children's illustrated encyclopedia

The World Economy

Orpheus

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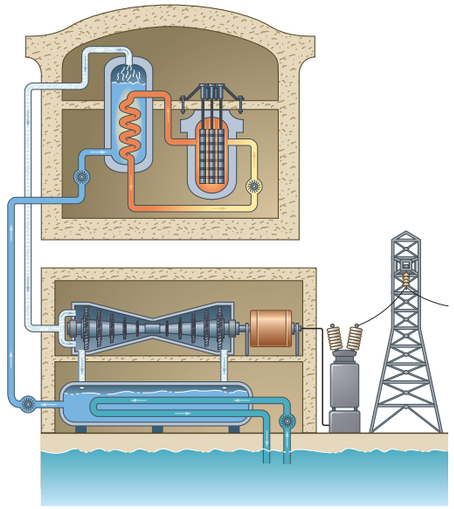


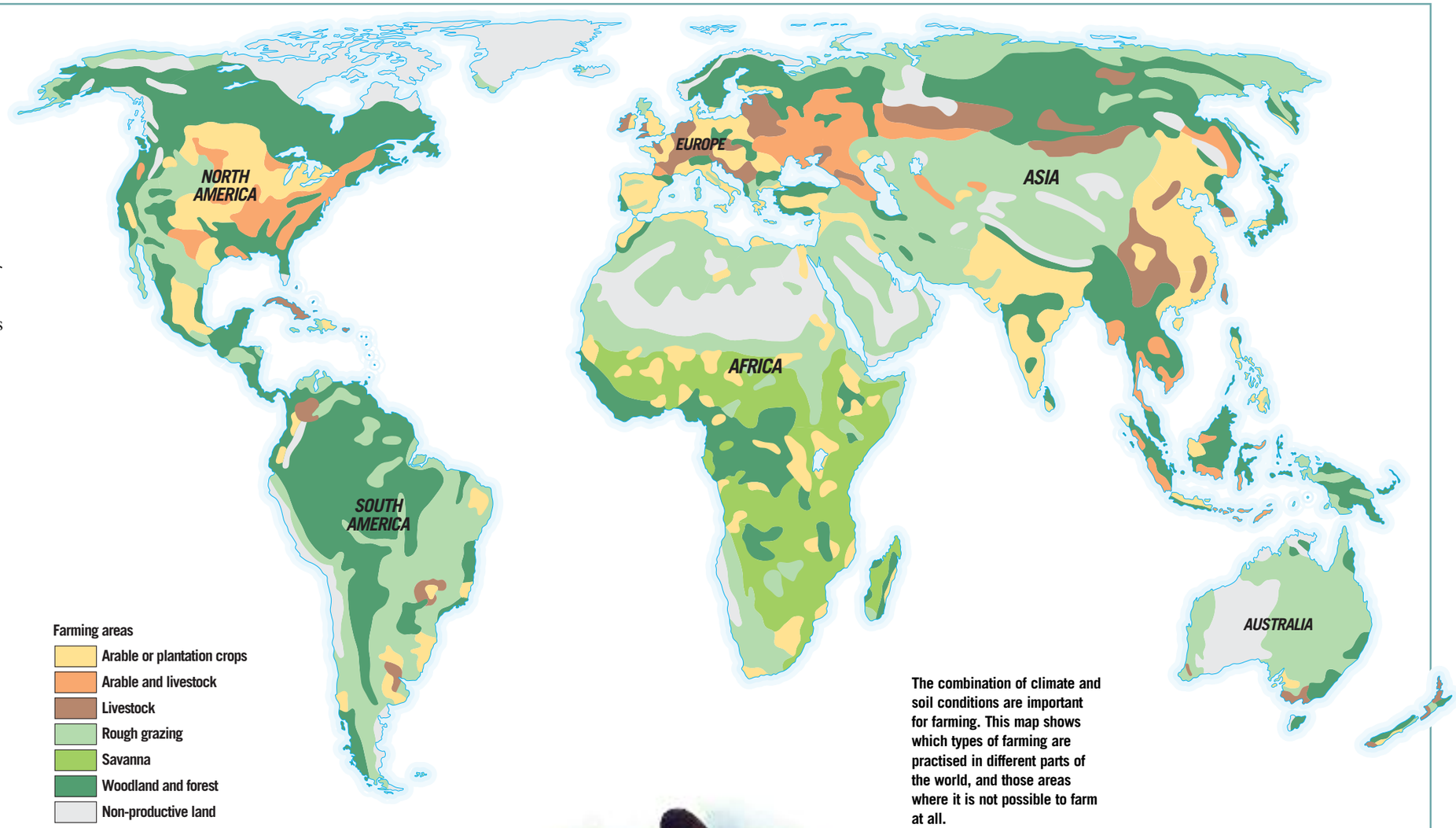
FARMING

FARMING

THE WORLD relies on farming (also called agriculture) for its food. Farms range in size from large commercial businesses that provide food for sale at home and abroad (cash crops), to small farms that produce only enough food for the community (subsistence farming).

There are several different kinds of farming. Arable farming is the cultivation of crops, which include cereals, vegetables and plants for making industrial products such as oil and cotton cloth. Another type of cultivation is growing trees or vines, such as fruit orchards, vineyards, rubber or coffee plantations. Livestock farming involves keeping animals such as pigs, cows and sheep for meat, milk or wool. The animals graze on permanent grassland or rough pasture, including heathland, scrub, mountain slopes or tundra grasses. Some farmers concentrate on one type of farming, while others have mixed farms where they both grow crops and keep livestock.

