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**Unit III**

**HUMAN ACTIVITIES**

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# 4

## CHAPTER

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## HUMAN ACTIVITIES — PRIMARY

**H**uman beings are engaged in various kinds of economic activities that pertain to the production, exchange or distribution and consumption of goods and services. With the evolution of human society, the nature of economic activities has changed and has become more and more complex.

### **HISTORICAL PERSPECTIVE**

Humans, ever since their appearance on the earth, have depended on the physical environment for their survival and development. Even today, we depend on the nature for many of our material and aesthetic needs. Without sunshine, rocks, minerals, soil, water, vegetation and animals, our very existence will be impossible.

The early humans led a simple, though arduous life. Their needs were limited. They moved from place to place in search of food and water. They hunted animals and gathered fruits, nuts, roots, stems and leaves of edible plants to satisfy their hunger. The subsistence of people based on hunting of animals and gathering of wild plant foods and fishing without domestication of plants and animals is known as *foraging*.

Use of fire for cooking and heating, domestication of animals, cultivation of crops and living in the permanent villages triggered off *agricultural revolution*. All these developments did not occur simultaneously, nor did they occur in isolation. They were interrelated, each acting as a cause as well as the effect of the rest.

When did the agricultural revolution take place? It is difficult to answer this question,

though it may be stated categorically that it took place at different times in various regions of the world. According to the available archaeological evidences, agricultural revolution was experienced in the river valleys, where ancient civilisations flourished.

Agricultural revolution changed the lives of people enormously as they had more time for other functions. Artisanal activities in support of agriculture as well as to meet other basic needs and aesthetic tastes grew. Trade in agricultural and artisan products led to the opening of transport routes. Villages increased in size to form small and then large towns. Some 5,000 years ago, the Nile Delta in Egypt, the river valleys of the Euphrates and the Tigris in Mesopotamia and the Indus in India witnessed the blossoming of well developed cities and towns. But the base of all these cities was agriculture and related activities.

After the elapse of several millennium, a revolutionary change in human civilisation took place in Europe during the eighteenth century. At that time, Europe was agriculturally less developed due to unfavourable climatic conditions. The *industrial revolution*, which started with the invention of steam engine, however, changed the course of development. While the agricultural revolution was triggered off by a better and more organised way of using the biological products of nature, the industrial revolution relied on the use of energy stored in nature in the form of coal, and later petroleum. It helped people avoid the drudgery of manual labour and produce non-agricultural commodities on a mass scale. It also had its

impact on education, health, transport and trade.

Industrial revolution had its adverse effects too. The European countries used its power to improve the life of their people. They had limited natural resources and hence, limited scope for development. They ventured out of their own countries to colonise people in other continents. The overseas colonies not only gave them ample natural resources but also vast market to sell their industrial goods. It is reflected through the transport routes that developed in these colonies during that period. Development of port cities and their linkages with the hinterland in several colonies explain this design. Consequently, the situation reversed. Europe which was underdeveloped became developed, and other continents specially Asia which were more developed became less developed.

By the middle of the twentieth century, signs of fatigue became clearly visible in the industrial apparatus of the world. The two world wars and several localised conflicts aroused the human conscience against unbridled industrialisation in producing arms and ammunitions. Environmental crises forced the people to think of an alternative sustainable development model. Growing poverty in the three continents of Asia, Africa and South America in the midst of increasing income in the industrial world, shook the faith of people in industrialisation as the panacea for all ills.

Before the thinking on a human model of development could take a concrete shape, the industrial world faced a challenge from within. The role of information increased and by 1980s, the production and transmission of knowledge became a major preoccupation in the west. A third major change in human civilisation, popularly known as *information revolution*, became a reality by the turn of the twentieth century. The Industrial Era still lingers on; but the signs of its early demise are clear and obvious.

Information revolution has potentials of sweeping the whole world — developed as well as developing — for obvious reasons that human potentials are not as unevenly

distributed as the natural resources. Moreover, the use of information technology in various sectors of our life and living world has opened up new and greater opportunities for development and if handled judiciously, without enlarging the gulf between the rich and the poor.

## **TYPES OF ECONOMIC ACTIVITIES**

With this background, we may now identify different kinds of economic activities such as hunting and gathering, pastoralism, mining, fishing, agriculture, manufacturing (industries), and various types of services—trade, transport, education, health care and administration. These are broadly grouped as primary, secondary, tertiary and quaternary activities.

*Primary activities* pertain to extraction of raw materials from the earth's surface. These include hunting and gathering, pastoralism, fishing, forestry, mining and agriculture.

*Secondary activities* include industries that transform raw materials into finished goods having higher value. For example, manufacturing cotton textiles from cotton, and iron and steel from iron ore come under secondary activities.

*Tertiary activities* include all kinds of services provided to people such as education, health, trade and transport.

*Quaternary activities* represent a special type of service, which is related to high intellectual activities e.g. research and development, high order of professional and administrative service, information generation, processing and transmission.

While labeling human activities as primary, secondary, tertiary, and quaternary, let us not think that they are independent of each other. Their boundaries are often overlapping. With advancements in science and technology, the nature of production in all fields has changed so greatly that all these sectors have become interdependent.

## **PRIMARY ACTIVITIES**

Primary activities in economically developed nations account for less than 5 per cent of

employment but in many developing countries of the world, they still employ a major segment of labour forces. In any case, primary activities are almost the only source of food supply and raw materials for industries. Among these activities are included some of the most primitive activities like hunting and gathering, which sustained human beings for more than 95 per cent of their existence on the earth. Also included are the modern agricultural systems. In this chapter, we propose to discuss only the primitive agricultural activities and mining.

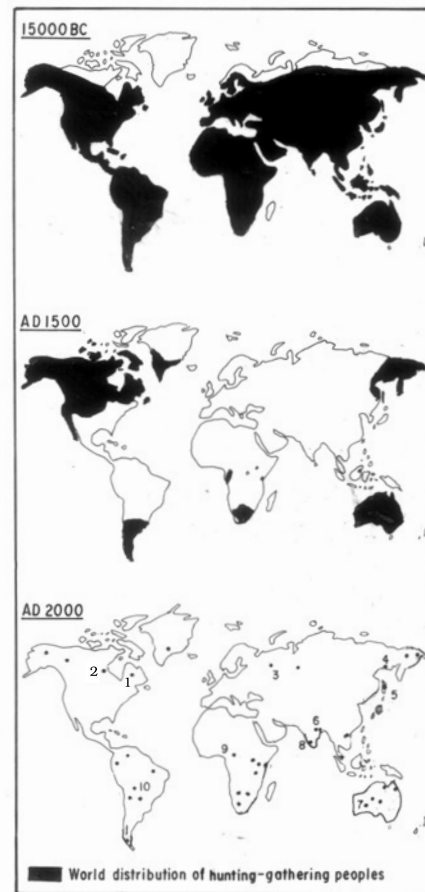
### **Hunting and Gathering**

Until 12,000 years ago, all humans lived as hunters and gatherers. They occupied nearly all the liveable space on the planet. At present, not more than 1 in 100,000 persons (less than 0.0001 per cent) live mainly this way; probably none does so entirely without any contact with the modern world.

Historically, this form of economy involved frequent migration in search of food. People lived in small groups, having virtually no private property. Simple implements like spears, bows and arrows were used for hunting. Locally available materials were used for their clothing and shelter.

The foragers were very successful in occupying a wide variety of habitats having different climates and biological resources. Fish and mammals from the sea provided subsistence to the people inhabiting the harsh landscapes of the polar coast. On the other extreme, the hunting – gathering people successfully colonised the tropical rainforests. By and large, the foragers simply live off the land without changing the natural ecosystem in a major way.

The hunting-gathering people have exhibited a great resistance. As recently as A.D. 1500, they occupied about one-third of the globe, including whole of Australia, most of North America and large tracts of South America, Africa and North-east Asia. Since, then their numbers have declined (Fig. 4.1). The twentieth century has witnessed profound changes in their ways of living. Their land and resources shrank as industrialisation and



**Fig. 4.1** World: Distribution of Hunters and Gatherers

(1) Innu; (2) Inuit; (3) Khanti; (4) Evenki; (5) Ainu; (6) Birhor; (7) Pintupi; (8) Paliyan; (9) Pygmie; (10) Toba

**Source :** Scarre, C.(ed.), 1988: *Past Worlds: The Times Atlas of Archaeology*. London: Times Book.

urbanisation progressed. Present day hunters-gatherers are confined to a few pockets in Australia, Africa, Asia, North America and South America. The Arctic Inuit; Pygmies and Kalahari San of Africa; Aboriginal Australians such as Pintupi; Paliyan of South India; and Semang of Malaysia are some examples of the foragers, who represent the oldest adaptation to human environment.

### **Pastoralism**

The domestication of animals was one of the early steps in the development of civilisation (Fig.4.2). People living in different climatic conditions selected and domesticated animals



**Fig. 4.2** The Likely Distribution of the Ancestors of Domesticated Animals

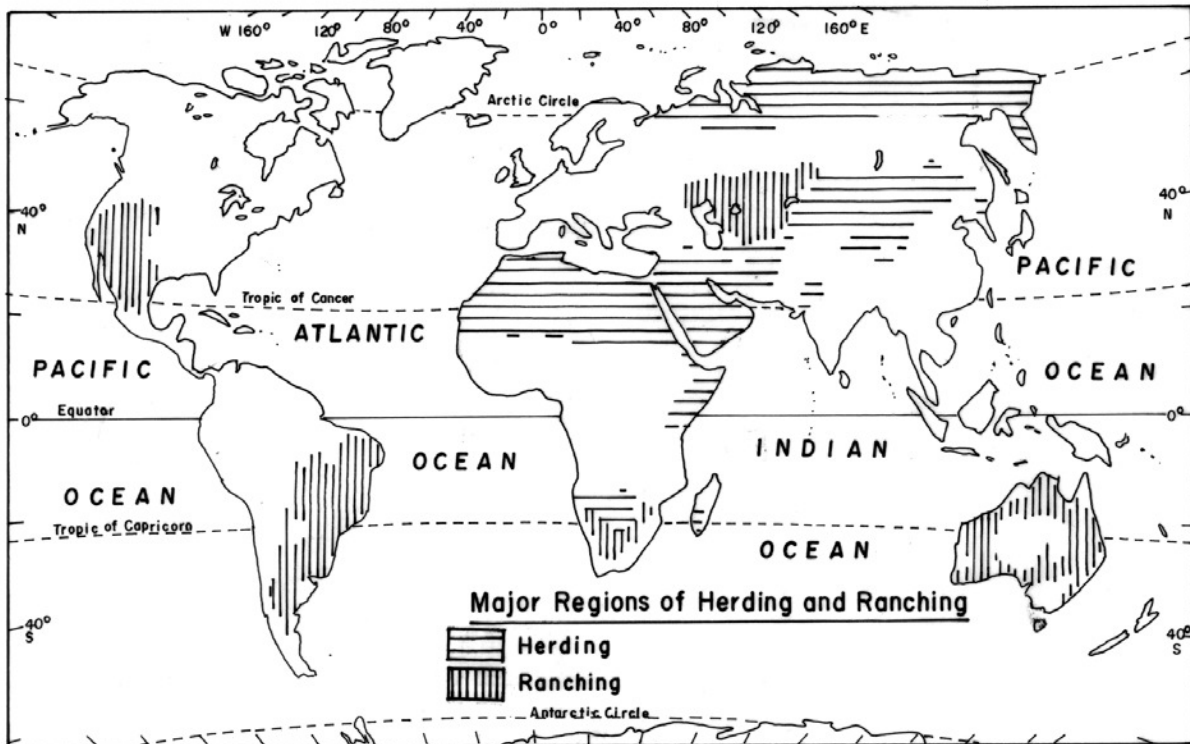
found in those regions e.g. cattle and horses in the grasslands, sheep and reindeer in the tundra regions, camel in the tropical deserts, and llama and yak in the high altitudes of the Andes and the Himalaya respectively. These animals were the chief sources of milk, meat, wool and hides. In the tropical and temperate

grasslands of the world, livestock herding and rearing continues even today either as traditional nomadic herding, also known as pastoral nomadism or commercial livestock rearing (ranching).

**Pastoral Nomadism** : It is a subsistence activity depending on animals. Since these people do not live a settled life, they are called *nomads*. Each nomadic community occupies a well-defined territory. These people are aware of the seasonal changes in the availability of pasture and water supply within the area occupied by them. The animals depend entirely on natural vegetation.

Cattles are reared in grasslands receiving more rain and having soft and long grasses. Sheep are reared in low rainfall areas with short grasses. Goats are common in the rugged terrain with scanty grasses. There are six widely distributed species reared by pastoral nomads: sheep, goats, camels, cattle, horses and donkeys.

In some parts of the world, the movement of herders follows the change in seasons. For



**Fig. 4.3** Areas of Nomadic Herding and Commercial Livestock Rearing

example, in the mountainous regions such as the Himalaya, *Gujjars*, *Bakarwals*, *Gaddis* and *Bhotiyas* migrate from the plains to the mountains in summers and from mountains to the plains in winters. Similarly, in the tundra region, the nomadic herders move from south to north in summers and from north to south in winters. Such seasonal migration of people with their animals is known as *transhumance*.

Pastoral nomadism is associated with seven distinct areas : high latitude Sub-Arctic; Eurasian steppe; mountainous south-west Asia; Saharan and Arabian deserts; Sub-Saharan savannas; the Andes; and the Asian high altitude plateaus. These may broadly be grouped under three broad regions. The largest region extends over nearly 13,000 km, from the Sahel and Sahara in Africa to Mongolia and Central China. The second region includes the southern border of the tundra region in Eurasia. The third region comprises of south-west Africa and the western part of Madagascar. These areas have either too hot and dry or too cold climates. In these regions, the social status of a person is measured on the basis of the number of cattle heads he possesses. International border restrictions and other developments are forcing nomads to abandon traditional migration routes and grazing lands. Today, nomadic herding supports only 15-20 million people in the world.

Pastoralism is a distinctive form of ecological and cultural adaptation to certain types of ecosystem in which humans and animals live in a symbiotic community typified by a fierce independence and self-determination.

*Commercial Livestock Rearing* : In modern times, the rearing of animals is being undertaken scientifically. Instead of depending upon natural grasslands, fodder crops and grasses are cultivated over extensive areas, and special breeds of animals are reared to give maximum yields of milk or meat. Emphasis is laid on genetic improvement, disease control and health care of animals. Cultivation of fodder crops, processing of milk and, meat, and packaging of animal products is carried out mechanically and on scientific lines.

The large-scale livestock rearing (ranching) on a commercial basis is typical in developed countries.

### **Mining**

The mining and quarrying of rocks and minerals is an age — old economic activity, though its nature and form has changed in many ways. Use of minerals by the early humans was probably restricted to picking up a rock and using it as a tool for crushing seeds or hunting animals. Gradually, humans switched over from tool-using to tool-making. The progressive and increasingly sophisticated use of mineral resources is marked with different stages of human civilisation. From flint spear head to clay pots, to copper dagger, to bronze vessels, to iron chains, and so on, humans have moved on discovering and using new minerals. On the basis of the mineral-use, eight ages of the human civilisation are usually identified. (Table 4.1)

**Table 4.1 : Minerals and Human Civilisation**

| <i>Age</i>               | <i>Approximate Date of Beginning</i> |
|--------------------------|--------------------------------------|
| Paleolithic (Old Stone)* | 500,000 B.C.                         |
| Neolithic (New Stone)    | 8,000 B.C.                           |
| Copper                   | 5,000 B.C.                           |
| Bronze                   | 3,000 B.C.                           |
| Iron                     | 1400 B.C.                            |
| Coal                     | A.D. 1,600                           |
| Petroleum                | A.D. 1,850                           |
| Nuclear                  | A.D. 1,950                           |

\* Use of Stone Tools

Mining probably began about 100,000 B.C. In simple terms, it means removing the rock materials from the earth's surface for processing, so that they are made more beneficial. It can be as simple as shoveling sand or as complex as drilling tunnels, blasting rock and lifting ore from thousands of metres deep beneath the ground.

Nature of mining activity has undergone many changes over the years. In the early days of the feudal period, mining was a work of

prisoners and slaves. Greeks and Romans in the ancient time operated their mines with captive armies or indigenous peoples under their control. By the Middle Ages, mining was considered a noble profession. Mining guilds in England and Germany were powerful organisations as they controlled the production of metals needed for arms and coinage. In modern times, mining is no longer a major employer. Mechanisation has increased efficiency and productivity and hence only a small percentage of work force is required in this kind of activity now compared to earlier times.

Globally, the mineral use has increased over time. Since the industrial revolution, associated technological developments and growing population, have increased the use of minerals at very high rates. During last century, mineral use increased 13 times or more.

### **Minerals : Types and Importance**

As we have read, mining refers to the extraction of minerals. What are minerals? Why are they important? Where are they found?

Minerals consist of one or more elements and have specific chemical composition. They

**Table 4.2: Minerals : World Reserves, Uses and Major Producers**

| <i>Mineral Resources</i> | <i>Uses</i>  | <i>World Reserves (Metric Tons)<sup>a</sup></i> | <i>Major Producing Countries</i>                             |
|--------------------------|--|---|--|
| Bauxite                  | Ore of aluminium   | 21,559,000                                      | Australia, Guinea, Jamaica, Brazil                           |
| Chromium                 | Alloys, electroplating   | 418,900   | South Africa, CIS <sup>b</sup> , India, Turkey, Zimbabwe     |
| Copper                   | Alloys, electric wires   | 3,21,000  | Chile, USA, Canada, CIS                                      |
| Gold                     | Jewellery, circuitry in computers, communications equipment, dentistry | 42  | South Africa, USA, CIS, Australia, Canada                    |
| Iron ore                 | Iron and steel   | 64,648,000                                      | CIS, Brazil, Australia, China, Canada, Venezuela, Mauritania |
| Lead                     | Storage batteries, solder, pipes                                       | 70,440  | CIS, USA, Mexico, Canada, Peru                               |
| Manganese                | Iron and steel production  | 812,800   | CIS, South Africa, Gabon, Australia, Brazil, France.         |
| Nickel                   | Stainless steel  | 48,660  | CIS, Canada, New Caledonia, Norway, Dominican Republic       |
| Silver                   | Jewellery, photography, dentistry                                      | 780   | Mexico, USA, Peru, CIS, Canada                               |
| Tin                      | Coating on metal, tin cans, alloys, solder                             | 5,930   | China, Brazil, Indonesia, Malaysia                           |
| Titanium                 | Alloys; white pigment in paint, paper, and plastics                    | 288,600   | Australia, Norway, CIS                                       |
| Zinc                     | Iron and steel, alloys, rubber products, medicines                     | 143,910   | Canada, Australia, CIS, China, Peru, Mexico, Spain           |

<sup>(a)</sup> One metric equals approximately 1.102 British tons.

