2 Nomadic herding

In areas where the climate is too extreme to support permanent settled agriculture, farmers become **nomadic pastoralists**. They live in inhospitable environments where vegetation is sparse and the climate is arid or cold. The movement of most present-day nomads is determined by the seasonal nature of rainfall and the need to find new sources of grass for their animals, e.g. the Bedouin and Tuareg in the Sahara and the Rendille and Maasai in Kenya (Places 65 and Case Study 12A). The indigenous Sami of northern Scandinavia have to move when their pastures become snow-covered in winter, while the Fulani in West Africa may migrate to avoid the tsetse fly.

There are two forms of nomadism. **Total nomadism** is where the nomad has no permanent home, while **semi-nomads** may live seasonally in a village. There is no ownership of land and the nomads may travel extensive distances, even across national frontiers, in search of fresh pasture. There may be no clear migratory pattern, but migration routes increase in size under adverse conditions, e.g. during droughts in the Sahel. The animals are the source of life. Depending upon the area, they may provide milk, meat and blood as food for the tribe; wool and skins for family shelter and clothing; dung for fuel; mounts and pack animals for transport; and products for barter. Just as sedentary farmers will not sell their land unless they are in dire economic difficulty, similarly pastoralists will not part with their animals, retaining them to regenerate the herd when conditions improve.

Places 65 Northern Kenya: nomadic herders

Rainfall is too low and unreliable in northern Kenya to support settled agriculture (Places 61, page 465). Over the years, the Rendille have learned how to survive in an extreme environment (Figure 16.26). All they need are their animals (camels, goats and a few cattle): all their animals need is water and grass. The tribe are constantly on the lookout for rain, which usually comes in the form of heavy, localised downpours. Once the rain has been observed or reported, the tribe pack their limited possessions onto camels (a job organised by the women) and head off, perhaps on a journey of several days, to an area of new grass growth. In the past, this movement prevented overgrazing, as grazed areas were given time to recover. Camels, and to a much lesser extent goats, can survive long periods without water by storing it within their bodies or by absorbing it from edible plants – food supply is as important as water. Humans, who can go longer than animals without food but much less long without water, rely upon the camels for milk and blood, and the goats for milk and occasional meat. Indeed, the main diet of blood and milk avoids the necessity of cooking and the need to find firewood.

But the Rendille way of life is changing. Land is becoming overpopulated and resources overstretched as the numbers of people and animals increase and as water supplies and vegetation become scarcer. Consequently, as the droughts of recent years continue, pastoralists are forced to move to small towns, such as Korr. Here there is a school, health centre, better housing, jobs, a food supply and a permanent supply of water from a deep well (Figure 16.26). The deep well waters hundreds of animals, many of which are brought considerable distances each day. However, the increase in animal numbers has resulted in overgrazing, and the increase in townspeople has led to the clearance of all nearby trees for firewood. This has resulted in an increase in soil erosion, creating a desert area extending 150 km around the town (desertification, Case Study 7). Although attempts are being made to dig more wells to disperse the population, travelling shops now take provisions to the pastoralists, and the tribespeople have been shown how to sell their animals at fairer prices, many Rendille are still moving to Korr to live. There the children, having been educated, remain, looking for jobs, with the result that there are fewer pastoralists left to herd the animals.

Figure 16.26
Rendille camels and goats at a waterhole

3 Shifting cultivation (extensive subsistence agriculture)

Subsistence farming was the traditional type of agriculture in most tropical countries before the arrival of Europeans, and remains so in many of the less economically developed countries and in more isolated regions. The inputs to this system are extremely limited. Relatively few labourers are needed (although they may have to work intensively), technology is limited (possibly to axes), and capital is not involved. Over a period of years, extensive areas of land may be used as the tribes have to move on to new sites. Outputs are also very low with, often, only sufficient being grown for the immediate needs of the family, tribe or local community.

The most extensive form of subsistence farming is shifting cultivation which is still practised in the tropical rainforests (the *milpa* of Latin America and *ladang* of South-east Asia) and, occasionally, in the wooded savannas (the *chitimene* of central Africa). The areas covered are becoming smaller, due to forest clearances, and are mainly limited to less accessible places within the Amazon Basin (Places 66), Central America, Congo and parts of Indonesia. Shifting cultivation, where it still exists, is the most energy-efficient of all farming systems as well as operating in close harmony with its environment.

Places 66 Amazon Basin: shifting cultivation

With the help of stone axes and machetes, the Amerindians clear a small area of about 1 ha in the forest (Figures 16.27 and 16.28). Sometimes the largest trees are left standing to protect young crops from the sun's heat and the heavy rain; so also are those which provide food, such as the banana and kola nut. After being allowed to dry, the felled trees and undergrowth are burnt – hence the alternative name of '**slash and burn**' cultivation. While burning has the advantage of removing weeds and providing ash for use as a fertiliser, it has the disadvantage of destroying useful organic material and bacteria. The main crop, manioc, is planted along with yams (which need a richer soil), pumpkins, beans, tobacco and coca. The Amerindian diet is supplemented by hunting, mainly for tapirs and monkeys, fishing and collecting fruit.