Intensive farming methods are used to increase food production. For example, intensive egg production involves keeping hens in tiny, crowded cages where they spend their lives just laying eggs. Many people regard this type of farming as cruel.



The combination of climate and soil conditions are important for farming. This map shows which types of farming are practised in different parts of the world, and those areas where it is not possible to farm at all.

A coffee plantation on the subtropical southern foothills of the Andes mountains in Colombia, South America.

"Free-range" products come from animals kept in more natural surroundings. These include eggs from hens that have been allowed to roam around in the farmyard.

Farmers on commercial farms use chemicals to keep pests and weeds at bay. These chemicals cause pollution of the soil and water, and may get into the crops or livestock themselves. Organic farmers do not use artificial pesticides or fertilizers, but enrich the soil with natural fertilizers such as seaweed and manure. Some people prefer free-range and organic products, believing them to taste better and be safer to eat.

This Romanian shepherd is grazing his sheep on the Carpathian Mountains. He moves his flock around to find good grass.

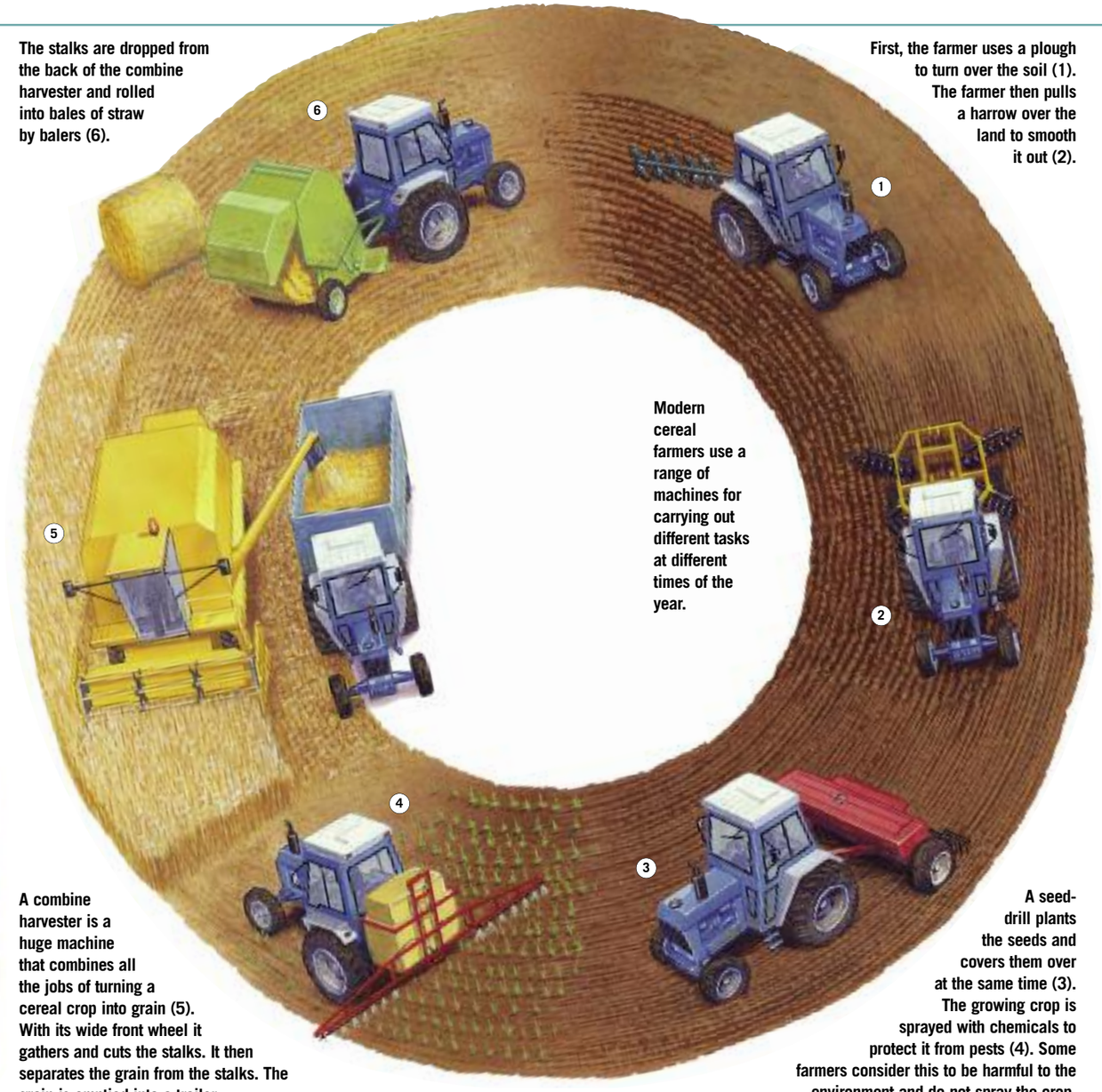
Not all farmers settle in one place. Some livestock farmers are nomadic—they move around with their herds, looking for fresh grazing land. Shifting cultivation is a system where arable farmers move on when the soil becomes exhausted. The most common method is slash-and-burn, which is practised in tropical regions such as the Amazon rainforests. Land is cleared by burning patches of forest. After a few years of planting crops such as maize, manioc, millet and yams, the rainforest soil is no longer fertile, so the farmers clear a new area, leaving the previous land to return to its natural state.

