by boat. In the early days this was an important factor in uniting the people. The chief rivers are the Seine and the Moselle in the north, the Loire and the Garonne in the west, and the Rhone in the east and the south. The Rhone is the least valuable of all these rivers, largely because of its swift current and poor outlet to the sea. The waterways of the country total over seventy-five hundred miles; and of this mileage, canals cover a little more than three thousand miles.

France has several great railway systems, which are operated by the state although they are privately owned. The most prominent routes running to adjacent countries are those



Underwood and Underwood

The French passenger ship, the *Champlain*, one of the vessels connecting France and the United States.

from Paris to Brussels, Paris to Berlin, Paris to Vienna, and Paris to Turin, in Italy. The first three follow either the plain or the passes through the low mountains to the east. The road to Italy reaches that country through the famous Mont Cenis tunnel. A line also reaches around the end of the Pyrenees to Barcelona, in Spain. France is fortunate also in having an excellent highway system, by means of which every town and village in the country can be reached. With the exception of Russia, France has the greatest highway mileage in Europe.

Although France has a favorable position for commerce, excellent river, railroad, and highway systems, and a coast facing two seas, she is almost stationary in population and trade. Havre, Bordeaux, Dunquerque, and Marseille are important ports. From these cities are shipped a large amount of exports of considerable value.

Cities. Paris, the largest city in France, has a city population of over 2,800,000 and is within a short distance of over 2,000,000 more people located in nearby suburbs. This city is

the natural meeting point of all routes in the Paris basin. As France became unified with the building of canals and railways radiating to all parts of the nation, the importance of this central position increased. In this respect Paris is equalled only by Berlin, in Germany, which is also situated on a plain so that it is the meeting point of all routes. Paris is the most important manufacturing and distributing center. Its products include chinaware, laces, clothing, and fabrics. It has world-famous museums and galleries, and has long been renowned as an art center.

Some distance east of the mouth of the Rhone is Marseille, second city of France, with over 650,000 inhabitants. Its position opposite French North Africa and its ready access to all trade of the Mediterranean Sea make this city a great shipping port. Because it finally outgrew its old natural harbor, it made a new and larger one with great breakwaters built along the coast. A canal also connects the city with the Rhone. Marseille is the commercial center for the Mediterranean Coast and the Rhone Valley, a rich agricultural region that not only grows wheat, grapes, and citrus and other fruits, but also has a large livestock industry. Marseille mills Algerian wheat, refines vegetable and other oils, makes soap, and has a wide range of other manufactures.

Lyon, a great industrial center located at the junction of the Rhone and Saône Rivers, is the third largest city in France. Many years ago it was found that the Rhone Valley was sufficiently warm and sheltered for the growing of mulberry trees and the feeding of silkworms. As a result Lyon developed into a great silk-spinning and weaving center. Today it manufactures some of the finest silk fabrics made in Europe. In recent years it has also branched out into a number of other textiles, including cotton, woolens, and rayon. Dyes, chemicals, and machinery are also made in this busy city.

Bordeaux is located some sixty miles from the sea on the broad estuary of the Gironde River. Its well-protected harbor has helped to make it the main French port on the Atlantic Coast. It is in the center of a great wine-producing region; it handles naval stores and lumber from the pine forests to

the south; and it manufactures cement from local limestone. Much of the trade with French Equatorial Africa centers in Bordeaux.

Havre, at the mouth of the Seine, with its great system of docks and wharves, warehouses, cargo-handling machinery, and shipbuilding yards, serves as the main western gateway for Paris. It is the busiest port of France.

Other cities of commercial importance are Rouen, farther up the Seine, with its oil refining and cotton spinning; Calais and Boulogne, busy channel ports for trade with the British Isles; Nantes, trade center of the Loire Valley; and Dunquerque, near the Belgian border.

Economic Position. With all its numerous and varied types of industrial and commercial activity, France is still predominantly agricultural. The people cling closely to the soil, and farming is their first occupation. The French are conservative, and agriculture fits in well with that characteristic. However, since the World War of 1914-1919 there has been a very definite trend toward the increased development of industry. The migration to the city from the country, together with the immigration of people from other countries, has afforded an increased labor supply for factory work. Located near the center of one of the great industrial regions of the world, France has many advantages for a varied industrial economy, in competition with her nearby neighbors.

TEXT QUESTIONS

1. What geographic and climatic advantages does France enjoy?
2. Describe the natural regions in France. How do they differ?
3. How nearly self-sufficient is France in food production?
4. Discuss the agricultural conditions and products of France.
5. What are the outstanding characteristics of French manufactures?
6. Is France fortunate in her transportation facilities? Give examples to support your answer.
7. What factors have helped Paris to become a great city?
8. How does Lyon compare with Paris in location and other advantages?
9. Contrast Marseille and Bordeaux in as many ways as you can.

SECTION 3—CENTRAL EUROPE

THE GERMAN REICH

Political Changes. No other country has experienced more political and economic changes in the last seventy years than Germany. The German nation before 1871 was a disunited group of hundreds of separate political units, each of which set up political and economic barriers that did much to prevent the growth of commerce and industry. In 1871 the states were reduced to about twenty-six in number, and these united to become the nucleus of the modern German nation. The industrial and commercial growth of the country up to 1914 was little short of phenomenal; until the outbreak of hostilities in 1914, Germany was among the leading nations of the world. The World War of 1914-1919, however, left the country greatly weakened. The Treaty of Versailles in 1919 stripped Germany of its political power and of its colonial possessions. Since that time it has gradually regained its former position as a world power and influence. With the recovery of the Saar Basin, and the addition of Austria and much of Czechoslovakia and Poland, the German nation became the largest state in the central European group and the second largest nation in Europe in respect to both area and population.

Topography. Germany has two main physical features: namely, the northern plain and the southern highlands. The highlands cover a larger area than the plains, and contain important sections of the Rhine, Elbe, and the Danube Valleys.

The plain is a part of the great northern plain of Europe that extends from the North Sea to the Ural Mountains. A large part of the north German plain is covered with a sandy soil, interspersed with a few areas of better clay soils. Much of the land originally was swampy and infertile: even today many swamps and moors are found. Careful drainage and scientific cultivation have made much of the plain productive. Alluvial deposits along some of the slow-moving rivers have produced certain areas of high fertility.

The southern highlands are more suited to forests than to crops. These highlands do, however, contain many fertile val-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Kattegat
Oland I.
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Danube
Po R.
Marmara
Stavanger
Kristiansand
Karlstad
Eskilstuna
Uppsala
STOCKHOLM
Norrköping
Jönköping
Göteborg
Visby
Tallinn (Reval)
Narva
Pärnu
Tartu
ESTONIA
L. Peipus
Novgorod
Pskov
Saare
RIGA
LATVIA
Liepāja (Libau)
Jelgava (Mitau)
Daugavpils (Dünaburg)
LITHUANIA
Klaipéda (Memel)
Vitebsk
WHITE RUSSIAN S.S.R.
Mogilev
Minsk
Wilno (Vilna)
KAUNAS (Kovno)
Königsberg
EAST PRUSSIA
Grodno
Białystok
(POLAND)
WARSZAWA (Warsaw)
Brześć nad Bugiem (Brest Litovsk)
Radom
Lublin
Aalborg
Randers
DENMARK
KØBENHAVN (Copenhagen)
Esbjerg
Halmstad
Karlskrona
Halsingborg
Malmö
Bornholm
Rugen
Kiel
Lübeck
Stralsund
Hamburg
Schwerin
Stettin
Bremen
Oldenburg
Norwich
'S GRAVENHAGE (The Hague)
Amsterdam
Rotterdam
NETHERLAND
Dunkirk
Antwerp
Calais
Krefeld
Essen
Düsseldorf
Köln
BRUXELLES (Brussels)
Charleroi
Koblenz
LUXEMBOURG
Frankfurt
Reims
PARIS
Metz
Karlsruhe
Strasbourg
Stuttgart
Nürnberg
Augsburg
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Basel
Dijon
Zürich
Luzern
Innsbruck
BERN
SWITZERLAND
Genève
Locarno
Lyon
Nice
Marseille
Toulon
Torino (Turin)
Milano (Milan)
Verona
Mantova
Genova (Genoa)
Parma
Modena
Carrara
Bologna
Lucca
Pisa
Livorno (Leghorn)
Firenze (Florence)
Ancona
Bastia
Elba I.
Udine
Venezia (Venice)
Trieste
ITALY
Hannover
GERMANY
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Magdeburg
BERLIN
Leipzig
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Plzeň
München
Salzburg
Graz
WIEN (Vienna)
Brno (Brünn)
Bratislava
SLOVAKIA
Kraków
Lwów (Lemberg)
Kamenets Podolsk
Zhitomir
Kiev
Berdichev
Cernăuti
Iaşi
Chisinau
Odessa
HUNGARY
BUDAPEST
Debrecen
Oradea-Mare
RUMANIA
Szeged
Timisoara
Brasov
Galati
Zagreb
YUGOSLAVIA
Split (Spalato)
Sarajevo
Niš
BEOGRAD (Belgrade)
BUCUREŞTI (Bucharest)
Constanţa
Danube R.
BULGARIA
Shkoder (Skutari)
TIRANE
ALBANIA
Taranto
Cosenza
Catanzaro
Corfu
Korça
Thessaloniki (Salonika)
BALKAN
Ioannina
Vólos
Trikkala
PINDUS
Patrai (Patras)
ATHENAI (Athens)
Corinth Canal
GREECE
Kavalla
Edirne (Adrianople)
Istanbul (Constantinople)
TURKEY
Krīti (Crete)
Rodi

leys in which cereals and fruits are grown. Many of these sheltered valleys contain rich agricultural districts, especially in the Rhine and Danube Valleys. Grazing and lumbering are important activities in the highlands. This region also furnishes a great deal of water power for the development of hydroelectricity. It is also an attractive section from a scenic point of view, and in normal times is visited by many tourists.

Climate. Germany has a more varied climate than either France or Great Britain. On the whole it is moderately cold in winter. This is, in part, due to differences in topography and the greater distance of the country from the ocean. In the western portion of Germany a modified type of marine climate prevails; towards the east the climate is of the continental type, with greater extremes of temperature in winter and summer. The temperature varies more from west to east than it does from north to south, because the higher altitude of the southern region tends to make this section cooler than its more southerly location would suggest.

Rainfall is greater in the west on both the plain and highland areas. In the western highlands around the famous Black Forest the annual rainfall is considerably over fifty inches; on the western plain it is about twenty-eight inches. The eastern highlands average between twenty-five and thirty inches of rain per year, while the eastern plain averages about twenty inches.

Forestry. The Germans were among the first people to make the growing of timber a matter of scientific study; forestry is far advanced as a practical science in Germany. Approximately one third of the country is forested. Much land that is too thin or too hilly to be used profitably for agriculture is suited to the growth of trees. The government regulates the selection of the trees, the cutting of timber, and reforestation. As a result Germany is able to supply much of her lumber needs. Over half of the German timber lands are owned by the government; the rest, by peasants or large landholders. Two thirds of the forested area is coniferous timber, and one third is deciduous, mainly beech and oak.

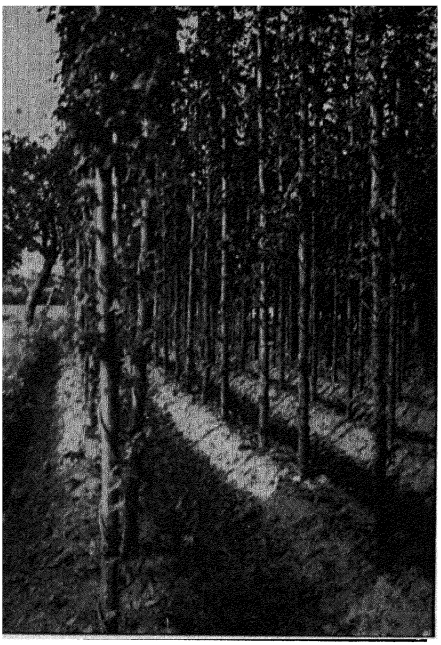
Minerals. England, the United States, and, to some degree, France were the leaders in the industrial world, prior to 1871; Germany was a rural nation of small farmers. Only after she began to utilize the mineral resources at her command did this country become one of the great industrial nations of the world.

Germany has deposits of many different minerals, but only coal and potash occur in large quantities. There is a limited supply of low-grade iron ores. Coal and potash have been most important factors in the progress of the country; the former in industry, the latter in agriculture. The largest coal deposit in Europe lies within the boundaries of the German Reich. The best fields are in the Ruhr Valley, Silesia, and the Saar Basin. A great deal of the coal of Germany is lignite or brown coal, which is found in widely scattered areas. Lignite is of minor value to industry.

Germany leads the world in the production of potash, which is mined at Stassfurt, between the Elbe and Weser Rivers. These deposits, which are estimated to last over a thousand years at the present rate of world consumption, are of great importance to agriculture. As a fertilizer potash has brought a high yield from poor German soils and is an important item for export. The United States has been one of Germany's best customers for this product.

The loss of the Lorraine iron ores by Germany very seriously affected steel manufacture. Local ores were insufficient; in recent years Germany has imported high-grade ores from Spain and especially from Sweden.

Agriculture. In order to feed a fast-growing population, the German agriculturist has turned to a study of soils and soil chemistry. As a result German agriculture has become highly intensive with high yields per acre. The northern plain is the leading agricultural area, even though much of the soil is sandy and relatively infertile. Since this region is cool and moist, rye and oats, rather than wheat, are the principal cereal crops of northern Germany. Nearly twice as much rye as wheat is grown, and Germans eat far more rye bread than do most other Europeans. Oats, the largest of the cereal crops, is used mainly as feed for livestock.



German Railroads

Cultivation of hops in Germany. Note how the vines are trained on high poles.

The cool climate and sandy soils also favor the growing of root crops, such as white potatoes, turnips, mangolds, and sugar beets. Along with rye bread, the potato is the great standby for the average household. Cabbage is another reliable food crop. Part of the potato crop is sent to distilleries to be made into industrial alcohol. In sugar beets Germany is second only to Russia in world production.

Sugar beets can be grown profitably, especially in the central section, because of suitable soil conditions and the large supply of cheap labor, which is essential for cultivation. The chief center of sugar production is the region around Magdeburg on the Elbe River; it grows one third of Germany's sugar beets.

In addition to some cereals and potatoes, the southern highlands produce a great variety of special crops, the most characteristic of which are apples, plums, and hops. Germany is the leading apple grower in Europe. Some of the most valuable land in Germany is along the protected Rhine Valley, where wine grapes can be grown. Barley and hops, cultivated in the highlands, are used for making beer.

Throughout Germany livestock are fattened on a variety of feeds, including hay, oats and barley, mangolds, turnips, coarse potatoes, and sugar-beet tops and pulp. The Reich has the most swine of any country in Europe, as well as large numbers of cattle and some sheep. The best dairy region is in the rainy northwest near the Danish and Dutch borders. In spite of strenuous efforts to encourage animal husbandry, Germany must import meat, lard, and dairy products.



German Railroads

The manufacture of cash registers in Essen, Germany, has been developed to a high degree of perfection in recent years.

Manufacturing. The Industrial Revolution did not affect Germany until late in the nineteenth century. After 1871 Germany was gradually transformed from an agricultural nation into one of the world's leading manufacturing nations. Her central location, which provides easy access to the markets of Europe, the abundance of fuel, and skilled technical leaders were major factors in causing that change. Raw materials were fairly plentiful in the beginning, but today they must be largely imported for many industries. The Germans, accustomed to hard work and thrift, made efficient factory workers; the country is famous for its highly skilled labor supply.

Iron and steel industries, especially the manufacture of machinery and scientific instruments, form the major portion of German manufacturing. Beet-sugar refining and the making of chemicals also play a large part in the commercial and industrial development of the nation. The manufacture of chemicals is perhaps Germany's most distinctive industry. The influence of chemistry is reflected in the development of dyes, drugs, explosives, soaps, artificial silk, plastics, and fertilizers. Textiles, especially cotton and woolen, hold a prominent place, although Germany must procure most of the raw materials for her textile industry from other countries. The

making of textiles ranks next to the manufacture of iron and steel in importance.

The chief centers for the manufacture of iron and steel are the Ruhr Valley (Essen, Dortmund, Bochum), the Saar Basin, and Silesia; Kiel is a shipbuilding port; the principal center of silk goods is Krefeld; the chief centers of dyes, Frankfurt and Elberfeld; that of chinaware, Meissen; and that of toys, Nurnberg. Many industries such as cotton spinning, knit goods, machinery, and brewing have no one recognized center.

In normal times the principal exports of Germany are manufactured products. These include iron and steel, machinery, chemicals, dyes, paper, copperware, glassware, leather, and silk, cotton, and woolen goods. Coal and potash are also in the export list.

Transportation. In railway mileage Germany leads all other European countries. Like the railway systems of England and France, which center at London and Paris, the railways of Germany converge on the German capital of Berlin. Lines run from the city to all the chief ports and the principal cities of the interior. The great German cities, in turn, have through railway connections with the major ports and capitals of most neighboring countries. The Reich has also been a pioneer in the development of air transport. It has a fine network of air lines, which cover the leading cities throughout the country.

A number of great rivers flow northward across the German plain. The Rhine, the Ems, the Elbe, the Weser, and the Oder, with the canals joining them, total more than seven thousand miles of water navigation. Four of them—the Rhine, the Ems, the Elbe, and the Weser—flow into the North Sea; the Oder flows into the Baltic. The Vistula River, in the Polish area, provides navigation from Danzig south through Poland. The Danube, the second longest river in Europe, has its sources in southwestern Germany. It is used as a transport freight route between central Europe and the Black Sea.

The canals on the northern plain make possible cheap transportation between the industrial West and the agricultural East. The Weser-Elbe Canal provides a continuous waterway from the Rhine to the Oder and the Vistula. The Rhine and

the Danube are joined by a canal through the Main Valley. Other canals of importance are the Kiel Canal, between the North Sea and the Baltic Sea, and the canal connecting Berlin with Magdeburg.

Commercial Centers. Berlin, the capital of Germany, lies in the heart of the northern plain and is easily reached by rail from all parts of the country. Other cities of importance are Königsberg, capital of East Prussia; Stettin, a shipbuilding city near the mouth of the Oder; and Kiel, at the Baltic end of the Kiel Canal. Dusseldorf and Cologne are commercial centers in the Rhine Valley. In the inland regions are Munich, Hanover, Magdeburg, Leipzig, and Breslau.

The most important German port is Hamburg. Located on the Elbe River, it is one of the natural gateways for goods entering Europe from England and America. Next in importance to Hamburg, as a seaport, is the city of Bremen, on the estuary of the Weser River.

Germany is essentially an urban nation. People have left the farms for the cities by the hundreds of thousands during the last quarter of a century. Today not more than one third of the people of Germany are living in rural sections or small towns. Berlin has more than four million inhabitants, and Hamburg, more than a million. There are also fifty-six other cities with a population of more than one hundred thousand.

Economic Position of Germany. Although Germany is almost surrounded by other nations, her position for commerce and industry is far from unfavorable. Occupying a large portion of the plain in northern Europe, Germany is, in a very true sense, at the crossroads of commerce between southern Europe and the North, and between the East and Great Britain and the Western Hemisphere.

The foreign trade, which amounted to five billion dollars in 1913, was almost totally destroyed by the World War, but it was practically restored by 1930. Its magnitude is partly due to the close co-operation of the German government with industry and to the high technical development of industry, but even more to the excellent quality and attractive prices

of German goods. Normally food and industrial raw materials constitute seventy-nine per cent of the imports and manufactured goods, especially iron, steel, and machinery, make up seventy-two per cent of the exports. Coal is the only raw material available for export in quantity. Since the major part of German trade is with the other European nations (seventy-four per cent of the exports and fifty-three per cent of the imports), the railroads and inland waterways carry an important percentage of the foreign trade.

Germany's present policy of maximum self-sufficiency has caused a sharp drop in imports from the United States, particularly in agricultural products. As late as 1932 Germany absorbed as much as fifteen per cent of the agricultural exports of our country, but in 1936 that figure dropped to less than eight per cent on the basis of a much smaller total volume of trade. Germany is swinging her trade to those countries that can buy her manufactured products in return.

Austria. After the World War of 1914-1919, Austria, very much reduced from its size and importance as center of the old Austro-Hungarian empire, was set up as a small separate state. Most of new Austria consisted of rugged hills and mountainsides, barely able to provide a meager living for the rural inhabitants. The only other natural resources were large forest areas in the mountains, considerable undeveloped water power, and some good deposits of coal and iron ore.

The most important part of Austria was the beautiful old city of Vienna with its 1,800,000 population. With its commanding location on the edge of the Hungarian plain, opposite good passes to the north and west, Vienna had become one of the great trade and cultural centers of east central Europe. The war and the loss of its richest provinces reduced Vienna from a gay European capital to a position of comparative poverty. However, it remained a center for the study of music, art, and medicine, as well as a skilled manufacturer of many fine and artistic wares, including textiles, tooled leather, musical instruments, optical goods, and surgical instruments. As part of the present German Reich, rural Austria will continue to be a province of rather limited resources; but Vienna should

retain its position as the leading urban and trade center for the Danube Basin, ranking in culture and manufacturing ability with any of the great German cities.

Czechoslovakia. In 1939 Czechoslovakia, an independent state for twenty years, was brought under the control of Germany. The three most important provinces were grouped into two protectorates known as Bohemia-Moravia and Slovakia. Bohemia-Moravia is rich agriculturally; it raises large quantities of sugar beets, hops, rye, oats, potatoes, and wheat. The climate, like that of most regions in this part of Europe, is of the continental type with moderate to light rainfall. The climate of Slovakia, still farther east, is generally similar, but most of the area is rougher, the soils are poorer, and agriculture is less productive. Slovakia has some good timbered lands among the Carpathian Mountains, but little else except its farm lands and livestock pastures.

The Bohemian Basin is well supplied with minerals, including large deposits of good bituminous coal. Iron ore, although not abundant, is sufficient to meet the needs of an iron-and-steel industry. In addition to developing its cheap power, Bohemia has engaged in skilled manufactures for several centuries. It has developed a large supply of skilled labor, particularly in the textiles, which include silk, cottons, woolens, and linens. The tanning of leather and the making of shoes are especially important in Moravia, with Zlin as its center. In many ways the industries of Bohemia-Moravia resemble those of Germany.

When the country was still independent, its goods were widely sold throughout the world. It remains to be seen whether this protectorate will be able to retain its former important place in the export of iron and steel products, munitions, textiles, glass, shoes, and sugar. The chief commercial centers are the former capital, Prague, with its many factories, and the steel-manufacturing and brewing city of Pilsen.

Poland. Until September, 1939, Poland was an independent country. Like the Baltic states of Esthonia, Latvia, and Lithuania, it was a product of the Versailles Treaty of 1919. Most of Poland is an open plain and, in spite of the fact that its



Underwood and Underwood

Planting sugar beets in Poland.

southern border is in the Carpathian Mountains, it is regarded as the flattest country in Europe. The lack of natural land defenses is one of the reasons why Poland has often been overrun by stronger neighbors. The one dominant feature in this vast plain is the Vistula River, which, with its many tributaries, drains the larger portion of the country.

The climate of Poland is a modified continental type, with long, cold winters and short, hot summers. More extreme than the climate of Germany, it somewhat resembles the climate of central Russia. About twenty per cent of the country is in forests, with coniferous softwoods predominating, especially in the Carpathian region. These forests furnish the wood for the pulp and paper industry.

Poland is well mineralized. It has coal fields in Posen, petroleum in Galicia, lead, zinc, radium, and graphite. Huge deposits of salt provide the raw material for a chemical industry near Krakow. Iron is worked, but the quality is poor.

Agriculture in Poland is similar to that in Germany, with approximately seventy-five per cent of the population engaged in farming. The chief crops are rye, flax, potatoes, sugar beets, and hemp. Horses, cattle, and swine are raised in considerable numbers.

Poland also has many varied industries, located chiefly in the triangle between Warsaw, Lodz, and Posen. Textiles, metals, leather, leather goods, sugar, and petroleum products are a few of the most important.

HOLLAND AND BELGIUM

Location for Commerce. Three factors make the location of Holland and Belgium excellent for the development of commerce: (1) These countries, on the English Channel and the North Sea, are directly opposite the great ports of the British Isles; (2) They have the advantage of navigation on the deep Rhine and the Scheldt Rivers; (3) Since they are a part of the northern European plain, they are easily connected by rail with the interior parts of the Continent. As a result Antwerp, Amsterdam, and Rotterdam are among the world's greatest seaports. With England to the west, Scandinavia to the north, Germany to the east, and France to the south, these low countries are a natural meeting point of trade routes on both land and sea.

Minerals. Belgium has been a country rich in minerals, but many of the mines are now approaching exhaustion. The large deposits of coal, iron ore, and zinc are one reason why Belgium developed industrially. The growing depth of the coal mines, however, makes the cost of mining very high; as a result much coal is now imported.

Holland has no minerals of great importance, although coal is mined near the Belgian border, where the reserve is estimated to be greater than that of Belgium.

Agriculture. The level nature of the land in Holland and Belgium is a great aid to agriculture. The soil, which has been brought down by the rivers from their upper courses, is deep and rich. With the exception of southern Belgium, the entire region is a low plain. Much of Holland lies below the level of the sea and has been drained by a great system of dykes. Under such conditions the soil is little affected by erosion or loss of fertility. The farms are small, often containing

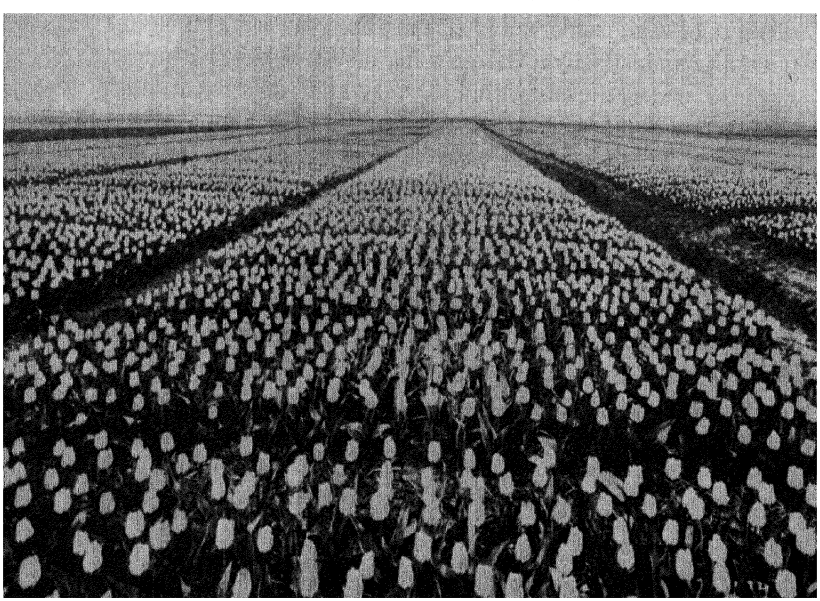
not more than two or three acres, but they are intensively tilled and highly productive.

These two small countries share with Denmark the distinction of producing the world's highest average yield per acre of most of the cereals—wheat, oats, barley, and rye—as well as of potatoes. Holland produces, on the average, forty-four bushels of wheat an acre. Belgium's production is almost forty. The United States produces, on the average, thirteen or fourteen bushels of wheat an acre. This difference in production is largely due to methods of cultivation rather than to fertility of soil; it is an excellent example of what may be done by intensive farming.

Most of Holland is good farming land, capable of producing cereals, sugar beets, potatoes, and even more profitable crops. The Hollanders are renowned as growers of fine fruits and vegetables for export to nearby manufacturing countries. For centuries they have been even more famous for their tulips and hyacinths; flower bulbs are one of their valuable exports. The outstanding occupation of the Holland farmer, however,

Tulip beds in the Netherlands.

Netherlands Railways

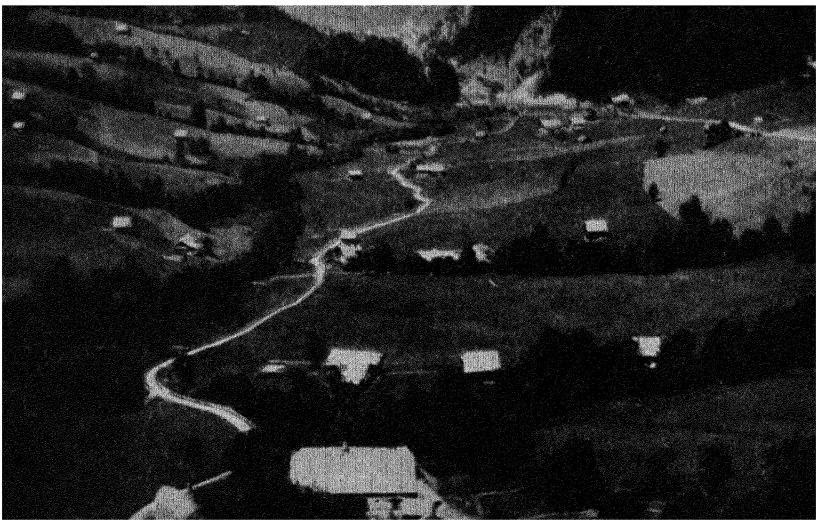


is dairying. In the low meadows, kept green the year round by the steady marine rainfall, are pastured thousands of black and white cows, which are good milk producers. A large part of the farm income is from the sale of cheese, condensed milk, and sometimes butter. Belgium raises cattle and is the home of the Flemish type draft horse, but it cannot equal Holland in dairying intensity.