The productivity of the rainforest depends upon the rapid and unbroken recycling of nutrients (Figure 12.7). Once the forest has been cleared, this cycle is broken (Figure 12.8). The heavy, afternoon, convectional rainstorms hit the unprotected earth causing erosion and leaching. With the source of humus removed, the loss of nutrients within the harvested crop, and in the absence of fertiliser and animal manure, the soil rapidly loses its fertility. Within four or five years, the decline in crop yields and the re-infestation of the area by weeds force the tribe to shift to another part of the forest. Although shifting cultivation appears to be a wasteful use of land, it has no long-term adverse effect upon the environment as, in most places, nutrients and organic matter can build up sufficiently to allow the land to be re-used, often within 25 years.

The traditional Amerindian way of life is being threatened by the destruction of the rainforest. As land is being cleared for highways, cattle ranches, commercial timber, hydro-electric schemes, reservoirs and mineral exploitation, the Amerindians are pushed further into the forest or forced to live on reservations. Recent government policy of encouraging the in-migration of landless farmers from other parts of the country, together with the development of extensive commercial cattle ranching, has meant that sedentary farming is rapidly replacing shifting cultivation. After just a few years, as should have been foreseen, large tracts of some cattle ranches and many individual farms have already been abandoned as their soils have become infertile and eroded.

Figure 16.27
'Slash and burn': a shifting cultivator clearing the rainforest

Figure 16.28
Crops gown in *chagras* (fields) around the *maloca* (communal house)

4 Intensive subsistence farming

This involves the maximum use of the land with neither fallow nor any wasted space. Yields, especially in South-east Asia, are high enough to support a high population density – up to 2000 per km^2 in parts of Java and Bangladesh. The highest-yielding crop is rice which is grown chiefly on river floodplains (the Ganges) and in river deltas (the Mekong and Irrawaddy). In both cases, the peak river flow, which follows the monsoon rains, is trapped behind bunds, or walls (Places 67). Where flat land is limited, rice is grown on terraces cut into steep hillsides, especially those where soils have formed from weathered volcanic rock as in Indonesia and the Philippines (Figure 16.29). Upland rice, or dry padi, is easier to grow but, as it gives lower yields, it can support fewer people. Rice requires a growing season of only 100 days, which means that the constant high temperatures of South-east Asia enable two, and sometimes even three, croppings a year (Figure 16.10).

The high population density, rapid population growth and large family size in many South-east Asian countries mean that, despite the high yields, there is little surplus rice for sale. The farms, due to population pressure and inheritance laws (page 467), are often as small as 1 hectare. Many farmers are tenants and have to pay a proportion of their crops to a landlord. Labour is intensive and it has been estimated that it takes 2000 hours per year to farm each 1 hectare plot. Most tasks, due to a lack of capital, have to be done by hand or with the help of water buffalo. The buffalo are often overworked and their manure is frequently used as a fuel rather than being returned to the land as fertiliser. Poor transport systems hinder the marketing of any surplus crops after a good harvest and can delay food relief during the times of food shortage which may result from the extremes of the monsoon climate: drought and flood.

Figure 16.29
Rice cultivation on terraced hillsides, Bali

Places 67 The Ganges valley: intensive subsistence agriculture

Rice, with its high nutritional value, can form up to 90 per cent of the total diet in some parts of the flat Ganges valley in northern India and western Bangladesh. Padi, or wet rice, needs a rich soil and is grown in silt which is deposited annually by the river during the time of the monsoon floods. The monsoon climate (page 239) has an all-year growing season but, although 'winters' are warm enough for an extra crop of rice to be grown, water supply is often a problem. During the rainy season from July to October, the *kharif* crops of rice, millet and maize are grown. Rice is planted as soon as the monsoon rains have flooded the padi fields and is harvested in October when the rains have stopped and the land has dried out. During the dry season from November to April, the *rabi* crops of wheat, barley and peas are grown and harvested. Where water is available for longer periods, a second rice crop may be grown.

