A GEOGRAPHY OF COMMODITIES

HARRAP'S NEW GEOGRAPHICAL SERIES

A GEOGRAPHY OF COMMODITIES

BY

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PREFACE

In a short book it is impossible to deal fully with the geography of every commodity, and yet pupils ought to know what a full geographical treatment means. Summaries make soulless catalogues of facts, and in a school text-book especially some descriptive matter is essential.

An attempt has been made in this book to solve the problem by emphasizing some special point of view in studying each commodity. According to the suitability of the subjects, different chapters stress climate, physical geography, labour problems, communications, etc., though these aspects necessarily become interwoven. The main theme throughout the book is the search for *order* in the distribution of products, and the avoidance of unreasoned lists of facts. With this end in view the illustrated maps contain many notes on the maps themselves. No product is marked without an attempt to give a geographical explanation of its distribution.

The book is intended for the upper forms of the Middle School and for the Upper School. It is hoped that it may be useful for classes doing commercial courses that include geography.

The author wishes to acknowledge his especial indebtedness to the following publications: *The Chambers of Commerce Atlas*; *Geography of the World's Agriculture* (United States Department of Agriculture); *Industrial and Commercial Geography*, by J. Russell Smith; many publications of the Empire Marketing Board; special supplements of *The Times* and *The Daily Telegraph*; *The Statistical Year-book of the League of Nations*; and *Climatology*, by A. Austin Miller.

H. A.

NOTE TO THE 1948 IMPRESSION

WHEN a reprint of this book was suggested in 1947, there arose the question of bringing the material up to date; but it has been decided, with some reluctance, to reissue the book in its original form, because (i) editions that vary considerably are a nuisance in class-teaching, and (ii) drastic alterations are barred for economic reasons.

With regard to the statistics, world-production has been so abnormal for eight years or more, and figures are so incomplete, that the facts given in the original book serve as a better general basis for lessons, although comments should be made on recent developments.

Many of the geographical principles, too, are changing: atomic energy has to be discussed in lessons on power; there have been remarkable agricultural developments in the Soviet tundra; and the political structure of the world, with consequent trade, is rapidly altering. Nevertheless, certain fundamentals of geography, which were the basis of this book originally, still remain true.

This new impression is issued in the confident belief that users will be indulgent of obvious shortcomings and critical of remarks that now need modification.

H. A.

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CONTENTS

MAPS AND DIAGRAMS

INTRODUCTION

First let us be quite certain about the meaning of the title of this book, *A Geography of Commodities*. Of course we understand the term 'commodities'; it means goods, produce, things bought and sold. But what is the 'geography' of a commodity? What exactly is meant by the geography of bread, or of coffee, or of paper?

We already know that the geography of a country is not a mere catalogue of names of rivers, mountains, products, towns, and so on, but that it is a scientific study which attempts to arrange such facts in reasoned order, reducing them to sequences of cause and effect. In just the same way the geography of any commodity is not just tables of statistics about where the product comes from, where it goes to, and in what quantities. From various reference books, such as *The Statesman's Year-book, The Statistical Year-book of the League of Nations*, encyclopædias, books like *The Corn Trade Year-book*, dealing with some special produce, or *The South African Year-book*, dealing with special regions—from such sources we can obtain most detailed figures about all the important commodities. In addition there are atlases devoted wholly to commodities and commerce, showing by maps and diagrams what reference books show in tables of statistics. Such figures and their corresponding maps are meant to be statements of fact only: the intelligent student, whatever his subject, is left to deduce his own theories. The statistics will obviously have very different meanings according to the readers' interests. For instance, figures about wheat will be studied from widely divergent view-points by an agricultural scientist, a geologist, a railway engineer, an economist, and a politician. But, whereas each of these looks at his subject from a very specialized point of view, the geographer tries to find some link connecting the separate sciences, and that link is a study of the earth itself, whereon all these affairs happen. The geographer himself is often a specialist. His interest may be perhaps in physical geography only, or in historical geography, or in human geography, or in cartography, or in climatology—each a wide field for separate study, and each contributing something towards linking up the many isolated facts about various countries, regions, products, people, etc. In this book we have to summarize the many geographers' view-points to obtain a general world outlook. Our aim will be to take the statistical tables about commodities as bases for study, and then to try to find the orderliness behind the figures. We want to read between the lines of these mathematical facts, to turn them into 'geography,' and especially to bear in mind the human geography concerned—for, after all, people matter more than commodities.

CHAPTER I

CEREALS

I. WHEAT

NOTEBOOK WORK

Turn the statistics of wheat production, given on page 123, into diagram form, as a set of strips with lengths proportionate to the figures; name each strip carefully. Next, using the statistics of exports of wheat, shade a part of each strip to show the proportion exported. If there is an import of wheat in any region, add to its strip a proportionate amount, shaded in another way. Put a title and key to your work.

THE first table of wheat-production shows that wheat seems to be widespread over the world—in North America, Russia and Siberia, Western Europe, Argentina and Australia, Egypt and India—*i.e.*, in regions of extreme climate, in mild, rainy countries,

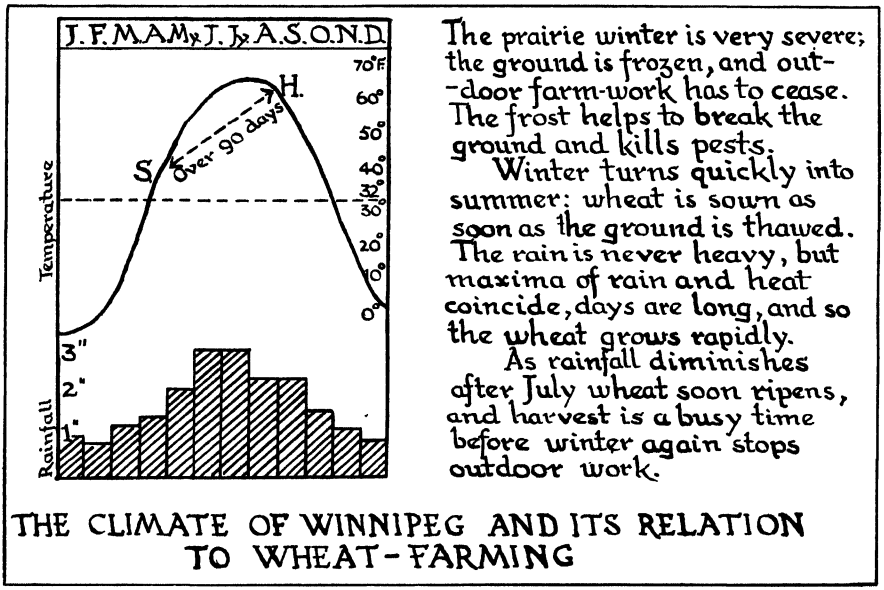


FIG. 1

in rainless Egypt, and in monsoon India. What order can there be in such a distribution? What is there in common to all these contrasted wheat-lands? Of course the lands must be arable; but are there any other factors which actually decide that these areas are specially suited to wheat?

SOME DIFFERENT WHEAT CLIMATES

—	—	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
A[1]	T.[2]	-4	0	15	S. 38	52	62	66	H 64	54	41	21	6
	R.[2]	0·9	0·7	1·2	1·4	2·0	3·1	3·1	2·2	2·2	1·4	1·1	0·9
B	T.	32	34	44	56	66	75	H 79	77	S 70	58	45	36
	R.	2·3	2·6	3·5	3·8	4·5	4·6	3·6	3·5	3·2	2·8	2·9	2·5
C	T	8	14	30	S 47	60	71	H 77	75	61	H 48	29	14
	R	0·2	0·3	0·8	1·1	2·2	3·4	6·3	6·1	3·3	1·6	1·0	0·2
D	T	21	23	31	S 45	57	64	H 67	65	S 57	46	34	24
	R	1·1	0·8	1·5	1·7	1·7	2·4	3·0	2·4	1·7	1·7	1·5	1·5
E	T	37	38	44	47	55	57	64	H 62	S 57	50	44	38
	R	1·6	1·5	1·4	1·5	2·1	2·3	2·8	2·6	2·4	2·7	2·4	1·9
F	T	51	52	55	58	64	H 71	76	77	S. 73	67	59	53
	R.	3·2	2·7	2·8	1·9	1·1	0·7	0·2	0·4	1·8	3·2	3·3	3·6
G	T	55	57	63	H 70	76	80	82	82	78	74	S 65	58
	R	0·4	0·2	0·2	0·2	—	—	—		—	—	0·1	0·2
H	T.	53	57	69	H 81	89	93	89	87	85	76	63	S 55
	R	0·9	1·0	0·8	0·5	0·7	1·4	5·1	4·7	2·3	0·3	0·1	0·4
I	T	79	77	71	64	55	S 49	47	51	56	63	71	H 76
	R	2·1	1·9	1·8	1·9	1·9	1·9	2·0	1·8	1·9	1·6	1·8	2·0
J	T	74	72	67	60	53	47	S 47	49	54	59	66	H 71
	R.	2·0	2·2	2·6	2·2	1·1	0·9	1·0	1·0	1·6	2·3	2·0	2·1

SOME CLIMATES QUITE UNSUITED TO WHEAT

—	—	Jan.	Feb	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
K	T	65	70	79	85	86	84	83	82	83	80	72	65
	R	0·4	1·1	1·4	2·0	5·0	11·2	12·1	11·5	9·0	4·3	0·5	0·2
L	T	78	78	79	79	79	79	79	79	80	81	81	80
	R.	7·6	5·7	5·7	6·5	10·9	12·0	9·7	6·7	2·7	2·4	5·7	11·3
M	T.	80	81	79	72	67	64	65	66	70	73	77	80
	R.	6·7	5·7	5·2	5·1	4·0	2·6	2·2	1·9	3·1	5·4	6·1	6·1
N	T.	-59	-47	-24	7	35	54	60	50	36	5	-34	-53
	R.	0·2	0·1	0	0·1	0·2	0·5	1·2	0·9	0·2	0·2	0·2	0·2
O	T	82	81	83	81	78	74	74	75	77	80	83	83
	R.	7·9	8·7	7·4	4·4	2·3	1·0	0·5	1·3	0·5	0·1	0·3	4·9

[1] A key to the places will be found at p. 147. It is worth while trying to locate the regions first, without reference to the key, by recollecting facts of climate from previous studies in regional geography.
[2] Here and in later tables temperatures are in degrees Fahrenheit and rainfall figures are in inches.

CEREALS

If we think of the farmers' task in raising a crop of wheat certain climatic essentials will appear: there must be some rain (or the equivalent in irrigation) to make the sown seed sprout; there must not be too much nor too heavy a rainfall when the stalks are long and tending to be top-heavy; there must be a drying season leading to harvest; and harvest-time must be fine and sunny.

With these facts in mind, let us consider the climates of the various important wheat-lands. The climate figures (p. 14) have been selected after studying statistical maps of the distribution of wheat so as to obtain places typical of each region. Seed-time (S.) and harvest-time (H.) are noted also.

Fig. 1 is a climate graph of A (Winnipeg), with a brief note to explain how the climate seems to suit wheat. This should be studied carefully before going on to the following brief notes about the other places and the exercises at the end of this section.

In both B and E winters are much milder than at A, and yet are cold enough to have heavy falls of snow. The wheat is sown before winter sets in; snow and occasional frosts discourage upward growth, but the ground is moist and comparatively warm, and so good strong roots develop during this time. In both cases there is a summer maximum of rain which encourages rapid growth, but the continuance of rain at harvest suggests that crops might be spoiled occasionally. C is similar to A, but the summer maximum of rain is more marked, and at the same time temperatures are very high.

> Wheat is sown as soon as the frost is out of the surface of the ground, and the further thaw provides water for the germinating seed. Temperature rises rapidly, and, aided by the rains, the plant makes rapid growth; by June the earliest cereals are ripened, and a second crop (buckwheat) may be snatched before October frosts put an end to the growing season.[1]

D is a type between A and B; it is doubtful whether the winter cold will be too severe to make winter sowing suitable. Actually in this area spring sowing is more common. F is an ideal wheat climate—a mild winter with gentle showers encourages early growth; as summer comes the rains dwindle to nothing, so that harvest is early and certain. I and J, in the Southern Hemisphere, are alike, with their mild winters and slight summer maxima of rain; of I especially it must be noted that, although the rainfall looks sufficient, the temperature is very high at the same time, so that evaporation is rapid. If also the soil happens to be particularly porous, then shortage of water might be disastrous. G and H are both exceptional. G has a desert climate, with a 'winter' harvest of wheat (it will be seen that there is really no 'winter,' as we understand it). Of course, the crop here must rely wholly on irrigation. H, too, has a 'winter' harvest, and irrigation is also necessary here. In the very hot summer —the rainiest season—tropical crops thrive.

> Small in amount though the [winter] rain is, it is of the greatest importance to the wheat and barley crops, and great distress is caused by its occasional failure. The comparative lightness of the fall increases its value inch for inch, as run-off is slight, and a high proportion is available for crops.[1]

Agricultural science has made rapid headway in the breeding of new types of cereals to thrive in climatic conditions that recently would have been considered outside the

[1] *Climatology*, by A. Austin Miller.

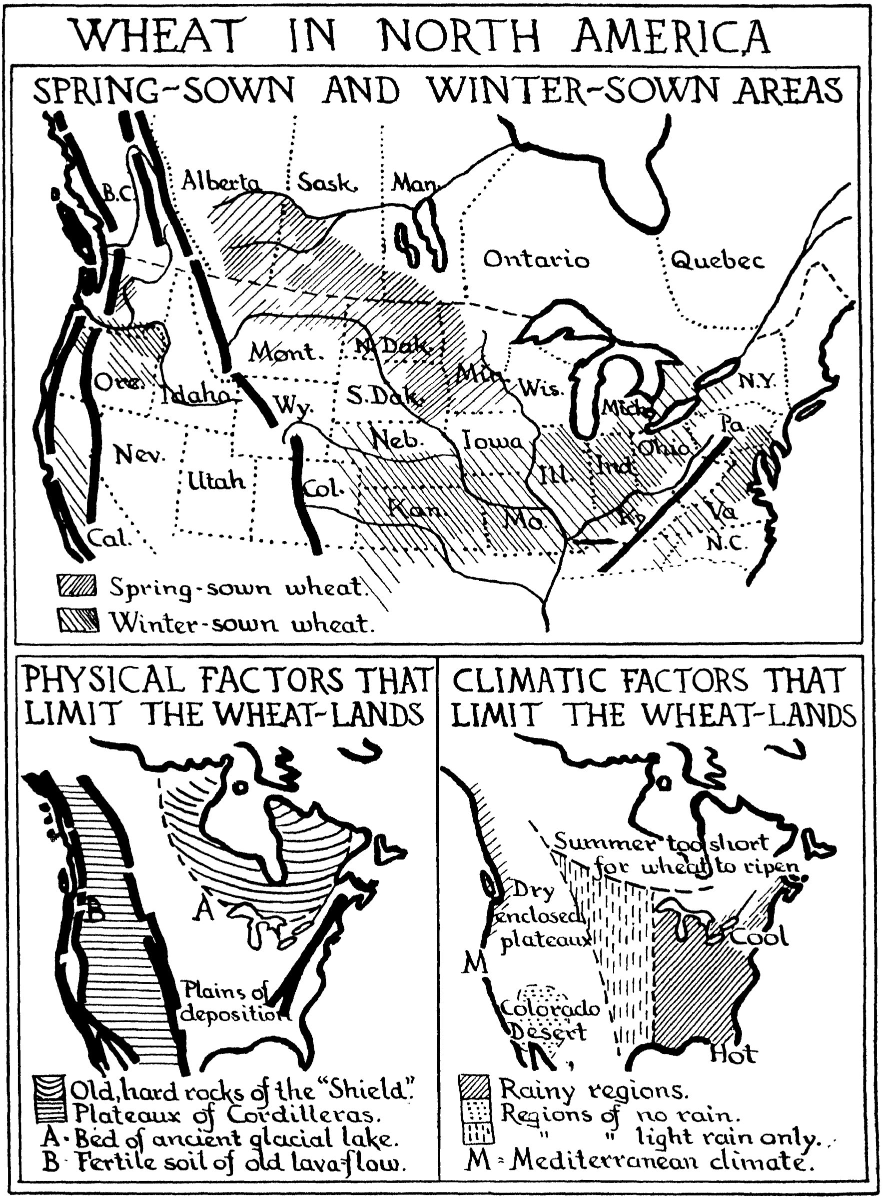

WHEAT IN NORTH AMERICA
SPRING-SOWN AND WINTER-SOWN AREAS
B.C.
Alberta
Sask.
Man.
Ontario
Quebec
Mont.
N. Dak.
Minn.
Wis.
Mich.
N.Y.
Ore.
Idaho
Wy.
S. Dak.
Pa.
Ohio
Neb.
Iowa
Ill.
Ind.
Nev.
Utah
Col.
Kan.
Mo.
Ky.
Va.
N.C.
Cal.
Spring-sown wheat.
Winter-sown wheat.
PHYSICAL FACTORS THAT LIMIT THE WHEAT-LANDS
A
B
Plains of deposition
Old, hard rocks of the "Shield."
Plateaux of Cordilleras.
A - Bed of ancient glacial lake.
B - Fertile soil of old lava-flow.
CLIMATIC FACTORS THAT LIMIT THE WHEAT-LANDS
Summer too short for wheat to ripen
Dry enclosed plateaux
M
Colorado Desert
Cool
Hot
Rainy regions.
Regions of no rain.
" " light rain only.
M = Mediterranean climate.

Fig. 2

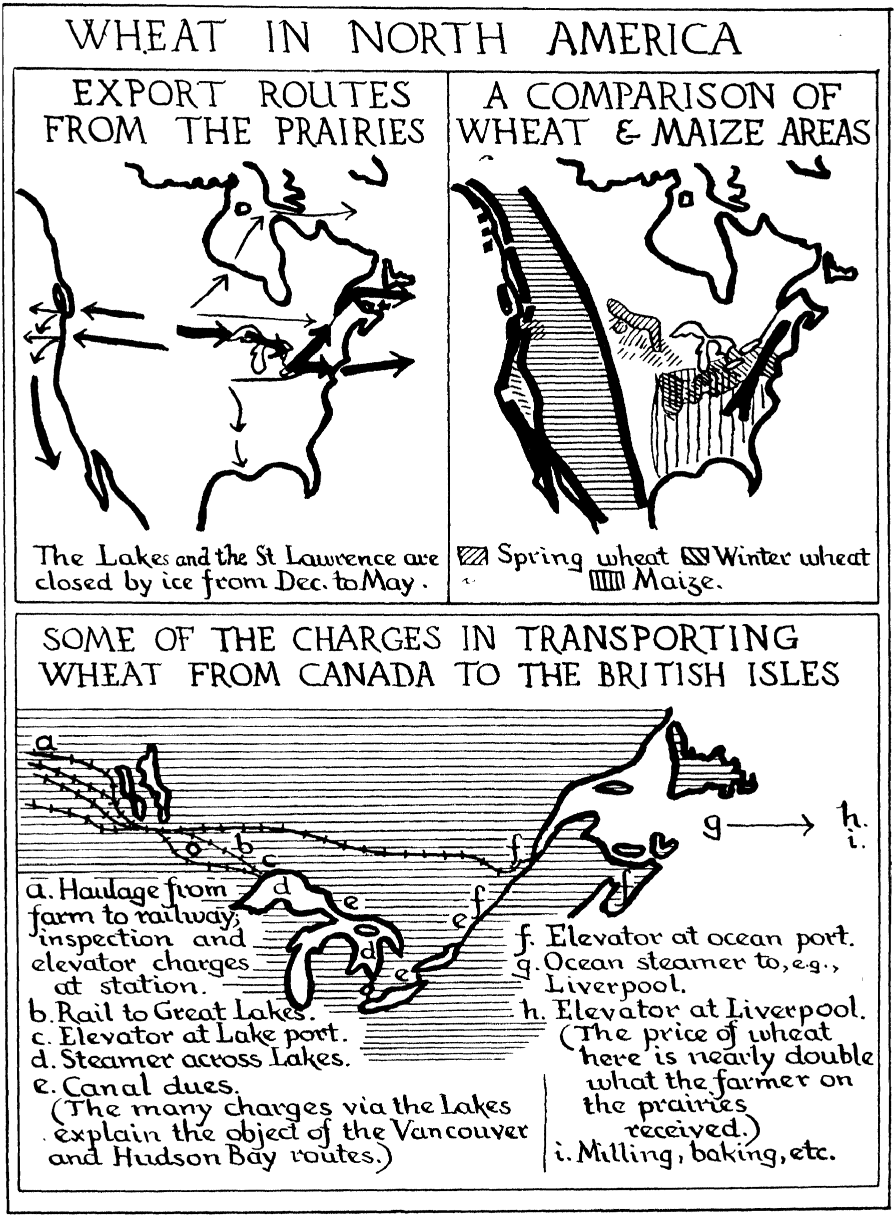

WHEAT IN NORTH AMERICA
EXPORT ROUTES FROM THE PRAIRIES
The Lakes and the St Lawrence are closed by ice from Dec. to May.
A COMPARISON OF WHEAT & MAIZE AREAS
Spring wheat
Winter wheat
Maize.
SOME OF THE CHARGES IN TRANSPORTING WHEAT FROM CANADA TO THE BRITISH ISLES
a
b
c
d
e
f
g
h.
i.
a. Haulage from farm to railway; inspection and elevator charges at station.
b. Rail to Great Lakes.
c. Elevator at Lake port.
d. Steamer across Lakes.
e. Canal dues.
(The many charges via the Lakes explain the object of the Vancouver and Hudson Bay routes.)
f. Elevator at ocean port.
g. Ocean steamer to, e.g., Liverpool.
h. Elevator at Liverpool. (The price of wheat here is nearly double what the farmer on the prairies received.)
i. Milling, baking, etc.

FIG. 2

possible limits. The actual climatic factors which limit wheat-lands at present are as follows: (*a*) Cool and moist at time of early growth; (*b*) warm and tending to be dry later; (*c*) harvest-time must be sunny; (*d*) a growing season of a minimum of ninety days; (*e*) annual rainfall 15–35 inches, or the equivalent in irrigation.

NOTEBOOK WORK[1]

Graph the climate statistics, A to J, given on p. 14, *using the same scales of temperature and rainfall for all. Below each write a brief note (similar to that in Fig.* 1) *about the suitability of the climate for wheat.*

II. WHEAT—*continued*

The maps of Fig. 2 were drawn in the following order:

First, the actual distribution of wheat was studied from both statistics and statistical maps in order to find out exactly where the important wheat areas are. These are shown, simplified, on the map entitled "Spring-sown and Winter-sown Areas." The next task was to discover the factors that limit the wheat-lands, and two maps—physical and climatic—explain these limits. Two more maps show what becomes of all this wheat, and, finally, the wheat-lands are compared with the maize-lands.

Fig. 2 should be studied very carefully to see what information and suggestion can be embodied in simple sketch-maps.

NOTEBOOK WORK

(i) *With the help of Fig.* 2 *write an essay on "The Distribution of Wheat in North America."*

(ii) *Write a series of orderly notes on "The Export of Wheat from North America."*

(iii) *With the help of the following information draw a map, or maps, entitled "Wheat in South Russia."*

Areas of densest production: winter wheat in Crimea and north of Caucasus between Sea of Azov and the Caspian; spring wheat in the area between Odessa, Kharkov, Samara, Saratov, and Taganrog, with densest production towards the south-west. From a vegetation map study the south edge of the deciduous forest belt and the desert and semi-desert area around the Caspian. The north edge of the black-earth region runs from Kiev to Kazan. Notice the facilities for transport—the big, navigable rivers and the nearness of the Black Sea; but note also winter isotherm 32° *F. Think of the importance of the coalfield in the Donetz Valley just north of Rostov.*

(iv) *Draw a map of the Trans-Siberian Railway to show the wheat-lands of Asiatic Russia and Manchuria. Think of the export of this wheat—not forgetting the very dense populations of Japan and North China.*

(v) *Study Figs.* 7 *and* 8, *and write notes on the wheat-lands of Argentina and Australia. Refer to the climate graphs of the exercise at the end of Section I.*

(vi) *Study Fig.* 4, *and write notes on the wheat-lands of the British Isles. Refer to the climate graph of the exercise at the end of Section I.*

III. WHEAT—*continued*

Let us look next at the statistics of wheat-yields per acre. These yields depend partly on soil and climate, but also on the skill of the farmers. The 'old' lands of Western

[1] It is suggested that pupils specializing in geography should do the whole of each exercise, but that in other classes the work might be distributed, in which case combined work should be available for class inspection.

A FOUR-YEAR ROTATION ON A FIELD IN NORFOLK

Year 1. TURNIPS—food for sheep and for cattle.

Sheep feed in the turnip field after the turnips are gathered, to trample and manure the ground for next year's crop.

Year 2. BARLEY—and clover sown together.

Sold to brewers. | Poultry. | Straw for bedding cattle, and then for manure.

Year 3. CLOVER—a natural restorative to the soil.

Hay for winter fodder.

Field manured and ploughed. | Wheat sown in September.

Year 4. WHEAT

Grain for millers. | Poultry. | Straw for bedding cattle, and then for manure.

Europe are densely populated; land is dear, and the farmers have to make the most of it. These countries have also other wealth from mines and factories. The result is a most carefully planned system of farming, that not only gives good returns, but also maintains the fertility of the soil. The plan on p. 19 shows one system of mixed farming. There are many variations of this system, and newer and better ones are constantly being sought by agricultural scientists. A careful study of the table explains the interweaving of crops and by-products to replace those constituents of the soil on which wheat thrives. Of course, for this particular four-year rotation a farm needs at least four fields—each one in a different year of development.

Then we ask, "Why do not the equally intelligent farmers of Canada and Australia obtain an equally high yield? Why is their yield so low?" Their lands are 'new' and comparatively empty. In order to farm such large areas with few workers they have adopted large-scale machine farming, and their methods have tended to be wholesale and slapdash rather than careful. Indeed, up to a point there has been little need for care, in the thrifty, European sense. But to-day that is altering. The constant repetition of wheat crops on the same land—no matter how fertile it may have been originally—is exhausting the soil of those constituents on which wheat lives, and yields are becoming poorer; moreover, new land is not readily available as it used to be. So it happens there is a gradual drift towards the European type of mixed farming, implying more care, smaller farms, and more labourers. This does not mean that farmers will abandon their ingenious machinery, but there will be a tendency to adapt it to the 'new' type of farming which is coming from 'old' lands.

In India there is a dense population, but, despite a long history, the people are poor and backward, farming methods are often very primitive, there is a lack of manure, and in consequence yields are at a minimum, though labour is at a maximum.

Notebook Work

(i) *Turn the statistics of wheat-yields per acre into diagram form, and write explanatory notes.*
(ii) *Turn the plan of a four-year rotation into an essay.*

IV. RICE AND MILLET

We know now that only certain climates and soils suit wheat, and it should be easy to suggest other types of climate which will certainly not suit wheat, and to explain reasons for their unsuitability—perhaps the summer is too short or too cool, or the rainfall is too heavy or too light, or occurs at an unsuitable time. Regions with climates unsuited to wheat have to use other cereals for their bread, or other forms of starch food altogether. The remainder of this chapter deals with these other bread-foods of the world.

Fig. 3 shows a graph of a typical monsoon climate, with London's climate graph for comparison. One of the chief characteristics of the monsoon climate is the extraordinary suddenness of the summer deluge. The first effect of this heavy downpour is a flooding of lowlands; the bread-food at this season must therefore be a swamp plant, and rice is the only such cereal. The heat and moisture together give monsoon lands for part of the year a kind of 'hot-house' or 'forcing-frame' climate, in which plants grow very quickly. As long as the rains continue the farmer can get several crops from the same plot of land, and if water can be stored 'winter' is so warm (as warm as an English summer) that another set of crops can be grown at this season too. But this same ease with which food can be grown has led to so dense a population that now, despite advantages of climate, not enough food can be grown to feed the teeming millions, however hard the people work. Rice is the main food of over one-third of the human race crowded into this specially favoured south-east corner of Asia. In India, China, and Japan agriculture has passed the stage of being 'farming,' and is better described as 'gardening'—a most intensive development of every available patch of ground—lands being divided into allotments, from each of which whole families must derive all their food, and often their

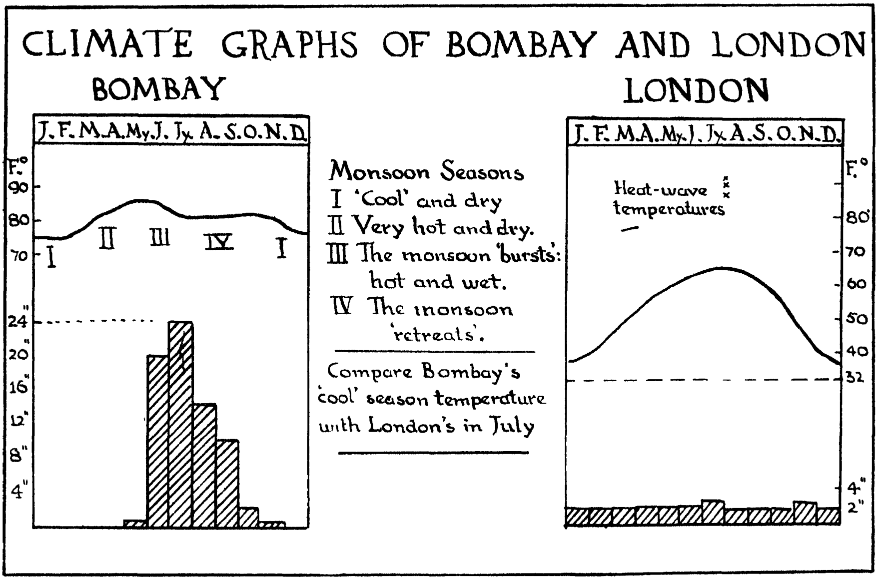


FIG. 3

clothing too. Of these three countries Japan perhaps is in the worst plight of all, for her land is nearly all mountainous. With infinite labour mountain-slopes have been terraced into fields held in place by walls, the soil having been carried from the little plains and valleys below by the men and women. Yet, even with all this intensity of development, food is scarce, and so Japan has attempted the only other possible way of feeding her people—she has become a manufacturing nation, and is trying to sell factory goods in order to buy bread. We can now understand her interest in the under-populated and under-developed wheat-lands of neighbouring Manchuria.

Not all parts of South-east Asia have this heavy summer rain; some areas are in the 'shadow' of mountains, which exhaust the rain-bearing winds. In the desert of Thar no rain falls at all, because the winds blow across very hot lowlands, and the vapour is not condensed. Some valleys, such as the Ganges, have heavy rains at the seaward ends, but gradually less rain farther inland. All these areas have bread crops other than rice.

Maize is grown where possible, but it requires a fairly heavy rainfall. In drier areas the staple food is millet, which is grown especially in regions like the Deccan or the Upper Ganges, where summer rain is not sufficient for rice, and where there are no light winter showers to eke out irrigation water for growing wheat. Hilly lands between the river plains grow barley. North China grows wheat, but here the climate is not exactly 'monsoon,' because winters are severe, and, though the same causes bring the summer rains, they are much lighter than in a true monsoon climate.

There is another type of region with heavy summer rain and with dry 'winters.' Around the equator is a belt of calms, hot and thundery, with no really dry season. This belt of thunder rain 'moves with the sun.' As the sun appears to swing north so the belt of thundery calm swings north too, though not nearly so far as the sun seems to move The result is that on both sides of the equator are belts of land receiving thunder rains when the sun is on their side—*i.e.*, in their summer—but none when the sun goes back to the opposite side. These lands are the tropical grasslands—llanos, campos, and the savanna type of Africa and Australia. The summer rain of these areas is not so heavy as in monsoon lands, nor so certain; there is risk of drought, especially towards the desert edges. These lands, especially in North Africa, have millet as their bread-food.

Notebook Work

(i) *Draw a series of maps to show rice in South-east Asia: (a) physical, showing the mountain barriers which limit the monsoon lands; (b) summer winds and rain; (c) river plains and rice; and (d) other bread-foods.*

(ii) *In the following places there are immigrants from the monsoon lands, and in their new homes they grow or import rice—the bread-food to which they are used. Mark the places on a world map, and find out the chief thing the immigrants are doing in each area: British Guiana, Jamaica, Trinidad, British Honduras, Réunion, Mauritius, Kenya, Madagascar, Natal, Malay, Java, and Hawaii.*

V. OTHER CEREALS

Let us come nearer home for other examples of cereals varying with climatic conditions. It is not just an accident that Scotland is a land of oatcakes and porridge, or that Ireland sings of her 'praties.' Wheat does not do well in either country; in Scotland the summer is too short and cool, except towards the south-east, and in Ireland the weather is too mild and rainy. Norway, facing the west winds of the Atlantic, is a rainy land, and a land of oats and potatoes. North Germany, with its poor clays, heath, and bog, is a land of potatoes and rye.

Oats are a much more important world crop than is generally realized (see statistics, p. 125). They are typical of cool, damp regions; warm, dry places are quite unsuitable. The same areas are often dairying regions also (see Chapter II), and so oats are a crop economically associated with intensive farming in well-developed dairying areas like Denmark, Ireland, and the Lower St Lawrence, where the grain is used as fodder. There is little trade in oats.

Barley has a wide climatic range, and is a bread-food in regions as diverse as Northern Europe, the Atlas Mountains, monsoon lands (Japan and China), and Tibet. But the biggest producers are Russia, the United States, and Western Europe, where the grain is used to feed cattle or pigs, and for brewing. The distribution of wheat, oats, and barley in the British Isles illustrates well the different climatic essentials for each of these cereals (see Fig. 4).

Fig. 4

Rye-bread ('black bread') is the staple food of European peasants east of the Rhine and north of the Alps—in the German Plain, Baltic lands, and Russia. Rye is a hardy cereal grown on soils too poor for wheat; it withstands coldness or rawness of climate, and ripens quickly. In Russia rye is the main bread-food, but wheat is being more extensively used.

Whereas wheat succeeds with a minimum of ninety summer days maize needs 150. Such a requirement—five months of summer—implies tropical or sub-tropical latitudes; and the size of the plant and its cob imply a need for plentiful rain. Towards the polar limits of maize areas winter-sown wheat also grows, but tends to be 'soft,' as distinct from the more desirable 'hard' wheats of severer climates. The increasing summer rain towards the equator marks the limit of the temperate wheat belts, because of diseases due to heat and damp. Maize, however, thrives as far as the equator, its importance often being masked by other products that enter more into commerce. As mealies, greencorn, polenta, pone, or hominy it forms a starch food for huge numbers of people in tropical latitudes. Commercially its chief use is as a cattle food, and as such it is imported into the Western European dairying countries, where animal industries have overtaxed the local supplies of fodder, despite intensive cultivation.

Notebook Work

(i) *Using Figs.* 5, 7, *and* 8, *write notes about the climatic conditions necessary for growing maize.*

(ii) *Turn the note in Fig.* 5 *about a maize-farm rotation into a plan like that on p.* 19.

VI. OTHER STARCH FOODS

The rain-all-the-year type of climate round the equator is apparently unsuited to the ripening of any grain. With the exception of Malay, Java, and Ceylon, equatorial lands are thinly peopled. It may be that the dense vegetation has kept man out, or, perhaps, the lack of cereals. The people of these areas use other starch foods. The Amazon basin has, in particular, its cassava or manioc obtained from certain roots; the East Indies have sago, obtained from the pith of a palm-tree; Central Africa has the plantain and manioc; and widely scattered over all these equatorial lowlands are yams and sweet potatoes. None of these products is very important commercially. In the few developed regions of the equator, such as Java, rice and maize are cultivated intensively.

It is of interest to find the potato as a staple food in those temperate lands where there is similar uncertainty of harvesting cereals owing to rain and cloud. In Ireland and North Germany the potato is a most important 'bread-food.' There are two essentials to its successful cultivation—a suitable climate and a supply of cheap labour for weeding, hoeing, and lifting. These essentials obtain particularly on the German plain, round New York, and on the sandy plains behind Chicago—all regions of dense population. The by-products of the potato industry are typical of scientific Germany—potato flour, imitation arrowroot, imitation brandy, starch, alcohol, and sugar.

Notebook Work

(i) *Draw a map called "The Breads of the World."*

(ii) *Turn the maize statistics, p.* 125, *into diagrams, making comparisons with wheat where possible.*

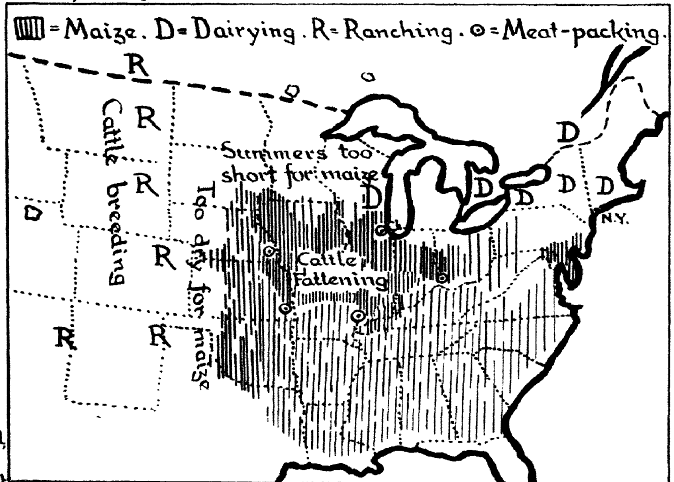
(iii) *From Fig.* 4 *write a short essay on "The Distribution of Cereals in the British Isles."*

MAIZE AND CATTLE IN NORTH AMERICA

The northern limit of the maize belt is fixed by the length of the summer – 150 frostless days (cf. wheat's 90). There is no southern limit, but more profitable cotton takes the place of maize in the south-eastern States.

Beef Cattle

The western plains and foothills are too dry for grain unless irrigation is used, so open ranches take the place of maize or wheat farms. Cattle spend one or two years on the ranches and then are moved to maize farms to be fattened. Later they are sent to big towns to be slaughtered. Meat is chilled or tinned, and full use is made of by-products.



Dairy Cattle

The dairy-farms are in the cool areas with densest population, supplying near markets for fresh milk and labour for the farms. Land is dear, farms are small, and farmers cannot compete with the Central Plains in grain-growing.

Canada is now the world's leading exporter of cheese

Maize yields twice as much grain and, with leaves, etc., three times as much fodder per acre as either wheat or barley. The U.S. corn-belt produces 3/4 of the world's maize, nearly all for home use. A typical maize farm rotation is: I. maize; II. another cereal; III. clover, beans, or peanuts; and IV. pasture.

FIG. 5

(iv) *Graph these climatic statistics of places in the British Isles, and write notes to say for what cereal each seems suitable. Compare these figures with those of p.* 14, *E.*

—	—	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
A	Temp.	40	41	42	46	51	57	59	58	55	48	43	41
	Rainfall	3·3	2·9	2·7	2·1	2·6	2·5	3·1	3·9	3·0	3·4	3·6	4·2
B	Temp.	36	37	39	44	49	54	57	56	53	46	41	38
	Rainfall	2·0	1·8	1·9	1·5	1·8	1·8	2·7	2·4	2·2	2·4	2·4	2·2

CHAPTER II

DAIRY PRODUCE

I. MILK, BUTTER, AND CHEESE

IN Chapter I the effects of climate in delimiting the wheat-lands were emphasized particularly, but it must be remembered that that is only one point of view. The geography of dairy produce could be studied in a similar way. However, to illustrate a different method of approach, this time we will specialize on other aspects, although climate is bound to enter into the study.

When a commodity is perishable—*e.g.*, milk, strawberries, or sausages—its *sale* assumes as much importance as its actual production. The producer has several options: (*a*) he may try for a quick sale of the perishable article by being near to a sure market; (*b*) he may preserve his perishable produce by scientific means like chilling, freezing, canning, bottling, pickling, or the use of chemical preservatives, so that he is less dependent on proximity of markets, though the increased cost of production makes the article dearer and often limits sales; (*c*) he may change his perishable goods into some less perishable form altogether—*e.g.*, the farmer turns cream into butter or cheese, plums into prunes, and pork into bacon.

Now let us consider a dairy-farmer's task. He has his cattle to feed. This is not just the simple matter of turning his cows out to grass. Good milch-cows need scientific care and feeding: pasture must be suitable, and must continue to be suitable; provision must be made for indoor feeding in cold weather, the milk-supply depends on the cows' diet, which must be varied methodically with roots, grain, and feeding-stuffs containing fat, sugar, or salt. There is the same scientific care needed in maintaining a dairy herd as in keeping race-horses or good dogs. But the farmer's task does not end there. All this care—the provision and the preparation of the foods, the milking and churning, the cleaning and doctoring—requires much skilled labour. The dairy-farmer cannot adopt the wholesale machine methods of the American wheat-farmer; of course, he uses what mechanical aids he can, but the supply of skilful, intelligent labour is a constant problem. Then comes the business of selling his milk, butter, and cheese, and, in the case of milk especially, of selling it very quickly.

The outcome of all these considerations is that dairying is limited to certain well-defined areas. These must be climatically suitable—neither too hot nor too cold, neither too wet nor too dry, with frequent gentle showers to maintain freshness in the cropped pastures, and with plenty of sunshine to keep the cattle healthy. The regions must have enough people to supply not only intelligent labour for the farms, but also a ready market for the perishable produce. Lastly, there must be good transport facilities.

If we look at the statistics about dairy produce on pp. 126–127, and at the exercises at the end of this chapter, the particular importance of transport becomes apparent. The supply of fresh milk to big industrial centres depends largely on rapid rail communication and, more recently, on good roads for the new, heavy milk lorries. The British supplies of cheap butter from New Zealand and Australia are due wholly to very modern developments in ocean transport, and especially to the provision of refrigerating chambers in the holds of big ships. Scientific improvements, such as the perfection in methods of tinning butter and milk, have increased the markets in tropical lands, where formerly climatic conditions made the provision of fresh and wholesome dairy produce almost an impossibility. To-day the white settler in the tropics can have butter and milk in perfect condition from the dairy-farms of temperate lands, and the cheapness of these tinned products is also attracting a big market among natives.