<sup>(b)</sup> Commonwealth of Independent States (includes much of the former Soviet Union).

are one of the most valuable resources of the earth because of their various uses. They are exhaustible or non-renewable. Besides, they are distributed very unevenly. They are generally found in the form of ores, which contain several impurities. Minerals are separated from the ores involving a number of distinct processes.

Minerals occur in different types of formations e.g. igneous intrusions, sedimentary ore deposits, alluvial deposits and oceanic deposits. Many important mineral deposits are contained within igneous intrusions and are found at different depths as they solidified at different temperatures. As such some of them are often found in association with the other such as silver with lead and zinc because they solidify at a similar temperature. Other minerals may be found at different levels e.g. tin is found at a greater depth than copper.

Minerals are broadly divided into two groups : metallic and non-metallic. *Metallic minerals* are those which yield metals such as iron, copper, silver and gold. They are indispensable to the contemporary society. All other minerals such as salts, sulphur, coal and petroleum belong to the non-metallic group. Majority of the minerals are inorganic in nature. Coal and petroleum or mineral oil owe their origin to the fossils of plants and animals (buried vegetation and animals) and hence are organic in nature. Since they are used as fuel, they are also known as *fossil fuels* or *mineral fuels*.

Minerals are distributed unevenly. Commercially viable mineral deposits are found only in selected places. However, because of the extensive use, many of the world's richest mineral deposits have either been depleted or are on the verge of depletion. Minerals found in insufficient concentration are not worth extraction because of high production cost. Economically important minerals include iron, manganese, lead, aluminium (bauxite), copper, nickel, tin and zinc.

### Distribution and Production of Some Minerals

We will now discuss the distribution and production of a few important mineral resources (Table 4.2). While iron, copper and bauxite are metallic minerals, coal and mineral oil are fossil fuels.

#### Iron

Iron is one of the most important metals, which is used most widely because of its certain qualities — hardness, strength, durability, malleability and above all the possibility of its conversion into different forms. Iron is found in the form of iron ores. They are of different types: haematite, magnetite, limonite and siderite. The metallic content of iron in these ores is highly variable. If the iron content of an iron ore is more than 30 per cent, only then it is worth extraction.

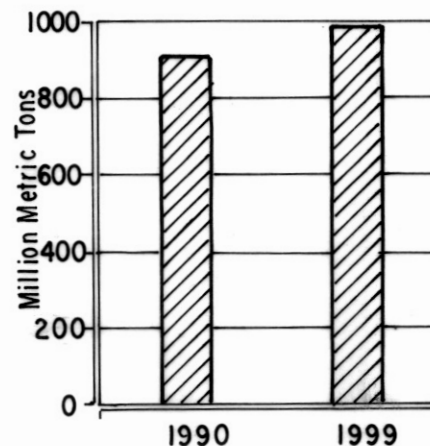


Fig. 4.4 World : Production of Iron Ore

Like several other metals, iron ore deposits are associated mainly with the major igneous intrusions. Good quality iron ore is found in Russia, Ukraine, China, the USA, Canada, Sweden, France, Germany, Spain, the UK, Liberia, South Africa, Brazil, India and Australia. Russia has the largest proven reserves of iron ore in the world. China emerged as the biggest producer of iron ore in the world in 1999, followed by Brazil, Australia, India and Russia. Find out the trend in the production of iron ore from Fig 4.4.

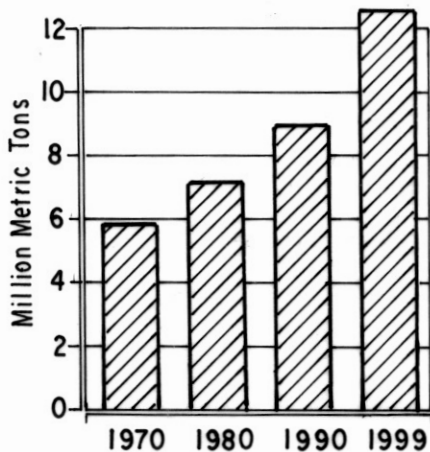


### Copper

Copper as a metal has been in use since ancient time. It is malleable and corrosion resistant. It is used mainly in the electrical industry because it is a good conductor. However, in recent years, the increasing use of glass fibres has reduced the pressure on copper.

Copper is used for making different kinds of alloys. For example, copper is mixed with tin to make bronze. Similarly, copper and zinc are mixed to make brass.

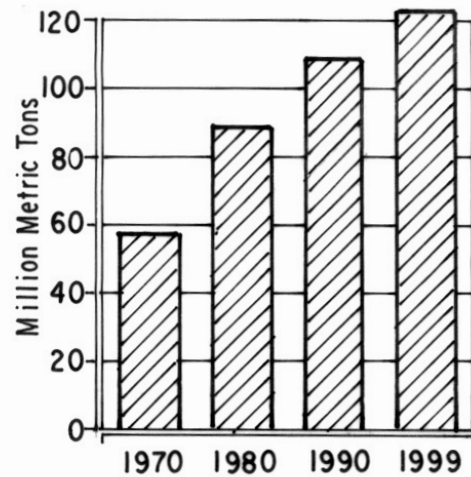
Copper is found in Chile, Peru, Mexico, the USA, Canada, Russia, Poland, Congo Democratic Republic, Zambia, Australia, Indonesia and India. Chile is the largest producer of copper. India's contribution in the world production of copper is negligible. Compare the production of copper with that of bauxite (Fig 4.5 and 4.6).



**Fig. 4.5** World : Production of Copper

### Bauxite

Bauxite is the ore of aluminium. Like iron, it is being used widely in a variety of ways — machine tools, electricals, utensils, aeroplanes, packing and construction. Extraction of aluminium from bauxite requires large amount of electricity. It is, therefore, called an energy intensive industry. Many major dams in the world have been constructed to supply cheap hydro-electricity for smelting aluminium. The Hoover dam on the river Colorado in the USA and the Akosombo dam



**Fig. 4.6** World : Production of Bauxite

in Ghana are such examples. Large deposits of bauxite are found mainly in the tropical regions — Australia, Surinam, Jamaica, Venezuela, Guyana, Malaysia, Indonesia and India. They are also found in China, Yugoslavia, the USA, Greece and Hungary.

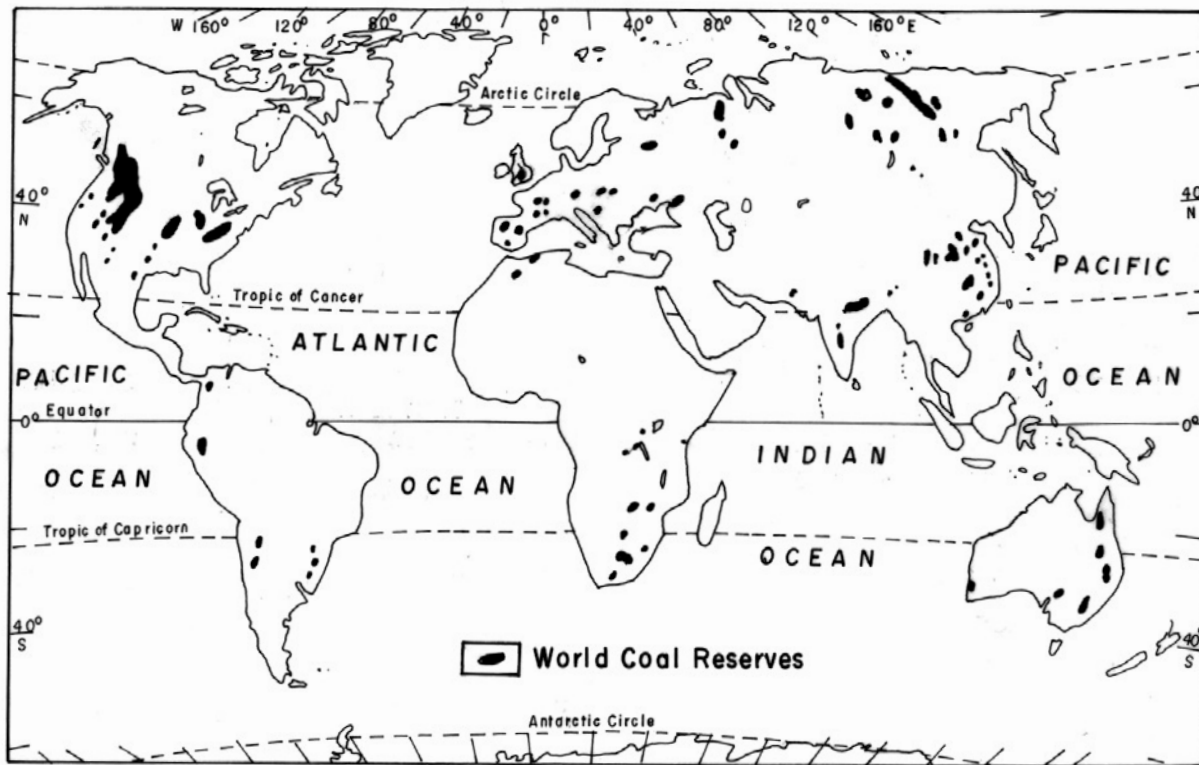
Aluminium production is, however, concentrated mainly in the developed countries, where electricity is cheap and abundant. Bauxite, if not available locally, is imported from outside.

### Coal

It is one of the most important sources of energy. It formed the basis of industrial revolution, though its importance has declined after the entry of mineral oil and natural gas later on. Still, it is the world's most abundantly used fuel sources.

Coal is found in seams of sedimentary rocks, mostly belonging to the carboniferous period. The quality of coal is judged by the amount of the carbon content. With age, the carbon concentration in the coal seams increases, while the moisture content decreases. Newly formed coal is of the most inferior quality for this reason.

There are three types of coal. Anthracite (more than 90 per cent carbon) is the best quality of coal. It is very hard, shiny, free of impurities, and less smoky, when burnt. It burns well and leaves little ash. This type of



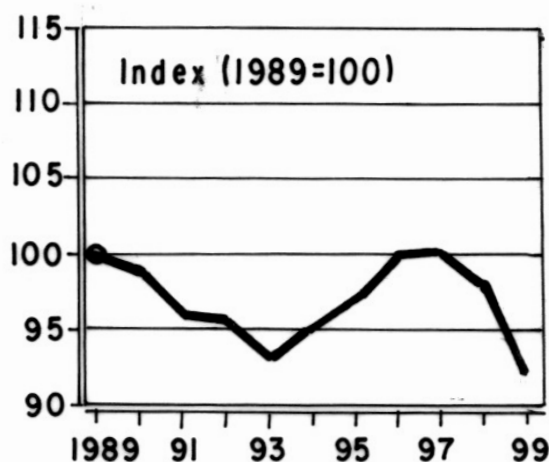
**Fig. 4.7** World : Major Coal Reserves

coal has comparatively small reserves. Bituminous coal containing 70-90 per cent of carbon, is black and shiny. When it is burnt, it gives smoke and leaves much ash. It yields bitumen or tar and hence called bituminous. Coal reserves of this type are quite large. Lignite or brown coal contains 45-70 per cent of carbon. It gives out highly smoky flames

because of the presence of more moisture compared to bituminous and anthracite coals. It is, therefore, of the lowest grade.

Coal is found in large quantities in the UK, France, Germany, Belgium, Poland, Ukraine, Kazakhstan, Russia, China, South Africa, India, and Australia (Fig. 4.7).

China and the USA, together contribute about 60 per cent of the total coal production in the world. Coal production has been fluctuating over the years (Fig. 4.8).

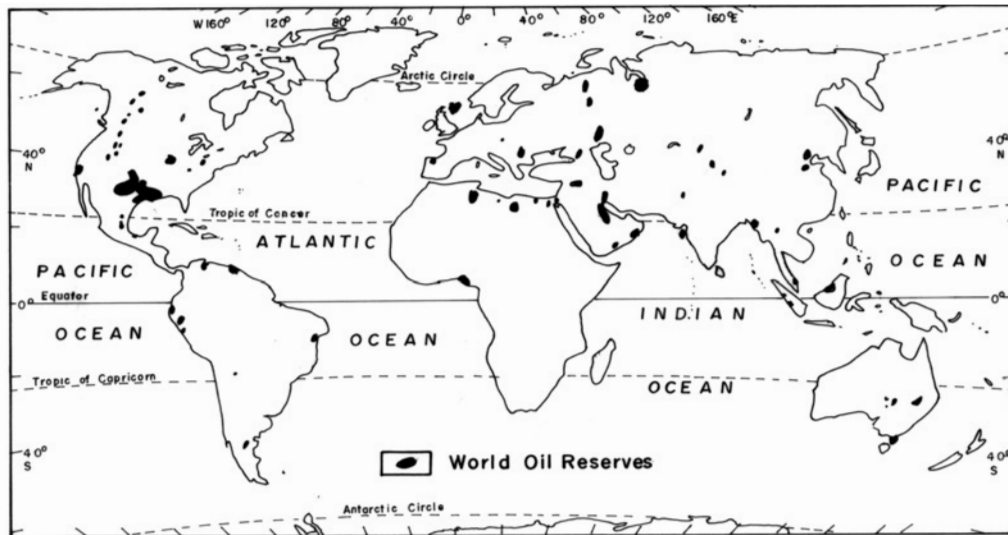


**Fig. 4.8** World : Production of Coal

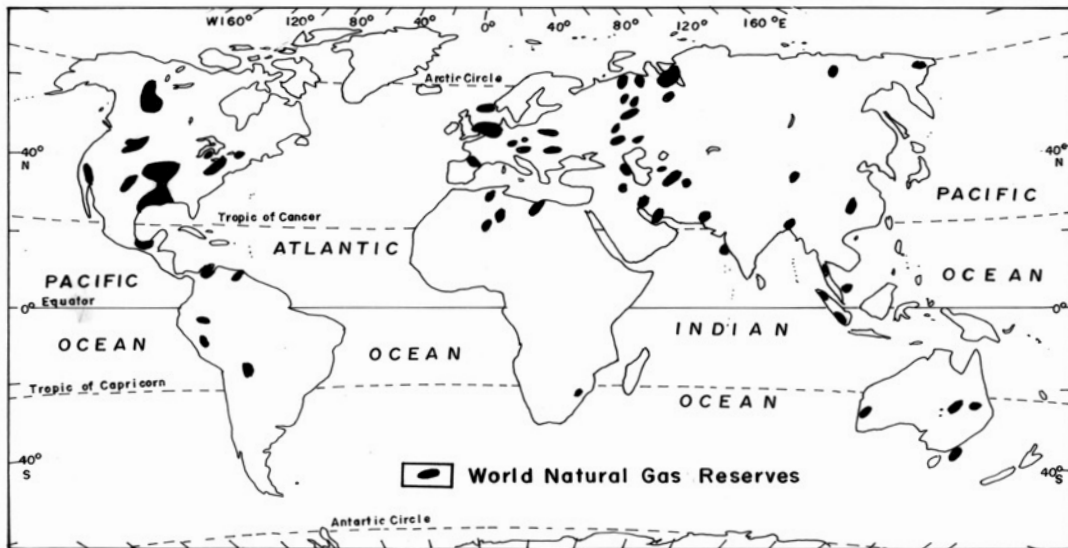
### Mineral Oil

Mineral oil is of great economic importance because of its efficiency and versatility. One unit weight of oil gives more energy than the same weight of coal.

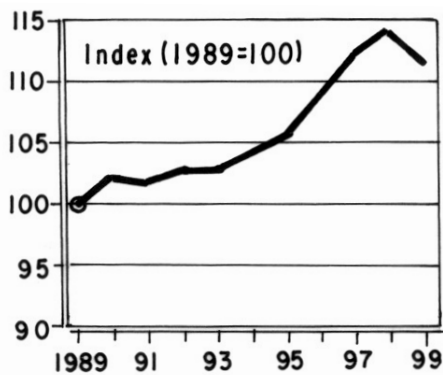
Mineral oil is generally, formed in the dome-shape structures of the sedimentary rocks. Invariably natural gas and mineral oil are found together (Fig.4.9 and 4.10). Though sedimentary rocks are widely distributed on the earth, all of them do not contain mineral oil. Only a few regions in the world have very rich mineral oil resources.



**Fig. 4.9** World : Major Mineral Oil Reserves



**Fig. 4.10** World : Major Natural Gas Reserves



**Fig.4.11** World : Production of Mineral Oil

Iraq, Saudi Arabia, Kuwait, Iran, United Arab Emirates, Qatar and Bahrain are the most important oil producing regions of West Asia. The United States of America, Venezuela, Mexico, Russia, Georgia, Armenia, Azerbaijan, the North Sea (shared by the UK, Norway, Denmark, Germany and the Netherlands), China and India have extensive oil reserves. Saudi Arabia is the largest producer of mineral oil, followed by the USA and Russia. There has been a steady rise in the mineral oil production in the world (Fig. 4.11).

## Types of Mining

Depending upon the location of mineral ores, mining is of two types: surface and underground. The *surface mining*, which is also known as open cast mining or quarrying, is easier. At present about 90 per cent of all mines and 99 per cent of non-metallic mines are surface mines. The mode of occurrence and the nature of the ore determine the method of extraction. Sedimentary or bedded ores lying close to the surface are called *open cast mines*.

*Underground mining*, in contrast to the open cast mining, is inherently risky. Poisonous gases, fires, floods and cavings lead to fatal accidents. In this kind of mining, vertical or inclined shafts and horizontal tunnels are made and connected with underground galleries. Rocks are extracted and transported to surface through these passages. It requires specially designed lifts, drills, haulage vehicles and ventilation system for safe and efficient movement of people and materials.

## Factors Influencing Mining Activity

The mining activity is influenced by both physical and economic considerations. Mere existence of minerals in the earth is not a sufficient condition for mining activity. The physical characteristics of ore formation — size,

depth and quality, are important factors as they determine the cost of working. Desirable knowledge and technology available for the use of minerals, sufficient demand for the ore, adequate supply of labour and capital to develop the requisite infrastructure as well as the mines are the major economic consideration.

Mineral production is extremely important in the economies of many developing countries. Several countries in Africa and a few in South America and Asia have over 50 per cent of their export earnings from minerals alone.

Mining employs millions of artisan miners across the world. In Latin America, about 1 million artisan miners are engaged in gold mining alone. Mining 'rushes' whether involving artisan or corporations quite often cause social conflicts. Much of the mining activity in today's world is dominated by the Transnational Corporations (TNCs). They serve the global markets through intense exploitation of mining areas, frequently at the cost of environment and local people. The Akosombo dam in Ghana, built in the 1960s to provide hydropower to smelt bauxite for an US company, flooded more than 5 per cent of the country. It displaced 80,000 people to create the largest artificial lake on the earth.