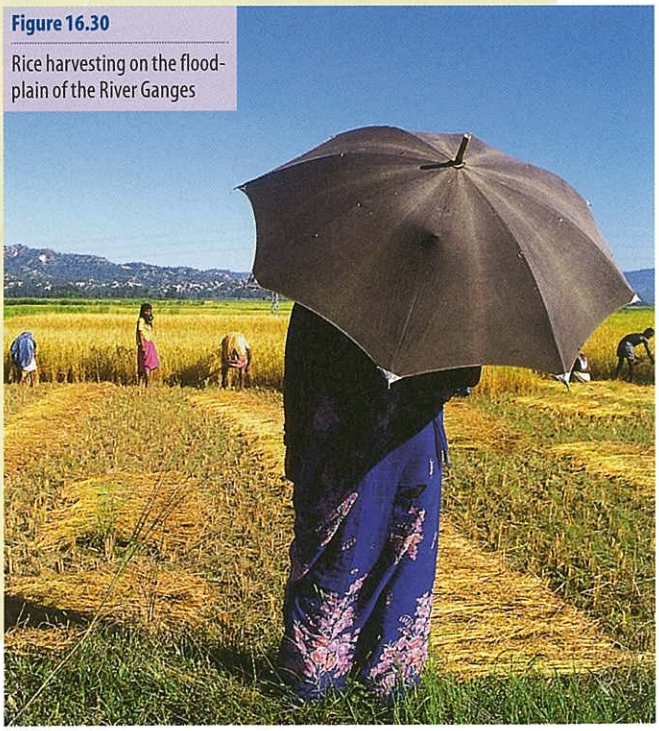


Figure 16.30
Rice harvesting on the floodplain of the River Ganges

Rice growing is labour intensive with much manual effort needed to construct the bunds (embankments); to build irrigation channels; to prepare the fields; and to plant, weed and harvest the crop (Figure 16.30). The bunds between the fields are stabilised by tree crops. The tall coconut palm is not only a source of food, drink and sugar, but also acts as a cover crop protecting the smaller banana and other trees which have been planted on the bunds. The flooded padi fields may be stocked with fish which add protein to the human diet and fertiliser to the soil.

In 1964, many Indian farmers and their families were short of food, lacked a balanced diet and had an extremely low standard of living. The government, with limited resources, made a conscious decision to try to improve farm technology and crop yields by implementing Western-type farming techniques and introducing new hybrid varieties of rice and wheat – the so-called Green Revolution (page 504). Although yields have increased and food shortages have been lessened, the 'Green Revolution' is not considered to be, in this part of the world, a social, environmental or political success (Figure 16.63).

5 Tropical commercial (plantation) agriculture

Plantations were developed in tropical areas, usually where rainfall was sufficient for trees to be the natural vegetation, by European and North American merchants in the 18th and 19th centuries. Large areas of forest were cleared and a single bush or tree crop was planted in rows (Figure 16.31 and 16.32) – hence the term monoculture (page 280). This so-called **cash crop** was grown for export and was not used or consumed locally (Places 68).

Figure 16.31
A rubber plantation in Malaysia

Plantations needed a high capital input to clear, drain and irrigate the land; to build estate roads, schools, hospitals and houses; and to bridge the several years before the crop could be harvested. Although plantations were often located in areas of low population density, they needed much manual labour. The owners and managers were invariably white. Black and Asian workers, obtained locally or brought in as slaves or indentured labour from other countries, were engaged as they were prepared, or forced, to work for minimum wages. They were also capable of working in the hot, humid climate. Today, many plantations, producing most of the world's rubber, coffee, tea, cocoa, palm oil, bananas, sugar cane and tobacco, are owned and operated by large transnational companies (Figure 16.32).

Plantations, large estates and even small farmers are being increasingly drawn into making commercial contracts to supply fruit and vegetables to consumers in the developed world. Although such contracts may help some developing countries to provide jobs and to pay off their international debts, it also means they have to import greater volumes of staple foods to make up for the land switched from staples to export crops (page 501).

Figure 16.32
The advantages and disadvantages of plantation agriculture

Advantages	Disadvantages
Higher standards of living for the local workforce	Exploitation of local workforce, minimal wages
Capital for machines, fertiliser and transport provided initially by colonial power, now the transnational corporations	Cash crops grown instead of food crops: local population have to import foodstuffs
Use of fertilisers and pesticides improves output	Most produce is sent overseas to the parent country
Increases local employment	Most profit returns to Europe and North America
Housing, schools, health service and transport provided, also often electricity and a water supply	Dangers of relying on monoculture: fluctuations in world prices and demand
	Overuse of land has led, in places, to soil exhaustion and erosion

Places 68 Malaysia: tropical commercial (plantation) agriculture

A plantation is defined in Malaysia as an estate exceeding 40 ha in size. Many extend over several thousand hectares. The first plantations were of coffee, but these were replaced at the end of the 19th century by rubber. Rubber is indigenous to the Amazon Basin, but some seeds were smuggled out of Brazil in 1877, brought to Kew Gardens in London to germinate and then sent out to what is now Malaysia. The trees thrive in a hot, wet climate, growing best on the gentle lower slopes of the mountains forming the spine of the Malay peninsula. Rubber tends not to be grown on the coasts where the land is swampy, but near to the relatively few railway lines and the main ports. The 'cheap' labour needed to clear the forest, work in the nurseries, plant new trees and tap the mature trees was provided by the poorer Malays and immigrants from India, (Figure 16.31).