One other point of view. Dairying, we have seen, is a business for the small farmer, which means only a small amount of produce from any one farm, and also a variety in quality according to the stock and the care at the different farms. Variety in quality makes the purchaser wary; standard quality gives confidence. So, to ensure uniformity most of the big dairying regions of the world have now adopted conditions of co-operative manufacture that conform to the highest ideals of hygiene, and "systems of government inspection of so searching a character that it attaches the final seal of excellence to the produce."

> The farmer has learned through dint of unceasing instruction from Agricultural Colleges, Cow-testing Associations, and Co-operative Societies that the actual production of milk and eggs is only one branch of his business. The marketing of these, the condition in which they reach the purchaser, the cleanliness, the tidiness, the neatness form no less important branches of the same business.[1]

Notebook Work

(i) *On a map of the British Isles shade the regions with most cattle—i.e., the wetter, western lowland pastures, such as Cheshire, Anglesey, Somerset, the plains of Devonshire and Cornwall, the lowlands of South and South-west Scotland, and all the centre of Ireland, excepting the bogs.*

Next, with a different shading mark industrial areas—i.e., the regions of dense population that will need big milk supplies.

For each industrial region print a 'D' (for dairy produce) in the nearest fertile lowland, whether among the previously marked cattle regions or not. For instance, you will mark the Vale of York and the Dales as the West Riding milk-supply district, the Vale of Trent and Derbyshire for Sheffield, Middle Trent for Nottingham and Derby, the rich farmland round Leicester, and so on. You will see that for some industrial regions—especially for London—lowlands partially unsuitable for the best dairying have to be used.

You will have left on your map certain rich dairying areas with no near markets for milk, or not for all the milk, and these regions you will find are specializers in butter and cheese—e.g., Irish butter, Cheddar, Wiltshire, and Cheshire cheese.

(ii) *Draw a map entitled "The World's Dairy Produce": (a) Western Europe—note the dense population, and mention Denmark especially as a country that has set the world an example of scientific, co-operative farming; (b) North America—note the dense population of the Lower St Lawrence–New York area—most dairying here and around Chicago—special note about Canadian cheese; (c) South-east Australia (the cool, rainy area with most people) and North Island, New Zealand (with the mild raininess and sunshine—special note about transport and markets); (d) regions unsuited to dairying, and why—the tropical lands; Mediterranean lands with hot, dry summers which wither pasture; and densely populated lands like China and Japan, where there is no land to spare for food other than human food. (For the type of map wanted see Fig. 18.)*

(iii) *Write special notes on two very different, important dairying lands—Holland and Switzerland—countries that might seem to have every physical disadvantage, the one a reclaimed delta, and the other a mass of lofty mountains, and yet are both world-famous for their dairy produce.*

[1] *Irish Creameries*, Empire Marketing Board pamphlet.

II. OTHER 'BUTTERS'—VEGETABLE OILS AND MARGARINE

Just as the breads of the world vary with climate conditions so also do the butters, but in their case not wholly for climatic reasons. Some regions are quite unsuited to dairying because of their climates, but others have no dairying for economic reasons. In China and Japan, for instance, the density of the population demands the use of every available piece of land for the production of human food. Butter, of course, is human food, but it is an expensive food, for a given area of land under crops can produce far more food than an equal area used for grazing cattle. So, in Japan and in China, although the climate is not unsuited to dairying, there are very few cattle, and other 'butters' have to take the place of what is, to the Japanese or Chinese, luxurious and even wasteful dairy butter.

Many plants contain stored fats in their seeds, and throughout the world vegetable fats are used. Beans, nuts, and various seeds provide the necessary fat in the diets of millions of people. Palm oil in West Africa is used by natives as we use lard, dripping, or butter for cooking purposes. In the coast-lands of tropical regions, especially in Oceania, coconut oil is used in exactly the same way. In India many seeds and nuts, such as sesamum, rape, cashew nuts, etc., are used for cooking purposes. Nearly all the vegetable oils are also used by these peoples for anointing their bodies, as we use soap. In Mediterranean countries, with their long summer drought, which is harmful to dairy cattle, the olive is widely cultivated for its oil, to be used for cooking purposes. In Japan and North China the soya bean is butter and milk to millions.

The modern development of trade in these oils is quite recent, and it is rather significant that the produce comes to Europe to be made into margarine—*i.e.*, the vegetable oils are coming to the dairying lands of Western Europe to be made into a cheap 'butter' for the many people who cannot afford the luxury of real dairy butter. Those people who rather despise margarine may be surprised to know that dairy cows which give them their butter are fattened partly on cake made from the refuse of margarine works.

Margarine can be made from any or all of the following vegetable oils: palm-kernel oil, coconut oil, cotton-seed oil, peanut oil, sesame oil, olive oil, soya-bean oil, and others less important. These oils are mixed scientifically and hygienically with milk, water, and salt, and often with animal fats such as whale oil. The places that manufacture margarine have 'colonial' trade, and are near centres of dense population—*e.g.*, Rotterdam, with its East Indian trade; Liverpool, with West African and Pacific trade; Marseilles, with Mediterranean, Indian, and African trade; and Hamburg, which used to monopolize German colonial trade.

Palm oil and palm-kernel oil come almost wholly from the hot, wet coast-lands of the Gulf of Guinea. The plant grows wild, and is not yet cultivated in plantations. Natives gather the nuts, which are like huge clusters of orange-coloured plums, and also do the pressing to extract the oil. The result is a rather wasteful, primitive production, but the native is kept on his own land without the problems attendant on concentration for plantation labour. Palm oil is used for soap, and the oil from the cracked kernels for margarine.

The coconut-palm thrives only near rainy sea-coasts in the tropics. In the Dutch East Indies, the Philippines, Ceylon, and elsewhere it is now cultivated in plantations. The outer fibre of the nuts is called coir, and is used for matting and ropes. The white flesh of the nut is dried in the sun to lessen its weight, and is compressed and exported as copra.

Ground-nuts (monkey-nuts) are widely grown in West Africa, China, India, and Java as human food, as well as for export, and in the United States as a 'refresher' to soils (just as British farmers often grow clover), as fodder, and as human food. In West Africa the ground-nut area is much farther inland than the palm-oil region, and

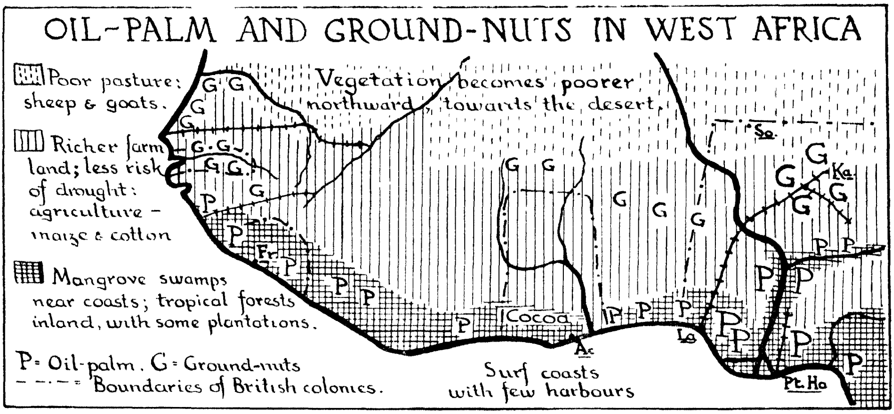


FIG. 6

lies between the very wet coast-lands and the very dry Sahara. Kano is an important centre. In the United States the peanut is grown throughout the cotton belt.

The other oil seeds, etc., can be mentioned only briefly. Manchuria and Korea produce 90 per cent. of the world's soya beans. The Mediterranean lands produce 90 per cent. of the world's olive oil. India produces most rape seed and castor oil—used mostly as lubricants.

Notebook Work

(i) *Draw a map entitled "The World's Butters." Add explanatory notes.*

(ii) *Write a note on the manufacture of margarine at either Rotterdam or Liverpool, stating whence you think the raw materials come.*

CHAPTER III

MEAT

I. BEEF

Notebook Work

(i) *From the statistics about cattle on p. 126 work out for the countries given (a) the number of cattle per 1000 people, and (b) the number of cattle per square mile.*

(ii) *Turn the figures of cattle numbers into diagram form, shade parts to represent number of cattle slaughtered, and divide the cattle countries into three main types: (a) beef, (b) dairy, and (c) draught.*

'John Bull' and 'roast beef' typify England. In our butchers' shops the pick of the beef is the home-killed, 'best English' or 'prime Scotch'; but a large proportion of the meat is 'foreign,' lacking the special flavour and quality that our own home supplies undeniably have. This means that evidently we can produce the best and most desirable beef, and yet do not produce it in sufficient quantities. The lack may be due to several causes. Perhaps we have not enough room to pasture all the beef-cattle we need; or perhaps we have the room but do not use it thoroughly; or perhaps other countries have such advantages for producing beef that they can supply meat of a sufficiently good quality and at a sufficiently low price to compete in the shops with our native produce. The actual causes are probably a combination of all three of these, as will be seen later.

Cattle feed on grass or hay, roots or maize, and various feeding stuffs made from locust beans, soya beans, vegetable oils, and sugar-beet refuse. Of these the main stock-food is grass. Now the quality of grasslands varies with climate and soil. Mild and rainy Western Europe has rich green pastures. These are not natural grasslands, but lands cleared of the original deciduous forest. The forests have mostly been replaced in rural areas by the green fields that are so typical of our countryside. Such pastures produce the finest cattle in the world.

> England has justly earned among other nations the title of the "Stud Farm of the World." Just as Britain has peopled vast regions of the world with men of her races, of English, Scotch, and Irish blood, so she has stocked them with her cattle, with her great breeds of Shorthorns, Herefords, Jerseys, Guernseys, Ayrshires, and the rest. Where men of European descent have colonized, cattle of British breeds predominate.[1]

It is this specialization of ours in cattle-breeding that partly explains the shortage or home supplies of beef and the large quantity of foreign meat in our shops.

The natural grasslands of the world do not have these luscious pastures. Such areas as the prairies, steppes, pampas, savannas, etc., are grasslands because of light rainfall, insufficient for tree growth. Here the grasses are green at the time of rain—mostly spring or early summer—but soon turn naturally to hay. These regions are ideal ranching country, provided the limited supply of grass is not overtaxed by too many cattle; but such meagre pasture cannot produce fat cattle. If such natural grasslands happen to be

[1] Empire Marketing Board pamphlet.

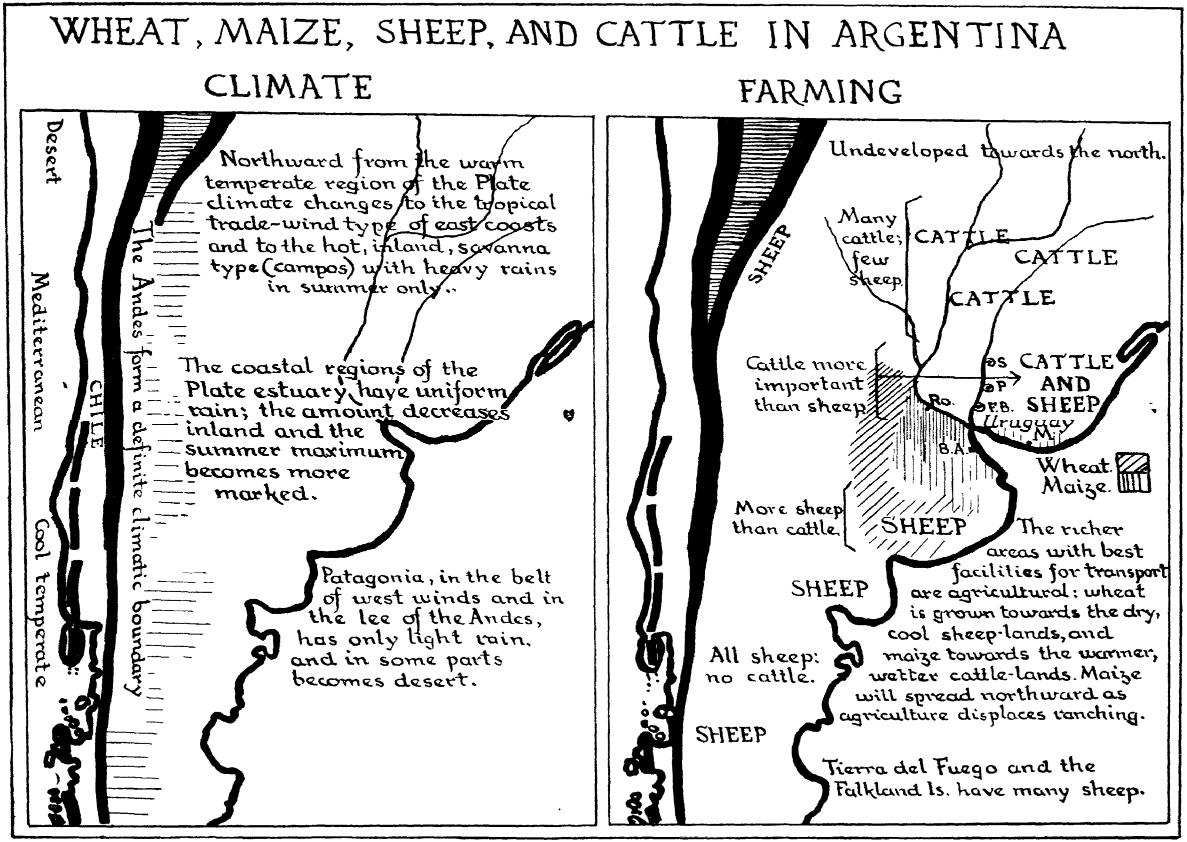

WHEAT, MAIZE, SHEEP, AND CATTLE IN ARGENTINA
CLIMATE
FARMING
Desert
Mediterranean
Cool temperate
CHILE
The Andes form a definite climatic boundary
Northward from the warm temperate region of the Plate climate changes to the tropical trade-wind type of east coasts and to the hot, inland, savanna type (campos) with heavy rains in summer only..
The coastal regions of the Plate estuary have uniform rain; the amount decreases inland and the summer maximum becomes more marked.
Patagonia, in the belt of west winds and in the lee of the Andes, has only light rain, and in some parts becomes desert.
Undeveloped towards the north.
Many cattle; few sheep.
CATTLE
CATTLE
CATTLE
SHEEP
CATTLE AND SHEEP
Cattle more important than sheep
Ro.
B.A.
Uruguay
M.
Wheat.
Maize.
More sheep than cattle.
SHEEP
The richer areas with best facilities for transport are agricultural: wheat is grown towards the dry, cool sheep-lands, and maize towards the warmer, wetter cattle-lands. Maize will spread northward as agriculture displaces ranching.
SHEEP
All sheep: no cattle.
SHEEP
Tierra del Fuego and the Falkland Is. have many sheep.

Fig. 7

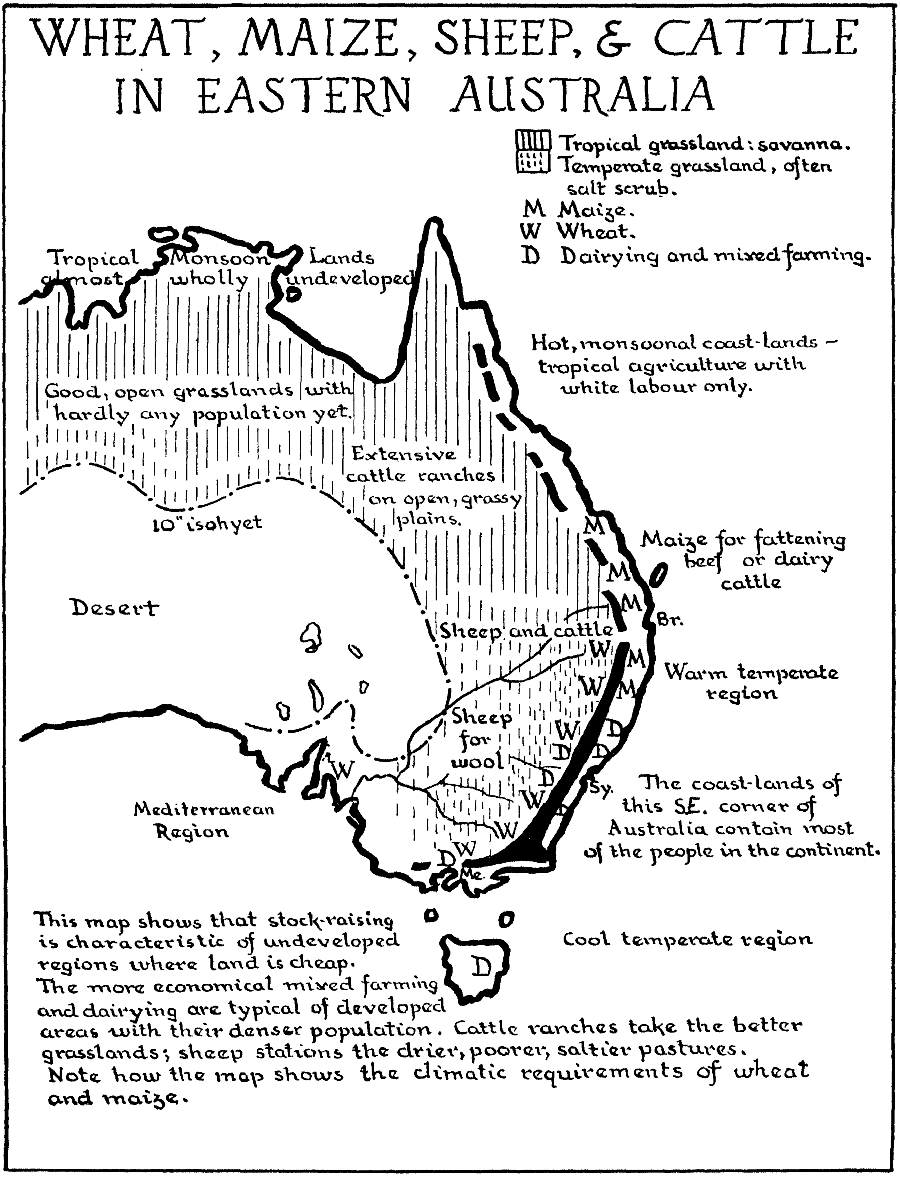

WHEAT, MAIZE, SHEEP, & CATTLE
IN EASTERN AUSTRALIA
Tropical grassland: savanna.
Temperate grassland, often salt scrub.
M Maize.
W Wheat.
D Dairying and mixed farming.
Tropical Monsoon Lands almost wholly undeveloped
Hot, monsoonal coast-lands – tropical agriculture with white labour only.
Good, open grasslands with hardly any population yet.
Extensive cattle ranches on open, grassy plains.
10" isohyet
Maize for fattening beef or dairy cattle
Desert
Br.
Sheep and cattle
Warm temperate region
Sheep for wool
Sy.
The coast-lands of this S.E. corner of Australia contain most of the people in the continent.
Mediterranean Region
Me.
This map shows that stock-raising is characteristic of undeveloped regions where land is cheap.
The more economical mixed farming and dairying are typical of developed areas with their denser population. Cattle ranches take the better grasslands; sheep stations the drier, poorer, saltier pastures.
Note how the map shows the climatic requirements of wheat and maize.
Cool temperate region

Fig. 8

near supplies of fattening foods for cattle—roots, maize, or 'cake'—there is obviously the making of a large-scale beef industry. Figs. 7 and 8 show the interrelation of grasslands, cultivated cattle foods, and the beef industry.

The tropical grasslands are among the last to be developed. The llanos and campos of South America are fast becoming important ranching areas as the development of intensive farming on the more accessible pampas pushes the extensive cattle-farms to other grasslands, thinly populated, and with ample room to spare. In Africa the savanna regions are commercially undeveloped as regards ranching, except in favoured parts of South Africa, because they suffer from disadvantages of transport, climate, or the tsetse plague. For the success of a beef industry, such as obtains in the maize-lands of the United States, or round the Plata estuary, there must not only be the natural advantages already mentioned, but economic advantages that enable full profit to be made from by-products of the industry. In some cases the actual production of beef is carried on at a loss, and it is only the full utilization and marketing of by-products that enable the industry to pay. So the meat-packing towns are near to centres of population in order that every chance may be had for marketing by-products—hides, bones, and horns (for handles, buttons, manure, etc.), hoofs (for glue), hair (for padding and brushes), intestines (for sausages and pepsin), blood (for blood manures and blood 'meal'), and fat (for dripping, tallow, soap, candles, etc.).

The stages of development of the beef industry illustrate how science has altered the wealth of these regions. The earliest stage on these grasslands was that of 'herding' (horses, often), with the production of hides as the prime object. The meat in those days was so much 'rubbish' that could not be used. This stage still persists to a certain extent on the steppes of Eastern Russia. Next, if markets developed near the ranching areas, and as transport improved, there grew up a trade in live cattle—a risky business in which the cattle deteriorated badly in transport. This stage occurs on the steppes of Hungary, whence live cattle are sent to industrial areas on and round the near-by Bohemian Plateau. The next stage was a big step forward—the discovery of the art of canning, and later of freezing, meat so that it remained in good condition for a long time.[1] This is the stage now reached in Argentina, Australia, and in the Central United States, the latter region having huge meat-packing works at Chicago, Omaha, Kansas City, and St Louis.

What are the next stages to which these regions can look forward? The ranches become more agricultural, partly because grain is a more profitable commodity, and partly because it is needed to feed the increasing number of cattle. This stage develops until even intensive agriculture cannot supply all the cattle food needed—the state of affairs reached now in our own country, Denmark, and Holland. Then comes the last stage. The land becomes too densely populated to allow any crops other than human foods, and cattle have to disappear—the stage reached in Japan and in parts of China.

India has more cattle than any other country in the world. For religious reasons (and probably climatic too) they are not used for beef or dairying, but as draught animals. Hindus eat no beef, and little meat at all. For milk they use buffalo milk, and this same animal draws the plough through the flooded rice-fields.

[1] 'Chilled' meat is refrigerated only just sufficiently to check decay; 'frozen' meat is really frozen hard at a temperature of 10° F.

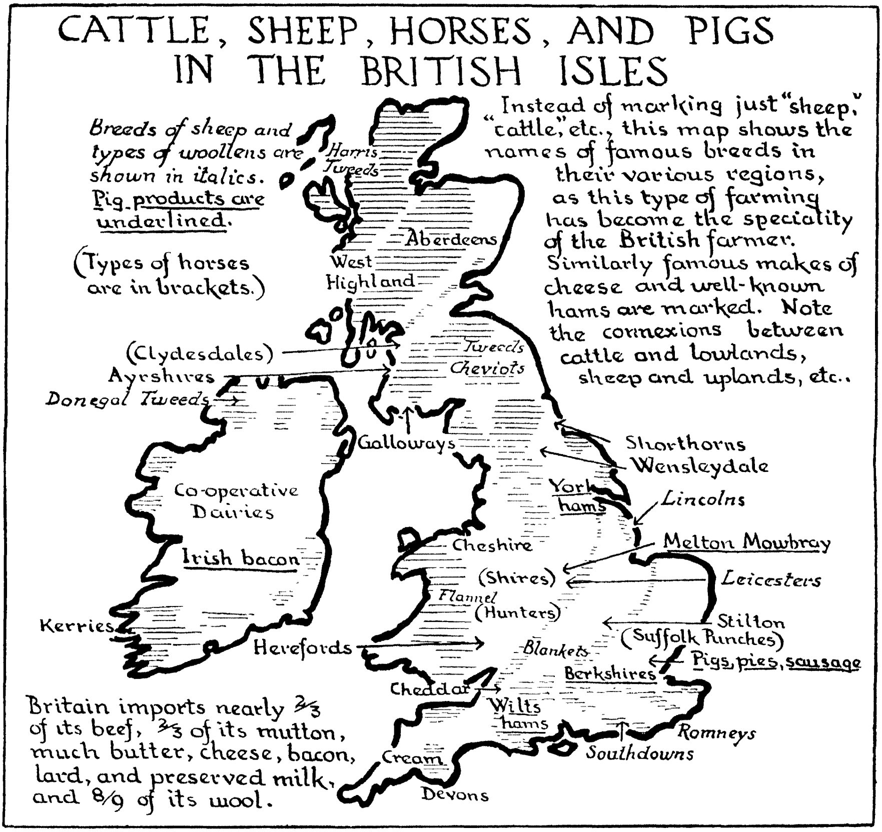


Fig. 9

Notebook Work

(i) *Write notes on "Cattle in Europe," bringing out the various stages reached in different areas according to their state of development.*

(ii) *Draw a world map entitled "Cattle." Show temperate grasslands and tropical grasslands, and note the importance of the cattle industry in each separate area. Note also the other important cattle lands—Western Europe and India—and finally note the fewness of the cattle in Japan and China.*

II. MUTTON

Fig. 9 shows the distribution of cattle, sheep, horses, and pigs in the British Isles, and illustrates the following principles: (*a*) Sheep belong to highland pastures where grass is shorter than in the lowlands, because drainage is more rapid and conditions are cooler. Cattle, on account of the structure of their mouths, cannot crop these very short grasses, but sheep nibble them, and thrive best on them. Moreover, the rapid drainage which partly accounts for the short mountain pasture also prevents foot-rot that sheep develop in damp lowlands. (*b*) Cattle belong to the rich pastures of the lowlands, especially in the mild and rainy west. Most of these cattle are for both beef and dairying, and many young cattle are shipped alive from Ireland to the Midland farmers to be fattened, partly on imported food-stuffs, and killed for the neighbouring markets of crowded industrial areas. (*c*) Pigs are important in cattle areas (see Section III of this chapter).

Many of the sheep in the British Isles are reared for both mutton and wool, and our climate enables the sheep pastures to be sufficiently rich to produce good, saleable qualities of both from the same sheep. This, of course, is a great advantage to the sheep-farmers, and wherever possible they try to obtain this double 'crop.' But in some regions pasture is too poor to produce sheep for mutton at all, because of shortage of rain to freshen the grasses. Such dry areas, like the Karroos of South Africa or the grasslands between the Murray and Darling rivers of New South Wales, specialize almost wholly in wool. New Zealand, however, has a climate somewhat like ours, and sheep there —bred from our Leicesters, Lincolns, Southdowns, and Romneys—serve the dual purpose of producing excellent mutton and good quality wool. In Southern Argentina similar conditions obtain, though the aridity of parts of Patagonia tends to the production of wool rather than mutton.

As we have seen in the case of beef, distant producers have been able to compete with the purveyors of home-killed meat only since the discovery of scientific means of preserving the perishable food. In New Zealand, for instance,

> at first the squatters depended for their living on the sale of wool. The mutton was of little use to them. Fifty years ago, when trade was bad and New Zealand was in dire poverty, shepherds were glad to sell the carcasses of sheep at sixpence apiece. Then the processes of freezing and chilling meat began to be developed, and from that time a trade began which saved the finances of the colony.[1]

NOTEBOOK WORK

(i) *Graph the four following sets of climate figures. A gives figures for the mutton-lands of the Canterbury Plains; B for the wool-lands of New South Wales; C for the dairy-lands of New Zealand; and D for the ranch-lands of Queensland. Write notes on what you observe.*

—	—	JAN.	FEB.	MAR.	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
A	Temp.	58	58	55	52	47	44	42	44	48	51	53	56
	Rainfall	3·4	2·7	3·0	2·7	3·2	3·2	3·0	3·1	2·8	3·0	3·3	3·5
B	Temp.	81	80	74	65	58	52	50	54	60	68	75	79
	Rainfall	1·0	0·8	1·1	0·7	1·0	1·1	0·6	0·8	0·7	0·9	0·7	0·8
C	Temp.	63	63	61	57	53	49	48	49	52	54	57	60
	Rainfall	3·3	3·1	3·3	3·9	4·7	4·8	5·6	4·5	4·0	4·1	3·5	3·2
D	Temp.	87	85	83	78	71	64	61	67	72	83	85	88
	Rainfall	5·1	4·9	2·7	0·9	0·4	0·3	0·5	0·1	0·5	0·5	1·1	3·0

[1] *Evening Standard*, New Zealand Supplement, July 10, 1931.

MEAT

III. PORK AND BACON

A map of the pig regions of the world shows that climate plays only a small part in their distribution, but that the arrangement depends to a large extent on economic conditions. The following types of region can be distinguished:

(*a*) Pigs of the grain and clover lands, fed on surplus farm produce—the maize-lands of the United States fattening pigs for lard, and the barley-lands of Western Europe specializing in bacon.

(*b*) Pigs of the dairy-lands, fed partly on dairy surplus, like skimmed milk (see Fig. 9) —the Lower St Lawrence and Denmark.

(*c*) Pigs of the forest-lands in Central Europe and in the Southern United States, feeding in herds on acorns, beech-mast, etc.

(*d*) Pigs in China, where the population has reached such a density that the keeping of animals is almost impossible. These pigs feed on domestic garbage, and are often kept penned, the stics even being slung over the sides of the boats on which so many people have to live. China has more pigs than any other country, but a trade only in by-products, such as bristles.

(*e*) The 'new' lands of the Southern Hemisphere, with scanty population and ample room, have no cause to intensify meat production. They are unimportant pig areas.

(*f*) Mohammedan lands have few pigs. The religion prohibits the use of fats.

Notebook Work

(i) *Turn the notes of this section into a world map.*

(ii) *Distinguish three types of pig regions in Europe:* (*a*) *dairying area*, (*b*) *forest area, and* (*c*) *maize area.*

IV. FISH

Over five-sevenths of the world's surface is under the water of seas, lakes, rivers, and marshes, and man has always sought some of his food from the teeming life of these waters. Natives of the selvas or Congo forests, far removed from civilization, have long had their ingenious traps and trawls for fish; the Red Indian, the horseman-hunter of the open prairies, was a skilled fisherman too, and Hiawatha sang proudly of his battle with the sturgeon; island peoples of cool or tropic seas have naturally sought part of their living from the surrounding waters; and to the Eskimo on the fringe of the cold Polar desert the sea is almost the only means of livelihood. Throughout the world to-day people obtain much food from sea and river. In many cases there are no statistics of the numbers of people employed in fisheries or of the amount of fish taken, but fishing is a more important occupation than is generally realized. For instance, in India both sea and river fisheries are developed, but there are few detailed statistics of the industry, and because other produce enters so largely into commerce we are apt to forget that India has fishermen at all. South Africa, which we think of as a miners' country with gold, diamonds, and copper, or as a farmers' land with fruit, sheep, and ostriches, has large local fisheries to supply the home market. Fishing is a most important occupation for natives round the African lakes, but we might overlook this in our study of such commodities of that region as particularly affect us. Chile calls to mind miners of nitrate and copper, but the country has fisheries supplying big cities like Santiago and Valparaiso.

Deep seas and shallow seas, warm seas and cold seas, all abound with life. The simplest forms of living things and the biggest living creatures both live in water. The shallow rock-pools of the seashore or the reedy margins of ponds yield a great variety of living things, animal and vegetable; from the deeps of the open ocean scientific expeditions have hauled up strange specimens of life in these abysses. The warm waters of tropical islands are gay with living coral and coloured streaks of darting fishes; the cold water beneath the Arctic ice gives the Eskimo, fishing through a hole in the ice, a rich harvest of edible fish. Yet a map of the world's large-scale sea-fisheries shows clearly that the industry is not scattered haphazard over the oceans, but is concentrated in the shallow waters of continental shelves in temperate regions. Statistics show that three areas are far more important than all others, viz., the Sea of Japan, the North Sea, and the Newfoundland Banks. Let us consider some reasons for these concentrations.

The arguments we have already used about trade in perishable commodities apply also to the fish trade. Most fisheries supply only their home markets, relying on rapid transport of the perishable fish and on quick sales. The three main fishing centres mentioned above are all near to centres of dense population in Japan, Western Europe, and the New York regions respectively. But, as in the case of butter and milk, more scientific transport methods tend to make proximity of markets less important. British trawlers now fish as far afield as the White Sea, Bering Sea, and Davis Strait, packing their catches in ice and returning home when the total catch is worth landing. Newfoundland salmon are exported frozen, and even after several months of freezing the fish have their original attractive appearance and desirable flavour.

But proximity of markets and improvements in transporting fish are in themselves not the prime cause of prosperous fisheries: firstly, there must be a plentiful supply of fish, which in turn depends on a plentiful supply of food for the fish; and secondly, conditions must facilitate the taking of catches.

The edge of the continental shelves marks the real margin of the continents; this edge is the 100-fathom line. Beyond the shelves the sea-floor slopes quickly down to the bottom of the deep ocean basins, the floors of which are vast plains broken in places either by deeps or by peaks or ridges that sometimes reach the surface. Conditions on the ocean-floor are most unfavourable to life; light never penetrates to such depths; the water is almost at freezing-point; a slow 'creep' of this icy water from pole to equator prevents stagnation, but the supply of oxygen in the current is limited, and the supply of food that slowly settles as surface organisms die is only small. Even so, some animal forms do exist in these conditions, but no plants can live. Obviously, then, the beds of the great ocean basins cannot be prolific fishing-grounds, even if man were to master the difficulties of trawling at such depths.

Conditions in the waters of the continental shelves are wholly different. The shallowness helps fishing operations; the 100-fathom line marks the limit of most fisheries, and the 200-fathom line of nearly all. Sunlight penetrates shallow water, and favours the growth of sea pastures (plankton), which are the basis of all life in the sea. There is a continual washing from land to sea of vegetable waste, which provides further food, especially for bottom-living fishes. Fisheries also depend on the habit of fish of coming to the shallows near the land to spawn—in the case of salmon of spawning in the fresh water of rivers—on the character of the bed of the shelf, and on the temperature of the water, but much research has still to be made into many of the mysteries of the food, movements, breeding, and life of fishes. Cool or cold water favours the growth of the minute plants on which all fish-life ultimately depends. Hence the abundant food fisheries of cold seas. We still know little about the effects of modern large-scale fishing methods, of the sudden disappearances or reappearances of certain types of fish, and of the reasons for good and bad harvests of the sea.

Although the British Isles are surrounded by shallow seas, all available as fishing-grounds, the North Sea fisheries are more important than those of the West Coasts, partly because the industry on the east is older, and partly because of the readier accessibility of markets. The fishing ports in order of importance by weight of fish landed are: Grimsby and Hull 4,600,000 cwt.; Yarmouth and Lowestoft 2,700,000 cwt.; Aberdeen and Peterhead 2,700,000 cwt.; Fleetwood (a West Coast port) 1,000,000 cwt. Landed fish go by fast trains to industrial areas, and at Billingsgate, London's fish market, 90 per cent. of the fish arrives by train.

The following extract gives a vivid picture of work on a trawler in the North Sea:

> The net was coming up. The sky, which had been as deserted as the sea, became suddenly full of wings. First twenty, then thirty, then a hundred gulls of all kinds appeared, it seemed, by magic. Soon there were thousands wheeling over us. . . . As these birds heard the winch and saw the movement of the trawl lines they became frantic with excitement. . . . The sea grew sandy. Twenty solan-geese dived together. Their white bodies cut a green line deep in the water. I could see a white blur of feathers where they fought to take fish from the net. . . . Gradually the dripping mesh was pulled up, and the bag was swung on the derrick high above the fo'castle. It hung there dripping sea-water. It shook with struggling fish. It was an enormous bag of life dredged from the sea-bed. I could see between the coarse mesh the flapping tails of flat fish, the gasping head of a cod or haddock, and pale pink sea-urchins by the thousand. Some one pulled a rope, and with a great wet splash thousands of fish fell struggling on the deck. It was an astonishing jumble. It looked like the end of some famous aquarium. Soles, plaice, cod, haddock, cat-fish, monk-fish, eels, mackerel, hake, and dozens of fish unknown to me lay in a great pile two feet deep. . . . No sooner was the net out again than work began. Every member of the crew sat side by side on the wooden edge of the 'fish-pond' with penknives in their hands. . . . Then began a horrible slaughter. The living fish were taken up one by one and gutted. The bodies were flung into baskets, flat fish in one, cod in another, haddock in a third, and so on. . . . In an hour and a half every fish was gutted and packed away in ice.[1]

Drifters catching herring, which are surface-swimming fish, in enormous numbers at a time cannot possibly do the cleaning on the ship. Frequently special fast steamers collect their catches, and hurry them ashore for women to clean. The herring season starts in February or March in North Scotland, and moves gradually down the East Coast, ending at Yarmouth in November. The women 'follow' the boats, moving south from Wick and Aberdeen, through Berwick, Shields, Scarborough, and Grimsby to Yarmouth and Lowestoft. Most of these fish are packed in salt for export and provide cheap food. Much of the white fish landed in this country goes to supply our fish-and-chip shops—an institution that other nations envy, as they have no shops of a similar nature where cheap meals can be obtained with such a high standard of cleanliness guaranteed by Government inspection.

The structure of Norway—the gaunt highlands, the lack of lowland, the stony soils, the effects of glaciation, the fiords—has driven her people to the sea for a living, first

[1] H. V. Morton in *The Daily Herald*, October 14, 1931.

and always as fishermen, then as pirates, yet again as colonizers and adventurers, and later as merchant seamen. Her cod fisheries are prolific, but there is only a small home market, and so the fish are dried or salted for export to countries demanding fish—especially to European Roman Catholic countries. Other fish are tinned for export.

Fig. 10 explains the origin of the Newfoundland fisheries. The chief catch is cod, which is landed in Newfoundland, and thence exported to Latin-American countries as dried or salted fish. The cod-liver oil goes to world markets.

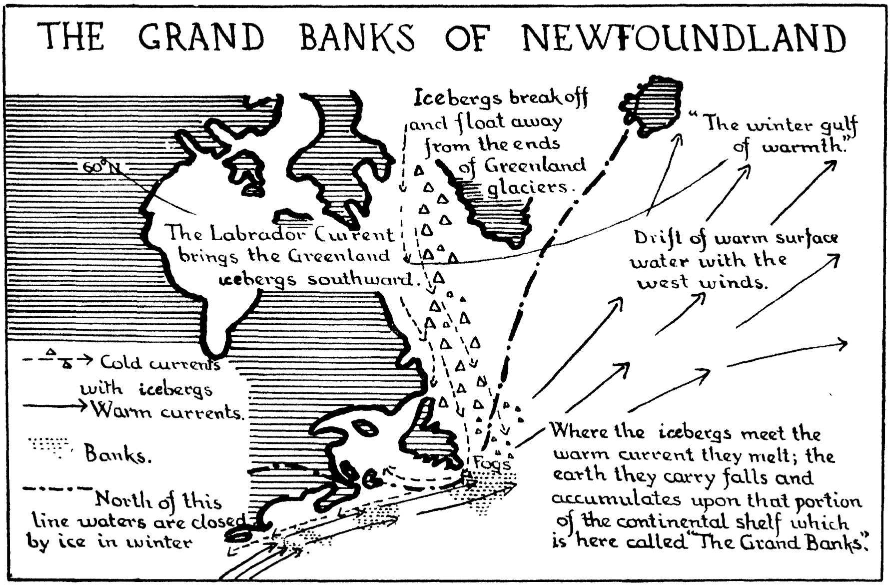


FIG. 10

Mention must be made of two other important fisheries. The large salmon fisheries of British Columbia and Alaska depend on the habit of the salmon of returning from the open sea to rivers to spawn.

> Each year from spring to autumn along 7000 miles of British Columbia's coastline, millions of mighty salmon besiege the mouth to stream and river. Fresh from their ocean feeding-grounds they are on their way back to the inland waters of their birth. It is off the coast in the tidal estuaries of the great rivers, before they reach the safety of their far retreats, that British Columbian salmon yield their harvest. The fish are taken just as they are about to leave the ocean, well-fed and healthy and in the best of condition. To-day, an average of 1,500,000 cases (72,000,000 tins) of canned salmon is produced annually, and the fish is exported to thirty different countries overseas.[1]

In 1930–31 no less than 42,874 whales were caught, of which number 40,201 came from the Antarctic. Norwegian enterprises accounted for 25,952 of these whales, and

[1] Empire Marketing Board pamphlet.

British enterprises for 13,019. The production of whale oil for the same year was 624,000 metric tons. Practically the whole of this output is purchased by the firm of Unilever for use in the manufacture of margarine.

These figures—and others, too—about the millions of fish caught should give cause for serious thought. Can such takings last? Are we, with our modern fishing methods, slowly draining the seas of food? There is no definite answer to this at present, but sufficient doubt about the wisdom of such wholesale methods has been aroused to call for elaborate, scientific inquiries being made into whaling and other fisheries. There is no doubt, however, that some reasoned care and cultivation of fisheries will be necessary in the very near future.

Notebook Work

(i) *Draw a map of the North Sea, and mark the Dogger Bank, the fishing-ports, the times and movements of the herring fishery, and the industrial areas opening to the East Coast.*

(ii) *Draw a map of Japan and the Sea of Japan, and show a similar arrangement of ocean currents as in Fig. 10. Mark also the very deep sea off the east coast of Japan.*

CHAPTER IV

FRUITS AND MARKET-GARDEN PRODUCE

I. FRUIT

Notebook Work

Make a tabular statement about fruits as follows: In Column 1 write a list of about twenty or twenty-five common fruits in our fruit-shops; in Column 2 indicate in three sections where these fruits come from, (a) certainly home produce, (b) perhaps home produce, perhaps foreign, and (c) certainly foreign; in Column 3 specify the perishable nature of the fruit, whether very perishable, fairly, or not very; in Column 4 write down the methods used to help to preserve these perishable goods—i.e., not only questions of cold storage, but also packing, jamming, drying, etc.; in Column 5 give the months when the fruits are in season. Leave Column 6 for extra notes.

The above table will show certain important conclusions about the fruit trade. The 'home produce only' fruits are all, or nearly all, very perishable. Such fruits as blackberries and raspberries do grow in other countries, but the risk of exporting such perishable goods is too great to make any trade worth while. These fruits, because of their nature, also form our commonest jams; the grower must sell quickly, and the jam maker is a ready bulk purchaser. The same perishable fruits are the ones that have 'seasons,' lasting in most cases only a few weeks.