## Exercises

### Review Questions

1. Answer the following questions briefly:
  - (i) What is foraging?
  - (ii) How did agricultural revolution change the lives of people?
  - (iii) What triggered agricultural revolution?
  - (iv) Name the four broad categories of human activities.
  - (v) What is mining?
  - (vi) Why is iron used most widely?
  - (vii) What are the uses of bauxite?
  - (viii) Which is the largest artificial lake on the earth and why was it built?
  - (ix) What is the basis of judging the quality of coal?
2. Distinguish between:
  - (i) Industrial revolution and information revolution;
  - (ii) Primary activities and secondary activities;
  - (iii) Pastoral nomadism and commercial livestock rearing;
  - (iv) Metallic minerals and non-metallic minerals.

3. Write short notes on the following:
  - (i) Hunting and Gathering;
  - (ii) Factors influencing mining activity.
4. Discuss the positive and negative impacts of industrial revolution.
5. Describe the main features of pastoral nomadism and the areas associated with it.
6. Explain why mining still continues to be an important human activity and what kind of changes it has undergone over the years.

**Geographical Skills**

7. On an outline map of the World, show the following:
  - (i) area inhabited by the Arctic Inuit, Australian Pintupi, Paliyan of South India and Pygmies of Africa;
  - (ii) two iron ore producing areas — one each in Europe and Asia;
  - (iii) one coal field each in China, Ukraine and the USA.

# 5

## CHAPTER

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## AGRICULTURE

**A**mong all primary activities, agriculture is the most important. Nearly half of the world population is still dependent on it. In developing countries, the proportion of people dependent on agriculture is over 65 per cent.

About 12,000 years ago, the first farmers selected their crops and animals for domestication from the existing flora and fauna, particular to the world's biomes, and began the cultivation of plants. Different crops and animals were domesticated in different parts of the world, some in more than one place simultaneously.

Despite all the developments since then, humans are still dependent basically on the choices made by people in particular climatic regions thousands of years ago. Only about 20 crops out of several thousands species of wild plants are grown the world over as the major food sources. It is clear from the brief description below that the initial selections were influenced by the climate and the natural vegetation. The distribution of biomes reflects the distribution of solar radiation, temperature and rainfall resulting in the spread of vegetation types from equatorial forest to the tundra of the sub-Arctic and the high

mountains. This broad climatic framework is still the main influence on the pattern of agriculture, though the limits of growing particular crops have now changed under human influence.

With the beginning of agriculture, the nomadic herding gave way to a comparatively settled life. The most primitive form of agriculture is known as *shifting cultivation*, which still persists in some parts of the world. It is mainly practiced in the tropical forests. Trees are cut and burnt to make a clearing in the forests. Using simplest tools, fields are prepared for planting crops. After a few years of crop production, the soils get exhausted. These fields are then left fallow and new clearings are made in the forest. This kind of cultivation is known by different names in different parts of the world e.g. as *Jhuming* in the north-east India, *Chengin* in Philippines, *Roka* in Brazil and *Masole* in Democratic Republic of the Congo. Though, shifting cultivation is also migratory in nature, it allowed people to stay in a place for a longer duration.

Subsequently, *sedentary agricultural systems* with permanent fields and villages emerged in areas of favourable climate and

Although plants and animals were domesticated at a number of places on the earth's surface, few areas are particularly important:

- South-west Asia and the Eastern Mediterranean Region: Wheat, barley, lentils, peas, figs olives, dates, garlic, almond; cattle, sheep and goats.
- South-east Asia: Mango, vege-culture i.e. cutting and planting parts of the growing plant such as yam, sago and bananas; pig, chicken and duck.
- China: Rice, millet, soyabeans, tea, onion, spinach and the mulberry; pig, chicken, duck.
- India: Rice, gram, brinjal, pepper, lemon, jute and indigo; cattle, buffalo, chicken.
- Africa: Yam, oil palm, coffee, sorghum.
- Americas: Maize, and beans in Central America, cassava and cocoa in the Amazon basin and potatoes in the Andes; Llama .

fertile soils. Great civilisations were built on the foundation of sedentary agriculture in the fertile river valleys – the Euphrates, the Tigris, the Nile, the Indus, the Huang He and the Chang Jiang, about 6,000 years ago. Gradually, the sedentary system of agriculture spread over most parts of the world.

The industrial revolution, which took place in the eighteenth century in Europe, influenced Asia, Africa and Latin America indirectly. It boosted agricultural production in Europe and changed the cropping pattern in the Asian, African and Latin American colonies. These colonies specialised in the production of crops such as cotton, sugarcane, rice, tea, coffee and rubber, which were processed in the European factories. As demands for these crops grew in Europe, the large-scale commercial farming of some of these crops, commonly known as *plantation agriculture*, was started. Large estates of monocrop were established. They were managed scientifically with the sole objective of export or trading for earning money.

One of the effects of colonisation was worldwide diffusion and exchange of several species of plants and animals. For example, potatoes, a native of the Andes, flourished in the cool damp environment of the northern Europe and soon became a world crop. Similarly, corn (maize) spread across the world to become the third most widely grown grain after rice and wheat.

The industrial revolution in Europe provided more efficient and more specialised agricultural implements such as plough, reaper, threshing machines, harvesters, tractors and milking machines. They changed the character, scale and geography of agricultural production. In North America, mechanisation enabled farmers to expand and specialise in the production of commodities that could be sold for the maximum profit. Thus *specialised commercial agricultural systems* emerged there, which gave rise to distinct crop regions—wheat belt, cotton belt, corn belt, dairy farming and truck farming (fruits and vegetables) regions. In other parts of the world also, similar technological revolutions brought power driven machines. In addition, adoption

of hybrid seeds, chemical fertilisers and pesticides increased the yield of crops dramatically in many areas, though at varying rates.

Plant dispersal and industrialisation of agriculture improved agricultural production profoundly. Large number of people were freed to pursue other economic activities because high yields could be achieved with less number of people and using scientific and technological innovations. The industrialised countries of the world, therefore, witnessed a perceptible shift of population from primary activities to secondary and tertiary activities in a sequential manner viewed as a sign of economic development, though in developing countries employment structure has moved directly from primary to tertiary sectors.

### **CROP DISTRIBUTION : A GLOBAL PATTERN**

Physical environment, which includes climate, soil and relief, imposes certain broad limits within which particular crops may be successfully cultivated (Fig. 5.1) or certain types of livestock profitably reared. Besides, socio-economic institutions are also important factors in crop production.

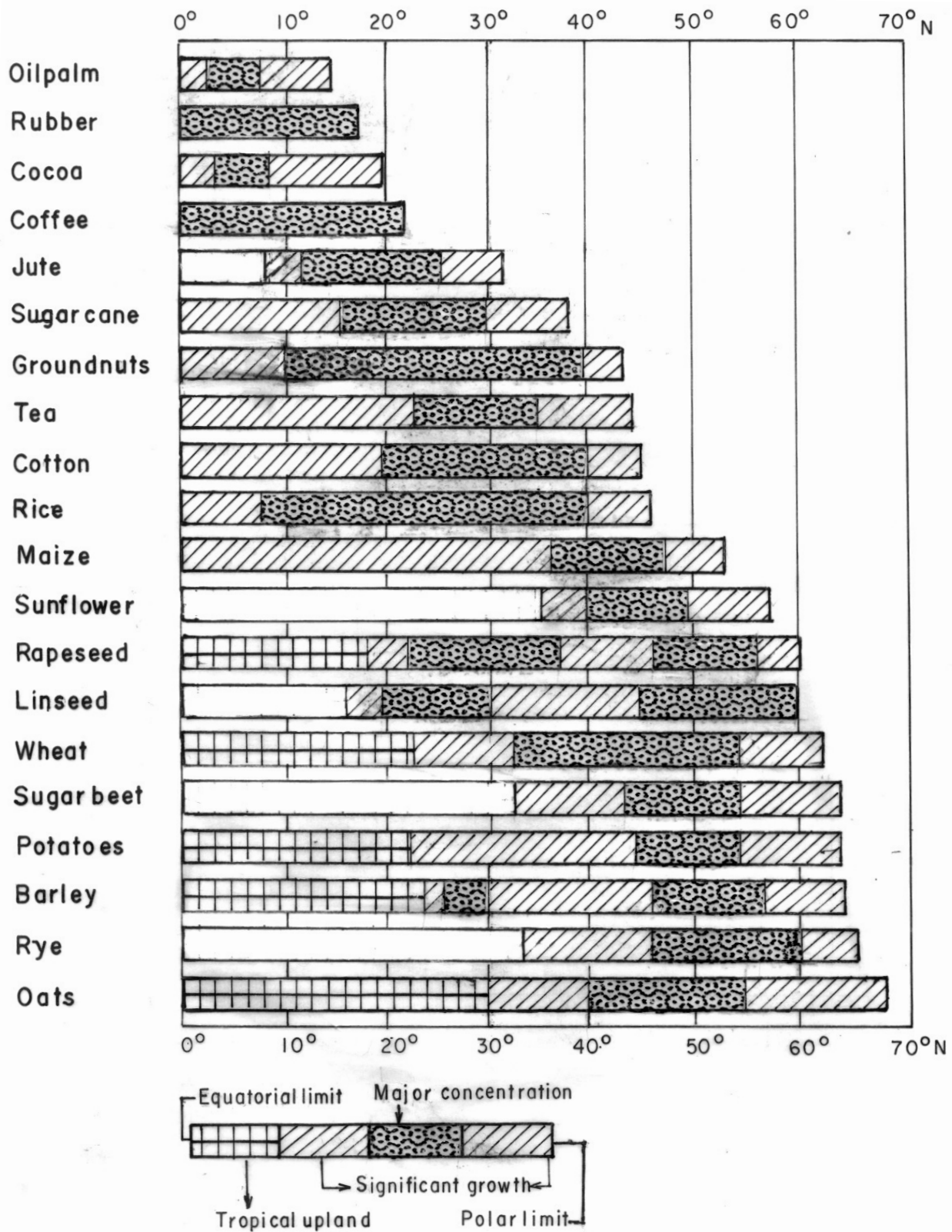
#### **Climate**

Temperature and rainfall are the two most important climatic factors in limiting the areas for the growth of a particular crop.

#### **Temperature**

It is an important determinant of the distribution of crops because suitable temperature conditions are essential for the successful germination of seeds and plant growth. On the basis of the temperature requirements, crops may be divided into two categories : crops adapted to the high temperature conditions of the tropics, and those adapted to the lower temperature conditions of the sub-tropical and temperate areas.

Tropical crops, adapted to high temperature conditions ( 31°C - 37°C ) may be damaged, if temperature falls below 0°C and



**Fig. 5.1** Latitudinal Spread of Major Crops

Source : Lydolph, P.E., 1985, *The climate of the Earth*, Rowman and Littlefield.



frosts occur. A few of them are so susceptible to cold that they will die at a temperature below 10°C. However, some of the temperate crops can be grown in the tropics at higher altitudes such as apples, wheat and oats.

Crops grown in the sub-tropics and the temperate regions are adapted to lower temperature. The *growing season* (between the last frost in winter and the first frost in autumn) is very crucial for the growth of plants in these regions. As one moves towards the poles, this period gets smaller. As such, the number of crops that can be grown polewards, also declines. North of the Arctic Circle only rye and oats have some significance.

Similarly, many crops also have limits towards the equator. Some of them need a cold period to trigger growth and cannot withstand high rainfall. They are also susceptible to diseases found in the tropics. There are a few crops e.g. flax and olives that are grown in a very narrow zone due to such climatic limitations. Despite varying temperature requirements, most of the crops need 5°C -7°C temperature during seed germination.

### **Rainfall**

It provides moisture to the soil that is essential for crop growth. Every plant has a root system with an enormous total surface area to draw water from the soil. Water-need of plants varies. While wheat requires about 1,500 kg of water to produce 1 kg of wheat, for the same amount of rice, 10,000 kg of water is required.

In the absence of sufficient amount of water, the plants cannot grow. It, however, does not mean that crop yields will increase proportionally with increasing amount of water supply. In contrast, if the supply of water is more than the plant's requirement, there will be decline in the crop yield. There is an optimum amount of water for every crop and this requirement varies significantly from one crop to the other. Rubber and tea, for example, need over 150 cm of annual rainfall. Wheat, on the other hand, can be grown in regions having the annual rainfall between 25 and 100 cm. Since more than 50 per cent of the land surface on the earth receives the annual rainfall

between 25 cm and 100 cm, wheat is the most widely grown crop. About 10 per cent of the land has more than 178 cm of annual rainfall and only 5 per cent of the land receives over 254 cm. As such tea and rubber, have a much more restricted distribution.

The deficiency in the rainfall can be overcome with the help of irrigation either from groundwater or from rivers and tanks. The amount of water available in the soil for the crop also depends on the rate of evaporation, which increases with temperature. Hence, crops in the tropics need higher rainfall than in the temperate zone.

### **Soil**

Soil is the essential material upon which all agriculture is based. Soil characteristics are largely the product of the climate. In addition to temperature and rainfall, plants need nutrients, which are mostly obtained from the soil. We have already read about the soil formation process in earlier classes. As we know, interaction and mixing of weathered rock with organic (plant and animal) matter along with groundwater produce the soil in which the plants grow. They contain minerals, which are essential for plant growth. The soil forming process makes the original elements of the rock more mobile so that plants could use them as nutrients.

There are six major nutrient elements. They are: nitrogen, phosphorus, potassium, calcium, magnesium and sulphur. Besides, iron and small quantities of trace elements such as boron and iodine are also required by plants. The capacity to provide nutrients varies greatly among different soils depending on the composition of the original rocks and the climatic factors — temperature and rainfall of the region. In tropical regions, the nutrients are easily leached out because of high rainfall. In temperate regions, the soils have more nutrients. Desert soils have high concentration of nutrients but the lack of water makes them immobile and unavailable.

The nutrients are replaced in the soil naturally through decomposition of plant and

animal organisms. It is a slow process. Hence, for faster nutrient replacement, chemical fertilisers, mainly nitrogen, phosphorus, and potassium are added to the soil.

Loamy soils are generally, considered ideal for agriculture because of their richness in plant nutrients, good drainage and ease in working. Heavier clay soils with adequate drainage are more suitable to certain crops. Sandy soils are usually infertile, although they may be used for cultivation after heavy application of fertiliser.

**Relief**

Three elements of relief — altitude, orientation of slope to sunlight and gradient, influence the pattern of agricultural activities. In middle latitudes, high altitudes restrict the number and types of crops that may be grown. In the tropics, on the other hand, increased altitude provide some relief from the excessively high temperature and humidity of the lowland plains.

On a local scale, orientation of the slope is an important element of relief. In the northern hemisphere, south-facing slopes receive more intensive sunshine for a longer period than their north-facing counterparts. The gradient of slopes affects the type of agriculture as well as methods of cultivation. Steep gradient restricts the use of heavy machineries. Besides, the risk of soil erosion is also greater here.

**Socio-Economic Institutions**

While factors of physical environment impose basic limits upon agricultural production,

they alone will not adequately explain patterns of agricultural land use. The scale, intensity and extent of production within physical limits is determined by *social and economic conditions* such as farm size, type of tenure (freehold ownership, various forms of tenancy and state ownership), consumer demand, transport and marketing facilities, the availability of capital, and government subsidies and support policies. The physical limits of production are relatively stable and can be extended only within narrow limits. But the economic margin of production fluctuates according to demand. Hence, within any particular environment many choices and options are normally open to the farmer. The actual farming pattern is determined by the farmer’s evaluation of the possibilities offered by the physical environment as well as various social and economic factors.

**AGRICULTURAL LAND USE**

The land under cultivation in the world is rather limited. Constraints of climate, slope, soil and pests continue to limit the arable land use to a comparatively small percentage of all land uses (Fig 5.2). Much larger areas are useable as pasture and forests.

If we compare the three major land uses at the global scale during last three centuries (Table 5.1), it would be evident how humans have increased croplands by encroaching on forests and grasslands.

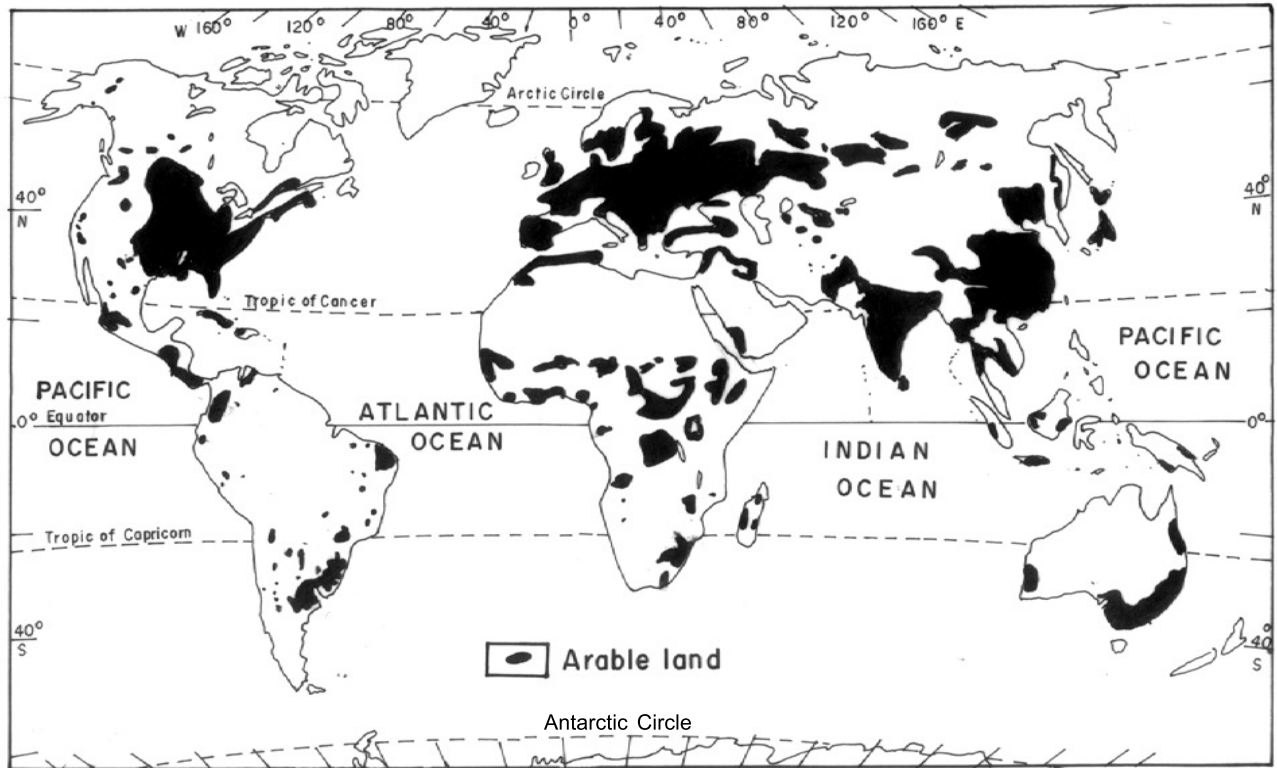
Presently, 32 per cent of the total land area of the world is under forests, 26 per cent under pasture, 1 per cent under permanent crops,

**Table 5.1 : Global Land Use Changes (Area in Million Hectares)**

| <i>Broad Land Uses</i> | 1700 | 1850 | 1920 | 1950 | 1980 | 2000* |
|------------------------|------|------|------|------|------|-------|
| Forests                | 6214 | 5965 | 5678 | 5389 | 5053 | 3454  |
| Grasslands             | 6860 | 6837 | 6748 | 6780 | 6788 | 3427  |
| Croplands              | 265  | 537  | 913  | 1170 | 1501 | 1512  |

**Source:** Richards, J. F. 1990: Land Transformation. In Turner, B.L. et.al (eds). *The Earth Transformed by Human Action*, Cambridge, Cambridge University Press.