The Malaysian government has now taken over all the large estates, formerly run by such trans-nationals as Dunlop and Guthries, having seen them as a relict of colonialism. Publicly owned companies now only account for 20 per cent of the land devoted to rubber: the remainder is in the form of smallholdings. In the early 1970s, the Federal Land Development Authority (FELDA) was set up. Under FELDA, the forest is cleared and land divided into 5 ha plots which are allocated to farmers. For the first four years, the government does all the work, supervising planting and caring for the young trees. The farmer is then put in charge, but is still provided with free fertiliser and pesticide as the trees are too young to provide any income. Once the crop is ready, it is bought and marketed by the government.

Since the Second World War, the world demand for rubber has steadily declined, mainly due to competition from synthetic rubber. Apart from the years immediately after the AIDS scare in 1988 which saw an increased demand for family planning, the price of rubber has continued to fall. By 1999, when the price was less than half that of 1995, it was estimated that the income of one-quarter of the 400 000 smallholders was below the poverty line. Half of Malaysia's smallholders are totally dependent upon rubber, with each having to support an average of four dependents.

Figure 16.33 Oil palm

The Malaysian plantation industry is now heavily dependent on just one crop – oil palm (Figure 16.33). Oil palm, which now covers 80 per cent of the country's plantations compared with rubber's 20 per cent, has many advantages (Figure 16.34) including higher yields, higher prices, lower production costs and a less intensive use of labour. A director of the Malayan Agricultural Producers Association claimed in 1999 that 'We are concerned about our heavy dependence upon oil palm, but we have no choice. Palm oil is not like rubber. It is more versatile, as it can be used in the food industry. As the world's population continues to grow it will need edible oils. Researchers are also coming up with new uses for palm oil, like vitamins and oleo-chemicals.'

Although oil palm fruits have still to be harvested manually (the fronds get in the way of machines) and the fruits have to be harvested within a short period of time (otherwise the oil is lost), the spraying of herbicides, the application of fertiliser and transportation have all been mechanised.

		Rubber	Oil palm
Production	1950 (thousand tonnes)	722	49
	1995 (thousand tonnes)	1089	7810
	Tonnes per ha	2	24–26
	Years for trees to mature	6–7	4–5
	Ha per worker	10	4
	Labour intensive	Higher	Lower
	Price	Very low, stagnant	Higher, rising

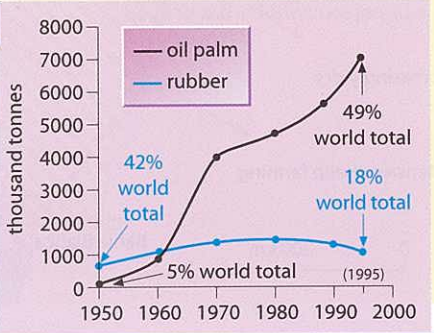


Figure 16.34 The changing importance of rubber and oil palm

6 Extensive commercial pastoralism (livestock ranching)

Livestock ranching returns the lowest net profit per hectare of any commercial type of farming. It is practised in more remote areas where other forms of land use are limited and where there are extensive areas of cheaper land with sufficient grass to support large numbers of animals. It is found mainly in areas with a low population density and aims to give the maximum output from minimum inputs – i.e. there is a relatively small capital investment in comparison with the size of the farm or ranch, but output per farm-worker is high. This type of farming includes commercial sheep farming (in central Australia, Canterbury Plains in New Zealand, Patagonia, upland Britain) and commercial cattle ranching (Places 69), mainly for beef (in the Pampas, American Midwest, northern Australia and, more recently, Amazonia and Central America). It corresponds, therefore, to the outer land use zone of von Thünen's model (Figure 16.20) and does not include commercial dairying which, being more intensive, is found nearer to the urban market (Places 71, page 487).

The raising of beef cattle is causing considerable environmental concern. It is a cause of deforestation (uses 40 per cent of the cleared forest in Amazonia), desertification and soil erosion (overgrazing) and global warming (release of methane). It also takes more water and feed to produce one pound of beef than the equivalent amount of any other food or animal product.

Places 69
The Pampas, South America: extensive commercial pastoralism

The Pampas covers Uruguay and northern Argentina. The area receives 500–1200 mm of rainfall a year – enough to support a temperate grassland vegetation. During the warmer summer months the water supply has to be supplemented from underground sources, while in the cooler, drier winter much of the grass dies down. Temperatures are never too high to dry up the grass in summer, nor low enough to prevent its growth in winter. The relief is flat and soils are often of deep, rich alluvium, deposited by rivers such as the Parana which cross the plain (Figure 16.35). The grasses help to maintain fertility by providing humus when they die back (Figure 11.29b).