Those fruits which are perhaps home-grown and perhaps foreign are generally less perishable. The foreign supplies depend on this and on scientific care in packing and transport. The more perishable their nature the more they tend to appear in other forms —dried, tinned, or bottled—and the more they have definite seasons. If, however, they are not very perishable they tend to be in season always, because supplies can come at various times from different parts of the world, according to their harvest-times. This stage is comparatively recent. Apples, pears, and oranges are now in our shops all the year round, but not long ago they had very definite 'seasons.' The change is due to improved transport and packing for transport.

The plenteous assortment of fruits that have certainly come from abroad is due partly to perfection of transport, and partly to clever advertising to cultivate a demand for such fruits. Half a century ago the banana was a luxury in Britain; now it is the cheapest fruit. We have seen in our own recent times the grape-fruit turn from an expensive luxury to a cheap, popular fruit; fresh pineapples are rapidly taking the same course —they are cheap now, but many people have still to learn to prefer a fresh pineapple to a tinned one. There is a wide range of other little-known fruits like custard apples, avocados, mangoes, and many more available for us, if and when the demand makes the trade worth while.

So the supply of fruit depends on the nature of the fruit, on demand or 'fashion,' on transport, with its consequent need for capital for fruit companies to run their own special fruit steamers, and also on climatic considerations.

In temperate latitudes perhaps the most decisive single climatic factor that limits apple-orchard areas is the risk of late frosts in spring, when blossom is forming into fruit.

Orchards are situated, therefore, sometimes in the lee of hills to protect trees from these cold winds that might do damage—*e.g.*, Cambridge orchards and the Vale of Evesham—and sometimes near large bodies of water, sea or lake, which moderate abnormalities of temperature—*e.g.*, Devon, Somerset, Hereford, Annapolis Valley, and the Lake orchards. In addition, rain and soil are important factors.

A peculiarity of temperate fruit-growing is extreme specialization in localities, so that a district may grow no fruit but apples, and only one kind of apple, perfected through long experience.

Certain regions, we have already seen, have the Mediterranean climate of winter

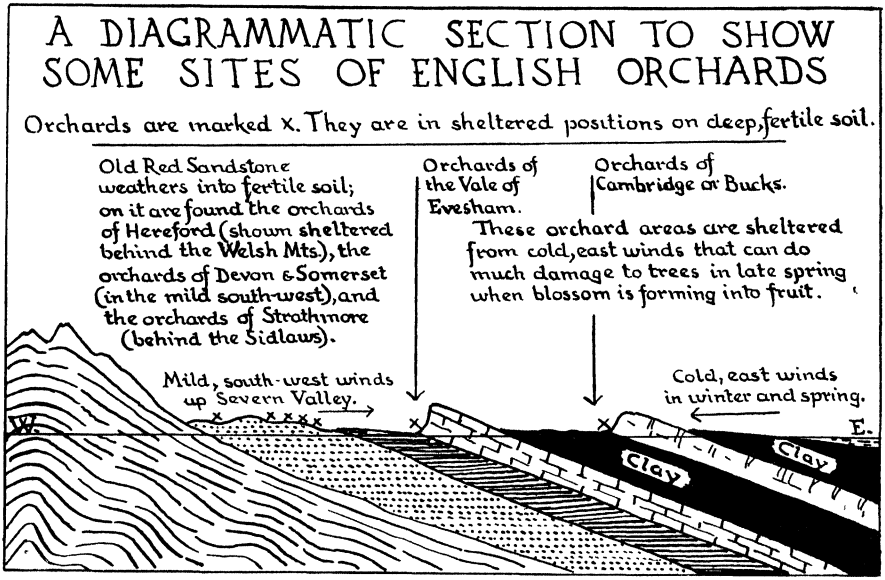


FIG. 11

See also Fig. 14

rain and summer drought. The mildness of the winter aids the formation of fruit (although even in these areas frost sometimes does severe damage), and the hot, dry summer favours the ripening and, if necessary, the drying of fruit. Mediterranean plants are characterized by drought-resisting devices: bark is thick (cork); roots are long (tap-roots of vine) and often bulbous; leaves are thick, dark, and glossy (laurel). The apple with its thin skin is quite unsuited to summer drought; it would shrivel. Many fruits, apart from these native to the Mediterranean, have been acclimatized to its conditions and do well, but often only with irrigation. The orange, which we now think of as a typical Mediterranean fruit, is really native to China. The following fruits are now cultivated in Mediterranean areas: olive, vine, orange, lemon, pomegranate, fig, plum, apricot, peach, quince, almond, chestnut, and walnut. Dried fruits are very characteristic: currants, raisins, figs, prunes, apricots, etc. (see Fig. 12).

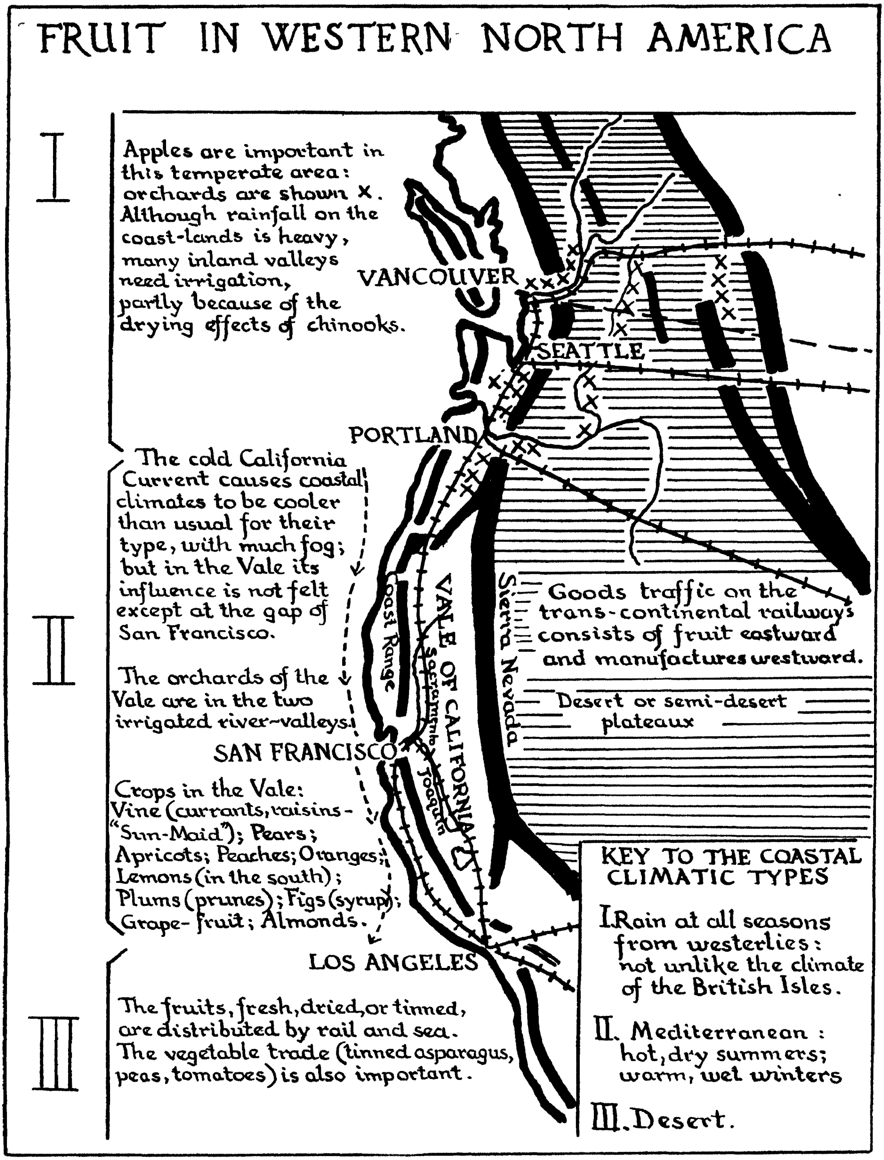

FRUIT IN WESTERN NORTH AMERICA
I
Apples are important in this temperate area: orchards are shown X. Although rainfall on the coast-lands is heavy, many inland valleys need irrigation, partly because of the drying effects of chinooks.
VANCOUVER
SEATTLE
PORTLAND
II
The cold California Current causes coastal climates to be cooler than usual for their type, with much fog; but in the Vale its influence is not felt except at the gap of San Francisco.
The orchards of the Vale are in the two irrigated river-valleys.
Coast Range
VALE OF CALIFORNIA
Sacramento
Joaquin
Sierra Nevada
Goods traffic on the trans-continental railways consists of fruit eastward and manufactures westward.
Desert or semi-desert plateaux
SAN FRANCISCO
Crops in the Vale: Vine (currants, raisins - "Sun-Maid"); Pears; Apricots; Peaches; Oranges; Lemons (in the south); Plums (prunes); Figs (syrup); Grape-fruit; Almonds.
LOS ANGELES
III
The fruits, fresh, dried, or tinned, are distributed by rail and sea. The vegetable trade (tinned asparagus, peas, tomatoes) is also important.
KEY TO THE COASTAL CLIMATIC TYPES
I. Rain at all seasons from westerlies: not unlike the climate of the British Isles.
II. Mediterranean: hot, dry summers; warm, wet winters
III. Desert.

FIG. 12

The Mediterranean areas vary in their stages of development. The countries actually round the Mediterranean Sea are among the 'oldest' lands, for the mild climate and the inland sea favoured early civilization. In the spread of newer civilizations in cooler regions Mediterranean peoples have tended to take a back place in modern trade hustle. California, on the other hand, with its clever marketing and advertising and full use of modern fruit-trade devices, is a good instance of northern vigour applied to the development of a sub-tropical region. The Mediterranean regions of South Africa and Australia

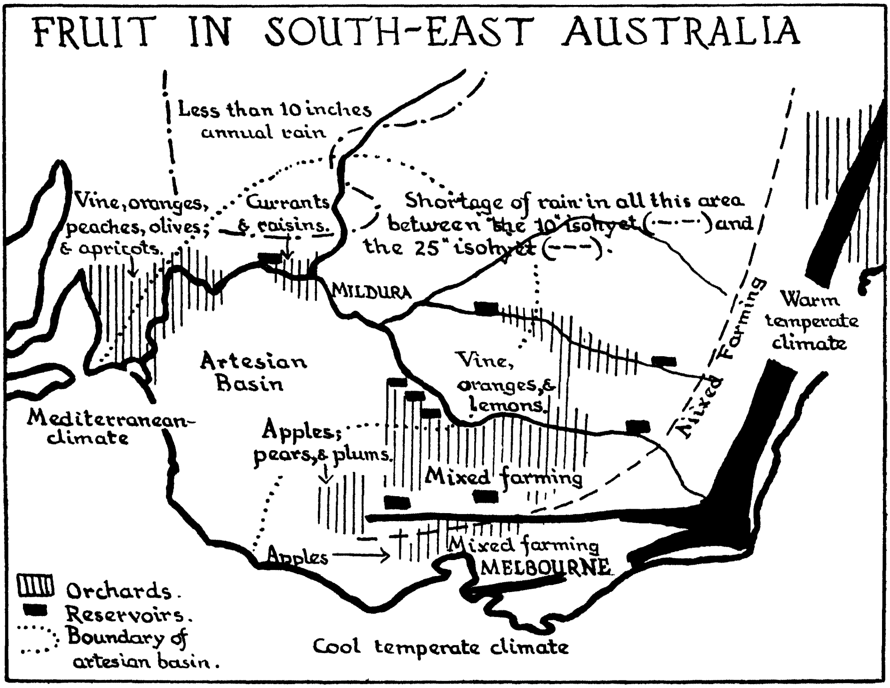


FIG. 13

have developed rapidly, as have also other Empire fruit-lands. Australian currants, raisins, and wines, Jaffa oranges, South African oranges and other fruits have all shown a rapid increase in their sales, thanks mostly to the advertising campaign of the Empire Marketing Board. Central Chile, the remaining Mediterranean region, though comparatively densely peopled for South America, is the most backward of these favoured areas, partly through isolation and partly through Chile's concentration on her mineral industries.

Only a few special tropical areas have developed a fruit trade. The chief banana region in the world is on the hot, wet coast-lands of Central America and Jamaica. The plantations are often found in connexion with cocoa cultivation (see Chapter V). The industry requires much capital to provide transport, docks, schools, hospitals, etc.—

capital that can be provided only by large concerns. The tropical republics are backward commercially, and much of their development is due to the fruit combines who rent and work the banana plantations. Similarly in the Canary Islands, which also have a big banana trade, the whole business is in the hands of large companies. The positions of the Canaries and Central America explain their markets in Western Europe and the United States respectively.

The West Indies grow limes (Montserrat), grape-fruit, and pineapples. Other pineapples come from the Azores and Canaries, Hawaii and Malay. Florida is specially important for grape-fruit and oranges.

Dates are a staple food in desert parts of North Africa. They are cultivated at oases, and exported *via* Biskra and Algiers to Marseilles. Irak also provides a supply.

Notebook Work

(i) *Draw a map of the Mediterranean region, and mark on it the following:* (*a*) *the mountain blocks and folds;* (*b*) *the boundary of true Mediterranean climate;* (*c*) *port wine, sherry, Seville, the region of 'huertas'; tangerines and wines of North Africa; wine, olives, and flowers of the Riviera; Lucca, the lemons of Sicily, and the chestnuts of the Apennines; prunes of Dalmatia, currants of Corinth, figs of Smyrna, oranges of Jaffa, and locust-beans of Cyprus. Write a note on the importance of the olive in relation to climate and lack of dairying.*

(ii) *On a map of the world show the regions with a Mediterranean climate. Account for their limits and their climate. Show by arrows the direction of their export fruit trade.*

(iii) *Draw separate maps to show the orchard lands of* (*a*) *Nova Scotia,* (*b*) *Ontario, and* (*c*) *British Columbia, and note any factors of climate, structure, soil, transport, etc., that favour these special areas.*

II. MARKET-GARDEN PRODUCE

Notebook Work

(i) *From the information on Fig.* 14 *write a reasoned account of the market-gardening industry of South-east England.*

(ii) *Make up a map similar to that of Fig.* 14 *for your own area.*

Supplies of market-garden produce come to Britain from as far away as Egypt or the Canary Islands and Madeira. These lands have climatic advantages for producing vegetables every year long before British supplies are available. The source of supply moves nearer to London with the approach of summer. The Riviera sends to London fresh flowers and vegetables by fast P.L.M. trains; later Brittany and the Channel Islands contribute their 'early' tomatoes and potatoes; then the Scilly Islands and Cornwall, the part of our islands with the mildest winters, send their 'early' flowers and vegetables; local supplies come next, and finally 'late' harvests arrive from northern counties, and from Central Scotland.

There is a similar movement for New York's supplies, starting with Christmas strawberries and lettuce from Florida, and gradually working northward up the sandy east-coast plains until the local supplies are ready in Maryland, Delaware, and New Jersey. These last are the biggest centres of market-gardening in the United States, owing to their sandy soils and their proximity to the area of densest population.

The whole market-gardening industry is risky. Early crops may be ruined by a late frost—even in regions like Florida or the Riviera—or by unexpected storms. There is continual risk of over-production, glutted markets, and uneconomic prices, or of under-production, consequent high prices, but inability to afford them in the cities.

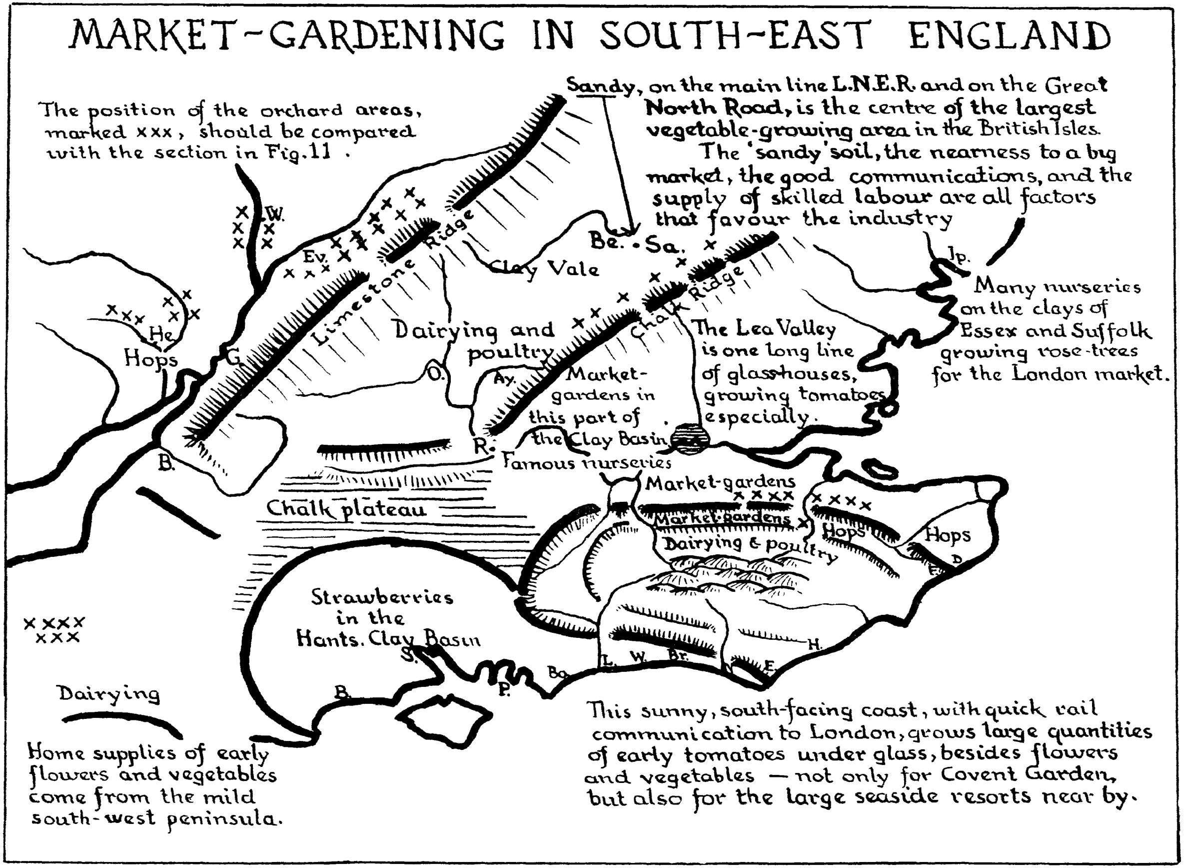

MARKET-GARDENING IN SOUTH-EAST ENGLAND
The position of the orchard areas, marked xxx, should be compared with the section in Fig. 11.
Sandy, on the main line L.N.E.R. and on the Great North Road, is the centre of the largest vegetable-growing area in the British Isles.
The 'sandy' soil, the nearness to a big market, the good communications, and the supply of skilled labour are all factors that favour the industry
W.
Ev.
He.
Hops
G.
B.
Limestone Ridge
Clay Vale
Be.
Sa.
Jp.
Chalk Ridge
Dairying and poultry
O.
Ay.
R.
Market-gardens in this part of the Clay Basin
Famous nurseries
The Lea Valley is one long line of glasshouses, growing tomatoes especially.
Many nurseries on the clays of Essex and Suffolk growing rose-trees for the London market.
Chalk plateau
Market-gardens
Market-gardens
Hops
Hops
Dairying & poultry
D.
H.
E.
L.
W.
Br.
Bo.
P.
S.
B.
Strawberries in the Hants. Clay Basin
Dairying
Home supplies of early flowers and vegetables come from the mild south-west peninsula.
This sunny, south-facing coast, with quick rail communication to London, grows large quantities of early tomatoes under glass, besides flowers and vegetables — not only for Covent Garden, but also for the large seaside resorts near by.

FIG. 14

CHAPTER V

DRINKS

I. WATER

It may seem strange that a humble commodity like drinking-water should have any geography at all, but a brief study will reveal some interesting facts. The British Isles are lands of ample rain and running streams, and yet our water-supply is an intricate problem. Hundreds of village sites are decided by water-supply, but only a detailed study of large-scale maps will reveal the lines of settlements where springs emerge at the junction of clay and porous chalk or limestone. The growth of huge industrial centres, with their consequent smoke and dirt, has presented a new problem in arranging the provision not only of enough water for so many people, but also of clean water. The wet, western, mountainous side of Britain has the heaviest rain and the least industrialization, and it is from these areas that present supplies are in many cases drawn, and whence future supplies, not only of water, but of power also, may be expected. Birmingham and Liverpool both draw their water from Welsh reservoirs, Manchester from the Lake District, and the West Riding woollen towns and the Sheffield area from neighbouring Pennine moorlands. London's supplies for her enormous population come from the Thames and Lea valleys, but there is a present tendency for these reservoirs to become inadequate, and a possibility of harnessing new supplies from the rainier west.

Not all parts of the world are equally fortunate. Some regions are faced with constant shortage owing to light rainfall, and merchants sell water as a commodity. In the dry sheep-lands of New South Wales farmers pay for the privilege of watering their sheep at artesian wells.

Other lands have ample rain, and yet drinking-water is scarce owing to the prevalence of disease germs. It is said that the origin of tea-drinking in the East was due to the need for boiling all drinking-water, and the resultant destruction of its palatability creating a desire to add some flavouring to the tasteless boiled water. In Mediterranean lands, too, water tends to be infected. As a consequence children do not run indoors for a drink of water as English children do, but for a drink of 'wine.' Many tropical developments have been retarded owing to this difficulty about drinking-water—*e.g.*, the construction of the Panama Canal. In regions like the cotton states of the United States, the West Indies, Natal, and others with "eastern-margin, warm-temperate" climates.

> summer is the most unhealthy season of the year, the mortality from dysentry . . . rises rapidly as heat and humidity increase, and it continues to rise into late summer and autumn, for the humidity remains high after the highest temperatures are past. Even when health does not actually suffer there is a loss of energy which makes such climates unsuited to manual labour by white men, and it has been found more satisfactory, if not absolutely necessary, to employ coloured labour.[1]

The progress of tropical medicine and arrangements for modern sanitation are doing much to better conditions in these regions.

[1] *Climatology*, by A. Austin Miller.

DRINKS

II. TEA

The statistics show that tea plantations are confined almost exclusively to monsoon Asia. Let us try to work out the geographical reasons for this. Tea is the dried leaves of an evergreen shrub. Imagine the number of leaves you would need to pick from, say, a privet hedge to make one pound. Then imagine the number of *dried* leaves necessary to make the same weight, and then realize what it means when India and Ceylon export 550,000,000 pounds of tea, and that when the commodity reaches us it is cheap enough for anyone to buy!

Two facts emerge: (1) the necessity for an enormous supply of cheap labour, and (2) the need of a climate that allows shrubs to be robbed of so many leaves without being killed altogether. The characteristics of the monsoon climate we have already discussed (Fig. 3); the recovery of 'damaged' plants is possible only in a climate of this type. The speed of the recovery depends wholly on the climate, and the amount of 'damage' done by picking the leaves is regulated by climatic conditions. In Ceylon, with its maximum heat and humidity, pickings take place every ten days during the season, but in China and Japan where conditions are cooler and drier (though still monsoonal) only three or four pickings can be made in the whole summer. We shall refer again to the picking of leaves in these areas in connexion with the silk industry (see Chapter XI).

We already know why the monsoon lands are the most densely peopled in the whole world, and that the people are mostly peasant farmers or gardeners. These peasants provide plentiful labour in the tea plantations, working for low wages because of their humble way of living. They are used from birth to gardening tasks, and so pick the leaves skilfully and delicately, doing a minimum of damage.

One last consideration—tea grows on hillsides, which ensure perfect drainage of the roots, for standing water is fatal.[1] If now we look on the map of monsoon Asia for (*a*) hilly land, (*b*) rainy land, and (*c*) densely peopled land the tea areas can easily be guessed. In India 82 per cent. of the tea area is in Assam and Darjeeling and its neighbourhood, where the production has trebled in the last forty years. In Ceylon tea is the most important commercial crop. The industry originated here when disease ruined the coffee crop about 1873. "Eighty per cent. of the area is located in Kandy . . . at elevations of 3000 feet. The best quality tea is produced between 4000 and 6000 feet."[2] In China the tea production exceeds that of India, but the exports are very much smaller. The plantations are situated in the hilly lands between the Yangtse and the Si rivers, especially towards the coast, which receives most rain from the south-east monsoon. Much of Japan is mountainous, but only the southern half of the country has a climate suitable for the growing of tea. The tea gardens on the west side, facing the Sea of Japan, receive heavy falls of snow in winter, when the north-west monsoon blows across this sea and deposits its moisture on the mountains; but this snow serves to protect the plants from injurious frosts.

Notebook Work

(i) *Draw a special map (or maps) of the Assam-Darjeeling tea region, showing the mountains, the rainfall, the tea and rice areas compared, and the railways to Calcutta which provide the transport for the export of the tea.*

[1] Tea can be grown also on plains where special attention is given to drainage.
[2] Empire Marketing Board pamphlet.

(ii) *Graph these two sets of climate figures, and write notes about tea growing and picking in each region:*

—	—	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
A	Temp. Rainfall	70 4	70 4	72 5	73 10	73 7	72 3	71 3	71 3	71 3	71 8	70 10	70 6
B	Temp. Rainfall	34 2	36 3	41 4	52 5	59 6	66 6	73 6	75 6	68 9	57 7	48 4	38 2

III. COFFEE

Like tea, coffee is a hillside plant. It requires warmth and moisture, and also a supply of cheap labour at harvest-time. Unlike tea, it cannot withstand frosts at all, and, moreover, it is grown for its berries, and not for leaves. The climate, therefore, must be suitable for the formation and ripening of fruit, and so too much rain is a disadvantage. In addition, it is a plant that needs shade from direct sunlight. These conditions limit possible areas to only a few regions. They must be in the tropics for warmth; they must be hilly, and yet not so high that frost becomes a danger; they must be rainy, and yet not too rainy; and they must be well populated to supply labour. The monsoon lands are often too rainy, and winter temperatures towards China and Japan are very low, but in Southern India and in Ceylon coffee is grown, although tea is of far more importance now, especially in Ceylon. Equatorial regions, as we saw in Chapter I, are thinly peopled, except in parts of the Dutch East Indies. Java grows much tea and coffee on its rainy mountain-slopes, and Chinese immigrants provide ample, cheap labour. There are also the east-coast, trade-wind regions and the savannah belts to be considered. The coast-land hill-slopes of the Brazilian highlands grow most of the world's coffee. The corresponding area north of the equator is also important—the Andean slopes in Venezuela and Colombia, and the plateau slopes of Central America. In East Africa the labour supply is a difficulty, but Empire coffee plantations are of increasing importance on the uplands of Kenya. Australia, with a definite ban on the import of coloured labour, grows no coffee, although hillsides in Queensland are suitable. The savanna lands are too far removed from facilities for export to be important yet. It will be noticed that all the producing regions mentioned are coast-lands.

The real home of the coffee plant is in Yemen, in the south-west of Arabia. This is the only part of Arabia with any rain, and warm mists rise up the hillsides and further water the coffee-trees, and incidentally provide shade from the burning sun.

Coffee farms in Brazil, the most important region of all to-day, are called *fazendas*. These are huge, self-contained estates with their own schools, workshops, hospitals, cinemas, etc. The labourers are partly negro descendants of the original slaves, but mostly recent immigrants from Italy and Germany. The over-specialization of these estates in coffee has had disastrous results during the present world slump in prices. The coffee, no matter how cheaply produced, could not be sold at a profit. In consequence, there is now a development of other crops, oranges in particular, and of ranching on the neighbouring campos—certainly a more sensible procedure than the first attempts to cure the depression in the coffee market by burning tons of good coffee and dumping more tons into the sea in an effort to produce a shortage and a rise in price.

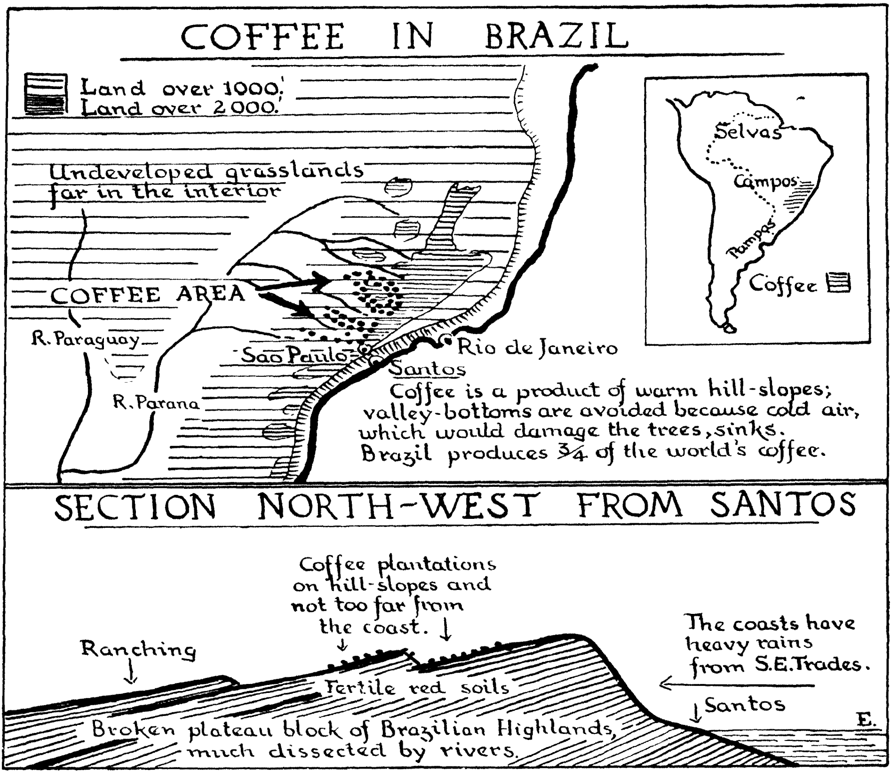


FIG. 15

An East African coffee plantation, when the trees are in bloom, is in its own way as lovely as an English orchard in April. The trees are planted at regular intervals, and are kept down to a height of about six feet. Immediately after the rains they are a sea of white, cherry-scented bloom, which 'sets' into clusters of green berries. In September, October, and November these ripen into red, so that to English eyes they are pleasantly reminiscent of holly. Inside each berry are two twin beans which, taken out of their coats and roasted, are all we know at home of the coffee-tree.[1]

IV. COCOA

The word 'cocoa' is a rather natural misspelling of the native word 'cacao.' The cocoa-tree is about the size of a normal apple-tree, but is peculiar in that its fruit grows direct from the trunk and large branches. The pods are large and heavy, but the sup-

[1] Empire Marketing Board pamphlet.

porting stalks are only slender. Severe storms of wind or rain would soon smash the pods from their stems, just as autumnal winds and rains in Britain scatter the chestnuts. Yet cocoa is a tropical plant requiring the ample rain and heat of tropical lowlands—*i.e.*, it thrives in regions that have heavy rainstorms, and seasonal hurricanes too. So the trees have to be protected from this damage. Young trees are often grown under banana

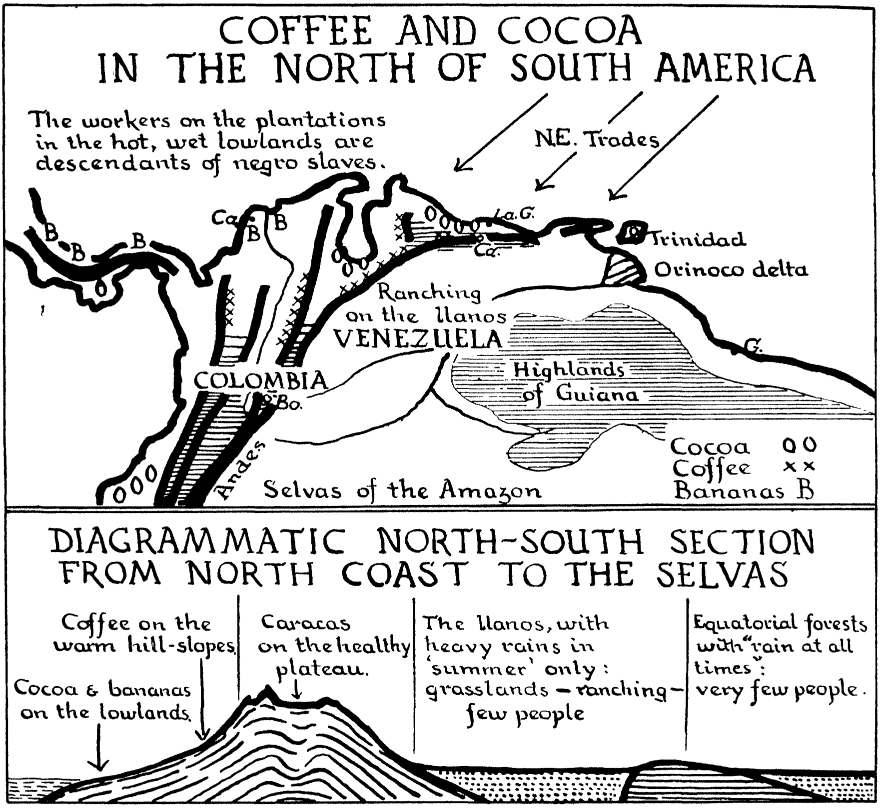


FIG. 16

'trees,' whose massive leaves give shelter from wind, rain, and sun. In Central America and in the north of South America the banana—the sheltering tree—is to-day often of more value than the cocoa it shelters. Sometimes wind-breaks are built. In West Africa the trees are planted "close enough for the branches of the grown trees to form a roof of foliage."

There are only two main areas of cocoa cultivation at present, one in the native home of Central America, producing the best quality cocoa, and the other in the Gold Coast, producing the larger quantity. In both cases the plantations are near to the coast for climatic reasons and for export. In South America the coast-lands of Brazil, Ecuador, and Venezuela all grow much cocoa (see Fig. 16), while of the West Indies Trinidad, San Domingo, Jamaica, and Grenada are important. Much of this area was once a colony of Spain. Cortez found the Aztecs had a national drink, *chocolatl*, and Spaniards introduced cocoa to Europe. Chocolate is still a national drink in Spain.

The industry in the Gold Coast is extraordinary in many ways. The coastal climate is, of course, suitable to cocoa, but little more than thirty years ago there was no cocoa there at all. To-day the colony exports about one-half of the world's supply. In a way the growth of the industry has been haphazard, in that there was no predetermined policy to make this the world's cocoa plantation. The natives themselves have developed the production from small, almost accidental beginnings. The farms are still native-owned and native-worked, as distinct from the plantation system of America, with its imported negro labour. The Agricultural Department has helped with advice, and the result is 180,000,000 trees in the Gold Coast alone, and this rapid growth has led to endless transport difficulties in a tropical colony with few roads or railways, and with a surf-beaten coast that has few harbours. (See Fig. 6.)

> Cocoa is only planted in the forest area [of the Gold Coast]. The grower first cuts away the undergrowth, and thins out the smaller forest trees. He usually leaves the larger ones standing. He scatters cocoa seed on ground that has been lightly hoed over, and so fertile is the soil that the seedlings flourish. The fertility, the climate, and the readiness with which the trees yield cocoa to a minimum of human effort incline the farmer, if disease attacks his trees, to desert the plot and cultivate another. That there is danger in this is obvious.[1]

Notebook Work

(i) *What do you notice about the position of the large sweet and chocolate works in the United Kingdom—namely, Fry's, Cadbury's, Rowntree's, Barrett's, Pascall's, Mackintosh's, Terry's, etc.?*

(ii) *Draw sections from north to south (a) across Venezuela and (b) through the Gold Coast, and note variations in rainfall, vegetation, occupations, and products.*

V. WINE, BEER, AND WHISKY

We have already spoken of the perishable nature of many fruits, its effect on supplies, and the methods adopted to prevent wastage. Grapes are particularly perishable. We know that they arrive at our fruit-shops carefully packed in broken cork. The juice is the only desirable part of the grape, and this can be preserved and kept indefinitely as wine. Not all grapes make good wine, and only a comparatively few special areas out of all the grape-growing regions have achieved any reputation in the world market. The reasons for this lie in special climates, soils, and the skill of the producers acquired from centuries of specialization.

The vine is native to the Mediterranean lands, and its special adaptation to their climate has already been mentioned. It grows outside the Mediterranean area only when favoured sites are chosen, especially on sunny hill-slopes. Shortness of summer limits its extent northward. Fig. 17 shows the well-known wine areas, but does not show the much more extensive other areas that grow the vine for their own local use, and

[1] *Cocoa*, a booklet from Bournville.

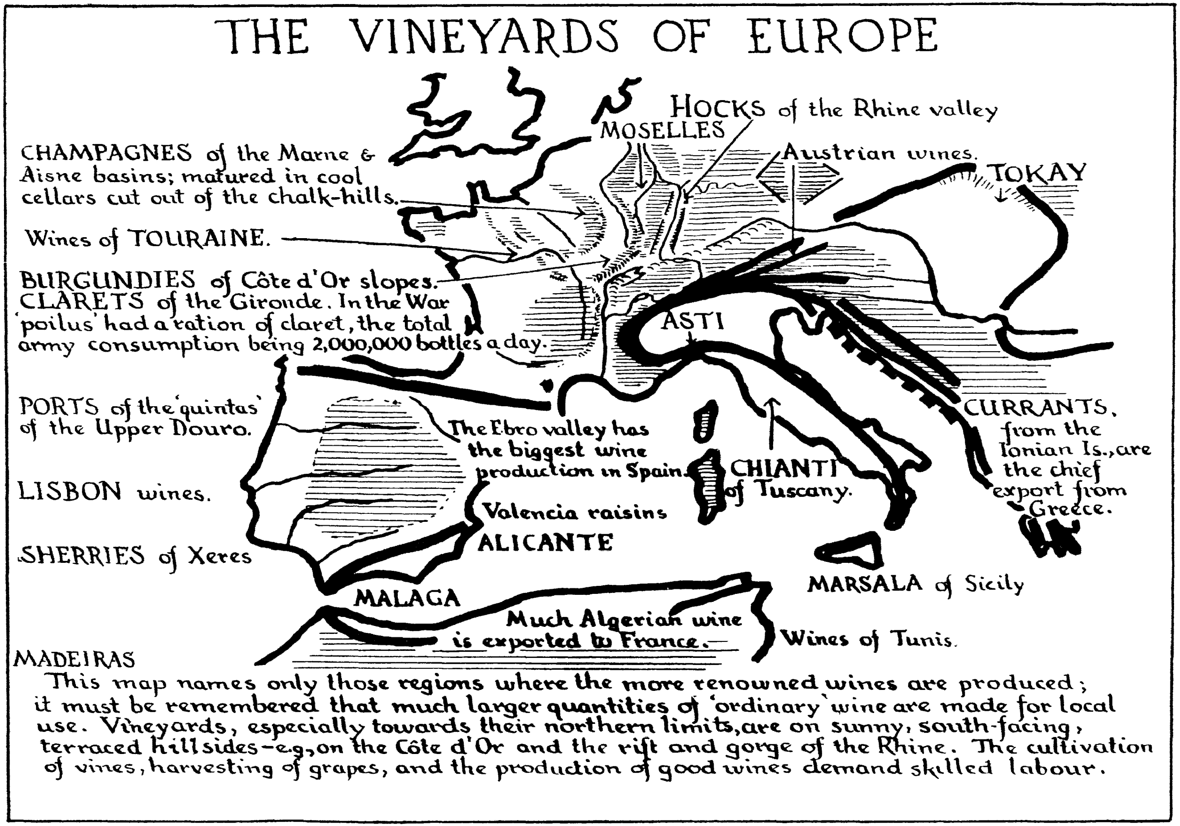

THE VINEYARDS OF EUROPE
HOCKS of the Rhine valley
MOSELLES
CHAMPAGNES of the Marne & Aisne basins; matured in cool cellars cut out of the chalk-hills.
Austrian wines.
TOKAY
Wines of TOURAINE.
BURGUNDIES of Côte d'Or slopes.
CLARETS of the Gironde. In the War 'poilus' had a ration of claret, the total army consumption being 2,000,000 bottles a day.
ASTI
PORTS of the 'quintas' of the Upper Douro.
The Ebro valley has the biggest wine production in Spain.
CHIANTI of Tuscany.
CURRANTS, from the Ionian Is., are the chief export from Greece.
LISBON wines.
Valencia raisins
ALICANTE
SHERRIES of Xeres
MARSALA of Sicily
MALAGA
Much Algerian wine is exported to France.
Wines of Tunis.
MADEIRAS
This map names only those regions where the more renowned wines are produced; it must be remembered that much larger quantities of 'ordinary' wine are made for local use. Vineyards, especially towards their northern limits, are on sunny, south-facing, terraced hillsides—e.g., on the Côte d'Or and the rift and gorge of the Rhine. The cultivation of vines, harvesting of grapes, and the production of good wines demand skilled labour.

Fig. 17

not for the world market. Vineyards are mostly on sunny hill-slopes, often terraced in specially favoured districts to increase the possible area. The importance of the vineyards of Europe decreases towards the north-east from the Mediterranean.

Australian and South African wines illustrate well how fashion can often override geography. The Mediterranean regions of these countries can produce excellent wines of the 'Bordeaux' and 'Port' kinds, but it has needed much advertising to persuade people to try these wines, just as it has taken Australia and South Africa a long time to master even the elements of wine production. To-day, however, quality and quantity are both good, and the trade is well established.

Beer and whisky belong to the cool or cold temperate lands farther north. Beer is made from malt—*i.e.*, barley which is made to sprout in artificial moist heat—fermented with yeast and flavoured with hops. Germany easily leads in production of beer, with the United Kingdom next. The chief hop-fields are in Kent and Hereford, in South Germany round Munich, and in the Bohemian 'Diamond.'

Whisky is distilled from fermented barley. It can also be made from maize, rye, oats, or potatoes. It is typical mostly of Scotland and Ireland.