\*UN



**Fig 5.2** World : Distribution of Arable Land

10 per cent is arable and 31 per cent is under other uses.

Crops are generally, categorised on the bases of their various uses such as cereals, pulses, oilseeds, fibres and beverages. The other way is to group them under food crops and non-food crops. Few crops have been selected for a detailed study keeping in view their importance and area under their cultivation. In our discussion we will be covering mainly food crops – their distribution pattern, production and sustainability (Table 5.2).

### **FOOD CROPS**

Food for the world's population is obtained almost entirely from plants. Of the immense varieties of plants, only a few were domesticated thousands of years ago and they still continue to be the major food sources. These species have three common characteristics: high production per unit of land; high food value; and storage ability.

It is interesting to note that the world's food supply is dominated by five crops. Of these, three are cereal grains : wheat, rice and maize (corn), and the other two : potatoes and cassava, are tubers. All of them share the above mentioned qualities. In combination they provide the staple food to nearly all the humans on the earth (Table 5.2).

The production characteristics of these staple crops as given in Table 5.2 reveals differences in the areas under each crop as well as in the average yield in developed and developing countries.

The difference in the area of the five major food crops is mainly because of the climatic requirements of the crop, which limit their cultivation. The developing countries in comparison to the developed countries have higher per hectare yield due to their relative access to agricultural technology such as the

**Table 5.2 : Staple Food Crops — Production Characteristics (1999)**

| <i>Crop</i>       | <i>Area Harvested (Million Ha)</i> | <i>Annual Production (Million Metric Tons)</i> | <i>World Average Yield (Tons /Ha)</i> | <i>Average Yield in Developing Countries (Tons/ Ha)</i> | <i>Average Yield in Developed Countries (Tons /Ha)</i> |
|-------------------|------------------------------------|--|---------------------------------------|---|--|
| Wheat             | 215.27                             | 583.6  | 2.71                                  | 2.70  | 2.72   |
| Rice              | 155.13                             | 596.5  | 3.85                                  | 3.78  | 6.19   |
| Maize             | 139.21                             | 600.4  | 4.31                                  | 2.93  | 7.08   |
| Potatoes          | 17.99                              | 294.3  | 16.36                                 | 16.09   | 16.57  |
| Cassava           | 16.58                              | 168.1  | 10.10                                 | 10.01   | n.a.   |
| All cereal grains | 679.88                             | 2064.2   | 3.04                                  | 2.76  | 3.55   |

**Source :** FAO Statistics, United Nations, Food and Agricultural Organisation, Statistics Division, 2000.

range of pesticides, fertilisers, hybrids and machineries.

### **Rice**

It is suggested that rice originated in the foothills of the eastern Himalayas in north-east India, Indo-China and south-west China perhaps on the basis of the large concentration of several perennial species. Based on the archaeological evidences, the earliest date of rice cultivation is supposed to be 7,000 years ago in the Chang-Jiang delta. Its cultivation spread to the remaining southern and eastern Asia over the next 6,000 years. While its cultivation was originally carried out in swamps, it spread to new areas, which meant its adaptation to a wide range of environmental conditions — temperature, day-length, rainfall and different soil types. As a result, the range of rice varieties is very broad, varying from the less humid upland conditions to the varieties of 'floating' rice, which can be grown in water upto 5 metres deep. There are more than 65,000 local varieties of rice grown the world over.

Rice is mainly the crop of the monsoon Asia, having hot and humid climate (Fig 5.3). Traditionally, rice was grown in the well-watered river valleys and deltas. However, with the help of irrigation it is now grown even on

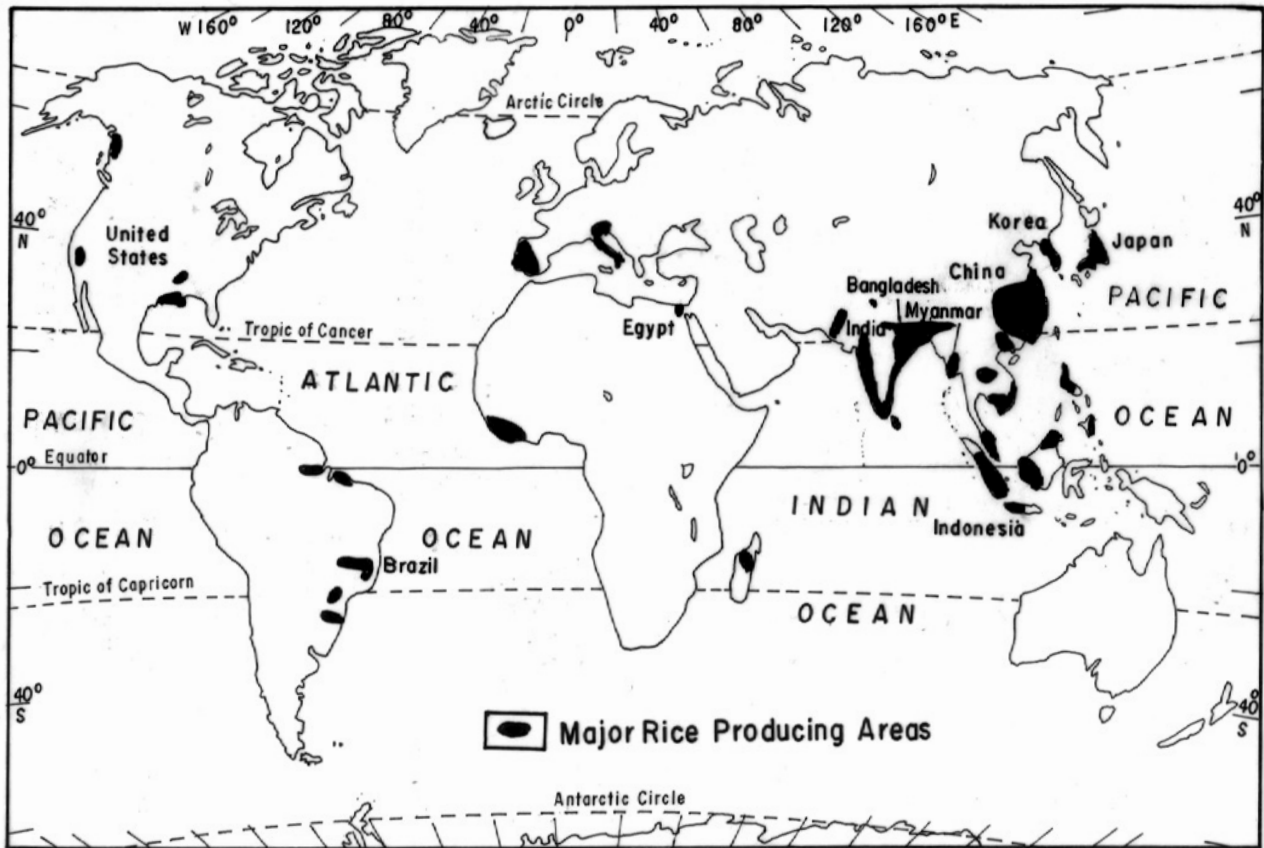
uplands and dry areas. The rice-plant (paddy) requires high temperature (27°-30°C) and high rainfall (about 100 cm) during its growth period. In fact, in the initial stages, the plant needs more of stagnant water. Hence, the paddy fields are flooded with 10-25 cm of water. On hill slopes, rice is grown in terraced fields. Claye loam soil is best suited for its cultivation because it can retain water.

Rice is a labour intensive crop. Most of the farming operations are done manually — uprooting the seedlings from nurseries transplanting them in the flooded fields, removing weeds from time to time and harvesting.

The nutritional value of rice is good especially when the outer layer containing important vitamins is not removed in the processing. Ninety per cent of the worlds' rice in grown in East and South Asia. It is the principal food crop for half the population of the world.

### **Wheat**

It is mainly a crop of the temperate region. But it is now the most widely grown of all the cereal grains because of its adaptability. There is hardly any country which does not grow some amount of wheat. With fair amounts of protein as well as carbohydrates, it is one of the most



**Fig.5.3** World : Major Rice Producing Areas

nutritious grains. It is the staple diet of people in a large part of the world. Although wheat is hardy, it does not grow well under conditions of high temperature and humidity. At the time of germination, it requires cool weather and sufficient moisture in the soil. The annual rainfall should be between 40-75 cm. An average temperature of 16°C and clear sky are required at the time of ripening. Loam and chernozem soils are best suited for wheat cultivation.

On the basis of the climate, there are two types of wheat : winter wheat and spring wheat.

Regions with mild winters grow winter wheat, whereas those with severe winter grow spring wheat. Wheat is also divided into two types on the basis of its quality i.e. soft and hard wheat. They are grown in humid and dry regions respectively.

Although yields are highest in the humid mid-latitudes, the major wheat belts are in the

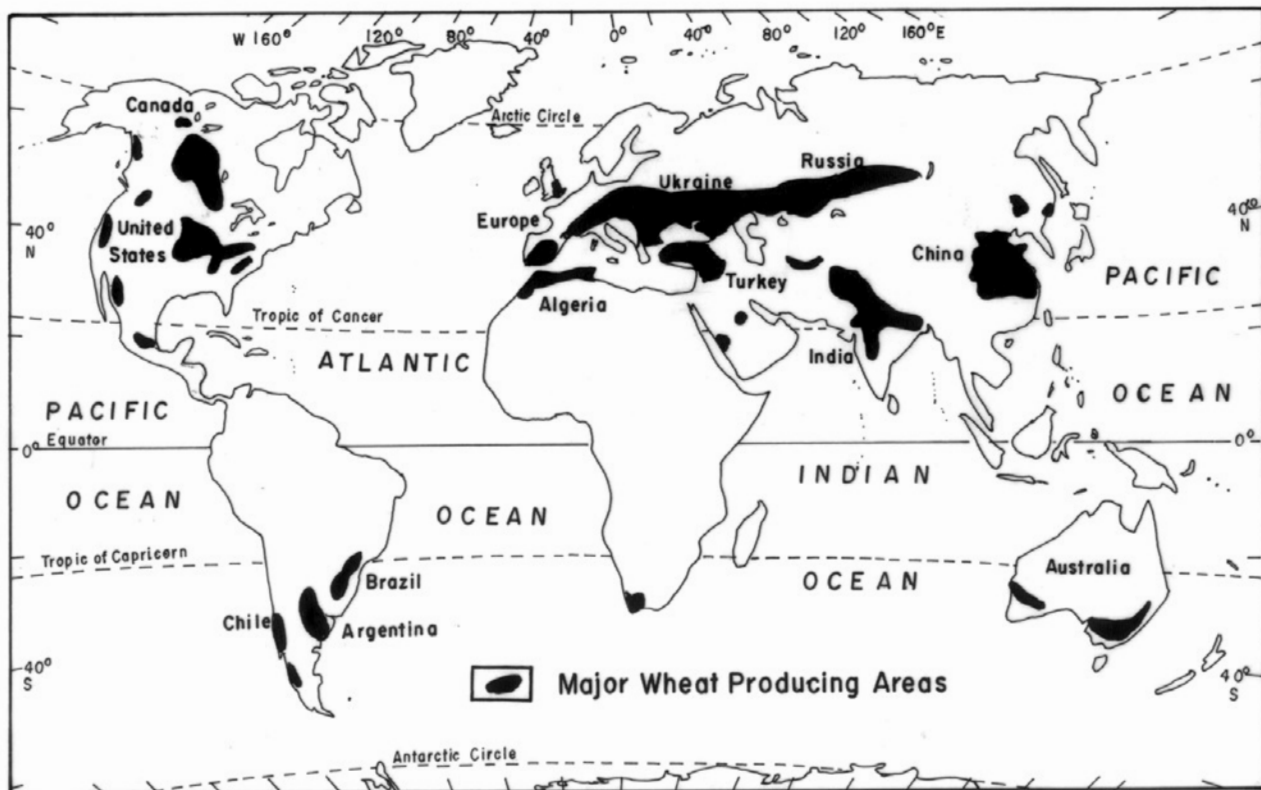
drier semi-arid climates (Fig 5.4). The areas of greatest production are the Great Plains of the United States, and Canada, the Steppe region of the Commonwealth of Independent States (CIS) and the North China Plain. Wheat is cultivated under intensive as well as extensive farming. Large-scale commercial production also occurs in Australia and on the Pampas of South America. Wheat is grown in almost every country of Europe but most of it is consumed locally. France is the largest producer and the only exporter of wheat among these countries.

### **Maize (Corn)**

It is another new world crop that has spread over the world from its origin in Central America to all over the world. It is a fairly high-yielding crop. It grows best where summers are warm and humid. Its nutritional value is less than

**Table 5.3 : Major Areas of Rice, Wheat, Maize and Potato Production**

| Rice       | Area % | Wheat      | Area % | Maize      | Area % | Potato        | Area % |
|------------|--------|------------|--------|------------|--------|---------------|--------|
| Asia       | 91     | Asia       | 38     | N. America | 48     | Europe        | 31     |
| Africa     | 3      | Europe     | 24     | Asia       | 25     | Asia          | 26     |
| S. America | 3      | N. America | 17     | S. America | 11     | South America | 4      |
| N. America | 1.5    | CIS        | 16     | Europe     | 10     | CIS           | 27     |
| Europe     | <1     | S. America | 2      | Africa     | 5      | North America | 9      |
| Oceania    | <1     | Oceania    | 2      | CIS        | 1      | Africa        | 3      |
|            |        | Africa     | 1      | Oceania    | <1     |               |        |



**Fig. 5.4** World : Major Wheat Producing Areas

wheat and rice as it does not contain as much protein. It is an important food crop in Central America, South America, Africa and to a lesser degree in India and China (Fig 5.5). About half of the world's maize is grown in the United States, but 80 per cent of it is used for animal feed and corn oil and not for direct human consumption.

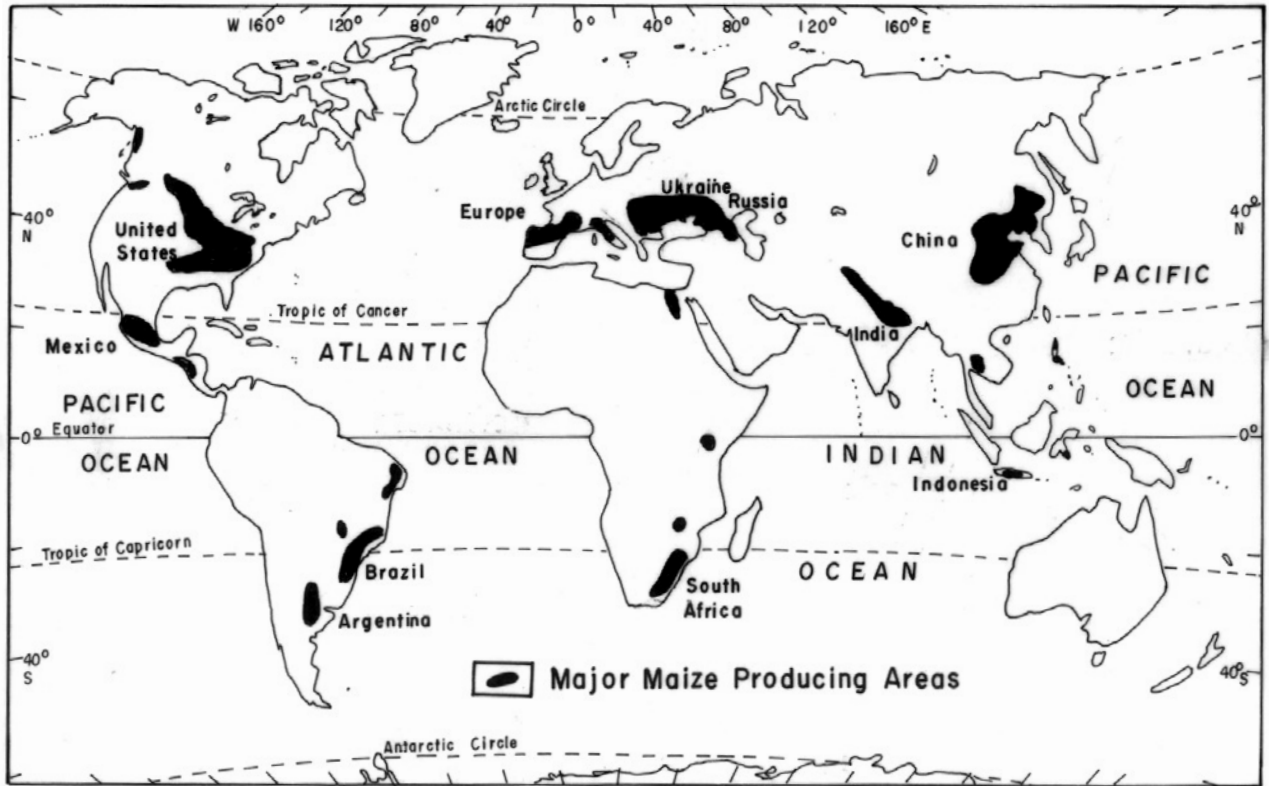
**Potatoes**

It is an important food crop that grows best in a mild and humid climate. It is now grown throughout the humid mid-latitudes. Eastern

European countries and the CIS produce more than 50 per cent of the world's crop. United States, Peru, China, India and Japan are the other major producers.

**Cassava**

It is strictly a crop of the tropical region, which originated in South America. Compared to the other four food crops, it is deficient in protein and minerals. However, there are several compensating advantages. It grows under a variety of tropical conditions where other crops cannot be grown. Besides, it is relatively



**Fig. 5.5** World : Major Maize Producing Areas

immune to most of the pests that affect food crops. Ripe tubers can be left in the ground for long periods without any deterioration. It is an extremely advantageous attribute in a tropical region.

Dry tubers are pounded to make flour. For these reasons, it is a staple crop for a large number of people in Southeast Asia, Central Africa and tropical South America.