Many ranches, or *estancias*, exceed 100 km^2 and keep over 20 000 head of cattle. Most are owned by businessmen or large companies based in the larger cities, and are run by a manager with the help of cowboys or gauchos. Several economic improvements have been added to the natural physical advantages. Alfalfa, a leguminous, moisture-retaining crop, is grown to feed the cattle

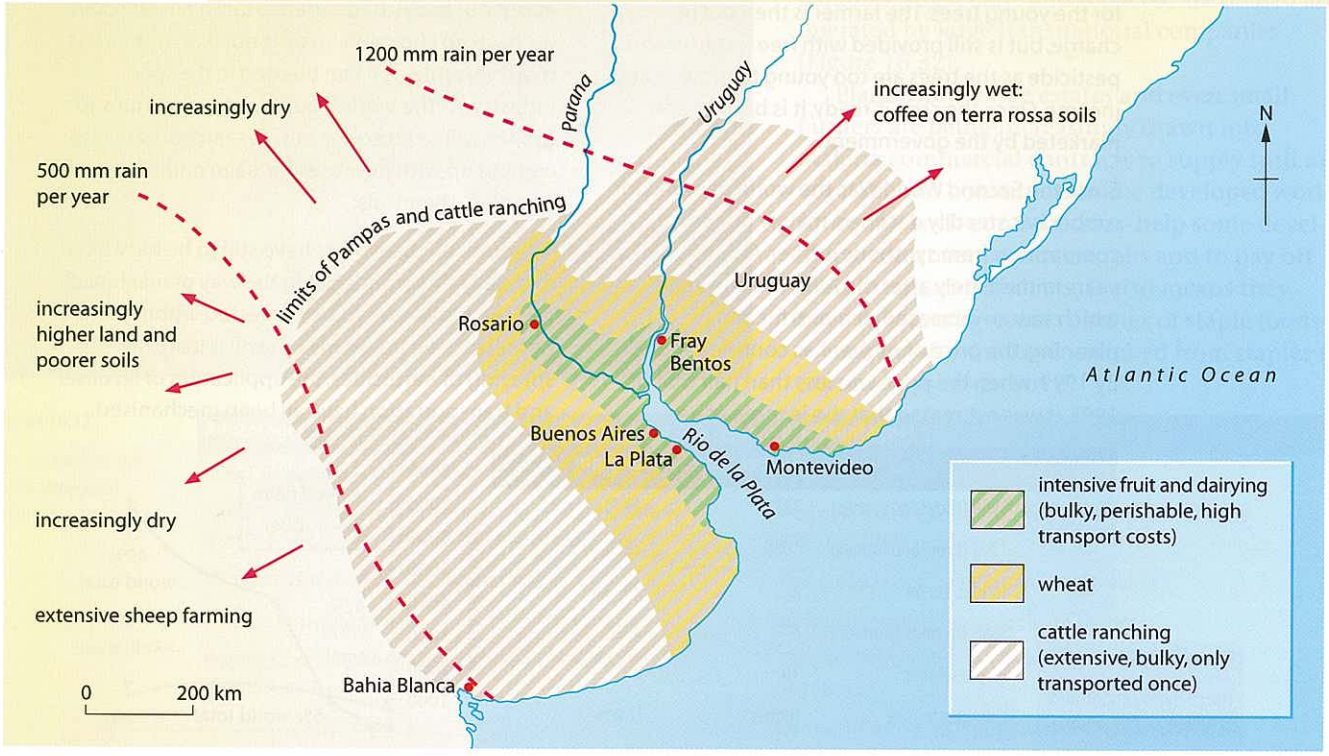


Figure 16.35
Land use on the South American Pampas, an area with a zonation similar to that suggested by von Thünen