Notebook Work

(i) *Draw a map entitled "The Drinks of the World," on which you insert in the appropriate regions tea, coffee, cocoa, beer, wine, whisky, maté, saki, koumiss, and any other native drinks you know.*

(ii) *Write notes about the following climates: A, a coffee region at a height of* 5500 *feet; B, a cocoa region lying near the coast.*

—	—	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
A	Temp.	64	65	66	65	63	61	59	60	63	66	64	63
	Rainfall	1·9	4·2	3·7	8·3	5·2	2·0	0·8	0·9	0·9	2·0	5·8	3·5
B	Temp.	80	79	81	81	80	78	77	76	77	79	80	80
	Rainfall	0·5	1·3	2·4	3·5	7·2	10·2	2·2	0·9	0·9	2·4	2·8	0·8

CHAPTER VI
SUGAR

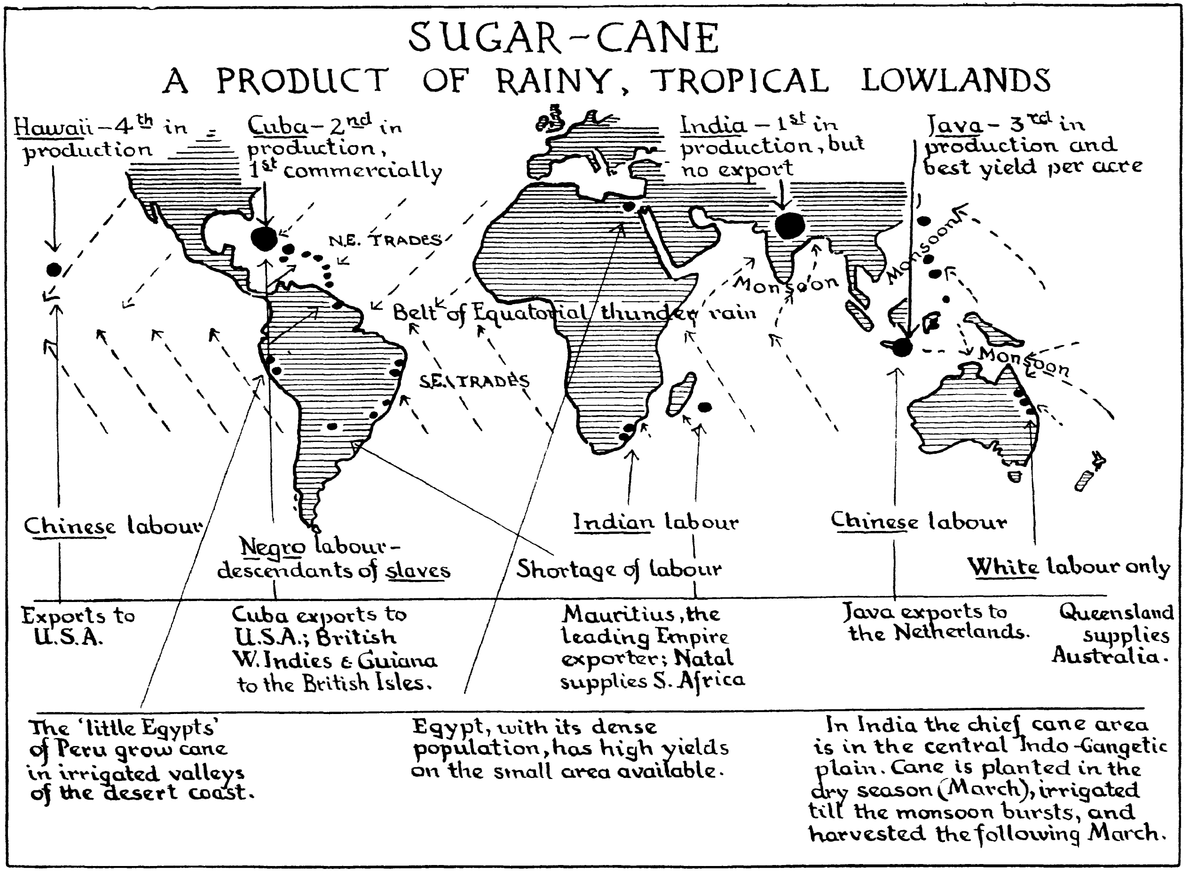
I. CANE-SUGAR

FIG. 18 shows two main facts about the cultivation of sugar-cane: (1) it is confined to hot, wet lowlands; and (2) there is a complicated problem of the labour supply to work in such climates—only in Queensland is there white labour for this crop. Let us consider these points in more detail than the map can show.

The cane is grown from sections of the previous year's cane. Planting is done before the heavy rains of the wet season begin. Combined heat and moisture soon cause rapid growth, so that by the end of the rainy season the plants are eight, or more, feet high, and the stems as thick as a wrist. This makes harvesting laborious. The canes are chopped down by hand, and the top leaves lopped off. Transport from the fields is made difficult, too, by the muddiness of the ground, consequent on the heavy rains. Carts with very broad wheels are used—in structure similar to the heavy wagons of our country before good roads were made—or in up-to-date plantations light tramways are laid, the locomotives burning the leaves and cane refuse. A modern factory employs heavy steam-driven crushing machinery to extract the sap from the cane, but in many areas the old windmills—a form of power typical of flat coast-lands—are still used. The sap is then concentrated and the sugar crystallized out. The 'mother liquid' is molasses, from which rum can be distilled. The cane refuse after crushing is almost useless, except as fuel. Production therefore depends not only on climate and labour, but also on organization, and much capital is needed to provide modern machinery. The big trade of Cuba is due, to a large extent, to American influence in providing up-to-date equipment. The lack of export trade from India is accounted for partly by dense population, and partly by primitive methods of production.

II. BEET-SUGAR

The story of the development of the sugar trade is historical and political rather than geographical. Before the Age of Discovery honey was the sugar of the British Isles, and it was only as colonies developed that a trade in cane-sugar arose, and with it the slave-trade also. Only cane-sugar was used until wars and blockades at the end of the eighteenth century cut off France's supply. This caused France to start the search for other sugars of commercial value, but it was in Germany that the beet-sugar industry developed fully. By means of tariffs on imported cane-sugar the industry was nursed, and a successful export trade eventually started. But tariffs in Germany (with consequent high prices for sugar), the prospect of ruin to cane growers, and discontent in Germany at the artificially high home prices led to a Sugar Conference at the beginning of this century, the result of which was that beet- and cane-sugar were to compete on equal terms without the uneconomic help of tariffs. By this time, however, scientific Germany had made such advances in her industry that the imports of cane-sugar into the British



SUGAR-CANE
A PRODUCT OF RAINY, TROPICAL LOWLANDS
Hawaii - 4th in production
Cuba - 2nd in production, 1st commercially
India - 1st in production, but no export
Java - 3rd in production and best yield per acre
N.E. TRADES
Belt of Equatorial thunder rain
S.E. TRADES
Monsoon
Monsoon
Monsoon
Chinese labour
Negro labour - descendants of slaves
Indian labour
Shortage of labour
Chinese labour
White labour only
Exports to U.S.A.
Cuba exports to U.S.A.; British W. Indies & Guiana to the British Isles.
Mauritius, the leading Empire exporter; Natal supplies S. Africa
Java exports to the Netherlands.
Queensland supplies Australia.
The 'little Egypts' of Peru grow cane in irrigated valleys of the desert coast.
Egypt, with its dense population, has high yields on the small area available.
In India the chief cane area is in the central Indo-Gangetic plain. Cane is planted in the dry season (March), irrigated till the monsoon bursts, and harvested the following March.

Fig. 18

Isles declined rapidly in favour of the nearer, cheaper beet-sugar. The Great War cut Britain off from this German supply, and immediately the cane-sugar trade began to flourish again. To-day the balance is slowly swinging again the other way—a reversion to beet-sugar, and an attempt is being made to develop that industry in the British Isles. The state of mind of West Indian sugar planters as the result of these changes in the course of thirty or forty years can well be imagined.

Beet-sugar is typical of cool temperate lands with dense populations. Much labour is needed in planting out the young beets, and in hoeing and weeding during growth. Machines turn out the grown roots, but hand labour is again needed for gathering, 'snacking' the tops, carting, and storing in earth and straw 'pies' to prevent damage by frosts. In winter-time the sugar factories are at their busiest, and absorb some of the farm labour that is idle during winter months.

The by-products from the beet industry are of far more use than those from the cane industry. The beet-tops make excellent fodder, and the beet refuse after crushing is fed to dairy-cattle and pigs. Indeed, dairying and the cultivation of beet are complementary, and both fit in admirably to an intensive system of mixed farming.

Notebook Work

(i) *Write a series of orderly notes about Fig.* 18.

(ii) *On a map of Europe mark the following areas that produce much beet-sugar:* (*a*) *Flanders,* (*b*) *the Middle Elbe Basin,* (*c*) *Bohemia,* (*d*) *Silesia,* (*e*) *in the Ukraine between Kiev and the Romanian border. Mark the whole of the European plain, and write notes to explain the limits of the sugar-beet regions—e.g., the moors, marshes, or forests of the Baltic coast-lands, the heaths between the Zuider Zee and Hamburg, and the forest belt of Russia.*

(iii) *Write notes about the following climates: A, a cane-sugar climate; B, a beet-sugar climate.*

—	—	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
A	Temp.	76	77	75	71	68	64	64	65	67	69	72	74
	Rainfall	4·6	4·9	5·4	3·4	1·9	1·2	1·2	1·7	3·2	5·1	5·0	5·1
B	Temp.	30	32	37	46	56	63	66	64	58	48	38	32
	Rainfall	1·3	1·0	1·6	1·5	2·4	2·4	3·4	2·8	2·0	1·5	1·5	1·5

CHAPTER VII

THE FOOD-STUFFS OF THE BRITISH ISLES

THE first six chapters of this book have dealt with various aspects of the geography of all the main foods; the remainder of the book will deal with produce that is raw material for processes of manufacture. Before going on, however, it is worth while summarizing the position in the British Isles as regards food-supplies.

Let us suppose for a moment that the British Isles are somehow entirely cut off from all foreign sources of food, relying wholly on home produce to feed nearly fifty million people; and let us suppose, too, that Britain has no export trade at all, but is a self-contained island community.

First, for climatic reasons Britain would have to do without tea, coffee, cocoa, many fruits, cane-sugar, many vegetable oils, rice, sago, tapioca, and some other foods that grow in warmer climates.

The area of the United Kingdom is about 120,000 square miles, and the population 48,000,000. This means that every square mile of the land would have to support an average of 400 people in food and clothing. Of this area about one-third is mountainous, so that each square mile of arable land would probably have to support 600 or more people in food, while uplands would have to provide power and clothing.

Let us consider the question of bread-supplies first. At present the wheat-yield of Great Britain is about 30 bushels per acre; the consumption of bread per person per year requires about 5 bushels. Each acre, then, supports about six people. One square mile of similar land should support $6 \times 640 = 3840$ people in wheat alone. But it need support only 600, or, say, one-sixth of the maximum possible. Five-sixths of each square mile might, therefore, be used otherwise than for wheat. It is well to remember also that wheat is not the only grain Britain can grow, or the most suitable for the climate; oats, barley, and rye all are more suited to cool temperate conditions. Whatever the crop, in such a climate ample storage would have to be made for bad seasons in order to avoid risk of famine. At present the United Kingdom grows only one-fifth of its bread, and this could obviously be vastly increased on a present basis, without considering possible improvements in scientific farming methods. The remaining five-sixths of each arable square mile would have to be used for meat, milk, root-crops, and grass. In this connexion we might recollect that a vegetarian diet is possible, that meat is not wholly essential, and that meat-eating is wasteful of land and crops. But just now we will consider that the diet would remain unchanged as far as possible.

Next, let us consider what meat and dairy produce Britain would have. To-day she produces about one-third of the beef and one-third of the mutton needed; she imports a big proportion of her butter and cheese, eggs, bacon, lard, and pork. As regards sheep, to be self-supporting in mutton Britain would need three times as many sheep, and these might provide enough wool, eked out with leather and flax, to supply clothing too, for, although now eight-ninths of our wool is imported, a large proportion of this is exported again as manufactured goods. There is no doubt that upland pastures in Wales, the

Southern Uplands, the Pennines, the Downs, etc., could support many more sheep, especially if fodder for winter use were economically stored where necessary.

Denmark and Holland afford examples of what can be done with intensive dairying. The production of dairy-stuffs could be vastly increased on British farms; the climate is ideal, and the pastures much superior to either the sandy soils of Denmark or the expensively drained polders of Holland. An increase in the number of goats on high or poor pasture and an imitation of the Swiss method of farming mountainous country might increase dairy produce still further.

The lack of the great variety of imported fruits would be a sad loss. The orchard area would have to be increased, the yield of fruit would need improvement, and careful storage would be an essential between harvests. As regards vegetables, foreign imports at present are mostly 'early' produce—a pleasant luxury. But market-gardens would have to increase their yield of small fruits—fresh, tinned, and jammed. Hillsides and mountains would have to be used for their fruits, but with some cultivation to improve yields of wild strawberries, blackberries, whortleberries, and various nuts. Without tea, coffee, or cocoa Britain would have to rely wholly on ale and a variety of country 'wines.' It is probably in this matter of fruits that she would feel her isolation most. The continual supply of cheap, fresh fruit from all over the world is one of the boons of present-day commerce.

Questions of the supply of clothing, machinery, building materials, etc., are worth considering after the remainder of this book has been studied in order to see to what extent the British Isles are independent of foreign supplies.

Summarizing what we have been studying, we might say that the possibility of a self-supporting United Kingdom is not ridiculous; the standard of life would alter considerably, but the standard of health need not deteriorate, and might well improve. But it is all a fanciful idea, we hope—only an interesting geographical exercise—for when we consider the wealth of world produce easily available isolation is merely folly. The standard of life—our very lives—depend to-day not on isolation but on the security in the distribution of the products of the whole world.

Notebook Work

(i) *Considering the production of food-stuffs alone, mark the following types of region on a map of the world:*

(*a*) *Regions where the production of food is most intensive and the fullest possible use seems to be made of the land. For instance, the allotments round our big towns, cultivation in over-populated China, and dairying in Denmark come under this heading. The use of farm-land in our own country, with its pasture and hedges, is certainly not included.*

(*b*) *Regions where the production of food is extensive—e.g., the wheat-lands of North America or South Russia, the ranches of the pampas, and the mutton-lands of New Zealand.*

(*c*) *Regions where the production of food is only primitive—e.g., in the selvas and in the Congo forests.*

(*d*) *Regions that import much food, not because they cannot grow any, but because they have specialized in manufactures which are sold in exchange for food grown elsewhere—e.g., the British Isles.*

(*e*) *Regions that export much food.*

(*f*) *Regions that produce little or no food.*

(ii) ***Draw a world map (with notes) to show British Empire supplies of food.***

CHAPTER VIII

TOBACCO

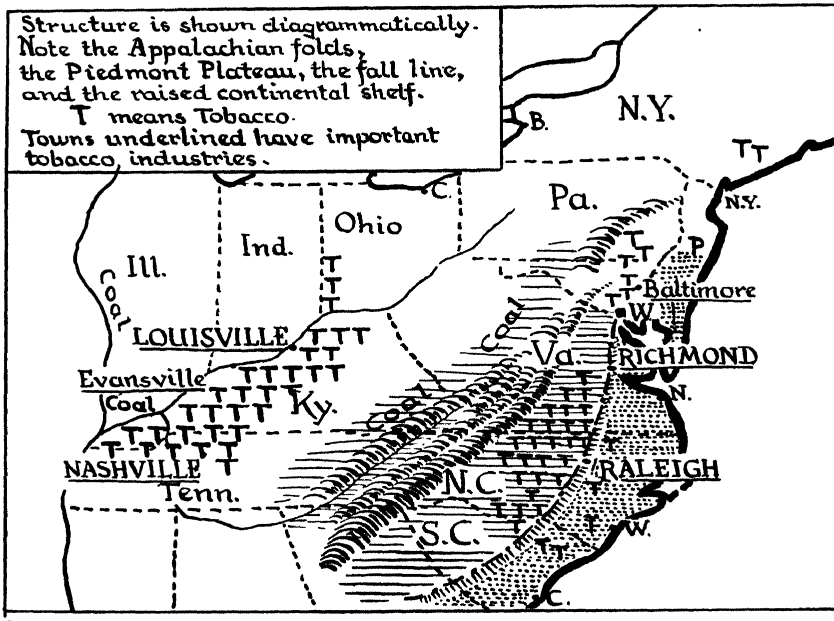
CONSIDER this subject first from an aspect that seems most ungeographical—from popular cartoons. Very often these pictures contain unwittingly much geographical and historical information. Let us think of those people who, according to the cartoonists, are characterized by their pipes, cigars, or cigarettes. The Englishman has his briar pipe or churchwarden; the German his long curved pipe with its meerschaum or porcelain bowl; Uncle Sam has his big cigar; so has the Dutchman; the Mexican has his cigarette; so has the cartoonist's Spanish lady; the Turk, the Shah, and the Caliph have their hookahs; the colonel from India has his cheroot; and the Red Indian smokes his pipe of peace. These caricatures tell much of the geography of tobacco.

Tobacco, of course, is native to America. Raleigh introduced smoking to England, and our early American colonies started the commercial cultivation of tobacco, which to them was a special boon, for in the young days of these first settlements the colonists needed to import much from home, but could find little to export in exchange; tobacco gave them a really profitable crop. Spanish colonies in Central and South America also participated in this early introduction of tobacco to Europe. The next stage was the cultivation of tobacco outside America, and it was found that it was a fairly hardy plant that throve not only in its tropical and sub-tropical home, but also in temperate lands, although it lacked something in quality in the cooler conditions. Its cultivation spread eastward from Spain through the Mediterranean lands to the Mohammedan countries. During this time Holland had acquired her East Indian colonies, where she introduced the profitable plant. The Boers in the Cape soon grew tobacco.

To-day its cultivation is widespread, from temperate latitudes to the equator. It is grown for its leaf, and needs a rainy climate, warm or mild, but not cold. But the soil is of more importance in producing desirable qualities of flavour, moisture, a minimum of nicotine, etc.—factors which decide its commercial worth. "As a rule light soils produce a thin leaf, with weak aroma, while heavy soils produce dark leaf, with strong aroma."

The various operations and processes in the growing and manufacture of tobacco illustrate some problems that limit its cultivation. It is grown in specially fertilized seed-beds, partly on account of the smallness of the seeds (25,000 to a teaspoon) and partly for climatic reasons. Tobacco needs five months without frost, and so seedlings are planted out only when risk of frost has gone. The seed-beds are covered with muslin to protect the plants from pests, strong light, and heavy rain; weeds must be removed by hand. When the young plants are strong enough they are transplanted in the fields by hand. These fields have been specially cultivated and fertilized, and before transplanting the hole for each plant is refertilized in turn. Transplanting takes place on rainy days when the soil is moist—4840 plants to the acre. Weeding and hoeing are needed as long as the plant grows. Next the plants are 'topped' to prevent their flowering. Skill in topping regulates the size of the future leaves. Then suckers from the leaves have to be removed—of course all this is done by hand—and finally the leaves are harvested just when they are perfectly matured. These leaves are strung in sheds to

TOBACCO IN THE UNITED STATES



Only certain special soils produce the best grades of tobacco, and so farms are very small, because good land is dear and the plants need much care. Tobacco exhausts the soil very quickly, but as the crop is so profitable the little farms tend to be worked without suitable rotations, to make money while the soil lasts, regardless of the future.

DIAGRAMMATIC SECTION, WEST TO EAST

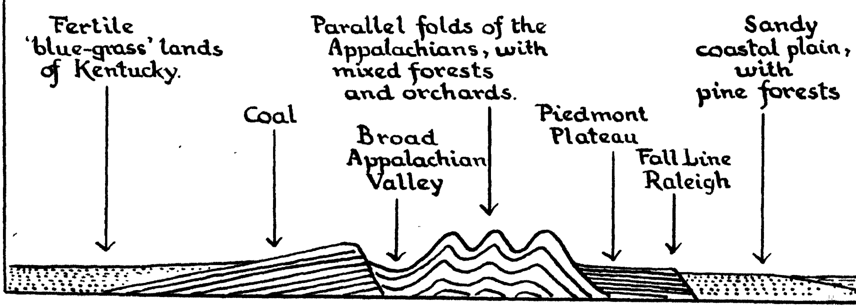


Fig. 19

wilt, and then cured in the sun or by fire or 'flue.' These processes make the leaves pliable, so that they can be handled without breakage. Grading and packing take place, then shipping, selling, manufacturing, and distribution.

Fig. 19 is a special map of the main tobacco area in the United States, which is by far the most important region. The following notes indicate the specializations of other areas: Cuba produces the best cigars in the world; Sumatra, Java, and Manilla grow excellent cigar-leaf, imported into both the United States and Holland; the Eastern Mediterranean produces tobacco for Turkish, Egyptian, and Russian cigarettes; Dordogne in France, Flanders, the Rhine Rift, and Central Hungary cater mostly for home markets; the chief tobacco region in India is Rangpur, in Northern Bengal, and the cigars of Trichinopoli, in the south, are famous; much tobacco for home use is grown in the southern half of Japan; 'Empire' tobacco comes from Southern Rhodesia, Nyasaland, and the Cape.

It is interesting to see that most of the tobacco factories in the British Isles are on the west side of the country—*i.e.*, facing America, whence the trade originally came from our early colonies, and whence also most of our tobacco is still imported. Wills' factories are at Bristol, Ogden's at Liverpool, Smith's at Glasgow, Gallagher's at Belfast; and Player's works are at Nottingham, but London too has its factories.

Notebook Work

(i) *Summarize the conditions necessary for the growth of tobacco—climate, soil, labour, transport.*

(ii) *Draw a map to show the site of Bristol, and write notes to explain its fruit trade, cocoa and chocolate works, and tobacco factories.*

(iii) *Draw a map to show the different farm produce around St Louis, and make a list of the manufactures in St Louis.*

CHAPTER IX

WOOL AND WOOLLENS

I. WOOL

THE wonderful fleeces of the best modern wool-sheep are the result of generations of careful cross-breeding. Constant restocking is needed to maintain a high quality. Sheep or cattle running semi-wild on the open grasslands of Australia, Argentina, and other 'new' countries tend to deteriorate. There is a constant demand for new and better blood, and keen competition to secure the most desirable breeding animals, which often fetch very high prices. The British farmer has specialized in this type of stock-raising, and our numerous shows of animals—not only in big centres, but in hundreds of small market towns and even villages—are opportunities for dealers to find the very best animals.

The north of Scotland is about the limit Pole-ward of successful sheep-farming; farther north it is too cold even for sheep. In cool, rainy lands the sheep produce good mutton, but the fleece is not at its best. In the hot, dry lands bordering the Sahara there is actually a type of woolless sheep—a natural result of the climate. Fleece develops best in highland regions with a tendency towards aridity, and with a winter cold enough to encourage the growth of a protective coat. But all such areas do not produce equally good wool at present, though improvement of flocks could no doubt better the quality in many places. A wool map of the world shows extensive regions producing coarse grades that enter little into commerce. Such areas stretch from Asia Minor and Palestine through the poor steppes from the Black Sea to the Caspian, to the plateaux of Central Asia. Sheep in India come under this class. The 'fine' grades of wool come from merinos and certain merino cross-breeds. The merino is native to the Atlas region, but is associated with the *meseta* of Spain—a dry plateau with severe winters despite its latitude. To-day the merino sheep is the important type in the big wool-producing areas of New South Wales, South Africa, and Patagonia, along with various cross-breeds, especially in rainier areas like New Zealand, Victoria, or the region of the Plata estuary, where the climate allows both wool and mutton to be produced from the same sheep.

Fig. 20 shows the sheep-lands of South-east Australia, where the main product is wool, and not mutton. The map shows the dryness of the region, its desert borders on the west, and the mountain barriers to the east and south which exclude the rain-bearing winds. Temperatures are high, rainfall is low, and the vegetation is sparse. Cattle could not thrive on such pasture, but wool-bearing sheep do well, more so as they prefer the salty grasses of the desert margin. Even so, there is constant risk of overstocking the poor pasture, need for maintaining the quality of the sheep, and an everlasting problem of watering the animals. Rivers are few, and often dwindle to strings of water-holes in the season when most water for animals is needed. At first the sheep-runs were in the rainier lands on the western side of the East Australian highlands, but the spread of agriculture into these desirable parts has displaced the old runs and driven them farther west into drier areas. Here farms must of necessity be large so that pasture has a chance to recover, and the type of farming alters entirely from the English type on the east, with wheat, fruit, dairying, and mutton, to the extensive ranching of the real sheep stations—lonely farms wholly specializing in wool. Fortunately for this region it is an artesian basin, so that water can be obtained from below when it does not fall from above; but the available supply of artesian water is limited. Most farmers cannot afford to provide their

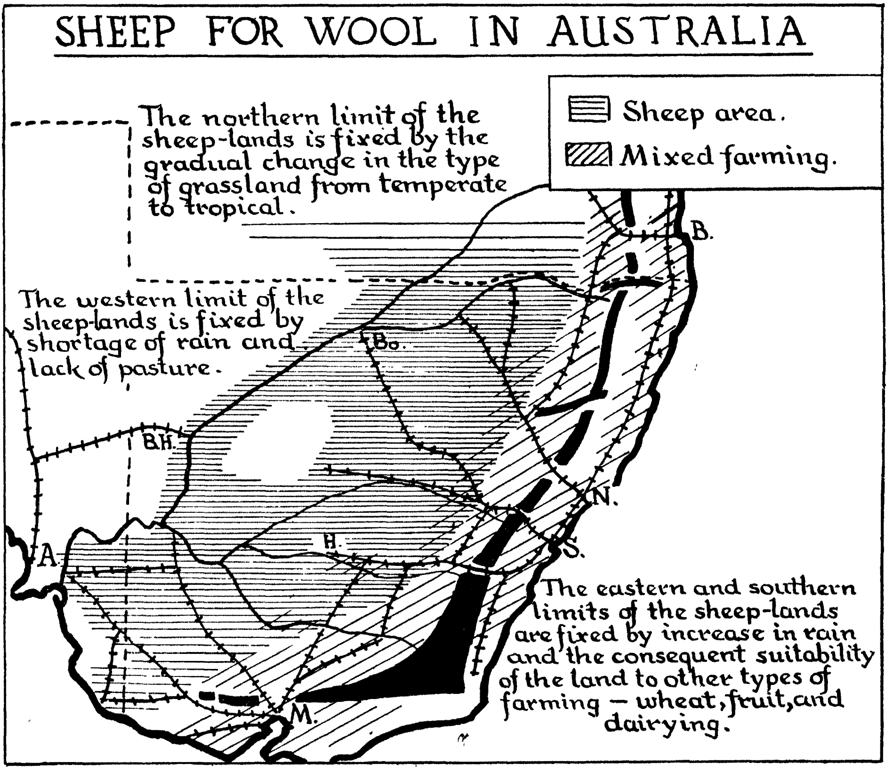


FIG. 20

See also Figs. 8 and 13.

own wells, and they argue that as wool is the staple export the Government might bear the initial cost of sinking them; but the Government is elected by an overwhelming majority of urban population in a few large towns, and the needs and interests of these people are not always the needs and interests of the farmers.

In South Africa the high veldt and the Karroos provide similar scanty pasture, and extensive sheep-farms for wool only. Fig. 7 explains conditions in Argentina. Modern transport and refrigeration have increased the demand for mutton as well as that for wool. In North America half the sheep are in the dry plateaux of the Western Cordilleras. This area, too, has passed through the stage of being primarily wool-producing, until now, with increasing population, improved transport, and the cultivation of fodder under irrigation, mutton is of more importance, and the merinos have given place largely to cross-bred types of sheep.

NOTEBOOK WORK

(i) *From Fig. 20 write a set of orderly notes on the sheep-lands of South-east Australia.*

(ii) *Write notes about the climates of the following areas where wool or woollen products are well known: (a) Kashmir (shawls); (b) Persia (carpets); (c) Peru (alpaca); (d) the islands of Harris and Lewis (tweeds); (e) the plateau of the Shotts (rugs).*

II. WOOLLENS

What picture does the word 'mill' bring to mind? A little stone building in a dell, with a stream that turns a moss-grown wooden wheel? Or the solemn sails of windmills in Holland and on the English Fens? Or a building where ghostly, flour-smothered men endlessly wheel and haul dumpy sacks? Or a humble coffee mill in the kitchen? Or, perhaps, having first noticed the title of this section, and certainly if you have lived in the North of England, you think of gaunt and grimy buildings, box-shaped and ugly, except when their rows and rows of windows are lit in early morning, at dusk, or on dark winter days—places that you associate with the clatter of machinery and clogs, with shawls of working women, and with a broad, kindly dialect.

The dictionary gives "Mill—a machine for grinding any substance by crushing it between two hard, rough surfaces; a place where corn is ground; a contest at boxing"; and the verb 'to mill' means "To grind, to stamp, to turn up the edge of a coin and put furrows on the rim, to beat severely with the fists." What has all this to do with a woollen mill or a cotton mill, where certainly none of this crushing and grinding goes on, but the much more delicate spinning and weaving of flimsy threads? The story of the origin of these 'mills' will explain their present misnomer and the geography of woollen goods.

Primitive man soon learned to protect himself from the cold by dressing in the skins of woolly and furry animals. The simplest way of making some sort of garment from such animals was Robinson Crusoe's method of wearing the entire skin with its wool or hair covering. Similar 'clothes' are still worn by many peoples. Trappers and farmers of the prairies wear furs. We have fur gloves or fur collars, and astrakhan is lambskin with the close, curly fleece still on. Such garments are bulky and wasteful. It is more economical not to kill the animal, but to shear it, use its wool or hair, and allow another fleece to grow, thus preserving both the animal and future supplies of clothes. Wool, because of its curly nature and the many little 'hooks' in its structure, binds easily on to other wool, and can be twisted, even in the fingers, into thread. Hair is too smooth, and will not interlock at all. So we find that very early peoples discovered the art of making woollen cloth. Their method was to clip the fleece, wash it thoroughly, and then twist the strands in the fingers into coarse thread, which was wound as finished on to a spindle, the supply of wool being carried on a distaff in the left hand. The simple apparatus could be easily worked as the women walked about or sat at their doors. Later a spinning-wheel quickened the operation. The distaff and its wool were above the wheel, and the fingers of both hands guided the threads down to grooves rotated by a treadle, whence they were wound, after being twisted, on to the spindle below. Spinning machinery to-day does exactly similar though more mechanical work, but still the skilled fingers of women tend the supply of wool, and deftly mend loose and faulty threads.

The next stage was to make such threads, which of course are easily broken, into cloth. The obvious method was to stretch many parallel lines of thread on a frame and then to interweave, as in darning, the crosswise threads one at a time, over and under. This was slow and laborious, and soon led to the ingenious idea of arranging the lengthwise threads into two groups, alternate threads forming a group. By this means all the odd-numbered threads could be raised, a crosswise thread run between the two groups, and then the even-numbered threads raised and the odd ones lowered, and the cross thread run back again between. The over and under movement of darning thus becomes automatic. The process looks complicated in print, but it is worth while making just a simple model with string threads to see the principle, or using the fingers of both hands as the two groups of threads, and passing a string between two or three times as the fingers change places. The modern loom does this work with many ingenious devices for altering the arrangement of the lengthwise groups to produce varying patterns. If in the old loom, with its two groups of threads, the wool were dyed and colours arranged in series in the threads the resultant woven patterns could only be simple stripes and checks, such as are seen to-day in tartans, Welsh shawls, and the ponchos of Andean Indians.

The requirements, then, for a simple 'cottage' industry in woollens were (*a*) a supply of wool, and (*b*) a supply of water for washing the wool. Until the machine age came the industry was widespread in the British Isles, especially at the foot of the hills on which sheep pastured. In many cases streams were made to turn water-wheels to abolish the labour of pedalling the looms or spinning-wheels. The idea, of course, was taken from the water-wheels of the flour-mills, and for want of a word the new little factories were called 'mills,' although they did no milling.

Less than 150 years ago came a great change due to several inventions and the use of steam power. One obvious use for the new power was to drive the looms. If only coal were available the mills would cease to depend on the vagaries of their streams, with their droughts, floods, and frosts. But only a few of the many woollen districts had coal near at hand. These few adopted the new ideas, with the result that their output increased enormously. The original little mills could not cope with the new development. Bigger mills were built (the name being still retained) in the same positions as the old ones, partly to continue the supply of water for cleansing, and partly because of inertia—where the industry was, there it should continue to be. Many of the little steep-sided valleys turned out to be most unsuitable for the extraordinary growth of population that rapidly occurred. The new mills, with their smoky chimneystacks, occupied river sites, and the houses for the influx of new workers grew tier on tier up the hillsides, jerry-built and gardenless, and overlooking the belching chimney-tops of the factories. This accounts for the present-day housing and sanitation difficulties in some of the industrial areas.

Most of the many original little woollen towns could not face this competition. Their workers went to the big new mills, where their labour was gladly accepted, and where wages seemed certain and high. Throughout the country the cottage industry declined and died, and the tremendous centralization on the West Riding coalfield grew almost uncontrolled, producing a new wealth never before realized. A huge export trade grew up, aided by simultaneous developments in transport, the perfecting of the railway and the steamship.

To-day all over our land are relics of the old widespread woollen trade; dead in many places, but in others carrying on in a specialized way because of some quality in the produce that cannot be reproduced elsewhere, either because of peculiar local conditions or because of traditional skill of the workers themselves. Witney blankets, Axminster and Wilton carpets, Harris tweeds, Donegal tweeds, and Welsh flannel are examples of this persistence. The Bradford–Trowbridge area has the Bristol coalfield near, and still makes 'West of England cloth'; Leicester has coal, and the woollen industry persists there in the hosiery trade. The Tweed valley has no coal, but is near to supplies from either Northumberland or Midlothian, and the mills still make high-grade cloth. Norwich makes woollens, too, but has to get coal from as far as Derbyshire. Worsted is a little village close to Norwich. Stirling makes tartans. All these places should be studied in relation to their neighbouring sheep pastures, their streams, and their original mill sites.

Fig. 21 explains in map form the West Riding woollen area. The maps should be studied very carefully.

Britain easily leads the world in manufacture and export of woollen goods, but certain other areas in Europe have the same intense industrialization as the West Riding, and produce enormous quantities of woollens. Careful study of the atlas ought to reveal a story of the development of such regions comparable to that in the West Riding. In Germany the Ruhr town of Barmen-Elberfeld manufactures woollen goods. Notice the original hill pastures, the coal, the rivers, and the ease of import of extra supplies of raw wool. In Saxony the many little towns around Chemnitz also make woollens. Here, too, there are similar conditions favouring the development of the industry. Note the chalk hills of the Paris Basin and the limestone Ardennes of Belgium in relation to the Franco-Belgian coalfield. The woollens of Lille, Roubaix, Arras, Brussels, and Liége are then understandable. None of these areas, however, is comparable with the West Riding region as regards the specialization in woollens.

The types of woollen goods from the West Riding are blankets, flannels, carpets, woollen and wool-mixture cloths of varying qualities—often in imitation of distinctive cloths of special areas, for example, tweeds or cashmere—ready-made suits, shoddy from rags, hosiery, and flocks for stuffing. Lanoline, for toilet preparations, and soap are made from the extracted grease of the wool. In addition, machinery is made for use in the mills, chemicals and dyes as by-products from coal, leather from skins, together with many local products, such as confectionery, glass and china, beer, etc., that have ready markets in the many big towns.

The woollens are sent all over the world, but mostly to temperate lands and least to tropical lands—for obvious climatic reasons. It seems strange to think of raw wool coming half-way round the world from Australia and New Zealand, from the distant Argentine and South Africa, to be manufactured and sent back to these countries as clothing. We naturally ask why these countries do not themselves make woollens. In most cases they have what seem to be all the necessaries, wool, water, and coal (or other power), but the chief hindrance is a lack of skilled labour. The manufacture of woollens is not the mere installing of up-to-date machines which do all the rest. It requires workers with a high degree of skill. It might seem worth while to import such workers with their


SOUTH LANCS & THE WEST RIDING:
COTTONS AND WOOLLENS
60"-80" annual rain.
40"-60" " "
C = Cottons.
W = Woollens.
Cotton manufactures on the west side, the rainy side, the side facing America.
Woollen manufactures on the east side, the dry side: sheep on the moorlands.
W
C
W
C
500'-1000'.
over 1000'.
M
S
S
Cottons.
Woollens.
Chemicals.
Iron & Steel.
Coalfields.
The mill sites, for cottons or woollens, are in valleys where Pennine streams leave the hills. Cotton-spinning mills are in rainier sites than weaving-mills. Liverpool and Hull export the products of both sides of the Pennines.
SECTION ACROSS THE PENNINES
Younger strata weathered from dome
Millstone Grit
Coal Measures
Upfold of carboniferous limestone

FIG. 21

machinery and establish new industries in these distant lands. But new habits and ideas grow slowly; new homes are not always readily sought, except under stress of constant unemployment; new factories require enormous capital, and it is not easy to persuade dealers to turn to new producers of the quality of whose goods there is no guarantee. These and other difficulties retard development, but it is coming nevertheless. The woollen industry of New England, supplying the New York market, owes its origin to the immigration of skilled wool workers from the British Isles, and later from other parts of Europe. In Australia, New Zealand, and Canada mills are producing good quality cloth for home markets; Argentina, probably because of her lack of a 'mother' country, lags behind, and manufactures little at all. Japan is competing in world markets, her workers having centuries of tradition as skilled weavers in silk, wool, and cotton. Finally, the present schemes of Russia include the establishment of modern factories of all kinds, including woollen mills, to develop independence of foreign imports. The early domination' of the West Riding has received challenges from many countries, and it no longer maintains the virtual monopoly it enjoyed so long, but the skill of the workers and the reputation of their products will remain.

Notebook Work

(i) *Draw maps or sections to show the factors that have made the following regions important for woollen manufactures:* (*a*) *The Ruhr;* (*b*) *New England;* (*c*) *Brussels;* (*d*) *the Tweed valley;* (*e*) *Witney; and* (*f*) *Silesia, Bohemia, and Vienna.*

(ii) *Draw a map of the world to show the movements of raw wool and finished woollens.*

CHAPTER X

COTTON AND COTTONS

I. COTTON

THE word 'cotton' calls to mind plantations and plantation songs, negroes and cabins, the twang of banjos, and syncopated croonings about Alabama, Tennessee, Kentucky, and *Ole Man River*, 'spirituals' that tell of a blissful heaven, and slaves. This is a very different scene from that which we associate with sheep and wool—rolling downs, and moorland pastures, with lonely shepherds and their dogs. Cotton is a product of lands of busy cultivation; wool of empty uplands or semi-arid grasslands. The weight of cotton produced in the world is three and a half times the weight of the wool, and the value of cotton goods exported is three times the value of exported woollens. Figures for comparative areas are not easy to calculate, but the space taken up by sheep-farms all over the world must far exceed the areas of all the cotton plantations. In comparing these two products we can see well, in the kind of country concerned, the amount of labour needed, and value of goods produced in a given area, the essential differences between agriculture and stock-farming.

> Let us in imagination pay a visit to the cotton-fields, and look more closely at the plant which produces the cotton. About a week or ten days after sowing the plant appears, and in due course forms branches on which flower-buds develop. These flowers are rather like those of a hollyhock, and on the day after they open they turn pink, and the next day fall. The flower is followed by the seed-pod, or 'boll' as it is called. When ripe these bolls are about the size of a hen's egg; they then burst open, disclosing a quantity of hairy down, looking like what we call 'cotton-wool.' This cotton is then picked; embedded in the down, which is called 'lint,' are the seeds—which are dark brown. The cotton containing the seeds is collected and sent to the ginning factory, where machines separate the lint from the seed. . . . The cotton lint, freed of seed, is pressed into bales and shipped to the great cotton markets of the world.[1]

Cotton, then, requires a warm climate in which a plant may flower and fruit, for it is the 'fruit' that is used in commerce. The plant needs a minimum of 200 summer days. Compare this with wheat's ninety days, and the 150 days for maize. Six or seven months' warmth implies the tropics. Cotton has to be sown, and the ground has to be cultivated for this sowing, and hoed and weeded as the plants grow—*i.e.*, cotton-lands must be arable. There must be ample rain to promote growth, and sunshine to encourage flowering and fruiting. After fruiting weather must be fine and sunny, so that the lint of the open bolls is not soddened and spoiled by rain.

Such conditions are exacting. The cloudy, thundery equatorial area is unsuitable, except in very favoured parts. The rain-all-the-year regions of east coasts facing the trade winds lack the dry season for fruiting. Desert areas are very suitable if only the cotton-plants can be watered artificially; heat and sunshine help the formation of flowers,

[1] Empire Marketing Board pamphlet.