Manufacturing and Commerce. With its minerals and its good coal, Belgium long ago became a hive of industry. For a small country it is one of the most successful steel workers and sells a wide array of steel products. Lead and zinc refining and glassmaking are among the other heavy industries. In textiles its most characteristic products are linen, lace, and carpets. Long a leader in fine handmade lace, Belgium now turns out machine-made lace also. The industries are centered as follows: lace and carpets in Brussels, cotton and other textiles in Verviers, linens in Ghent, and heavy industries in Charleroi. Another important industry is diamond cutting, which is located largely in Antwerp and Amsterdam, uncut stones coming from Africa or South America.

The recent development of coal mining in Holland has greatly stimulated manufacturing. Dutch manufactures include bicycles, rubber goods, textiles, and dairy products. Holland, with rich colonies in the East Indies, is, however, commercial rather than industrial. Since the sixteenth century Dutch traders have brought to Europe spices and other products from the Far East. Because of her colonies Holland is a great importer and re-distributor of sugar, tobacco, spices, rubber, and other subtropical products. Rotterdam, Amsterdam, and The Hague are her chief cities, the first-named handling nearly three fourths of the Dutch ocean traffic.

While Belgium exports chiefly manufactures, Holland exports principally dairy products, vegetables, flowers and bulbs, and the above-mentioned colonial wares. The dense populations of the countries cannot be fed by home-grown foodstuffs alone, so both are large importers of cereals and other foods, as well as raw materials for their factories.



U. S. Department of Agriculture

Valleys like this one in Switzerland explain the devotion of the Swiss peasant to his farm home and its mountainous environment.

SWITZERLAND

A Mountain Republic. Just as Belgium and Holland flank Germany on her lowland side, Switzerland flanks her highland border. In fact, the tiny mountain republic is almost entirely in the Alps and Juras, with far more mountainside than usable flat land. However, since Swiss valleys and plateaus are rich, they have given the hard-working Swiss a modestly productive agriculture, particularly in dairying and cheese making.

Minerals are lacking, but the Swiss have made full use of three other advantages—water power, a good commercial location, and beautiful scenery. As a result they have not only become prosperous but also enjoy a big trade and an excellent standard of living.

Switzerland has an abundance of water power, which compensates for a lack of coal. The railroads are now almost completely electrified; every town and most farm houses have electric current for all uses; and the industrial plants are hydroelectric power. The proximity of three great commercial nations, France, Germany, and Italy, affords nearby markets for Swiss manufactures. As these manufactures are chiefly products of small bulk and great value, they can also be sent to all parts of the world. Characteristic products are watches

and clocks, silk, rayon, aluminum, chemical products, and electrical machinery. The centers of industry are Zurich, Basel, and Geneva.

Another source of wealth to Switzerland is its wonderful mountain scenery. This country is often called the "Playground of Europe," because it affords summer vacations and winter sports to millions of tourists from all parts of the world. The hotel business is almost a national industry.

HUNGARY

The Danube Plain. Modern Hungary, once part of old Austria-Hungary, includes the best agricultural region of the former empire. Since it lies in the center of the Danube Basin, it includes thousands of square miles of fertile and nearly level plains drained by the Danube. In climate and general productivity, the Hungarian Plain is somewhat comparable to the eastern portions of Nebraska and South Dakota; the rich wheat fields, waving corn, and large areas of sugar beets help add to the resemblance. Herds of white cattle with long

A farm in Hungary.

Vitaphone



horns and droves of horses, in care of herdsmen, pasture some of the drier plains. Although most of the farms are smaller than those in the American Middle West, there are many large estates. The country as a whole is a surplus land for the production of wheat, meat, and other farm crops.

Budapest, the capital, lies on both banks of the winding Danube; it is the only large industrial and commercial city. Its industries, including flour milling, meat packing, and sugar refining, reflect the agricultural character of the country.

BALKAN LANDS

Rumania, Yugoslavia, and Bulgaria. To the south of the Danube Basin, with its fine agricultural plains, lies that area of Europe known as the Balkans, or, sometimes, the Balkan Peninsula. All the countries composing it have a maximum of rough mountain area and a minimum of suitable farm land. In Yugoslavia and Bulgaria there are a few narrow valleys where agriculture is profitable. Most of these lands, however, are inhabited by small peasant farmers who grow patches of corn, wheat, and rye for their own subsistence and sometimes work in the forests part time. Many of the valleys are almost isolated from the world. Most of the population is rural. Natural resources are scant; transportation is difficult because of the rough topography; and cities are few. Manufacturing is still mainly in the local handicraft stage. The many different races and languages also make commerce difficult.

Rumania is the largest and most important of the three countries. Because much of it lies in the lower Danube Valley, it objects to being called a Balkan nation. Rumania is relatively rich as an agricultural state. Many of its crops are the same as those of Hungary, and its best farm areas are similar to those of Hungary. Rumania is part of the corn belt of eastern Europe. It raises not only corn and winter wheat, but also some of the coarser grains, such as rye and barley; and it pastures considerable livestock. Rumania uses the Danube River as its main shipping route for its surplus agricultural products, which are exported.

Rumania has one of the three best oil fields in Europe, and therefore sells large amounts of petroleum and petroleum products.

The leading cities of all three countries are their capitals; Belgrade, Bucharest, and Sofia. None of them are industrial cities, as the term is understood in Western Europe, but all have small industries for local supply.

TEXT QUESTIONS

1. Give a résumé of the political history of Germany to the present time.
2. What kind of climate prevails in Germany?
3. Why has scientific farming attracted the attention of the Germans?
4. What are the principal crops grown in Germany? Which crops are cultivated in the northern plain? in the central section? in the southern highlands?
5. What has the government of Germany done in order to conserve the forests of the country?
6. What effect have the mineral resources of Germany had on the development of industry?
7. Discuss the transportation facilities of Germany.
8. Contrast the cities of Berlin, Hamburg, and Vienna in as many ways as you can.
9. Is the location of the Low Countries favorable or unfavorable? Why?
10. Discuss the agricultural and industrial aspects of Holland and Belgium.
11. Can you explain the economic success of Switzerland, a small mountainous country?
12. Of what importance are the Balkan states in world commerce and industry?
13. In what kind of products does the wealth of Hungary consist? of Bohemia-Moravia?

SECTION 4—MEDITERRANEAN COUNTRIES

INTRODUCTION

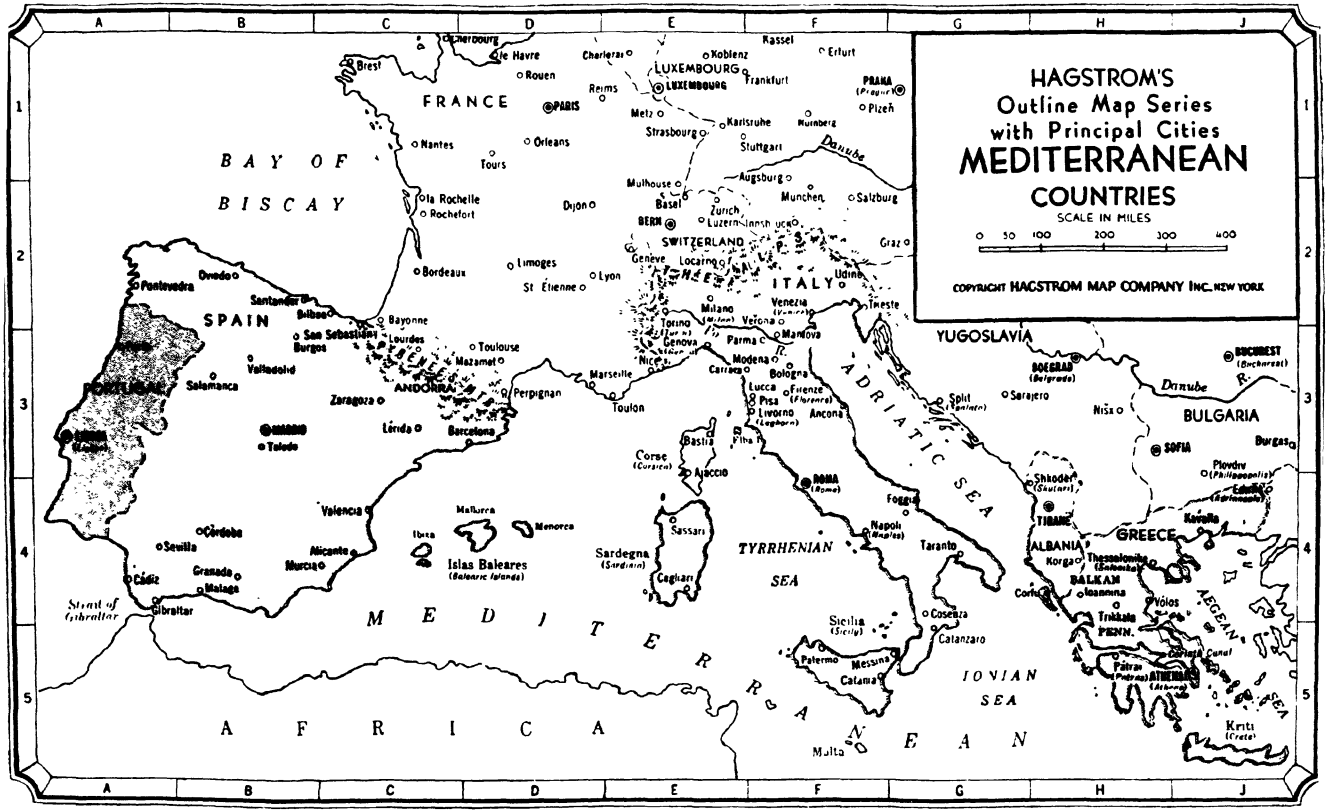
South of the Pyrenees, the Alps, and the Balkan Mountains are the countries of Portugal, Spain, Italy, and Greece. All these countries, with the exception of Portugal, border on the Mediterranean Sea. The mild Mediterranean type of climate, with warm, sunny summers and winter rains, prevails. In past centuries each of these countries played a large part in the affairs of the world, but today only Italy ranks with the neighboring countries to the north.

ITALY

In General. Italy is by far the most important of the Mediterranean countries. It is the only country of southern Europe that has become a great power in modern times. Its progress has been particularly noteworthy since all of Italy was not combined into one kingdom until 1870.

In area the kingdom of Italy is about 120,000 square miles; it includes the Italian Peninsula and the islands of Sicily and Sardinia. Italy is separated from the rest of Europe by the lofty Alps in the north; on the east, south, and west it is encircled by the Mediterranean Sea. The coast line is relatively unbroken and provides only a few good natural harbors.

Topography. The Alps and the Apennines dominate the relief of Italy. The former, which help form the northern boundary of the country, descend steeply to the floor of the Po Valley. The plains of northern Italy, drained by the Po, are accessible, productive, and flourishing. They include fifteen per cent of the area of Italy and support forty per cent of the population. This plain was once an arm of the Adriatic Sea, which was gradually filled up by soil brought down by streams from the Alps and the Apennines. The overflowing of the Po increases the fertility of this land, as the Nile enriches Egypt. The lower slopes of the Alps contain long, narrow lakes, which attract many tourists. Because of the surrounding mountains, the climate of the northern plain is more continental than that of the peninsula, which is influenced by the sea.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MEDITERRANEAN
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Sofia
Kavalla
Thessaloniki
Corinth Canal
Athens
Patras
Kriti

The farm land in the interior of Italy is limited by the Apennines, a lofty range that separates the east and west coasts. In the northern region is located Genoa, the leading Italian seaport and a rival of Marseille for the trade of the Mediterranean. It has a large and rich hinterland.

The plain of western Italy consists really of three plains—the Arno, toward the north; the Campagna, in the central section of the country; and the Neapolitan, toward the south. Florence is the leading city of the Arno Valley, where extensive agriculture is carried on. The Campagna, on which Rome is located, is famous for its pasture land and central position in Italy. Naples is the largest city of the fertile Neapolitan Plain.

The plain of eastern Italy, situated on the leeward side of the Apennines, is suitable for drought-resistant crops, especially durum wheat, olives, and grapes.

Sicily, the largest island of the Mediterranean Sea, is separated from Italy by the straits of Messina. On this Italian Island, which is subject to violent earthquakes and volcanoes, is found Mt. Etna, the highest volcano of Europe. Sicily, with four hundred fifty people per square mile, is one of the most densely populated agricultural regions of Europe. Dire poverty is common here because of the depressing climate, scanty rainfall, primitive methods of agriculture, absentee landlordism, and the illiteracy and backwardness of the people. Sardinia, another Italian island in the Mediterranean, although only a trifle smaller than Sicily, contains but one fifth as many people. Its minerals and forest resources have not been developed to any extent, and life is primitive.

Climate. The climate of northern Italy is a blend of the marine and continental types. The sharpest contrasts of temperatures are experienced in the Po Valley where cold winds blow and snow falls during the four or five winter months. The plentiful rainfall is regular and well distributed. Farther south the temperature becomes warmer, and the Mediterranean type of climate prevails, with rainy winters and dry summers. There are long periods of drought, often as long as seven months. The hot climate produces inertia and fatigue,

although the nights are cool and refreshing. Drought-resistant crops like durum wheat, olives, and grapes grow advantageously. After a scorching summer the people welcome the winter rains.

Rivers. Italy is unfortunate in having few navigable rivers. The Po is her largest and most important river. However, its swiftly flowing current and delta mouth render it virtually useless for modern commerce. The tributaries of this river afford passes through the Alps and thus make Switzerland and southern Germany the hinterland of Northern Italy. The second longest river is the Tiber, which drains the Campagna; it is navigable as far as Rome, the capital of Italy. The Arno River enriches northern Tuscany.

Italy of today, like Italy of ancient times, is faced with the serious problem of supplying the people with good drinking water. The fact that the water in many sections is impure helps us to understand why the yearly per capita consumption of light wine is more than one barrel.

Forests. Like other Mediterranean countries Italy has few forests. The lack of forest products is especially serious, because she is deficient in coal, iron ore, and petroleum. One sixth of the land is forested, an extremely small percentage for such a mountainous country. In forests, as in other respects, northern Italy is richer than southern Italy. Most of the Italian forests are hardwoods—beech, oak, and chestnut. In the north, mainly in gardens and church yards, the cyprus tree attracts attention. It is a stiff, monotonous, ornamental tree that has wood of but little value and fruit of no value.

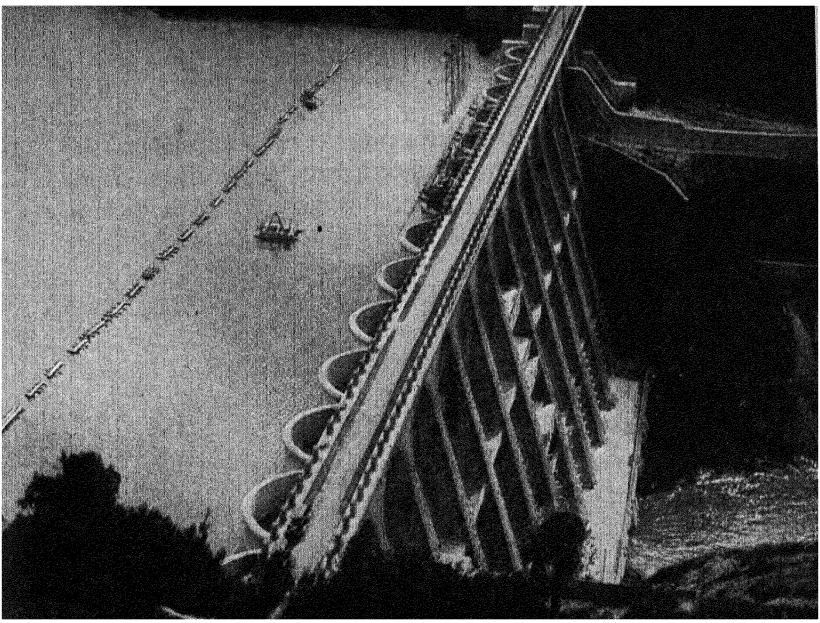
Minerals. Italy is poor also in mineral resources. Because she has but little coal, she must import sufficient for her needs. Most of her imported coal comes from Great Britain and Germany. The narrowness of the peninsula and the adequate railroad lines enable her to transport the coal quickly and cheaply. The Italian peasantry welcome the peat, which is found mainly at the foot of the Alps, as a cheap fuel. There is no petroleum. Limestone is abundant in many sections,

especially in the Apennines. There is much gypsum and sulphur. Italy ranks second only to the United States in the world's production of sulphur, and second only to Spain in the production of mercury. Because of its freedom from arsenic, sulphur of Italy is well suited to use in chemical preparations. The pure marble quarries of Carrara are the most important in the world.

Agriculture. Agriculture is the most important occupation in Italy. It is carried on in different ways, according to the tenure of the land, the type of soil, and the extent of the arable districts. On huge estates owned by a few landholders, wheat is cultivated on a large scale and seasonal workers are employed. On land divided among many owners, the cultivation of fruits and vegetables prevails. On rugged land, such as mountainous regions, terrace cultivation is the most suitable method. As in France, the farmers live in villages, and go back and forth to their farms.

In the Po Valley agriculture is much more advanced than it is in southern Italy. Irrigation, fertilization, and rotation of crops are carefully practiced. Wheat is the most important crop, and corn ranks second among the cereals. Much of the land is given over to forage crops. Rice, oats, hemp, and sugar beets are also raised extensively.

Southern Italy is characterized by a depressing Mediterranean climate, poor soil, and scanty rainfall. The people in this part of the country are less progressive, less educated, and less wealthy than those in the North. As a result agriculture is extremely primitive, and the main crops are, by necessity, those which can resist the dry climate. It is here that the olive flourishes. Italy ranks first in the world in acreage, but second to Spain in the production of the olive. This crop is well adapted to its environment, for its large, leathery leaves, extensive root system, and rough, thick bark all prevent rapid evaporation. Grapes are another characteristic crop. Italy is more dependent upon them than is any other country. Most of the grapes are pressed into wine and serve as a national drink. Citrus fruits, especially the lemon, grow abundantly. Lemons are exported as fresh fruit, in extracts, and in concentrates.



Italian Library of Information

The dam of one of the hydroelectric projects in Italy.

Oranges, figs, sugar cane, cotton, and pomegranates are also important in southern Italy.

Manufacturing. The World War of 1914-1919 stimulated Italy in manufacturing. Her more than forty-three million people cannot all earn their living from agricultural pursuits. Abundant cheap labor and Alpine water power stimulated manufacturing. By the end of 1929 there were 588 hydraulic plants, operating with an installed capacity of 2,300,000 horse power. Italy has more developed water power than any other country in Europe.

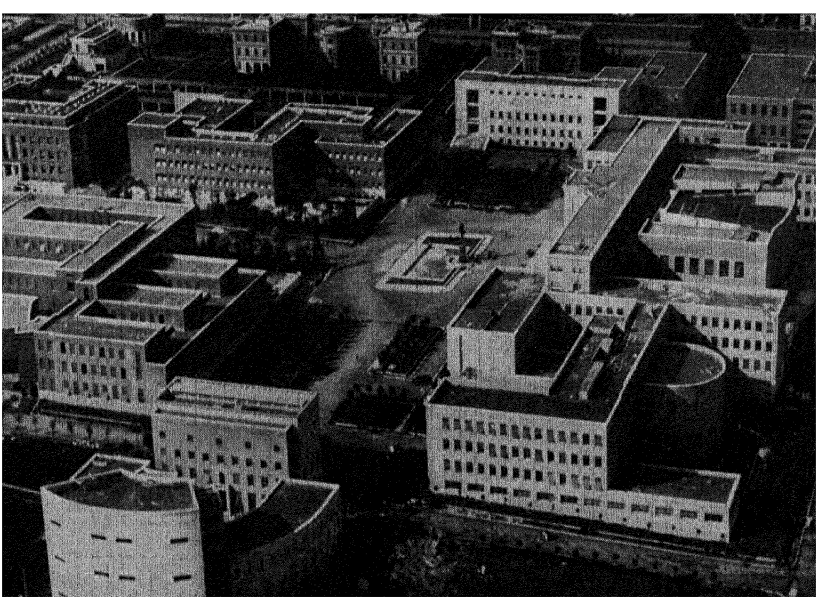
By the use of electricity the textile industry has made great strides forward. Italy ranks second to Japan and China in the production of raw silk. Most of the cocoons are grown in the homes of the peasants of the Po Valley. This abundant, cheap labor fosters the concentration of the raw silk industry here. The cheaper labor in the Far East and the more advantageous climate for the growth of the mulberry tree are bringing about a gradual decline in the silk production of Italy and a rapid rise in the rayon industry. In the production of rayon,

a silk substitute, Italy ranks as one of the leaders. Imported cotton is manufactured extensively in the Genoa district. More workers are employed in the cotton industry than in the silk industry. However, silk is by far the more important in Italian foreign trade.

A distinctive industry is the production of artificial wool fiber from cow's milk. Italian scientists have perfected this process to such a degree that the manufacture of artificial wool from the casein in cow's milk on a large commercial basis is highly successful. This artificial wool is water resistant, nonshrinkable, and much cheaper in price than natural wool.

Cities. Italy has, perhaps, the largest number of famous cities of any country in the world. Some of her cities have been world renowned since ancient times. Rome, the capital, is famous not only for its political and commercial significance, but also for the fact that it contains the center of a great religion. Genoa and Naples, on the western coast of Italy, and Palermo, on the island of Sicily, are the chief ports. The most important industrial cities, which are also cities of even ancient

Modern buildings in University City, the great university center of Rome, the capital of Italy.



renown, are Milan, Turin, Genoa, Florence, Naples, Venice, and Trieste.

Foreign Trade. Italy is not so highly industrialized as England, France, or Germany, but it has reached the stage where exports are chiefly manufactured articles and imports are chiefly raw materials. Important exports are textiles, chemicals, machines and apparatus, and dairy products. Imports are minerals such as coal, iron, copper, and petroleum; cereals and other food products; and raw materials of various kinds for the factories.

In normal times Italy is aided in maintaining a favorable position in international commerce by a large tourist trade and by money sent to the mother country by her loyal emigrants.

Economic Position of Italy. Italy is primarily agricultural, even though much of her soil and climate are unfavorable for farming. One great obstacle to the development of manufacturing is the lack of coal and iron. Another is the lack of capital and buying power of the great mass of the people. However, there are signs that Italy may overcome these handicaps. The development of hydroelectric power makes the lack of coal less serious, and improved farm methods have increased not only the crops but also the standard of living and income of the people. As a result the manufacture of cotton goods, motor cars, iron and steel products, hats, and rubber tires has been stimulated. One important item of revenue, the tourist trade, will probably be more or less permanent as long as political conditions are favorable. Any land so filled with sunshine and ancient history is bound to attract visitors from all parts of the world.

SPAIN AND PORTUGAL

In General. These two countries share that part of southern Europe known as the Iberian Peninsula. Spain and Portugal have both had a long commercial history. They were active in early Mediterranean trade and then took part in the dis-

covery and exploitation of the western world. Later, after a glorious era when the wealth of the Americas poured into Spanish and Portuguese ports, both countries declined gradually and lost most of their colonies. Today they play but minor roles in world trade; they are now mainly agricultural in their activities and depend on the products of farm, garden, and pasture.

The Iberian Peninsula has three main types of climate. The entire southern and eastern coast from northern Portugal to Barcelona has the well-known Mediterranean type with mild, rainy winters and long, dry summers; the central plateau of Spain, called the meseta, is semiarid and has hot summers and cold winters; northern and northwest Iberia along the Bay of Biscay has a modified marine climate with ample rainfall, more like that of western France. The small country of Portugal thus has mainly Mediterranean conditions, while Spain has all three types of climate.

Spanish agriculture throughout the Mediterranean zone from Cadiz around the coast to Barcelona is characterized by the growing of wheat and barley in small fields, the grape, the olive tree, citrus fruits, nut trees, and winter vegetables. The finest grape district, where the best sherry wine is made, is in the vicinity of Barcelona, but grapes are cultivated almost everywhere. Raisins are dried along the south coast. Valencia is the center of the best orange district, although oranges are also grown around Seville. Spain is the largest exporter of oranges in the world. Almonds and filberts are export specialties. The olive tree is found almost everywhere in southern Spain; Seville is the most important oil-processing and shipping center. Dairy cattle are limited because of poor pasture most of the year, but goats graze the dry hillsides and are used as milk animals. Olive oil is a common substitute for butter in Spain.

Semiarid central Spain is unsuitable for crops requiring much moisture, but great fields of wheat are grown in its better northern half. Here is also the traditional home of long-horned cattle, which graze the dry ranges, and of Merino sheep, which are noted for their fine wool. Sheep frequently

pasture highlands in the summertime and return to the lower plateau in the winter. Horses and mules are also raised in this section.

Northwest Spain, which has more moisture, is too rugged and broken for much good farm land, but it has sufficient moisture for corn. It is also the region of hardwood forests, including the oak and the chestnut. The cork forests, however, are found in the southwest.

The agriculture of Portugal resembles that of southern Spain, but it is on a smaller scale. It includes the same cereals and vineyards, port wine for export in the Douro Valley, and many groves of olive trees and cork forests in the south.

Spain, which is widely mineralized, has workable quantities of a dozen different minerals. The iron mines of Bilbao on the north coast are the leading resource at present. Considerable ore is shipped to the steelmakers of Great Britain. Spain also has a small iron-making industry of its own. There are fair supplies of local coal. Copper, lead, and zinc have been worked for centuries, and the mines are still operating.

Spain and Italy share the production and export of the mercury of the world. To help supplement a limited coal supply, Spain has recently begun the development of hydroelectric power, principally in the northern mountains near Barcelona.

The ports of Portugal are the fine old city of Lisbon on the Tagus River in the south and the city of Oporto at the mouth of the Douro in the north.

In the beginning Spain had few good harbors; but it has now developed satisfactory ones on both sea fronts. Bilbao, facing the Bay of Biscay, serves the north; Seville, in the south, has access to the Atlantic by way of the navigable Guadalquivir. Malaga, Cartagena, and Valencia are minor shipping centers. The great port of Spain, however, is Barcelona, with its million inhabitants, its busy mills and factories, and its teeming docks and warehouses. Barcelona is the industrial and commercial heart of Spain to a far greater extent than Madrid, the capital, which is located in the middle of the dry and wind-swept meseta.

GREECE

In General. Greece, the smallest of the Mediterranean countries, might well be included with the Balkans, as it forms the south end of the Balkan Peninsula. All of its activities, however, classical, cultural, and commercial, have been associated with the Mediterranean. Not only is its climate of that type, but its products are typical of this climatic zone. In addition, its commerce has to do with the Mediterranean Sea.

With a maximum of rugged mountain range and rough hills, Greece has found it difficult in modern times to find enough level and arable land to support its dense population. Its coast is one of the most broken in the world, with jutting promontories and hundreds of rocky islands nearby. The few level areas of any size, such as the plain of Thessaly, are farmed with the utmost care. However, the soils throughout Greece are none too fertile.

The surest and best returns are from the more intensive horticultural crops, which include grapes, olives, figs, citrus fruits, and vegetables. Grapes are made into wine and are dried for raisins; most of the olives are pressed into oil. Tiny seedless grapes, grown mainly on the Corinth Peninsula, go to market as dried currants. Probably the most important commercial crop of the country is tobacco, a very fine quality of leaf purchased by Turkey and Egypt for the manufacture of Turkish cigarettes. Agricultural and horticultural products provide most of the export, one half of which is tobacco.

Natural resources are limited. There are overworked fisheries, almost no timber, and but few of the world's leading minerals. Iron, silver, and lead are of minor value. Chrome, now in greater demand as a steel alloy, is more promising. Fine marble is more plentiful than any other mineral, but the demand for it is limited.

Manufacturing based on Western methods is not a leading activity in Greece, although there are mills for cotton, silk, and woolens, and the processing of many foodstuffs. The cities are more commercial than industrial; Athens is the metropolis. Athens and its port of Piraeus have now grown together into

one continuous city. Salonika in the north handles not only Greek commerce, but also the trade of the southern part of Yugoslavia.

TEXT QUESTIONS

1. Why is Italy the most important of the Mediterranean countries?
2. Describe the topography and climate of Italy.
3. Is Italy fortunate in her river systems?
4. What are the characteristic crops of Italy?
5. Which are the best agricultural districts in Italy?
6. Describe the progress that Italy has made in manufacturing in recent years.
7. Are the Italian cities of recent origin and importance? Which cities are most prominent?
8. Contrast and compare northern and southern Italy as to resources, industries, wealth, crops, climate, and character of the people.
9. Divide Spain into climatic regions and contrast them.
10. What forest product is of prime importance in Spain and Portugal?
11. What agricultural products are of greatest importance in Spain?
12. Contrast the two cities of Genoa and Barcelona in as many ways as you can.
13. How does the present position of Greece among the countries of the world compare with her position in ancient times?