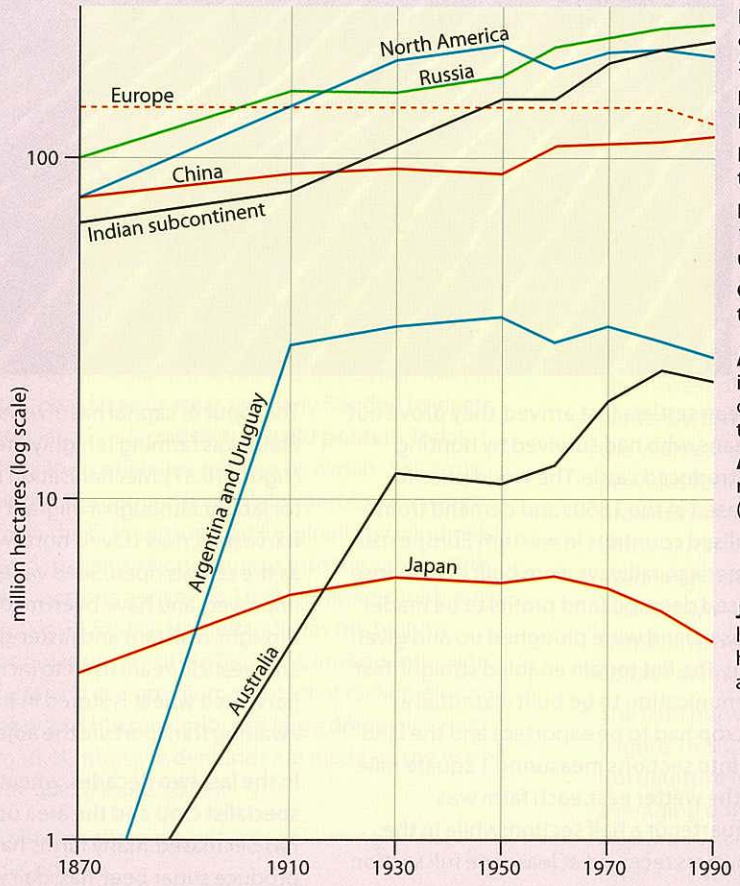
when the natural grasses die down in winter. Barbed wire, for field boundaries, was essential where rainfall was insufficient for the growth of hedges. Pedigree bulls were brought from Europe to improve the local breeds and later British Hereford cattle were crossed with Asian Brahmin bulls to give a beef cow capable of living in warm and drier conditions. Initially, due to distances from world markets, cattle were reared for their hides. It was only after the construction of a railway network, linking places on the Pampas to the stockyards (*frigorificos*) at the chief ports of Rosario, Buenos Aires, La Plata and Montevideo on the Rio de la Plata (Figure 16.35), that canned products such as corned beef became important. Later still, the introduction of refrigerated wagons and ships meant that frozen beef could be exported to the more industrialised countries.

7 Extensive commercial grain farming

As shown on the map of the Pampas (Figure 16.35) and in the von Thünen model (Figure 16.20), cereals utilise the land use zone closer to the urban market than commercial ranching. Grain is grown commercially on the American Prairies (Places 70), the Russian Steppes (Figure 16.6) and parts of Australia, Argentina and north-west Europe (Figure 16.25). In most of these areas, productivity per hectare is low but per farmworker it is high.

It was the introduction and cultivation of new strains of cereals that led to the first permanent settlements (Figure 14.1) and, later, it was a reliance upon these cereals to provide a staple diet which allowed steady population growth in Europe, Russia and South-east Asia (Figure 16.36). A demand for increased cereal production came, in the mid-19th century, from those countries experiencing rapid industrialisation and urban growth. This demand was met following the building of railways in Argentina, Australia and across North America (Figure 16.36). More recent demands have, so far, been met by the 'green revolution' in South-east Asia (page 504) and increases in irrigation and mechanisation.

Figure 16.36
Changes in the world's arable areas, 1870–1990



Russia: more mechanised, cultivating new lands, irrigation, 5-year plans

North America: overproduction, bad harvests about 1960

Indian subcontinent: growth due to 'green revolution'

Europe: stable, most land used in 19th century, now a decline due to urbanisation and EU policies

China: increase in late 1950s due to expansion of communes

Argentina and Uruguay: rapid increase due to railways; decline due to increasing costs of transport to overseas markets

Australia: rapid increase due to railways, growing population and (recently) irrigation

Japan: only a limited amount of land available (competition from housing and industry); rice provides a higher yield

Places 70
The Canadian Prairies: extensive commercial arable farming

The Prairies have already been referred to in the optima and limits model (Figure 16.3). Although this area has many favourable physical character-istics, it also has disadvantages (Case Study 12B). Wheat, the major crop, ripens well during the long, sunny, summer days, while the winter frosts help to break up the soil. However, the growing season is short and in the north falls below the minimum requirement of 90 days. Precipitation is low, about 500 mm, but though most of this falls during the growing season there is a danger of hail ruining the crop, and droughts occur periodically. The winter snows may come as blizzards but they do insulate the ground from severe cold and provide moisture on melting in spring. The chinook wind (page 241) melts the snow in spring and helps to extend the growing season, but tornadoes in summer can damage the crop. The relief is gently undulating, which aids machinery and transport. The grassland vegetation has decayed over the centuries to give a black (chernozem – page 327) or very dark brown (prairie) soil (page 328). However, if the natural vegetation is totally removed, the soil becomes vulnerable to erosion by wind and convectional rainstorms.