In addition to the above mentioned five major staple food crops, there are many other food crops such as cereals (barley, rye), pulses, oil seeds, sugarcane and sugar beet, beverages (tea and coffee), vegetables and fruits, which come under this category. Pulses include lentils, black gram, peas, soybeans and several other kinds of beans.

Most of these crops are of local and regional importance only. Oil seeds refer to a wide variety of seeds, which are the sources of the edible oil e.g. sesame, mustard, rape seed, groundnut, coconut, sun-flower, olives and

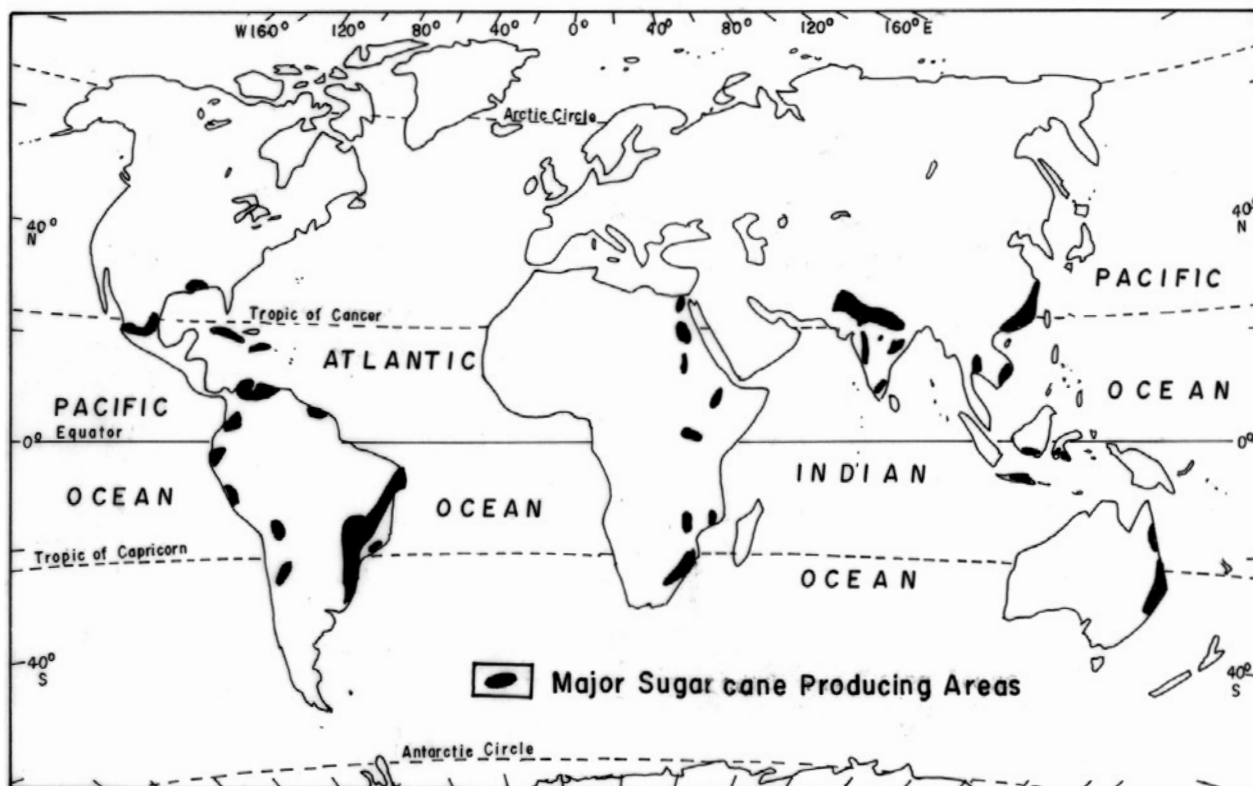
maize. Like pulses, there is a great regional variation in oil seeds grown in different parts of the world.

### **Sugarcane**

It is a tropical crop, which is an important source of sugar. In temperate countries, however, sugar beet is the main source of sugar.

Sugarcane requires hot and humid climate. Temperature ranging between 20°C and 27°C and a rainfall between 75-120 cm are ideal. At the time of ripening, a low temperature, but not falling below 20°C, and dry weather enhance the sucrose content of the crop. Once cultivated, crop can give yield for at least three years.

Deep soil with high moisture retention capacity is most suited. Loam, clay, alluvial and black soils are good for sugarcane cultivation. Compost manures and chemical fertilisers are necessary for maintaining soil fertility.



**Fig. 5.6** World : Major Sugarcane Producing Areas

Brazil, Cuba, Mexico, India, Pakistan, China, Thailand, Indonesia and Australia are main producers of sugarcane (Fig 5.6).

### Tea

It is a very popular beverage obtained from the tender leaves of an evergreen bush. It requires warm and humid climate but water should not stagnate near the roots. It is, therefore, grown mainly in a region between 27° south and 43° north latitudes on hill slopes, where annual rainfall is between 125 and 750 cm. Tea plants need fertile soils with high humus.

Tea is a plantation crop. It is grown in large tea — estates. Tea plant is not allowed to grow beyond a height of 40-50 cm. The total life span of a tea plant is about 40-50 years. Application of nitrogen fertilisers is essential to maintain soil fertility. Tea leaves are picked up by hand. As such availability of cheap labour is an essential factor.

India, China, Sri Lanka, Bangladesh, Japan, Indonesia, Argentina and Kenya are the main tea producing countries (Fig 5.7).

### Coffee

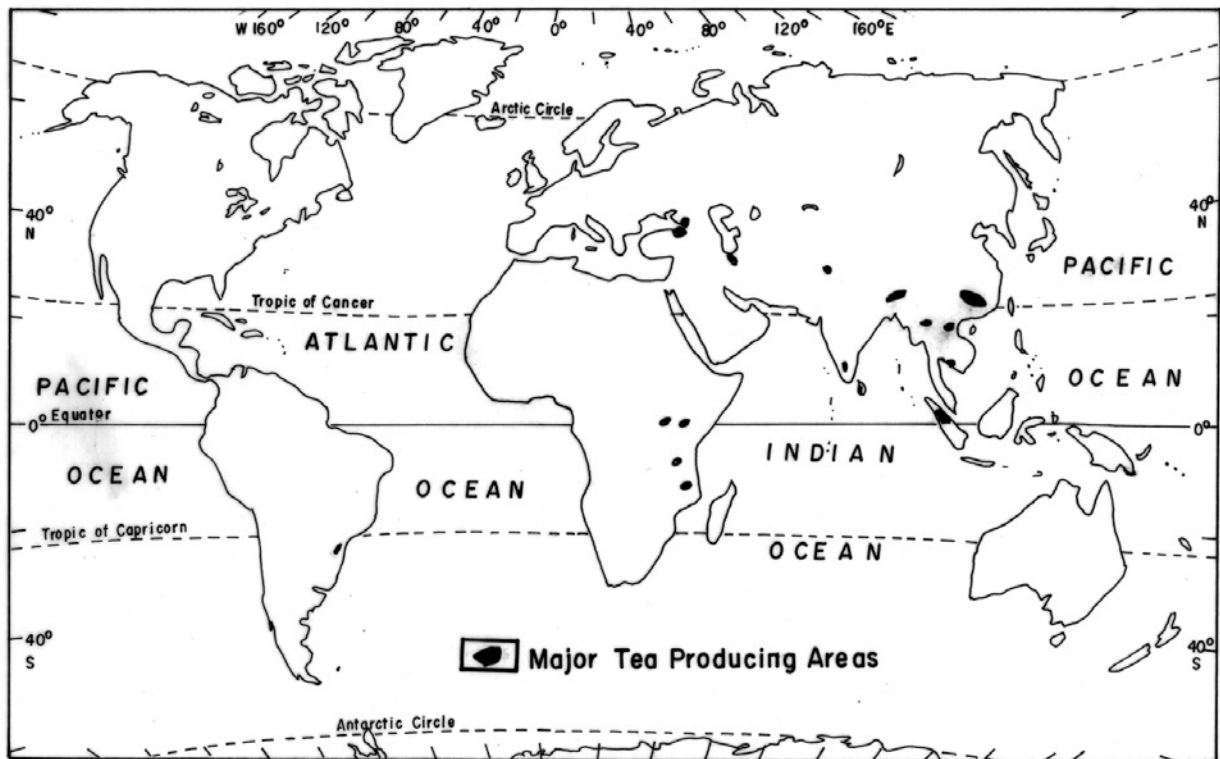
It is also a plantation crop, which grows in the tropical highlands at an altitude between 500 and 1,500 metres above the sea level. Coffee plant cannot tolerate frost. It is, therefore, grown under shady trees. It requires high humidity and hence, grows well in the areas having rainfall between 160 and 250 cm. It is, generally grown in deep, porous and water retentive soil with high humus content.

Brazil, Colombia, Venezuela, Guatemala, Haiti, Jamaica, Ethiopia and Indonesia are major producers. In India, coffee is grown mainly in Karnataka (Fig 5.8).

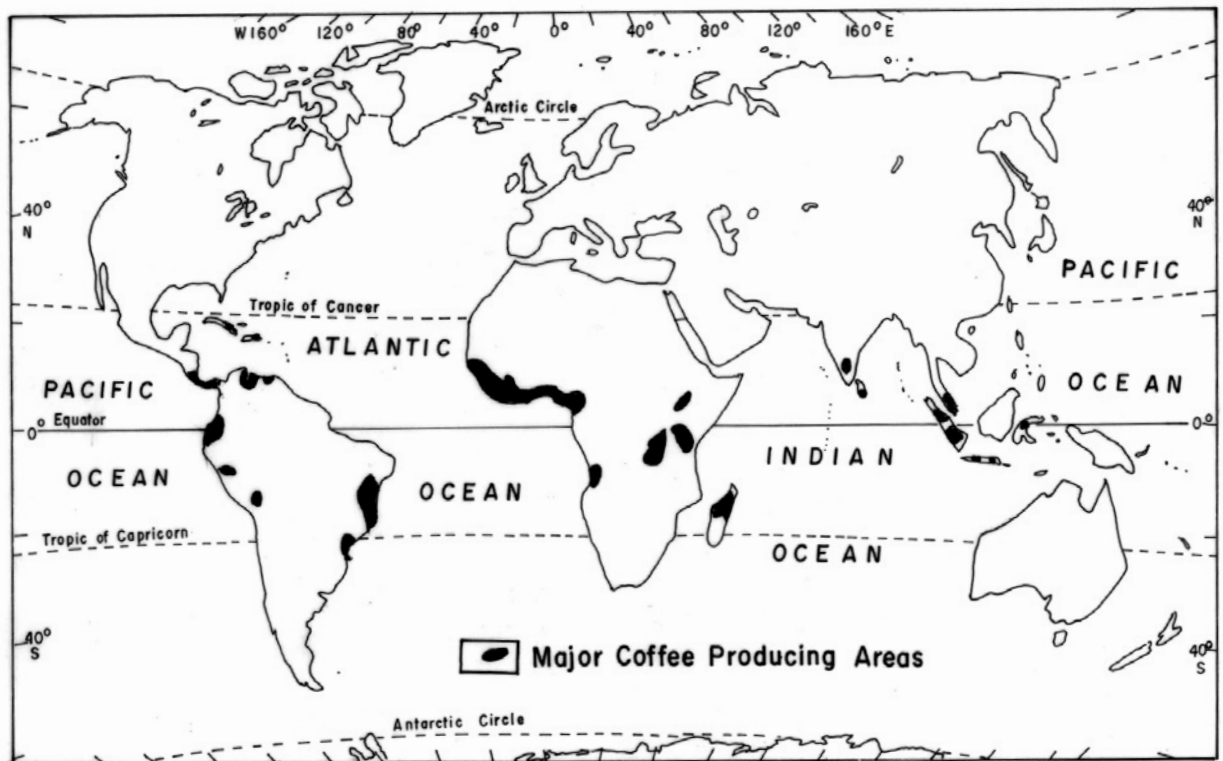
### NON-FOOD CROPS

Fibre crops such as cotton and jute, rubber and tobacco are the major non-food crops. Cotton and jute are the crops of the tropical region. However, the climatic conditions i.e., temperature and rainfall, for their growth are totally different. Rubber tree is found widely in the Amazon and Congo basins. Its





**Fig. 5.7** World : Major Tea Producing Areas



**Fig. 5.8** World : Major Coffee Producing Areas

plantations in South-east Asia, India, China, Sri Lanka and Kenya have also been successful.

**Cotton**

It is one of the most important fibre crops. The quality of cotton is judged on the basis of the length of its staples. The best quality of cotton has a long staple, more than 5 cm. This variety of cotton is grown on the south-eastern coast of the USA and in the West Indies. The medium variety of cotton having a staple length between 3.75 to 5 cm is produced in the Nile Basin, the USA and Central Asian Republics of Tajikistan, Kazakhstan, Turkmenistan and Uzbekistan, and the USA. The small stapled cotton having a length of less than 2.5 cm is grown in India and Brazil.

Cotton is a tropical crop. It can tolerate high temperature, but ideally it should be between 21°C and 27°C during its growth-period. Its plant cannot tolerate temperature below 21°C and frost. A rainfall of 50 cm is enough, but it should be distributed evenly during its growth

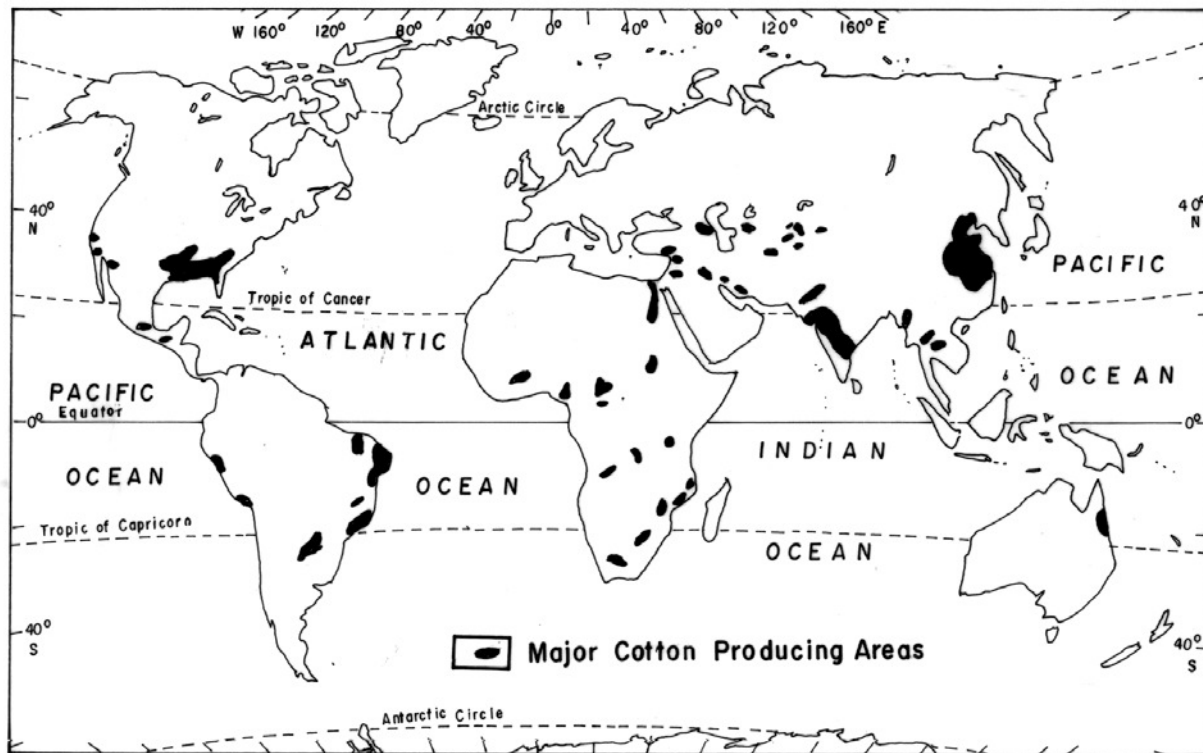
period. Cloudless sky at the time of the ripening of the cotton balls is essential. A well-drained soil is suitable for its cultivation. Volcanic, black and alluvial soils are good for it.

In addition to the countries mentioned earlier, cotton is grown in China, Pakistan, Sudan and Turkey (Fig 5.9).

**Agricultural Regions**

One of the earliest but one of the most satisfactory classifications was proposed by D.Whittlesey in 1936. He employed five criteria to classify agricultural regions of the world: crop and livestock combination; intensity of land use; processing and marketing of farm produce; degree of mechanisation; and types and associations of buildings and other structures associated with agriculture. In this scheme, 13 main types of agricultural regions were identified as follows:

- (i) Nomadic herding;
- (ii) Livestock ranching;
- (iii) Shifting cultivation;
- (iv) Rudimental sedentary tillage;



**Fig. 5.9** World : Major Cotton Producing Areas

- (v) Intensive subsistence, rice dominant;
- (vi) Intensive subsistence, without rice;
- (vii) Commercial plantation;
- (viii) Mediterranean agriculture;
- (ix) Commercial grain farming;
- (x) Commercial livestock and crop farming;
- (xi) Subsistence crop and livestock farming;
- (xii) Commercial dairy farming; and
- (xiii) Specialised horticulture.