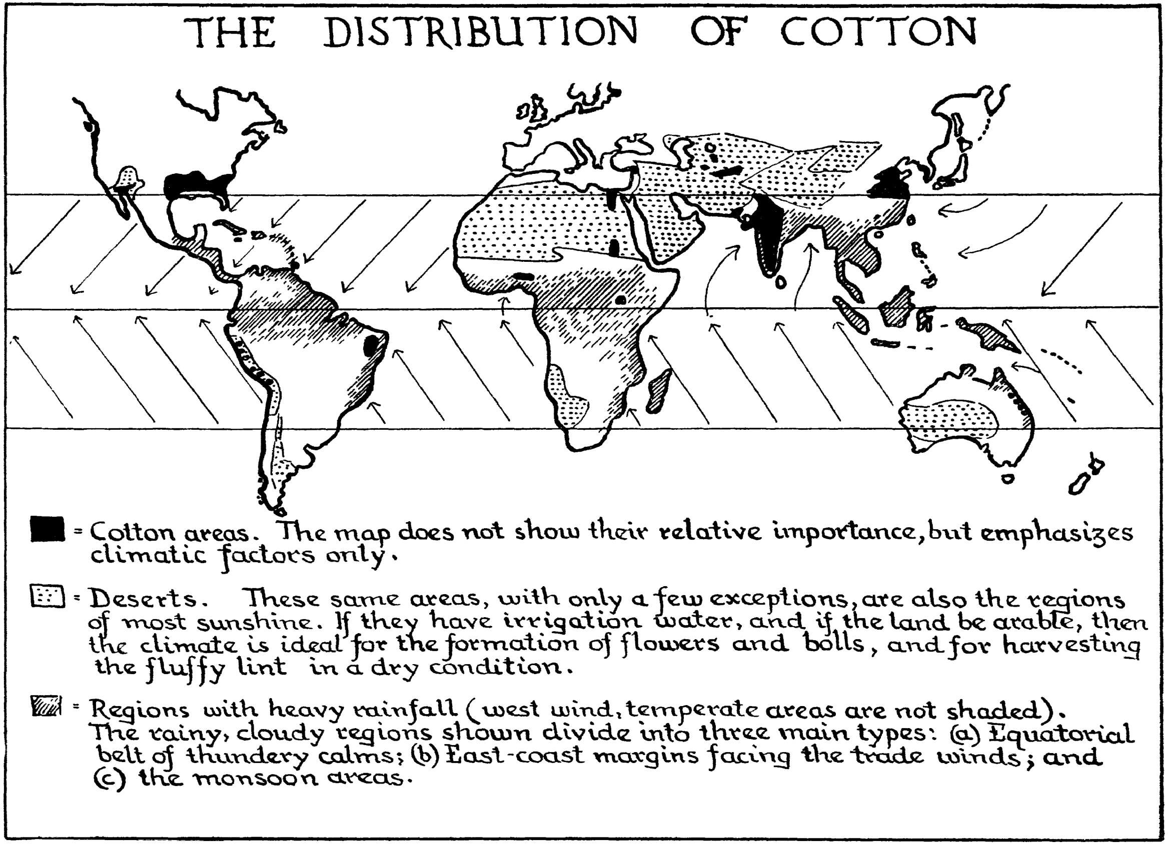

THE DISTRIBUTION OF COTTON
= Cotton areas. The map does not show their relative importance, but emphasizes climatic factors only.
= Deserts. These same areas, with only a few exceptions, are also the regions of most sunshine. If they have irrigation water, and if the land be arable, then the climate is ideal for the formation of flowers and bolls, and for harvesting the fluffy lint in a dry condition.
= Regions with heavy rainfall (west wind, temperate areas are not shaded). The rainy, cloudy regions shown divide into three main types: (a) Equatorial belt of thundery calms; (b) East-coast margins facing the trade winds; and (c) the monsoon areas.

Fig. 22

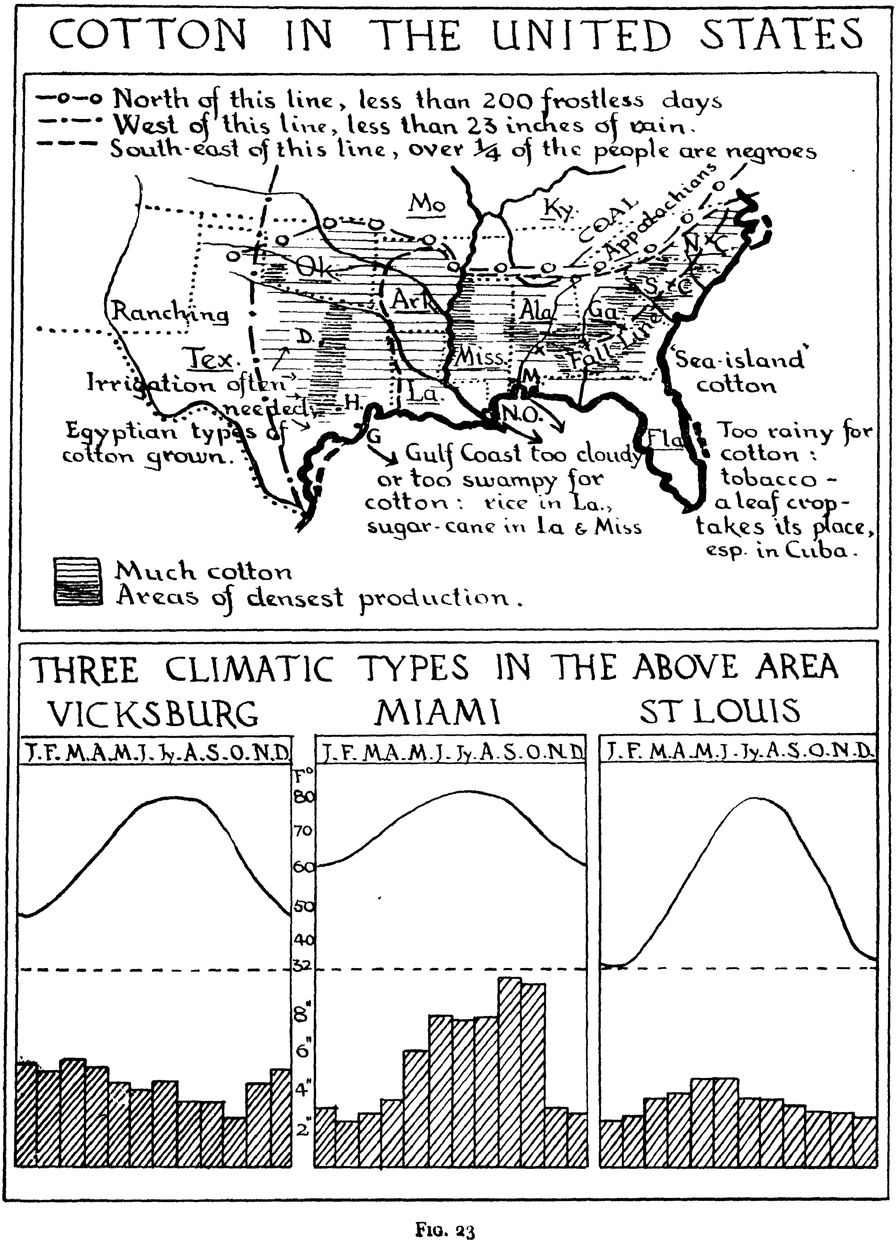

COTTON IN THE UNITED STATES
North of this line, less than 200 frostless days
West of this line, less than 23 inches of rain.
South-east of this line, over 1/4 of the people are negroes
Mo
Ky.
COAL
Appalachians
N.C.
Ok
Ark
Ala
Ga
S.C.
Ranching
D.
Tex.
Miss.
Fall Line
'Sea-island' cotton
Irrigation often needed.
H.
La.
M.
N.O.
Egyptian types of cotton grown.
G
Gulf Coast too cloudy or too swampy for cotton: rice in La., sugar-cane in La & Miss
Fla
Too rainy for cotton: tobacco - a leaf crop - takes its place, esp. in Cuba.
Much cotton
Areas of densest production.
THREE CLIMATIC TYPES IN THE ABOVE AREA
VICKSBURG
MIAMI
ST LOUIS
J.F.M.A.M.J.Jy.A.S.O.N.D.
F°
80
70
60
50
40
32
8"
6"
4"
2"

Fig. 23

and the dryness facilitates the picking of the lint. Many monsoon lands have too sudden and too heavy a rainfall, but others with lighter rain (see Fig. 24) suit cotton well, although irrigation is needed if the rain be too light. The period of the retreating monsoon provides just the necessary sunny spells for picking.

In the south-east of the United States there is a climate ideally suited to cotton. The area is outside the rainy trade-wind area of the West Indies, but receives a maximum of rain in summer from the monsoon effect from the Gulf of Mexico. The rain is not nearly so heavy as in a true monsoon climate, but, like the monsoon, coincides with the period of high temperature. In the cotton states rainfall diminishes rapidly after summer, and the dry autumn helps the harvesting. Towards the west of this area—*i.e.*, especially in Texas, towards the Rockies—rainfall is much lower, and cotton often has to be irrigated.

Fig. 23 shows this most important cotton region, its limits, and its areas of densest production.

The second largest grower of cotton is India, but very little Indian cotton goes to Lancashire mills, because it is not of the quality which those mills require. Japan imports much Indian cotton. Just as all sheep do not produce the same quality of wool, so also different climates, soils, and species of cotton-plant produce varying types of cotton. Varieties differ in 'staple'—*i.e.*, the length of the threads forming the lint. The longer the staple, and the finer the thread forming it, the finer the material that can be woven from it. Indian cotton is coarse and short stapled, but attempts are being made to improve the quality. The cotton areas are in the drier parts, as we have seen—*e.g.*, on the Deccan, in the Upper Ganges, in Sind and Gujrat. The chief of these regions is in the hinterland of Bombay, where the lava soil of the Deccan is most suitable, because it holds moisture well in a region where rain is apt to be light.

China grows much cotton in the Yangtse valley and in the Great Plain of the north, where hot summers with monsoon rain and dry autumns favour growth. The crop is either for home use or for export to the mills of Japan. Korea also grows some cotton.

Egypt is the fourth producer of cotton, with a crop of excellent quality, commanding a high price in Lancashire. The crop relies entirely upon irrigation. The dense populace of the Nile oasis, and their desire to grow this lucrative crop, have given rise to a situation not wholly desirable, since land is being used for cotton when over-population demands that it should be used for food production.

Peru has its 'little Egypts' of irrigated fields by the side of streams that flow from the melting snows of the Andes across the small desert plain where cotton is grown. The rather dry hinterland of Pernambuco in Brazil also grows cotton, negro labour being available.

The labour question in the plantations is a problem that limits the world's cotton areas. In monsoon lands there is ample, cheap, skilful labour. The climate necessary for cotton growing is very enervating, especially in summer, and it is at this season that work in the cotton-fields is at its height. It consists in walking along the rows of plants and picking off the lint of opened bolls. This work is not heavy, and is done mainly by women and children. The bolls open irregularly, only one or two on each bush every day, and so day after day brings the same monotonous round. If only the bolls opened simultaneously the whole bush might be harvested by machinery. The early planters in the United States solved the labour difficulty by buying labour in the form of negroes exported from Africa. The later idea of liberating these slaves seemed to the planters

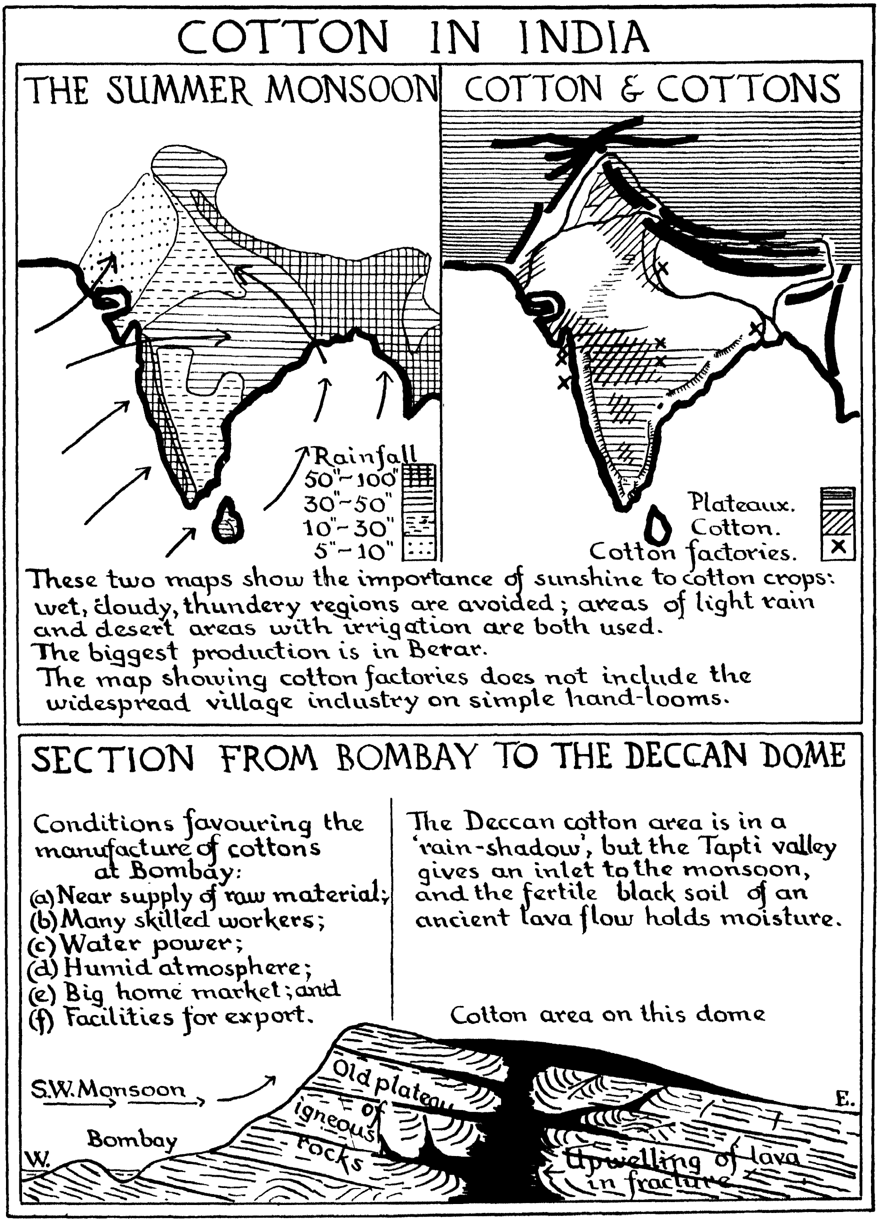

COTTON IN INDIA
THE SUMMER MONSOON
COTTON & COTTONS
Rainfall
50"-100"
30"-50"
10"-30"
5"-10"
Plateaux.
Cotton.
Cotton factories.
These two maps show the importance of sunshine to cotton crops: wet, cloudy, thundery regions are avoided; areas of light rain and desert areas with irrigation are both used.
The biggest production is in Berar.
The map showing cotton factories does not include the widespread village industry on simple hand-looms.
SECTION FROM BOMBAY TO THE DECCAN DOME
Conditions favouring the manufacture of cottons at Bombay:
(a) Near supply of raw material;
(b) Many skilled workers;
(c) Water power;
(d) Humid atmosphere;
(e) Big home market; and
(f) Facilities for export.
The Deccan cotton area is in a 'rain-shadow', but the Tapti valley gives an inlet to the monsoon, and the fertile black soil of an ancient lava flow holds moisture.
Cotton area on this dome
S.W. Monsoon
Bombay
W.
E.
Old plateau of igneous rocks
Upwelling of lava in fracture

FIG. 24

to mean absolute ruin, and the South fought the North on the issue, and lost. The slaves were freed, and the very large majority stayed on their plantations under conditions not unlike the old, but with the stigma of 'slave' removed.

Vast potential cotton-lands exist undeveloped on account of labour or transport problems. In Uganda cotton is native-grown in gardens. There are no plantations, but there is British control to regulate quality and organize purchase. In the Sudan huge irrigation works on the Blue Nile are designed for the development of cotton-lands between the Blue and White Niles. Labour is a problem there. Queensland is the one region in the world where white men grow and harvest their own cotton. The work is only possible in small holdings, where the family is the work unit. Each family grows its patch of cotton, selling its produce to a local co-operative organization, which arranges for bulk marketing.

Notebook Work

On a world map mark the cotton areas, and the Empire producers. From a rainfall map shade the tropical areas of very heavy rain, marking where necessary the prevailing winds. Mark also the deserts, especially the Sahara and its eastward extension towards Central Asia. Notice the cotton-lands in and round this desert—namely, Egypt, Nigeria, Sudan, the oases of Bukhara and Tashkent, Sind and Gujrat. Draw squares or circles to show the comparative importance of producing areas, emphasizing the U.S.A. region. Show by arrows the direction of the export trade—the U.S.A. cotton to Lancashire and New England, and the Indian and Chinese cotton to Japan.

II. COTTON GOODS

In primitive manufacture the machine went to the raw material; to-day the raw material comes to the machine. We have already given the example of early woollen manufacture being carried on close to the sheep-runs. An interesting relic, also, is the case of the Chiltern chair manufacturers—'bodgers,' as they are called—who move their simple workshops to the suitable beech-trees which have been selected for felling, each 'factory' staying by its tree until the timber has been used up, after which the workshop and its owner move to new supplies. Of course such movements compel the 'factory' apparatus to be light and portable. The bodger has a treadle-lathe, a few saws, and chisels. The early woollen mill consisted of a spinning-wheel and a treadle-loom.

To-day the cottage industry has almost gone, ousted by the competition of mass-production in huge factories. Such factories are necessarily large because of the nature of their machinery, which is driven by mechanical power, and the power may as well drive many machines as few. The extraordinary wealth suddenly derived from the first successful machinery encouraged the enlargement and multiplication of factories. This same increase in the size and number of factories created a sudden demand for enormous extra supplies of raw material to feed the new machines. All this change from the plodding old days of little, individualistic factories happened with such remarkable suddenness, and upset the age-long traditions so completely, as to earn the name of 'the Industrial Revolution.'

This revolution gave the cotton plantations a sudden prosperity. True, there was a demand for more wool as well as for more cotton, but it was far easier to increase the cotton-supply by planting new acres of shrubs than to increase rapidly the number of sheep in the world. Thus cotton boomed; wool had to wait.

COTTON AND COTTONS

The processes in manufacturing cotton are similar to those already described for wool, but the threads of the lint are finer, shorter, and more liable to snap. The people who knew the art of spinning and weaving wool were the obvious people to acquire a similar skill with a new material, and the sites of the woollen mills suited the needs for working cotton, for they provided a supply of running water and power. There seemed to be no reason why any woollen mill should not become a cotton mill. However, it was found that only in damp and rainy places would the cotton threads bind without snapping; dry air and sunshine prevented spinning. So the cotton industry developed in rainy Lancashire, at the foot of the Pennines, in little valleys with their running streams and ancient mills similar to those used in connexion with woollens. Exactly similar difficulties arose in connexion with housing congestion. Another cotton region soon grew in Scotland, on the wet western side round Paisley. Both these areas had the advantage, too, of facing the ocean across which most of their raw material came.

Summarizing the peculiar qualities of the Lancashire cotton region, we may note the following:

(1) Coal, for power.
(2) A damp climate.[1]
(3) Skilled workers.
(4) Facing U.S.A., whence the cotton comes.
(5) Ease of import and export; proximity to the coast and a fine estuary.
(6) Near-by salt-mines, giving raw material for the chemicals for bleaching and dyeing. (See Fig. 21.)

The English factories, for cottons as well as for woollens, iron and steel, etc., were the first in the world to develop mass-production, because of the excellent coal available and the inventions that made the system possible. The island site, in the centre of the nations leading in Western progress and civilization, gave extra impetus to the export trade, and a growing colonial empire provided still more markets. It was at this early stage, while Britain had a monopoly, that her wealth accumulated to make her the leading financial and creditor nation of the world. But such conditions could not continue indefinitely; the business was attractive to other progressive peoples, and competitors soon appeared.

Of these the United States had an obvious advantage; they grew the raw material. Their cotton industry has grown up in New England—*i.e.*, in a region with ample water supply for cleansing or for power, and where early colonists had built their old mills for both flour and wool, near the excellent coal of Pennsylvania, in the region with most people available for factory work, and on a coast with fine harbours to aid import of raw material and, later, export of finished goods. The ring of towns at the edge of the hills behind Boston is the cotton region, and the name 'Manchester' speaks for itself. The following cotton manufacturing areas should be studied from points of view similar to those outlined in previous paragraphs—*i.e.*, the natural sites of mills, climate, population, coal or other power, import of raw cotton, and export of finished goods: in France, (*a*) Rouen, Lille, and the Jura region; in Belgium, (*b*) Liége, Brussels, Ghent, and Antwerp; in Germany, (*c*) the Ruhr, (*d*) Saxony, (*e*) Silesia; in Czecho-Slovakia, (*f*) Prague; in Poland, (*g*) Lodz; in Scandinavia, (*h*) Oslo and Gotenburg; in Russia,

[1] This can now be made artificially in any factory.

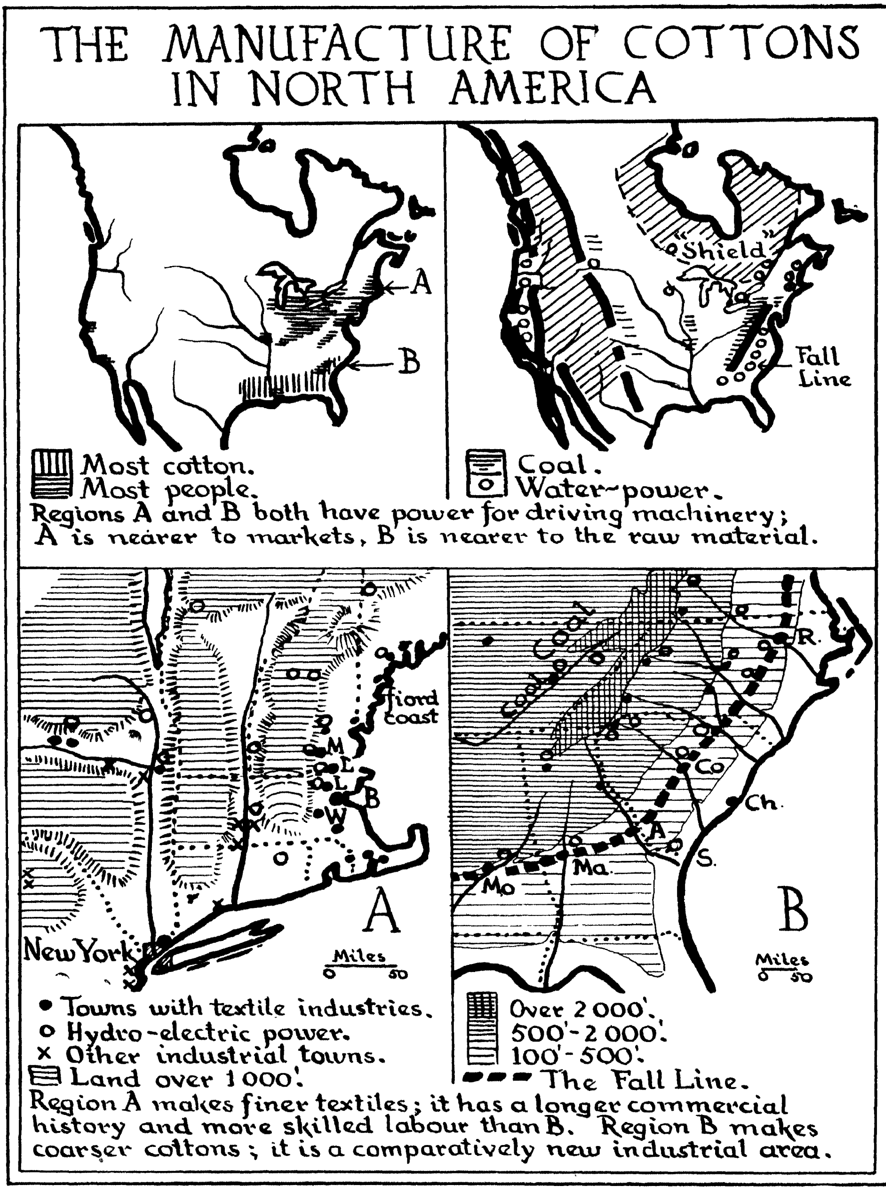

THE MANUFACTURE OF COTTONS IN NORTH AMERICA
A
B
Most cotton.
Most people.
"Shield"
Fall Line
Coal.
Water-power.
Regions A and B both have power for driving machinery; A is nearer to markets, B is nearer to the raw material.
Fiord coast
M
L
L
B
W
New York
A
Miles
0 50
Coal
R.
Co
Ch.
A
S.
Ma.
Mo
B
Miles
0 50
• Towns with textile industries.
o Hydro-electric power.
× Other industrial towns.
Land over 1000'.
Over 2000'.
500'-2000'.
100'-500'.
The Fall Line.
Region A makes finer textiles; it has a longer commercial history and more skilled labour than B. Region B makes coarser cottons; it is a comparatively new industrial area.

Fig. 25

(*i*) Moscow (in relation to U.S.S.R. supplies of material from the Trans-Caspian area); in Switzerland, (*j*) Zurich and Basle; in Mediterranean lands, (*k*) Barcelona, and (*l*) Milan and Naples.

All the above areas, even including New England, draw their supplies of material from afar. The obvious places in which cotton manufacture might be carried on most economically are on the cotton-fields themselves, always provided, of course, that power and labour are available. It is the labour problem—especially skilled labour—which has retarded this development. However, the introduction of improvements in machinery, like the automatic loom, has made possible the recent growth of the industry actually on the cotton plantations. The woven cloth is coarse, and in no way comparable to the fine products of Lancashire or of Switzerland, but there is a market for this cheap cloth, and so the new industries thrive at the expense of the old-established ones. In the Southern States many 'Fall Line' towns now make cotton—Columbia, Macon, Augusta, and Montgomery. In addition to the water power that 'Fall Line' implies, there is the coal of the South Appalachian field.

Fig. 24 has already explained the cottons of Bombay. There are also busy mills at Lucknow and Cawnpore. Much Indian cotton, as we have seen, is exported to Japan, its quality being unsuited to Lancashire products. The 'Manchester' of Japan is Osaka. The potential market is crowded China, but Japanese cottons already find their way into most countries of the world because of their cheapness and now promise to surpass in value British exports.

In China itself the manufacture of cottons is a widespread cottage industry, but modern mills, erected with foreign capital, work at Shanghai, Hankow, Changsha, Nanking, Tientsin, and Canton. These mills cater wholly for the huge home market.

Notebook Work

(i) *Draw a map of the Paisley cotton manufacturing area.*

(ii) *Draw a map of the Saxony-Bohemia cotton manufacturing area.*

(iii) *Draw a section of the Lancashire cotton manufacturing region similar to the section of the Bombay region in Fig.* 24.

(iv) *Draw a map of Japan, and mark on it all you can about Japan's cotton trade.*

CHAPTER XI

THE OTHER FIBRES

I. FLAX, HEMP, AND JUTE

FLAX. Linen is made from flax, but not all flax makes linen. When the plant is grown in warm, damp climates it runs to seed; but in cold, damp climates it develops tough fibres. The seed from flax grown in warm lands is crushed to make linseed oil for mixing paint and for linoleum. Argentina produces half the world's linseed oil; India grows large quantities of flax for linseed, partly for export and partly for home use as cooking oil. Among other producers are the central plains of the United States and South Russia.

Flax for linen is grown almost entirely on the European plain. In the British Isles Ulster is the only important region. The fibre used in making linen is obtained by removing the softer part of the stems. This is done by 'retting'—*i.e.*, rotting in water and then beating the pulp away from the tough fibre. The whole process needs much labour. The crop is harvested by hand because it has to be pulled up by the roots to get the maximum length of grass. Then comes the retting, a rather unpleasant task in the stagnant tanks, but work demanding skill in knowing exactly when the rotting has proceeded far enough. Next, the fibre is separated by machinery, and sorted according to quality. Later processes of spinning and weaving are similar to those used in cotton mills.

In the British Isles the manufacture of linen is carried on chiefly in Belfast and in smaller towns around, namely, Larne, Antrim, Ballymena, Lisburn, Lurgan, and Londonderry. Linen is also made in Eastern Scotland—*i.e.*, in regions facing the supply of raw material from the Baltic lands—namely, at Dunfermline, Kirkcaldy, and Dundee, and also in certain woollen towns of the West Riding—*e.g.*, Leeds and Barnsley, where coarser cloths are made

On the mainland of Europe linen is made where there is both raw material and coal: in North-eastern France at Cambrai (cambrics) and Lille; in Belgium at Brussels (lace), and at most of the cotton towns already mentioned; in Holland (holland); in Silesia and Bohemia; and in Poland. In Baltic lands and in Russia the making of linen is a cottage industry, most country houses having their linen looms for making their own cloth; but much raw flax is exported to Ulster and other manufacturing areas of Western Europe. Russia is the chief flax producer, and, with the new Baltic States, produces over three-quarters of the world's supply. The flax area is north of the wheat-lands—*i.e.*, north of the steppes—in clearings of the deciduous or coniferous forest belts. Flax grown farther south on the steppes is for linseed.

HEMP. Hemp is similar to flax in many ways. It is produced from the fibres of a tall, slender plant, and it has to be hand-pulled, retted, and 'scutched.' The chief producing area is in Russia, in a region just overlapping the flax area southward. Here the retting of both flax and hemp is done in the fields by allowing the grasses to rot with the action of either dew or melting snow, but this method produces poorer fibre than the more careful artificial retting in tanks of water. The best quality of hemp comes from the Plain of Lombardy.

Hemp is used for making rope and canvas. To-day there are over 400 factories in the British Isles engaged in rope- and cord-making, and other factories specialize in the manufacture of machinery for these roperies. In addition to hemp, flax, coir, jute, sisal, manila, and New Zealand hemp are used for various ropes and twines. The varieties of strings, cords, etc., demanded by industry is amazing, and a characteristic of the rope factories is extreme specialization in one type of product. The fishing industry consumes more than half the total production of cordage for nets, lines, etc.; shipping demands many qualities of rope, hauling lines and mooring ropes, ropes for towing and salvage, great hawsers, rigging, special ropes that will neither twist nor kink for use for the lowering of ships' lifeboats—all of which have to be specially prepared to withstand not only heavy strains, but also the effects of constant soakings by rain or sea-water. Different trades demand different types of string and cord—newspaper houses need special strings for bundling papers; farmers, forage-merchants, market-gardeners, and horticultural concerns have their own peculiar demands; shop-keepers, wholesalers, the building trade, the fishing trade, the sports trade, balloon and parachute manufacturers—all these and many others want cords of very special qualities. Roperies are situated in London, Dundee, and Belfast, and the special machinery is made at Leeds and Belfast, where the industry is, of course, associated also with the woollen, jute, or linen mills.

JUTE. Jute is the fibre used for sacking. It is made by retting the stems of a plant grown wholly in India, in the wet Lower Ganges plain. Much jute is manufactured in Calcutta into sacking known as 'gunny-cloth.' In the British Isles its manufacture has developed in towns already used to working coarse fibres like hemp or the coarser qualities of flax. The jute industry is more recent than either of these, and when it developed it went to those areas where mills and skilled labour could easily be adapted to a new process. Dundee and Kirkcaldy make jute sacks, tarpaulins, and linoleum; the carpet factories of the West Riding use much jute, and the roperies of London and Dundee have already been mentioned.

Notebook Work

(i) *Draw a map to show the linen towns of Ulster. Note the lack of coal in the area and the import of coal from Ayrshire and Cumberland. Note also the import of much flax from Baltic lands.*

(ii) *Draw a map or section to show how the agricultural products of the Indo-Gangetic Plain change from those of the rainy, low-lying delta to those in the dry Punjab.*

(iii) *Make a table to show the types of agricultural products in the different vegetation belts of Russia.*

II. SILK

Silk is an animal fibre obtained from the cocoons of silkworms. It is a fine gossamer not unlike the fibre of the spider's web. Most of the world's silk comes from the monsoon lands, especially Japan and China, and the supply depends partly on climate and partly on labour.

The silkworms are kept in the houses of peasants, in trays arranged along the rafters of the roofs. The caterpillars are fed twice a day on mulberry leaves. The climate allows new growth of leaves on the trees after the frequent pickings (*cf.* tea). In Mediterranean lands, where also silkworms are reared, pickings of mulberry leaves are possible only before the summer drought puts an end to leaf growth. During the caterpillar stage the insects require not only much leaf-food, but also warmth and attention to cleanliness.

The industry is carried on almost wholly by women and children, who pick the leaves, look after the 'worms,' and later, either at home or in factories, spin and weave the silk. In many parts of China and Japan silk is the cheapest cloth available. Its lightness makes it suitable for hot weather, and by padding and quilting it can be made suitable wear for the cold winters.

The largest manufacture of silk is in China in peasants' homes, for local use. Japan has adopted Western factory methods, but, even so, still exports more raw silk than silk cloth. This raw silk goes to Western Europe or to the United States to be manufactured by large-scale methods. In Europe the chief centre is at Lyons, in the Rhône Valley, where much raw silk is produced, and much more imported from the East, *via* Marseilles. The densely populated Plain of Lombardy has a silk industry at Milan, depending partly on home supplies, some of which also go by rail, *via* the Mount Cenis Tunnel route to Lyons or *via* the St Gothard and Simplon Tunnels to Zurich and Basle in Switzerland. In the Ruhr manufacturing area, in the West Riding of Yorkshire, in Lancashire, and at Nottingham silk is mixed with cotton or wool in the making of plush, carpets, lace, etc., but in the British Isles the manufacture of silk is unimportant.

The United States manufacture in the iron and steel towns of the busy north-east two-thirds of the world's exported raw silk.

> Silk manufacture is comparatively light work, and the percentage of women operatives in the silk mills is higher than in any other branch of textiles. The predominance of women employees gives the silk mill a tendency to be what is sometimes called a 'parasitic' industry; that is, its location depends on the presence of other industries which employ large numbers of men. Wives and daughters of the workmen provide the labour supply for the silk mills. Paterson, N.J., an important place for the manufacture of various classes of iron goods, which employs large numbers of men, has for this reason long been the most important silk manufacturing town in the United States.[1]

III. OTHER FIBROUS MATERIALS

A brief consideration of the various kinds of fibre used for the furnishings of our homes illustrates how widespread are the sources of supply of many cheap articles of everyday use.

The door-mat is probably made of coir, the fibrous covering of the coconut, softer fibres forming the woven base and coarser ones the upper bristles. This coir probably came from Ceylon. The Pacific Islands and other tropical coast-lands like those of East Africa and Brazil, where the coconut-palm thrives, also export the fibre.

Carpets are of wool or wool mixtures woven on to a jute framework. Carpet strips for passages or stairs are often made wholly from coir or jute. Light fancy matting of woven fibrous strips may be of bamboo from the Far East, or of raffia from the leaves of a palm-tree that grows in Madagascar and West Africa.

Linoleum is a mixture of cork and paint pressed on to a base of jute, which will certainly have come from India.

Curtains may be of cotton, silk, artificial silk, wool, linen, jute, or mixtures of two or more of these fibres. Velvets, satins, tussores, and brocades are all woven from silk, the different textures of the cloths being produced by arrangements and treatments of the threads during weaving.

[1] *Industrial and Commercial Geography*, by J. Russell Smith.

The stuffing for cushions, mattresses, and upholstered chairs may be of various fibres. Flocks are the very short pieces separated from scoured wool when it is being combed ready for spinning. Kapok, which can be woven into plush and lace, is the fluffy covering of the seeds of a tree grown in plantations in Java. Coir is a hygienic stuffing for upholstery, but hair, flocks, and sometimes shredded rags are used also. Pillows, cushions, and beds may be stuffed with feathers and down—perhaps from the eiderduck, which nests in remote islands of the sub-Arctic region and off North-west Europe, but more likely from hens, ducks, geese, and turkeys, which form part of the livestock of farms in Western Europe.

Window-cords are made from either the true hemp, which has already been described, or other fibres which are called hemp only because they have similar uses. Manila hemp is obtained from the covering of the stems of a species of banana 'tree' grown exclusively in the Philippines, and it is used for fine quality ropes of many kinds. Sisal is grown in plantations in Tanganyika and Kenya in clusters of long spiky leaves, which are cut and scraped in factories until the fleshy part is removed and only the fibre remains. Its use is for cheap, tough string—the 'whiskery' kind we often see. Its special use is for 'binder twine' in harvesting machines. Henequen is a similar fibre from Yucatan, whence the plant was imported into East Africa.

The bristles of brooms and scrubbing-brushes are of *piassava*, obtained from certain palm-trees in West Africa and Brazil. Other finer brushes may have pigs' bristles, imported, perhaps, from China or Russia. The shopping basket and the clothes basket are of withies from the willows, maybe, of Sedgemoor or the Fens. American cloth on the kitchen shelves is calico coated with a linseed oil mixture and varnished. Gas mantles are made from *ramie*, a fibre obtained from a kind of nettle grown in North China. The seat of the cane chair is of bamboo fibre.

Llamas and alpacas, the 'camels' of the high Andean plateaux, yield a silky wool used often for dress linings. Camels' hair is used in carpets, and the finer qualities for dressing-gowns and other articles of clothing. Mohair, for plush, is the silky hair of the Angora goat, now bred specially on the Karroos of South Africa. Cashmere is goat hair, too, used for shawls and more expensive fabrics.

Just as nearly every part of the world now contributes something to our food-supply, so we are indebted to workers the world over for our clothes and the furnishing of our homes. The woollen coat, the cotton handkerchief, the linen collar, the silk tie, the felt hat, the straw Panama, the canvas shoes, the shoe-laces, the raincoat; the jute carpet, the coconut matting, the cane chair, the string, the clothes-line, the raffia in the garden, the hair mattress, and the kapok cushion; the bindings of books, the picture-cord, the school-bag, and the garden tent—all these tell the same story of the wide ramifications of modern commerce.

Notebook Work

(i) *Draw a world map to show the distribution of fibres, and write necessary notes.*

(ii) *In this book there is no special chapter about furs. The following sections in a 'geography of furs' might be shared by a class, and the combined essays read out: (a) climates that will produce the richest furs, and the seasons in such climates when furs will be at their best; (b) the trappers' work; (c) trading ports and the Hudson's Bay Company; (d) fashion centres; (e) a list of furs that appear in the furriers' windows.*

(iii) *In a similar way a geography of the ornamental and precious feathers might be written.*

CHAPTER XII

TIMBER AND FOREST PRODUCTS

I. THE DISTRIBUTION OF FORESTS

We become familiar with certain trees and shrubs in our own climate, and are apt to forget that similar plants grow very differently in other climatic conditions. The pine-tree is not everywhere the tall, stately tree we generally picture; on the edge of the tundra it becomes stunted almost to a shrub; the ash-tree grows in some localities as a small creeping plant; ferns that grow in Britain as low plants are represented by tree-forms in New Zealand and elsewhere. Both climate and soil affect plant growth. Within a short distance of our homes we can see vegetation types affected by soil—the miniature deserts of rocky slopes or sand-dunes, the jungle of a bramble copse in a swampy hollow, and the rich grassland of a well-drained meadow. If we live near mountains in a short distance we can see vegetation types affected by climate, and can climb upward through successive belts of broad-leaved trees and needle-leaved trees to cold, windswept, treeless heights where heather grows; but we must be careful to distinguish here the effects of soil and those of climate.

Climatic factors primarily determine the main vegetation regions of the world, but differences of soil affect vegetation within any one climatic region. For instance, the British Isles have a cool, temperate climate that naturally favours the growth of deciduous forest, but dry limestone hills or rocky tors make breaks in the continuity of the forest type. Again, the south edge of the deciduous forest belt in Russia is not wholly a climatic boundary, but is also the southern limit of moisture-holding, glacial clays.

In general, wherever there is a season of marked drought, whether in winter or summer, trees thin out to parkland or scrub, and grasses, which depend only on surface moisture, take their place. In such climates trees may not wholly disappear, but they develop certain characteristics which enable them to survive through the dry season.

There are three main types of region with no dry season: (*a*) temperate west coasts, with rain all the year from westerlies; (*b*) east coasts, with rain all the year from trade winds; and (*c*) equatorial regions, with the regular thunder rain of the doldrums. To these must be added two less simple types: (*d*) Eastern North America, which lies in the west wind belt and also has much cyclonic rain from the south; (*e*) parts of the monsoon lands, especially in China and Japan, where there is rain during both the summer and the winter monsoons. All these regions are natural forest-land.

Rainfall decides whether or not there shall be forests, but temperature decides the type of forest. In the British Isles trees are deciduous—*i.e.*, they shed their leaves in winter. If they did not winter snowfalls would break the branches and winter gales would tear away the leaves. The trees, adapted to such conditions, shed their leaves automatically, 'sleep' through the winter, and await spring and summer to recommence their active growth. With the coming of spring in temperate lands there is an amazing revival, for between about April and October the trees have to break into new leaves, blossom, and fruit—that is to say, they have to complete their natural cycle in little more than half the year. Where summers are short or cool the type of tree alters; the deciduous tree disappears and the conifer takes its place.

Conifers are specially adapted to cold climates with short summers. In shape the trees are conical, so that winter snows slide from the 'roofs' of their sloping branches; leaves have dwindled to needles, exposing a minimum surface through which moisture can be lost during cold, dry winds when the ground is probably frozen. In addition, conifers are generally evergreen, so that at the first signs of the short summer they are already equipped with leaves to carry on the round of life.

The forests of the trade-wind coasts and of the equatorial calms are evergreen also, because at no time of the year are conditions unfavourable to tree growth. There are no seasons as the term is understood in temperate latitudes. A single tree may be in bud, leaf, flower, and fruit all at the same time. In a climate with no lack of moisture or risk of frost leaves grow large and broad.

In low latitudes towards the equator it is, then, mainly the distribution of rainfall that limits the forests. In high latitudes the distribution of temperature and wind is as important as that of rainfall. The inland limit of the deciduous forest is fixed by the amount of rain, but the limit polar-ward mainly by the length of the growing season. Generally we can say that the deciduous tree is typical only of coast-lands in the region of westerlies, and that as temperatures become more extreme away from the ocean and as rainfall decreases conifers take the place of deciduous trees. By its structure and growth the conifer needs less rain than the broad-leaved tree. The pine-forest belt round the northern hemisphere has on its southern boundary a minimum of fifteen inches of rain. Its northern boundary is fixed by the length of the growing season.

East-coast climates in the west-wind belt are more extreme than those of west coasts, and the result of this is seen in the extension equator-ward of the forest types.

Altitude affects climate in much the same way as latitude. Temperature decreases about 1° F. for every 300 feet of ascent, so that even on the equator some high mountains have ice deserts on their summits. Up to a point rainfall increases with altitude owing to the forced ascent of winds, the expansion of the air, and consequent cooling with forced precipitation. But the increase in precipitation cannot go on indefinitely, for a stage is reached when the supply of vapour is exhausted, after which there is a sudden decrease of rain. The results of these changing factors are well seen in the vegetations of Mount Kilimanjaro. On this mountain up to an altitude of 3000 feet, where the rainfall is less than 40 inches, the vegetation is grass and bush; between 3000 and 5000 feet the rainfall is from 40 to 60 inches, and there is a belt of tropical forest, often cleared for native agriculture; between 5000 and 9000 feet, with rainfall varying from 70 to 100 inches, the forest belt continues through successive belts of tropical, sub-tropical, and temperate types; between 9000 and 13,000 feet the rainfall is less than 40 inches, and alpine meadows or heathlands occur; beyond 13,000 feet there are only lichens, and a cold ice desert caps the summit.