Arable Farming

PEOPLE first started to grow crops about 12,000 years ago. They discovered that certain wild plants, which produced seeds that were ground for flour to make bread, could be made to grow in fields. Crop, or arable, farming had begun.

Today, huge swathes of land that were once natural grasslands or woodlands are under cultivation. Finding new land to farm is sometimes so important that tropical rainforest, desert and swamp are turned into farmland. Even land under the sea has been reclaimed to find more room for crops.

In rich countries, farmers use modern machines and methods to produce better crop yields—more grain from a certain size of field. In poorer countries, most of the population still work in the fields and depend on a small number of crops, together with a few animals, for their livelihood. They grow only enough food for themselves. This is known as subsistence farming.



The stalks are dropped from the back of the combine harvester and rolled into bales of straw by balers (6).

First, the farmer uses a plough to turn over the soil (1). The farmer then pulls a harrow over the land to smooth it out (2).

Modern cereal farmers use a range of machines for carrying out different tasks at different times of the year.

A combine harvester is a huge machine that combines all the jobs of turning a cereal crop into grain (5). With its wide front wheel it gathers and cuts the stalks. It then separates the grain from the stalks. The grain is emptied into a trailer.

A seed-drill plants the seeds and covers them over at the same time (3). The growing crop is sprayed with chemicals to protect it from pests (4). Some farmers consider this to be harmful to the environment and do not spray the crop.

Some crops are grown not for food but for making cloth. Flax and cotton *(right)* are examples. Cotton thread is made from the fibres surrounding the seed inside the ripening fruit, or bolls, of the cotton plant. The bolls are cleaned, untangled, spun into thread and woven into cloth. Cotton can only be grown in hot countries. Usually, the fields are irrigated (water is channelled from rivers).

Planting rice in paddies.

The World's Crops

The most important crops are the cereals: wheat, rice, maize, barley, rye and millet. These provide many people with their basic source of food, their staple diet.

Rice is the main food for millions of Asians. Rice-fields, known as paddies, must be flooded, so in hilly country flat shelves of land, or terraces, are built so that the floodwaters do not flow away. The rice seedlings are planted in rows under water, often by hand. After harvesting, the crop is threshed, to separate out the grain, then winnowed, to lose the husks and grit.

Other important staple crops include beans, peas and lentils. Fruit and vegetables add vitamins and carbohydrates to our diet.

Soya beans, groundnuts and palms are also useful for the oils in their seeds. A range of crops are grown as fodder (livestock feed). They include grasses, some root vegetables and alfalfa.

Groundnuts are a staple food in many tropical countries. They are also grown for edible oil and fodder.

Soya beans originally came from the Far East. Once grown only for fodder, they are also used for oil.

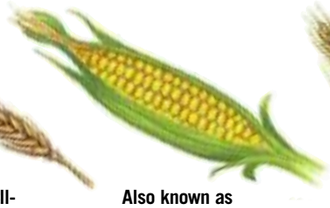
Coffee comes from the hard beans contained inside berries from small trees cultivated in tropical countries.

Cassava roots provide a staple food in the tropics. Tapioca and bread can also be made from the plant.

Sugar cane is a type of grass that produces sugar. Syrup, alcohol and industrial fuel can all be made from it.

Rice is the world's most important staple crop. This cereal is normally grown in hot, wet climates.

Wheat is well-suited to cultivation on the plains of North America, Europe, Russia and Central Asia.



Also known as corn, maize was first cultivated in the Americas. It is grown in warm, dry regions.

Barley is a hardy cereal, suitable for growth in colder or wetter areas. It is used for brewing beer and as fodder.

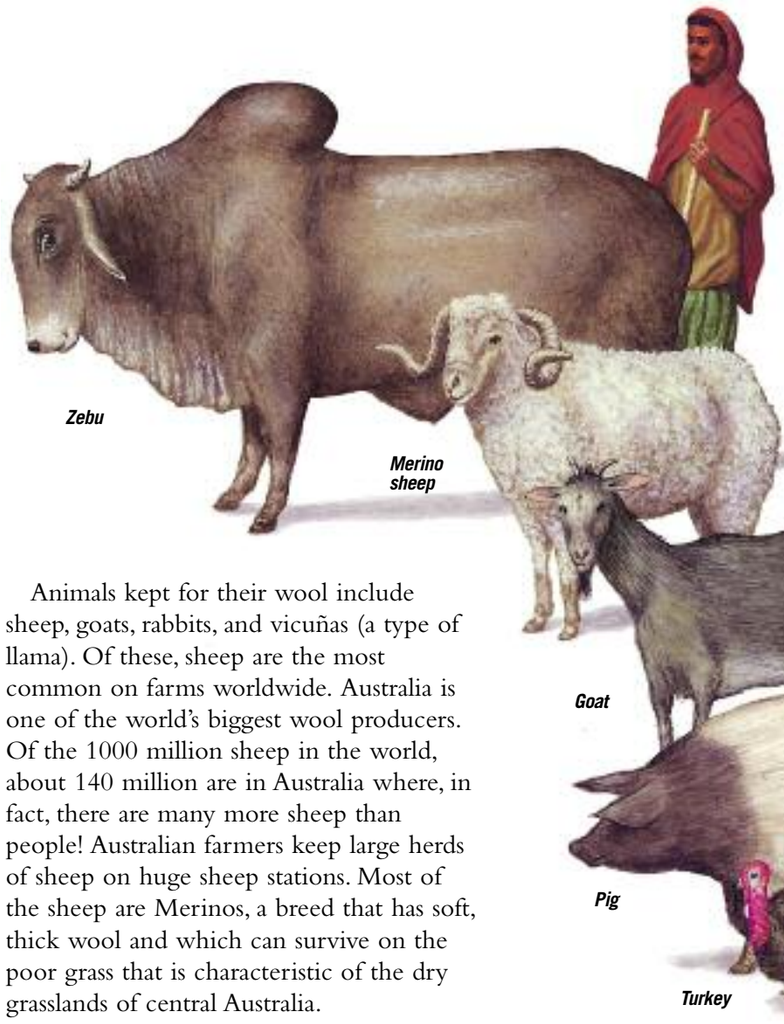
Millet is one of the chief cereals grown in dry tropical lands. In North America it is grown as fodder.