SECTION 5—SCANDINAVIAN COUNTRIES

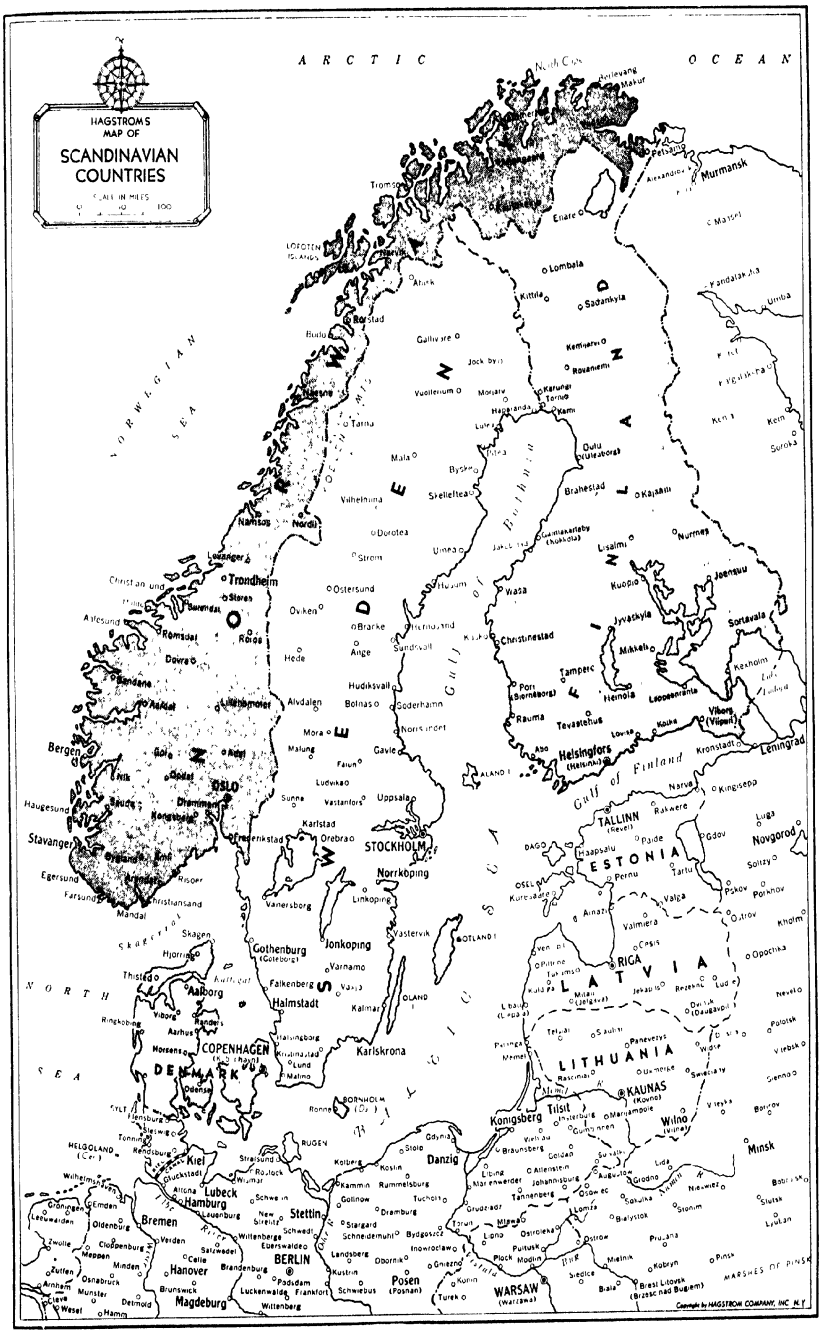
INTRODUCTION

There are four countries in northern Europe classified as Scandinavian: Norway, Sweden, Denmark, and Finland. The inhabitants of these countries are representative of the light-haired Nordic race. All four countries are located on peninsulas and are greatly influenced by the water about them. The land of each is used chiefly for forests and dairying. The latter industry has been built up gradually on lands with only fair soils, but has been aided by proximity of food-importing industrial areas in Britain and Germany. None of them enters into the commerce of the world like Great Britain, France, or Germany, although Norway carries much cargo for other nations. These hard-working Scandinavian countries are generally prosperous and highly cultured.

DENMARK

In General. Denmark, a level plain almost entirely surrounded by water, is a very small country, having an area of about sixteen thousand square miles. The soils are sandy and relatively poor. The country has no iron and is almost without forest resources. Its position with reference to trade routes is not so favorable as that of Belgium or Holland. Its climate is rainy and relatively cool and raw. Despite these handicaps the Danish people have replaced poverty with prosperity by the most intelligent use of such resources as they possess. The wealth of the country is based largely on its animals—cows, pigs, and poultry. Special emphasis has been placed on dairy products. By careful selection the Danish cows have been made into superior producers of milk rich in butterfat.

The abundance of rain, too much for the profitable growing of cereals, is excellent for grasses, clover, and other forage crops. Such an environment is favorable to dairying, which is the chief specialty of the farmers of this country. Danish butter now finds a market in all parts of Europe; Great Britain


HAGSTROM'S
MAP OF
SCANDINAVIAN
COUNTRIES
SCALE IN MILES
0 50 100
ARCTIC OCEAN
North Cape
Murmansk
Petsamo
Tromsø
Narvik
Lofoten Islands
Lombata
Kittilä
Sadankyla
Rovaniemi
Kemijarvi
Kemi
Suomussalmi
Kajaani
Oulu (Uleaborg)
Brahestad
Joensuu
Kuopio
Nurmes
Lisalmi
Jyvaskyla
Sortavala
Mikkeli
Keuruu
Tampere
Heinola
Loppeenranta
Vilborg (Viipuri)
Rauma
Tavastehus
Abo
Helsingfors (Helsinki)
Kronstadt
Leningrad
Gulf of Finland
Narva
Kingisepp
TALLINN (Reval)
Rakvere
Luga
Novgorod
Pskov
Polkhov
Ostrov
Valga
Valmiera
Cesis
RIGA
Opochka
Nevel
Polotsk
Vitebsk
Sienno
Minsk
Borisov
Wilno (Vilna)
KAUNAS (Kovno)
Marijampole
Suwalki
Grodno
Lida
Baranovichi
Slutsk
Luninets
MARSHES OF PINSK
Brest Litovsk (Brzesc nad Bugiem)
Kobryn
Pinsk
Pruzana
Ostrow
Bialystok
Lomza
Mlawa
Plock
Modlin
Sierpc
Biala
WARSAW (Warszawa)
Kutno
Turek
Posen (Poznan)
Gniezno
Kustrin
Schwiebus
Landsberg
Inowroclaw
Bydgoszcz
Schneidemuhl
Oborniki
Stargard
Schwedt
Eberswalde
Wittenberge
Brandenburg
Frankfort
Potsdam
BERLIN
Luckenwalde
Wittenberg
Magdeburg
Hanover
Celle
Brunswick
Osnaburg
Munster
Detmold
Hamm
Wesel
Arnhem
Zutfen
Deventer
Zwolle
Meppen
Cloppenburg
Oldenburg
Emden
Leeuwarden
Groningen
Bremen
Verden
Lueneburg
Hamburg
Altona
Wilhelmshaven
Rendsburg
Kiel
Gluckstadt
Tonning
Flensburg
Aabenraa
Sonderborg
Aarhus
Horsens
Randers
Viborg
Aalborg
Thisted
Hjorring
Skagen
Frederikshavn
Aalborg
Ringkobing
Esbjerg
Ribe
Haderslev
Kolding
Vejle
Odense
COPENHAGEN (Kobenhavn)
Helsingborg
Kristianstad
Malmo
Lund
Karlskrona
Ronne
BORNHOLM (Dk.)
Gothenburg (Goteborg)
Falkenberg
Varnamo
Jonkoping
Halmstadt
Kalmar
Vastervik
Norrkoping
Linkoping
Vanersberg
Trollhattan
Uddevalla
Strommstad
Frederikstad
Karlstad
Orebro
Sunne
Vasteras
Uppsala
STOCKHOLM
Gavle
Sundsvall
Hudiksvall
Soderhamn
Norrsundet
Bolnas
Alvdalen
Mora
Falun
Ludvika
Malung
Hede
Ange
Ostersund
Storen
Oviken
Brarke
Hemosand
Umea
Vasa
Christinestad
Lulea
Boden
Haparanda
Torneo
Karunki
Vuolterium
Muonio
Gallivare
Jock Byn
Mala
Bysko
Vilhelmina
Stellefteaa
Dorotea
Strom
Nordli
Namsos
Trondheim
Roros
Romsdal
Molde
Aalesund
Sandane
Dombas
Lillehammer
Hamar
Kongsvinger
Drammen
Skien
Arendal
Lillesand
Flekkefjord
Mandal
Farsund
Egersund
Stavanger
Haugesund
Bergen
Voss
Hjelle
Florø
Christiansand
Risor
Arendal
OSLO
Fredrikstad
Sarpsborg
Halden
Fredrikshald
Kongsvinger
Lillehammer
Gudbrandsdal
Romsdal
Aalesund
Sandane
Dombas
Roros
Hede
Ange
Ostersund
Storen
Oviken
Brarke
Hemosand
Sundsvall
Hudiksvall
Soderhamn
Norrsundet
Bolnas
Alvdalen
Mora
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Uppsala
Vasteras
Sunne
Karlstad
Orebro
Norrkoping
Linkoping
Vanersberg
Trollhattan
Uddevalla
Strommstad
Frederikstad
Sarpsborg
Halden
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Kongsvinger
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Flekkefjord
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Farsund
Egersund
Stavanger
Haugesund
Bergen
Voss
Hjelle
Florø
Christiansand
Risor
Arendal
OSLO
Fredr

alone uses seventy per cent of the supply. Co-operative farming and dairying are carried on to a great degree in Denmark, and the Danes have organized co-operative buying and selling organizations. The importance of co-operatives in Denmark is shown by the fact that over ninety per cent of the area devoted to dairy products belongs to the co-operative dairy associations. Nearly half a million farmers belong to export co-operatives for farm products. There are also import co-operative societies, which enable the Danish farmer to buy fertilizer and feed to good advantage. Bacon and poultry products are also marketed in large amount by the co-operatives.

Denmark has one large city, Copenhagen, which is excellently located as a distributor of goods. It is situated on a water pathway leading into the central part of Europe.

NORWAY

In General. Norway is a long narrow country occupying the western slope of the Scandinavian Peninsula. Nearly one third of the country is within the Arctic Circle, but the climate is greatly modified because of the westerly winds blowing over the warm gulf drift in the Atlantic Ocean. Most of the land is hilly and mountainous, so that less than four per cent is fit for cultivation. In spite of this, agriculture is a leading industry, and about one half of the people are farmers. In proportion to the population, the Norwegians are also the greatest fishermen in the world; one sixth of the people are fishermen. The land, the forests, and the sea are the basis of Norway's economic life.

Western Norway has a marine type of climate with rainfall averaging from thirty to thirty-five inches a year. Even in this far north latitude, the winters are not severe, and all the harbors are ice-free. Cloudiness makes evaporation slow and greatly aids agriculture and forest growth. The long hours of daylight in the summer months are favorable to agriculture because crops mature in a relatively short period.

Because of the rugged nature of the land, the soil is thin and patchy. Approximately seventy-five per cent of the coun-

try is waste land, and about twenty-two per cent is covered by coniferous forests. The fertile land is mainly in the south and southeast where most of the people live. Farms are small and vary in size from three to twenty-five acres each. The relatively moist climate limits agriculture to hay, oats, barley, and potatoes, but pasturage is abundant enough to support many dairy cows. Modern creameries produce excellent butter, cheese, and condensed milk for export to nearby European markets, although Norway cannot equal Denmark in total dairy output.

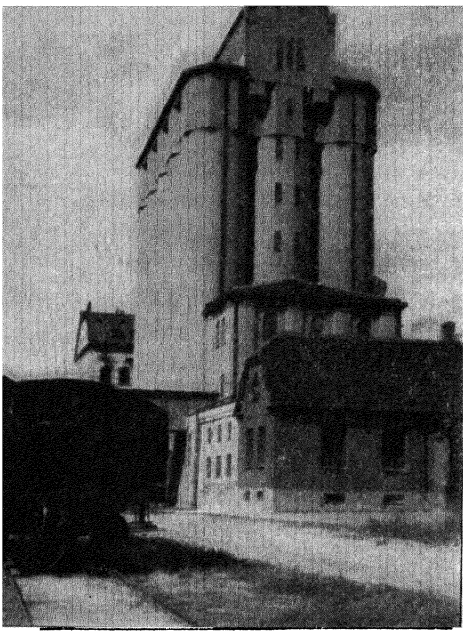
Next to agriculture, fishing is an important activity, especially in the region near Bergen around the Lofoten banks in the North Atlantic. The catch is chiefly cod, herring, and mackerel. A by-product of the fishing industry is cod-liver oil, which is a large item of export in Norway.

Timber occurs on the seaward slopes of the mountains. The most characteristic timber is coniferous, although birch, beech, elm, and oak are found. Most of this is exported as lumber or wood pulp. It is also the raw material for paper and match industries as well as furniture.

One of the great resources of Norway is its potential hydroelectric power. The lakes and glaciers, assisted by the winter snowfall, make this rugged country specially suitable for electric power. Approximately two million horse power has already been developed; three or four times as much more is available. This will be of great assistance to industry and will add materially to the income of the people.

Although located somewhat off the main routes, Norway plays an important part in world trade. The Norwegians, trained like the British in the fisheries, are naturally a maritime people. In proportion to its population, Norway has the largest merchant marine in the world.

While the nation is largely rural, three important centers of wood industries, lumbering, and papermaking have developed around Trondhjem, Bergen, and Oslo. The fact that the Norwegians are a united, thrifty, frugal, and intelligent people (illiteracy is less than one per cent) promises well for their future prosperity.



Swedish Travel Information Bureau, Inc.

A modern flour mill of the Co-operative Society of Sweden.

SWEDEN

In General. A high, barren plateau region known as the Kjölen Mountains serves as an effective boundary line between Norway and Sweden. Sweden is the larger of the two countries. It lacks direct contact with the Atlantic Ocean except at Göteborg because transportation across the Kjölen Mountains is difficult and expensive. As far as geography is concerned, Sweden is a Baltic country, sloping toward that sea and facing Finland and the countries of central Europe.

Southern Sweden has a modification of the marine type of climate, although the central and northern portions are more severe. Winters are colder and summers are warmer and drier than those in Norway because most of Sweden is sheltered from the heavy rains and winds of the Atlantic Ocean by the Kjölen highlands. However, Sweden has more sunshine and less fog and mist than Norway. The rainfall, about fifteen inches, is abundant enough for good pasturage, so dairying is dominant. Sweden does not extend so far north as does Norway, but has colder winters because of its distance from the ocean.

Sweden has one major mineral and several minor ones. Iron ore, which is the principal mineral, is especially valuable in industry because of its high ore content. This rich ore is exported to a number of steel-manufacturing countries in Europe, particularly Britain and Germany. Most of the iron ore deposits are in the Lapland north, and some important mines are located near the Norwegian border.

Forests cover nearly fifty-five per cent of the land in Sweden; the soils and climate are better adapted to forest growth than

to agriculture. The chief varieties of timber are birch, pine, fir, and beech. Lumbering has become a principal source of income for the Swedes. Some of the typical industries allied to it are the production of matches, wood pulp, tar, pitch, and resin. Silviculture, the science of growing trees, is developed to a high degree in Sweden, so that not only the cutting and marketing of trees is controlled, but the conservation of timber is assured for the future.

Although about half the people of Sweden live on farms, not enough food is produced to satisfy the nation's needs. Partial reasons for this are the patchy nature of good land, small holdings, and the large amount of farmwork done by hand. The farm crops include hardy cereals like barley, oats, and rye. Very little wheat is grown, but potatoes, sugar beets, and many garden vegetables thrive. Hay is not allowed to remain on the ground after it is cut because of the dampness of the earth, but is tied to rocks and poles for drying. As in Norway, cattle raising and dairying are prominent factors in the farmers' income.

Most manufacturing in Sweden is concerned with raw materials of local origin, particularly wood. Wood pulp, papermaking, matches, and furniture are characteristic wood manufactures. Iron and steel making are also prominent. Chemical industries are relatively numerous, especially those producing such products as fertilizers, explosives, dyes, and paints. Textiles are made for local use; the cotton and most of the wool are imported. Skilled labor and cheap electric power favor the expansion of the textile industry in this far north land. Electric power is an important resource in this land of lakes, snow-covered mountains, and melting glaciers.

Sweden is a well-balanced and prosperous country. Forest products account for about forty per cent of its exports. Iron ore and dairy products also rank high.

Most of the foreign commerce of Sweden goes through the ports of Sundsvall, Kalmar, and Göteborg. The position of Sweden is excellent for trade with central and eastern Europe. Stockholm, the capital and largest city, is also a great commercial center.

FINLAND

In General. The fourth Scandinavian country, Finland, has had a more difficult political history than its neighbors farther west. In addition to enjoying periods of independence, it has at various times been under the control of Sweden or of Russia.

In many ways Finland is a counterpart of Sweden. It is an interior peninsula with the best lands at the south end; it has huge areas of timber; and it is considered a Baltic nation. Unlike Sweden, it has the severe climate of continental interiors, and a larger share of the surface is covered with lakes, swamps, and bogs. Unlike Sweden, also, Finland extends to the Arctic Ocean. It has an ice-free port, Petsamo, far beyond the Arctic Circle. In contrast, the Baltic ports in southern Finland must be kept open by ice breakers in winter.

The long, frozen winters and the short, cool summers limit agriculture to the hardier crops. Oats are far more important than any other cereal. Oats, potatoes, and hay are the leading farm crops. As in Sweden, hay must be cured on racks.

Finnish dairy herds are well managed; high-quality creamery butter similar to that of Denmark is a leading Finnish export. Most of the farms are located in the narrow coastal plain around the south end of the peninsula.

Central Finland is largely in forests; two thirds of the entire surface is covered with spruce, pine, and fir, the great national resource. So dominant is timber that Finland is sometimes called the "Timber Republic." As the interior is also a great maze of lakes and waterways, it is relatively easy to float the logs down to the mills.

Between the coastal plain and the higher interior is a line where great falls and rapids, like Imatra, can be harnessed for the development of electric current. Most of the sawmills and pulp mills are near this fall line, or in the coastal ports. Logs are turned into a great variety of timber products, which include lumber, plywood, box shooks, barrel staves, and — most important — wood pulp and paper. Timber products, pulp, and paper together provide four fifths of Finland's export trade.

The republic is almost completely electrified, using water power for nearly all purposes.

With their great forests, abundant water power, and limited farm land, the sturdy Finns have managed to create a sound economic society. They are worthy representatives of the Scandinavian people. Helsinki, Turku, and Viborg, the three leading cities of Finland, are neat and prosperous commercial centers.

TEXT QUESTIONS

1. What countries are included in Scandinavia?
2. What are the outstanding characteristics of the agricultural system in Denmark?
3. Describe the functions of the co-operative associations in Denmark.
4. What part does Norway play in world commerce?
5. What climatic factors aid agriculture and forest growth in Norway?
6. What natural feature of the Scandinavian Peninsula serves as a boundary between Norway and Sweden?
7. How does Sweden differ from Norway in climate? in resources? in agriculture?
8. Explain the resources and activities of Finland.
9. What kind of products provides the greatest percentage of the export trade of Finland?
10. Describe the similarities found in all four Scandinavian countries.
11. Describe the economic progress made by all four Scandinavian countries.


HAGSTROMS
MAP OF
EUROPEAN AND
ASIATIC RUSSIA
ARCTIC OCEAN
GREENLAND SEA
BARENTS SEA
ATLANTIC OCEAN
SPITSBERGEN
NOVA ZEMBLA
KARA SEA
NORDENSKIOLD SEA
UNION OF SOVIET SOCIALIST REPUBLICS
EUROPE
ASIA
SIBERIA
NORWAY
SWEDEN
FINLAND
GREAT BRITAIN
GERMANY
FRANCE
SPAIN
ALGERIA
LIBYA
EGYPT
AFRICA
FRENCH WEST AFRICA
ANGLO EGYPTIAN
TURKEY
IRAN
IRAQ
SAUDI ARABIA
ARABIAN SEA
INDIA
CHINA
SINKIANG
TIBET
OUTER MONGOLIA
MANCHUKUO
JAPAN
PACIFIC OCEAN
BERING SEA
SEA OF OKHOTSK
SEA OF JAPAN
PHILIPPINE ISLANDS
BAY OF BENGAL
ARAL SEA
BALKHASH
Murmansk
Archangel
Kotka
Helsingfors
Leningrad
Kalinin
Moscow
Minsk
Kiev
Odessa
Saratov
Stalingrad
Astrakhan
Kazan
Gorki
Ufa
Stockholm
Oslo
Bergen
Trondheim
Copenhagen
Berlin
Paris
Madrid
Lisbon
Rome
Naples
Barcelona
Algiers
Tunis
Tripoli
Cairo
Mecca
Khartoum
Angora
Istanbul
Bagdad
Tehran
Isfahan
Kabul
Delhi
Bombay
Calcutta
Rangoon
Bangkok
Hanoi
Manila
Nanking
Shanghai
Tokyo
Hsinking
Mukden
Urumtsi
Kashgar
Urga
Irkutsk
Kiakhta
Bargusin
Ilimsk
Tomsk
Narym
Omsk
Semipalati
Tobolsk
Surgut
Beresov
Obdorsk
Dudinsk
Turuchansk
Yeneseisk
Khatansk
Vitim
Vadomsk
Yakutsk
Ayan
Nikolayevsk
Okhotsk
Yamsk
Gishiginsk
Kamensk
Konstantinov
Takakogin
Ustyansk
Verkhoyansk
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Krasnoe
Kolimsk
Nikolaievsk
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Kurile Is
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Wrangell I
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Edinburgh
Belfast
Dublin
Liverpool
London
Bordeaux
Marseille
Gibraltar
Tangier
Alexandria
Jordan
Syria
Tehran
Muscat
Aden
Socotra
Laccadive Is
Bay of Bengal
Hanoi
Indo China
Hong Kong
Canton
Shanghai
Nanking
Hankow
Chengtu
Peiping
Tientsin
Mukden
Harbin
Vladivostok
Hokkaido
Sakhalin
Amur
Lena
Yenisei
Khatanga
Yana
Kolyma
Amur R.
Irtish
Ishim R.
Tobol R.
Kazan
Dvina R.
Volga R.
Dnieper R.
Don R.
Vienna
Munich
Warsaw
Poland
Bulgaria
Rumania
Yugoslavia
Albania
Greece
Black Sea
Caspian Sea
Mediterranean Sea
Persian Sea
Red Sea
Arabian Sea
Bay of Bengal
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SECTION 6—RUSSIA (Union of Soviet Socialist Republics)

In General. Nowhere will one find a better example of the influence of geographic environment on the economic life of a people than in Russia. The almost limitless landscape, which stretches across two continents, contains over eight million square miles (compare this with the three million square miles of the United States of America) and is the home of over one hundred sixty-eight million people. Although the people are largely of Slavic origin, the inhabitants represent more diversity of race and language than all the rest of Europe. In this country are taking place vast economic and social changes that may affect the whole world.

Geographic Factors. (1) The most characteristic geographic feature of Russia is the generally level nature of the land. Russia is almost entirely flat. The main elevations are the low Ural Mountains, the Caucasus Mountains on the southern border, and the Valdai Hills northwest of Moscow, which do not rise more than one thousand to eleven hundred feet above the sea. The rest of the country is scarcely more than five hundred feet above sea level until the Yenesei River is crossed in central Siberia.

(2) A second factor of importance is the far northern location of Russia. Nearly all of the nation lies north of the forty-fifth parallel of latitude. Such a northern position has a definite bearing on the length of the growing season and thus limits the kinds of crops that can be grown. In fact, the northern quarter of the nation is too cold for the cultivation of most crops. The continental type of climate, with great extremes of cold and heat, prevails. The average January temperature of Moscow is more than thirty degrees lower than that of Glasgow, in the corresponding latitude of western Europe; and the July temperatures of Moscow are much higher than those of Glasgow. Generally speaking, the average winter temperature of all Northern Russia is distinctly low. The temperature of Archangel, in the North, averages thirty-two degrees Fahrenheit; that of Moscow, thirty-eight degrees Fahrenheit; in contrast, that of Odessa, in the South, is fifty degrees Fahrenheit.

(3) A third factor is the uncertain rainfall of this entire region. In the northern section and the southeastern section near the Caspian Sea, the annual rainfall is less than ten inches; hence a large part of Russia is so dry that only a few crops can be grown. In the best agricultural region, the west and the central portions, the average rainfall is only twenty inches. Even this region is subject to periodic droughts, which in the past have brought crop failure and consequent famine in nearly two years out of every five.

(4) Russia is virtually an inland country, far from the oceanic routes of the world. Its only outlets to the Atlantic Ocean, via the White, the Baltic, and the Black Seas, require more than a thousand miles of travel before reaching that ocean. The remoteness of Russia increases as one goes east into Asia, where high mountains and vast desert regions separate this country from others and from the markets of the world. On the North Pacific Coast, Asiatic Russia actually reaches the sea, but the value of this shore line is lessened by the great distance from the more productive regions of the nation.

(5) Russia is in a transitional position between Asia and Europe. Here two civilizations, that of the East and that of the West, meet. Not all the races of Russia came from Asia, but most of their civilization did. Hence, Russia has never been totally East or totally West.

Natural Regions. Throughout the wide expanse of Russia, there are distinct differences in climate, soil, vegetation, population, and resources. Based on vegetation, seven natural regions are usually recognized by most students of Russian geography.

(1) *The Tundras.* These are plains stretching along the shores of the Arctic Ocean and extending down to about sixty-five degrees north latitude. Although treeless, these plains are covered with a dense growth of small shrubs and mosses. The region is sparsely settled by wandering Lapps and Samoyedes.

(2) *The Coniferous-Forest Belt.* Most of this region, which is just south of the tundras, is still covered by forests, for

only the areas near the rivers are cleared. Some four hundred million acres of forest are here.

(3) *The Deciduous-Forest Belt.* The center of this broad tract of land is Moscow. Vast areas of the forest have been cleared, and the western section is an important agricultural region. The climate of this belt corresponds generally to that of the Prairie Provinces of Canada.

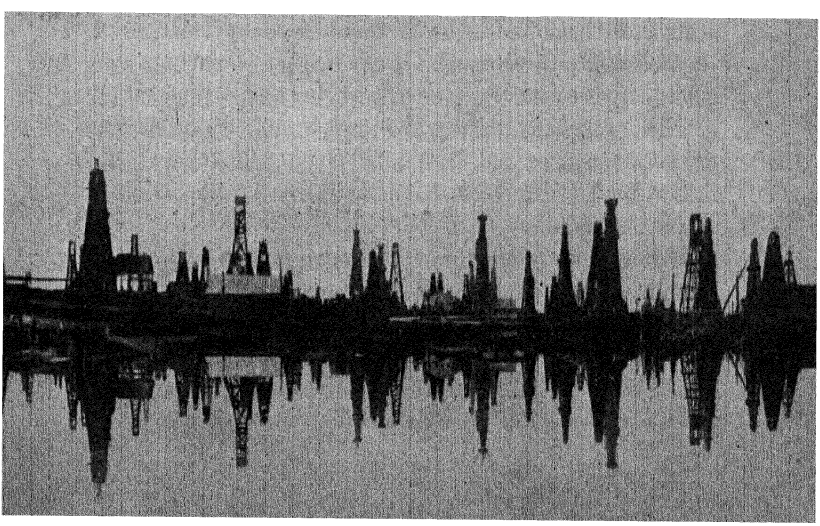
(4) *The Fertile Steppes.* In southwestern Russia is the rich black soil that is ideal for wheat. This is one of the richest wheat areas in the world. The population here is more dense than that of any other part of Russia. The Donetz coal basin is in this region, and nearby are rich deposits of iron ore. The temperature of this region corresponds to that of the American corn belt, but the steppes have less rainfall.

(5) *The Grassy Plain.* As one goes east from the fertile steppes, the rainfall becomes less abundant, trees and shrubs disappear, and only grass abounds. Here the great grassy plain affords pasturage for horses and cattle. This is a semiarid region, like the Great Plains of the United States.

(6) *The Desert.* Although there is no region in Europe that is absolutely rainless, the region in the southeast, around the Caspian Sea, closely resembles a desert. The rainfall is

A scene at Baku, an important oil center of Russia.

Underwood and Underwood



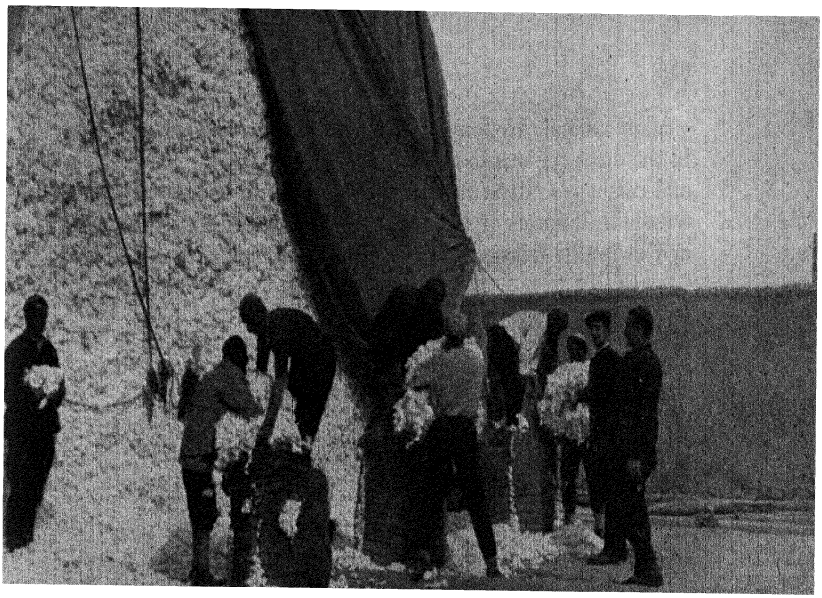
considerably less than ten inches, and the whole region is characterized by drought-resistant vegetation.

(7) *Mountainous Russia.* The Urals are famous for their minerals, especially platinum and iron ore. Caucasia is another important high region. It is noted chiefly for its oil fields around Baku.

Minerals. Russia is one of the best mineralized nations in the world, both in variety and in quantity. New discoveries are made every year. Iron, manganese, coal, petroleum, copper, gold, platinum, zinc, lead, and salt exist in relatively large amounts. Except in the Donetz region the basic minerals of coal and iron are too widely separated for the most efficient manufacture of iron. The best coal is located in Siberia many hundreds of miles from the iron of the Urals and industrial regions of European Russia.