Figure 16.37
Extensive commercial cereal farming on the Canadian Prairies

When European settlers first arrived, they drove out the local Indians, who had survived by hunting bison, and introduced cattle. The world price for cereals increased in the 1860s and demand from the industrialised countries in western Europe rose. The trans-American railways were built in response to the increased demand (and profits to be made) and vast areas of land were ploughed up and given over to wheat. The flat terrain enabled straight, fast lines of communication to be built (essential as most of the crop had to be exported) and the land was divided into sections measuring 1 square mile (1.6 km^2). In the wetter east, each farm was allocated a quarter or a half section; while in the drier west, farmers received at least one full section.

The input of capital has always been high in the Prairies as farming is highly mechanised (Figure 16.37). Mechanisation has reduced the need for labour although a migrant force, with combine harvesters, now travels northwards in late summer as the cereals ripen. Seed varieties have been improved, and have been made disease-resistant, drought-resistant and faster-growing. Fertilisers and pesticides are used to increase yields and the harvested wheat is stored in huge elevators while awaiting transport via the adjacent railway.

In the last two decades, wheat has become less of a specialist crop and the area upon which it is grown has decreased. Many farms have diversified to produce sugar beet, flax, dairy produce and beef (Case Study 12B).

8 Intensive commercial (mixed) agriculture

This corresponds with von Thünen's inner zone where dairying, market gardening (horticulture) and fruit all compete for land closest to the market. All three have high transport costs, are perishable, bulky, and are in daily demand by the urban population. Similarly, all three require frequent attention, particularly dairy cows which need milking twice daily, and market gardening. Although this type of land use is most common in the eastern USA and north-west Europe (Places 71), it can also be found around every large city in the world. Intensive commercial farming needs considerable amounts of capital to invest in high technology and numerous workers: it is labour intensive. The average farm size used to be under 10 ha but recently this has been found to be uneconomic and amalgamations have been encouraged by the American government and the EU in order to maximise profits. This type of farming gives the highest output per hectare and the highest productivity per farmworker.

Food surpluses

As farming in the more developed countries of North America and the EU continued to become more efficient, output increased. Farmers were paid subsidies, or a guaranteed minimum price, for their produce. The result was the overproduction of certain commodities for the American and European markets. Although food surpluses are needed for trade to take place, the issue is the unit cost at which the surpuses are produced. The problem arises when surpluses are produced at costs and subsidised prices that are above world market prices. This means that the commodities can only be sold on at a further subsidised price which then either distorts world markets or makes them inaccessible to developing countries. The EU has been trying to bring down 'internal' prices to meet world prices since the early 1990s, and attempts to slim down the 'mountains' and 'lakes' have met with some success (page 493). The EU has spent most money on dairy products. In 1986 it cost almost £1 million a day to store butter, and when some of it was sold to the then USSR at 7p/lb there were political repercussions. This action, together with some limited sales at reduced prices to the poor and the elderly within the Community, used up large amounts of the EU budget. Although the decision in 1986 to reduce milk output by 9.5 per cent by 1989 may have appeared sensible, it should be remembered that this has forced many dairy farmers to sell up and to slaughter some 5 million cattle. In 1988, attention was turned to cereals. It was agreed that £35/ha should be paid to arable farmers if they 'set-aside' their land (i.e. took it out of production) instead of growing crops on it (page 493). The beef mountain and wine lake were tackled after 1989. In the late 1990s the EU, in an attempt to keep land in production and farmers in employment without generating food surpluses, encouraged the cultivation of non-food crops such as fibres and oleochemicals.

Places 71 The western Netherlands: intensive commercial farming

Most of the western Netherlands, stretching from Rotterdam to beyond Amsterdam, lies 2–6 m below sea-level. Reclaimed several centuries ago from the sea, peat lakes or areas regularly flooded by rivers, this land is referred to as the **old polders**. Today, they form a flat area drained by canals which run above the general level of the land. Excess water from the fields is pumped (originally by windmills) by diesel and electric pumps into the canals. With 469 persons per km^2 in 1998 (compared with only 360 in 1975), the Netherlands has the highest population density in Europe. Consequently, with farmland at a premium, the cost of reclamation so high and the proximity of a large domestic urban market, intensive demands are made on the use of the land (Figure 16.38).

There are three major types of farming on the old polders.