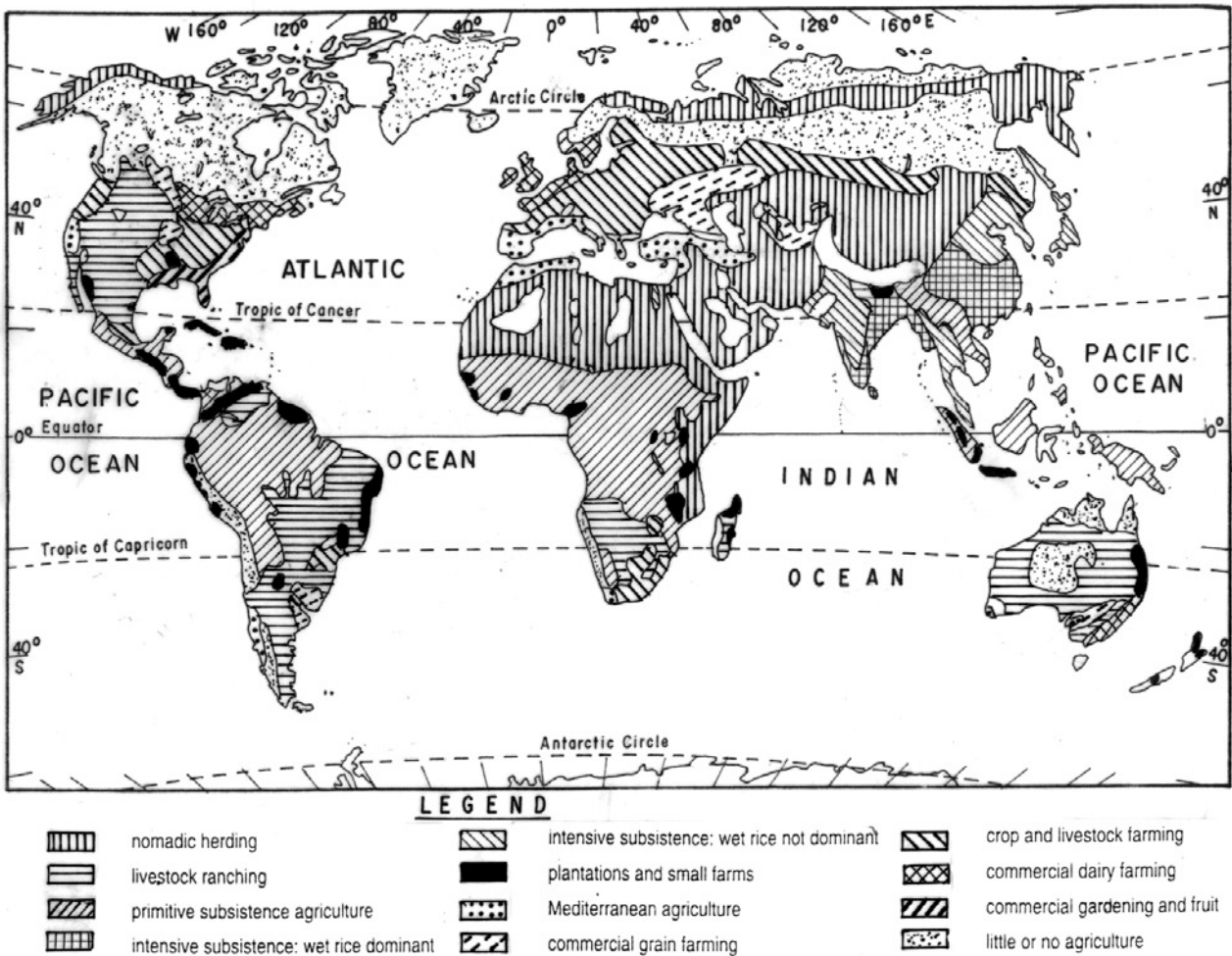
The above mentioned regions have been simplified in Fig 5.10.

Assessment of the factors selected for the above classification seems to be subjective rather than quantitative. In spite of this, Whittlesey's classification provides the foundation for latter attempts in this direction.

On the basis of the main characteristics of the farming practices and the production characteristics, agricultural systems of the world can be broadly grouped into subsistence agriculture and commercial agriculture, though the distinction between the two, at times is quite blurred.

**Subsistence Agriculture**

It is the most widespread form of agricultural production. It is a way of life for almost half of the world's population i.e. some 2.9 billion people. In most of the developing countries, food production is so important that a majority of the people in the work force are subsistence farmers. The sole objective of the farmer is to sustain her/his family. Typically, the production units (farms, fields or livestock



**Fig. 5.10** World : Major Agricultural Regions

herds) are small and relatively self sufficient, so that in good years basic needs of the family are met leaving a small surplus for storage or trade. Three traditional subsistence systems are : nomadic herding, shifting agriculture and intensive subsistence agriculture. We have already discussed nomadic herding and shifting agriculture earlier. Here, we will look at the main characteristics of the intensive subsistence agriculture.

More than 2.4 billion people are supported by intensive subsistence agriculture. In the densely populated countries of Monsoon Asia such as India and China, it provides the economic base. It produces relatively high yields per unit of agricultural land as a result of heavy input of labour. Rice is the principal crop in areas with long, warm and rainy growing seasons. Wheat, upland rice and other grains are the staple crops in the regions having cooler and drier climates. The specialisation of crops is not possible because the farmers like to grow as many crops as required by the household and are possible to be grown. *Multiple cropping*, which produces two or even three crops in a year on the same field is, therefore, common especially in areas where soils and climates (temperature and rainfall) are most favourable. Such intensive food production is also illustrated by vegetables and fruits, *intercropped* or grown along paddy dykes and by fish raised in the flooded rice fields. Poultry, cattle and other livestock are also raised as they are required by the household. Over the last two decades or so, the productivity has increased significantly in those areas where hybrid varieties of rice and wheat have been adopted. In addition, with the use of chemical fertilisers, pesticides, insecticides, and irrigation facilities, the traditional subsistence form of agriculture in certain areas has developed some characteristics of commercial agriculture.

### **Commercial Agriculture**

In contrast to the subsistence agricultural system, commercial agricultural system emphasises on specialised production of crops and livestock for sale. Most commercial farms

are relatively large. They utilise specialised machinery, seeds, fertilisers, and other products to increase production efficiency. Through commercial farming, a single farmer can produce enough food to feed a large number of people. As such less than 10 per cent of the population of developed countries are directly engaged in farming. For example, each US farmer produces enough to feed more than 60 additional people.

The production efficiency is realised in two ways. Improved inputs such as seeds, fertilisers and pesticides promote higher yield. Specialised machinery speeds up production and reduces the human labour required for cultivation, irrigation, harvesting and other farming operation. In the USA, agricultural output has doubled over the past half – century, while its agricultural work force has declined more than three times. At the same time the number of farmers has dropped from 6.5 million to just over 2 million, with less than 500,000 full time farmers today.

Reduction in the number of farms and farmers and increase in food production reflect the trend towards large size of farms, fields and livestock herds. It thus creates more savings in labour and production costs. The full time commercial farm in the developed countries is more like a business enterprise than a traditional way of life as in developing countries. Agricultural operations and management strategies must consider production costs and market prices that are driven by the interplay of economic, political and institutional forces at work in the national and global economies.

### **World Hunger, Malnutrition and Food Security**

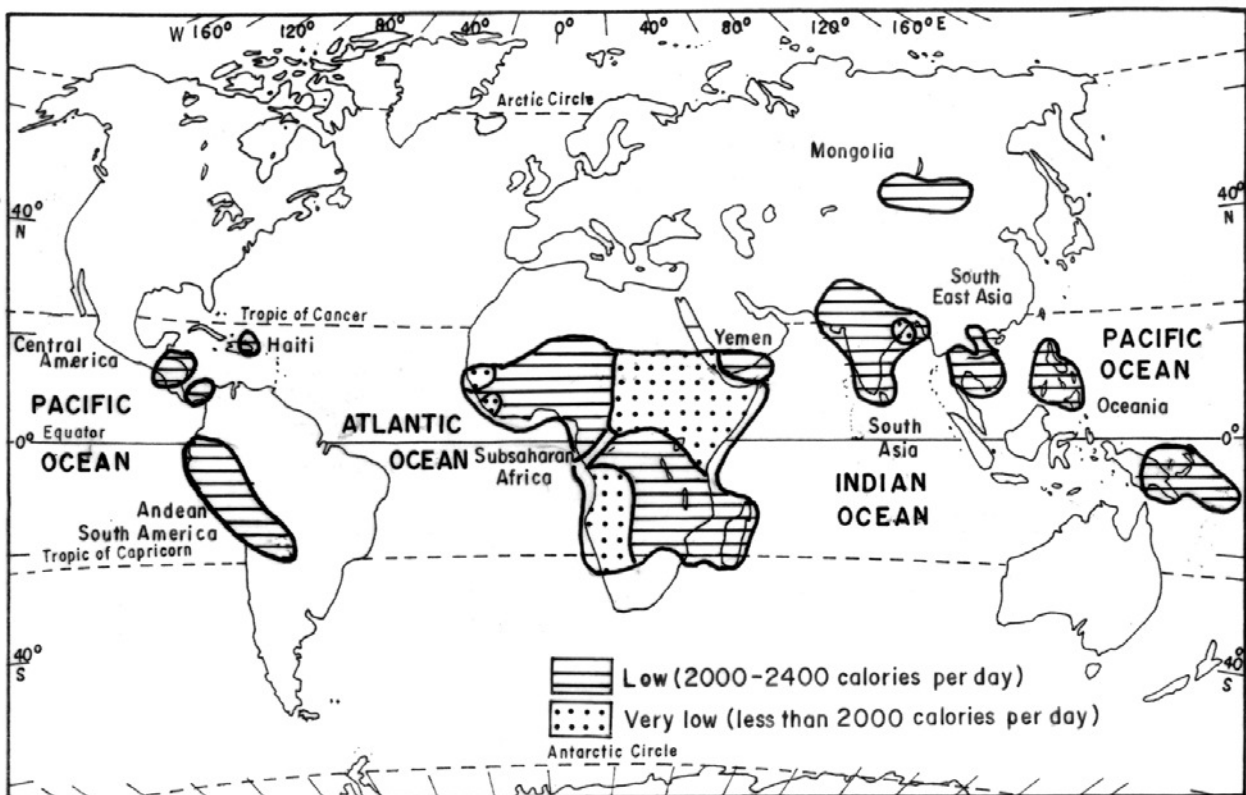
Despite significant increase in agricultural production, more than 1 billion people, about one out of every six persons suffer from chronic hunger and nutrient deficiencies. *Hunger* means that the daily diet does not provide the quantity and type of food needed to maintain health, normal growth and productive work. For estimating global hunger, four indicators are used: starvation, undernutrition; micronutrient deficiencies; and nutrient

depleting diseases and parasites. Widespread starvation most often occurs as a consequence of *famines* — the acute shortage or absence of food within a region due to crop failure or destruction or by withholding or blocking food shipments into a country or a region. Although famines are associated with widespread crop failure, most are the result of social or political processes that disrupt traditional agricultural production strategies. *Food security* refers to the access by all people at all times to the food required for a healthy life.

In Sub-Saharan Africa in the 1970s and 1980s, famines caused widespread sufferings and deaths. These famines were associated with recurrent droughts and subsequent failure of crops and lack of forage for livestock. Changes in the traditional agricultural practices prompted by the government policies to increase production of non-food crops for export, resulted in the shortfall of the subsistence food crops for local consumption during the string of dry years. Besides, the

ongoing military conflicts and civil unrest in some areas aggravated the famine situation further. As a result, hundreds of thousands starved in Sudan, Ethiopia, Somalia, Angola and Rwanda. Today, about 15-35 million people are at the risk of starvation in any given year.

In Fig. 5.11, areas affected by malnutrition and hunger have been shown. Why are so many million hungry and malnourished when there is more than enough food produced in the world each year, and which is adequate to feed everyone? There are a number of social, economic, political and environmental reasons. War, the ownership of land and the structure of agriculture, commercialisation, poverty, the geography of food production and food aid are some of the important reasons. The hungry throughout the world have one common trait that they are poor. The landless and unemployed do not have means or money to acquire food. Commercialisation is aimed at exports, rather than providing subsistence food



**Fig. 5.11** World : Hunger and Malnutrition

for the local people. It also means growing non-food crops having more market value in place of traditional food crops. The poor obviously cannot compete for food in the global market place.

The world's food supply is unevenly distributed. Only a few regions produce large grain surpluses — North America, Western Europe and Australia. These developed regions sell their grains at world market price. The poor developing countries hardly can afford to buy grains at the world market prices. Only a small fraction of the grain entering international trade is given as *food aid*. It is often provided to suit the foreign policy rather than given where and when it is needed most. For example, in 1980s when Sub-Saharan Africa was struck by the famine, USA shipped nearly four times more food to its political allies — Central American countries than the entire famine-ravaged Africa.

Grain stockpile is often used as a measure of *food security*. The fast rate of growth in food production started with the introduction of the hybrid varieties of rice and wheat to subsistence agricultural economies, nearly 50 years ago. It ushered an era of green revolution. It has now started slowing down. Since 1990, world grain yields have risen only about 0.5 per cent annually compared to over 2 per cent annually between 1950 and 1990. As a result, the stock pile of grain has declined. New strategies are, therefore, required to improve the sustainability of food production and to increase food security.

Most likely the greatest potential for expanding food production will be in the areas that already are the granaries and bread-baskets of the world. Plant breeders are currently exploiting the long over looked genetic resources of seed banks –repositories

that contain more than 6 million varieties of the seeds of some 100 crop species and their wild ancestors. One such experiment in China has produced rice varieties that may yield 20-40 per cent more than current hybrids by using genes from uncultivated rice varieties.

New strategies also focus on the most efficient use of the limited resources coupled with the traditional intercropping method that have sustained land productivity for centuries. It is advantageous both environmentally and economically compared to monoculture i.e. single crop cultivation. Sharing of certain crops enhance soil fertility, control soil erosion and increase the crop yield. Besides, the risk of total crop failure is also reduced. In areas of shifting agriculture, *agro-forestry* and nutrient recycling increase the productivity of the soil. For example, in Sahel region of Africa, shifting cultivation system is being modified to an agro-forestry system in which nitrogen-fixing acacia tree are intercropped with traditional millet and sorghum crops. The trees improved the productivity of the soil in several ways. Similarly nutrient-recycling cropping system has been developed in the Peruvian-Amazonian region to suit its infertile acid soils. High-yielding acid — tolerant rice and nitrogen-fixing cowpea varieties are rotated without fertilisers, lime or tillage. Crop residues are returned to fields and human labour is used to control weed. After several satisfactory harvests, a cover of tropical Kudzu (a local plant) is planted to choke the invading weeds. After one year, this cover is buried and the nutrients of soil are restored.

In recent years, genetic engineering has systematically altered the genetic structure of plants and animals. It is still in the early stages of development and it is difficult to assess its impact on human society.

## EXERCISES

### Review Questions

1. Answer the following questions briefly:
  - (i) Why is agriculture the most important primary activity?
  - (ii) Which factors impose limits on crop cultivation?
  - (iii) Name the five staple food crops of the world?
  - (iv) Which of the staple food crops has the highest average yield?
  - (v) Why are tea plants grown on hill slopes?
  - (vi) Which criteria were used by D. Whittlesey to classify agricultural regions of the world?
  - (vii) What is food security?
2. Distinguish between :
  - (i) Shifting cultivation and sedentary agriculture;
  - (ii) Subsistence and commercial agriculture;
  - (iii) Hunger and malnutrition.
3. Give reasons:
  - (i) Rice is a labour intensive crop.
  - (ii) Wheat is the most widely grown cereal.
  - (iii) Although the USA produces about half of the world's maize, 80 per cent of it is not directly used for human consumption.
  - (iv) Despite being deficient in protein and minerals, cassava is a staple food of a large number of people in South-east Asia, Central Africa and South America.
  - (v) Cloudless sky is essential for the cotton plants at the time of ripening.
  - (vi) World food production is enough to feed everyone, yet there are millions of people hungry and malnourished.
4. Discuss the major trends and shifts in agricultural development process.
5. Explain how physical environment affects the crop distribution pattern in the world.
6. Classify crops on the basis of their uses. Explain why only a few varieties of plants domesticated several thousands years ago still continue to be the major food sources.
7. Describe the geographical conditions necessary for the cultivation of wheat and rice in the world and their distribution pattern.
8. Discuss the geographical condition of growing tea and coffee and their distribution pattern.
9. Describe the major agricultural regions of the world.
10. Discuss the problem of hunger and malnutrition in the world and the ways of ensuring food security.

### Geographical Skills

11. Study Fig.5.1 and answer the following :
  - (i) Which crops can be grown only in a very narrow zone and why?
  - (ii) Which crops can be grown widely and why?
  - (iii) Name the crops which are grown mainly in the tropical regions.
  - (iv) Name the crops grown mainly in the temperate regions.

# 6

## CHAPTER

## SECONDARY ACTIVITIES — MANUFACTURING

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**W**ith industrial revolution, the use of inanimate power by harnessing the energy of water, coal, and petroleum brought tremendous changes in the primary sector. It helped in the evolution of large manufacturing system, which utilised products of the primary sector and hence, called secondary. Production of raw materials for both domestic and industrial uses grew. As a result, the purchasing power of the people engaged in primary activities increased and it led to the growth in the demand for manufactured goods. It thus, promoted growth of the secondary activities.

At the outset, it would be useful to explain what do we mean by the terms 'industry' and 'manufacturing'. We, very often, use terms like film industry, fishing industry, steel industry and tourism industry, but each of these represents a different kind of economic activity. However, geographers usually use the term 'industry' to describe those activities which are concerned with processing, fabricating and manufacturing of primary products obtained from agriculture, forestry, fishing and mining. Industry is called a secondary activity to distinguish it from primary activities.

*Manufacturing* literally meant 'making by hand', but now it also includes goods made by machines. It is a process, which involves transformation of raw materials into finished goods of higher value. For example, cotton is an agro-product. It is used as a raw material in the manufacture of cotton textiles, which may further be transformed into garment. Cotton textiles and garments are products of manufacturing.

The United Nations defines *manufacturing* as 'the mechanical and chemical transformation of inorganic or organic substance into new products, whether the work is performed by power-driven machinery or by hand, whether it is done in a factory or in the worker's home, and whether the products are sold wholesale or in retail.' This is, however, a very broad definition. Usually modern *manufacturing industry* is characterised by complex organisation, specialised labour, use of machinery and inanimate power and mass production.

### CLASSIFICATION OF INDUSTRIES

Industries can be classified in many ways: size, nature of products and raw materials, and ownership.

#### Classification by Size

The amount of capital invested, number of people employed and the volume of production determine the size of an industry. Accordingly, industries may be classified into the following groups: cottage or household, small scale and large scale industries.

*Cottage or household industries* are the smallest manufacturing units. The craftsmen or the artisans with the help of their family members manufacture goods within their homes using local raw material and simple tools. The skills of production are passed on from one generation to the other. The scale of operation is small. The tools and equipments are ordinary. The goods produced are generally, sold locally. Thus potters, carpenters, weavers and blacksmiths produce



goods in the household sector. In many countries of Asia and Africa, this sector is quite important and some of the handicraft items are in great demand in the developed countries.

*Small scale industries* are differentiated from the former by the technique of production. They use modern power driven machines and employ labour as well. The raw materials are also obtained from outside, if not available locally. These industries are larger in size than cottage industries. Their products are sold through traders beyond local markets. In many developing countries, the role of these industries are crucial as they provide employment to a large number of people. In countries like India and China, a large number of goods such as clothes, toys, furniture, edible oil and leather goods are produced by small scale industries.

*Large scale industries* include mainly heavy and capital intensive industries, which use heavy machineries, employ large number of workers and produce goods for a bigger market. The management is hierarchy-based and complex. Emphasis is laid on quality control and production specialisation. Such industries require a very large resource base and hence, raw materials are obtained from various places. The production of goods is also on a large scale, which is sent to distant markets. These industries, therefore, require good infrastructure facilities such as roads, railways, and power supply. Iron and steel industry, petro-chemicals, textiles and automobiles fall under this category.