Livestock Farming

AT ABOUT the same time as people began to grow crops, they also domesticated wild animals for meat, milk and skins or wool. This was the start of livestock farming.

Cattle are kept for milk and meat. There are about 200 million cattle in India alone, with about 1000 million in the rest of the world. Breeds of cattle can be divided into two main groups: the European breeds, which are descended from a now-extinct species of long-horned wild cattle called the auroch, and the various breeds of zebu, the humped cattle of India.

Some livestock farmers keep pigs for meat. On large modern pig farms, the animals are kept indoors in controlled conditions and fed a mixture which makes them put on the most weight in the shortest time. About 400 breeds of pig have been produced over the centuries but many of these have now disappeared with the development of intensive farming methods *(see page 4)*. The main surviving breeds include the Berkshire, Chester White, Poland, China, Saddleback, Yorkshire, Duroc, and Razorback. There are about 800 million pigs in the world, half of them in Asia. Their meat is sold as pork (fresh meat), bacon or ham (cured or preserved meat).



Different breeds of animal are kept in different parts of the world. Zebu are larger and thinner than western cattle and have a large hump on their shoulders. There are many breeds of sheep in the world but the Merino is widespread because it has adapted to hot, dry climates. Goats are kept where the land is dry and poor, and they provide meat and skins as well as milk. Turkeys are native to North America but were brought to Europe in the 16th century.

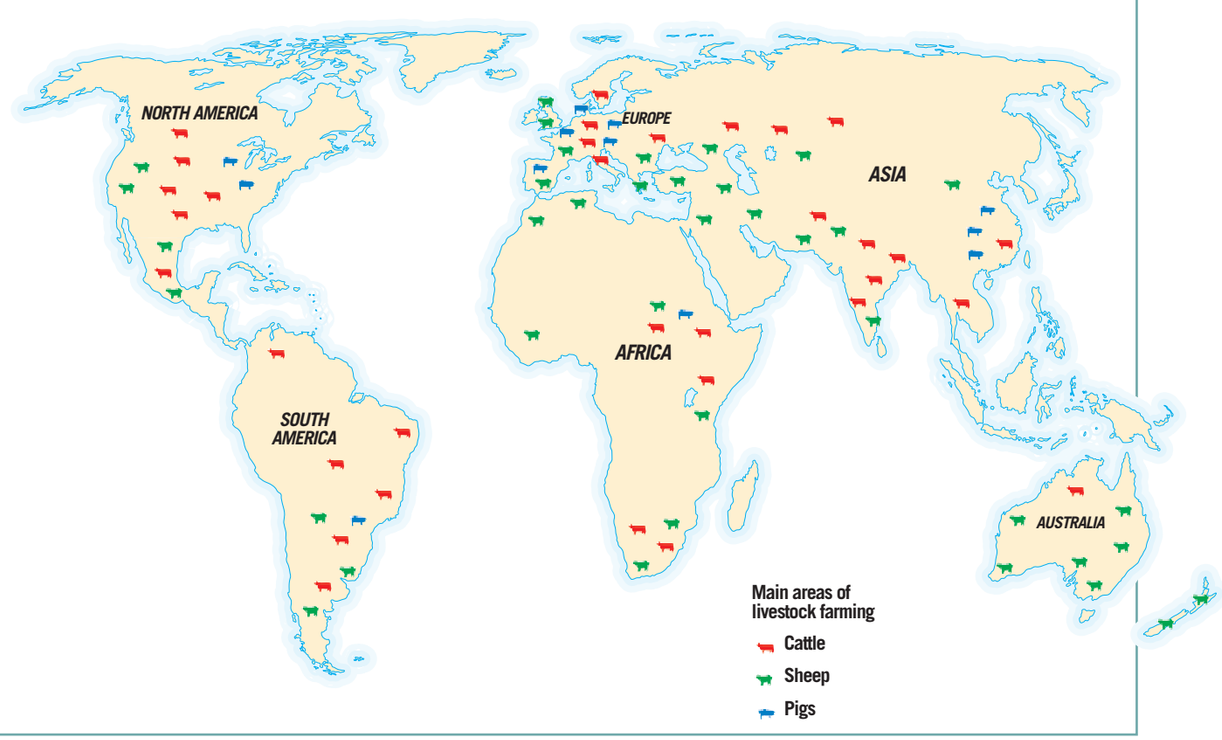
Animals kept for their wool include sheep, goats, rabbits, and vicuñas (a type of llama). Of these, sheep are the most common on farms worldwide. Australia is one of the world's biggest wool producers. Of the 1000 million sheep in the world, about 140 million are in Australia where, in fact, there are many more sheep than people! Australian farmers keep large herds of sheep on huge sheep stations. Most of the sheep are Merinos, a breed that has soft, thick wool and which can survive on the poor grass that is characteristic of the dry grasslands of central Australia.