In Europe the higher mountains make 'islands' of coniferous forest in the deciduous forest natural to the region, and the highest mountains of all have caps of tundra or cold desert.

Notebook Work

(i) *Draw a map of the world showing the wind system and the rain-all-the-year regions.*
(ii) *Draw a map of Russia in Europe. Show the vegetation belts, and explain their limits.*

II. THE NORTHERN FORESTS

Timbers vary much in hardness, and so in their uses and their value. Those from the severe climates of the northern pine forests are generally soft, while those from the equatorial forests are, as a rule, hard, although soft woods do occur. Another difference in forest growth is that in the warmer lands many varieties of tree grow, but in the colder lands only a few specially adapted types. The result is that the northern forests have 'stands' of homogeneous timber, while in equatorial forests a bewildering variety occurs, and single examples of trees that are particularly wanted may be far apart. In India and Burma alone there are 2500 varieties of tree, of which only a few have any present value.

So the northern forests are the site of the most extensive and intensive lumbering, partly because the timber is easily worked, and partly because the stands are regular. Yet in all the great forest belt of the north only a few areas not too remote from markets are thoroughly worked. In the Old World the conifers stretch continuously from Scandinavia, across Russia and Siberia, to the Pacific coasts; but lumbering is concentrated chiefly at each end—close to markets. In North America the forest belt stretches from coast to coast across Canada, but the main lumbering centres are at or near the seaward ends.

The types of trees felled are varieties of pine, spruce, larch, and fir. Their uses are for telegraph-poles, scaffolding, pit-props, masts, sleepers, planks, window-frames and general building work, paper, and artificial silk. Europe and North America each produce half of the world's wood-pulp, all from the northern forests.

Before considering some of these commodities in more detail let us think of the lumberjack's task in getting the raw material.

The Red Indians travelled these forests on snow-shoes in winter, and in birch-bark canoes in summer, when the rivers were in spate and flat lands were swampy with melted snow. To-day timber is moved through the forests on snow-slides in winter, and in the rivers in summer. Trees are felled in winter, when sawing is easiest because sap is low, and when the frozen, snow-covered ground makes a good surface for haulage. The logs are piled by the frozen rivers to await the thaws of early summer, when they are floated down, loose or in rafts, to the sawmills. The actual floating needs little labour compared with the felling, and so in summer many lumbermen have to leave the forests. They find work on farms farther south till after harvest-time, when farmers no longer need the extra labour, and the men go back to winter lumbering in the forests.

The sawmills must be not only where logs can reach them, but also at a source of water-power, and in touch with transport for their finished products. In the St Lawrence area they are situated where tributaries tumble from the edge of the Laurentian Shield, and the St Lawrence itself gives an ocean exit. The Baltic mills have similar advantages with regard to timber, power, and the European market. British Columbia has its fiords, with many harbours, and waterfalls for power.

The mills either turn logs into timber roughly ready for the builders and miners, or make the actual finished products, like doors, window-frames, etc., to standard sizes, or turn the logs into pulp for paper. To make pulp the logs are crushed in water by heavy machinery, and rolled into solid slabs for export. This pulp is the raw material for newspapers and other cheap paper. Better quality paper has to be treated chemically to make it less absorbent. Canadian pulp goes mainly to the United States, some Newfoundland pulp comes to us, but we receive nearer supplies from the Baltic. Japan, too, has pulp to spare, and exports much in the form of fancy-paper goods, lanterns, fans, *papier-mâché* articles, and toys to a world market. The largest paper mills in the United Kingdom are situated along the Thames estuary and the Forth—*i.e.*, on the side of the country facing the Baltic, and near the demands of London and Central Scotland respectively. In and around London, Edinburgh, and other large centres of demand papers of many grades and qualities are manufactured.

The production of artificial silk has increased seven-fold since 1922. The weight of artificial silk manufactured in 1931 was four times the total for natural silk, whereas in 1922–23 the weights were about equal. The processes of manufacture vary considerably, and improvements are still being made, but in principle the method is to force a wood-pulp jelly through fine glass tubes, the thin filament setting when it comes in contact with the air, just as the spider's gossamer turns from jelly to solid as it emerges into the air. The United States are the largest manufacturers, making twice as much as Italy or the United Kingdom, which are Europe's largest producers. Germany and France each make rather less than Italy. Japan is a large producer.

In the British Isles the industry has grown, especially in Essex, as one of the many new industries that are springing up round Greater London. In this connexion we might note here the present drift of certain types of finishing industry towards the London area. Machinery and many of the raw materials for these new industries come from the old industrial coalfield areas, but the assembling and finishing occur in the new factories. Their products include motors, wireless apparatus, gramophones, pianos, paper, hats and clothing, cinema necessities, patent foods, and artificial silk—mostly a type of luxury product depending on a big neighbouring market.

Newspapers, many books, and dress materials like 'Celanese' bring to mind

> glimpses of one of the most picturesque and romantic industries of modern times—pictures of hardy loggers in the woods vanquishing the mighty trees with flashing axe and cross-cut saw until, as the warning cry of "T-i-m-b-e-r!" rings out through the woods, the giant of two or three centuries' growth comes thundering down exactly where the woodsmen planned; of monster logs rushing helter-skelter in the wooden flumes down steep mountain-sides to splash with terrific force into the water of lake or sheltered harbour; of snake-like booms of logs being towed along the sheltered waters of the coast; of sawmills, with tall smoke-stacks and screaming machinery waking the echoes of the forests; of courageous 'high-riggers' risking death as, lashed to the slender trunk of a tree a hundred or more feet from the ground, they top the willowy giant, and the trunk springs back and forth like a steel spring. . . . A discontented settler is said to have described British Columbia as "all blooming rocks and Christmas trees!" That was thirty years ago, and he could not foresee that the world demand for what he contemptuously dismissed as Christmas trees would one day be the largest item in the prosperity and progress of this rich province of Canada.[1]

Notebook Work

(i) *On a map of North America show the following:*

(1) *The areas without trees:* (*a*) *the desert, too hot and dry;* (*b*) *the prairies, too dry;* *and* (*c*) *the tundra, too cold and dry.*

[1] *British Columbia*, Empire Marketing Board pamphlet.

(2) *Forest areas: (a) the northern belt from coast to coast (one-third of Canada is forest); (b) the pines of the Higher Appalachians (where too much timber has been removed with little or no reafforestation the soils have washed away and left barren slopes where once the forests grew); (c) the hardwood, deciduous forests round the Lower Appalachians in the south, and the pines of the south-east sandy coasts; (d) the forests of the Western Mountains, on the Pacific slopes where the giant trees grow, and on the eastern folds of the Rockies; (e) the National Forests preserved by the Government, cut and replanted on scientific and economical lines—large areas along the Sierra Nevada and the Rocky Mountains. (Yellowstone Park is the centre of a large preserved forest area).*

(3) *The sawmills—think of their essentials as regards site.*

(4) *The markets consuming the products of* (3).

(ii) *Write notes beside the map to the effect that* 82 *per cent. of Canada's wood-pulp goes to the United States,* 40 *per cent. of Newfoundland's paper comes to the United Kingdom and the remainder to the United States, and that* 53 *per cent. of Newfoundland's wood-pulp goes to Canada for re-export to the United States.*

(iii) *Graph the following climate figures of a northern forest lumbering region, and write notes about when the trees are felled, floated, etc. (cf. Fig.* 1) :

—	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Temp.	13	15	25	41	55	65	69	67	59	47	33	19
Rainfall	3·7 (Snow)	3·2 (Snow)	3·7	2·4	3·1	3·5	3·8	3·4	3·5	3·3	3·4	3·7 (Snow)

III. OTHER FORESTS

Lumbering in hot wet tropical forests is a very different business from lumbering in the pine forests. There is no cold season to make a hard surface for haulage, no dry season to clear the ground of swamp, no regular stands of homogeneous trees, but single specimens at wide intervals, hard timbers instead of the easily worked pines, difficulties about labour, health, sanitation, and drinking-water, and, lastly, a big distance from markets. The result of all these handicaps is that tropical lumbering is very restricted, the price of its timber tends to be high, and the products are often 'precious' luxury woods. This compels their economical use, and often these precious woods are veneered on to the cheaper timber. Mahogany comes from the forests of Central America, Guiana, West Africa, and the East Indies; ebony from Equatorial Africa, India, and Malay; satinwoods from the Indies and West Africa; and rosewood from Brazil. The areas worked are in every case as near to the sea as possible. Mechanical aids like motor-tractors and the progress of medical science to-day lessen some of the many difficulties.

Teak, a hard, heavy timber from Burma, is used in ships, dockworks, building, etc., where a wood is needed to withstand rot and the attacks of boring animals on land or in the sea.

The deciduous forest regions in Europe and the mixed deciduous and coniferous forests of the eastern United States have become the centres of world civilization. In our own land the forests have disappeared to make room for pasture, arable land, and industrial town sites, and remain only in preserved patches like Epping Forest, Sherwood Forest, the New Forest, and the Forests of Dean and Arden. On the mainland of Europe much the same wholesale destruction has occurred in the west, but towards the east, where population is less dense and industrialization less developed, large areas of forest still remain. These regions often have herds of pigs feeding on the acorns and beech-nuts. In the mountain regions of Europe conifers take the place of deciduous trees for climatic reasons. These pine forests, too, have so much diminished that every effort has to be made now to preserve the remains, and, if possible, make good the damage. In Switzerland, South Germany (the Black Forest), and Austria the mountain pine forests are felled most systematically and thoughtfully, and replanted as used. Sweden and Finland also regulate cutting and replant actively. In the British Isles the Forestry Commission is extremely active, and large areas have been reforested since the War.

To-day 80 per cent. of the oak we use in this country is imported from the United States, and 10 per cent. from Poland. Of the pit-props used in our mines 60 per cent. comes from the Baltic, and 40 per cent. from the carefully replanted forests of France.

IV. OTHER FOREST PRODUCTS

Besides yielding timber, the forest trees give a variety of other products. Some of the fruits, for instance, we have already considered, such as coconuts and the nuts of the oil-palm. The sago-palm is chopped down for its pith, the coconut yields coir for mats and brushes, and the Mediterranean oak is stripped for its cork.

Brazilwood, logwood, and fustic are felled to make dyes and ink. Barks, leaves, roots, and fruit are used to make tans for turning hides into leather; oak, chestnut, willow, acacia, mangrove, wattle, and larch all produce 'tans,' but the chief tanning extract is from the quebracho tree ("axe breaker") found in the forests of the Upper Parana and Paraguay. Gums and resins are obtained from trees, and are used for gum, ink, and varnish, and for stiffening textiles. Gum Arabic is obtained by notching certain trees of the Sudan so that the gum oozes out and sets in the air. The oozing of the gum is the tree's effort to heal the wound made by the notch. Copals are resins from tropical forests, and they are used for varnish. Kauri gum is dug out of the ground in parts of New Zealand, where forests once grew. Turpentine is obtained from pine-trees by making incisions and allowing the liquid to collect in little pans in much the same way as rubber is collected. Rosin is the material left over after turpentine is distilled. Camphor is an oil obtained from a laurel in South-east Asia. Quinine is made from the bark of a tree native to the high Andes, but wholesale destruction has almost exhausted the supply from wild trees, and the product is now cultivated in the East Indies. Ginger is the root of a tropical plant; cinnamon is obtained from the bark of a tree in Ceylon; and cloves are the dried leaf-buds of a tree cultivated now almost exclusively in Zanzibar.

One obvious question needs to be answered in connexion with lumbering and all other forest industries: "How long can supplies last?" Trees grow slowly and are cut down by mechanical saws in a few minutes. The demand for paper increases, and the northern forest dwindles as the demand is met. The United States, which once had vast forests, has consumed them so rapidly, and so foolishly, that most of her supplies now come from Canada. Another aspect is that when trees are felled the unprotected soil is soon washed away by rain, and parts of the world that have had forests have now, instead, the barren, bare rock of hill-slopes.

> China is swept by disastrous floods almost yearly because the Chinese for ages have been stripping their land of every tree and shrub. The bare soil that is left will not absorb heavy rainfall, and give the waters forth gradually for the rivers to carry it away in safety to the sea. The whole downpour rolls off at once, sweeping the good soil from the hillsides. . . .
>
> Just as the hunter goes out and shoots a wild rabbit, so the woodsman cuts a wild tree which Nature similarly has provided. The time may not be far distant when we shall be obliged to pay as much attention to lumber growing as we do to wheat production and cattle raising. At present we are cutting timber four times as fast as we are growing it, which is indeed the handwriting on the wall. Do we care enough about the coming decades to read it? [1]

A solution to the problem lies in various directions. There is no doubt that lumbering will have to be regulated, that replacement—perhaps by better quality trees—ought to follow cutting, not only to ensure future supplies of timber, but also to preserve soil and even to maintain rainfall, for this is affected considerably by forest growth. Economy might be exercised now in the use of waste paper; boxes, often made of good timber, might well be replaced by strawboards, and serve the same purpose. A further economy in mines and buildings and on railways might be an increased use of steel instead of timber for pit-props, rafters, and sleepers. This would be a boon to metal industries, and a respite for the forests. The problem of the demand for newspaper will probably be solved by the invention of processes making good enough paper from grasses such as bamboos, fibres, straws, bracken, or heather. But it is to-day that the foresight is needed to prevent a more sudden dilemma in the future.

Notebook Work

(i) *Draw a map of South America to show the types of forest—tropical, sub-tropical, Mediterranean, deciduous, and coniferous—and explain their boundaries.*

(ii) *Draw a map of Japan, and show the rapid alterations in the types of forest from south to north. Write climate notes to explain.*

(iii) *Make a list of the uses of bamboo in China.*

(iv) *Write a note on Australian trees, the distribution of Australian forests, and Australian timbers used in commerce.*

(v) *Graph the following teak-forest climate, and write notes about what it shows with regard to lumbering:*

—	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Temp.	77	79	84	87	84	81	80	80	81	82	80	77
Rainfall	0·2	0·2	0·3	1·4	12·1	18·4	21·5	19·7	15·4	7·3	2·8	0·3

[1] *Industrial and Commercial Geography*, by J. Russell Smith.

CHAPTER XIII

SPICES AND RUBBER

I. THE SPICE ISLANDS

THE Malay Archipelago was known of old as 'the Spice Islands,' and, although the spice trade is still important in parts, the trade in rubber and vegetable oils has in many cases caused almost an abandonment of the one-time profitable spice cultivation.

The story of the spice trade is one of historical geography and discovery. In the days before the great voyages of the sixteenth century all countries grew their own food. There was little trade in food-stuffs on account of their perishable nature. Diet was apt to be monotonous. If we imagine for a moment what eatables we should have if we had to rely wholly on home produce we can realize something of the diet of the common folk in, say, Elizabeth's time. There was no tea, coffee, cocoa, or chocolate; no sugar, except honey; no jam; no rice, sago, or tapioca; no bananas, oranges, peaches, apricots, pineapples, or grape-fruit; few currants and raisins; no pepper, nutmeg, cloves, or cinnamon. Instead, they had wholemeal bread, ale, English fruits in season only, and meat—a healthy enough diet, but rather dull. Another difficulty was the preserving of meat. When a bullock or pig was killed it was not always easy to dispose of the whole carcass in the small communities in which people lived. To stop wastage joints were pickled in salt; but this made meat somewhat tough and tasteless, and, incidentally, caused scurvy, unless plenty of fruit and fresh vegetables were eaten also. A more tasty dish could be made by pickling in spices, rare luxuries that could be bought from certain Mediterranean towns, especially Venice.[1] Venice, in turn, received her spices from Egypt and Palestine, where they arrived from a strange, mystical "East."

Some travellers, like Marco Polo, had been to this "East," and had returned with wonderful stories of its wealth and spices. Adventurers in Europe longed to have a share in Venice's profitable spice trade, but the Mediterranean route was most jealously guarded. The earliest rivals for the trade were Spain and Portugal, who had this wealth at their 'back door,' but could not get a share because of the might of Venice and the power of her fleets. Portuguese sailors especially realized that between them and this wondrous East was a great land mass—Africa—of which only the northern, Mediterranean fringe was known. If only they could sail round the end of Africa, then, they reasoned, they ought to reach the Spice Islands.

The voyages organized by Prince Henry the Navigator, of Portugal, were undertaken with the idea of finding the 'end' of Africa, but great difficulties faced the tiny ships. Since little was known of navigation in the open ocean, ships kept close inshore for fear of falling over the 'edge' of the flat world. In any case the sailors of those days were ill-equipped for finding their way over the open seas. Progress along the African coast at first revealed little but desert, and it took many voyages to pass this barren stretch and reach a green land again (Cape Verde). Then came a tropical region, with a climate that carried strange diseases. But, much to the delight of the sailors, the coast soon turned

[1] Other towns in the Mediterranean also shared this trade, but Venice outrivalled all.

due east, and they were sure that Africa had been rounded. Their joy was short-lived; the eastward bend was the Gulf of Guinea, and the coast turned due south again. Voyage after voyage was made, terrible hardships were suffered, many valiant little crews never returned, but still the quest went on, while Venice grew richer and richer, and became 'Mistress of the Mediterranean.' At last Diaz did reach the end of Africa, the Cape of Good Hope—'good hope' of finding the way to the Spice Islands. Shortly afterwards Vasco da Gama rounded the Cape, sailed on up the eastern side of Africa, crossed the Arabian Sea, and reached the long-sought goal. A sea route to the East had been found, and the fate of Venice was sealed.

Such a discovery, and the wealth that resulted from it, could not long be kept secret, but Portugal, at the height of her power, monopolized the eastward route. The next nation which would obviously be keen to share the profit of the discovery was Portugal's neighbour, Spain, for both of these countries were favourably placed for the New African route. But Portugal had made it clear by force and by law that she would have no competitors, and thereby had compelled Spain to search for an alternative way to the East.

The long series of Portuguese voyages, the improvements in ships and navigation, and the 'Revival of Learning' that spread from Italy had all been renewing the Greek idea that the world was round. Spain put this notion to the test, and sent out ships to reach the East by sailing into the West. The voyages of Columbus on behalf of Spain discovered an 'East' beyond the Atlantic Ocean, islands with a luxuriant, tropical vegetation, such as had been described by sailors from the East Indies. Columbus jumped to the obvious conclusion, and announced that he had reached the Indies by sailing west, and his error remains to this day in the name West Indies.

Other Spanish voyagers, and perhaps Columbus himself after his last expedition, soon realized the error and the fact that actually a 'New World' had been discovered, with civilizations and wealth in gold and silver that eclipsed even the princely profits of the spice trade. Both Portugal and Spain became enormously rich—the one from a luxury trade in the East, and the other from loot in the West. They became the leading nations of the world; so much so that, very magnanimously they signed a treaty to share the world between them—anything and everything discovered eastward of a line in the Atlantic Ocean was to be Portugal's, all westward Spain's!

During the times of these wonderful discoveries the nations of North-west Europe —British, French, and Dutch—had been 'growing up.' The sudden enlargement of the known world brought them into a more central position, instead of being merely on the fringe of civilization. The wealth of Iberia began to attract their attention, and another series of voyages started. There still remained two other possible routes to the East—namely, by sailing round the north 'ends' of either Eurasia or North America. Actually it was not until the nineteenth century that either the North-east Passage or the North-west Passage was accomplished. Long before it had been realized that even if the routes were discovered they would be too difficult for trade. But the results of the many valiant attempts to find them were the exploration of vast areas in North America and North Eurasia. A more obvious way to share in Spain's treasure was by piracy, by sudden raids on Spanish towns in America, where gold was awaiting shipment, or by attacking the galleons as they brought their wealth home.

We must return to the East and the Spice Islands. Portugal's monopoly could not last long. Spanish expeditions, beginning with Magellan's, reached the East Indies by sailing westward round the south of South America and across the Pacific, and the Dutch trespassed successfully on the Cape route. Spain was too preoccupied with her new American wealth to bother about the East, but Portuguese, Dutch, and British continued to compete for spices. Presently the might of Portugal declined, the British concentrated their attentions on India rather than the Indies, and so the Dutch came to control the Spice Islands. This state of affairs continued until the Napoleonic Wars, when British expeditions again attacked and captured the Dutch possessions. In 1814 the Indies were returned to Holland. The later redistribution of power in parts like Borneo, New Guinea, Malay, and the Philippines is mainly historical and political rather than geographical.

NOTEBOOK WORK

(i) *Draw a political map of Indo-China and the East Indies to show how this area of potential wealth is shared by leading European nations. Note the independent buffer state of Siam.*

(ii) *Make a list of the Straits Settlements and Federated Malay States.*

(iii) *Find out how the following spices from the East Indies are produced: cinnamon* (*Ceylon especially*), *nutmegs, pepper, ginger* (*from India and also West Africa and the West Indies*), *and chillies* (*India*).

II. RUBBER

In the middle of last century the world export of rubber was about two tons a week, all from the Amazon forests, where the product was collected 'wild,' in haphazard and wasteful fashion by natives. There was no attempt at cultivating rubber, and there was no other rubber production in the world. To-day these same selvas produce less than 2 per cent. of the world's rubber. Practically the whole supply now comes from plantations in Malaya, the neighbouring Dutch East Indies, and Ceylon. The vast areas of the Amazon and Congo forests still produce 'wild' rubber; the small areas of the East *cultivate* their rubber. No better example could be found of the results of scientific farming in the increased yields, the economy in space, the advantages to labour and the enormous addition to the world's wealth.

The seeds of the first rubber-trees [1] for plantations were obtained by a ruse. Henry Wickham, a young pioneer, collected the seeds in the selvas, and more or less smuggled them on board a British steamer—which he met only by chance—as "exceedingly delicate botanical specimens specially designed for delivery to Her Britannic Majesty's own Royal Gardens at Kew." The Brazilian authorities thought of orchids and ferns, and did not bother to examine the cases. The seeds eventually reached London, and at Kew were carefully planted and nursed. Soon seedling trees were on their way to the Botanical Gardens in Ceylon, and later were sent to Malaya. That was how the world's rubber plantations began.

The starting of a rubber plantation nowadays is a complicated and expensive business. First the land is chosen, special attention being given to the nature of the soil, to the rainfall of the area, and to the drainage. Rubber is an equatorial product only, and so this virgin land that has been chosen for the plantation is covered with natural forest and jungle. The heavy work of clearing is done by Sinhalese in Ceylon and by Chinese

[1] There are many varieties of tree and creeper that yield rubber, but Para rubber is the best and only one in commerce.

in Malaya. At a suitable time in a temporary dry spell (the equatorial climate has two maxima and two minima of rain) the land is 'burned off.' Accommodation has to be built for the native and European staffs, the burned area is drained, roads are laid, and finally the trees are planted with careful, symmetrical spacing, so as to get the largest number without overcrowding. About 150 trees go to the acre. A clearing in the dense forest is an ideal place for a host of weeds and creepers to flourish in the sunshine, and for jungle animals to come into the open and trample the young rubber-trees. So in the early days of the plantation a constant watch has to be kept. Weeding and hoeing have to be regular, and the soil has to be cleared of fungi that sprout from old, rotting stumps. After five years of toil like this the rubber-trees have grown into a sturdy forest, and production can start. A factory is built, and the original shacks have become more permanent buildings, with the necessary hospital for tropical diseases.

The methods of tapping the trees vary, but as soon as the 'wound' is made latex oozes out to heal the scar. Aluminium cups are placed below the cuts to catch the flow. A coolie soon taps 200 trees, because they have been planted so symmetrically that he can make the same cut in the same relative position over and over again. As soon as he has finished his round he returns to the start with a pail, into which he pours the contents of all the little cups. The latex, which looks just like milk, is put into a tank at the factory, and acid is added to make the rubber 'curdle.' The solid rubber, in a white lump on the surface, is taken out, full of moisture which has to be evaporated. The slab is cut into slices, and either hung out to dry in the air or over a smoky fire, according to the kind of rubber wanted. The dried sheets are then packed, and are ready for export.

The following is an example of the work of one of the big combines who own rubber plantations:

> To-day the estates in which the firm is concerned are represented by eight big companies in Ceylon, four in Southern India, seven in the Federated Malay States, two in Burma, and one each in British North Borneo, Dutch Borneo, Sumatra, and Java. In Ceylon and South India the tea interests predominate; in the other areas the principal product is rubber. The tea acreage is 30,000, producing 14,568,500 lb.; that of rubber is 53,000, producing 14,884,000 lb. Coffee, cardomoms, and coconuts account for a further 869 acres, which have an average yield of 155 tons of coffee, 22,000 lb. of cardamoms, and 275,000 coconuts. Among the firm's most important auxiliary agencies is that for Imperial Tea Chests, Ltd., the largest producers of tea chests in the world, and leaders in the substitution of aluminium linings for modern tea chests.[1]

London is the world's chief rubber market, but the United States consume two and a half times as much rubber as the rest of the world put together, mostly in her vast motor industries. Rubber works in Great Britain are situated mainly in Central Scotland and the Midlands of England, near the manufacture of motors and electrical goods. The rubber industry and the motor-car industry have grown up together. Although there are many other uses for rubber, four-fifths of the world's supply to-day is for tyres.

The other uses for rubber can be dealt with only briefly, but the proofing of textiles and the making of mackintoshes deserve special mention. Certain mills in Lancashire, Yorkshire, and Eastern Scotland make fabrics—cotton, woollen, or linen—specially for proofing. Their products include not only cloths to be made into mackintoshes, trench

[1] "The British Rubber Industry," *Daily Telegraph* Supplement, November 19, 1929.

coats, etc., but also belting for driving machinery, canvas and cord for motor tyres, shoe canvas for plimsolls, heavy textiles for miners' and divers' suits, motor hoods, and canvas for large and small hose-pipes. All these products are for a world market, and vary in quality from cheap yet serviceable goods for countries like China to highly finished products for fashion centres like Paris, New York, or Buenos Aires.

Rubber soles (10,000,000 are sold annually in this country alone), hot-water bottles, surgical rubber goods in hospitals (the canvas of the stretchers, air or water beds, antiseptic gloves and tubings used by surgeons, etc.), rubber floorings in varieties of designs and colourings, sports gear (football bladders, golf balls, tennis balls, grips and gloves for cricket, shoes, cushions for billiard tables, mats for bowling-greens, swimming-caps, etc.), door stops, table mats, aprons, fittings for taps, brushes, feeding-bottles, sponges, toys, fountain-pens, plates for false teeth, insulation for cables—these are some of the many uses for rubber, and still more uses are being found as processes of manufacture develop.

The above list shows how other industries, too, are associated with the rubber trade —textiles, machinery for mixing and preparing rubber, chemicals to adapt rubber to its various uses, and metal, pot, and glass containers for many articles have to be made.

Notebook Work

(i) *Find out where motor-cars are made, not only in the British Isles, but also in North America, France, Italy, Belgium, etc.*

Mark the places on a series of maps, and add any other notes to explain why the industries are centred in these places—e.g., notes about neighbouring coal, iron- and steel-works, centres of population affording markets, the type of motor produced (luxury cars, cheap cars, heavy lorries, tractors, etc.).

Add also those places that make tyres.

(ii) *Graph the following figures of a rubber climate, and write notes about its effects on plantation work:*

—	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Temp	80	80	81	82	82	81	81	81	81	81	80	81
Rainfall	9·9	6·6	7·4	7·6	6·7	6·8	6·8	7·9	6·8	8·1	9·9	10·6

CHAPTER XIV

COAL

I. INTRODUCTION TO THE GEOGRAPHY OF MINERALS

THE skilled farmer, whatever his crops—wheat, cotton, rubber, wool, and all the other commodities we have considered—is concerned not only with his present produce, but also with future supplies. We have seen that not all farmers are equally careful about preserving the fertility of their land and maintaining or improving the quality of their crops, but conditions to-day are compelling farmers everywhere to exercise increased care to produce better and better results, and to keep pace generally with the new advantages that science is constantly bestowing. Scientific and economical rotations are being more and more used, not only in Western Europe, the home of methodical farming, but on farms and plantations everywhere. Farmers generally tend to be wary of novelty, slow to adopt new ideas, proud of tradition, and confident in their established methods; but throughout the world the progressive farmer gains on his more conservative brothers. State-aided experimental farms serve as display-shops for new agricultural ideas, and government money spent in Departments of Agriculture is an investment that is rapidly increasing the products of the land, from which all wealth is primarily derived.

Mining is sometimes called a 'robber' industry; it wrests its produce from the earth but never repays. The farmers' crops also take from the land certain minerals on which plants thrive, but the object of all thrifty farming is to replace by manures or rotations what the plants extract, and so to maintain or improve the original goodness of soils. Mining, by its very nature, cannot possibly attempt any replacement. The coal, iron, copper, salt, and all the other substances taken from mines or quarries are the spending of so much capital that Nature has stored in the ground. The supplies cannot last indefinitely. Coal-mines, oil-wells, and mineral veins all become exhausted; and it is our duty to see that while the wealth lasts it shall be used as far as possible for the utmost advantage of mankind.

The word 'mining' is sometimes applied metaphorically to other industries which seem to be using their supplies of raw material without attempting replacement. Lumbermen in many areas are 'mining' the forests without any thought of reafforestation; some fisheries are 'mining' their resources—whaling, sealing, and the salmon fisheries of western North America all approach this state; the primitive collection of wild rubber is often most wasteful; and an instance nearer home is the wholesale 'mining' of wild flowers and plants round our big towns to such an extent that bluebells, primroses, wild roses, and ferns have actually ceased to exist in places that only recently were their natural homes.

The aim of this book is to try to find order in the distribution and production of commodities. In the case of minerals this order becomes largely a subject for the geologist, whose business is to arrange the various types of rock and the minerals they include into some reasoned sequence. His first big classification is to divide rocks into igneous and aqueous groups—*i.e.*, fire-formed and water-formed. Simple instances of the former are the lava and pumice from volcanoes; and of the latter the layers of mud, sandstone, or chalk. Then he further subdivides igneous rocks into those which have cooled quickly at the surface of the earth and those deep down which have cooled more slowly; the former tend to be glassy, the latter crystalline. Aqueous rocks by their nature are in layers, but, although the strata must once have been horizontal, subsequent shrinkages and other movements of the earth's surface may have distorted the original formation. Of the aqueous rocks, some are organic in origin—*i.e.*, formed by living things—as, for example, chalk, which is made of millions of skeletons of marine creatures, or coal, formed of altered trees, while others are inorganic, as sands and clays. The geologist classifies rocks by age, and he names the ages according to the types of fossil he finds in the various strata. Thus, he has his oldest rock classed as 'Azoic,' meaning 'without life'—no known fossils; then 'Palæozoic'—early life fossils; then 'Mesozoic'—middle life fossils; and so on through the evolution of forms of life.

Ores—meaning "minerals from which precious or useful metal may be profitably extracted"—are of two types. In some cases they are in the old igneous rocks. The original molten matter of these has cooled, and in cooling the various constituents have solidified in order, according to their solubility in the molten mass; hence the different substances have 'separated out.' Ores in these rocks are frequently in thin veins or reefs, or sometimes in bigger masses in what were once cavities in the rock.

But ores are also found away from their 'parent' rock. They have been transported to younger aqueous rocks. Gold, for instance, may be weathered from its reef, carried as fine grains in streams, and deposited far away from its original home. Frequently these secondary deposits are extremely valuable. Sometimes a chemical action between two solutions, one containing a metal salt, may result in a heavy precipitate of ore. Many iron ores in limestone have been formed in this way.

Lastly, ores are rarely pure metal; far more often they are compounds of metals. Gold and platinum are often found pure, but iron ores are various carbonates and oxides, copper ores are sulphides, tin ores are oxides, lead ores are chiefly sulphides, zinc ores are carbonates and sulphides, etc.; and, in addition, the ores of several metals are often combined. Mining is not, then, the mere digging of some metal all ready for use in the world, but more often its products are complicated mixtures of ores, impurities, and much waste material. The preparation of this raw material into substances wanted in manufacture is an expensive business requiring much capital to erect works and brains to discover the full use of products and by-products. So in some parts of the world rich deposits lie unworked for want of capital and skill, while in other parts comparatively poor ores have been developed fully, not only because money and brains are available, but also because necessity has demanded the product. In China thick surface seams of excellent coal are unworked commercially, while in England some thin, contorted seams have to be worked, and in Germany lignite—brown coal in a stage between peat and coal—is the basis of many important industries. The West has reached a machine age, and power is all-important; the East and other vast areas in the world are mainly agricultural. Till recently the two types were complementary, the specialized industrial areas supplying manufactures to the agricultural areas in return for food and raw material. To-day we are in the midst of a change; new and small industries in agricultural lands are supplying their home markets; the machinery for the exchange of food for manufactures seems to be out of gear; the problem at present facing us is to try to foresee the future, and so perhaps to prepare the way for a reorganization of a new series of complementary world units.

II. COAL

Before studying the actual distribution of the world's coalfields and their associated commodities we ought to know something of the work at a colliery. Many books have been written about each part of this work. Most of these are very technical, and deal with special branches like haulage, shafts, machinery, transport, marketing, housing of miners, sanitation in mines, and all the many other sections of a great industry. In this book we can attempt only a summary to illustrate the vastness and complexity of coal-mining. The notes apply to British coalfields, but exactly similar work and problems occur in all modern coalfields in Europe and in the United States especially.

Various Stages in the Development of a Mine

1. Experimental borings are made to test the depth, thickness, and extent of the coal-seams.

2. Sites for the main shaft and areas for works, sidings, miners' homes, etc., are chosen.

3. The shaft is sunk. Arrangements have to be made to cope with the indraining of underground water, which "may be pouring in at the rate of 10,000 gallons per minute." Into the sides of the shaft cement or freezing mixtures are injected to check this inflow of water. The shafts, which vary in diameter from 18 to 24 feet and in depth from 500 to 1100 yards, are lined with steel or concrete fittings. The rock removed from an average shaft weighs 90,000 tons.

4. The branch 'roads' are made from the main shaft along or just above the coal-seams. These roads increase in length and complication as the mine develops. Tramways for haulage and lighting, ventilation and pumping machinery have to be installed.

5. The business of coal-getting starts, which requires not only its own special underground machinery, but large surface works.

6. The pit-head works cost from £250,000 to £450,000, and include not only haulage machines, but apparatus for grading and cleaning the coal, and for loading on to trucks for transport. The winding-engine alone "has to lift from rest a load of 30 tons, raise it 1000 yards, and bring it to rest again at the pit top within 60 seconds."

7. The business, organization, and clerical side of the works all employ a big staff.

The following is a typical example of the large-scale combined operations of mining concerns:

> The United Steel Companies, Ltd. [South Yorkshire], own eleven iron-ore mines, fourteen coal-mines, seven by-product plants, thirty blast-furnaces, forty-nine steel furnaces and converters, and twenty-three rolling mills. The group can turn out 1,600,000 tons of steel products and 3,000,000 tons of coal in a year. The Appleby Mills can roll slabs up to a thickness of 17 inches; Fox's can roll strip down to a thinness of one-thousandth of an inch. The united factories can make anything from railway materials to an umbrella frame, or from marine forgings to wire for fish-hooks.[1]

[1] "British Coal Mining Industry," *Daily Telegraph* Supplement, September 16, 1930

COAL

By-products from Coal

The following is a partial list of the by-products of the South Metropolitan Gas Company:

Benzene, for dyes and explosives.
Benzole, for varnish, lamp-black, dry-cleaning, engraving, sugar manufacture, and motor-spirit.
Toluene, for explosives, dyes, saccharin, and perfume.
Naphtha, for illuminant, solvent for rubber, and for varnish.
Carbolic acid, for disinfectants, tanning, and explosives.
Creosote, for preserving timber and for fuel.
Heavy oils, for Diesel engines.
Naphthalene, for dyes.
Tar, for roads, etc.
Pitch, for insulating electric cables.
Sulphuric acid and hydrochloric acid, for many chemical industries.
Ammonium sulphate, for fertilizer.
Ammonium chloride, for electrical batteries.
Ammonia, for household purposes, and for fertilizer.
Ferrous sulphate, for horticultural purposes.

The above notes should show the vastness and intricacies of the coal industry, its relation to many other important products, its need for large capital, manual skill, and brains, and its consequent limitation to certain well-defined areas.

Varieties of Coal

COAL

Peat — Lignite (brown coal): The vegetable matter only partially changed

Bituminous — Anthracite: Increased changes under increased pressure

Peat is partially decayed moss and other plants that grow in swamps. It is an important fuel in Ireland and highland Scotland, which have little or no coal. Its occurrence is widespread in cool wet climates, but on the whole it has little value so far.

Lignite is important in Germany for household use and for industry.

Bituminous coals include gas coal (cannel), coking coal, household coal, and steam coal.

Anthracite is the hardest and glossiest coal, a smokeless fuel used almost wholly in fast steamships before oil became a cheap commodity.

III. THE DISTRIBUTION OF COALFIELDS

Notebook Work

The key to a geological map arranges the rocks in order of age, starting with alluvium—i.e., recent mud, the youngest rock—going through the series of aqueous rocks until the oldest are reached, and ending with the igneous rocks. Copy the key to a geological map of the British Isles, and note

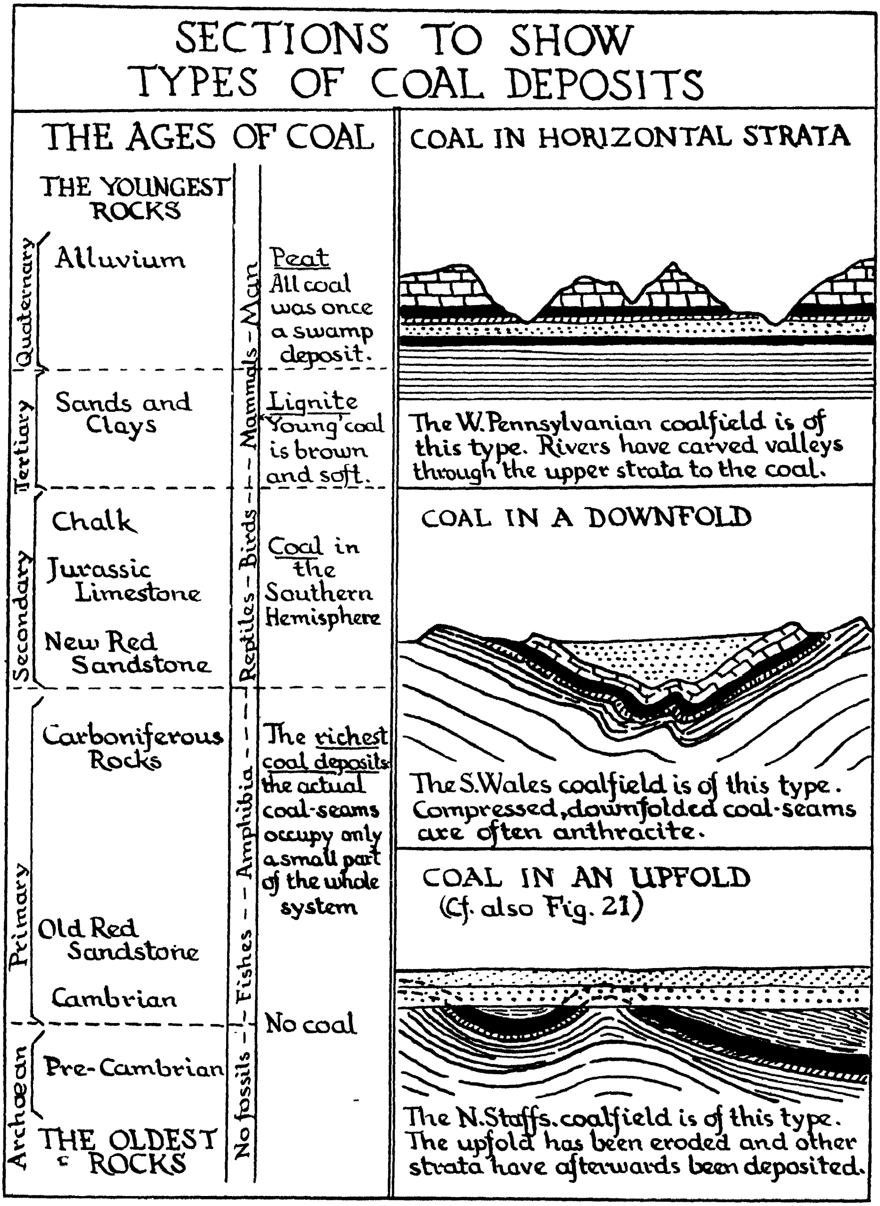

SECTIONS TO SHOW TYPES OF COAL DEPOSITS
THE AGES OF COAL
THE YOUNGEST ROCKS
Quaternary
Alluvium
Peat
All coal was once a swamp deposit.
Tertiary
Sands and Clays
Lignite
'Young' coal is brown and soft.
Secondary
Chalk
Jurassic Limestone
New Red Sandstone
Coal in the Southern Hemisphere
Primary
Carboniferous Rocks
The richest coal deposits: the actual coal-seams occupy only a small part of the whole system
Old Red Sandstone
Cambrian
No coal
Archaean
Pre-Cambrian
THE OLDEST ROCKS
No fossils - - Fishes - - Amphibia - - Reptiles - Birds - - Mammals - Man
COAL IN HORIZONTAL STRATA
The W. Pennsylvanian coalfield is of this type. Rivers have carved valleys through the upper strata to the coal.
COAL IN A DOWNFOLD
The S. Wales coalfield is of this type. Compressed, downfolded coal-seams are often anthracite.
COAL IN AN UPFOLD
(Cf. also Fig. 21)
The N. Staffs. coalfield is of this type. The upfold has been eroded and other strata have afterwards been deposited.

Fig. 26

especially where coal measures and carboniferous limestone occur in the list. Explain the arrangement of the key.

The above exercise and Fig. 26 show that it is useless to look for coal in many kinds of rock—they are either too old or too young. The forests which have become coal were the growth of only very special periods in the earth's history. A geological map shows surface rocks only, but by referring to the key we can make a reasonable guess at the kinds of rock below the surface. Generally speaking the rocks lie in order of age, the oldest at the bottom. Of course earth movements may upset this perfect arrangement, but misplacements in the series are the exception rather than the rule. If, then, we saw on a geological map rocks older than coal measures actually at the surface we should know that these areas cannot have coalfields, but they might have primary metal deposits. Again, if we found layers of coal-bearing rocks crumpled into folds we should expect the coal to be in the downfolds and to have weathered from the crests of the upfolds.