Agriculture. Russia is still essentially agricultural. Although exact figures are not available, probably about seventy-five per cent of its people are farmers. The best region for farming is in what may be called the "Fertile Triangle," the base line of which may be drawn from Leningrad to Odessa, the north line from Leningrad to Novosibirsk in Siberia, and the south line from Odessa to Novosibirsk. This area contains more good farming land than is to be found in Great Britain, France, Germany, and Italy combined. But this section represents a very small proportion of the entire area of the U.S.S.R. Approximately three fourths of the country is unfit for agriculture. In the north the long cold winters and swampy nature of much of the land make agriculture virtually impossible. As one goes south and east, the rainfall is too light (less than ten inches) for growing crops; and in the extreme southeast desert conditions prevail.

A characteristic feature of Russian agriculture is the tendency toward the one-crop system of farming. Cereals form the most important crops raised on Russian farms. Most of the cultivated land is devoted to oats, rye, barley, corn, and wheat. Russia is the greatest wheat-producing nation in the world. It also leads in several of the other cereals. The dark, rich humus



Sovfoto

Packing cotton at a cotton provisionary station in Russia in preparation for sending it to a cotton-cleaning plant.

soil of the Ukraine is especially capable of growing huge quantities of that cereal. Fruits and vegetables are rare in Russia. A partial reason for their relative scarcity is the cold continental climate, which is too severe for their best development. However, in Crimea and the Caucasus region, with their dry subtropical conditions, fruit orchards are more numerous.

Among other crops are potatoes and sugar beets, in the production of which Russia ranks high, and cotton in the region beyond the Caspian Sea. This latter crop is raised on irrigated lands. Russia grows twelve times as much fiber flax as any other country and also large amounts of hemp.

Russia is capable of producing a great variety of products. The different climatic areas and soils are such that Russia can raise almost all varieties of foodstuffs except those requiring a tropical or subtropical climate. By the use of up-to-date methods of agriculture and better machinery, Russia may become not only one of the world's greatest granaries but also a supplier of raw materials. Efforts have been made to grow wheat in large quantities on state farms, which are completely mechanized and called "wheat factories" by the Russians.

Many animals are found on the farms in European Russia, and in the drier regions to the southeast and east in Siberia sheep and cattle are numerous. Russia ranks high among the countries in the number of its livestock. The number of cattle, sheep, and swine in Russia have increased greatly in recent years.

Manufacturing. Manufacturing in Russia is making progress. But the Russians are essentially an agricultural people, and it will require many years for them to become a highly industrialized nation. The industry of the country is directed by the government, which is making every effort to increase manufacturing. Russia has plenty of coal and iron. A large hydroelectric project, which will have a huge horse-power capacity, has been finished at Dnieperpetrovsk, on the Dnieper River. The most active heavy-industry region is in the Ukraine, which produces much of the steel used in Russia. A second large steel center at Magnetogorsk, in the Urals, and a third center in the Kuznetz Basin in central Siberia each help to supply the iron demands in their own vast territories. Kuznetz coking coal is hauled west to Magnetogorsk in exchange for the high-grade iron ore from "Magnet Mountain."

Among the other manufacturing centers, Rostov, on the Don, is the biggest producer of farm machinery and tractors, which are also made in Gorki, Kharkov, and Stalingrad. Aluminum is made at Dnieperpetrovsk, where cheap current from the new water-power plant is used. Proximity to the forests has made Leningrad the center for lumber mills and woodworking industries. Textiles, clothing, and shoes are made in Moscow, which also has metal industries.

Much Russian industry is still in an experimental stage and will no doubt grow in value and importance. The present handicaps to industrial development seem to be: (1) the extremely cold weather, which increases the cost of maintenance; (2) relatively poor transportation facilities; (3) lack of mechanical skill on the part of the workers.

Transportation. Transportation facilities in Russia have long been below the stage of development that one would expect in such a level country. The lack of stone in the soil makes

the building of good roads far more expensive than in hilly and rocky countries. Then, too, the lack of development in many parts of Russia lessens the demand for good roads. With the exception of the Ukraine district, Russia is poorly supplied with railroads. The cold winters make railroad operation difficult, while the scarcity of stone for road ballast adds materially to the expense of building the roadbed.

Russia has many good waterways, but they are frozen over four or five months in the year. The Volga loses much of its commercial importance because it empties into the landlocked Caspian Sea. The Don and Dnieper Rivers are important; the latter, with its series of rapids, furnishes hydroelectric power for that district. Canals have been dug to connect some of the principal rivers and thus to add considerable mileage to Russian waterways.

Economic Outlook. What the future holds for Russia, no one can say with certainty. That Russia is capable of greater development in industry and agriculture cannot be denied. Most of the people have been tillers of the soil, and the land is highly suitable for agriculture, although methods are still primitive in many areas. The cold climate, the relative isolation, the illiteracy of many of the people, the lack of adequate transportation facilities, and the distances between important coal and iron fields and the markets are, however, factors that will undoubtedly delay the industrialization of Russia.

The Baltic States. Three new countries along the Baltic Sea were carved out of western Russia in 1919: Lithuania, Latvia, and Esthonia. After some twenty years of separate existence, these countries have now become protectorates of the Soviet. Both their political and economic life are, therefore, tied up closely with that of Russia. All three of these countries are predominantly agricultural; more than seventy-five per cent of the population are engaged in farming. Large quantities of flax, rye, potatoes, barley, and wheat are raised. Dairying also is growing in importance. The forests of Lithuania, consisting of pines and firs, are a very important source of wealth. The industrial life of these countries is concerned, for

the most part, with the preparation of agricultural produce for market; it consists chiefly in flour milling, brewing, tanning, and lumbering.

TEXT QUESTIONS

1. How has the geographic environment influenced the economic life of the people of Russia?
2. What are the natural regions of Russia?
3. Discuss the climate of Russia from north to south.
4. What section of Russia is most favorable for agriculture?
5. Which type of crop is most important in Russia?
6. How highly developed is manufacturing in Russia?
7. What handicaps does Russia have to overcome in providing adequate transportation facilities?
8. Of what importance are the minerals in Russia?

PROBLEMS AND PROJECTS

1. On an outline map of Europe, draw a line paralleling the coast about five hundred miles from it. Approximately how much of Europe is more than five hundred miles from the sea? How does this fact influence commerce?
2. Name four major relief divisions of Europe. How far is relief responsible for the expansion of the various nations? What other factor tends to limit the extent of nations in Europe?
3. Compare the cities of Europe with those of the rest of the world. Divide the cities into three groups: (1) those having over 1,000,000 people, (2) those having 500,000 to 1,000,000 people, and (3) those having 300,000 to 500,000 people. How many are located within 200 miles of the North Sea or the English Channel?
4. Determine the area of the great European Plain. Compare the area of this lowland with the area of equally fertile lowlands in other parts of the world. Compare the obstacles to travel in the European lowland with those in the world's other lowlands, i. e., mountains, forests, dry areas, etc.
5. Compare the transportation facilities of England with those of the United States. What are the economic and geographic reasons for the differences you find?
6. Under each of the following headings, make a list of five leading imports into Great Britain and discuss their value: (1) raw materials, (2) food, (3) manufactured products. From what part of the world do these imports mainly come?

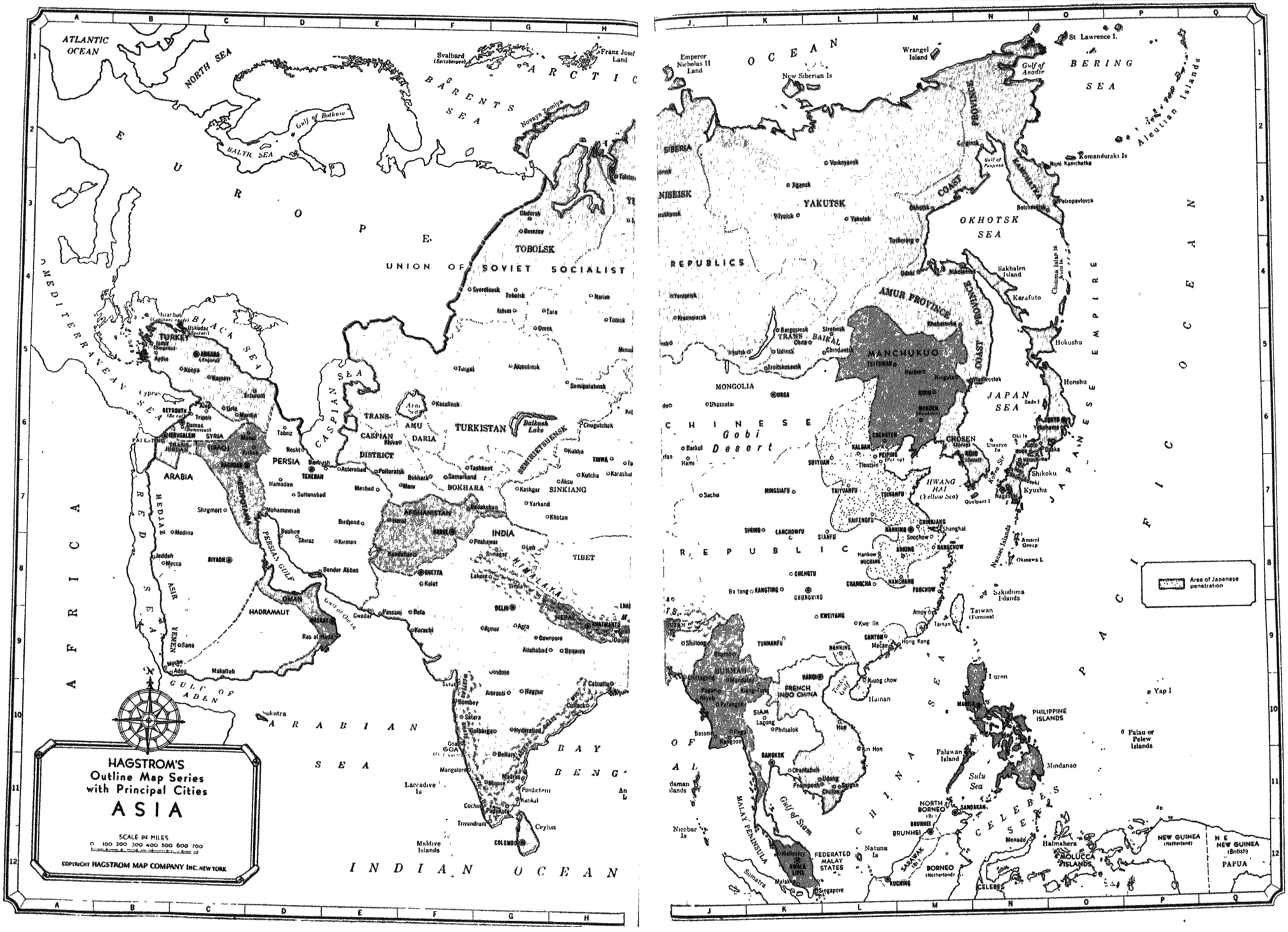
7. Make a list of the geographic factors that make the Rhine River so important to Germany.
8. Compare the amounts of exports and imports of the cities of Marseille and Bordeaux. Give the general sources of the imports.
9. On an outline map of the world, shade the regions having the Mediterranean type of climate. What advantage of geographical location has the region about the Mediterranean Sea over other areas of Mediterranean climate? Explain.
10. List all the countries of the Danube Basin. Discuss the advantages that would be enjoyed if all these countries were in one free trade union.

TOPICS

1. The British Commonwealth of Nations as a self-sufficient trade unit.
2. Nationalism and its effect on commerce and trade.
3. The desirability of an economic union of free trade states in Europe.
4. Co-operative marketing in Denmark and Sweden.
5. The economic importance of the European lowland.
6. Control of the seas as a necessity in British commerce.
7. Holland's strategic geographic position.
8. The character of French foreign trade.
9. Steel manufacturing in Russia.
10. Hydroelectric power in Italy.

FOR CLASS DISCUSSION

1. Barter will become the leading method of conducting international trade.
2. Resources are the most important reason for the supremacy of western Europe.
3. English will become the universal language of business.
4. The British are no longer the industrial leaders of the world.
5. The Spanish people would be as progressive as the English if they had been inhabitants of the British Isles.
6. The proposed tunnel under the English Channel, between England and France, would be of great value to both nations.
7. Italy can never become a great industrial nation.
8. Russia has better resources than any other country in Europe for becoming a self-sufficient nation.


HAGSTROM'S
Outline Map Series
with Principal Cities
ASIA
SCALE IN MILES
0 100 200 300 400 500 600 700
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Area of Japanese penetration
ATLANTIC OCEAN
NORTH SEA
BARENTS SEA
ARCTIC OCEAN
EUROPE
UNION OF SOVIET SOCIALIST REPUBLICS
TOBOLSK
YAKUTSK
OKHOTSK SEA
BERING SEA
AMUR PROVINCE
MANCHUKUO
MONGOLIA
CHINESE Gobi Desert
JAPAN SEA
HONSHU
HOKUSHU
SHIKOKU
KYUSHU
KOREA
CHOSEN
TURKISTAN
TRANS-CASPIAN DISTRICT
BOKHARA
SINKIANG
AFGHANISTAN
PERSIA
ARABIA
INDIA
TIBET
HIMALAYA
HADRAMAUT
ASIR
HEDJAZ
RED SEA
PERSIAN GULF
GULF OF ADEN
GULF OF OMAN
ARABIAN SEA
BAY OF BENGAL
INDIAN OCEAN
MEDITERRANEAN SEA
CASPIAN SEA
BALTIC SEA
REPUBLIC
FRENCH INDO CHINA
SIAM
PHILIPPINE ISLANDS
LUZON
MINDANAO
PALAWAN ISLAND
SULU SEA
CELEBES SEA
CHINA SEA
PACIFIC OCEAN
FEDERATED MALAY STATES
NORTH BORNEO
BRUNEI
SARAWAK
BORNEO
NEW GUINEA
PAPUA
HALMAHERA
MOLUCCA ISLANDS
TAIWAN
HAINAN
GULF OF SIAM
MALAY PENINSULA
SUMATRA
CELEBES
Aleutian Islands
Kuril Islands
Sakhalen Island
Karafuto
Nansei Islands
Sakishima Islands
Palau or Pelew Islands
Yap I
Amami Group
Okinawa I
Quelpart I
Tsushima Is
Natuna Is
Nicobar Is
Laccadive Is
Maldive Islands
Ceylon
Novaya Zemlya
Franz Josef Land
Svalbard (Spitzbergen)
New Siberian Is
Wrangel Island
Emperor Nicholas II Land
St. Lawrence I.
Romanduraki Is
Nyni Kamchatka
Petropavlovsk
Bolsheretsk
Yakutsk
Verkoyansk
Jigansk
Yilyuisk
Tashkent
Samarkand
Bokhara
Kashgar
Yarkand
Khotan
Aksu
Kutcha
Karashar
Kuldja
Chuguchak
Semipalatinsk
Akmolinsk
Turgai
Kasalinsk
Aralsk
Omsk
Tomsk
Tara
Ishim
Tobolsk
Narim
Syerdlovsk
Beresov
Obdorsk
Tolstoi
Yeniseisk
Krasnoiarsk
Irkutsk
Bargusinsk
Udinsk
Chita
Strelnsk
Khabarovsk
Nikolaevsk
Vladivostok
Harbin
Mukden
Hsinking
Changchun
Kirin
Antung
Fengtien
Chinchow
Jehol
Kalgan
Chengteh
Peiping (Peking)
Tientsin
Taiyuanfu
Tsinanfu
Kaifengfu
Hwang Hai (Yellow Sea)
Nanking
Shanghai
Soochow
Hangchow
Anking
Hankow
Wuchang
Changsha
Fuchow
Kiukiang
Chungking
Chengtu
Kangting
Ba tang
Lanchowfu
Sining
Hami
Barkul
Suiyuan
Ningsiafu
Sianfu
Sachu
Kweiyang
Kwe lin
Amoy
Tainan
Taiwan (Formosa)
Canton
Macao
Hong Kong
Kung chow
Hainan
Yunnanfu
Shillong
Mandalay
Rangoon
Bassein
Lashio
Lagong
Phitsalok
Hue
Bangkok
Chanthaburi
Udong
Saigon
Phnompenh
Kon Hon
Iloilo
Manila
Menado
Sandakan
Kuching
Brunei
Labuan
Wellesley
Kuala Lipis
Singapore
Malacca
Natuna Is
Halmahera
Molucca Islands
Celebes
New Guinea (Netherland)
New Guinea (British)
Papua
Amboina
Timor
Java
Sumatra
Nicobar Is
Andaman Islands
Laccadive Is
Maldive Islands
Ceylon
Colombo
Trivandrum
Cochin
Pondicherry
Karikal
Madras
Vellore
Bangalore
Mysore
Goa
Bellary
Hyderabad
Sholapur
Bombay
Surat
Amraoti
Nagpur
Calcutta
Chandernagore
Allahabad
Benares
Cawnpore
Agra
Aymer
Delhi
Lahore
Amritsar
Srinagar
Peshawar
Leh
Kabul
Kandahar
Quetta
Kalat
Gwadar
Passani
Beta
Karachi
Muscat
Ras al Hadd
Sana
Aden
Mocha
Makallah
Socotra
Jeddah
Mecca
Medina
Riyadh
Shagmort
Mohammerah
Bushire
Shiraz
Kirman
Bender Abbas
Birdjend
Meshed
Mew
Suttanabad
Hamadan
Teheran
Asterabad
Pultoratsk
Bokhara
Tabriz
Reshd
Enzeli
Kazvin
Tehran
Baghdad
Mosul
Aleppo
Damascus
Jerusalem
Beyrouth
Tripoli
Latta
Mersina
Adana
Konya
Kayseri
Ankara
Aydin
Smyrna
Istanbul
Uskudar
Ismit
Cyprus
Tiflis
Batoum
Erzerum
Trebizond
Sivas
Angora
Kastamuni
Eregli
Zonguldak
Samsun
Amasia
Tokat
Kerasund
Ordu
Giresun
Trapezunt
Rize
Artvin
Kars
Ardahan
Batum
Ajaria
Georgia
Abkhasia
Tiflis
Kutais
Sukhum
Poti
Novorossisk
Tuapse
Sochi
Gagri
Maikop
Armavir
Stavropol
Kislovodsk
Pyatigorsk
Grozny
Vladikavkaz
Nalchik
Ordzhonikidze
Kizlyar
Derbent
Makhach Kala
Petrovsk
Baku
Kuba
Shemakha
Elisavetpol
Nukha
Erivan
Nakhichevan
Julfa
Tabriz
Urmia
Sakiz
Saujbulak
Kasvin
Hamadan
Kermanshah
Sultanabad
Arak
Isfahan
Yezd
Kerman
Meshed
Nishapur
Turbat
Askabad
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Aralsk
Kazalinsk
Perovsk
Turgai
Akmolinsk
Petropavlovsk
Omsk
Tara
Ishim
Tobolsk
Tyumen
Yekaterinburg
Chelyabinsk
Troitskosavsk
Verkhneudinsk
Chita
Nerchinsk
Blagoveshchensk
Khabarovsk
Komsomolsk
Okhotsk
Ayan
Nikolaevsk
Alexandrovsk
Dikson
Yeniseisk
Krasnoiarsk
Irkutsk
Bargusinsk
Udinsk
Chita
Strelnsk
Khabarovsk
Nikolaevsk
Vladivostok
Harbin
Mukden
Hsinking
Changchun
Kirin
Antung
Fengtien
Chinchow
Jehol
Kalgan
Chengteh
Peiping (Peking)
Tientsin
Taiyuanfu
Tsinanfu
Kaifengfu
Hwang Hai (Yellow Sea)
Nanking
Shanghai
Soochow
Hangchow
Anking
Hankow
Wuchang
Changsha
Fuchow
Kiukiang
Chungking
Chengtu
Kangting
Ba tang
Lanchowfu
Sining
Hami
Barkul
Suiyuan
Ningsiafu
Sianfu
Sachu
Kweiyang
Kwe lin
Amoy
Tainan
Taiwan (Formosa)
Canton
Macao
Hong Kong
Kung chow
Hainan
Yunnanfu
Shillong
Mandalay
Rangoon
Bassein
Lashio
Lagong
Phitsalok
Hue
Bangkok
Chanthaburi
Udong
Saigon
Phnompenh
Kon Hon
Iloilo
Manila
Menado
Sandakan
Kuching
Brunei
Labuan
Wellesley
Kuala Lipis
Singapore
Malacca
Natuna Is
Halmahera
Molucca Islands
Celebes
New Guinea (Netherland)
New Guinea (British)
Papua
Amboina
Timor
Java
Sumatra
Nicobar Is
Andaman Islands
Laccadive Is
Maldive Islands
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Kabul
Kandahar
Quetta
Kalat
Gwadar
Passani
Beta
Karachi
Muscat
Ras al Hadd
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Aden
Mocha
Makallah
Socotra
Jeddah
Mecca
Medina
Riyadh
Shagmort
Mohammerah
Bushire
Shiraz
Kirman
Bender Abbas
Birdjend
Meshed
Mew
Suttanabad
Hamadan
Teheran
Asterabad
Pultoratsk
Bokhara
Tabriz
Reshd
Enzeli
Kazvin
Tehran
Baghdad
Mosul
Aleppo
Damascus
Jerusalem
Beyrouth
Tripoli
Latta
Mersina
Adana
Konya
Kayseri
Ankara
Aydin
Smyrna
Istanbul
Uskudar
Ismit
Cyprus
Tiflis
Batoum
Erzerum
Trebizond
Sivas
Angora
Kastamuni
Eregli
Zonguldak
Samsun
Amasia
Tokat
Kerasund
Ordu
Giresun
Trapezunt
Rize
Artvin
Kars
Ardahan
Batum
Ajaria
Georgia
Abkhasia
Tiflis
Kutais
Sukhum
Poti
Novorossisk
Tuapse
Sochi
Gagri
Maikop
Armavir
Stavropol
Kislovodsk
Pyatigorsk
Grozny
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Erivan
Nakhichevan
Julfa
Tabriz
Urmia
Sakiz
Saujbulak
Kasvin
Hamadan
Kermanshah
Sultanabad
Arak
Isfahan
Yezd
Kerman
Meshed
Nishapur
Turbat
Askabad
Kizil Arvat
Krasnovodsk
Mangishlak
Aralsk
Kazalinsk
Perovsk
Turgai
Akmolinsk
Petropavlovsk
Omsk
Tara
Ishim
Tobolsk
Tyumen
Yekaterinburg
Chelyabinsk

CHAPTER XXIII

ASIA

Introduction. Asia is not only the largest of the continents but also, in many respects, the grandest and most interesting. Here are the oldest nations, the highest tablelands and mountains, the least populated as well as the most densely populated areas.

Geography has, however, handicapped Asia's economic development. Tremendous size and rugged topography are a disadvantage in transportation, and many parts of the continent are highly isolated. The climatic handicap appears in great areas of unproductive desert and in the northern lands where the climate is too cold to attract many people and where most of the rivers drain into the Arctic Ocean. A large part of Asia is unfavorable for settlement and development because of elevation, aridity, or extreme cold. There are, however, fertile alluvial plains, which are intensely cultivated and which are among the world's most densely populated lands. There are also several large and important rivers: The Tigris-Euphrates in Iraq: the Indus and Ganges in India; the Irrawaddy in Burma; the Yangtze and Hwang in China. Civilization, based upon agriculture, developed in all these river valleys several thousand years ago.

In considering the commerce of Asia, we shall discuss in a general way only four regions: Western Asia, India, China, and Japan.

WESTERN ASIA

In General. Western Asia (including Turkey, Syria, Palestine, Arabia, Iraq, Iran, and Turkestan) consists mainly of extensive plateaus and mountainous areas. The Arabian and Iranian plateaus are continuations of the Anatolian Plateau. There are high mountain ranges in eastern Turkey, as well as in Arabia and Iran. Other physical features are the Mesopotamian lowland, the great rift valley, and the inland



Underwood and Underwood

A Bedouin camp on the Arabian Desert.

drainage basins of the Aral, Caspian, and Dead seas. Rugged topography makes transportation difficult. The region as a whole is further handicapped by deficient rainfall, resulting in large semiarid and desert areas. The coastal plains bordering the Mediterranean and Black seas have adequate winter rainfall for Mediterranean-type agriculture.

Occupations. Over large portions of semiarid western Asia, where rainfall is too scant for agriculture, grazing is the main occupation and sheep and goats are pastured. The fleece of the Angora goat, known as mohair, which is longer and whiter than the wool of sheep, is exported. Pastoral life is common in this region, particularly in Arabia and Iran, where nomads keep camels, sheep, and goats and depend upon animals and animal products for their livelihood.

Agriculture is practiced wherever there is sufficient water. Oasis agriculture is well developed and intensive; the chief crops are dates, barley, fruits, and vegetables. The fertile

lowland watered by the Tigris and Euphrates rivers is a large oasis, comparable to that of the Nile, which is noted as one of the world's leading date-producing areas. Basra, at the head of the Persian Gulf, is the chief date market. Smaller oases are found in all countries in western Asia. Oases vary in size according to the amount of water available for cultivation.

Yemen, southwestern Arabia, has subsistence agriculture, but it is best known for its high-grade Mocha coffee, most of which is exported. The coastal plains along the Mediterranean and Black seas have adequate winter rainfall to grow Mediterranean-type crops, such as olives, figs, and citrus fruits; cotton and tobacco are cultivated in Turkey. Large irrigation works have been developed in Turkestan by the Russian government, and cotton is grown on most of the irrigated acreage. Turkestan is now one of the leaders in the production of cotton, most of which is used to supply Russian textile mills.

Minerals. Western Asia contains a variety of minerals. In most cases, however, the deposits are so small that they are not important in world production. Petroleum, the resource of greatest value, is found in Arabia, Iraq, and Iran. Newly discovered oil fields in Arabia are being developed. Iraq and Iran, however, have the most valuable deposits. The Mosul field is now served by a twelve-hundred-mile pipe line to the Mediterranean; oil is shipped out by tankers from ports in Syria and Palestine. Iran, which ranks high in world production of petroleum, has rich fields near the Persian Gulf. Many ships are fueled at Bushire and other Persian Gulf ports. Petroleum is the most valuable commodity exported from Persia.

In Arabia the output of salt is valuable; in Turkey chrome, emery, and manganese are exploited. There are other minerals in the region, but they occur only in sufficient quantity to be locally useful.

Manufacturing and Commerce. Turkey is the only country in western Asia that has seriously undertaken an industrialization program. Factories are concerned chiefly with cotton textiles and the packing of fruits and nuts for export. All

countries have cottage industries that turn out silks and woolens, copper goods, and oriental rugs for export, as well as a variety of goods to satisfy domestic needs. Petroleum ranks first among the exports; oriental rugs second. Of lesser value are wool and skins, nuts, tobacco, and dried fruits.

There are several commercial cities on the coasts: Smyrna, Beirut, Basra, Bushire, and Aden. Aden, under British control, is the chief trade center of Arabia. Since medieval times Damascus has been an important center in overland trade. Baghdad, admirably located for trade, is served by both motor and air transportation. Teheran, the capital of Iran, is on the new railway being constructed from the Caspian Sea to the Persian Gulf.

In addition to ruins recalling the ancient civilization of western Asia, there are two cities of great historical and religious significance. Thousands of Moslems make pilgrimages to Mecca, in Arabia, holy city of the Mohammedans, just as thousands of visitors go every year to Jerusalem, holy city of Jews, Arabs, and Christians.

INDIA

In General. India, one of the larger political units and comparable in size to China or Argentina, has great variety in topography and climate. Topographically it may be divided into four regions: (1) the Himalaya Mountains and foothills; (2) the great plain of the Indus, Ganges, and Brahmaputra rivers; (3) peninsular India, including the Deccan Plateau; (4) the narrow coastal plain of the peninsula. Since the coast line is regular, there are few good natural harbors.

India consists of about fifteen British provinces and eleven native states. British India is governed by a viceroy, or governor-general, who is assisted by a council. Both British and native states send representatives to Parliament.

Burma, formerly part of India, was separated from India and made a crown colony in 1937. The separation of Burma will reduce India's output of rubber, petroleum, silver, and tungsten, since these commodities were produced chiefly in Burma.

Climate. The climate of India is dominated by the monsoon. The term "monsoon" means "seasonal wind." During the summer months, when the great Asiatic land mass heats up, winds blow from the cooler ocean to the warmer land. The summer monsoon, blowing from the southwest, brings rain to southern and eastern Asia. During the winter months, when the Asiatic continent is cold, the winds, which are dry, blow from the colder land to the warmer ocean. This reversal in the direction of the winds is the chief explanation of the alternate wet and dry seasons in India.

The areal distribution of rainfall is influenced by topography. Precipitation is heaviest on the windward side of mountains, as on the western side of the Deccan, and the south slopes of the Assam Hills. Rainfall decreases from the lower Ganges Valley to the northwest, where semiarid and desert conditions prevail. Most of the Deccan Plateau receives from twenty to forty inches of rain but, because of evaporation caused by high temperatures, the rain must be supplemented by irrigation. Over most of India temperatures are high. Seasonal changes are based more upon rainfall than upon temperature changes. The foothills and the Himalayas have lower temperatures because of elevation; Europeans have established a number of hill stations to which they go for recreation and change in climate.

Population and Cities. The distribution of population in India corresponds closely to rainfall distribution. The best-watered lands of the western coastal plain and the Ganges Valley are the most densely populated, averaging more than five hundred people to the square mile. In contrast, the semiarid and desert lands of the northwest are sparsely populated, some areas having less than two people per square mile. Much of peninsular India has a density of about two hundred persons per square mile. This is the great famine area. Formerly when drought or crop failures came, thousands of people perished. The famine problem has been partially solved by improved transportation and by better agricultural practices.