Geese on a farm *(left)* in Europe. In parts of France, geese are kept to make the famous *pâté de foie gras* (pâté of goose liver). In Eastern Europe, people have small mixed farms where they keep pigs, chickens and geese. They grow crops in the fields to feed their animals.

For many years, gauchos *(below)* were nomadic cattle-herders on the grassland plains, or pampas, of Argentina, Uruguay and Paraguay in South America. In recent times, most gauchos have abandoned their traditional way of life.

Poultry

Poultry farmers keep chickens, turkeys, geese and other birds for meat and eggs. Chickens are descended from tropical forest birds found in Southeast Asia. They can be reared by intensive or free-range methods *(see page 4)*. There are about 7000 million chickens in the world. Good breeds for egg-laying include Leghorns and Minorcas. Dorking and Cornish breeds are good for meat, and Orpingtons and Rhode Island Reds are useful for both. Turkeys, ducks and geese are mainly reared for their meat.



FISHING

PEOPLE have been catching fish from the sea, rivers and lakes for thousands of years. Fishing is still a source of food, and an important industry for many people living near the sea. Japan, China and Russia are the largest commercial fishing nations. The world's major fishing grounds *(see map below)* are the areas of relatively shallow waters that lie above the continental shelf—those parts of the Earth's landmasses that are submerged by ocean waters.

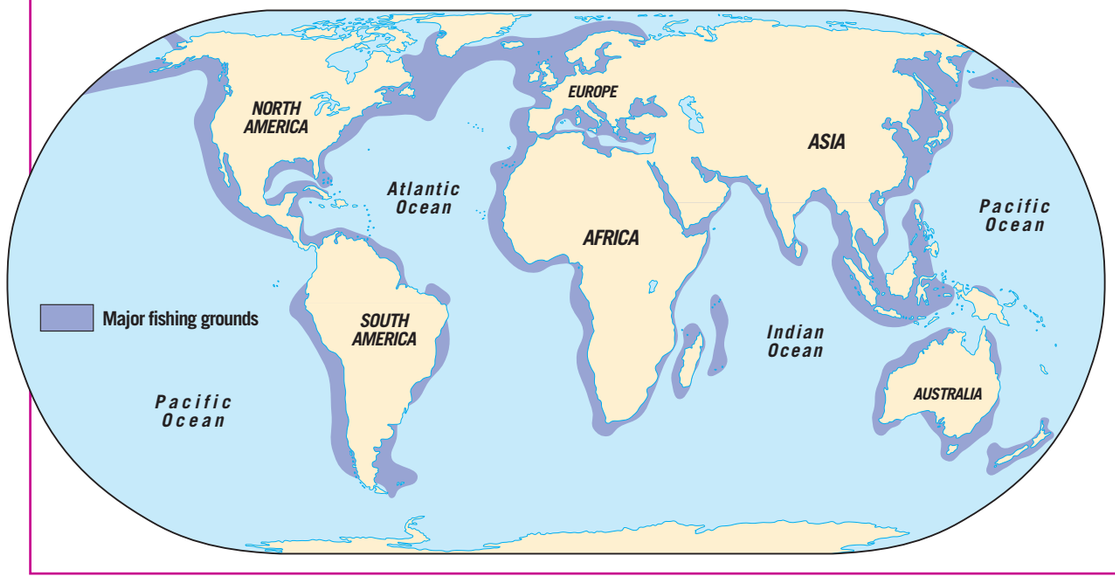
Most sea fish are caught by fishermen working on trawlers. Trawlers are equipped with a large net that is trawled (dragged) along the sea bed. Distant-water trawlers, the most numerous type, can stay at sea for several months. Many of them have freezers so the fish can be gutted and frozen on board. Middle-water trawlers go out for two or three weeks and near-water trawlers for only a few days at a time.

Trawlers catch demersal fish, those kinds that live near the sea bed. North Atlantic trawlers catch cod in the cold waters off Canada, Greenland and Scandinavia. Japanese and American fleets catch tuna in the deep waters of the Pacific Ocean.

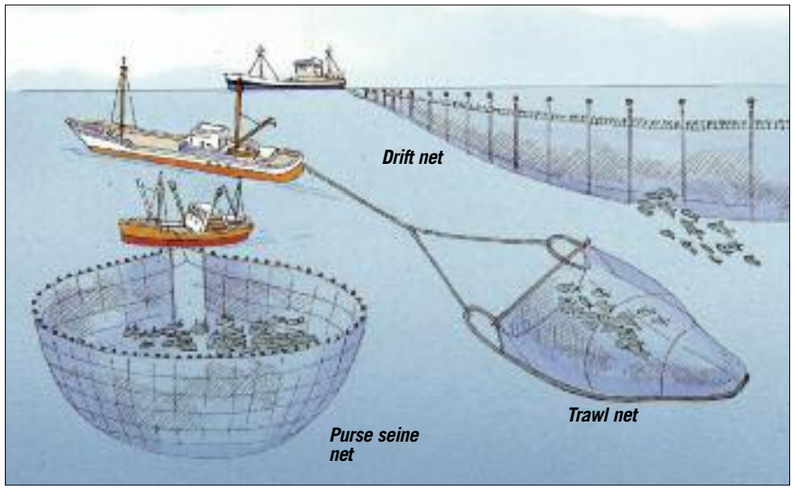
Middle-water trawlers catch fish such as halibut and plaice, while near-water vessels catch fish that live in the warmer waters close to shore, such as haddock, plaice, sole and turbot. These boats do not have freezers on board but the fish can be packed in ice to keep them fresh.