Lastly, although we may see on the map areas of rocks younger than coal at the surface, this does not imply that there are no coalfields, for the younger rocks may actually be protecting seams of coal deep below them.

Across Europe can be traced the remnants of a belt of old, hard rocks now much worn into low plateau country. These masses have remained in solid blocks despite upheavals that have occurred in the course of the earth's history. As a result of their firmness these blocks resisted later wrinklings of the crust. Newer rocks flank their edges, and conspicuous folds on the south are a more distinctive feature to-day than the old, worn blocks. These great folds are the Pyrennees, Alps, Carpathians, Balkans, and other mountains. The old blocks are represented to the north of them by the Ardennes, the Lower Rhine Highlands, the uplands of Southern and Central Germany, Bohemia, hilly lands to north-east of the Carpathians, and the much-worn plateau of Central Russia. The European coalfields lie mainly associated with these old blocks.

In the British Isles the arrangement of the coalfields is less simple. The Pennine coalfields lie on opposite sides of the uplifted Pennine Chain; the coal has been weathered from the top of the arch. The Northumberland and Durham coalfield has the Cumberland field as its 'opposite,' and the York, Notts, and Derby field has South Lancashire and North Staffordshire to correspond on the west. The three Scottish coalfields—Ayr, Stirling and Lanark, and Fife and Midlothian—lie in downfolds in a rift valley between the old rock masses of the Grampians and the Southern Uplands. In the Midlands the coal is probably continuous beneath younger rocks, but is at present worked only in certain favoured regions like South Staffordshire, Leicester, etc. The South Wales coalfield lies in an east-west fold at the edge of the Welsh Mountains. Towards the west of this coalfield, where the seams have been more contorted and subjected to extra pressure, the coal has become anthracite. The central plain of Ireland is all carboniferous limestone, but the coal measures which should rest on it have been mostly removed by weathering, except in small isolated patches in the south-west and at Kilkenny.

The coalfields so far considered lie in a belt round temperate latitudes. Starting from the British Isles and going eastward, we note in order the following regions that once must have been in a great forest belt which in the course of ages has disappeared, where climate has entirely changed, and where seams of coal are to-day the only relics of past conditions: (*a*) coalfields of the British Isles; (*b*) European coalfields, (1) Franco-Belgian

THE COALFIELDS OF EUROPE

This simplified geological map illustrates the following points: 1. The Great European Plain consists mainly of rocks much younger than coal; 2. Across the centre of Europe, from east to west, there is a broken series of old, firm blocks; 3 In the south, crumpled against this central core, is a system of folded mountains with rocks of all ages—weathering has removed much of the softer rock, leaving the hard strata as peaks; 4. Between these folds and the old blocks is a hollow now filled with young rocks; and 5. The coalfields lie along a fall line, where rivers leave the central blocks and descend to the young rocks of the Plain.

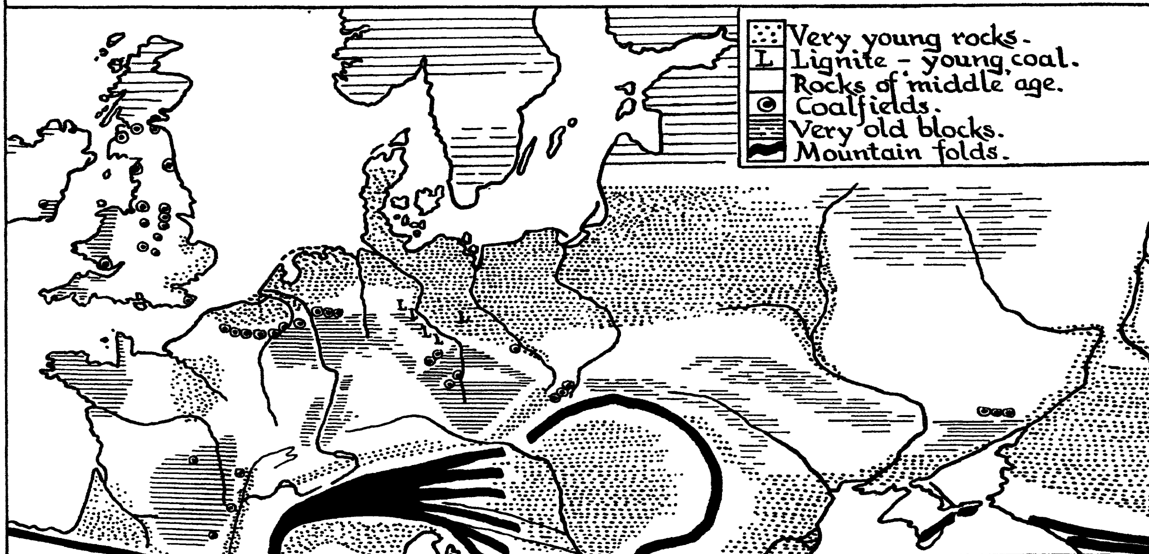


FIG. 27

and Dutch, (2) Ruhr, (3) Saxon, (4) Silesian, and (5) the Donetz basin and the Tula field near Moscow; (*c*) Siberian coalfields undeveloped or only slightly developed; (*d*) coalfields in North China and South Japan; (*e*) coalfields in North America, with little associated with the Western Mountains, but increasing amounts towards the Appalachian system of the east.

In the Southern Hemisphere Natal has a coalfield that supplies South African industries and shipping. The Hunter river fields near Newcastle, N.S.W., supply Australia, and Chile has a small coalfield. The Southern Hemisphere, partly owing to its old, plateau-block structure, has not the wealth of coal of the Northern Hemisphere, so that as long as coal remains an important source of power the North will continue to be more industrial than the South.

Notebook Work

Draw separate maps and sections of the coalfields of the British Isles as follows. Use the geological and physical maps in your atlas to guide you, but see that your sketch-maps illustrate the points in these notes. Draw diagrams to show the comparative production of the coalfields, etc.

(i) *A map of the Pennine coalfields. Show how they flank the Pennine Chain, and how, where the hills approach the coast, the coalfields are also on or near the coast.*

(*a*) *Northumberland and Durham.*

Northumberland: speciality is steam coal—export of coal from Blyth—the nearness of the pits to the coast makes the Blyth coal commercially nearer to London than any other coal (thirty hours' voyage, and cheap freightage)—exports to the mainland of Europe have decreased owing to the fall in trade with Russia, and to competition from the Silesian mines of Poland.

Durham: speciality is gas and coking coal—much for London gasworks—mines near coast penetrate three miles under the sea.

Total production of coalfield 52,000,000 *tons* [1]—38,000,000 *from Durham and* 14,000,000 *from Northumberland. Tyne ports export* 13,000,000 *tons abroad*—21 *per cent. of foreign exports of coal from the United Kingdom.*

(*b*) *The York, Notts, and Derby coalfield—largest in British Isles—divides into three sections:* (1) *West Yorkshire—i.e., the Leeds area (production* 13,000,000 *tons);* (2) *South Yorkshire —i.e., the Sheffield area (production* 33,000,000 *tons)—exports via Hull; and* (3) *Notts and Derby (production* 30,000,000 *tons)—'Derby Brights' are London's standard household coal. The middle part of this coalfield is the only coal-mining area in the British Isles where recent extension of the area has been large—new pits being opened farther away from the Pennine flank around Doncaster in the Vale of Trent.*

(*c*) *Cumberland coalfield—very small—note how close to the coast the Lake Mountains lie —production* 2,000,000 *tons.*

(*d*) *South Lancashire coalfield—note the crescent shape of the hills round Manchester, and compare with the coalfield in geological map—production* 19,000,000 *tons.*

(*e*) *North Staffordshire (the Potteries)—production* 6,000,000 *tons.*

(ii) *The South Wales coalfield—show the Brecon Beacons as the northern boundary, the lowland plain of the coast and the hilly downfold between—show the radiating rivers and the railways that follow them, the coastal plain, and the northern trough—show two sets of towns (a) the line at the foot of the Brecon Beacons, and (b) the ports. Note anthracite in west, bituminous coal in east. Total production* 50,000,000 *tons* (27,000,000 *steam coal,* 17,000,000 *bituminous, and* 6,000,000 *anthracite).* 70 *per cent. of the coal is shipped, and* 80 *per cent. of this goes abroad.*

(iii) *The Midland coalfield—show the Midland plateau between Trent, Severn, and the limestone*

[1] These figures are for 1930.

ridge—show Birmingham in the centre of the plateau on the main watershed—show the three coalfields of the plateau, (a) South Staffordshire (the Black Country), (b) Warwickshire (north-west of Coventry), and (c) Leicestershire (Ashby de la Zouch area). Show the old, hard, intrusive rocks of Charnwood Forest, Cannock Chase, Clent Hills, and the Wrekin.

Production: Cannock Chase, 6,000,000 *tons; Warwickshire,* 5,000,000 *tons; Leicestershire,* 3,000,000 *tons; South Staffordshire,* 2,000,000 *tons.*

(iv) *The Scottish coalfields. Show the central rift valley of Scotland between the Highlands and the Southern Uplands. Show the lines of volcanic hills intruded in the rift valley—Sidlaws, Ochils, Campsie Fells, and Hills of Largs. Show the coalfields in relation to the above physical features.*

Production of all the Scottish coalfields, 34,000,000 *tons;* 13,000,000 *tons are exported,* 6,500,000 *tons of which go abroad. In proportion to their size eastern coalfields have a bigger export trade than the more industrial west.*

Lanarkshire, etc. . .	17,000,000	*tons production.*
Fife, etc. . . .	8,000,000	,, ,,
Lothians . . .	4,500,000	,, ,,
Ayrshire, etc. . .	4,500,000	,, ,,

NOTE. It must be emphasized that the above figures of coal-production in British coalfields are for one recent year only. They do not represent by any means maximum capacity or even normal production, such as would occur if trade were moving more smoothly than it has done in the slump of the past few years. Nor do the figures of coal-production only indicate the comparative commercial importance of the industrial areas—*e.g.*, the figures for the Black Country are much smaller than those for Fifeshire, but the former is a far more important industrial region.

As instances of variation in production we may note the following: (*a*) the South Yorkshire coalfield has shown a steady increase in production over a long series of years, but even so the output of most of the pits is far from full capacity; (*b*) production in West Yorkshire was over 16,000,000 tons in 1923 but only 12,000,000 tons in 1928; colliery companies that might produce 6000 tons of coal a day mine only half that output; (*c*) in Northumberland many pits are working half-time, and lack of trade with Russia and competition by Polish coal in Scandinavian markets have had serious effects on production; (*d*) in Durham annual production has varied from 40,000,000 tons in 1913 to 22,000,000 tons in 1921, 14,000,000 tons in 1926, and 38,000,000 tons in 1929; (*e*) the decrease in exports of coal from South Wales in 1929 compared with 1913 was over 20 per cent. Similar vagaries in figures might be produced for other coalfields and for most mineral regions throughout the world. Statistics can be misinterpreted, mineral statistics perhaps most of all.

CHAPTER XV

IRON AND STEEL

MOST of the world's metal industries depend on coal for the extraction of the metals from the ores, and nearly all industries depend to a large extent on machinery—*i.e.*, on the finished products of the metal industries. If we think for a moment of all the various machines, in farm, factory, and transport, that help to give us our bread, our clothes, and our homes, the suitability of the title 'Machine Age' for our times becomes very apparent.

Of all the metals used in the making of these machines iron is by far the most important. Iron, we have seen, is mined or quarried as ore, which consists of various oxides or carbonates of iron with many impurities imbedded in them. The explanation of how the metal is obtained from such ores is the business of the specialized chemist, who can tell exactly what chemical actions have to go on, and what reagents are needed to produce them. It is enough for us to know here that the work is done in a blast-furnace, in which a coke fire is built whose heat can be increased by a 'blast' of air in the same way as we use bellows for our hearths. On to this fire the iron ore is tipped, together with a limestone flux, which combines readily with the silica and alumina that are usually constituents of the ore. The whole mixture is heated intensively. The carbon in the coke combines with the oxygen of the oxides, and the metal runs free. Being heavy, this sinks to the well of the furnace. The fused flux impurities settle also, but float on the molten iron. Coke is used instead of coal so that there shall be a minimum of ash and rubbish from the fire itself. The furnace is tapped at the bottom, and at first the white-hot molten iron runs out into troughs of sand that have been laid at the base. Here it cools into stumpy bars—pig iron. The flux and other rubbish that run off after the metal are carried away in small trucks and tipped on to slag-heaps.

Only dwellers near blast-furnaces can have a true idea of the conditions of work there, of the peculiar, sulphurous pall that overhangs the district, of the depressing grimness of vast slag-heaps, and of the majesty of ironworks at night when the blast shoots mighty flames from the furnace tops, and when the tapping of the metal at the base of the furnace sheds a strange brilliance on to the works and the clouds above.

For the production of pig iron there are three essentials: (1) a supply of good coking coal, (2) ore, and (3) limestone. There must also be transport facilities for moving the heavy product. Fig. 28 shows various combinations of these factors.

Reference should be made again to the list on page 98 of the undertakings of the United Steel Companies, Ltd.

The supplies of iron ore often found in conjunction with coal-seams are quite insufficient for the needs of a large-scale, modern industry, although they served in early days. Ore is now quarried in other areas, and taken to the coal for smelting. Often to-day the trucks that take the ore, instead of returning empty, bring back coke, so that some smelting may be done actually at the quarries. The proposal to erect the newest and most up-to-date iron plant in this country at the iron-ore quarries in the Northampton Uplands,

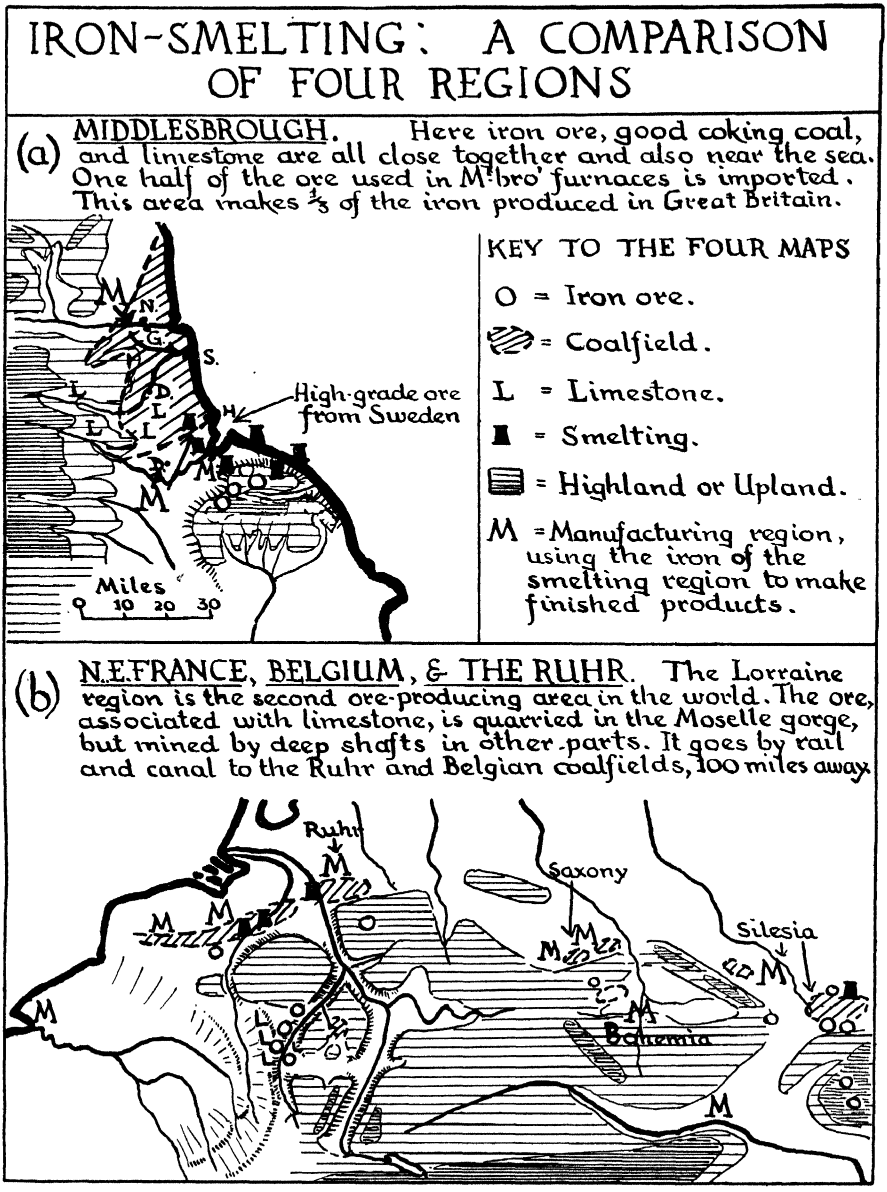
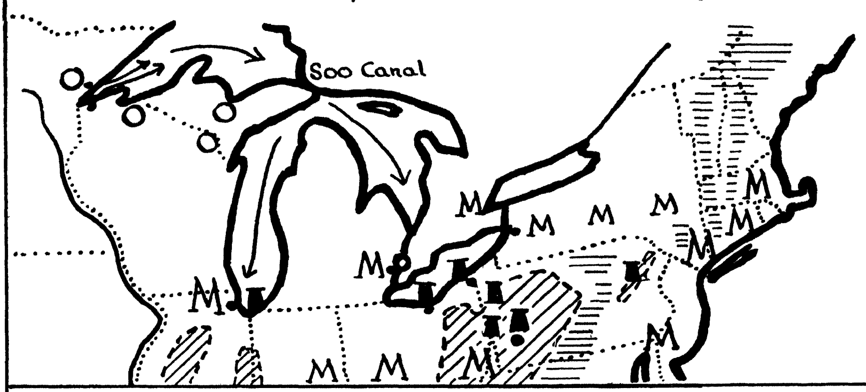

IRON-SMELTING: A COMPARISON OF FOUR REGIONS
(a) MIDDLESBROUGH. Here iron ore, good coking coal, and limestone are all close together and also near the sea. One half of the ore used in M'bro' furnaces is imported. This area makes 1/3 of the iron produced in Great Britain.
M
N.
G.
S.
L
D.
L
L
L
M
M
High-grade ore from Sweden
Miles
0 10 20 30
KEY TO THE FOUR MAPS
O = Iron ore.
= Coalfield.
L = Limestone.
= Smelting.
= Highland or Upland.
M = Manufacturing region, using the iron of the smelting region to make finished products.
(b) N.E. FRANCE, BELGIUM, & THE RUHR. The Lorraine region is the second ore-producing area in the world. The ore, associated with limestone, is quarried in the Moselle gorge, but mined by deep shafts in other parts. It goes by rail and canal to the Ruhr and Belgian coalfields, 100 miles away.
Ruhr
M
M
M
Saxony
M
M
Silesia
M
M
L
L
L
Bohemia
M

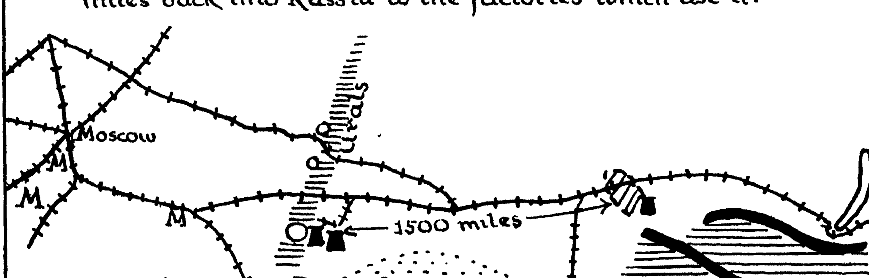
FIG. 28

IRON-SMELTING: A COMPARISON OF FOUR REGIONS

(c) PITTSBURG. Here the ore is over 800 miles from the coal, but they are linked by a chain of lakes and canals. The L. Superior ore is high grade, occurs in large, surface masses, and is easily shipped. The W. Pa. coalfield is the largest single bituminous coal-producing area in the world: seams are thick, uniform, shallow, and so easily worked.



(d) THE URAL REGION. Here, at the new Russian iron-works, coal is brought 1500 miles by rail to the furnaces at the ore deposit: the trucks take back ore to be smelted at the coalfield. Further, the finished iron has to go over 1000 miles back into Russia to the factories which use it.



To produce 1 ton of pig-iron requires on an average the collection in the furnace of 2½ tons of ore, 1¼ tons of coke (made from 2½ tons of coal), and ½ ton of limestone.

FIG. 28

and not on a coalfield, is of interest in this connexion. In North America boats not only bring iron ore from the shores of Lake Superior to the coal of the Pittsburg-Cleveland region, but also take back cargoes of coke, and so another smelting area grows at the ore end of the Lakes.

Fig. 29 shows where ore is quarried in Britain, the coalfields that each area supplies, and the positions of the blast-furnaces.

In addition to our home supplies of ore, which provide two-thirds of our needs, ores of special quality are imported from Bilbao in Spain, and from the far north of Sweden. Note the railway access to the ice-free Atlantic port of Narvik. These ores go to South Wales and the Clyde, and to the Forth and Middlesbrough.

Pig iron can be run into moulds, and the products turned out are cast iron, which is hard but brittle. Many brackets, handles, fire-bars, etc., are made of cast iron. Pig iron contains much carbon. If it be remelted and stirred ('puddled'), while a flame plays over its surface to remove carbon impurities, the resultant metal is wrought iron, which is malleable. This is what the blacksmith beats and bends to the shapes he wants. Both of these irons have their uses, but also obvious disadvantages. The next stage is to turn iron into steel, which may combine the good qualities of both wrought and cast iron, and have other qualities that neither possesses. Steel can be hardened and tempered. There are many steels, each with peculiar properties suitable for special work. In order to make them accurate proportions of carbon and special metals are introduced into remelted wrought iron—the amount of carbon and the kind of metal, or metals, producing the different steels. Manganese, nickel, chromium, and tungsten are some of the metals used. The sources of supply may be seen in the tables of Chapter XVI.

Where the necessary conditions for the production of iron and steel occur the type of goods made depends partly on local facilities, partly on experience and tradition, and partly on the demands of markets. In many cases tradition and history rather than geography have decided types of product.

Shipbuilding needs not only iron and steel, but a suitable waterway for launchings. Britain's island site, her colonial development, and her early lead in manufactures and export trade have given her a supremacy in shipping and shipbuilding. In 1931 out of a world total of 70,000,000 tons of merchant shipping Britain had 20,000,000 tons, and the United States 13,500,000 tons. The next biggest was Japan's 4,300,000 tons, and then came Germany and Norway each with nearly as much as Japan. In the same year of bad trade 15 per cent. of British vessels were laid up, 22 per cent. of those of the United States, and 8 per cent. of Japan's. In 1931 Britain had 400 vessels under construction compared with 200 in the United States, while in 1921 Britain had 2600 and the United States 200. The shipyards of the Clyde, the Tyne, Belfast, and Barrow have long held a unique position in the world.

It is not easy to find equally advantageous sites for shipbuilding elsewhere. On the mainland of Europe coalfields and ironworks are farther from the coast or near shallow deltas rather than tidal estuaries, but many shipyards have been built. Stettin, Hamburg, Le Havre, St Nazaire, Marseilles, and Genoa all have busy shipyards, but in no case is the industry due to a combination of natural facilities as on the Clyde or Tyne. Japan builds ships at Nagasaki, and in this instance the island site of the country, the maritime tendencies, the availability of recruits from the fishing fleets, and the recent industrialization of Japan have all led to the inevitable establishment of a merchant navy and its

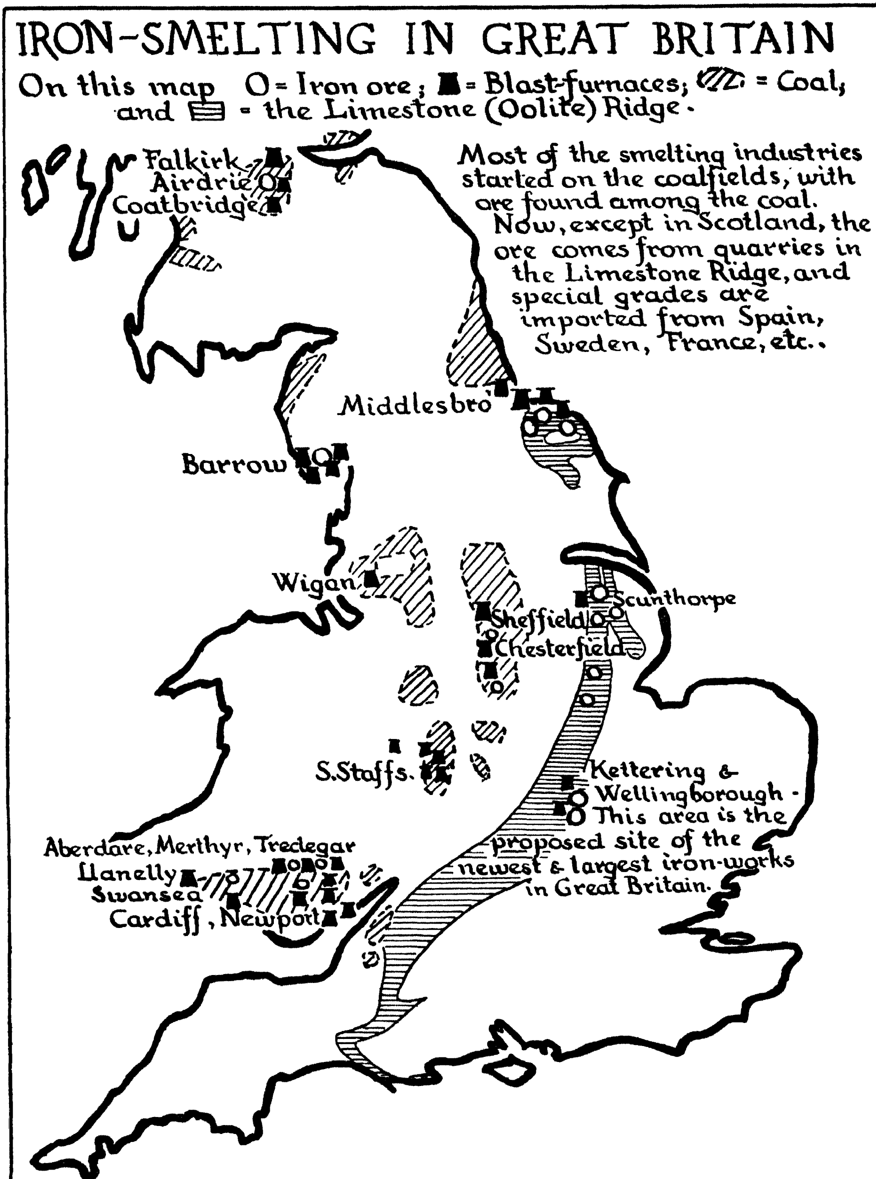

IRON-SMELTING IN GREAT BRITAIN
On this map O = Iron ore; ■ = Blast-furnaces; = Coal, and = the Limestone (Oolite) Ridge.
Most of the smelting industries started on the coalfields, with ore found among the coal. Now, except in Scotland, the ore comes from quarries in the Limestone Ridge, and special grades are imported from Spain, Sweden, France, etc..
Falkirk
Airdrie
Coatbridge
Middlesbro'
Barrow
Wigan
Scunthorpe
Sheffield
Chesterfield
S. Staffs.
Kettering & Wellingborough. This area is the proposed site of the newest & largest iron-works in Great Britain.
Aberdare, Merthyr, Tredegar
Llanelly
Swansea
Cardiff, Newport

FIG. 29

protective fleet to foster and guard export trade. New York Harbour and the Delaware and Chesapeake rivers are the sites of important shipyards in the United States.

Iron and steel industries on many coalfields supply machinery for the special products of their areas—for woollen, cotton, linen, or jute mills, potteries, motor and railway works, etc. Heavy iron goods tend to be made near the coast, where transport by water is available—*e.g.*, the heavy girder work of Middlesbrough and Darlington near by—though Sheffield, in the heart of England, makes heavy as well as light goods. Iron- and steel-works away from coasts and relying wholly on transport by rail tend on the whole to make smaller articles of sufficiently high value in little bulk to be able to stand the extra cost of railway freightage. Thus the Black Country specializes in smaller metal goods—pins, screws, railings, electrical fittings, chains, cycles, motors, rolling-stock, and small arms. The Ruhr, adjoining the navigable Rhine, combines the industries of many British coalfields, and makes not only the heavy iron and steel goods of the Krupp works, but small metal goods of all kinds, including cheap toys, together with woollens, cottons, silks, and all the associated by-products like dyes and chemicals.

Swansea, in South Wales, specializes in tin- and copper-smelting and plating, an industry depending partly on the former near-by supplies of Cornish tin and copper, and partly on ease of import of foreign ores.

The iron and steel area of the United States, besides making both heavy and light goods of all kinds, is the home of large-scale motor production—an industry that developed from the demand for mechanical appliances to work the extensive wheat-lands of the central plains and from the early prosperity of the farmers. The same area, too, has an extensive tin-plating industry in response to the demand in both canning and motor work.

But in all these industries certain parts of the finished products are imported from other industrial areas. The motor chassis demands special quality steel, the linings of the big guns for battleships must have a particular hardness and trueness, the propeller shaft of the liner has to be flaw-proof, the blades of the turbine must withstand a tremendous pressure of steam, the tyres and axles of rolling-stock must be perfect for their task, and the whirling propellers of the aeroplane rotate on bearings of constant precision. A town like Sheffield specializes in these fine-quality steels, not only for the cutlery that has made its name famous, but also for supplying those parts made of special steels needed in other industries. Thus, in the making of a liner at, say, Belfast all the British industrial areas will supply some part or parts in which they are particularly specialized—a propeller shaft will come from Sheffield, the screws and rudder from Darlington, heavy framework from Middlesbrough, electrical appliances from Birmingham, luxury fittings from London, and so on.

Solingen in the Ruhr coalfield has a specialization in cutlery and fine steels similar to Sheffield's. The Creusot works of France and the Skoda Combine of Bohemia draw main supplies of material from local works, but special products are drawn from wide areas, and even from Great Britain. The exercises at the end of this chapter give particulars about the main European coalfields.

Besides the areas mentioned above there are other important manufactures of iron and steel. Fig. 28 (*c*) has already shown the iron and steel region of Pittsburg. Liége, Namur, and Mons on the Belgian coalfield have large iron- and-steel works. The products are characterized by their cheapness—the result of low labour costs. The workers at these Belgian foundries are farmers too. Most of them have small-holdings on which they raise much of their food, so that the wages received from the iron-works are regarded not as the sole means of existence, but as so much extra pocket-money for purchasing those necessities that the little farms cannot produce.

The northern iron-ore deposits in Sweden are exported as ore, but other deposits at Dannemora, north of Stockholm, are smelted either with imported Polish coal or in electric furnaces, partly for home use and partly for export. Some of this Swedish bar iron of special quality is used in Sheffield for the making of fine steels for cutlery.

In India, in the Lower Ganges Basin, at Raniganj and Jherria is a coalfield whose products with the iron ores near by form the basis of big iron- and steel-works. It is strange to think of big, up-to-date blast-furnaces in the middle of China, but Changsha, south of Hankow, in a tributary basin of the Yangtse, has an important smelting industry, and Hankow makes machinery for cotton and silk mills.

Russia has built the biggest iron plant in the world at Magnitogorsk in the Southern Urals. It is too early to say whether the venture will be successful, but it is a novel experiment in that it relies on the extraordinary quantity of high-grade ores at the works, while coal for the smelting has to come along the Trans-Siberian Railway from over 1500 miles away.

So we see that a few comparatively small areas supply the world with iron and steel. The railways, rolling-stock, bridges, steel-frame buildings, dock-works, and farm and mining machinery of the world come from the coalfields of Europe or the United States. It would seem as if there should be ample scope for these few industrial regions to work at full pressure to supply such vast markets, and yet to-day large numbers of iron-workers are unemployed. Their goods are wanted, new lands need development, but the most complicated machine of all—the means of exchange—has gone wrong, and a new confidence and a wide outlook are needed to start it working again.

Notebook Work

Put the following tables into map form. Try to associate the manufactures with the natural resources, and the importance of the regions with their positions with regard to import, export, markets, etc.

EUROPEAN COALFIELDS

Resources	Towns and Products
Saxony, Silesia, and Bohemia	
Coal on north edge of Ore Mountains and Giant Mountains, and on south edge in Bohemia.	Dresden: Machinery, paper, pianos, tobacco, glass, and chocolate. Banking centre.
Lignite to west of Elbe (Magdeburg).	Meissen: Pottery, iron and steel, and jute.
Iron and copper in Silesia.	Leipzig: Printing, scientific instruments, pianos, paper, chemicals, and dyes. Banking centre. Industrial "Fairs."
Iron, copper, and lead in the Harz Mountains.	Halle: Glass, chemicals, sugar, cottons, and machinery.
Iron at Pilsen.	Jena: "Zeiss" factories.
Potash at Stassfurt.	Zwickau: Pottery, glass, cottons, and machinery.
Graphite in South Bohemia.	Chemnitz: Cottons, woollens, and machinery.
Sheep on hills.	Many small places round Chemnitz with cottons, woollens, gloves, and lace.
Beet, flax, potatoes, hops, orchards, and tobacco.	
Ease of import and export *via* Elbe and Oder.	
Petroleum in South Poland.	
Salt near Cracow.	

EUROPEAN COALFIELDS—*continued*

Resources	Towns and Products
Saxony, Silesia, and Bohemia—*continued*	
	Prague: Iron and steel, beer, glass, cottons, woollens, sugar, gloves, machinery, linen, and lace. Pilsen: Paper, beer, glass, woollens, and machinery.
	Breslau: Sugar, cottons, chemicals, and iron and steel. Cracow: Machinery, chemicals, tobacco, and leather. Many small towns in Upper Oder Valley have similar products.
Ruhr and Franco-Belgian Coalfields	
Coal, anthracite in North France. Iron and lead ores in hills south of Ruhr. Iron ore in Moselle valley from Luxemburg to Metz and Nancy. Potash of Rhine Rift (Strassburg). North-east France and the Belgian Plain have flax, beet, hops, and tobacco. Sheep on hills. Timber. Ease of export and import *via* Rhine and Scheldt.	Liége: Cottons, woollens, chemicals, leather, electrical goods, arms, cutlery, gloves, iron and steel, and zinc work. Namur: Cutlery, iron and steel, leather, paper, and brass. Charleroi: Glass, iron, and chemicals.
	Lille: Linen, gloves, chemicals, sugar, and electrical goods. Roubaix: Cottons and woollens. Courtrai: Cottons, woollens, and linen. Cambrai: Cambrics. Valenciennes: Linen.
	Brussels: Linen, silk, machinery, cottons, electrical goods, chemicals, lace, and carpets. Ghent: Cottons, linen, iron and steel, lace, leather, motors, and machinery. Antwerp: Shipbuilding, tobacco, cottons, linen, electrical goods, silk, lace, sugar, and diamond cutting.
	Ruhr Valley: Iron and steel. Duisburg: Cottons and ships. Krefeld: Silk, machinery, and dyes. Essen: Iron and steel and brass. Barmen-Elberfeld: Woollens, cottons, and dyes. Solingen (not on coalfield): Steels. Cologne: Dyes, cottons, woollens, glass, machinery, leather, chocolate, and scent.
	Metz: Lace, linen, and woollens. Saarbrücken: Cottons, woollens, leather, silk, chemicals, iron and steel, and machinery. Nancy: Iron and steel, machinery, woollens, leather, and glass. Strassburg: Cottons, woollens, leather, and pottery.

CHAPTER XVI

OTHER MINERALS

Notebook Work

Put the facts of the following tables on to a series of maps, showing not only the mining centres, but the structural regions with which the minerals are associated.

The percentages given and other quantitative remarks apply to production in 1931, but it must be remembered that mineral production is affected by varying circumstances, such as exhaustion of deposits, uneconomic prices, political disturbances, the interdependence of different mineral industries, labour problems, etc. So the figures for any one year do not give indications of similar or better production in the future; some places may be at the peak of production and decline may be very rapid, while other places with only minor production may have sudden booms. There cannot be the same orderliness in studying the geography of the minerals of a region as in studying the agriculture; so many factors, not geographical, affect mining more than farming.

Region	Minerals
MAP 1. The western system of plateau blocks and surrounding folds of North America, stretching from Alaska to Mexico. Note also the railways which serve this mineral region.	*Copper.* In Arizona, Montana (Butte), and Utah. U.S.A. mines over 50 per cent. of the world's copper ore, while U.S.A. and Canada together produce nearly 50 per cent. of the world's copper. The mines in western North America have probably reached the peak of production. In Alaska (Copper River). In British Columbia (Boundary). *Silver and Lead.* In Utah, Colorado, and Nevada; also associated with copper in Montana. In Mexico nearly 50 per cent. of the world's silver is produced; U.S.A. produces over 16 per cent. It is stated that 80 per cent. of the world's production of silver to-day is derived from lead, zinc, and copper ores. *Arsenic.* U.S.A. is the world's chief producer. Arsenic is derived as a by-product during the smelting of copper, lead, silver, etc. *Gold.* In Alaska (Juneau, the capital, is near the goldfields) and Klondyke. In California (the gold rush of '49 began California's development). *Salt and Soda.* Salt Lake. *Molybdenum.* Used for special steels. Associated with copper in Colorado, etc.—almost all the world's supply.
MAP 2. The remainder of North America. Show the Laurentian Shield, the Ozark Dome, and the Appalachian system.	In Laurentian Shield *Copper.* At Sudbury, Ontario, and in Quebec. *Nickel and Cobalt.* At Sudbury.

Region	Minerals
MAP 2—*continued*	*Platinum and Allied Metals.* Associated with the nickel and cobalt. *Gold.* At Porcupine. *Asbestos.* In Upper Quebec. Canada is the British Empire's biggest copper producer and the world's second gold producer; 80 per cent. of the world's nickel comes from Ontario and over 60 per cent. of the world's asbestos from Quebec. IN THE OZARK DOME *Zinc and Lead.* At Joplin. U.S.A. produces over 25 per cent. of the world's lead, and 25 per cent. of the world's zinc; Europe produces 25 per cent. and 25 per cent. of the world's total of these metals respectively. Fifty years ago Europe produced 90 per cent. of the world's lead. IN THE APPALACHIAN SYSTEM *Copper and Zinc.* In eastern Tennessee. *Mica.* In the Southern Appalachians. U.S.A. is the world's chief producer. *Coal.* Especially in the western flank of this system, coal is by far the most important mineral in this area. *Aluminium.* In Arkansas. U.S.A. is the world's second producer of bauxite, but easily the largest producer of smelted aluminium.
MAP 3. SOUTH AMERICA. Show three Highland areas: (*a*) The Andean system of plateaux and folds—a continuation of the system in western North America; and the very ancient plateau block of (*b*) the Guiana Highlands, and (*c*) the Brazilian Highlands. There is a central lowland of young rocks between these two blocks and the Andean folds.	IN THE ANDEAN SYSTEM *Copper.* In Northern and Central Chile. Chile is the world's second producer of copper; further developments are likely. *Silver.* In Peru (Cerro de Pasco), Bolivia (Potosi), and, associated with copper, in Chile. *Tin.* Associated with silver, in Bolivia. Bolivia is the world's second producer of tin ore. *Platinum.* In Colombia. Production has more than doubled since 1914. *Nitrates.* In the Atacama Desert. Chile has a world monopoly of natural nitrates. The mineral deposits of the highlands of Guiana and Brazil are undeveloped. Both areas produce some diamonds, other precious stones, and gold. The manganese of Brazil (Minas Geraes) is important.
MAP 4. AFRICA is almost wholly a plateau block; only in the extreme north (Atlas Mountains) and in the extreme south are there younger folds. The block is similar in structure to the blocks of Guiana and Brazil, Arabia, the Deccan, and western Australia.	*Gold.* In the Rand, Southern Rhodesia, and the Gold Coast. A new goldfield in Kenya. The British Empire produces 70 per cent. of the world's gold; South Africa alone produces 50 per cent. Canada is the second producer, with 12 per cent.; U.S.A. produces only slightly less.

Region	Minerals
MAP 4—*continued*	*Copper.* At Katanga, on the southern border of the Belgian Congo, in adjacent Northern Rhodesia, in Southern Rhodesia, and in South-west Africa. *Radium.* Nearly all the world's supply is at present coming from Katanga. *Chrome Ore.* Southern Rhodesia is the world's biggest producer. *Tin.* In Nigeria (Bauchi). *Diamonds.* At Kimberley, Pretoria, and in South-west Africa. *Platinum.* Just east of Pretoria. South Africa is becoming very important as a producer. *Cobalt.* Used in the making of special steels, and also for glass and pottery. Found in the Belgian Congo. *Manganese.* The Gold Coast is the world's third producer, after Russia and India. The Atlas folds and plateaux produce iron ore, manganese, zinc, and phosphates, especially in Tunis. U.S.A. (Florida) is the world's biggest producer of phosphates (35 per cent.). Tunis is second, with only slightly less.
MAP 5. India, Burma, Malay, and the East Indies. Show clearly the plateau block of the Deccan, the young folds of the Himalayas, and the hollow of the Indo-Gangetic Plain filled with very young rocks. Show the parallel folds of Burma. In Indo-China the plateau-block structure re-appears.	*Manganese.* In the Central Provinces. India is the world's second producer (20 per cent.); Russia in the same year (1931) produced nearly 45 per cent. of the world's total. *Gold.* In Mysore. *Silver and Lead.* Burma is the world's second producer of lead ore. *Precious Stones, Graphite.* In Ceylon. *Tin.* In the Malay Peninsula (Perak, Selangor, Negri Sembilan), and in the island of Banka. The Federated Malay States and the Dutch East Indies together produce over 50 per cent. of the world's tin ore.
MAP 6. China and Japan.	In China especially mineral deposits are only slightly developed; the country is definitely agricultural. *Tungsten.* In Hunan and Kwangtung. China is the world's first producer. *Tin.* In Yunnan. *Copper.* Japan is the world's fifth producer. *Silver.* In Japan. *Sulphur.* In Japan—the world's third producer, after U.S.A. (Louisiana and Texas) and Italy. *Antimony.* In Hunan. China is easily the world's biggest producer. *China Clay.* In both China and Japan. China is the world's biggest producer, but Cornwall is the world's biggest exporter. *Graphite.* In Korea.