India's 352 million population includes people of many races, languages, and religions. Although India is mainly agricul-

tural and millions of people are listed as rural, there are some thirty cities of more than one hundred thousand population. Calcutta, which is the largest city, about one and one half million, handles a large share of India's trade. It serves the fertile Ganges Plain and is the outlet for jute grown in Bengal. Bombay, slightly over one million, has a fine natural harbor and is the leading center in the manufacture of cotton textiles. Karachi is the outlet for the Indus Valley; it exports wheat, hides, and skins. Madras, on the east coast, is a railway junction. It serves the central part of the Deccan Plateau and exports chiefly leather, hides, and skins. Delhi, the capital, is an attractive city of about three hundred fifty thousand. Because of its lowland location and warm weather, Delhi is abandoned during the summer when the government moves to the summer capital, Simla, which is a hill station.

Minerals. India possesses a variety of mineral resources, most of which satisfy local demands but are of little world importance. Coal, which is widely distributed, provides fuel for railways and steamships and for industry. Iron ore and coal have laid the basis for a small steel industry. India is relatively rich in gold and silver, which have been mined for centuries. Most people hoard both gold and silver, but India is a leading exporter of gold. There are valuable deposits of mica and manganese. Petroleum production, formerly credited to India, is chiefly in Burma. Unless new oil fields are discovered, Indian production will be small.

Agriculture—the Leading Occupation. India is predominantly an agricultural country. Before the development of modern transportation, crops were grown to supply the local demands. Subsistence agriculture is still widely practiced but, with the decline of native handicrafts in competition with European machine-made goods, more attention was given to agricultural crops that could be exported to Europe in exchange for manufactured goods.

About three fourths of India's 352 million people are engaged in agriculture. In addition to the people to be fed, there are some 210 million cattle, most of which are not used as work

animals and therefore add little or nothing to farm efficiency. Hundreds of millions of people and additional hundreds of millions of cattle place a tremendous burden upon the land to produce sufficient food. In actual production India ranks high along many lines but, because of the increasing demand for food, there is normally little surplus.

The backwardness of agriculture may be traced to a number of causes, some of which are: (1) overpopulation; (2) the fact that the animals do not earn their keep; (3) poor agricultural methods; (4) lack of education and training in agriculture; (5) the poor soil in many areas; (6) unreliable rainfall; (7) fragmentation of farms; that is, one small farm is divided into several tracts; and (8) the poverty of the masses.

Agriculture in India is regulated by the wet and dry seasons. During the rainy or summer season crops such as rice, cotton, and jute are grown; during the cooler, dry season beans and peas and drought-resistant crops like millet and sorghum are cultivated. In the semiarid and desert lands of the upper Ganges and Indus valleys, several large irrigation projects have been completed. These provide sufficient water to irrigate some forty million acres of farm land. These large-scale developments in irrigation by the British were designed to serve three purposes: (1) to increase the production of wheat and cotton; (2) to relieve population pressure in the famine districts; and (3) as a practical demonstration in scientific agriculture. The success of Indian agriculture has for centuries been dependent upon the rains brought by the summer monsoon; abundant rains meant good crops and food for millions, while drought meant crop failures and famine for millions.

Chief Crops. Rice occupies a larger acreage than any other cultivated crop; it is a staple food for millions of people. Rice is grown wherever there is adequate water, but the chief producing areas are the lowlands of the Ganges and Brahmaputra valleys and along the west coast of the peninsula. India ranks first among producers of rice, growing about one half of the world crop, and has for a number of years ranked first as an exporter.

Wheat ranks second in acreage to rice. Wheat is grown over large areas in the central part of the Deccan and in the Indus Valley, but the chief producing area is in the central and upper Ganges Valley. India ranks fourth in world production of wheat but, because of local demands, is not an important exporter.

Cotton, which ranks third in acreage, is extensively grown in the Deccan Plateau. India ranks second both in production and export of cotton. Most of the cotton, however, is short staple and is used mainly in the manufacture of cheap cotton cloth.

India ranks first also in world production of cane sugar. Despite the large output, local demands make it necessary to import additional sugar.

Most of the world's supply of jute is grown in Bengal, in the low and well-watered Ganges Valley. Bengal has so many advantages in the production of jute that there are no competitors.

Another crop of commercial importance is tea. Europeans have established successful tea plantations on the well-drained

Picking tea in India.

McCormick & Co.



slopes in Assam. British India has for many years ranked first in the export of tea. In Ceylon, a crown colony, black tea is produced under the plantation system.

Pulses and oil seeds are widely cultivated; these supply protein and fats in a diet that is deficient in meats and dairy products.

Manufacturing and Trade. Cottage industries, developed in India in connection with agriculture, and handicrafts formerly supplied all the necessary manufactured goods. Skilled workers made distinctive silks, cottons, brasses, silver, or carved wood and ivory. With the introduction of European machine-made goods, handicrafts declined. More recently there has been a revival of interest in handicrafts and also a beginning of modern large-scale industry.

India's late start in industrial development was the result of a combination of geographic, economic, and social factors, among which are: (1) the dominant position of agriculture; (2) the desire of England to keep India as a market for her own manufactures and her consequent discouragement of industry in India; (3) the caste system; (4) illiteracy; (5) lack of capital; (6) lack of technical training.

Textile manufacturing employs more workers than any other industry. Cotton manufacturing is centered in Bombay, which has the two chief advantages of being near the main cotton-producing areas and being well served by sea and rail transportation. Woolen mills are increasing in number. Jute manufacture is concentrated in Calcutta, the trade center of the jute-producing area. A large proportion of the total crop is now manufactured in India, and the bagging exported to many countries. A small steel industry has been developed; this promises to be more important in the future.

Other industries are concerned chiefly with the processing of foodstuffs, such as the milling of rice and wheat and the packing of tea.

Products of agriculture, including cotton, tea, jute, rice, and oil seeds, account for more than half of the total value of Indian exports. Animal products—wool, hides, and skins—and minerals make up most of the remaining exports. India im-

ports a great variety of manufactured goods, machinery, motor vehicles, and fuel oils.

The larger share of India's foreign trade is with the United Kingdom first, Japan second, and the United States third.

Transportation. Prior to the development of modern transportation, various parts of India, because of distance and rugged topography, were isolated from each other. Travel by bullock cart over unimproved roads was both slow and uncomfortable. Railway building first undertaken by the British was planned not only to serve the most densely populated areas but also to relieve the famine area in the Deccan by making it easier to import food in time of need. Building has continued; India now has almost fifty thousand miles of railways. An efficient railway net serves the Ganges Valley and the chief ports, and there are trunk lines serving peninsular India. Improved highways are also being increased. India is so vast, however, that areas twenty-five miles or more from a railroad are almost as isolated as they were a century ago.

India has regular steamship and air service to and from eastern Asia, Australia, and Europe.

CHINA

In General. China includes four great regions: China proper (eighteen provinces), Mongolia, Tibet, and Sinkiang. China also still claims Manchuria, now known as Manchukuo, lost to Japan in 1931. The Republic of China is a country of vast area, the largest Asiatic country, with a population of four to five hundred million people. Geography has been a vital factor in China's development. Separated from other countries by high mountains, vast deserts, and the sea, China was isolated from other peoples. Living for centuries entirely within its own boundaries, the Chinese developed a social and economic system without the interchange of commodities and ideas so characteristic of the western nations. Chinese history and civilization go back at least five thousand years.

Soil and Topography. The topography of China shows great variety. To the west lie the high plateaus of Central Asia; to

the south are the mountains and plateaus of Tibet and Yunnan; to the north and west are great desert regions, including the famous Gobi Desert. This arid region is characterized by a large interior drainage system centering in the Tarim basin.

Generally speaking, China is mountainous, except for the North China Plain and the great river valleys. The valleys of the Hwang, the Yangtze, and the Si rivers are the most densely populated areas. It was in these valleys that Chinese civilization started. Here the floods of the great rivers deposited huge quantities of silt, or alluvium, from the uplands. There are large areas of loess, a fine silty soil that has been carried by the winds from the desert regions farther west and deposited in North China. Many other soils are of great fertility also, especially the red sand and clay soils in the upper Yangtze Valley. The Yangtze is the main highway to the rich interior of China.

Climate. The geographic extent of China suggests a wide variety of climates. In northern China the climate is continental in type, with great seasonal extremes in temperature. Central China, including the Yangtze Valley, is subtropical, somewhat like Georgia and Alabama in the United States. Southern China is still warmer, almost tropical, with a wet and a dry season.

A large part of China, especially the east and southeast, receives monsoon rains during the summer months. Although these rains are a great aid to agriculture, they are variable and unreliable; some years they are too heavy and cause disastrous floods, while in other years scant rainfall causes drought and famine.

In north and northwest China are large areas where the yearly rainfall is less than ten inches. Almost all of Mongolia is a desert; Tibet is, for the most part, quite dry.

Minerals. Although there is a tendency to overestimate the mineral resources of China, it is probably correct to say that this country possesses one of the world's largest coal reserves. Coal is found in many of the provinces, especially in Shansi and Shensi. Most of the coal is of the bituminous

type, although there are also large reserves of anthracite. The coal is of an excellent grade; but because of the lack of transportation facilities and the limited use of coal by the Chinese, production is small. Some of the fields, like those on the Shantung Peninsula, are conveniently located near iron ore.

China has large reserves of iron ore. The few deposits that have been worked provided the ore for the Chinese steel industry and also the quantities which have for some years been exported to Japan.

Other valuable minerals are found in Yunnan, a province in southwestern China. Here silver, lead, tin, antimony, gold, and sulphur are mined. These same minerals are found also on the Shantung Peninsula and in the provinces of Shansi, Hunan, and Kwangsi. Copper, zinc, and mica are also produced in small quantities.

Agriculture. Agriculture is the dominant occupation of and provides the livelihood for about three fourths of China's four hundred million people. With farmable land limited to less than twenty per cent of the total area, population tends to be concentrated in the coastal plains and river valleys where topography and soil are most favorable. All available land is carefully and intensively tilled in order to get the highest possible yield from each acre. Through the centuries Chinese farmers have developed an efficient system of agriculture, including irrigation, terracing, fertilizing, crop rotation, and multiple cropping. Despite their industry and thrift, millions of people barely exist. Farms average about three and one half acres in size, and in the more densely populated areas more than one thousand persons per square mile are supported by agriculture.

Because of vast size, varied topography, and difficult transportation, different parts of China developed a subsistence economy—producing all their own foodstuffs and manufactured goods. In comparison to subsistence agriculture, cash crops are of slight importance.

There are a number of agricultural contrasts between the lands lying north and south of the Yangtze River.

South China has a warmer climate, a longer growing season, and heavier rainfall than north China. In south China ter-



U. S Department of Agriculture

Transplanting rice on a large farm in China.

raced, irrigated agriculture is the rule, with rice as the chief crop. Two or three crops per year are harvested; crop failures are rare. Tea and silk are produced chiefly south of the Yangtze. Many types of vegetables are grown for subsistence.

North China, in contrast, has less rainfall and is often subject to drought. Farms are larger; the leading crops are wheat, millet, cotton, and sorghums. Crop failures and famine, caused by drought and flood, are common.

China produces enormous quantities of foodstuffs, but, because of the demands of her people, there is little surplus. China is the world's leading producer of vegetable oils, millet, rice, kaoliang, sweet potatoes, and tea; it ranks second as a producer of wheat and raw silk; and third in cotton. China ranks first as an exporter of eggs and tung oil.

Throughout the country pigs, chickens, and ducks are generally found on farms. They supply meat and eggs for local consumption and quantities of eggs for export. Farm animals are more commonly used in China than in Japan. In south

China the water buffalo works the rice fields; in north China horses, mules, and oxen are commonly used; in the drier lands the camel is worked.

Agricultural reforms recently undertaken by the government include such things as the use of marginal lands, the introduction of new crops, and improved methods, especially with reference to sugar, tea, cotton, and the culture of silk.

Manufacturing. The characteristic industries of old China were those of the handicraft type, such as the carving of wood, jade, and ivory, and the making of paper, matting, rugs, silk and cotton cloth, fine porcelain, and metal work. In China, as in India, home industries were developed along with agriculture. China is said to have subsistence industries as well as subsistence agriculture. Because of the isolation factor and difficult transportation, various parts of China developed economic self-sufficiency. With all her immediate needs supplied locally, China was slow in beginning industrialization.

Some of the reasons for China's late start in modern industry are: (1) the home industries supplied local demands; (2) the emphasis was upon agriculture; (3) capital was lacking; (4) transportation was inadequate; (5) China was less dependent upon foreign trade than many other countries.

Modern machinery and modern factory methods have been introduced and adopted in certain parts of China. Since 1900 rapid progress has been made in establishing factories for the manufacture of textiles and steel especially. Using her own supplies of coal and iron, China had a small but growing iron and steel industry prior to the outbreak of the war with Japan in July, 1937. The steel industry was located in the lower Yangtze Valley.

The textile industry has developed rapidly to a position of first rank. In 1936 there were 140 factories spinning and weaving cotton, most of them owned by the Chinese. Cotton cloth is manufactured chiefly in the vicinity of Shanghai and Tientsin; silk is manufactured from Shanghai southward to Canton.

Other manufacturing enterprises are concerned with flour milling, paper and printing, chemicals, cement making, leather and rubber goods, tobacco, and wearing apparel.

China's industrial future is uncertain. Necessary minerals are available in sufficient variety and quantity for a great increase in industrial development. It is unlikely that China will specialize in the heavy industries requiring steel because she could not stand the competition of better-endowed and better-developed countries.

The greatest advantage for industrial development is in textiles. Here the Chinese have had centuries of training in home industries; they produce all the raw materials—cotton, silk, and wool; and they have a great potential market in China's four hundred million people.

Transportation. One of the chief handicaps in the economic development of China is the lack of adequate, modern transportation facilities. The great rivers, supplemented by canals, afford excellent transportation in the interior. The Yangtze is the chief water route; it ranks as one of the great rivers of the world. Ocean-going vessels may proceed as far as Hankow, while smaller river steamers go through the gorge to the western provinces.

On land, it has been customary to transport freight on the backs of men, in wheelbarrows, or on pack animals. Roads and roadways have always been rare in China, except in the flatter plains. Within recent years, however, much attention has been given to road building. It is said that China now has over forty thousand miles of good automobile roads, and that the number of motor vehicles is increasing each year.

There are relatively few railroads in China. Because she was adjusted to her system of river and canal transportation, China did not start building railways until recently. There are now some sixty-five hundred miles, and the mileage is steadily increasing. There are two long and important north-south railway lines: The first runs south from Peiping through the coastal plain to Nanking and Shanghai; the second line, also starting from Peiping, runs south, using an interior route via Hankow, on the Yangtze, to Canton. There is also the Kalgan railway, running north and west from Peiping to Mongolia. There are other short lines. The first railways constructed served only the most densely populated areas; more recently

railways have been built in order to make distant parts of China more accessible and to unify the country.

Vast distances and rugged topography, which have hindered railway building, are no obstacle in air transportation. Regularly established air lines, having a greater mileage than have the railways, serve remote provinces and shorten the travel time tremendously. Thirty years ago to travel from Hong Kong to Chungking required forty-five days; the same journey can now be made by air in four and one half hours.

Cities. China has many large cities, most of which are river ports or seaports. Shanghai, with a population of about three and one half million, is the largest city and the chief port. Shanghai serves as an outlet for the productive Yangtze Valley and coastal plain. Canton is the outlet of the Si Valley and is the chief silk market and tea-exporting city. Tientsin, in the north, ranks second to Shanghai in volume of trade; it is noted for its textile industry. Hong Kong, a British crown colony since 1841, handles most of the ocean-going trade of Canton and is one of the world's greatest seaports. Peiping, second city in size and the former capital of China, commands the caravan and rail routes to Mongolia. Nanking, capital of the Republic of China, is an important port and manufacturing city on the Yangtze. Hankow and Chungking, on the Yangtze, are also important river ports.

Foreign Trade. Because of the subsistence economy of China, there is little emphasis upon special commodities for export. Consequently the export list contains many items of approximately the same value.

The leading export for some years has been tung oil, sent chiefly to the United States to be used in paints and varnishes. After tung oil, other exports fall into three main groups: (1) agricultural products, including cotton, tea, millet, beans, and oil seeds; (2) animal products including wool, meats, eggs, hides and skins, bristles, and feathers; and (3) handicrafts such as rugs, linen, laces, and embroideries.

China imports manufactured goods of all types, kerosene, lubricating and fuel oils, machinery, and motor vehicles.

Economic Position. Unsettled conditions in the Orient in recent years make it difficult to speak with certainty regarding the economic position of China. Although the present buying power is low, the possibilities of trade expansion make China a country of great possibilities. If China's buying power in creases and the standard of living rises, this country will be the largest undeveloped market in the world. All of the industrial countries are anxious to share this market, but the direction of Chinese trade in the future largely hinges upon maintenance of the "open-door policy."

JAPAN

In General. Japan proper consists of the four main islands, Honshu, Kyushu, Shikoku, and Hokkaido, plus many small islands nearby. Since 1870 Japan has acquired other territory. The Japanese Empire now includes Japan proper, Taiwan or Formosa, Karafuto—southern half of the island of Sakhalin, Korea or Chosen, the Kurile Islands, and several small islands between Japan proper and Taiwan. Japan also received a mandate over some of the former German islands near the equator.

Because it is located on the great circle route of the North Pacific, Japan has an advantageous location for trade.

Topography and Soil. The Japanese islands are mainly mountainous in the interior. Much of this rugged land, too steep and too unfavorable for human habitation, is forested. There are several plains areas along the coasts, and some of the broader and more fertile river valleys also have land suitable for cultivation. Less than twenty per cent of the land is farmable.

Some of the soil is of volcanic origin, but there are also large areas of alluvium. Since some of the agricultural land has been cropped for about two thousand years, it must be heavily fertilized in order to keep up production.

Because of the mountainous character of the islands, streams are short and swift, and afford many excellent power sites. Many streams are diverted to irrigate the rice lands. Rivers are, therefore, unimportant for navigation.

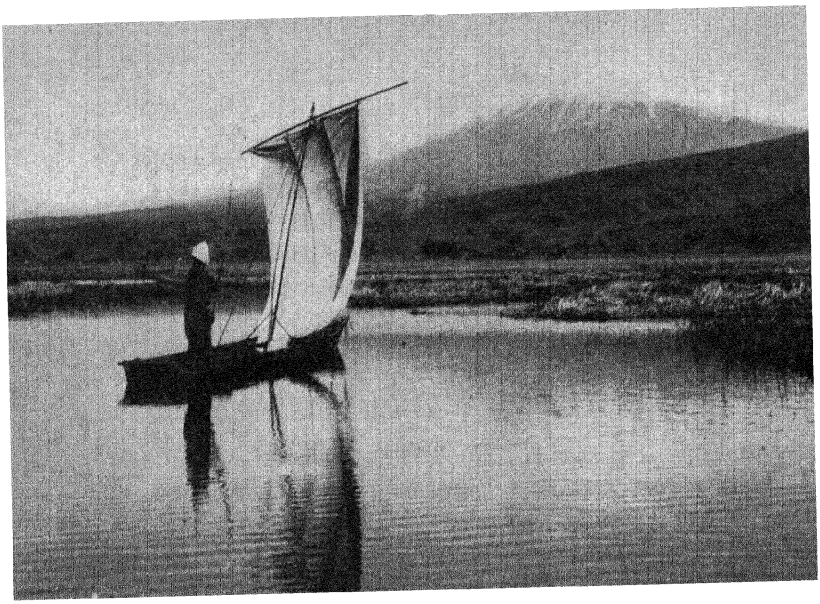
Japan experiences frequent earthquakes. Most of them are minor, but disastrous earthquakes occasionally occur, causing great loss of life and property. There are a number of extinct and a few active volcanoes. The many hot springs areas are favorite resorts.

Climate. Because of its tremendous north-south extent, Japan has many types of climate. In addition to latitudinal extent, elevation, the Asiatic monsoon, and ocean currents are climatic influences.

Taiwan or Formosa is tropical in character. Temperatures are high, precipitation is heavy, and tropical vegetation is luxuriant. Honshu, Shikoku, and Kyushu are subtropical and have cool winters and hot, humid summers. The mountainous interior of Honshu has cold winters with heavy snowfall. Hokkaido, farther north, is similar in climate and crops to our New England states. Karafuto, in the higher latitudes, has greater seasonal contrasts. Summer is short and cool; winter, which comes quickly, is long and cold. Both Hokkaido and Karafuto are usually snowbound for several months of each year. In general, however, temperature contrasts are not so great in any part of Japan as in the larger land masses in similar latitudes.

Forests. Much of the mountainous interior of Japan is forested. Large areas in the south, formerly cut over, are being reforested. The chief sources of timber are now the fir and spruce of Hokkaido and Karafuto. Karafuto trees, smaller in size, are used chiefly for pulp, paper, and rayon. In southern Japan the bamboo is used in many ways. Japan does not have an adequate supply and imports both timber and wood pulp.

Fisheries. Fish is a main item in the Japanese diet. The inland streams and shallow coastal waters are well stocked. The Japanese fish along the east coast of Asia, going as far as the Bering Sea; they also engage in whaling in the Antarctic. Canneries pack many types of fish for export, especially salmon, tuna, and crab. Japan leads in the production of culture pearls.



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A Japanese fishing in Lake Kawaguchi. Mount Fiji is in the background.

Agriculture in Southern Japan. Agriculture in southern Japan is necessarily intensive. It employs about fifty-four per cent of the seventy million people. The average farm is two and one half acres. All the better plains areas are carefully tilled and, where water is available for irrigation, hillsides have been terraced to increase the farm land. Since there are practically no domesticated animals in southern Japan, and since tracts are too small for efficient use of machinery, work must be done by hand. All crops require a tremendous amount of hand labor.

Rice and fish are the main food of millions of Japanese. About half of all the cultivated land is given to rice. In many places the climate is mild enough for two or three crops to be harvested in a year. Intensive cultivation and high yields make it possible to support several hundred people per square mile. A variety of vegetables such as sweet potatoes, taro, beans, and peas are grown for subsistence.

In southern Japan there are two cash crops—tea and silk. Tea is grown from central Honshu south, but Shizuoka is the chief producing area. In Japan tea is produced by small farmers rather than under the plantation system, as in Taiwan.

Although most of the tea is green tea and is consumed locally, exports are valued at about four million dollars annually.

Silkworms are commonly kept on small farms, though there are also a few large factories. Silk culture requires a mild climate, mulberry leaves to feed the worms, and a large supply of cheap but efficient labor. Japan has become the leading exporter of raw silk chiefly because of improved quality. The United States is the largest buyer of raw silk.

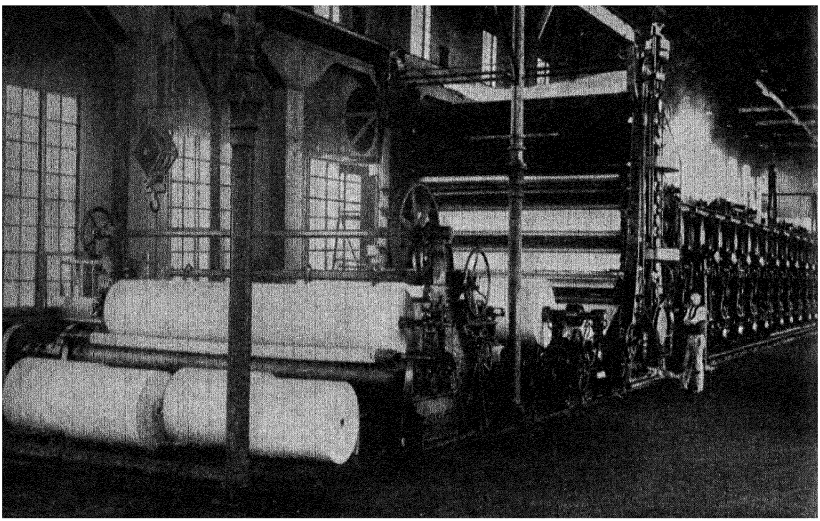
Plantation-type agriculture is being developed in Taiwan. The output of cane sugar and tea is increasing.

Agriculture in Northern Japan. The northern islands, Hokkaido and Karafuto, are newer, less well developed, and less densely settled than the southern. Farms average twelve acres in size but, because of the colder weather, only one crop per year can be harvested. Animals and farm machinery are commonly used. Wheat, barley, oats, and white potatoes are grown, as well as peas, beans, corn, and sugar beets. Animal industries are being encouraged, and both islands have a growing dairy business. Some sheep are pastured; the wool is used locally.

Minerals. Japan is poor in the minerals needed for industry. Coal deposits of good quality, located in Kyushu, have been practically exhausted, and the best remaining deposits are in Hokkaido. Iron ore is deficient. To offset these deficiencies in basic minerals, Japan imports coal from China and Manchukuo and iron from China and the United States. Japan has small supplies of gold, silver, copper; large supplies of sulphur; no aluminum, and no petroleum.

A large proportion of all the minerals used in industry, as well as raw materials, are imported.

Manufacturing. Japan, like China and India, had well-developed home industries and handicrafts centuries before the modern factory system was introduced. Skilled craftsmen have made fans, lantern, porcelains, tapestries, and artistic articles of gold, silver, and bronze. The small workshops, as developed under feudal organization, still function; they account for a



Underwood and Underwood

A paper machine in a Japanese paper mill.

large share of Japanese manufactures. Thousands of workers are today employed in making a variety of articles by hand.

Modern industry began in Japan soon after the Restoration in 1868. The government encouraged and subsidized railways, shipping, and certain industries; modernization thus started rapidly. Japan's success in industry and commerce is due to: (1) government encouragement and financial aid; (2) a large and industrious labor supply; (3) labor experienced in handicrafts; (4) water power; (5) the low cost of living; and (6) the use of their own merchant marine, and, as a result, a reduction in transportation costs.

Textile manufacture is the most important phase of industrial development. The transition from hand spinning and weaving to mechanical spinning and weaving was easily made. Raw cotton is imported from the United States, India, and China and is made into cheap cotton cloth, mainly in the Osaka industrial district.

Silk fabrics are made primarily for the domestic market, but wool cloth is made for foreign markets. Japan has recently become a leading country in the manufacture of rayon and has a valuable trade in rayon piece goods.

The iron and steel industry has developed rapidly since 1920. Since both coal and iron must be imported, emphasis is upon steel products needed for Japanese development, such as ships,

locomotives, and textile machinery. Hydroelectric plants provide power for electrifying railways in the metropolitan areas; electricity is also supplied to all parts of the country by transmission lines.

Japan makes a variety of articles of small unit value, such as pottery, glassware, plastics, toys, and souvenirs.

Other industries are concerned chiefly with the processing of local crops, as milling of rice and wheat, canning and preserving, oil pressing, tobacco manufacture, and brewing.

Transportation. Although rugged topography makes railway building expensive, Japan has an excellent network of railways covering all the large islands. There is a scarcity of improved highways but, with the wider use of motor vehicles, mileage is increasing. Japan is connected with the Asiatic mainland by air, and with all the world by water.

The large merchant marine distributes Japanese manufactures all over the world in exchange for needed raw materials; it also engages in a profitable carrying trade.

Cities. The population of Japan has more than doubled since 1870. With this increase in numbers has come an increase in urbanization. There are now about thirty cities having more than one hundred thousand people, and four cities having more than one million—Tokyo, Osaka, Nagoya, Kyoto.

Tokyo, the capital, has nearly six million people, many of whom are engaged in industry and trade. Only a few miles away is Yokohama, the chief port. On all north Pacific steamship lines, Yokohama is an important world port. Osaka, with nearly three million population, is the industrial center; this city specializes in textiles. Nagoya, third in size, is the center for pottery and glassmaking. The ancient capital, Kyoto, is known for all types of art goods. Kobe is an important port serving nearby industrial cities. In Nagasaki and Mojii, in Kyushu, and Shimonoseki, in Honshu, rail and water transportation meet.

Foreign Trade. Since the World War, Japan has exported a variety of manufactured goods. Exports fall into four main groups: (1) textiles and knit goods, which account for nearly

forty per cent of the total exports; (2) wearing apparel; (3) raw silk, the largest single item, and tea; and (4) pottery and glass. Japan is increasingly dependent upon foreign trade for industrial expansion and as a means of support for her increasing millions.

Japan imports (1) raw materials for industry, such as cotton and wool; (2) minerals, such as petroleum, iron, copper, and aluminum; (3) machinery and automobiles; and (4) foodstuffs.

TEXT QUESTIONS

1. What are the chief topographic features of Asia?
2. Where were the ancient civilizations located?
3. What are the chief agricultural products of India?
4. Describe the main physical features of India.
5. What are the three largest rivers in China?
6. Name the principal articles of export from China.
7. Why do the farms in Japan seldom average more than two and one half acres?
8. Why is Japan dependent upon foreign trade?
9. What advantages has Japan for further development in manufacturing?
10. What commodities of commercial value are produced on the island of Taiwan?

PROBLEMS AND PROJECTS

1. Contrast India with Mexico, accounting for the differences in (a) products, (b) imports, (c) exports, (d) countries with which trade is carried on.
2. As a market for American goods, is Asia or South America more important to the United States? Refer to statistics on the foreign trade of the United States with both continents.
3. Why has Japan developed industry and commerce?
4. Why is rice growing prominent in monsoon lands?
5. Why do summer temperatures in India increase from south to north?
6. Make a list of the geographical factors that have contributed to the economic development of China.

7. Contrast the industrial development of Japan and China.
8. Characterize the manufactures of India. What advantages for manufacturing are found in that country? Where are the manufacturing industries chiefly located?

TOPICS

1. Cotton production in India.
2. A comparison of the commercial and industrial aspects of Japan and Great Britain.
3. The river trade of China.
4. The growing, harvesting, and marketing of tea.
5. The influence of conservatism on the commerce and industry of China.
6. The foreign trade of India.
7. The foreign trade of Japan.
8. The remedy for the overpopulation of Japan.