Some geographers prefer to divide manufacturing industries on the basis of size of operation and the nature of products together. Accordingly, there are two classes. *Heavy industries* are of large-scale. They deal in bulky products and are heavily dependent on the raw materials and hence, tend to be located near the source of raw material e.g. iron and steel industry. *Light industries* are usually small-scale in operation. They deal in lighter and compact products. For them, accessibility is the most important factor. The electronics is one example of this kind.

### **Classification by Outputs**

Industries whose products are used to produce other goods are called *basic industries*. Iron and steel industry is one of the basic industries because steel produced by this industry is used in many other industries as a raw material. Some basic industries produce machines which are used to produce other goods.

Industries which produce goods for direct consumption such as tea, bread, soap and television are known as non basic or *consumer goods industries*.

### **Classification by Inputs**

Depending upon the raw materials used for the industries, they may be classified as agro-based, forest-based, mineral-based industries, and chemical industries.

*Agro-based industries* are those which utilise agricultural products as raw materials. Cotton Textiles, tea, sugar and vegetable oil industries are its examples. *Forest-based industries* are those which utilise forest products as raw materials e.g. paper and furniture industry. *Mineral based industries* are those which use minerals as raw materials. Industries based on metals are known as *metallic industries*. These are further divided into ferrous and non-ferrous industries. Industries based on metals having iron content are called ferrous industries e.g. iron and steel industry. On the other hand, industries based on metals without iron content fall into the category of non-ferrous industries e.g. copper and aluminium. Industries based on chemicals are called *chemical industries* e.g. petro-chemicals, plastics — synthetic fibres and pharmaceuticals. Some of these industries use raw materials found naturally e.g. minerals such as mineral — oil, salts, sulphur and potash, and vegetable products. Some chemical industries use the by-products of other industries.

### **Classification by Ownership**

On the basis of the ownership pattern and management practices, industries can be classified into government or public, private

and joint sectors. When the ownership and management of an industry is in the hands of the state, it is called a *public sector* industry. The state establishes and runs these units. Industries owned and managed by an individual or a corporate body belong to the *private sector*. Individuals invest their own capital to establish these industries and they manage them as private enterprise. Sometimes individuals join together under partnership to establish industries. The share of partners, both in the capital investment and profits, is pre-decided. Industries are also established by corporations. Such a body is formed by individuals or organisations to fulfill pre-determined objectives and goals. Capital for the industry is collected by selling shares. The large multinational corporations such as Pepsi, Hindustan Lever and General Electric have set up industries in several countries across the globe. An industry own and managed jointly by the state and private initiatives falls in the *joint sector*.

### **THE LOCATION OF INDUSTRY**

The location of industry at a particular place is governed by many factors. Traditionally, these were grouped under geographical and non-geographical factors. While geographical factors included relief, climate, raw materials, energy sources, labour market and means of transportation, non-geographical factors comprised of governmental policies, capital, market and management.

This view is highly deterministic because location cannot be explained in absolute terms. For example, the location of cotton textile in Lancashire (UK) cannot be explained only in terms of the presence of the humid climate, soft water, abundant coal and the position of Liverpool in the Atlantic trade. Similar conditions were present at many other places including South Wales. Lancashire, therefore, had the relative rather than the absolute advantage of time and space. To get over this shortcoming, industrial location is now explained in terms of factors associated with assembly, processing and distribution, government policies, environment, industrial inertia and the human factor. These factors do

not operate in isolation, but in a complex system of interrelationships. The relative importance of these factors varies with time, space, type of industry and also the economy. It is important to remember that not all factors at a particular time are favourable, and that most of the good locations have been those where the number of favourable factors have outweighed the unfavourable ones. In fact, an optimum location is a relative term.

### **Assembly, Processing and Distribution Factors**

A number of factors associated with the assembly, processing and distribution of materials and products are crucial in the location of an industry.

### **Distance**

It is one of the most important factors explaining the location of industries. It is not simply a question of physical distance in terms of km, although it is not unimportant. It is a question of cost and time involved in moving goods. It is, therefore, appropriate to talk in terms of *economic distance*, which is determined by the mode of transport, the type of commodity and freight rates. The prime concern of a manufacturer is to reduce the economic distance and hence, transport plays a crucial role in location of industries.

### **Raw Materials**

All industries use *raw materials* which should be available economically. In early times, location of industries was tied to the location of raw materials. With improvements in transportation and handling facilities, the movement of raw materials has become easier. Industries are becoming more and more specialised and complex. As a result, fewer and fewer firms are directly based on crude and bulky raw materials. In countries like USA and Japan, most of the manufacturing industries use semi-produced products. Technological advancements have intensified the use of raw materials by reducing waste in manufacturing and also improving them at the source itself so that they can be easily transported.

Nevertheless, there are certain industries in which raw materials play an important role. For example, industries which lose either bulk or weight in the manufacturing process such as copper smelting, or in industries where the raw material is perishable such as fruit canning, the processing takes place near the raw material.

### **Energy Sources**

Historically, *energy sources* have had considerable effect on the location of industry. Even today there is a strong correlation between industry and coalfields. Industries using large amount of energy such as electro-chemical and electro-metallurgical industries, are still located near the sources of electricity generation. But it is declining in importance as a location factor because fuel efficiency has been improving considerably. While in the eighteenth century, more than 8-10 tonnes of coal were required for smelting 1 ton of pig iron, today less than 1 ton is needed. Besides, development of electric grids, and oil and natural gas pipelines has made the energy source as a locational factor less important.

### **Water**

It is used in most industrial plants for processing, steam raising or cooling. As such, water supplies both in terms of quantity and quality, are important in considering the location of industry. Water requirement of industries varies considerably. While some need more such as iron and steel industry (200,000 litres to produce one ton of steel), others like electronics need less. Yet, shortage of water in an area can be a serious deterrent for locating an industry.

### **Access to Labour Market**

It is also an important locational factor. Differences are found not only in the quantity of labour available but also the quality of labour as represented by the skills that an area can offer. For example, diamond cutting and polishing need skilled workers. It explains the concentration of diamond cutting and polishing in Surat (India).

### **Access to Good Management**

It is an important factor in the choice of sites. For example, it is vital to know whether the selected site will be able to attract good managers.

### **Capital**

It is yet another important locational factor because it is less mobile internationally. Unstable areas with high risk and uncertain returns are likely to be less favoured. However, with the development of banking services money capital has become much more mobile within a country.

### **Government Policies**

Governments encourage or restrict developments in certain areas. Economic and social considerations are important factors influencing the government's decision. It is the duty of a government to ensure that the country's resources are used to the best advantage and that there are no great inequalities in the distribution of wealth. Similarly, political and strategic considerations also have strong influence on industrial location. In order to reduce regional imbalances, many countries and regions demarcate certain areas for location of industries.

### **Environment**

Physical attraction of an area is an important factor. Congenial living conditions are preferred while setting up industries. For example, in the USA, the aircraft industry has moved to the southwestern part of the country because of climatic advantage. Due to warm climate, hangar heating costs are less in this region.

### **Industrial Inertia**

Many industries remain at a particular location even after the disappearance of initial advantages. Availability of infrastructure facilities such as transport and services, and immobile physical capital such as building encourage inertia and new industries are attracted. Some industries are location leaders,

either because they provide raw materials for other industries, or because they require specialist firms to supply parts.

### **The Human Factor**

Among several considerations, the ultimate decision is taken by the humans. Their personal choices thus, influence locational decisions.

### **Some Major Industries of the World**

Manufacturing contributes significantly to the world economy. More than fifty per cent of the world's total manufactured goods is shared by the USA, Japan and Germany (Fig 6.1). Iron and steel, textiles, automobiles, petrochemicals and electronics are some of the world's most important manufacturing industries. We will be examining the distribution pattern of the iron and steel and petro-chemical industries.

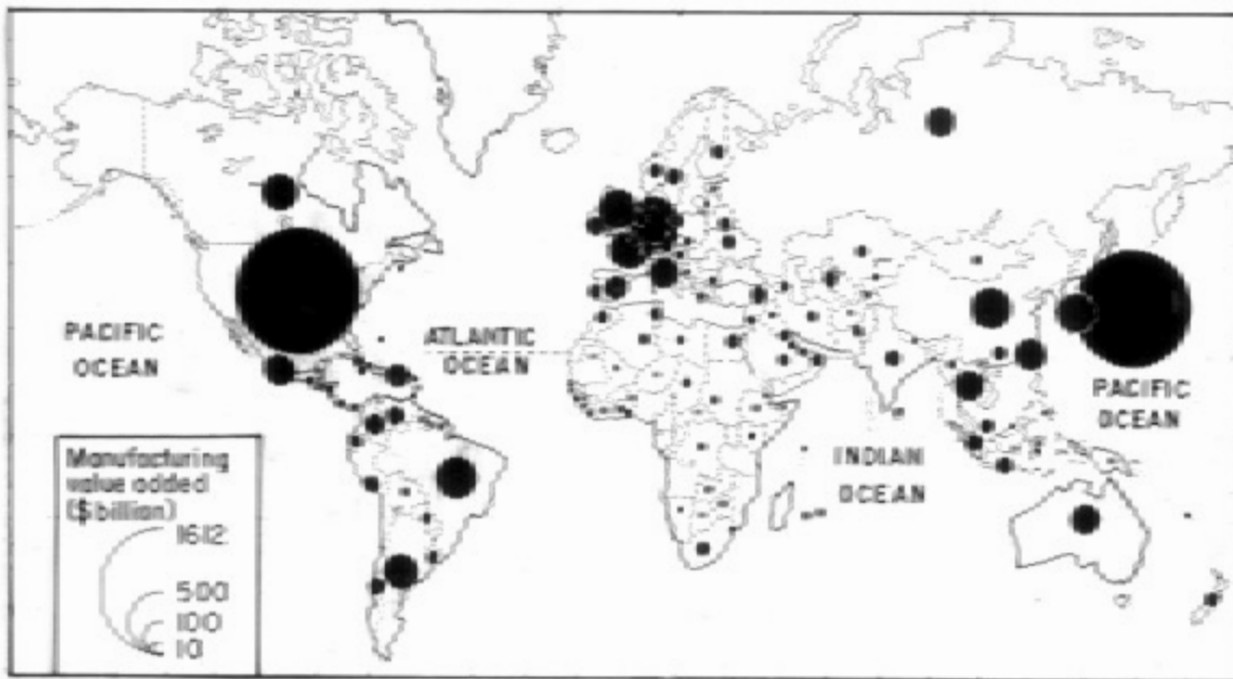
### **Iron and Steel Industry**

Iron is a relatively dense metal having distinctive magnetic properties. It is one of the most abundant metal on the earth, but is rarely

found as a free metal. It is extracted from the iron ore by smelting the ore with carbon (coke) and limestone in a blast furnace.

The molten iron, after being separated from the ore, is either cooled and moulded to form pig iron or is used for making steel. Iron, in its pure form is soft and generally not useful as an engineering material. By adding small amount of carbon (upto 2 per cent) and other strengthening elements such as nickel or manganese, it is converted into steel, which is very strong and malleable. It enhances its utility, making it the most widely used material for building the world's infrastructure and industries. It is used to fabricate everything from sewing needles to rail sheets, tubes, wires, huge machines and tankers. Its importance can be assessed from its production which is around 800 million tons, while the production of the next most important engineering metal, aluminium is about 20 million tons.

The iron and steel industry provides the base for all other industries and, therefore, it is called a basic industry. It may also be called a heavy industry because it uses bulky raw materials in large volumes and its products are also heavy.



**Fig 6.1** World : Distribution of Manufacturing

The industrial revolution led to a fast development of iron and steel industry because of the relative low cost of the metal and the wider utility as an engineering material. Since the industry was based on heavy and bulky raw materials — coal, iron ore, manganese and limestone, this industry developed mostly in and around the mining areas, or at a place where the raw materials could be easily brought.

The Great Lakes region and the Atlantic coast in the United States; the northern, north-eastern and central parts of the UK; France — Belgium, Lorraine — Luxemburg — Saar and Ruhr in Western Europe; Ukraine; the Ural region of Russia, and the Chhotanagpur region in India are some of the important iron and steel producing areas of the world. The location of the industry in these areas is attributed mainly to the presence of important mineral ores.

In advanced economies, traditional industries such as iron and steel are declining very fast. Manufacturing employment centring around iron and steel reduced by about 1,30,000 jobs during 1956-82 and coal mining by 1,20,000.

### ***Petro-Chemicals Industries***

Along with the refining of mineral oil, a large number of industries based on petroleum have developed around these centres which utilise the infrastructure facilities available there. Generally, such complexes are huge and they are located near the market or the ports. Fertilisers, plastic and artificial fibres such as rayon are some of the common industries located near the mineral-oil refineries.

The development of petro-chemical industries has taken place in North America and Europe after the World War II. Most of these complexes in the USA are located near the coast as oil is mostly imported from Latin American countries and West Asia. Mineral oil is transported through pipelines and tankers to inside locations. Chicago, Toledo, Philadelphia, Delaware and Los Angeles have large petro-chemical complexes.

The European petro-chemical complexes are located mainly near the market. The major

complexes are located on the coasts of southern North Sea and English Channel (Antwerp, Rotterdam and Southampton), Ruhr region in Germany, and Le Havre-Roven-Marseilles region in France. There are a number of petro-chemical complexes in the Central Asian Republics, Russia, West Asia (Abadan in Iran, Ras Tanura in Saudi Arabia and Mina-el-Ahmadi in Kuwait), and in India (Trombay, Vadodara and Bongaigaon).

### **Changing Trends**

Locational factors, discussed earlier are not equally significant for all industries. Over the years these factors have become less and less important especially in industrialised developed world. Energy and materials efficiency through waste avoidance, recycling, substitution and alternatives in recent years have contributed positively towards enhancing environmental sustainability in these regions. Logging, mining and heavy industries like iron and steel are already far less important today than they were once for economic growth.

Modern industrial activity and its spatial distribution has changed in many ways. It can be understood better in the context of the development process. W. Alonso (1980) talked of 'five bell shapes in development'. He observed that during a period of development several features moving in the same direction rise to a peak and then subside. These features are : (a) the economic growth rate; (b) the level of social inequality; (c) the level of regional inequality ; (d) the level of spatial or geographical concentration (urban-industrial growth in a few centers); and (e) the population growth rate in demographic transition. All these five features do not rise and fall simultaneously, though they are interconnected. According to him geographical concentration was the first process followed by economic growth and then by social and regional disparities.

As such, concentration has a positive value in the process of development. With the progress of economy and scientific and technological advancements, structure and form of industries change. For example, textile industry in Federal Republic of Germany

### **Deindustrialisation**

*Deindustrialisation* is the term given to the decline in manufacturing industries both in term of employment and industrial output. Deindustrialisation in the developed countries has resulted from:

- machinery replacing people in most manufacturing industries;
- competition from countries abroad producing manufactured products at much cheaper prices;
- prices of products being too high, due to low labour productivity (output per person) and a lack of investment in new machinery;
- highly qualified people preferring jobs in the tertiary and quaternary sectors;
- high interest rates making products expensive to be bought abroad.

witnessed constant growth since World War II till late seventies. It declined with the shift of whole textile industry to less developed countries where labour costs were low and labour laws were less rigid.

Accordingly, industries with sophisticated parts are kept in advanced countries and those with low technology, labour-intensive units are exported to poor countries. This kind of change observed by the early eighties was known as 'new international division of labour'. This meant that while there was a continuous technological change and new industries were in the centre, some less demanding industries could be located in the periphery. If, in the past, Germany made steel and Brazil produced iron ore for it, now Brazil might make steel and Germany would work these into engineering products such as cars.

The other change is noticed in terms of large factories giving way to smaller units dispersed over a large area. Some of the nineteenth century factories were spread over very large areas and they employed several thousands people e.g. Douglas's Long Beach aircraft plant employed 100,000 and steel mill complex at Tienshan, China held over 200,000 workers.

Instead, mini steel plants are in vogue today.

New trends can be observed for certain kinds of industrial production which are organised in more flexible ways. There are two broad types of flexibility: flexible production and flexible specialisation. Both of these allow smaller volumes of production to be handled economically, enabling rapid changes in matters such as design or even the process used in manufacturing. It is popularly known as 'post-Fordism' in advanced countries of the world, which is in contrast to 'Fordism'. Henry Ford endorsed the use of mass production lines, the excessive division of labour and the manufacture of highly standardised products in developing the North American car industry. It served as a model for many industries for a long time, and was known as 'Fordism'.

*Flexible production* involves the use of automation in order to be able to programme designs and rapid changes of design (computer-aided design or CAD). The machines used in manufacturing may be computer controlled and hence, flexible. One well-known form of flexible production is the system entitled 'Just in time'. Components are not stocked at the factory but brought in from

### **Reindustrialisation**

*Reindustrialisation* refers to the growth of some sectors of new industries in places and areas where classical industries have declined. Reindustrialisation in highly developed countries has the following characteristics:

- the growth of high-technology firms — these are firms that produce very advanced products with a great deal of scientific research and development e.g. pharmaceuticals and micro-electronics;
- such new firms that set up manufacturing often having only a small, highly skilled labour force;
- the new firms are located in the less industrialised areas or peripheries of the metropolitan cities.

near by factories on demand to meet the requirements of production for the next few hours. Toyota car manufacturing plant at Toyota City is a typical example of this kind of production.

The system has the advantage of little waste, since faulty products may be identified immediately and their supply stopped. Quality control is, therefore, easy. Besides, flexibility of output, in types and quantities and low inventory cost are other advantages. Such a system clearly depends on a closely linked network of factories, with good transport and communication links.

Such a system has a definite spatial form with subsidiaries and support activities constituting a kind of industrial district.

In recent decades the Japanese model has been transferred to other countries. In order to establish a new work pattern and work ethic, new industrial space adjacent to old industrial belts are preferred. In the USA, for example, industrial relocation by General Motors, Ford and Chrysler to outer Mid West has become an important feature. However, Toyota pattern is not being followed by all companies. Many countries specialise in the production of components which could be put together in a number of final assembly plants.

While flexible production is related to

vertical linkages i.e. first level producers of components to second — level assemblers, *flexible specialisation* refers to a more complex, horizontal inter firm network of linkages. In this system, many firms in one kind of industry are involved in the production of specialised items. Further flexibility in such a system is endowed by moving the work amongst the different specialist firms. If a normal run of business is disrupted by a sudden demand for a large quantity, flexibility in cooperation allowed the contracting firm to share the order with several firms in the same business, or to subcontract some of the business to outside firms.

### ***New Industrial Spaces***

In past few decades, high-technology activities are expanding fast. Highly sophisticated products are developed involving a great deal of scientific research and development. These industries improve their products very fast to suit the market demand and employ highly skilled labour. Such industries are referred to as *footloose industries* as they have relatively free choice of location.

The growth of some industries has been explosive. Employment in computer software in the United States has increased about four times during 1970-2000.