A Dutch trawler in the North Sea. Modern ships are equipped with radar, lifting gear and on-board freezing plants.

Different techniques are used to catch other marine creatures. Lobsters and crabs are caught in small traps called pots. Oysters and scallops are collected with a dredge, a triangular steel frame with a net on it, which is towed along by a fishing boat.



A trawl net dragged along the sea bed behind a trawler scoops up thousands of fish at a time. Fish that live near the surface, such as herring and sardines, are caught in purse seine nets. The nets are spread out to catch the fish and the ends are then pulled together to trap them inside. Drift nets are sometimes used to catch mackerel and herring. The net hangs down into the water and fish are trapped as they try to swim through.



Today, in many traditional fishing grounds numbers of fish are declining fast, the result of overfishing. In the North Atlantic, herring are now almost extinct and there are far fewer cod and haddock. The use of huge factory ships, on which large quantities of fish can be frozen, is severely depleting supplies for local people in developing countries, who rely on fish for their livelihood. There is also concern about the destruction of ocean food chains by overfishing. It is estimated that 20 million tonnes of fish a year are discarded by fishing boats because they are not the right kind—a practice that needlessly reduces stocks of other kinds of fish.

TRADITIONAL FISHING

In some parts of the world, fishermen still go out in small boats and catch fish with hand-held nets, as they have done for centuries. These fishermen catch only enough fish for their local communities.

Whales used to be hunted for their meat and oil. Harpoons and factory ships were used. So many species became endangered that commercial whaling of a number of different species was banned by international agreement in 1986.

A traditional fisherman from Mexico *(above)* uses "butterfly nets" in his small boat. The nets are dipped into the lake to collect the fish.

The catch is hauled aboard a fishing boat *(left)* off the coast of Newfoundland, Canada. The Grand Banks were once rich fishing grounds but overfishing has drastically reduced numbers.

MINING AND INDUSTRY

THE EARTH contains many minerals that are vital to us today. Minerals are non-living substances such as rocks and metals found naturally in the Earth's crust.

Some metals, such as gold, can be found at the surface, but others are buried deep in the ground and have to be mined. Copper was one of the first metals to be used by people, but it is brittle and breaks if it is hammered too much. Early metalworkers discovered that if they hammered copper, then heated it in the fire and then hammered it again, it was easier to work with. This was the discovery of a process called annealing.

Some metals have to be extracted from the rock, or ore, in which they are found. The process used is called smelting. The rock is heated to a high temperature so that the metal melts and runs out.

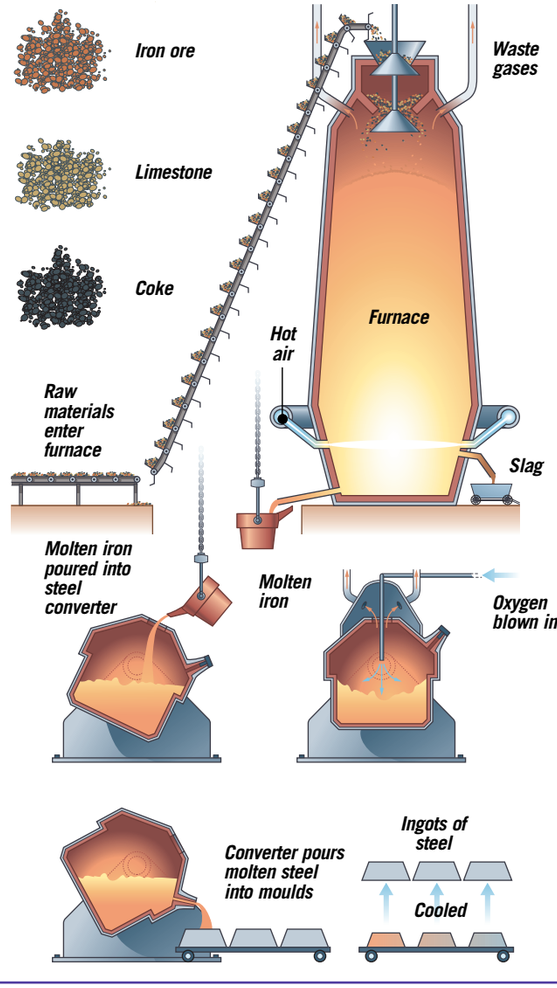
This is an opencast copper mine. Huge excavators cut away the surface rock and dig up the ore.

Metals found near the surface are mined by the opencast method but those found deeper down have to be drilled out of the ground. First, geologists determine where the metals are. They carry out surveys of the rock layers beneath the surface, and also measure the magnetism of the rocks and minerals. This is because the magnetic field is stronger in rocks that contain metals such as iron, nickel and cobalt.

INDUSTRY

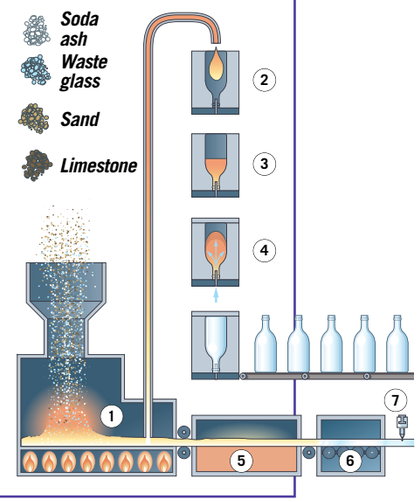
The word "industry" describes an activity that produces the goods or services that people need or want. There are many different kinds of industry, including mining, farming, fishing, manufacturing and the provision of services for people to use.