FOR CLASS DISCUSSION

1. China will some day be the leading industrial and commercial nation of Asia.
2. China is the best market in the world for American cotton goods.
3. In the near future India will develop machine manufacturing on a large scale.
4. Japan's colonies are not so valuable as those of England.
5. It will require more than five hundred years to industrialize China.

CHAPTER XXIV

AUSTRALASIA

THE MALAY PENINSULA AND EAST INDIES

In General. The Malay Peninsula, which extends southward from Siam and Burma, is a highly productive region that is especially famous for tin and rubber.

The islands lying to the south and east of Malaya are known as the East Indies. Included in the East Indian group are Java, Sumatra, Borneo, New Guinea, the Moluccas, and many smaller islands. Most of the East Indian group are controlled by the Netherlands and constitute a rich colonial empire.

In recent years the Malay States and the East Indies have attracted attention because of the increase in plantation agriculture. This development resulted from the demands of industrial countries for larger and larger quantities of foodstuffs and raw materials. Rubber, for example, was originally obtained by tapping the wild rubber trees of the Amazon Valley. However, as new uses were found for rubber, it became necessary to seek larger supplies than could be obtained in this one way. Rubber was therefore planted in huge plantations and cultivated and tapped scientifically, in order to increase the quantity and to improve the quality.

Plantation agriculture is largely concentrated in the Malay Peninsula and the East Indies because of favorable soil and climate, a large and efficient labor supply, and easy access to water transportation. Other products, in addition to rubber, that are grown under the plantation system are tea, coffee, cacao, sugar cane, coconuts, tobacco, and palm oil.

Malay Peninsula. The Malay States rank first in world production of tin. Valuable veins of this mineral in the mountainous center of the peninsula make deep mining necessary. However, most of the tin is obtained by placer mining from alluvial deposits. The ore is rich and easily obtained; it is chiefly exported through or smelted in the city of Singapore.

Singapore, on an island at the extreme south tip of the peninsula, has been owned by England for more than a century. The British have developed it to serve both strategic and economic purposes. Singapore is an important center (1) for the collection and export of tropical products and minerals from nearby areas, (2) for the distribution of incoming cargo, and (3) as a port of call for many steamship lines.

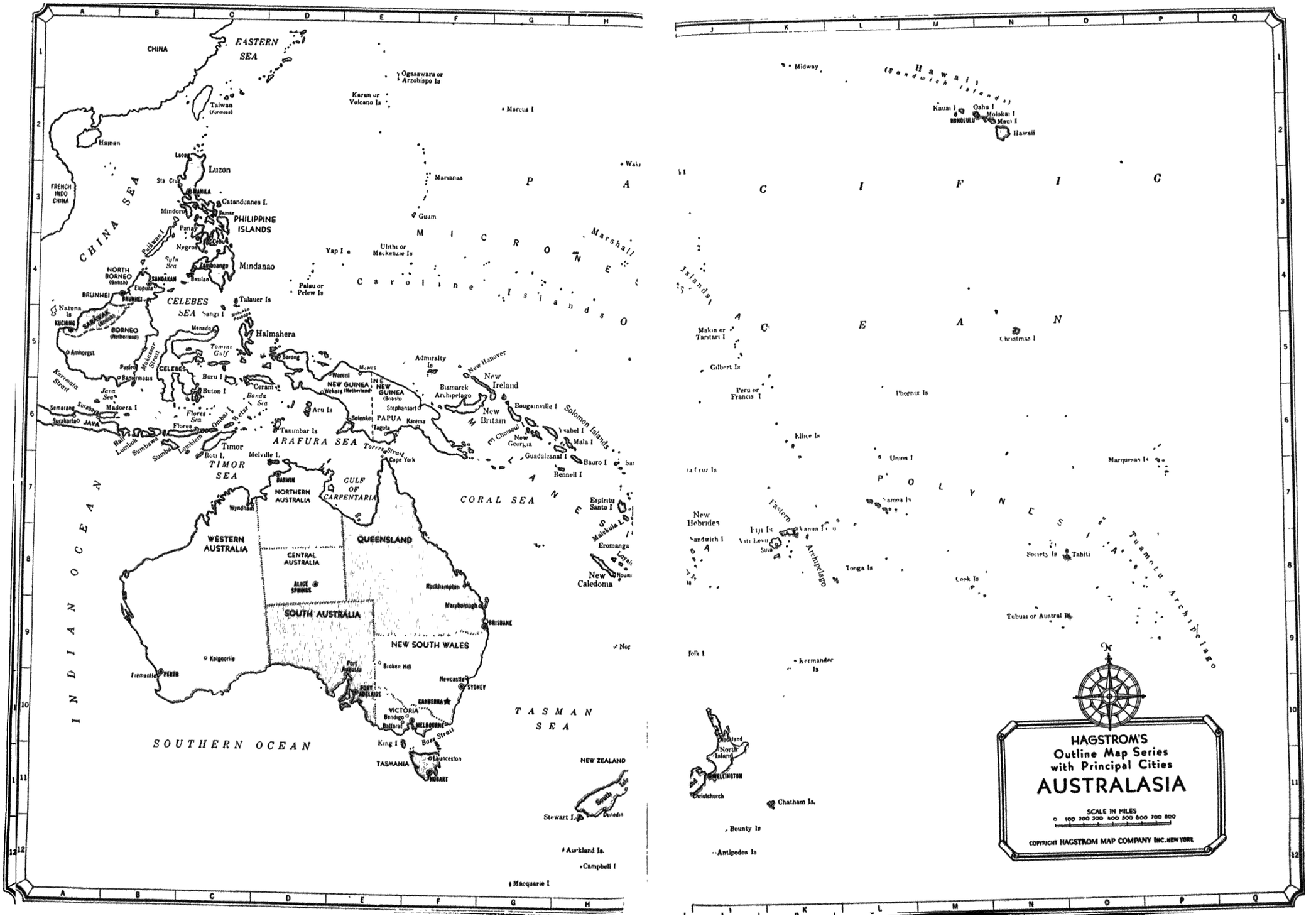
East Indies. Java is by far the most valuable island in the East Indian group. It produces a surplus of tea, coffee, spices, rubber, cane sugar, coconuts, and petroleum; it is also the chief source of quinine and kapok. Rice, cassava, and sweet potatoes are grown for the native food supply.

Agriculture, the chief industry of Java, supports a population of more than forty million people. This island is one of the most densely populated areas in the world, with eight hundred and twenty people to the square mile. Industrious natives cultivate the rich, volcanic soil and, with the aid of a wet tropical climate, receive large yields per acre.

The most important minerals are tin and petroleum. Manufacturing is concerned chiefly with native handicrafts and the processing of foodstuffs for local use. Most of Java's foreign trade is with Holland.

Sumatra, one of the larger islands in the East Indian group, is about three times the size of Java. It is, however, neither so densely populated nor so well developed as Java. Since Sumatra came under the control of Holland in 1904, great progress has been made in developing plantation agriculture, especially in rubber, coconuts, tobacco, tea, and palm oil.

Borneo, Celebes, and the Moluccas are less developed than either Java or Sumatra. Since these islands are largely covered with tropical forest, little agriculture is practiced except along the narrow coastal plains. Although natives produce their own food crops, commercial agriculture is just beginning. These islands produce rice, coffee, coconuts, timber, spices, and pearls. Borneo also exports gold and petroleum.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Hainan
FRENCH INDO CHINA
CHINA SEA
Luzon
MANILA
Catanduanes I.
Mindoro
Samar
PHILIPPINE ISLANDS
Panay
Negros
Cebu
Palawan I.
Sulu Sea
Zamboanga
Mindanao
Basilan
NORTH BORNEO (British)
SANDAKAN
Elopura
BRUNHEI
Natuna Is
KUCHING
SARAWAK (British)
BORNEO (Netherland)
Amhorgst
Pasir
Banjermasin
Karimata Strait
Java Sea
Madoera I
Semarang
Surabaya
Surakarta
JAVA
Bali
Lombok
Sumbawa
Sumba
Lombiem
Flores Sea
Flores
Ombai I.
Wetar I.
Timor
Roti I.
TIMOR SEA
CELEBES SEA
Sangi I
Talauer Is
Menado
Halmahera
Tomini Gulf
Sorong
CELEBES
Buru I
Buton I
Ceram
Banda Sea
Aru Is
Tanimbar Is
ARAFURA SEA
Melville I.
Wareni
Mawes
NEW GUINEA (Netherland)
Wekara
NE NEW GUINEA (British)
Solenke
PAPUA
Tagota
Stephansort
Karema
Torres Strait
Cape York
Admiralty Is
New Hanover
New Ireland
Bismarck Archipelago
New Britain
Bougainville I
Choiseul I
New Georgia
Ysabel I
Mala I
Guadalcanal I
Bauro I
Rennell I
Solomon Islands
Espiritu Santo I
Malekula I.
Eromanga
New Caledonia
CORAL SEA
BARWIN
NORTHERN AUSTRALIA
GULF OF CARPENTARIA
Wyndham
WESTERN AUSTRALIA
CENTRAL AUSTRALIA
ALICE SPRINGS
QUEENSLAND
Rockhampton
Maryborough
BRISBANE
SOUTH AUSTRALIA
NEW SOUTH WALES
Kalgoorlie
Fremantle
PERTH
Port Augusta
Broken Hill
PORT ADELAIDE
Newcastle
SYDNEY
CANBERRA
VICTORIA
Bendigo
Ballarat
MELBOURNE
Bass Strait
King I
TASMANIA
Launceston
HOBART
INDIAN OCEAN
SOUTHERN OCEAN
TASMAN SEA
NEW ZEALAND
Stewart I.
Dunedin
Auckland Is.
Campbell I
Macquarie I
Ogasawara or Arzobispo Is
Kazan or Volcano Is
Marcus I
Marianas
Guam
Yap I
Ulithi or Mackenzie Is
Palau or Pelew Is
Caroline Islands
Marshall Islands
MICRONESIA
PACIFIC OCEAN
Midway
Hawaii (Sandwich Islands)
Kauai I
Oahu I
Molokai I
Maui I
HONOLULU
Hawaii
Makin or Taritari I
Gilbert Is
Peru or Francis I
Christmas I
Phoenix Is
Ellice Is
Union I
Marquesas Is
POLYNESIA
Samoa Is
New Hebrides
Sandwich I
Fiji Is
Viti Levu
Suva
Eastern Archipelago
Tonga Is
Society Is
Tahiti
Cook Is
Tuamotu Archipelago
Tubuai or Austral Is
Kermandec Is
Auckland
North Island
WELLINGTON
Christchurch
Chatham Is.
Bounty Is
Antipodes Is

AUSTRALIA AND NEW ZEALAND

In General. Prior to the development of modern transportation and communication, Australia and New Zealand were greatly handicapped by their isolation. Now, however, the frequent steamship and air services from all parts of the world have decreased the importance of the isolation factor.

Both Australia and New Zealand were colonized by north Europeans. They have been under British control for more than a hundred years. These two dominions supply the mother country with foodstuffs and raw materials and receive in return a variety of manufactures.

AUSTRALIA

Climate and Topography. The climate of Australia shows great diversity. About half of the continent is located in the tropics and half in the middle latitudes. The extreme northern part has a humid tropical climate that is favorable for the growth of luxuriant vegetation. Farther south are humid subtropical and marine regions. Part of South Australia is Mediterranean in its climate, while the center of the continent is arid or desert territory. Extremes of temperature are rare anywhere along the coast, but high temperatures occur in the desert during the summer months. Australia's chief climatic handicap is deficient and unreliable rainfall. Areas devoted to agriculture and the animal industries are selected chiefly because of rainfall.

The continent of Australia has three main physical features: (1) The western plateau, from one to three thousand feet in altitude, occupies nearly two thirds of the continent. (2) The Great Australian Mountains, which are roughly parallel to the east coast, present a steep face eastward and a long gentle slope toward the interior. (3) The central lowlands extend from the Gulf of Carpentaria southward to the ocean.

The only important river system in Australia, the Murray-Darling, drains the west slopes of the mountains and flows through the southern part of the lowland area. In South Aus-

tralia there is a large inland drainage region centering in Lake Eyre, which is below sea level and is usually dry.

Minerals. In mineral resources Australia ranks high. Gold had previously been found in several places, but it was the discovery of rich deposits in Victoria in 1851 that first attracted large numbers of Europeans. Within a few years other deposits of gold, silver, lead, and copper were discovered in New South Wales and Queensland. Thousands of prospectors rushed to the mines. From 1880 to 1900 several rich gold deposits were located in northern and western Australia, with the fields around Coolgardie the richest. Western Australia has for some years produced more gold than the eastern states.

Silver often occurs with gold, especially in Victoria. Both silver and lead are found in the chief producing areas, as in Broken Hill.

Copper is widely distributed, so that every state has productive mines. Tin is also worked in every state, but New South Wales has the largest output.

Coal, the first mineral found in Australia, has provided fuel for domestic uses, railways, steamships, and industry. Coal is widely distributed, but some of the most valuable deposits occur in New South Wales near Newcastle. Victoria boasts one of the largest open-pit coal mines in the world.

Iron deposits have been known for over a century, but smelting and steel manufacture have developed mainly since 1900. Australia has an iron mountain on the west side of Spencer Gulf in South Australia, which supplies the smelters at nearby Port Pirie. Iron ore is shipped by water to Newcastle, which has become an important steel-manufacturing center. Coal from Newcastle supplies fuel for the smelters in Port Pirie, which is also developing a steel industry.

Minerals exported from Australia in a recent year were valued at about seventy million dollars; gold accounted for about half of this amount.

Agriculture and the Animal Industries. Although Australia is approximately the size of the United States, about forty per cent of the land is too dry for agriculture. Because of inade-

quate rainfall large sections are pastoral rather than agricultural. Where there is sufficient vegetation and water, sheep and cattle are grazed. Australia leads the world in wool clip, and products of the animal industries are the country's chief source of income. The merino sheep are valued for their large fleeces of fine wool, but Australians have found it more profitable to keep dual-purpose animals—sheep that give a good wool clip and are also good food. The refrigerator ship makes possible the export of large quantities of frozen and chilled beef and mutton.

Dairying is also locally important in many parts of Australia. The chief commercial dairy regions are, however, in the coastal sections of New South Wales and Victoria, which are accessible to large urban centers. Australia ranks high as an exporter of canned milk, butter, and cheese. Dairy products, like meats, are shipped under refrigeration and go mainly to the British Isles.

The chief cultivated crop of Australia is wheat. The producing areas are limited chiefly by rainfall. Although wheat is the principal crop, both acreage and yield vary according to the seasons and the price of wheat in the world market. Australia is, however, one of the three leading exporters of wheat, largely because of the small domestic consumption.

Other crops of importance are oats, barley, corn, and potatoes. Cane sugar, cotton, and tobacco are grown only in Queensland.

Fruitgrowing has become an important industry. Many varieties of tropical fruits are grown in Queensland. These include bananas, pineapples, pawpaws, and breadfruit, as well as oranges and lemons. In Victoria and Tasmania the stone fruits are common, and Tasmania is particularly famous for its apples. The largest commercial fruit-producing areas are the lands irrigated by the Murray River, with Mildura as the most important center.

All types of citrus fruits are grown under irrigation; apricots, peaches, figs, dates, walnuts, almonds, and grapes are also important. Some fruits are used fresh; others are dried or made into jam or marmalade.

Australia has built a thriving wine industry, patterned after the French, which is centered in the Murray Valley. A variety of wines of high quality are now made and exported, chiefly to the British Isles.

Manufacturing. As an industrial nation, Australia does not compare with England, Belgium, or the United States. Industrialization is under way but, because of the isolation factor and world competition, Australia's manufactures are mainly for the domestic market. Two further handicaps to industrial development are the requirements of labor as to hours and wages and the small home market. On the other hand, Australia has not only an efficient labor supply but also the coal and iron needed in heavy industries; she also produces wool, cotton, tobacco, hides and skins, wheat, sugar, and other raw materials. The leading manufactures are industrial metals and machines, with steel mills largely concentrated in Newcastle, Port Pirie, and Broken Hill; clothing and textiles in Sydney, Melbourne, and Adelaide; the processing of foodstuffs; and paper, printing, and binding. Other industries of increasing importance are shipbuilding and the manufacture of airplanes.

Australia is still primarily an agricultural country; only about half a million people are classed as factory workers. Industrial output, however, is almost as valuable as the combined products of agriculture, forestry, and mining.

Population and Cities. In an area almost as large as the United States, Australia has only 6,750,000 people—fewer people than live in the city of London. More than half of the population is concentrated on the east and southeast coasts, because these regions are better watered and have the most favorable living conditions. In contrast, thousands of square miles in the desert interior have less than two people per square mile.

Sydney, with a population of 1,125,000, is the largest city. Located on an excellent natural harbor and serving the best-developed and most densely populated part of Australia, Sydney is the shipping center of the Dominion. Melbourne, which has slightly over a million people, is the second largest Aus-

tralian city and the capital of Victoria. Melbourne serves a productive hinterland, has great meat-packing plants, and is the terminus of many steamship lines.

Perth, in western Australia, is the chief western port. It is noted for the export of wheat and is on the steamship routes between Europe and Australia.

Adelaide, the capital of South Australia, and Brisbane, the capital of Queensland, are local trading centers.

Australia is building a new federal capital. A tract of land comparable to the District of Columbia in the United States was acquired by the Federal Government, and a planned city, Canberra, is being constructed. Canberra now has a population of about 8,000.

Transportation. Because of tremendous size and sparse population, it has been difficult for Australia to provide adequate transportation facilities. The densely populated east and southeast coastal areas are, however, well supplied with railways and improved highways. There are also four railways that start from the east coast and cross the mountains to serve the interior.

When railway building began in Australia, there was no national plan; consequently, each state adopted a different gauge. This has made it necessary to transship goods going from one state to another and has, of course, added to the cost of transportation.

The Trans-Australian Railway, connecting Sydney and Perth, was constructed by the Commonwealth Government primarily to bring western Australia closer to the eastern states. The railway, which requires a government subsidy to operate, traverses hundreds of miles of barren territory. A railway journey from Sydney to Perth is comparable to one from Los Angeles to New York, except that on the Australian railway one must change trains five times because of the different gauges used.

Some years ago Australians talked of building a north-south railway connecting Adelaide and Darwin and following the route of the overland telegraph. A thousand-mile railway line was actually constructed from Adelaide to Alice Springs, and

a second line southward from Darwin for about three hundred miles. The two lines have not been connected. With the wide use of motor cars and trucks, and the tri-weekly air service from Europe and Asia, it seems unlikely that this railway link will be completed.

Australia has an excellent system of airways; and those parts of the continent which are not served by railways are usually accessible by air. Motor vehicles are commonly used whether on improved or unimproved roads, although camel caravans are still used in the desert interior.

Foreign Commerce. Since Australia is predominantly an agricultural country, exports consist largely of products of agriculture and the animal industries—wool, meats, dairy products, hides and skins, wheat, and sugar. Australia also exports timber and minerals, principally gold, silver, lead, copper, and zinc. Imports are chiefly manufactured goods, machinery, chemicals, and other items not produced in Australia. The larger share of the foreign trade is with Great Britain.

NEW ZEALAND

In General. New Zealand consists of a series of mountainous islands. The three largest are known as North Island, South Island and Stewart Island.

New Zealand is about the same size as New York, New Jersey, and Pennsylvania. It has a population of 1,500,000 but, as in Australia, the population is unevenly distributed. The majority of the people live in cities and along the eastern lowlands, while the mountainous interior is sparsely settled.

New Zealand, like Australia and Canada, has dominion status in the British Commonwealth of Nations.

Topography and Climate. New Zealand has a north-south length of about one thousand miles, but none of the islands are more than two hundred and eighty miles across at their broadest points. A mountain chain makes both the North and South Islands highly rugged. In the South Island, where there are a number of peaks more than ten thousand feet in elevation, there are many glaciers in the higher valleys. New Zealand

has few good natural harbors; Auckland, the chief port, and Wellington, the capital, are the best. The largest and most productive plains area is the Canterbury Plain on South Island, with Christchurch as its principal city. Dunedin serves a smaller plain where gold mining is important.

Because of oceanic influence the climate of New Zealand may be classed as marine or cool temperate. Rainfall, which comes chiefly in the winter months, is heaviest on the west side of the islands because the eastern lowlands are protected by the mountains. Weather conditions in North Island are similar to those in southern England, but South Island is colder and, particularly in the mountainous areas, receives heavy snowfall.

Minerals. New Zealand has a great variety of minerals, but only a few can be profitably mined in competition with other countries. Iron ore, which is found in South Island, has formed the basis for a small steel industry. Coal, bituminous and lignite, is widely distributed and supplies local demands. Gold mining, important in New Zealand's early history, has been greatly stimulated in the last decade by higher prices. The two chief gold-producing regions are Auckland, North Island, and Otago, South Island.

Agriculture and the Animal Industries. Agriculture in New Zealand is greatly influenced by the rugged topography and the mild climate. In the more favorable areas grains—wheat, corn, barley, and oats—are produced, but hay and root crops occupy nearly seventy per cent of the total area under cultivation. New Zealand is noted for its fine pastures, in which millions of sheep and cattle graze.

As in Australia the sheep kept must serve two purposes—wool clip and meat. New Zealand ranks fourth among world exporters of wool. It has also developed a profitable business in frozen and chilled mutton and beef. Even greater emphasis is placed upon dairying, which is controlled by co-operatives similar to those in Denmark. Skimmed milk is fed to pigs and chickens, which add to the local food supply. There are many factories for making butter, cheese, condensed milk,

and casein. New Zealand butter and cheese are favorites in the English market.

Manufacturing and Trade. Industrial development is largely dependent upon agriculture. The most valuable industry is concerned with processing farm materials and their products; this includes meat freezing and preserving, ham and bacon curing, butter, cheese, condensed milk, brewing, and milling. Another important group of industries includes textiles, clothing, boots, and shoes. It is apparent that New Zealand's industrial development will be limited by the small home market.

Foreign trade shows the great emphasis placed upon the animal industries, which account for more than ninety per cent of the total value of exports. Since 1930 New Zealand has been the world's leading exporter of cheese. The dominion ranks second as an exporter of butter, second in meats and meat products, and fourth in the export of wool. Gold is the next most valuable commodity exported.

New Zealand imports clothing and textiles, sugar, tea, metals and machinery, motor vehicles, and chemicals. About three fourths of the foreign trade is with the United Kingdom.

TEXT QUESTIONS

1. Name two important products obtained from the Malay Peninsula.
2. Compare the topography of Australia with that of the United States.
3. Why is the raising of sheep and dairy cattle more important in Australia and New Zealand than other types of farming?
4. Why is Australia a leading exporter of grain?
5. What is the importance of minerals in the settlement of Australia?
6. How does Australia rank as a producer of wool?
7. What are the main cities of New Zealand?

PROBLEMS AND PROJECTS

1. Account for the development of Java over that of the other East Indian islands.
2. Make a table comparing Australia and the United States as to size, latitude, products, rivers, and population.

3. Explain the distribution of population in Australia.
4. Contrast and compare the sheep-raising industry of Australia with that of New Zealand.
5. Why does a large part of the Australian population live in cities?
6. Why is the foreign commerce of New Zealand relatively large?
7. Why was Australia slow in developing her iron and steel industry?
8. Why is there little immigration into Australia?
9. Why should the United States continue to cultivate Australia as a market?

TOPICS

1. Wool production in New Zealand and Australia.
2. Rubber plantations on the Malay Peninsula.
3. The refrigerator ship.
4. The importance of tin.
5. The commercial value of the Dutch East Indies to Holland.
6. The importance of the dairy industry in Australia and New Zealand.
7. Australia and New Zealand as markets for goods of the United States.
8. The sugar industry in Australia.
9. The importance of the meat industry in New Zealand.

FOR CLASS DISCUSSION

1. New Zealand will develop a highly industrialized type of life in the future.
2. An obstacle to the industrial development of Australia is the small home market.
3. Irrigation of the arid and semiarid parts of Australia is impracticable.
4. Australia will become an important manufacturer of both wool and cotton textiles.
5. Australia and New Zealand serve the needs of the British Isles better than do any other British dominions.
6. Java is the most prosperous island of the East Indies.
7. Singapore occupies the most strategic position of all the cities in the area including the East Indies and the Malay Peninsula.

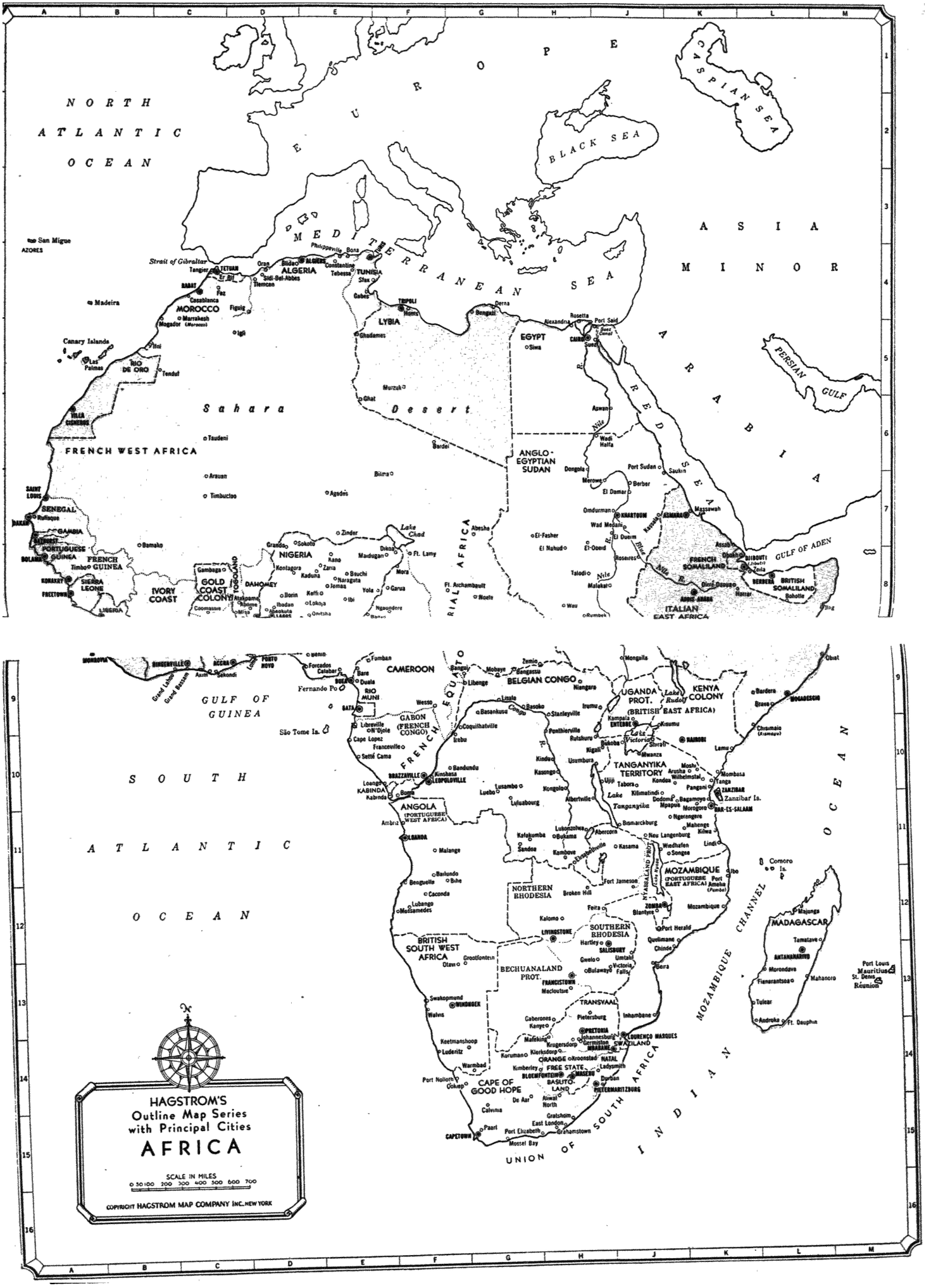
CHAPTER XXV

AFRICA

In General. Africa is probably the least known of all the continents. For hundreds of years Europeans heard stories of the fabulous wealth of Africa, of the rich Arab traders, of the gold and spices to be obtained there. Adventurers went in search of these riches, but many of their expeditions were unsuccessful. One of the greatest obstacles they encountered in trying to go into the continent was the presence of waterfalls in all the large streams, which made it impossible to go far into the interior. Centuries passed. Africa remained impenetrable while other new lands like America and Australia were discovered and settled.

The larger part of Africa is now well known, although there are still a few unmapped and unknown areas. Modern motor transportation has made most parts of the continent accessible, and airways give regular service to and from Europe and Asia. Aerial surveys have contributed greatly to our knowledge of the lesser known parts of Africa.