Region	Minerals
MAP 7. The line of the TRANS-SIBERIAN RAILWAY. Note the northern edge of the folds and plateaux of Central Asia, the recent deposits of the steppes of Western Siberia, and the denuded highlands of the eastern peninsulas of China and Manchuria.	The mineral wealth of the Urals. *Iron, Platinum, Gold.* Before the War Russia produced nearly 90 per cent. of the world's platinum. *Coal.* At Tomsk. *Iron Ore.* On the flank of the folds to the south of Tomsk. *Gold.* At the source of the Yenesei. The Lena goldfields north-east of Lake Baikal. Partial exploitation along the course of the Amur river. Much mineral wealth, little developed in the Yablonoi Mountains. Both coal and iron in northern Sakhalin. (The Persian oilfields are explained in Chapter XVII.)
MAP 8. AUSTRALIA. Show the Western Plateau, the East Highlands, and the central plains.	*Gold.* At Kalgoorlie, Coolgardie, and neighbouring areas, and at Ballarat and Bendigo; also at other places on or near the Great Divide. *Silver, Lead, and Zinc.* At Broken Hill. Australia is the Empire's chief producer of lead. The British Empire produces 25 per cent. of the world's lead, and consumes 21 per cent.
MAP 9. EUROPE. For structure, see Fig. 27 and Chapter XIV, Section 3.	*Zinc and Lead.* In Lower Rhine Highlands, in Silesia and Bohemia. *Graphite.* In Germany and Bohemia. *Potash.* At Stassfurt—the world's richest deposits. *Mercury.* Italy (Tuscany) is the world's biggest producer. *Copper.* At Rio Tinto in Spain. *Silver, Lead, Mercury; Pyrites* (for sulphur). In Spain in the Southern Meseta or Sierra Nevada. *Iron.* At Gellivare in Northern Sweden, and in many parts of the hinterland of Stockholm. *Manganese.* In Russia in the Donetz Basin and in the Caucasus area. *Aluminium.* Southern France (lower Rhone) is the world's largest producer.

The Uses of the Metals

Copper. An increasing demand occurs in electric generating plant, light and power transmission lines, telephone and telegraph wires and cables, motor-cars and aircraft, brass and bronze ware, locomotives, roofing, and cooking utensils. The demand has nearly doubled in the last ten years.

Platinum and Allied Metals. There is an increasing demand for these metals for dental and surgical work, jewellery, and fountain-pens.

Nickel. This is used for a variety of steels, nickel-copper alloys, and wireless valves.

Tin. A metal used for bronze (with copper), tin-plate, and motor work. The world's output of tin-plate has doubled in the last ten years, being used for containers for fish, meat, fruit, vegetables, tobacco, coffee, biscuits, oils, polishes, paints, and for toys.

Lead. This is used for cable coverings, storage batteries, ammunition, solder, type, pewter, paints, pipes, and sheets for buildings.

Zinc. A metal used for brass, paints, for galvanizing iron products, and in the rubber industry (a motor-tyre contains zinc-oxide to 50 per cent. of its weight).

Aluminium. During the last twenty years the world's aluminium output has increased from 40,000 tons to 260,000 tons. On account of its lightness and its rustlessness aluminium finds many uses in engineering and in domestic work. The metal exists widely in nature as ores, and never as pure metal. The chief are in bauxite, found in British and Dutch Guiana, India, the South of France, Italy, and the U.S.A. An electric current is passed through a mixture of alumina (pure oxide of aluminium) and cryolite (a rare mineral from Greenland). The mass is fused, and the metallic aluminium is freed and tapped. The electric furnace works continually, and the source of power must be cheap and large in amount. For these reasons water-power is always used. British works are situated at Fort William, close to Ben Nevis, where the metal is extracted. Alumina is prepared at Larne Harbour, Antrim, and in Fifeshire. Carbon electrodes are made at Greenock; and rolling mills are at Warrington. Norway, with its lofty plateau and many waterfalls, has important electric furnaces for extracting aluminium, and France and Italy have water-power from the Alps.

A Note on the Stages of Development in Mining Industries

The stages in the mining of gold may be classified as follows. First, there is the lucky finding of nuggets—lumps of gold that have broken from a reef and may have been transported far from it by streams. The lucky finds cannot long be kept secret, and sooner or later a 'rush' follows, and claims are staked on the 'fields.' If the reef happens to be near the first finds, and rich and easily worked, many fortunes may be quickly made; but soon mining the reef becomes more and more difficult, until eventually the primitive pick and shovel cannot cope with the task. As this stage advances, or as the reef thins, or its gold content dwindles, machinery is needed, and this can be supplied only by companies with large capital. Some miners may find employment in the mining company, but usually highly skilled labour is necessary. Employment in shops or gardens providing food for the new concern is often more profitable than the actual mining. Operations go deeper and deeper, become more and more difficult, and still more machinery is needed, until at last (and eventually always) the mine does not pay its way. Its life may be prolonged by the discovery of new reefs, but, even so, in the long run the supply of gold must be exhausted.

If the original nuggets had been transported from their reef an intermediate stage comes in. Nuggets are soon exhausted. After their disappearance the river gravels are 'panned' for smaller grains of gold. Only simple apparatus is needed for this—shovels and a series of sieves in which to sort out the rubbish from the heavier particles of gold. Slowly the miners work up-stream, until, perhaps, a lucky man finds the reef whence the alluvial gold has come. A new rush starts, primitive tools are soon inadequate, machinery has to arrive, and the cycle continues its course until the gold is exhausted or is too difficult to obtain.

South African gold-mining is along a rich reef. The material brought up from the mines is crushed to a fine slime, which in turn is passed into leaching vats, where it is treated with a cyanide solution. The compound next goes to the precipitation plant, where it is brought into fine contact with zinc dust. It is then filtered, and the superfluous zinc is extracted with sulphuric acid. The fine gold is washed and dried, melted with various fluxes, and run into moulds.

The nickels and gold of Ontario and the platinum of the Urals are in reefs too, while the rich iron ore of Sweden is a deposit filling great cavities in igneous rocks. The silver and tin of Bolivia, the tin and tungsten of Yunnan, the silver and cobalt of Canada are all mined in complicated reefs. The gold of Alaska and the tin of Malaya are transported deposits, and the ores are found in river-beds or in alluvium that was once river-beds.

The problem of labour limits activity in many mineral regions. The plateau of Bolivia is between two and three miles high, and work at such altitudes is extremely laborious. The metals are there, capital is available, but labour for the mines is not easy to obtain, for native population is sparse, largely on account of the physical conditions.

Similar conditions prevail on the plateaux of Peru. The transport of ore from these high mines among lofty mountain-chains is another hindrance to active development.

The Mexican Plateau is not so high, but the country is poor, and foreign capital runs the wealthy mines. This raises political difficulties that hamper progress.

The tin mines of Malaya, in an unhealthy equatorial lowland, owe their success mainly to the supply of cheap labour available from neighbouring monsoon lands, especially China. The ease of working, the low labour costs, and the nearness to the coast offer a marked contrast to conditions in the tin mines of Bolivia.

Much of the heavy work at the gold and diamond mines in South Africa is done by natives, and labour supply also helps the tin mines of Nigeria, the manganese mines of India, and the workings for precious stones in Ceylon.

It is strange to find the three deserts of the Southern Hemisphere and the Colorado Desert of North America the sites of busy industries. The Atacama Desert of Chile has its nitrate works and copper mines; the Kalahari of South-west Africa has gold, diamond, and copper workings; West Australia has two big gold towns, Kalgoorlie and Coolgardie, in a rainless desert; and many of the silver mines of Colorado are in desert regions. In all these places food and drink for the workers have to be brought from afar, adding to the expense of the undertakings. It is only the richness of the workings, and in the case of Chile a monopoly in natural nitrates, that enable work to go on in such unusual conditions.

> Mankind's dependence upon metals and their mechanical employment has increased within the last century to an incredible degree. Few are the activities of life in this age in which metal in some form or other does not enter. The predominant lines of progress which we may see in operation round about us day by day might well be termed metallic lines. They are such as leave us in no doubt that for a long time the world will be preoccupied with metallic and mechanical things. New uses are being found, and will still continue to be found, for the earth's materials. The advance of electrical science, moving at an ever increasing pace, has been responsible for a great growth in the demand for copper. It is scarcely to be questioned that during the coming decades changing and widening applications of other metals and their indispensable alloys will form one of the vital features of industrial progress.[1]

[1] "British Mining and Metallurgy," *Daily Telegraph* Supplement, April 27, 1931.

CHAPTER XVII

PETROLEUM

Notebook Work

Turn the statistics of petroleum production into diagram form.

Mining a liquid is a very different business from mining a solid. The depth and extent of many coal-mines are often limited by the human element; the increased pressure at great depths, the rise in temperature, and the trying conditions of doing heavy manual work in cramped space all help to restrict mining operations. If, however, the mineral sought can be pumped out, then miners need not descend and shafts need be only tubes to hold pumping apparatus, and they may go to great depths (over 8000 feet), limited only by the efficiency of drilling machinery. The storage and transport of coal and ores at pit-heads is a big problem, because the material is bulky and wastes much space in stacks and trucks; but oil can be carried in pipes direct from the well to any place where it is needed.

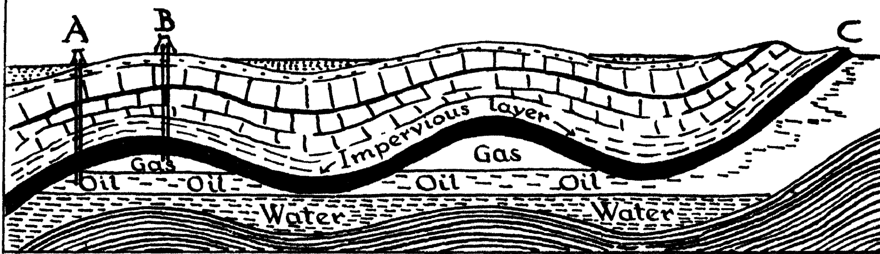
The geological conditions for the preservation of a liquid material are a downfold of pervious rock between impervious layers.

Petroleum has been formed by the decomposition of marine life in bygone ages. Just as limestone ridges are compressed accumulations of myriads of tiny marine skeletons, so the supplies of petroleum are the remains of fish-forms that have been trapped and have perished in ancient seas. We should expect, then, to find the oilfields on lowlands that may once have been the beds of seas. Old land-masses that have never been sea-floors cannot have oil, and so the great plateau blocks of ancient rock do not have oil, except where rifts and other fractures have let in the sea. In the United States there is oil on both sides of the Cordilleras and Appalachians, with the richest fields towards the western foothills of the central plains.

In Europe the Romanian oilfields lie along the south-east edge of the Carpathian fold, and the Baku fields of Russia are between the Caucasus folds. The Persian and Mesopotamian fields lie at the foot of the great folds that border Western Persia. The Burmese field lies in the trough of the Irrawaddy valley between two parallel folds. East Indian fields are on the edges of the great folds of Sumatra, Eastern Java, and Eastern Borneo. In South America there is a rapid development of oilfields on the Maracaibo coast of Venezuela at the foot of the Andean folds, while Mexico has very important wells on the low, hot eastern coast-lands at the foot of the mountain ranges bordering the plateau.

The crude oil which gushes, or is pumped, from these wells has to be 'refined'—*i.e.*, it is separated, or 'cracked,' into a number of oils or greases demanded by commerce. At first—the whole industry dates only from the middle of last century—petroleum was used solely for paraffin lamps, and the chief trade was to the East, where no other means of lighting was known. The next development was the use of oil fires under steam-boilers. Later came the idea of driving machinery by a series of explosions of gasified petroleum

PETROLEUM



SECTION TO SHOW THE STRUCTURE OF AN OILFIELD

The light oil floats on water; lighter gases rise above the oil: both gas and oil tend to rise, and are trapped only in upfolded hollows of the strata. There is seepage at C. A well sunk at A will probably gush; another well at B might stop the flow at A: hence companies try to control the borings of a whole basin. The structure of the surface rocks gives a skilled geologist clues about the extent of the basins.

OILFIELDS OF THE UNITED STATES

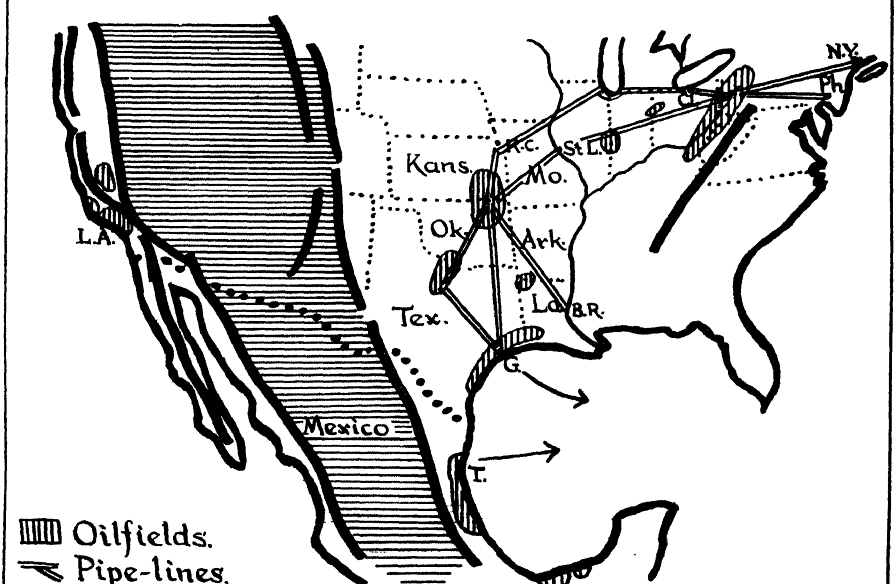


Fig. 30

and air ignited by an electric spark, an application which grew with amazing speed, and the new light engine of to-day evolved. The Diesel engine, which burns heavy oils that are much cheaper, ignites its explosive gases with the heat derived from the compression of air, and so needs no magneto.

The refining of petroleum is being carried on less and less at the wells and more and more in big centres of industry where there is a variety of demand for by-products. Besides, it is cheaper for oil-tankers to handle crude oil—a single product easily carried—than a variety of refined products, solid and liquid. In the United States refineries are on the eastern side, near centres of densest population, or at the large towns of the Pacific coast. In 1929 Britain imported 2,000,000,000 gallons of oils, of which about one-quarter was crude oil needing refining. The remainder arrived refined in various forms, of which petrol was the chief. The refining industry in Britain is growing, and all the big oil combines have established plants at many big ports. Shell-Mex advertises the following petroleum products, the results of the separation at the refineries: petrols of various grades, lubricating oils and greases, road materials (pitch), fuel oil for ships, Diesel oil, bitumen for building purposes, kerosene, lamp-oils, floor and furniture polishes and insecticide—*i.e.*, a variety of by-products ranging from light oils to heavy oils, grease, and wax.

As examples of large-scale production and the need for much capital, organization, etc., we may note the following:

> The Anglo-American Oil Company, Ltd., employs over 10,000 British workers; the company owns twenty-four ocean tankers and twenty coasting vessels; 615 installations and depots; thousands of barrels, millions of cans, miles of pipe-line; eighty-two barges and tugs for inland waterways; 1648 railway tank-cars; 1937 lorries, 706 motor-cars, and a fleet of light aeroplanes. All these are British made. . . .
>
> The Anglo-Persian Oil Company owns a fleet of eighty-five tankers to take oil to refineries at Llandarcy and Grangemouth. The amount of crude oil handled daily by the Abadan Refinery (Persian Gulf) is upward of 4,000,000 gallons. The company has made roads and railways. It has built houses, workshops, hospitals, laboratories, X-ray and dental departments, and schools. It has instituted medical and public health services. Its employment roll in Persia is 30,000, of whom 27,000 are Persians. In 1929 the total national revenue of Persia was £8,200,000, of which £2,000,000 was received in oil royalties.[1]

Lastly, we must revert to an old theme:

> Resources have been squandered at a rate which can only be called wasteful, and as an aftermath there must be very hard work to neutralize this wastage in order to give to consumers the supplies of petroleum products which can no longer be looked upon as a luxury. . . . . In all the major oilfields of the world outside the Dutch East Indies and Persia, owing to the absence of wise laws or reasonable understandings between producers, countless thousands of unnecessary wells have been drilled to prevent 'the other fellow' from getting the oil. . . . A true solution to the problem would mean conserving to the world valuable supplies of oil for future needs.[1]

Notebook Work

Draw a map from the following information:

Irak, with rivers Euphrates and Tigris in the hollow between the Syrian plateau and the folds of Western Persia. Show the pipe-line (150 miles) to Abadan from the edge of the mountains to the

[1] "Petroleum Industry," *Daily Telegraph* Supplement, December 15, 1930.

north-east. Show potential oilfields along the mountain edges to the north-north-east of Baghdad to the source of the Tigris, and also just west of Baghdad in the Euphrates valley. Show the pipe-line that is being built from here to Haifa. Show the motor route, Damascus to Baghdad, and the Imperial Airways route to India.

Perhaps the map will go far enough northward to include the Baku oilfield and the pipe-line to Batum. Mark the Caucasus folds. Add political boundaries.

STATISTICS

The figures given are for very recent years, and it must be remembered that the present state of world trade is making production and consumption abnormal. Where differences from the normal are very great other figures for past years are added.

The following may be noted as sources of statistics: *The Mineral Industry of the British Empire and Foreign Countries Annual;* the Annual Report of the Secretary of Mines; *The Corn Trade Year-book; The Statistical Year-book of the League of Nations.*

Wheat in 1930

—	Area, in 1000 Acres	Yield, in 1000 Qrs. of 480 Lb.	Exports	Imports
World Total	300,000	580,000	67,000 [5]	68,720
North America				
U.S.A.	59,000	106,370	11,930	1,650
Canada	24,900	49,700 [1]	19,470	—
U.S.S.R.	70,000 (?)	130,000 [2]	810 [6]	—
Europe (excl. U.S.S.R.)	72,380	168,930 [3]	8,000 [7]	59,860 [8]
Argentina	21,300	30,000	18,090	—
Australia	18,200	25,100 [4]	5,100	—
India	31,350	48,660	570	—
Egypt	1,600	5,000	—	200

Wheat Yields, in Bushels per Acre, in 1930

Old Lands		New Lands	
Holland	34·5	U.S.A.	14·4
Sweden	34·2	Canada	16·0
Belgium	32·7	Argentina	11·3
Great Britain and N. Ireland	31·9	Australia	11·0
Germany	29·9		
Egypt	26.1		
Japan	25·5		
India	12·3		

[1] In 1928 Canada's production on the same area was 70,840.
[2] There has been a rapid increase in area and production recently.
[3] France, Italy, and Spain account for almost one half of this.
[4] Area and production increasing.
[5] In 1928, 100,000.
[6] In 1926, 5550.
[7] The Danubian Steppes mostly.
[8] In 1928, 80,000.

Wheat Crop of U.S.A. in 1930

Winter Wheat		Spring Wheat	
State	Production, in 1000 Bushels	State	Production, in 1000 Bushels
Kansas	158,422	North Dakota	99,807
Nebraska	70,267	South Dakota	38,824
Illinois	37,584	Montana	28,258
Oklahoma	33,696	Minnesota	18,505
Indiana	28,998	Idaho	14,703
Ohio	28,640	Other States	45,000
Texas	28,270		
Washington	20,240		
Missouri	19,740		
Oregon	18,538		
Idaho	13,520		
Other States	146,000		

Wheat Production of Canada in 1930

Province	Production, in 1000 Bushels
Saskatchewan	196,322
Alberta	132,900
Manitoba	45,278

Growth of Wheat Production in Canada

Year	Production, in 1,000,000 Bushels
1871	16
1881	32
1891	42
1901	55
1911	132
1921	300
1928	566
1929	300

Imports of Wheat into Great Britain and Northern Ireland in 1930

Source	Imports, in 1000 Qrs.
Argentina	8,377
Canada	5,401 [1]
U.S.A.	5,102 [2]
Australia	2,736
France	957
Total imports	23,763
Home supplies	5,400

[1] 8734 in 1929. [2] Some Canadian wheat included

STATISTICS

Some Comparisons of Wheat and other Crops in 1930

Region	Wheat	Oats	Maize	Barley
Areas under Cultivation, in 1000 Acres				
World	300,000	150,000	175,000	88,000
Europe (incl. U.S.S.R.)	142,380	90,000	37,000	47,000
North America	84,000	55,000	102,000	18,000
Argentina	21,300	3,940	13,950	1,400
Production, in 1000 Qrs.				
World	580,000	490,000	400,000	220,000
Europe (incl. U.S.S.R.)	298,930	283,000	84,000	124,000
North America	156,000	186,000	243,000	55,000
Argentina	30,000	5,500	29,100	2,000

Maize Crop of U.S.A. in 1930

State	Production, in 1000 Bushels	State	Production, in 1000 Bushels
Iowa	360,750	Texas	91,408
Illinois	238,298	Ohio	88,816
Nebraska	235,695	South Dakota	76,958
Minnesota	135,780	Kansas	76,164
Indiana	110,197	Missouri	72,841

Maize Exports and Imports in 1930

Source	Exports, in 1000 Qrs. of 480 Lb.	Imports, in 1000 Qrs. of 480 Lb.
World	34,560	34,470
Argentina	18,650	—
Balkans	8,350	—
South Africa	1,900	—
Europe	—	33,720
Great Britain and N. Ireland	—	7,640
Holland	—	4,890
Germany	—	3,860
France	—	3,510
Italy	—	3,040
Belgium	—	2,620

Imports of Grain into British Ports, in 1000 Qrs., in 1930

Port	Wheat	Maize	Barley	Oats
Mersey Ports	7339	2067	280	319
London	6578	1174	787	1577
Hull	4133	857	772	319
Bristol	1703	908	1243	238
Cardiff	999	92	102	93
Glasgow	753	269	196	105
Belfast	400	1392	1	52

Cattle, 1929–30

Country	Number, in Millions (incl. Beef, Dairy, and Draft Animals)	Number, in Millions, Slaughtered (to show Proportion of Beef Cattle)	Notes
India	147	Very few	Second exporter of hides.
U.S.A.	60	12	Exports beef and hides.
U.S.S.R.	53	8	—
Argentina and Uruguay	39	7·3	Exports over one-half of world's exported beef, and one-third of hides.
Brazil	34	(?)	Exports beef. Third largest exporter of hides.
Germany	18	3·5	Imports beef.
France	15	·6	Imports beef.
All Europe (excl. U.S.S.R.)	93	—	—
Australia	11	2	Exports beef, hides, and dairy produce.
South Africa	10	·7	Exports hides.
United Kingdom	8	1·8	Imports over one-half of world's exported beef.

The Sources of British Supplies of Beef in 1930

Source	Quantities, in 1000 Cwt.
Argentine and Uruguay	12,000
Home supplies	7,500
Other countries	2,500
Total	22,000

Comparative Numbers, in Thousands, of Animals in certain Countries in 1930

Country	Horses	Cattle	Sheep	Pigs	Goats	Area of Country, in 1000 Sq. Miles	Population of Country, in Millions
South Africa	—	10,000	45,000	—	7,800	500	8
U.S.A.	13,000	60,000	52,000	54,000	—	3,000	123·6
Argentina and Uruguay	10,000	39,000	65,000	—	—	1,000	13
India	—	147,000	35,000	—	44,000	1,800	352
United Kingdom	1,200	7,800	22,000	2,700	—	95	46
Australia	—	11,000	106,000	—	—	3,000	6·4
New Zealand	—	3,700	30,000	—	—	100	1·5

Dairy Produce in 1930

Butter

World Exporters: Denmark, 30 per cent.; New Zealand, 14 per cent.; Holland, 11 per cent.; Australia, 9 per cent.

Where British Supplies come from (in 1000 cwt.): Denmark, 1906; New Zealand,[1] 1154; Australia, 752; Argentina, 514; Ireland, 500; total, 5818.

Over 90 per cent. of the margarine imported into the British Isles comes from Holland.

Cheese

Where British Supplies come from (in 1000 cwt.): New Zealand, 1497; Canada, 1057; total, 3014.

Eggs

World Exporters: Denmark, Holland, China (each about 13 per cent. of total), Italy, Ireland, and Poland (each about 9 per cent. of total).

Milk

World Exporters: Holland (35 per cent. of world's exports), Canada, U.S.A. (15 per cent. each), Switzerland, and Denmark.

Bacon

Where British Supplies come from: Denmark, 40 per cent.; U.S.A., 25 per cent.; Canada, 12 per cent.

NOTE. British legislation in 1933 has already affected figures for imports of dairy produce: Government marketing schemes are increasing home supplies and decreasing imports.

SHEEP: WOOL AND MUTTON IN 1930

COUNTRY	SHEEP, IN THOUSANDS	WOOL, IN 1000 TONS	SHEEP KILLED
Australia	106,377	390	15,000
New Zealand	30,841	120	12,000
Argentina and Uruguay	65,000	210	10,500
North America	55,000	200	22,000
U.S.S.R.	89,000	130	45,000 [2]
South Africa	45,000	130	5,500
Spain	20,000	36	2,800

Mutton

Where British Supplies come from: New Zealand, 30 per cent.; Home, 30 per cent.; and Argentina, 16 per cent.

SEA FISHERIES IN 1930

COUNTRY	QUANTITIES, IN 1000 TONS	COUNTRY	QUANTITIES, IN 1000 TONS
Japan	2800	Norway	970
Korea	900	Canada	470
U.S.A.	1230	Germany	360
Great Britain and N. Ireland	1180	France	280

BRITISH HERRING FISHERIES

YEAR	LANDINGS, IN CWT.	EXPORTS
1913	12,000,000	Over half
1932	8,000,000	Over half

[1] Figures for 1933 show that New Zealand and Denmark now send about equal quantities.
[2] Estimate for 1927.

Various Vegetable Oils

The Percentage Production of Producing Countries in 1930

Cotton-seed

U.S.A., 50 per cent.; India, 20 per cent.; China, 9 per cent.; Egypt, 7 per cent.

Linseed

Argentina, 40 per cent.; U.S.A., 14 per cent.; U.S.S.R., 22 per cent.; India, 10 per cent.

Hempseed

U.S.S.R., 90 per cent.

Rape-seed

India, 85 per cent.

Sesamum

India, 65 per cent.; Sudan, 6 per cent.

Copra

South-east Asia and East Indies, 75 per cent.; Oceania, 15 per cent.; Africa, 4 per cent.; Philippines, 30 per cent.; Dutch East Indies, 30 per cent.; Ceylon, 12 per cent.

Ground-nuts

Asia, 70 per cent.; India, 55 per cent.; West Africa, 17 per cent.; All Africa, 20 per cent.; U.S.A., 6 per cent.

Soya Beans

Manchuria, 80 per cent.

Palm Oil and Palm-kernel Oil

West Africa (especially Nigeria), 90 per cent.

The Sources of British Supplies of Various Fruits in 1931

Apples

Home Supplies		Imported Supplies	
Country	Production, in 1000 Cwt.	Country	Production, in 1000 Cwt.
England and Wales	2388[1] (including 859 cider apples)	U.S.A.	3533
		Canada	1773
Scotland	11		
Northern Ireland	640[2]	Australia	1033
Total home supplies	3039	Total imports	7601

[1] A small crop; *cf.* 5947 in 1927 and 6145 in 1929.
[2] A heavy crop; *cf.* 27 in 1925. Weather conditions, especially in spring, affect orchard crops in temperate lands.

STATISTICS

Bananas

Country	British Imports, in 1000 Bunches
British West Indies	6,970 [1]
Honduras	2,700
Colombia	1,675
Costa Rica	1,622
Brazil	1,472
Canary Islands	892
Total British imports	16,062

A Comparison of Imports of Bananas in 1900 and 1931

Year	From British West Indies	From Colombia and Central America	From the Canary Islands	From Brazil
1900	20 per cent.	13 per cent.	66 per cent.	Nil till 1927
1931	43 per cent.	41 per cent.	5 per cent.	9 per cent.

Oranges

Country	British Imports, in 1000 Cwt.
Spain	5,921
Palestine	1,287
Brazil	1,119 [2]
South Africa	969 [3]
United States	847
Total British imports	10,397

An example of the recent rapid growth in Empire fruit trade:

1906	A few sample oranges from South Africa.
1907	3,000 boxes.
1927	845,000 "
1930	1,800,000 "
1940	The production could be 10,000,000 boxes.

Lemons

	1000 Cwt.
Imports from Italy	1155
" " Spain	186
Total imports	1408

[1] This trade is controlled by two big combines, the United Fruit Company and the Jamaica Banana Producers Association.

[2] In 1926 imports from Brazil were less than 500 cwt.; in 1930 they were 351,000 cwt.

[3] Includes 85 from Southern Rhodesia, exported *via* Beira or Cape Town.

BRITISH IMPORTS OF FRESH FRUIT

(*Only those fruits the imports of which are large compared with home production are included*).

Fruit	Months when each Fruit is imported	Sources of Supply for each Fruit	Months when Fruit is exported from each Source *Italics indicate time of maximum export*	Quantitative Notes
Apples	All the year	U.S.A. and Canada Australia and New Zealand	Sept., *Oct.*, *Nov.*, *Dec.* to April April to *June*, July	Imports in Oct., Nov., and Dec. = 3,800,000 cwt. Imports for rest of year = 3,800,000 cwt.
Apricots	(i) May to July (ii) Dec., Jan.	Spain and France South Africa	May, *June*, July Dec., *Jan.*	Imports from Spain and France = 87,000 cwt. Imports from South Africa = 300 cwt.
Bananas	All the year	West Indies and Central America Colombia Canary Islands	All the year. *May to Oct.* Jan. to May June to Aug.	The Caribbean region is easily the biggest producer, supplying the North American as well as the European market.
Cherries	June to Aug.	France Belgium	*June* *July*	Imports in June = 27,000 cwt. Imports in July = 22,000 cwt.
Red and Black Currants	June to Aug.	France Holland and Belgium	*June*, July *July*, Aug.	Imports in June = 17,000 cwt. Imports in July = 80,000 cwt.
Grape-fruit	All the year	U.S.A., Puerto Rico, and Cuba South Africa Palestine	All the year June, *July*, Aug. Oct. to Dec.	80 per cent. of British supplies come from Florida, Porto Rico, and Cuba.

GRAPES	All the year	Spain Holland South Africa Argentina	Aug., *Sept.*, *Oct.*, Nov., Dec. Aug., *Sept.*, Oct., Nov. Feb., *March*, April *May*, June	60 per cent. of British supplies come from Spain. The imports from Argentina are the most recent development.
LEMONS	All the year	Italy Spain	All the year All the year	75 per cent. of British supplies come from Italy (Sicily especially).
ORANGES	All the year	Spain Palestine U.S.A. South Africa Brazil	Nov., *Dec.*, *Jan.* to May Oct., *Nov.*, *Dec.* to March *May*, June, July May to Sept. May to Dec.	Spain is the biggest supplier, but there has been a remarkable increase in supplies from other sources, especially Brazil, Palestine, and South Africa.
PEACHES	(i) June to Nov. (ii) Jan. to March	Italy South Africa	June, July, *Aug.*, *Sept.* to Nov. Jan., *Feb.*, March	60 per cent. of British supplies come from Italy; 20 per cent. from South Africa.
PEARS	All the year	U.S.A. and Canada Belgium Australia and New Zealand South Africa	July, *Aug.*, *Sept.*, *Oct.* to May Aug., Sept. March, *April*, *May*, June March, April	Belgium is the biggest supplier, but Empire supplies have increased rapidly.
PINEAPPLES	All the year	Azores South Africa U.S.A.	All the year. *Dec.*, *Jan.* Feb. to July (*a*) *Feb.* (*b*) *July*	The trade in cheap, fresh pineapples is only beginning to compete with that in cheap, tinned pineapples.
PLUMS	All the year	France and Spain Italy Belgium South Africa	May, June, July June, July, Aug. Aug., Sept., Oct. Jan., Feb., *March*, April	Home supplies are far larger than imported supplies. France is the chief exporter. Winter supplies from South Africa have increased rapidly.
TOMATOES	All the year	Canary Islands Channel Islands Holland	Aug., *Sept.*, *Oct.*, *Nov.* to June May, *June*, *July*, *Aug.* to Oct. June, *July*, *Aug.*, Sept.	45 per cent. of British supplies come from the Canary Islands; 25 per cent. from the Channel Islands.

A Calendar of British Imports of Oranges

January, February, March	From Palestine and Spain.
April	From Palestine, Spain, and the United States.
May	From Spain, the United States, and Brazil.
June	From Spain, the United States, Brazil, and South Africa.
July, August, September, October	From the United States, Brazil, and South Africa.
November	From Palestine, Spain, Brazil, and South Africa.
December	From Palestine, Spain, and Brazil.

Production of Beverages in 1930

TEA		COFFEE	
Country	Production, in 1000 Tons	Country	Production, in 1000 Tons
World	440 (exports only)	World	1500 (2480 in 1929)
India	170	Brazil	780 (1740 in 1929)
Ceylon	110	Colombia	180
Dutch East Indies	70	Central America	250
Japan	36	Dutch East Indies	74
China	400 (?) (Export only was 42)	Kenya	14

COCOA		WINE	
Country	Production, in 1000 Tons	Country	Production, in 1000 Hectolitres
World	520	World	162,000
Gold Coast	220	Europe	137,000
Central America	62	France	59,000
Brazil	66	Italy	33,238
Ecuador and Venezuela	36	Spain	19,074
		Portugal	6,750
		North Africa	17,000

STATISTICS

Production of Sugars in 1930

CANE-SUGAR		BEET-SUGAR	
Country	Production, in 1000 Tons	Country	Production, in 1000 Tons
World	17,600	World	8750
Central America	4,700	Europe	5760
Cuba	2,750	Germany	1570
India	3,940	Czecho-Slovakia	800
Dutch East Indies	2,450	France	850
Philippines	860	U.S.A.	1080
Hawaii	860	U.S.S.R.	1800
Australia	590		
Fiji	82		
South America	2,000		
Brazil	980		
Peru	460		
Africa	850		
South Africa	290		
Mauritius	175		
Egypt	140		

Annual Production of Beet-sugar in England

Year	Production, in 1000 Tons
1922	7
1923	13
1924	26
1925	57
1926	165
1927	208
1928	195
1929	295
1930	440
1931	255

Production of Tobacco in 1930

Country	Area of Tobacco-fields, in 1000 Hectares	Production of Tobacco, in 1000 Quintals
Whole world	2700	23,000
U.S.A.	850	7,303
All Asia	1000	9,200
India	560	6,370
Dutch East Indies	202	850
Europe, incl. U.S.S.R.	390	4,440
All South America	270	1,300

Sources of British Supplies of Raw Cotton and Raw Wool in 1930

COTTON		WOOL	
Country	Percentage Contribution	Country	Percentage Contribution
United States	42	Australia	35
Egypt	30	New Zealand	25
British Africa	12	South Africa	18
		Home	10
		Argentina	6

Production of Raw Cotton in 1931

Country	Production, in 1000 Tons	Country	Production, in 1000 Tons
World	5870	Egypt	278 [2]
U.S.A.	3660	South America	196
India	726 [1]	U.S.S.R.	335 [3]
China	400 (?)		

[1] 1049 in 1928. [2] 380 in 1929. [3] Rapid increase in production.

Cotton Spindles in 1932

Country	Number of Spindles, in Thousands	Country	Number of Spindles, in Thousands
Europe, incl. U.S.S.R.	100,000	Asia	21,000
United Kingdom	53,000	India	9,000
Germany	10,000	Japan	7,500
France	10,000	China	4,000 (?)
U.S.A.	32,000		

Cotton States in U.S.A.

State	Production, in Million Bales of 500 Lb., in 1931	Chief Type Produced
Texas	5·3	Egyptian
Georgia	1·4	Sea Island
Alabama	1·4	
South Carolina	1·0	Sea Island
Mississippi	1·7	Long Staple Upland
Oklahoma	1·2	
North Carolina	·7	
Arkansas	1·8	
Louisiana	·9	
Tennessee	·6	

"Short Staple Upland" is by far the most general type of cotton.

Production of Flax and Linseed in 1930

FLAX		LINSEED	
Country	Production, in 1000 Tons	Country	Production, in 1000 Tons
World	620	World	3160
U.S.S.R.	430	Argentina	1990
Rest of Europe	190	U.S.A.	540
Poland	40	India	380
Lithuania	29	Europe (excl. U.S.S.R.)	240
France	27	U.S.S.R.	730
Latvia	19		
Belgium	14		

STATISTICS

World Production of Coal in 1931

Country	Production, in 1000 Metric Tons	Net Exports as Percentage of Production	Net Imports as Percentage of Consumption
World	1,117,000	—	—
U.S.A.	397,000	3·7	—
All Europe	600,000 [1]	—	—
United Kingdom	223,600	27·8	—
Germany	250,000 (half as lignite)	16·9	—
France	50,000	—	28·7
Poland	38,000	36·6	—
Belgium	27,000	—	15·9
Czecho-Slovakia	24,000	5·0	—
U.S.S.R.	56,000	3·0	—
Japan	26,000	—	4·3
India	20,000	1·7	—
Natal	10,000	9·0	—
Australia	10,000	—	5·0

[1] This figure includes that for the U.S.S.R.

World Trade in Coal, in Millions of Tons, in 1931

Country	Production			Production of Coke	Total Exports of Coal and Coke	Total Imports
	Anthracite	Bituminous	Lignite			
U.S.A.	53·2	337·6	—	29·9	15·1	·6 [1]
United Kingdom	5·8	213·6	—	21·0	60·8	—
Germany	—	116·8	131·2 [2]	22·3	28·2	8·0
U.S.S.R.	—	56·8	—	6·0 (?)	1·7	
France / Saar	5·2	47·9 / 11·2	1·1	11·0	3·8	26·0
Poland	—	37·6	·5	1·3	13·8	—
Belgium	5·7	21·3	—	5·6	6·2	11·5
Czecho-Slovakia	—	12·9	17·6	2·0	3·9 [3]	2·0
Holland	—	12·7	·1	3·4	8·6	8·6
Spain	·5	6·5	·3	·8		1·2
Japan	—	25·4	·1	—	1·5	2·6
China	3·0	24·0	·3	—	3·5	1·9
India	—	21·7	—	·8	·9	—
South Africa	—	10·7	—	·1	1·8	—
Australia	—	8·7	1·9	1·0	·9	—
Canada	—	7·9	2·6	1·4	·3	12·0

[1] Import of anthracite mainly.
[2] Germany produced 31,000,000 tons of briquettes from brown coal.
[3] 1,900,000 tons of lignite included.

Importers of Coal—other than those shown in the Foregoing Table

Country	Quantity Imported, in 1,000,000 Tons, in 1931	Country	Quantity Imported, in 1,000,000 Tons, in 1931
Italy	10·6	Norway	2·0
Sweden	5·8	Spain	1·2
Denmark	4·7	Egypt	1·1
Austria	4·0	Brazil	1·1
Switzerland	2·7	Portugal	1·0
Irish Free State	2·3	Finland	1·0

The British Coal Trade, in 1,000,000 tons

Year	Output	Total Export	Shipped to Foreign Countries	Coal for Steamers
1913	287	98	73	21
1920	229	44	25	14
1924	267	84	61	18
1928	237	72	50	17
1931	219	62	39	15

Home Markets for Coal in 1930

Market	Consumption, in 1,000,000 Tons
Iron and steel works	21·9
Various factories	52·0
Household	37·1
Gas and electricity	27·9
Railways	13·8

Total home market, 153,000,000 tons.
Total coal raised, 258,000,000 tons.

The Rise of the British Coal Export Trade

Year	Export to Foreign Countries, in 1000 Tons	Year	Export to Foreign Countries, in 1000 Tons
1840	1,592	1900	44,089
1850	3,211	1913	73,400
1860	7,060	1923	79,500
1880	17,891	1930	55,000

STATISTICS

The Cargo Export Trade of Coal of the United Kingdom

A Comparison between 1913 *and* 1930

—	1913	1930
Percentage of total output exported (as coal cargoes, bunkers, coke and patent fuel) .	35	31
Percentage of world's shipping dependent on oil for power	3	40
Percentage of world's shipping dependent solely on coal	88	57
British percentage of world production of coal	24	20

Coal Output in 1930

District	Output, in 1,000,000 Tons
Yorkshire	100
South Wales	60
Northumberland and Durham .	50
Scotland	35
Lancashire	20

Direction of British Coal Exports in 1930

Importing Region	Exports, in 1,000,000 Tons
North Sea and Baltic	19·8
France and Mediterranean . .	30·0
South America	5·1
North and Central America .	1·2
Others	1·7

British Ports exporting Coal

Ports	Percentage of Export Trade in 1930
Bristol Channel	41
North Eastern	34
Humber	11
Scottish	11
Others	3

Two Examples of Coal Export Trade in 1929

Destination	From South Wales Ports, in 1000 Tons	From Tyne Ports, in 1000 Tons
France	7,000	4,000
Portugal	900	100
Belgium	400	2,300
Germany	90	3,400
Denmark	30	900
Norway	80	900
Sweden	100	1,200
Spain	1,100	300
Italy	3,100	2,900
South America	4,300	100
U.S.S.R.	3	30
Egypt	1,600	300
Holland	200	1,500
Total exports	24,700	20,000

Percentage Production of Petroleum in Producing Countries in 1931

Country	Percentage of 1931 World Production
U.S.A.	60
U.S.S.R	12
Venezuela	9
Romania	3·5
Persia	3
Mexico	2·5
Dutch East Indies	2·3
British Empire	1·8
Colombia	1·3

Of the U.S.A. production only one-fifth is exported. The Kansas-Oklahoma field is by far the most important. The other producing countries export almost all their oil.

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