Industries fall into three groups. Primary industries are those which extract or grow raw materials, such as mining, fishing, farming and forestry. Manufacturing industries, which turn the raw materials into products such as cars, matches, books and buildings, are known as secondary industries. Tertiary industries include transport, shops, health care, banking, education, leisure and tourism.



Iron is smelted from the ore in a blast furnace by mixing it with coke and limestone. The molten iron is poured into a steel converter. Oxygen burns off impurities, mostly carbon, to create steel.

To make glass, *(right)* sand, limestone, soda ash and old glass are melted in a furnace (1). Molten glass may be poured into a mould (2). A plunger (3), followed by compressed air, forces it into the shape of the mould (4). In the float glass process, molten glass is floated on a bath of molten tin (5), before being cooled (6) and cut into lengths (7).



One of the oldest methods of shaping glass is to blow it. The glass-blower blows into a hollow metal pipe which has a blob of molten glass on the end. The glass blows up like a balloon. Glassblowers have plied their trade since ancient times.

In many manufacturing industries around the world, for example, cars, plastics and electrical appliances, machines are used instead of people to make goods. Highly automated industries, as they are called, are using more and more specialized equipment such as electronic technology and industrial robots to increase productivity. This has been partly responsible for increasing unemployment in certain countries. During the last part of the 20th century, Japan and other east Asian countries have developed highly automated industries, including electronics, computers and cars.

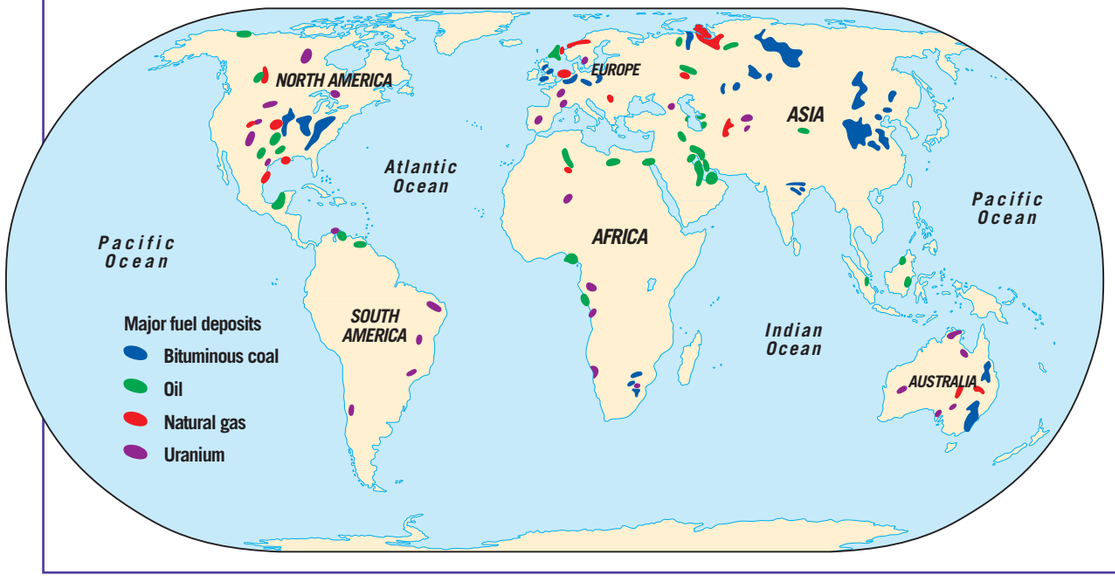
Fossil Fuels

FOSSIL FUELS—coal, oil and gas—were formed from the remains of living things that died millions of years ago and are preserved as fossils.

Coal began to form about 350 million years ago. At that time parts of the Earth's surface were covered with swamps and lakes. Forests of huge trees and giant ferns grew in the swamps *(right)*. When these plants died, they rotted down and gradually changed into a type of dark soil called peat. As the centuries passed the peat was buried under layers of sand and mud. Successive layers pressed down more and more tightly until the peat was compressed into layers of hard, black, shiny rock—coal. Folding and faulting of rock layers, the result of Earth movements over millions of years, together with erosion, have brought some coal layers close to the surface and within reach of underground mines.

Coal was first mined as a fuel on an industrial scale in the 18th century when it was used in furnaces to power steam engines and smelt iron. Today it is used in power stations to produce electricity. Coke, a baked form of coal, is a smokeless fuel used in making iron and steel *(see page 13)*.

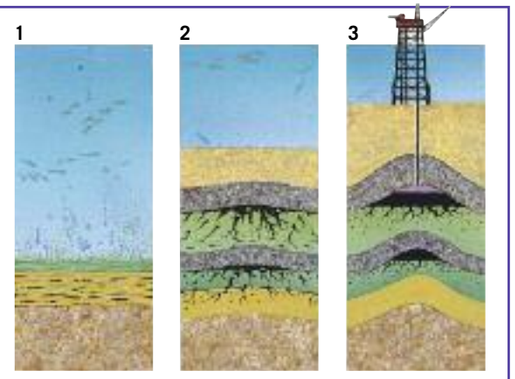
Today much of the world's coal is buried under layers of rock. It can reached only by underground mining *(above right)*. The coal is found in layers called seams. First, geologists locate the coal by studying rock formations in the Earth's crust. Then the mining company drills vertical shafts down to the level of the coal. A network of tunnels lead from the bottom of the shafts to the coal face. Miners are taken down the shafts in lifts. They mine the coal using powerful, electric coal-cutting machines. The coal is brought to the surface in large containers.