Topography. The continent of Africa is largely a vast plateau, from one to six thousand feet in elevation. On the eastern side of the plateau there are extensive areas of higher land, six to twelve thousand feet, with peaks rising to nineteen thousand feet. In the highlands of East Africa there are also a number of large and important lakes; for example, Lake Victoria ranks among the world's largest lakes. The Tibesti Highlands vary the topography of the Sahara Desert, while the Atlas Mountains in the northwest and the Drakensberg in the southeast are important locally. Large sections of the plateau have inferior drainage, but there are several large rivers that plunge over the edge of the plateau to the narrow coastal plain below and flow out to the sea. The Nile River, flowing many miles through a narrow valley cut through the rock, contains cataracts that interrupt river transportation.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ARABIA
ASIA MINOR
RED SEA
PERSIAN GULF
GULF OF ADEN
GULF OF GUINEA
MOZAMBIQUE CHANNEL
Sahara Desert
FRENCH WEST AFRICA
MOROCCO
ALGERIA
TUNISIA
LIBYA
EGYPT
ANGLO-EGYPTIAN SUDAN
SENEGAL
GAMBIA
PORTUGUESE GUINEA
FRENCH GUINEA
SIERRA LEONE
LIBERIA
IVORY COAST
GOLD COAST COLONY
TOGOLAND
DAHOMEY
NIGERIA
CAMEROON
FRENCH EQUATORIAL AFRICA
GABON (FRENCH CONGO)
RIO MUNI
BELGIAN CONGO
UGANDA PROT.
KENYA COLONY (BRITISH EAST AFRICA)
TANGANYIKA TERRITORY
ANGOLA (PORTUGUESE WEST AFRICA)
NORTHERN RHODESIA
SOUTHERN RHODESIA
BECHUANALAND PROT.
BRITISH SOUTH WEST AFRICA
MOZAMBIQUE (PORTUGUESE EAST AFRICA)
NYASALAND PROT.
UNION OF SOUTH AFRICA
CAPE OF GOOD HOPE
NATAL
TRANSVAAL
ORANGE FREE STATE
BASUTOLAND
SWAZILAND
ITALIAN EAST AFRICA
FRENCH SOMALILAND
BRITISH SOMALILAND
MADAGASCAR
Canary Islands
Madeira
AZORES
Strait of Gibraltar
Lake Chad
Lake Victoria
Lake Tanganyika
Lake Rudolf
Nile R.
Niger R.
Congo R.
Zambezi R.
Orange R.
Limpopo R.
Red Sea
Suez Canal
Persian Gulf
Gulf of Aden
Mozambique Channel
Indian Ocean
Cape of Good Hope
Cape Town
Port Elizabeth
East London
Durban
Pietermaritzburg
Johannesburg
Pretoria
Salisbury
Bulawayo
Victoria Falls
Livingstone
Lusaka
Ndola
Elisabethville
Leopoldville
Brazzaville
Stanleyville
Coquilhatville
Kisangani
Kampala
Entebbe
Kisumu
Nairobi
Mombasa
Zanzibar
Dar-es-Salaam
Tanga
Lourenco Marques
Beira
Quelimane
Port Herald
Blantyre
Zomba
Tete
Mozambique
Port Amelia
Lobito
Benguela
Nova Lisboa
Luanda
Matadi
Boma
Pointe Noire
Brazzaville
Libreville
Port Gentil
Douala
Fernando Po
São Tome Is.
Comoro Is.
Mauritius
Réunion
Port Louis
Tananarive
Majunga
Tamatave
Diego Suarez
Fianarantsoa
Morondava
Tulear
Androka
Ft. Dauphin
Mahanoro
Tripoli
Benghazi
Cairo
Alexandria
Port Said
Suez
Khartoum
Omdurman
Wadi Halfa
Aswan
Port Sudan
Asmara
Massawah
Addis Ababa
Dire Dawa
Harrar
Djibouti
Berbera
Mogadiscio
Kano
Ibadan
Lagos
Accra
Kumasi
Sekondi
Takoradi
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Dakar
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Rio de Oro
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Fez
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Agadir
Oran
Algiers
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Bone
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Constantine
Tebessa
Biskra
Tlemcen
Sidi-Bel-Abbes
Gabes
Sfax
Tunis
Misurata
Homs
Derna
Bengasi
Siwa
Ghadames
Ghat
Murzuk
Bilma
Agades
Zinder
Maiduguri
Dikoa
Ft. Lamy
Mora
Garua
Yola
Ibi
Makurdi
Jos
Kaduna
Kontagora
Zaria
Sokoto
Gando
Bamako
Timbuctoo
Araouan
Taudeni
Tendut
Figuig
Igli
Ouargla
Biskra
Constantine
Bougie
Philippeville
Bona
Tunis
Sfax
Gabes
Tripoli

The Niger River drains a large part of the Sudan; the Congo and its tributaries on the plateau afford thousands of miles of navigable waterways. The fourth large river is the Zambesi, which flows southeastward and is particularly famous for the Victoria Falls. The Senegal and Gambia rivers, while not so large as any of the four already mentioned, are highly valued for their deep natural harbors and strategic locations. A compact continent with a smooth regular coastline, Africa has few good natural harbors.

Climate and Vegetation. The varied climates of Africa are influenced by the compact character of the land mass, topography, and location with reference to the equator.

The lowlands of the equatorial region are characterized by high temperatures, high humidity, heavy rainfall, and practically no seasonal change. Vegetation is luxuriant, and there are large areas of tropical forest. North and south of the rainy tropics are regions that have definite seasonal contrasts in both temperature and rainfall, and in which grasses predominate as vegetation types; these regions are known as savannas.

A large part of Africa is influenced by the trade winds. These warm winds, blowing toward the equator, absorb moisture and thus make the areas over which they blow semiarid or desert. Africa contains two great deserts—Kalihari and Sahara—which have scanty vegetation except in the oases where sufficient water may be obtained for plant growth, or crops such as dates, barley, and figs.

The northwest coast, including the Atlas Mountains, is Mediterranean in its climate, with mild temperatures and winter rainfall. In this area the native vegetation is drought-resistant, as the olive and cork oak. In the southwestern part of Africa, with Cape Town as its center, there is another region having a Mediterranean climate. In contrast, the southeast coast is humid subtropical, with higher humidity and heavier rainfall, similar to southeastern United States. In the eastern highlands both climate and vegetation vary with elevation and exposure. In general, however, this is the region that is described as a white man's land in the tropics, because of the

lower temperatures. The chief European developments in commercial agriculture are in the eastern highlands.

Zones of vegetation in Africa are mainly a response to climate; the types vary with distance from the equator and with elevation above sea level.

Population and Transportation. The population pattern of Africa is influenced by climate, soils, and vegetation. The rainy, tropical areas, which are too hot and moist, and the deserts, which are too dry, are sparsely populated. Larger numbers of people settle in the tropical highlands because of the lower temperatures and more pleasant living conditions. The savanna lands support a fairly dense population by grazing and agriculture. This region tends to be overpopulated, especially in the Sudan, and occasional droughts cause severe famines. Nigeria, the most densely populated of all the tropical states, is supported by agriculture, grazing, and mining.

Three areas of greater concentration are Egypt, the Barbary Coast, and the Union of South Africa. Since most of Egypt is desert, its fifteen million people are concentrated in the Nile Valley where water may be obtained for irrigating the fields. In the Barbary states—Morocco, Algeria, and Tunisia—the dense population is supported chiefly by agriculture and mining. The Union of South Africa has about ten million people, mainly along the coast from Cape Town to Durban. There are also several large mining centers in the interior.

The population of Africa is about one hundred and fifty million. Although Europeans control most of the continent, they account for only a small percentage of the total number of people.

The transportation pattern is a response to topography and climate, plus population demands. In the sparsely populated areas, human porters and camel caravans are often used. In the more heavily settled areas in north and south Africa, railway systems have been developed. Elsewhere railroads serve the chief purpose of transporting goods of all types to the coast for export. There is an east-west railway serving the mining district of the Belgian Congo and the plantations of east Africa; commodities go west to Benguela, or east to

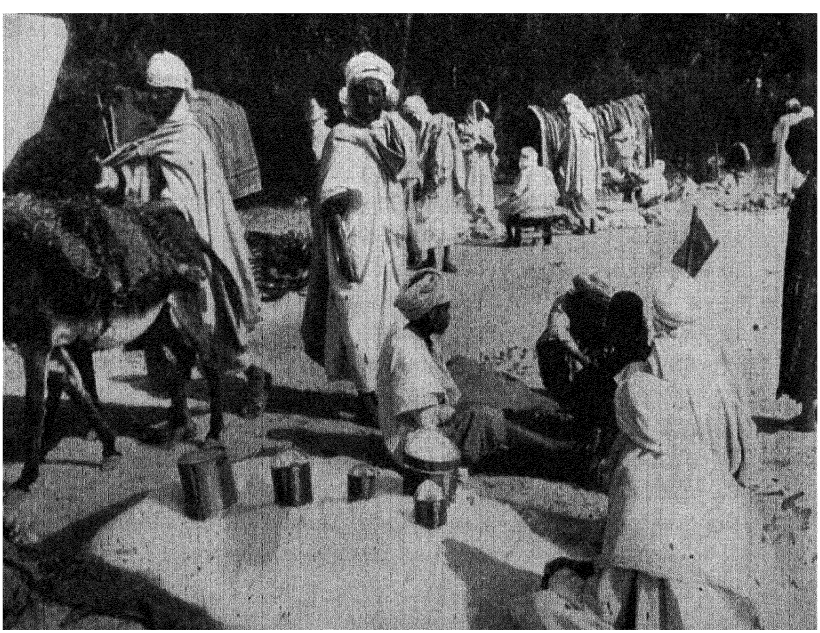
Beira or Dar es Salaam. Railway mileage is steadily increasing. Motor and air transportation supplement railways, and are destined to be even more important in the future.

Northwest Africa. This region contains the political units known as Morocco, Algeria, and Tunisia. In the coastal areas of all three the climate is Mediterranean type, with moderate rains during the winter months. In the interior, mountain barriers and distance from the sea combine to produce a variety of climates. South of the Atlas Mountains the rainfall decreases rapidly; in fact, the desert begins almost at once on the southern slopes.

Native vegetation and cultivated crops both show considerable variation. Along the Mediterranean agriculture is well developed, olives are widely grown for subsistence, and winter vegetables are produced for the European markets. This is also an important grape and wine area. In the mountainous interior tree crops are common and, where there is suitable

A market scene in Algeria. The merchant in the foreground has salt heaped upon a cloth and is selling it from measures.

Underwood and Underwood



pasturage, sheep and goats are kept. The Algerian Plateau is an important wheat and barley area. Farther south in the desert agriculture is possible only in the oases; here sufficient water is available for dates, barley, apricots, and certain vegetables. In the drier areas people tend to be migratory. Most nomads keep camels and sheep and depend upon animals and animal products for their livelihood.

Algeria and Tunisia have some minerals; the most valuable are iron ore and phosphates.

Egypt. In ancient times a high civilization developed in the Nile Valley, which is the most habitable portion of Egypt. The Egyptians developed an orderly government and an efficient system of agriculture, erected impressive buildings and pyramids, worked metal, wove fine linens, made paper and glass, and developed printing. Egyptian civilization, based on agriculture, flourished for centuries. Now, however, countries with coal and iron have taken the leadership in world affairs, and Egypt has declined in prestige.

Since the opening of the Suez Canal in 1869, the Mediterranean-Suez Canal route to the Far East has become the second most important trade route in the world. Each year thousands of ships pass through this hundred-mile canal, which has no locks.

Egypt has always depended primarily upon agriculture. Thousands of years ago the Egyptians developed irrigated agriculture in the lower Nile Valley. At first they merely took advantage of the annual overflow of the Nile, which not only watered the land but also enriched it by depositing silt. When all the land that could be flooded in this way had been cultivated, they developed basins for storing and ditches for distributing the water. In the twentieth century large, modern irrigation works have been built by the British in order to (1) regulate the flow of the river for navigation purposes and (2) increase the amount of cultivated land. The Aswan Dam, completed in 1902, was the first of these large projects; it added about one and one-half million acres to the farm land. This dam has been enlarged twice, and five or six other large dams and reservoirs have been constructed on the Nile.

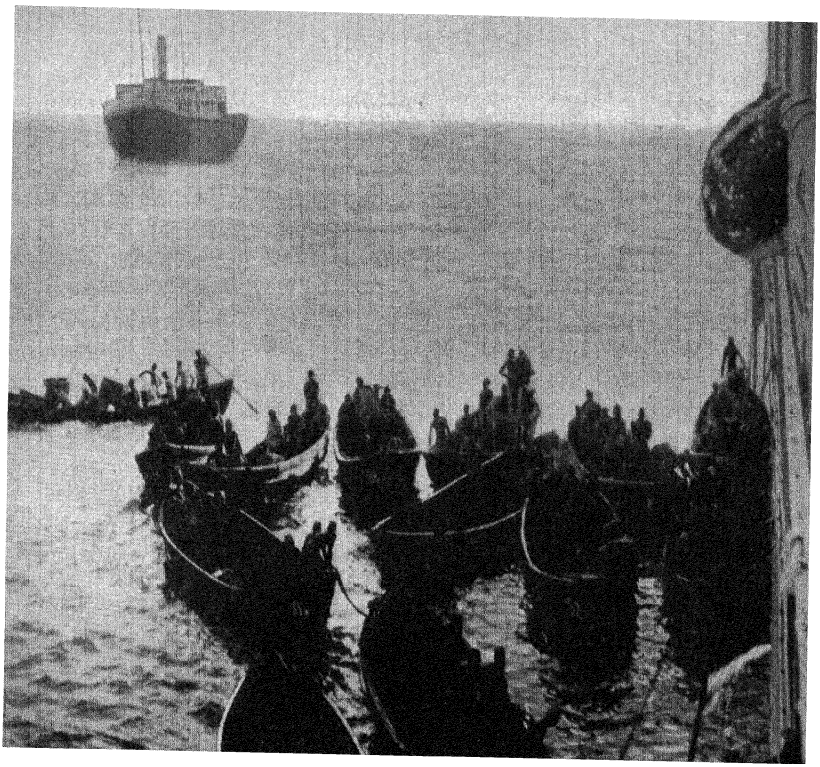
Cotton is the principal crop; Egypt ranks fifth in world production. Because of its long fiber Egyptian cotton commands a high price in the world markets. Other leading crops are sugar cane, corn, beans, millet, lentils, onions, dates, and rice. Every bit of land that can be watered is carefully tilled, and two or three crops per year are harvested. The most crowded area is the delta of the Nile, where more than one thousand people per square mile are supported by agriculture.

Cairo, the capital, is located at the head of the delta and has a population of over one million. Alexandria and Port Said are leading ports.

Outside the Nile Valley there are a number of oases, each supporting several thousand people. There are also some forty thousand pastoral nomads in the drier portions of Egypt.

Equatorial Africa. The Sudan is a broad band of grassland or savanna extending from the west coast of Africa eastward to the Ethiopian highlands. On its southern border, bush and scrub forest finally merge with the tropical forest. Because of the alternate wet and dry seasons, such crops as millet, sorghums, beans, and peas are common. In the better watered lands, and especially where irrigation is possible, as along the Niger and Nile rivers, cotton is an important crop. Both France and England are encouraging the cultivation of cotton in the Sudan in order to obtain a larger supply for their own factories. In addition, many of the native peoples keep cattle.

South of the Sudan, the tropical forest is found in French Equatorial Africa and the Belgian Congo. Smaller forested areas are in Nigeria and other Guinea coast countries. Over large areas the forest is practically impenetrable, and all transportation is by waterways. Settlements are along the streams. The tropical forest is less valued for timber than for forest products. The Belgian Congo produces some wild rubber, and plantation production has started. There is a valuable export trade in gums, palm oil, palm kernels, and copra. In many areas the natives carry on subsistence agriculture. In a few places the emphasis is on commercial agriculture; the Gold Coast and Nigeria, for example, produce more than half of the world's crop of cacao. Peanuts are also grown commercially.



Hershey Chocolate Corporation

Loading cacao beans at Akkra, in the Gold Coast Colony of Africa. Because of the shallowness of the water, the boats stand far out from land and are loaded from the small rowboats of the natives.

Equatorial Africa has valuable mineral deposits in the gold and manganese of the Gold Coast, tin in Nigeria, and copper in the Katanga district of the Belgian Congo. Katanga is one of the half dozen leading copper producers.

Much of the eastern horn of Africa is semiarid or desert, except where elevation modifies the climate of the Ethiopian highland. Italy now controls the larger part of the eastern horn, except for British and French Somaliland. From the port of Djibouti, in French Somaliland, a railway climbs to the plateau to Addis Ababa, capital of Ethiopia.

Equatorial Africa is inhabited chiefly by negroid peoples. Partly because of the easy environment in which they live and partly because of their scant need for manufactured goods, many natives dislike to work steadily for wages. Europeans, who have taken the leadership in the organization and develop-

ment of plantation agriculture and mining, have at times found it difficult to obtain an adequate supply of labor. Population is relatively sparse and, because of the common distaste for regular and exacting work, Europeans have been forced to recruit workers from a distance and to provide housing facilities for them on plantations and in mining camps. During the last century increasing numbers of Europeans have been attracted to Equatorial Africa as traders, or in order to exploit the valuable resources. Europeans, however, account for only a small percentage of the total population.

South Africa. In South Africa the European population is larger than that in most other parts of the continent, but even here Europeans represent only one fifth of the total population of ten million.

The major part of South Africa is not well suited to agriculture because of the very small amount of rainfall. The eastern section, however, receives sufficient rainfall so that farming can be carried on, mainly by descendants of the Dutch and by some of the more progressive natives. Irrigation is a matter of great importance, although relatively little has been accomplished in this respect. Corn is the chief farm crop. Other crops are sugar cane, citrus fruits, tobacco, wheat, and cotton. These crops are not large, and in some cases, like that of wheat, are not sufficient to satisfy domestic needs.

The most profitable phase of agriculture in this region is the raising of livestock. Millions of sheep and cattle find excellent pasturage on the grassy plains. A unique and original variation of South African farming is the production of ostrich feathers.

The most valuable resource in South Africa is minerals. This region is the chief source of diamonds; more than ninety-five per cent of the diamonds in the markets of the world come from South Africa. The most famous field is around Kimberley, in Cape of Good Hope. The largest single mine is near Pretoria. The annual output of rough diamonds is valued at many millions of dollars; this value is increased greatly after the rough stones have been cut and polished in Amsterdam, Antwerp, or New York. Since diamond mining is con-

trolled by one company, the number marketed is strictly limited in order to maintain fairly uniform prices.

Gold was found in South Africa more than a hundred years ago, but not until 1885 was the richest gold field discovered in the Transvaal. More than one third of the gold mined in the world comes from this province. Other minerals of importance are coal, iron, copper, lead, zinc, silver, tin, manganese, and chrome. Of these, coal is perhaps the most important in that it has enabled many of the gold mines to be operated at a profit. This mineral is found chiefly in the Transvaal, Orange Free State, and Natal.

Railway building has been somewhat handicapped in South Africa by the elevation of the plateau and of the mountains and the consequent difficulty of building roads into the interior. There are about fourteen thousand miles of railways, connecting the ports in the South and the East with the cities on the Veldt. Many of the roads, particularly those of Natal, have been electrified. All the roads are narrow-gauged and are controlled by the government.

The chief cities are the ports of Cape Town, Port Elizabeth, and Durban, the inland mining towns of Johannesburg and Kimberley, and Pretoria, the capital.

The foreign trade of South Africa reflects economic activities—eighty per cent of the exports are products of mines. Imports consist mainly of foodstuffs, machinery, and various manufactured products. There is very little manufacturing here, although a start has been made in the manufacture of boots and shoes and woolen goods. As in the case of other British dominions, the bulk of South African trade is with Great Britain.

TEXT QUESTIONS

1. Why is the continent of Africa less well known than others?
2. Summarize the geographic advantages and disadvantages of Africa.
3. What are the chief products of northern Africa?
4. What are the chief products of equatorial Africa?
5. Describe the various geographic divisions of Africa.

PROBLEMS AND PROJECTS

1. Compare South Africa with Mexico as to population and minerals.
2. Discuss the conditions that favor, and limit, the large-scale production of cacao and rubber in equatorial Africa.
3. Is Victoria Falls in Africa likely to prove as valuable for power development as Niagara Falls?
4. Why does the Kalahari Desert extend only part way across southern Africa, while the Sahara Desert extends across all of northern Africa?
5. Why is there no north-south transcontinental railway in Africa?
6. What animal industries have the South Africans developed? In what sections of our country have the same industries been developed to a limited degree?
7. Why are the rivers of Africa of relatively little commercial importance?

TOPICS

1. Transportation possibilities across the Sahara Desert.
2. The importance of the Suez Canal.
3. The diamond mines of South Africa.
4. The importance of the Nile for agriculture.
5. The difficulties of plantation farming in Africa.
6. The effect of the trade winds.
7. The importance of Ethiopia to Italy.

FOR CLASS DISCUSSION

1. The Cape to Cairo Railway, if completed, can never be a great commercial highway.
2. The economic development of the continent of Africa is almost entirely controlled by Europeans.
3. Italy should have a representative on the board of the corporation that governs the Suez Canal.
4. Equatorial Africa has greater economic possibilities than equatorial South America.
5. The keynote of the development of Africa is transportation.

APPENDIX

CEREALS

WHEAT

Leading States in Wheat Production

In Thousands of Bushels

Table 1

States	Average 1924-28	Average 1929-38	1938	1939	1940 [1]
Ohio	27,153	40,211	46,420	37,150	42,137
Indiana	26,037	30,321	28,848	27,612	32,147
Illinois	35,075	36,387	41,792	41,472	40,155
North Dakota	122,600	65,828	76,384	79,068	97,054
South Dakota	33,537	22,628	28,377	18,990	26,221
Nebraska	54,508	45,081	55,714	36,376	34,821
Kansas	137,983	135,972	152,184	111,657	123,848
Montana	58,210	34,255	69,522	51,473	56,070
Idaho	24,125	24,624	32,332	21,311	24,383
Washington	39,207	44,421	54,590	43,822	41,808
Oklahoma	52,072	46,763	61,677	60,438	56,332
Texas	22,749	32,958	35,046	29,032	29,355
Oregon	20,754	19,285	23,496	16,108	17,184
Minnesota	26,674	22,622	38,948	22,108	32,069
Missouri	20,822	25,561	31,600	30,429	31,707
United States	828,647	754,685	931,702	751,435	816,698

U.S.D.A. [1] Preliminary.

Leading Countries in Wheat Production

In Thousands of Bushels

Table 2

Countries	Average 1925-29	Average 1930-34	1938	1939	1940 [1]
Russia	790,863	924,536	1,500,000	———	———
United States	822,712	732,629	931,702	751,435	816,698
China	———	820,624	640,000 [3]	667,000 [3]	700,000
India	320,462	355,593	401,856	371,952	402,603
Canada	430,704	348,560	360,010	520,623	551,390
France	291,354	305,318	360,121	273,470	———
Argentina	243,028	243,932	379,142	119,453	271,173
Italy	226,181	252,604	300,701	293,210	268,226
Australia	136,006	185,773	155,369	210,284	83,192
World [2]	5,302,000	5,540,000	6,587,000	6,212,000	6,067,000

[1] Preliminary. [2] Estimated by U.S.D.A. [3] Unofficial.

Principal Wheat-Exporting and Wheat-Importing Countries

In Thousands of Bushels
(Including Flour in Terms of Grain)

Table 3

Exporting Countries	Average 1925-29	Average 1930-34	1937	1938	1939 [1]
Canada	307,640	220,491	94,546	159,885	210,212
United States	170,077	73,403	100,060	106,645	44,868
Argentina	159,377	143,537	69,670	116,116	177,561
Australia	83,268	128,363	123,454	96,423	80,161
Hungary	23,539	17,123	9,102	27,875	40,358
Russia	17,731	48,272	43,354	—	—
British India	10,080	4,129	19,677	10,097	2,368
Rumania	6,528	11,482	32,259	42,863	34,138
Yugoslavia	10,822	5,421	5,011	5,352	6,687
Importing Countries					
United Kingdom	215,655	299,584	197,509	224,804	49,190 [3]
Germany	85,668	28,388	46,206	37,452	—
Italy	76,212	36,469	10,826	18,427	2,642 [4]
France	46,574	53,674	19,483	17,978 [2]	—
Belgium	43,482	47,186	40,927	42,986	21,181 [5]
Brazil	32,839	32,026	36,545	39,578	34,261
China	23,486	42,162	7,702	28,269	22,153
Japan	23,158	21,740	4,693	10,491	2,139
Netherlands	30,050	28,488	24,318	28,947	22,505
Greece	20,055	18,583	17,563	13,547	12,511

[1] Preliminary. [2] In 1928 France exported almost as much as she imported. [3] 2 months only; later data not available. [4] 1 month; only data available. [5] 6 months; only data available.

CORN

Corn Production

Table 4

Leading States	Production in Thousands of Bushels				Yield per Acre in Bushels 1940 (Average)[1]
	Average 1924-28	Average 1929-38	1939	1940 [1]	
Iowa	417,713	394,166	494,312	460,581	51.0
Illinois	328,470	311,056	413,296	332,244	44.0
Nebraska	213,537	149,599	82,032	106,913	17.0
Missouri	180,603	107,653	120,118	119,280	30.0
Indiana	165,420	152,216	213,416	145,669	37.0
Kansas	140,024	67,786	37,220	41,028	15.5
Minnesota	135,170	138,187	204,796	172,457	39.5
Ohio	128,042	134,812	171,250	120,750	37.5
United States	2,625,063	2,299,342	2,602,133	2,449,200	28.3

Selected Countries	Production in Millions of Bushels				
	1936	1937	1938	1939	1940 [1]
United States	1,507	2,651	2,562	2,602	2,449
Danube Valley	561	540	514	527	498
Argentina	340	174	191	408	411
Italy	120	134	116	102	135
Brazil	225	228	239	234	—
Russia	163	153	106	—	—
World [2]	4,052	4,980	4,879	5,108	5,054

[1] Preliminary. [2] Estimated total including Russia.

RICE

Rice Production

Table 5

Leading States	Production in Thousands of Bushels				Yield per Acre in Bushels
	Average 1924-28	Average 1929-38	1939	1940 [1]	1940 [1]
Arkansas	8,097	8,320	8,430	9,741	51.0
Louisiana	16,944	18,316	21,120	18,040	40.0
Texas	6,952	9,770	15,172	16,005	55.0
California	6,856	7,848	9,000	8,968	76.0
United States	38,850	44,254	52,722	52,754	50.2

Selected Countries	Production in Millions of Pounds				
	1936	1937	1938	1939	1940 [1]
India and Burma	71,199	67,903	63,192	65,334	———
Japan	21,146	20,835	20,693	21,665	19,124
Chosen (Korea)	6,098	8,418	7,583	4,510	6,659
Taiwan (Formosa)	3,003	2,977	3,084	2,875	2,482
French Indo-China	8,595	9,585	9,708	6,276	6,260
Java and Madura	8,696	8,733	17,931	18,225	19,107
Thailand (Siam)	4,600	6,156	6,206	6,917	———
Philippines	3,260	3,102	3,231	2,492	3,014
United States	1,384	1,483	1,458	1,492	1,465
World [2]	138,000	139,000	133,000	134,000	———

[1] Preliminary. [2] Estimated excluding China

MISCELLANEOUS CEREALS

Oats Production

Table 6

Leading States	Production in Thousands of Bushels				Yield per Acre in Bushels
	Average 1924-28	Average 1928-38	1939	1940 [1]	1940 (Average) [1]
Iowa	233,326	191,235	155,496	206,640	40.0
Minnesota	153,293	132,787	151,652	180,795	42.5
Illinois	144,486	119,452	92,520	152,496	48.0
Wisconsin	94,993	76,147	71,012	96,793	43.0
South Dakota	72,267	39,538	43,929	53,240	27.5
Nebraska	65,398	48,256	20,576	35,760	24.0
Ohio	75,086	44,220	33,150	44,880	44.0
Indiana	62,818	43,936	25,225	49,950	45.0
United States	1,277,127	1,024,852	935,942	1,235,628	35.5

Selected Countries	Production in Millions of Bushels				
	1936	1937	1938	1939	1940 [1]
Russia	923	1,506	1,171	———	———
United States	786	1,162	1,068	936	1,236
Germany	387	408	439	437	———
Canada	289	285	395	408	404
France	290	299	376	363	284
Poland	182	161	183	198	———
England & Wales.	76	66	75	78	———
Argentina	55	47	50	60	37
Estimated World.	3,865	4,842	4,710	4,499	4,576

[1] Preliminary.

Barley Production

Table 7

Leading States	Production in Thousands of Bushels			
	Average 1924-28	Average 1929-38	1939	1940 [1]
Minnesota	38,045	43,217	59,808	57,348
California	24,460	29,590	30,850	33,516
North Dakota	37,630	25,478	28,962	28,064
South Dakota	22,797	24,661	24,633	30,821
United States	218,868	225,486	274,767	309,235

Selected Countries	Production in Millions of Bushels				
	1936	1937	1938	1939	1940
Russia	429	487	377	—	—
United States	147	220	253	275	309
Germany	156	167	195	182 [2]	—
Hungary & Rumania	104	68	71	74	58
India	109	108	97	87	—
North Africa	114	85	92	175	—
Spain	79	70 [3]	34	65	92 [3]
Canada	72	83	102	103	104
Japan	69	72	64	82	70
World [3]	2,301	2,347	2,411	2,547	2,500

[1] Preliminary. [2] Including Sudetenland and Memel. [3] Estimate.

Rye Production

Table 8

Leading States	Production in Thousands of Bushels			
	Average 1924-28	Average 1929-38	1939	1940 [1]
North Dakota	16,277	7,865	7,000	9,776
Minnesota	7,076	6,533	7,350	5,598
South Dakota	2,049	4,555	4,752	5,640
Wisconsin	3,065	2,768	2,380	2,509
Nebraska	2,448	3,008	3,568	2,608
Michigan	2,501	1,850	1,512	1,260
United States	44,081	38,095	39,049	40,601

Selected Countries	Production in Millions of Bushels				
	1936	1937	1938	1939 [1]	1940 [1]
Russia	—	1,159	—	—	—
Germany	291	272	339	372 [3]	—
Poland	251	222	286	300	—
France	28	29	32	—	—
Hungary	28	24	32	34 [4]	30 [4]
Czechoslovakia	57	58	75	—	—
United States	25	50	56	39	41
World [2]	903	895	1,079	1,064	—

[1] Preliminary. [2] Official estimates, excluding China and Russia. [3] Includes Austria, Sudetenland, and Memel. [4] Territory within new boundaries.