- Dairying is most intensive to the north of Amsterdam, in the 'Green Heart' and in the south-west of Friesland. It is favoured by mild winters, which allow grass to grow for most of the year; the evenly distributed rainfall, which provides lush grass; the flat land; and the proximity of the *Randstad* conurbation. Most of the cattle are Friesians. Some of the milk is used fresh but most is turned into cheeses (the well-known Gouda and Edam) and butter. Most farms have installed computer systems to control animal feeding.
- The land between The Hague and Rotterdam (Figure 16.38) is a mass of glasshouses where **horticulture** is practised on individual holdings averaging only 1 ha. The cost of production is exceptionally high. Oil and natural gas-fired central heating maintain high temperatures

and sprinklers provide water. Heating, moisture and ventilation are all controlled by computerised systems. Machinery is used for weeding and removing dead flowers, and the soils are heavily fertilised and manured. Sometimes plants are grown through a black plastic mulch (heat-absorbing) which has the effect of advancing their growth and thus extending the cropping season to meet market demand for fresh produce. Several crops a year can be grown in the glasshouses, i.e. cut flowers in spring, tomatoes and cucumbers in summer, and lettuce in autumn and winter.

- The sandier soils between Leiden and Haarlem are used to grow **bulbs**. Tulips, hyacinths and daffodils, protected from the prevailing winds by the coastal sand dunes, are grown on farms averaging 8 ha. The flowers form a tourist attraction, especially in spring (Figure 16.39) and bulbs are exported all over Europe from nearby Schipol Airport.

Figure 16.38
Agricultural land use in the western Netherlands

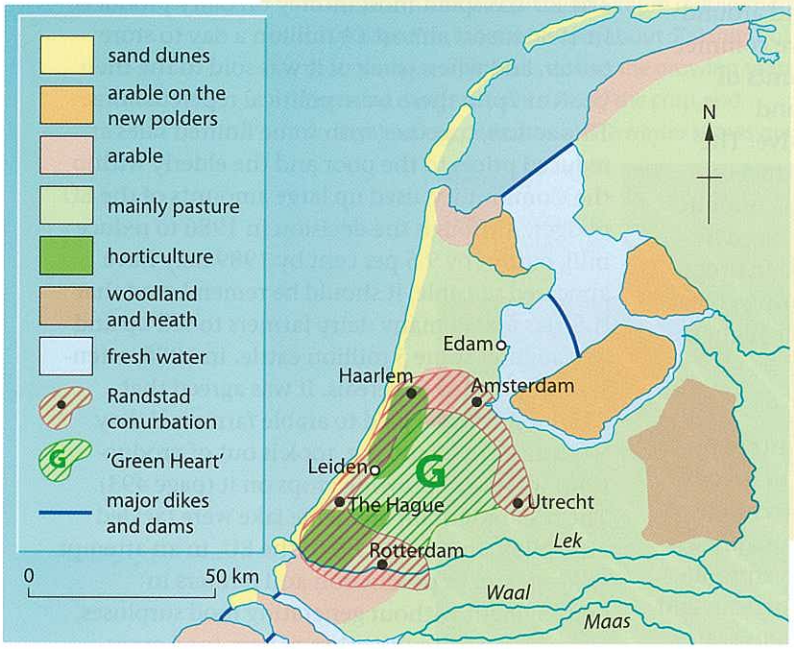


Figure 16.39
Intensive farming on reclaimed polder land in the western Netherlands

9 Mediterranean agriculture

A distinctive type of farming has developed in areas surrounding the Mediterranean Sea. Winters are mild and wet, allowing the growth of cereals and the production of early spring vegetables or *primeurs*. Summers are hot, enabling fruit to ripen, but tend to be too dry for the growth of cereals and grass. As rainfall amounts decrease and the length of the dry season increases from west to east and from north to south, irrigation becomes more important. River valleys and their deltas (the Po, Rhône and Guadalquivir) provide rich alluvium, but many parts of the Mediterranean are mountainous with steep slopes and thin rendzina soils (page 274). Due to earlier deforestation, many of these slopes have suffered from soil erosion. Frosts are rare at lower levels, though the cold mistral and bora winds may damage crops (Figure 12.22).

Farming tends to be labour intensive but with limited capital. There are still many absentee landlords (latifundia, page 466) and outputs per hectare and per farmworker are usually low. Most farms tend to be small in size. Land use (Figure 16.21) shows the importance of tree crops such as olives, citrus and nuts, while land use frequently illustrates that crops which need most attention are grown nearest to the farmhouse or village, and that land use is more closely linked to the physical environment than controlled by human inputs (Places 72). Many village gardens and surrounding fields are devoted to citrus fruits, such as oranges, lemons and grapefruit, as these have thick waxy skins to protect the seeds and to reduce moisture loss. These fruits are also grown commercially where water supply is more reliable, e.g. oranges in Spain around Seville and on *huertas* (irrigated farms) near Valencia, lemons in Sicily and grapefruit in Israel. Recently there has been a rapid increase in the use of polythene, especially in south-east Spain, where the area around Almeria has become known as the 'Costa del Polythene', and in Israel. The polythene, which is stretched across 3 m high poles, creates a hothouse environment suitable for the growth of tomatoes and other crops such as melons, green beans, peppers and courgettes. The crops are harvested twice yearly, usually when they are out of season in more northerly parts of Europe.