#### **Footloose Industries — Factors that Favour Free Choice of Location**

- light industries that often do not use raw materials but component parts;
- power requirements, usually only electricity — available from the national grid;
- end product is small and often cheaper and easier to move;
- employs a small labour force;
- non-polluting industries which can be located near residential areas;
- accessibility; needs to be near a road network.

#### **Examples of High Tech Industries**

##### **Electronic Equipment**

- computers;
- telecommunicators;
- industrial control system;
- testing and measuring equipment;
- office equipment;
- aerospace and military equipment;
- incorporation in consumer products, e.g. automobiles, washing machines, ovens, etc.

##### **Consumer Electronics**

- colour and monochrome television receivers;
- radio receivers;
- video cassette recorders;
- audio-tape recorders;
- record players;
- hi-fi equipment (tuners, amplifiers);
- pocket calculators;
- electronic games.

### **Technopoles**

The locational impact of these high-tech activities is already emerging in advanced industrialised countries. The most noticeable phenomena is the emergence of new technology — oriented complexes or technopoles. A *technopole* is a planned development within a concentrated area, for technology innovative, industry related production. Technopoles include science or technology parks, science cities, and other high-tech industrial complexes.

*High-tech Industrial — States and Technology Parks* : Footloose industries tend to be attracted to purpose — built industrial estates or technology parks on the edge of towns and cities as is the case with London or Tokyo. These places offer a number of advantages over inner city locations:

- space for single-storey factories and future expansion;
- cheaper land values on edge-of-city;
- accessibility to main roads and motorways;
- pleasant environment (often located on a greenfield site);
- labour supply from nearby residential areas and commuter village.

*Silicon Valley — A Technopolis* : The silicon valley is located in the north - western part of Santa Clara County of California. In 1930s, F. Terman, a professor and later, Vice-President of Stanford University at Palo Alto encouraged his students in electrical engineering to

establish their own companies. One of the first companies was set up by William Hewlett and David Packard in a garage near the University campus. Today, it is one of the world's largest electronic firm. By the end of 1950s, at the persuasion of Terman, Stanford University developed a special industrial park for such new high-tech firms. It created a hot house of innovation and generated a significant specialised work force and producer services. It has sustained the continued agglomeration of high-tech electronics and has also attracted other high-tech industries. For example, nearly a third of all employment in biotechnology in the USA is located in California. Of this, over 90 per cent is located in the San Francisco Bay area. Stanford University has been receiving increasing amount of donations from grateful companies, which runs into millions of dollars annually.

The linkage between the research in universities and high-tech activity is key to the success of these industries. While the new industries thrive on a symbiotic relationship with one another and university research departments, key workers also tend to favour technology complexes associated with top ranking universities. It provides them a job market and abundant socio-cultural activities. It soon acquires a reputation as 'the right place to be'.

Such techno-poles have also emerged in other countries. But except Germany, most of them are centred around big metropolitan cities such as London, Paris, Milan Tokyo, Shanghai, Taipei, Moscow, Singapore and Sao Paulo.

## **Exercises**

### **Review Questions**

1. Answer the following questions briefly:
  - (i) What are secondary activities and why are they called secondary?
  - (ii) What are manufacturing industries?
  - (iii) What are the bases of classifying industries?
  - (iv) Give two examples each of basic and consumer industries.
  - (v) Why iron and steel industry is considered a basic industry?
  - (vi) Why petro-chemical complexes in the USA are located mostly on the coast?
  - (vii) What is a technopole?



2. Distinguish between:
  - (i) Cottage and large scale industries;
  - (ii) Metallic and non-metallic industries;
  - (iii) Deindustrialisation and reindustrialisation;
  - (iv) Flexible production and flexible specialisation.
3. Write short notes on the following:
  - (i) Small scale industry;
  - (ii) Silicon Valley.
4. Discuss the major factors influencing the classical location of industries.
5. Describe the distribution of iron and steel and petro-chemical industries in the world.
6. Discuss the major trends of the modern industrial activities especially in advanced industrial countries.
7. Explain why high-tech industries in many countries are being attracted to the peripheral areas of major metropolitan areas.

**Geographical Skills**

8. With the help of an atlas, locate the following places on an outline map of the world:
  - (i) the iron and steel centres in the Great Lakes region,
  - (ii) the petro-chemical complexes at Antwerp, Rotterdam and Southampton
  - (iii) the Silicon Valley

# 7

## CHAPTER

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## TERTIARY AND QUATERNARY ACTIVITIES

As discussed earlier, *tertiary activities* revolve round the intangible outputs which encompass a diversity of services ranging from that of a technician or a plumber to that of a restaurant chef or a lawyer, a teacher or a computer operator. Services are usually defined as 'activities,' which are relatively detached from material production and hence, are not directly involved in the processing of physical materials. Thus, they stand in contrast to manufacturing, the product of which can be seen in the form of goods. But how can we measure the output of a plumber or a lawyer? It is impossible to measure these outputs except indirectly in terms of wages and salaries. However, there are some services, which can generate tangible output e.g. a fast-food franchise. Nevertheless, measuring outputs in services in general cannot be based on nature of output. The main difference between manufacturing and service products thus, seems to be that the expertise provided by services relies much more directly on work-force skills, experience and knowledge than on physical techniques embodied in machinery or process of production.

### SERVICES

Services are an important constituent of modern economic development, which include retailing and the sale of goods to the people, the provision of services of all kinds — education, health and welfare, leisure, recreation and business services. *Business services* refer to those services that enhance the productivity or the efficiency of other firms' activities or that enable them to maintain their specialised roles e.g. advertising, recruitment and personnel training.

This sector was not given as much attention earlier as was given to the production of goods. In advanced economies, service-based development has been very rapid. As statistical data show, employment shifts continuously into services in these countries.

In developing countries too, the service sector is growing faster than the manufacturing sector. Its contribution to national wealth is also increasing. But the services are still very poorly accounted because many people are engaged in unorganised services, often referred to as informal sector. The informal sector in cities offers employment to a large number of rural migrants, who are poorly paid especially if they are unskilled. Then, there are housewives and child labourers whose services are not accounted.

During the development process, a normal course of events takes place in most countries over a period of time. There is a transition from dominance of the primary sector, to the secondary sector, and in the later stages, to the tertiary and quaternary sectors. In some countries, there is a tendency to delay the decline of their manufacturing. Japan and Germany, for example, are still able to manufacture successfully for world markets from a home base. Even in such countries, the importance of manufacturing, in employment and also as a proportion of GNP, declines eventually. It is balanced by concomitant rise of the service sector. This deindustrialisation shift can be seen at the regional level too. In the USA, this decline was first observed in New England in 1950s and 1960s. Later in 1970s, the middle Atlantic States of Virginia, Maryland and Delaware were affected by this decline. The

industrial Mid-West faced it in 1980s. It is supposed to be a predictable process, which leaves behind a well of human skills, organisations and offices.

The growing importance of services has now given it an independent status as a productive sector in the economy. Instead of being an accessory to manufacturing or to the people at large, it is an exporter. The competitive advantage of some countries such as Switzerland and the UK, and of some regions or cities is in service provision.

Under the old thinking, there was a special geographical pattern of industrial locations, while services were distributed evenly matching population distribution. As such there was a precise geography of iron and steel making, but banking might be found in every market town even with a small population. These services also organised in a hierarchy, placing higher order services in the large city, and lower order services in small areas. There was little need for these services to agglomerate for interaction among themselves. Now, however, there are major concentrations of services. Some of them are catering to new industrial structures and needs such as advertising and marketing. They have distinctive spatial patterns. One of the most distinctive pattern is that of global cities, located in relation to the international economy. We will learn more about them later in this chapter.

The major components of services may broadly be grouped as the following:

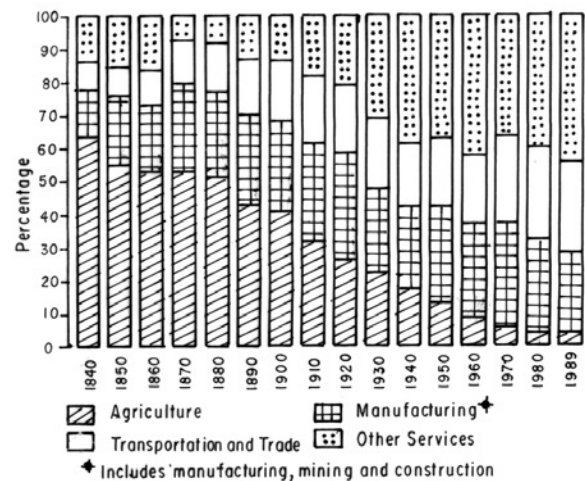
- (i) Business services include advertising, legal services, public relations, and consulting.
- (ii) Finance, insurance and real estate include savings and investment banking, insurance and real estate (commercial as well as residential).
- (iii) Wholesale and retail trading links the producers with consumers. Personal services such as maintenance services, beautician and repair work are also included in this.
- (iv) Transport and communications include railways, roadways, shipping and airline services and post and telegraph services.

- (v) Entertainment such as television, radio, film, and literature.
- (vi) Government at different levels — local, state and national includes bureaucracies, police and army, and other public services.
- (vii) Non-governmental agencies include those organisation which have been set-up by individuals or groups for charity on non-profit social activities concerning education, healthcare, environment, rural development etc.

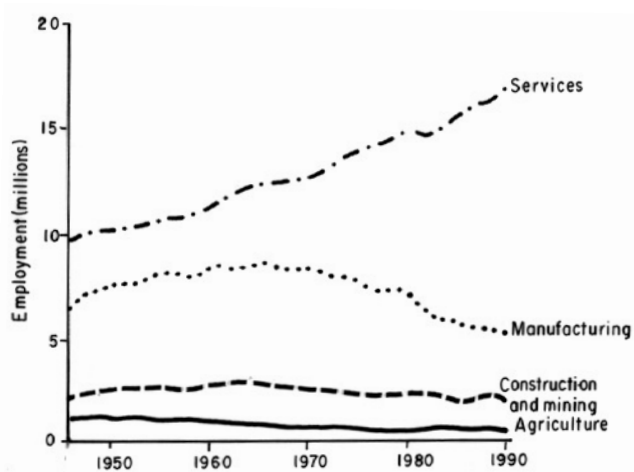
Employment in the service sector has increased steadily in the developed countries during the twentieth century despite low population and significant job losses in manufacturing (Figs 7.1 and 7.2). Compared to manufacturing sector, it employs large number of women. In general, the increase in the services employment throughout the world is attached to various reasons.

Rising per capita income in the developed countries has generated proportionately larger increases in the demand for many kinds of services especially healthcare, entertainment and transport. The increasing value of time has led to more household functions being accomplished outside the home.

Similarly medical services as a proportion of gross national product (GNP), have increased steadily in Europe, North America and Japan. It is mainly due to the changing demographic composition of the population in



**Fig. 7.1** Employment Shares by Economic Sector in the USA



**Fig. 7.2** *Employment Shares by Economic Sector in the UK*

highly industrialised countries. The demand for medical care is more from the elderly population. There is also a rise in demand for educational services at all levels with the increasing demand for literacy, mathematical and computer skills at workplaces.

The growth of services reflects the increasing proportion of non-direct production workers. Most manufacturing companies also need administrative set-up to collect and process information and make strategic decisions. As such clerical staff, sales people, researchers, advertisers, public relations experts, accountants, financial experts, and lawyers provide assistance in a complicated decision-making process.

Despite globalisation, liberalisation and privatisation, the size and role of the public sector has been increasing. The government is usually the largest employer because it provides innumerable services to the people such as defence, education, health, sanitation and law and order. In developed countries, rising levels of service exports within and among nations have also led to the growth of services. Many nations derive a substantial amount of their aggregate revenues from the sale of services to clients located elsewhere. Services are extensively traded on a global basis, contributing about 20 per cent of international trade.

### **Advanced Services, Information Flows and the Global City**

The information based global economy especially in highly industrialised societies, has given rise to specialised activities, which are fairly advanced. They include finance, insurance, consulting, information gathering, management of information services, as well as research and development, and scientific innovations, which are at the core of all economic activities. All of them can be reduced to knowledge generation and information flows.

Due to advanced telecommunication systems, it is possible for these activities to have a scattered location around the globe. Yet, they reveal dispersal and concentration simultaneously. While a number of activities are dispersing widely, those belonging to the upper tier still reflect concentration in few countries. In fact, there is a hierarchy between tiers of urban centres, with the higher level of functions in terms of both power and skill being concentrated in a few major metropolitan areas. For example, New York, London and Tokyo together cover the world for the purposes of financial trading and work largely as a unit in the same system of endless transactions. They jointly dominate in international finance, and in most consulting and business services of international scope.

Some of the services are managed from within the firm. Thus, some of the legal works, advertising or accounting are conducted within the firm, often at the head office or offices attached to it. This is indexed by the number of major firms that have head offices in specific cities. Among the top 500 biggest global firms, Tokyo is home to 34, New York to 59, London to 37, and Paris to 27. Mexico City, the world's largest city today, has only one such firm. There is no such firm in any Indian City.

As the global economy expands, new units join the system and new linkages get established. New regional centres of processing of service activities have emerged in the USA (e.g. Phoenix, Wichita), in Europe (Barcelona, Nice, Stuttgart), and in Asia (Mumbai, Bangkok, Shanghai). However, decentralisation

of such activities are concerned mainly with 'back offices'. It means mass processing of transactions that only execute the strategies decided and designed in the corporate centres and headquarters located in a few global cities. For example, within one country, the UK, of the top 500 company headquarters, 198 re-located within London. These activities employ the bulk of semi-skilled office workers, many of them replaceable as technology evolves. The significance of this spatial system of advanced service activities lies in the versatility of its network based on the information flow. The growing megalopolis of Hongkong – Shenzhen – Guangzhou – Zhuhai – Maccau is expected to be a major financial and business hub in the early twenty-first century in Asia.

### **QUATERNARY ACTIVITIES**

In recent years, economic activities have become much more specialised and complex. As a result, a new category called *quaternary* has come into use now. Activities concerning knowledge such as education, information, research and development (R&D) are recognised as a different class of services even among intangible outputs and hence, placed under this category. The term quaternary basically refers to the 'more intellectual occupations, whose task is to think, research and develop ideas'. As such, this sector is especially concerned with research and development. In the most economically advanced nations, the quaternary activities involve a small but growing proportion of the population, characterised by the highest incomes and a higher degree of mobility in the process of career advancement.

In recent years, revolution in information technology has given rise to knowledge-based industries. There has been a remarkable growth in the science and technology based industrial complexes called Science and Technology Parks in places such as Boston, Massachusetts, and California in the USA. Development of softwares is an example of such activities.

What do we mean by Information Technology and how has it helped in the development of quaternary activities? It refers to a converging set of technologies in microelectronics, computing (machines and software), telecommunications, broadcasting and optoelectronics. Around the nucleus of information technologies, a number of major technological breakthrough e.g. genetic engineering has taken place in the last two decades of the twentieth century. These have application in various fields such as energy medicine, health care, transportation and manufacturing. In other words, the core of the transformation refers to technologies of information processing and communication i.e. they are process-oriented. An important characteristic of the current technological revolution is the application of knowledge and information to knowledge-generation and information-processing devices. The Information Age has revolutionised the technical elements of industrial society. As a result, economic activities of today are overwhelmingly dominated by the production of such intangibles in which knowledge information and communications are critically important. You have read about them in earlier pages.

The vast majority of employment in industrialised nations of the world — particularly well — paying, white collar employment — consists of information collection, processing, and transmission in one form or another. These functions have increased in importance with declining cost of computers and their increasing power. At the same time, accelerated technological changes, shortened production — time, and growing competition and uncertainty in the investment and job markets due to liberalisation and globalisation, have made the production and marketing of goods and services more information-intensive. Therefore, the geography of world economy rests heavily upon invisible flow of data and capital, binding places unevenly to the world system. Economic activities have stretched over ever-larger distances, at times, across different continents and hence, closely tied to the deployment and

use of telecommunication systems. With the digitisation of information in the late twentieth century, telecommunication steadily merged with computers to form integrated networks, most spectacularly through the internet. It has helped professionals to move away from the congested city centres or offices, and work at home, where they can conduct most of their business on line without face-to-face contact. Banks, insurance companies and securities firms, which are highly information-intensive economic activities, have been at the forefront of developing extensive world wide network of leased and private communication networks. Electronic funds transfer systems form the nerve centre of the international financial economy, allowing banks to move capital around at a moment's notice.

One of the most significant repercussions of the internationalisation of financial markets has been the growth of global cities, notably London, New York and Tokyo. Though a number of other cities such as Paris, Toronto, Los Angeles, Osaka, Hongkong and Singapore, are also important in a global economy, the role of the trio — New York, London and Tokyo in the production and transformation of international economic relations in the late twentieth century has been the most significant. They act as the command and control centres of the world system by providing home to massive complexes of financial firms,

business services and corporate headquarters of Transnational Corporations (TNCs). They create opportunities for interaction through face-to-face contact, political connections and cultural activities.

In short, the telecommunications today tend to reinforce the agglomeration of high-wage and high-value-added, white collar functions. At the same time, they promote decentralisation of low-wage and low-value-added, blue or pink-collar jobs. They have a variety of impacts upon cities and regions, both positive and negative. Electronic systems are of great use in everyday life, including credit cards, visa, passports, tax records, medical report, telephone and crime statistics. But they also reinscribe the social categories of wealth and power and geographical categories of core and periphery. For example, inequalities in access to internet internationally, measured in terms of hosts per 100,000 people reflect the long standing division between the developed and developing countries. The best connected nations are Scandinavia, Canada and Australia. Countries such as the UK, Germany and Japan are next in rank. The USA, surprisingly is ranked relatively low, reflecting its sizeable, poorly served population. Yet 90 per cent of all international internet traffic is either to or from the USA. The vast majority of the world's people in Asia, Africa and South America have little or no internet access.

## **Exercises**

### **Review Questions**

1. Answer the following questions briefly:
  - (i) What are tertiary activities?
  - (ii) Why did manufacturing decline in advanced economies?
  - (iii) What are the major components of services?
  - (iv) What is a global city? Name three global cities.
  - (v) What are quaternary activities?
  - (vi) Name the world's three best connected nations through internet.
2. Discuss the importance and growth of service sector in the modern economic development.

3. In what ways the service sector in developing countries is different than those in the advanced countries? Explain.
4. Why specialised activities of the advanced economy such as finance and insurance have a scattered location around the globe? How are they managed?
5. Discuss the nature and growth of quaternary services in the world.
6. 'The global cities act as the command and control centres of the world system'. Elaborate

**Geographical Skills**

7. On an outline map of the world show the following:
  - (i) One global city each from North America, Europe and Asia
  - (ii) The growing megalopolis of Hongkong - Shenzhen - Guangzhou-Zhuhai - Maccau.

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**Unit IV**

**TRANSPORT, COMMUNICATION AND TRADE**

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