BEVERAGES

COFFEE

Principal Coffee-Exporting and Coffee-Importing Countries

In Thousands of Pounds

Table 1

Exporting Countries	Average 1925-29	Average 1930-34	1937	1938	1939 [1]
Brazil	1,865,392	1,975,720	1,603,557	2,263,586	2,182,365
Netherland Indies	187,523	175,039	76,303	152,035	145,834
Colombia	324,155	418,078	546,135	559,404	489,730
El Salvador	96,466	114,182	147,620	118,607	122,995
Venezuela	118,217	120,925	———	79,123	59,590
Guatemala	100,953	98,394	103,881	108,069	96,782
Importing Countries	**1935**	**1936**	**1937**	**1938**	**1939 [1]**
United States	1,755,809	1,739,191	1,697,100	1,987,144	2,014,279
France	415,686	411,361	409,103	410,807	———
Germany	325,554	342,616	392,169	435,339	———
Netherlands	81,625	71,459	84,932	114,984	100,625
Italy	89,301	70,203	83,223	78,561	———
Belgium	107,986	115,512	112,768	113,913	120,740
Sweden	106,853	102,954	104,410	116,310	———

[1] Preliminary.

TEA

Principal Tea-Exporting and Tea-Importing Countries

In Thousands of Pounds

Table 2

Exporting Countries	Average 1925-29	Average 1930-34	1937	1938	1939 [1]
British India	364,848	354,412	343,733	365,927	339,306
Ceylon	228,444	234,931	213,133	235,739	228,059
Netherland Indies	124,947	142,385	138,402	154,188	162,177
China	116,300	91,888	88,550	89,109	49,340
Japan	24,631	27,303	54,195	37,039	51,756
Taiwan (Formosa)	20,431	16,836	22,467	22,374	16,486
Importing Countries					
United Kingdom	429,507	449,885	417,808	460,621	354,156
United States	93,052	87,876	94,817	81,372	97,746
Australia	49,242	46,542	42,379	48,671	51,632
Russia	43,287	46,739	33,490	36,914	———
Canada	38,268	40,474	40,122	37,591	43,394
Netherlands	26,144	29,754	26,546	28,687	34,559
Ireland	23,221	23,614	24,014	22,603	———

[1] Preliminary.

SUGAR

Leading Producers of Sugar Beets

Table 1 In Thousands of Short Tons

Leading States	Average 1924-28	Average 1929-38	1939	1940 [1]	Yield per Acre 1940 [1]
Michigan	773	792	1,033	1,022	9.1
Nebraska	933	897	790	933	13.3
Montana	321	700	894	1,166	14.0
Idaho	303	600	985	1,141	16.1
Colorado	2,446	2,248	1,543	2,092	14.9
Utah	671	602	683	504	10.5
California	551	1,418	2,707	2,803	16.2
United States	7,389	8,937	10,781	12,192	13.3
Leading Countries	**Average 1925-29**	**Average 1930-34**	**1939**	**1940 [1]**	**Yield per Acre 1940 [1]**
Germany	11,856	11,642	19,109 [2]	23,000 [2]	11.5 [2]
France	6,367	8,704	9,370	3,858	5.7
United States	7,355	8,945	10,781	12,192	13.3
Czechoslovakia	7,952	5,171	4,050 [3]	———	12.8 [3]
Italy	2,373	2,825	4,046	5,890	13.8
Poland	4,609	3,147	———	———	———
Russia	9,075	11,680	23,167	26,455	9.0
Great Britain	1,425	3,215	———	———	———
Netherlands	2,317	1,886	1,892	2,039	16.9
All Countries [4]	64,489	69,793	93,093	99,405	10.4

[1] Preliminary. [2] Includes Sudetenland and Austria. [3] Bohemia, Moravia, Slovakia. [4] Estimated.

Sugar Production in the United States

Table 2 In Short Tons

Regions	1936	1937	1938	1939	1940 [1]
Cane Sugar:					
Continental U. S.	437,000	462,000	583,000	504,000	336,000
Puerto Rico	996,303	1,077,149	851,969	1,018,803	907,564
Hawaii	944,382	941,293	994,173	968,912	968,800
Philippines	1,186,184	1,115,574	1,149,376	1,141,841	1,282,440
Virgin Islands	8,478	3,923	5,936	7,236	8,400
Beet Sugar	1,395,000	1,378,000	1,803,000	1,758,000	1,884,000
All Sugar	4,967,347	4,977,939	5,387,454	5,398,792	5,387,204

[1] Preliminary.

Sugar Production in Selected Countries and Estimates of All World

Table 3 In Thousands of Tons

Countries	1936	1937	1938	1939 [1]	1940 [1]
United States	1,832	1,840	2,386	2,262	2,220
Cuba	3,375	3,380	3,094	3,157	2,726
India [2]	7,494	6,143	4,581	5,977	5,560
Java	1,546	1,542	1,730	1,769	1,960
Germany	1,992	2,437	2,327	3,461	3,782
Czechoslovakia	802	817	585	———	———
Poland	504	619	602	———	———
France	934	1,023	937	1,102	386
World (cane sugar) [3]	23,995	22,830	21,714	23,019	22,127
World (beet sugar) [3]	11,197	12,137	11,559	12,433	12,587
World (all sugar) [3]	35,192	34,967	33,273	35,452	34,714

[1] Preliminary. [2] In terms of gur, an unrefined sugar. [3] Estimated.

Principal Sugar-Exporting and Sugar-Importing Countries

Table 4 — In Tons

Exporting Countries	Average 1925-29	Average 1930-34	1938	1939
Cuba	5,032,658	2,911,526	2,870,151	3,069,178
Netherland Indies	2,380,762	1,672,683	1,188,087	1,509,027
Czechoslovakia	792,566	381,607	280,249	—
Philippines	612,260	1,046,077	957,076	1,073,783
Dominican Republic	353,915	383,422	447,174	451,149
Peru	332,668	369,999	275,504	300,023
Australia	179,533	333,787	524,706	426,193
Mauritius	242,199	214,838	322,834	324,749
Importing Countries				
United States	4,428,566	3,102,806	2,976,559	2,903,319
United Kingdom	2,135,293	2,266,067	2,693,848	2,354,841
British India	904,568	555,898	11,183 [1]	308,545
China	823,225	495,504	114,310	248,861
Canada	524,446	441,572	483,769	521,178
France	460,753	435,730	349,432	—
Japan	414,134	158,690 [1]	42,320 [1]	905 [1]
Netherlands	316,951	142,193	174,249	181,021

[1] Exported more than she imported.

PLANT PRODUCTS

TOBACCO

Tobacco Production

Table 1

Leading States	Production in Thousands of Pounds				Yield per Acre in Pounds
	Average 1924-28	Average 1929-38	1939	1940 [1]	1940 [1]
North Carolina	403,133	496,101	821,207	526,505	1,043
Kentucky	330,574	320,407	346,138	338,477	1,002
Virginia	126,860	97,395	143,847	100,509	926
Tennessee	91,399	109,895	110,267	109,690	966
South Carolina	68,328	81,068	133,200	82,215	1,015
Pennsylvania	51,840	36,004	45,337	49,590	1,472
Connecticut	33,892	23,108	25,116	23,321	1,340
Wisconsin	38,868	30,559	23,391	36,260	1,480
Maryland	24,369	26,096	32,800	31,920	840
Georgia	52,632	67,464	95,986	76,420	1,060
Ohio	37,175	32,924	30,395	28,376	989
United States	1,298,947	1,360,661	1,874,407	1,451,966	1,033.9

Selected Countries	Production in Thousands of Pounds				
	Average 1925-29	Average 1930-34	1938	1939	1940 [1]
United States	1,356,486	1,236,559	1,375,823	1,874,407	1,451,966
Brazil	181,959	216,447	190,894	—	—
Russia	345,981	340,805	—	—	—
Italy	91,138	106,218	92,814	—	—
Greece	137,964	103,615	106,033	125,201	107,818
Turkey	114,531	84,740	117,201	124,560	135,583
India	1,135,680	1,071,616	1,094,240	—	—
Java & Madura	137,072	117,107	59,629	51,849	—
Japan (proper)	141,785	145,330	137,979	180,799	—
Cuba	61,488	56,447	55,232	45,067	56,130
World (Estimated)	4,916,000	4,904,000	4,948,000	5,630,000	—

[1] Preliminary.

THE POTATO

Potato Production

Table 2

Leading States	Production in Thousands of Bushels				Yield per Acre in Bushels
	Average 1924-28	Average 1929-38	1939	1940 [1]	1940 [1]
Maine	37,684	45,137	37,260	44,055	267
Minnesota	33,855	23,630	20,315	23,750	95
Michigan	26,510	25,778	24,250	20,640	86
New York	28,363	28,811	26,797	26,838	126
Pennsylvania	22,872	24,927	22,440	24,570	130
Wisconsin	26,308	22,208	17,336	15,054	78
Idaho	16,503	24,232	28,520	32,800	265
United States	361,115	366,949	363,159	397,722	130.3

Selected Countries	Production in Thousands of Bushels				
	Average 1925-29	Average 1930-34	1938	1939	1940 [1]
Germany	1,400,991	1,681,628	1,870,119	2,067,902 [2]	2,411,088 [3]
Poland	972,152	1,129,238	1,269,777	———	———
France	523,939	574,531	636,194	———	———
Czechoslovakia	312,867	336,044	361,151	———	———
United States	349,434	369,907	374,163	363,159	397,722
Russia	1,578,964	1,758,036	1,541,740	———	———
European Total	6,092,200	6,941,900	7,333,152	7,326,552	———
World Total	6,660,800	7,562,000	7,967,000	7,960,000	———

[1] Preliminary. [2] Includes Austria, Sudetenland, Memel. [3] Includes Austria, Sudetenland, Memel, Danzig, Western Prussia, and Wartheland.

FRUIT

Leading States in Citrus-Fruit Production

In Thousands of Boxes

Table 3

Crop and State	Average 1929-38	1937	1938	1939	1940
Oranges:					
California	34,875	45,914	41,420	44,404	45,340
Florida	19,470	26,200	33,300	28,000	31,100
Texas	947	1,440	2,815	2,360	2,750
Arizona	213	220	350	430	520
Louisiana	271	238	385	228	253
Grapefruit:					
California	1,668	1,943	1,924	1,975	1,863
Florida	14,000	14,600	23,300	15,900	24,600
Texas	5,065	11,840	15,670	14,400	13,800
Arizona	1,252	2,750	2,700	2,900	2,800
Lemons:					
California	8,228	9,304	11,106	11,963	13,588
Limes:					
Florida	28	70	95	95	80

Leading States in Apple Production

Table 4 Production in Thousands of Bushels

Leading States	Average 1927-36	1937	1938	1939	1940 [1]
Washington	31,372	29,346	30,150	26,000	28,804
New York	17,125	21,528	15,048	24,650	12,936
Virginia	11,533	14,898	8,648	10,800	10,325
Pennsylvania	9,465	11,567	8,378	10,998	9,100
California	9,288	9,339	7,364	8,024	6,608
Ohio	6,095	8,531	2,684	8,756	5,074
West Virginia	5,780	6,384	4,290	5,670	4,868
Oregon	4,590	3,320	3,400	2,900	3,160
Illinois	4,099	4,395	1,447	4,107	1,876
Michigan	7,731	10,026	5,251	10,501	5,967
Idaho	4,859	3,960	2,960	2,574	2,160
United States	180,262	156,376	109,595	143,085	115,456

[1] Preliminary.

Leading States in Grape Production

Table 5 In Short Tons

Leading States	Average 1929-38	1938	1939	1940 [1]
California	1,950,700	2,531,000	2,228,000	2,246,000
New York	74,910	55,600	75,600	75,800
Michigan	57,960	16,900	58,100	54,600
Ohio	27,430	9,800	42,800	37,500
Pennsylvania	21,770	15,700	23,200	23,000
United States	2,220,001	2,703,560	2,525,830	2,543,910

[1] Preliminary.

FOREST PRODUCTS

LUMBER

Table 1 *Lumber Production in the United States by Regions*

Regions	Production in Millions of Board Feet				Percentage of Distribution
	1935	1936	1937	1938	1938
Northeastern States	750	880	930	809	3.7
Central States	1,005	1,258	1,292	863	4.0
Southern States	7,829	9,528	10,292	9,359	43.2
Lake States	808	938	1,005	775	3.6
Rocky Mountain States	1,149	1,408	1,577	1,202	5.6
Pacific States	7,953	10,297	10,840	8,601	39.7
All Other States	45	46	60	37	.2
United States	19,539	24,355	25,997	21,646	100.0

Wood-Pulp Production in the United States

Table 2 In Thousands of Tons

Leading States	1936	1937	1938	1939
Washington	896	1,184	837	1,126
Maine	934	1,003	847	941
Wisconsin	605	638	586	656
Louisiana	474	506	454	590
New York	453	503	427	461
Other Southern States	753	1,006	874	1,033

RUBBER

Leading Rubber-Producing Regions

Table 3 In Long Tons

Leading Regions	1936	1937	1938	1939	1940
Middle East	833,656	1,108,717	864,098	985,141	1,353,052
Amazon Valley	14,216	15,576	14,293	13,968	17,661
Mexican Guayule	1,228	2,691	2,485	1,964	3,364
Africa	6,122	7,882	7,919	16,090	16,314
World	856,376	1,135,398	889,438	1,017,458	1,390,661

Leading Rubber-Importing Countries

Table 4 In Thousands of Pounds

Selected Countries	Average 1925-29	Average 1930-34	1938	1939
United States	1,009,851	1,024,129	923,086	1,118,820
United Kingdom	124,052	214,628	295,778	155,087
France	106,453	121,057	142,627	———
Germany	87,825	117,514	202,642	———
Canada	59,580	54,982	57,563	72,817
Japan	50,307	121,950	103,624	94,871
Italy	27,855	38,014	64,797	———

VEGETABLE FIBERS

COTTON

Cotton Production

Table 1

Leading States	Production in Thousands of Bales			
	Average 1924-28	Average 1929-38	1939	1940 [1]
Texas	4,840	3,876	2,846	3,234
Mississippi	1,562	1,619	1,582	1,250
Arkansas	1,298	1,283	1,413	1,501
Oklahoma	1,443	812	526	802
Alabama	1,228	1,200	785	779
Georgia	1,158	1,175	915	1,010
South Carolina	832	820	871	966
United States	15,028	13,547	11,817	12,566

Selected Countries	Production in Thousands of Bales.			
	1937	1938	1939 [1]	1940 [1]
United States	18,946	11,943	11,817	12,566
India	4,741	4,248	4,136	4,841
China	3,600	2,300	1,883	2,354
Russia	3,700	3,800	4,000	3,000
Egypt	2,281	1,728	1,801	1,900
Brazil	2,075	1,989	2,141	2,464
Peru	376	396	378	383
World [2]	36,625	29,125	28,950	30,230

[1] Preliminary. [2] Estimated, including China.

Principal Cotton-Exporting and Cotton-Importing Countries

Table 2 In Thousands of Bales

Exporting Countries	Average 1925-29	Average 1930-34	1937	1938	1939 [1]
United States	8,805	7,672	6,070	4,577	4,809
India	3,023	2,492	3,049	2,137	2,573
Egypt	1,480	1,510	1,836	1,643	1,889
Brazil	109	175	1,089	1,239	1,492
Peru	220	249	372	321	356
Importing Countries					
United Kingdom	3,208	2,487	3,348	2,429	2,589
Japan	3,108	3,289	3,794	2,589	2,789
Germany	1,819	1,668	1,129	1,153	——
France	1,638	1,320	1,299	1,280	——
Italy	1,072	987	763	724	——
China	636	878	*	*	1,143

[1] Preliminary. * Exports greatly exceeded imports.

ANIMAL FIBERS

WOOL

Leading Producers of Wool

Table 1

Leading States	Production in Thousands of Pounds				
	1936	1937	1938	1939	1940 [1]
Texas	64,265	75,835	79,305	77,290	80,352
Wyoming	29,952	30,361	31,389	32,932	33,271
Montana	29,351	24,892	25,245	26,885	29,946
California	26,897	25,962	28,237	29,132	27,280
Utah	19,488	19,221	19,909	19,444	20,581
Ohio	18,800	18,450	17,753	18,063	17,840
Oregon	17,957	17,501	17,499	16,901	16,446
New Mexico	15,904	15,394	15,400	15,168	15,944
United States	360,327	366,609	371,972	377,397	387,763

Selected Countries	Production in Millions of Pounds				
	Average 1925-30	Average 1931-35	1938	1939	1940 [1]
Australia	926.4	1,010.5	983.6	1,128.1	1,090.0 [2]
United States	364.3	432.1	436.5	441.9	449.8
Argentina	327.0	360.8	399.0	403.0	397.0
New Zealand	258.2	281.1	327.7	310.0	315.0
South Africa	294.1	269.5	248.0	246.2	260.0
Russia [2]	362.8	157.6	300.0	——	——
Uruguay	140.1	110.6	125.4	133.9	122.0
United Kingdom	112.4	114.4	111.5	111.8	——
World [2 3]	3,220.0	3,380.0	3,510.0	3,670.0	3,640.0

[1] Preliminary. [2] Estimated. [3] Exclusive of Russia and China.

SILK

Percentages of Production of Silk of Leading Countries

Table 2

Selected Regions	Estimated Percentages of Production of World Supply				
	1936	1937	1938	1939	1940
Japan	74.54	75.17	82.19	78.62	77.39
China	9 77	9 36	8.99	10.85	11.16
Near East	4.90	5.17	3.60	4.01	4.04
Italy	8.49	8.17	3 53	5.02	5.83
All Others	2.30	2.13	1.69	1.50	1.58
Total	100.00	100.00	100.00	100.00	100.00

CATTLE

States Leading in Number of Cattle

In Thousands of Cattle

Leading States	1936	1937	1938	1939	1940
Texas	6,861	7,547	7,245	6,955	6,677
Iowa	4,661	4,335	4,465	4,465	4,688
Nebraska	3,491	3,037	2,824	2,909	3,011
Kansas	3,149	2,834	2,607	2,711	2,928
Minnesota	3,179	3,211	3,275	3,308	3,407
Wisconsin	3,178	3,242	3,274	3,339	3,439
United States	67,929	66,803	66,083	66,789	66,801

SWINE

States Leading in Number of Swine

In Thousands of Hogs

Leading States	1936	1937	1938	1939	1940
Iowa	7,250	6,525	7,504	8,179	10,714
Illinois	3,860	4,053	4,134	4,423	5,750
Indiana	2,942	3,089	3,182	3,405	4,189
Ohio	2,333	2,660	2,607	2,763	3,316
Missouri	2,760	2,622	2,622	3,120	3,775
Minnesota	2,242	2,242	2,466	2,811	3,823
Nebraska	2,238	1,567	1,598	1,998	2,498
United States	42,837	42,770	44,218	49,293	60,207

DAIRY PRODUCTS

Annual Per Capita Consumption in Continental United States

	1936	1937	1938	1939	1940
Butter (Pounds)	16.7	16.7	16.9	17.8	17.0
Cheese (Pounds)	5.4	5.5	5.8	5.9	5.9
Evaporated Milk (Pounds)	14.1	15.0	15.6	16.3	17.6
Condensed Milk (Pounds)	.4	.3	.3	.3	.2
Ice Cream (Gallons)	1.9	2.2	2.2	2.3	2.3
Milk in Cities (Gallons)	38.2	38.4	38.2	38.7	—

NONMETALLIC MINERALS

COAL

Leading States in Bituminous Coal Production

In Thousands of Short Tons

Table 1

Leading States	1931-35	1937	1938	1939	1940
Alabama	9,252	12,440	11,061	19,995	15,150
Indiana	14,386	17,765	14,758	16,650	18,565
Illinois	40,198	51,602	41,912	46,450	49,495
Kentucky	38,130	47,086	38,545	42,805	48,400
Ohio	19,151	25,178	18,591	19,632	22,092
Pennsylvania	86,592	111,002	77,705	92,190	112,907
Virginia	8,252	13,795	12,283	13,230	14,950
West Virginia	95,748	118,646	93,288	107,938	126,302
All States	351,433	445,531	348,544	393,065	453,245

Principal Regions of Coal and Lignite Production

In Thousands of Metric Tons

Table 2

Regions	Average 1926-30	Average 1931-35	1936	1937
World Total, Coal and Lignite	1,456,000	1,234,400	1,446,000	1,515,000
Lignite, Total	205,000	184,000	223,000	253,000
Coal Equivalent	68,000	61,000	74,000	83,000
World Total in Terms of Coal	1,319,000	1,111,400	1,299,000	1,345,000
United States	540,223	363,506	433,293	457,575
Percentage of Gross World Total	37.1	29.4	30.0	30.2
Percentage of Total in Terms of Coal	41.0	32.7	33.4	34.0
Anthracite	69,507	48,692	49,513	46,189
Bituminous and Lignite	470,716	318,814	393,780	401,385
Europe:				
Austria:				
Coal	192	240	244	230
Lignite	3,175	2,985	2,897	3,242
Belgium	26,949	25,331	27,876	29,681
Czechoslovakia:				
Coal	14,742	11,164	12,233	16,952
Lignite	20,089	15,789	15,949	18,046
France	53,549	47,403	45,226	44,319
Germany:				
Coal	150,592	120,263	158,283	184,512
Lignite	155,707	133,416	161,397	184,681
Saar	13,439	10,862	11,673	13,371
Poland	39,638	30,446	29,748	36,218
Union of Soviet Socialist Republics	36,679	79,991	123,700	127,000
United Kingdom	245,689	226,308	232,120	236,936
Asia and Oceania:				
India	22,932	21,902	22,974	24,600
China	24,921	———	33,250	———
Japan (Proper)	32,890	32,352	41,803	———
Australia	13,435	11,988	14,647	15,700

Note: The heat value of lignite is estimated to average 33 per cent of that of coal. The above figures represent actual tonnage of lignite produced except in computing the "world total in terms of coal." The world total includes countries not listed.

PETROLEUM

Leading Countries in World Production of Crude Petroleum

In Millions of Barrels (42 Gallons to a Barrel)

Table 3

Countries	1936	1937	1938	1939	1940
World Total [1]	1,791.5	2,039.0	1,987.7	2,078.8	2,149.4
United States	1,099.7	1,279.2	1,214.3	1,264.9	1,351.9
Russia	186 2	193.2	204.9	212.5	212.9
Venezuela	154.8	186.2	188.2	205 8	184.8
Rumania	63.6	52.4	48.4	45.6	43.2
Iran	30 4	31.8	32.6	30.8	25.7
East Indies	50.0	56 7	57 3	62 1	60.8
Mexico	41.0	46 7	38.3	42.8	44.1

[1] Including countries not shown.

METALLIC MINERALS

Iron-Ore Production in the United States

In Thousands of Long Tons

Table 1

Regions	1936	1937	1938	1939	1940
Lake Superior	41,781	61,657	21,308	41,680	61,808
Birmingham	4,008	5,953	4,156	5,735	7,239
All Other	3,000	4,483	2,983	4,306	4,759
United States	48,789	72,093	28,447	51,721	73,806
Leading States	**1935**	**1936**	**1937**	**1938**	**1939**
Minnesota	19,375	31,634	48,417	14,449	31,548
Michigan	5,206	9,178	12,085	6,004	9,159
Alabama	3,378	4,180	6,308	4,303	5,961
Penn.-New York	1,277	1,910	2,625	2,121	2,714
Wisconsin	788	970	1,156	855	973
Kinds	**1935**	**1936**	**1937**	**1938**	**1939**
Hematite	28,864	46,108	68,073	25,607	47,757
Magnetite	1,352	2,206	3,354	2,476	3,378
Brown Ore	267	475	666	363	586
Carbonate	1	1	1	*	*

* Less than 500.

Principal Producers of Iron Ore

In Thousands of Metric Tons

Table 2

Selected Countries	Average 1921-25	Average 1931-35	1936	1937	1938 [1]
United States	53,271	23,497	49,572	72,251	28,904
France	24,660	32,093	33,208	37,839	33,137
Germany	5,325	3,388	7,340	9,575	10,939
United Kingdom	8,611	8,921	12,905	14,443	12,050
Russia	788	17,100	27,918	26,000	26,530
Sweden	6,584	5,251	11,250	14,953	13,928
Luxemburg	4,725	3,862	4,896	7,766	5,141
World			173,300	211,000	162,000

[1] Because of war conditions, last available authoritative data from Europe.

Principal Producers of Gold and Silver

In Thousands of Fine Ounces

Table 3

States or Territories	Gold			Silver		
	1938	1939	1940	1938	1939	1940
Alaska	664.9	676.7	765 2	554.0	298.0	———
Arizona	305.0	316.5	292 5	7,479.2	7,824.0	6,948.0
California	1,311.1	1,435 2	1,408.7	2,590.8	2,559.1	2,235.0
Colorado	367.5	366.9	368.8	7,932.1	8,496.5	9,559.8
Idaho	375.0	371.0	315.0	18,994.6	17,222.4	17,235.0
Montana	203.3	264 2	275.7	6,404.0	9,087.6	12,357.0
Nevada	296.4	361.5	367.4	4,355.5	4,316.0	5,105.0
New Mexico	42.0	36.0	———	1,229.9	1,400.9	1,372.1
South Dakota	594.8	618 5	592 9	158.0	171.0	———
Utah	200.6	277.8	352 8	9,682.7	10,758.7	12,266 1
Philippine Islands	903.3	999.4	1,079.9	976.0	1,248.0	———
Texas	*	*	*	1,433.0	1,341.9	1,365.7
United States	5,090.0	5,611.0	———	62,665 0	65,120 0	———

In Millions of Fine Ounces

Selected Countries	Gold			Silver		
	1938	1939	1940	1938	1939	1940
Union of S. Africa	12.1	12.8	12.8	———	———	———
United States	5.1	5 6	———	58.7	57.8	67.0
Canada	4.7	5 0	———	22 2	23.2	23.8
Mexico	.9	.9	———	81.0	75.8	82.6
World	37.5	39.8	———	264.1	259 5	———

* Less than 500 ounces.

Copper Production

In Thousands of Pounds

Table 4

States of Origin	1935	1936	1937	1938	1939
Arizona	278,519	414,144	580,193	420,351	469,713
Utah	120,973	261,202	401,169	229,877	326,117
Montana	157,760	215,433	280,662	156,250	203,512
Nevada	72,819	146,154	149,964	93,656	184,543
Michigan	73,812	91,105	84,751	75,281	89,402
New Mexico	4,560	6,975	63,574	43,913	74,084
United States	962,587	1,222,819	1,669,322	1,124,657	1,425,349

In Short Tons

Leading Countries	1936	1937	1938	1939	1940 [1]
United States	614,971	834,835	556,673	734,990	908,003 [2]
Canada	210,824	262,432	290,200	310,257	———
Chile	282,418	455,562	787,409	373,870	———
Peru	36,764	39,354	41,368	39,021	———
Russia	91,491	101,963	108,000	118,000	———
Japan	81,350	83,665	84,900	84,900	———
Belgian Congo	105,454	165,993	136,622	133,929	———
World [2]	1,848,521	2,498,693	2,187,037	2,382,641	———

[1] Preliminary. [2] Estimate.

FOREIGN NAMES WITH NEW AND CONVENTIONAL SPELLINGS

Throughout the expository material in the text, the spelling of foreign names is, in the interest of clarity, almost always the same as that used in current newspapers, periodicals, and books with which the students are likely to be familiar. The maps show, in many instances, both the conventional spelling and the spelling given in recent rulings of the United States Geographic Board. The former spelling is given in parenthesis. For convenience foreign names are listed with both the new and the conventional spelling in the following table:

New Spelling	*Conventional Spelling*	*New Spelling*	*Conventional Spelling*
Ankara	Angora	Livorno	Leghorn
Anverso	Antwerp	Lwów	Lemberg
Arkhangelsk	Archangel	Manchukuo	Manchuria
Athenai	Athens	Marrakesh	Morocco
Belem	Pará	Milano	Milan
Beyrouth	Beirut	Moskva	Moscow
Boegrad	Belgrade	Mukden	Moukden
Brasov	Kronstadt	München	Munich
Brno	Brünn	Napoli	Naples
Bruxelles	Brussels	Nidaros	Trondhjem
Brześć nad Bugiem	Brest Litovsk	Nürnberg	Nuremberg
Bucurest	Bucharest	Oulu	Uleåborg
Chisimaio	Kismayu	Pátrai	Patras
Chosen	Korea	Peiping	Peking
Corse	Corsica	Plovdiv	Philippopolis
Damas	Damascus	Port Amelia	Pemba
Daugavpils	Dvinsk	Poznán	Posen
Djibouti	Jibuti	Praha	Prague
Edirne	Adrianople	Roma	Rome
Estonia	Esthonia	Rumania	Roumania
Faeröerne	Faroe Islands	's Gravenhage	The Hague
Firenze	Florence	Sardegna	Sardinia
Galati	Galatz	Shkoder	Skutari
Genève	Geneva	Sicilia	Sicily
Genova	Genoa	Split	Spalato
Helsinki	Helsingfors	Svalbard	Spitzbergen
Hwang Hai	Yellow Sea	Taiwan	Formosa
Iraq	Mesopotamia	Tallinn	Reval
Islas Baleares	Balearic Islands	Thessalonike	Salonika
Ismir	Smyrna	Tokyo	Tokio
Istanbul	Constantinople	Torino	Turin
Jelgava	Mitau	Turku	Abo
Kaunas	Kovno	Ulyanovsk	Simbirsk
Keijo	Seoul	Union of Soviet Socialist Republics	Russia
Klaipeda	Memel	Üsküdar	Scutari
Köbenhavn	Copenhagen	Venezia	Venice
Kriti	Crete	Viipuri	Viborg
Le Havre	Havre	Warszawa	Warsaw
Liepaja	Libau	Wien	Vienna
Lisboa	Lisbon	Wilno	Vilna

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