Oil and Gas

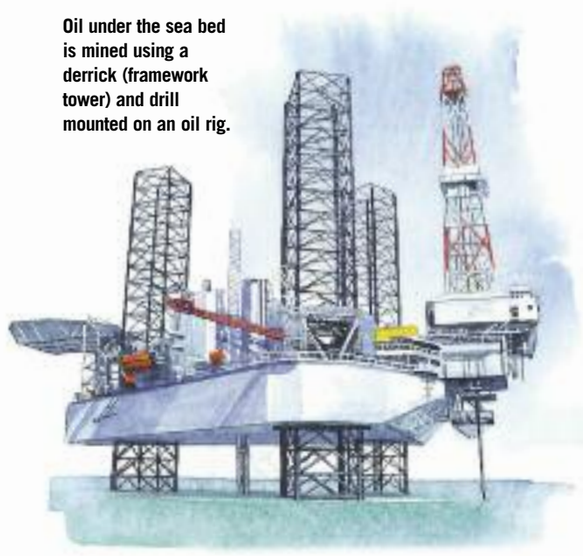
Oil is a very important substance. It is used as a fuel in power stations, cars, ships and aircraft, and is an essential raw material for plastics and chemical industries.

Oil and gas were formed in the seas millions of years ago. When the tiny plants and animals that lived in them died they sank to the bottom and were buried under layers of sand and silt. These were gradually compressed into layers of sedimentary rock. The heat action of bacteria changed the remains into crude oil and natural gases.



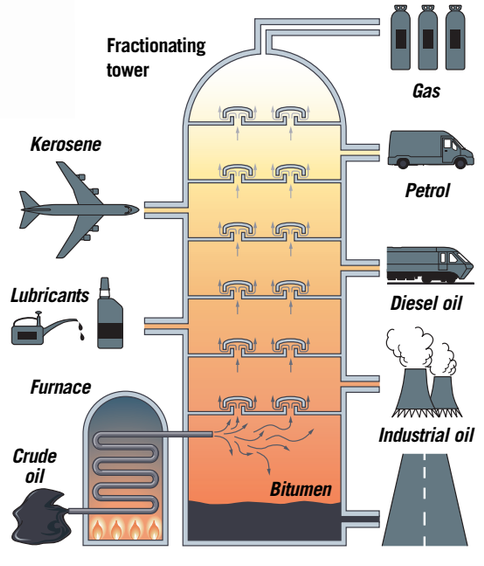
Tiny animals and plants die and settle on the sea bed (1), where they are covered by sediments. The oil and gas that form are trapped under domes of hard rock (2). A drill suspended from a derrick releases the oil (3).

Oil under the sea bed is mined using a derrick (framework tower) and drill mounted on an oil rig.



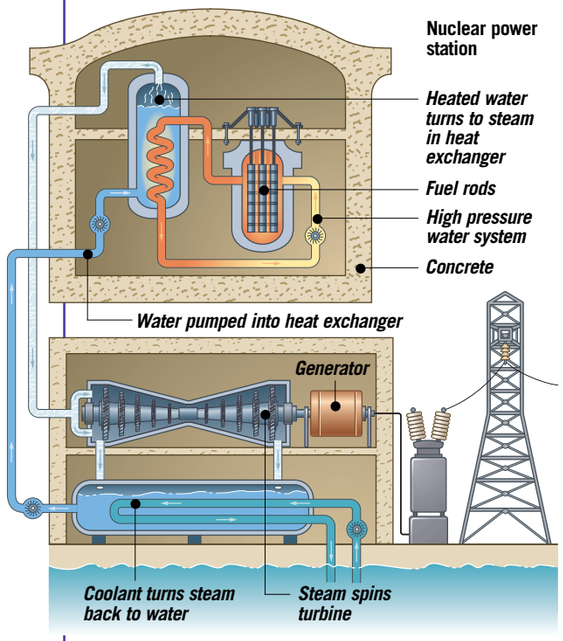
Pressures in the Earth force the oil up through the sedimentary rock, which has tiny holes in it like a sponge. The oil rises until it comes to a layer of hard rock. If the hard rock has formed a dome over the soft rock, the oil is trapped under it. Geologists looking for oil study the local rock formations and make test drillings. If oil is found, wells are drilled into the ground. When the drill reaches oil, the pressure may be enough to send it gushing up to the surface. If not, it is pumped. The crude oil from the well is sent by pipeline or tanker to a refinery where it is separated into different substances by distillation *(right)*.

The oil is boiled at the bottom of a huge tank called a fractionating tower. The vapours that are formed float upwards, cool and condense into liquids at different temperatures. Trays at different heights in the tower collect the liquids as they form. These separate parts, or fractions, are formed into different oil products, such as petrol, kerosene and diesel oil. At the top of the tower, gas comes off. The thickest, heaviest products, such as bitumen, used for making roads, sink to the bottom. They can be refined again to make lubricating oils.



ELECTRICITY

ELECTRICITY is a type of energy that gives us heat and light and drives machines. To be useful, electricity must be made to flow in a current. In 1831 the British scientist Michael Faraday used a magnet to produce electricity. He moved a loop of wire over the magnet, causing an electric current to flow through the wire. This principle is used to generate electricity in power stations today. In thermal power stations, coal, oil or gas are burned to boil water, producing steam to drive a generator.

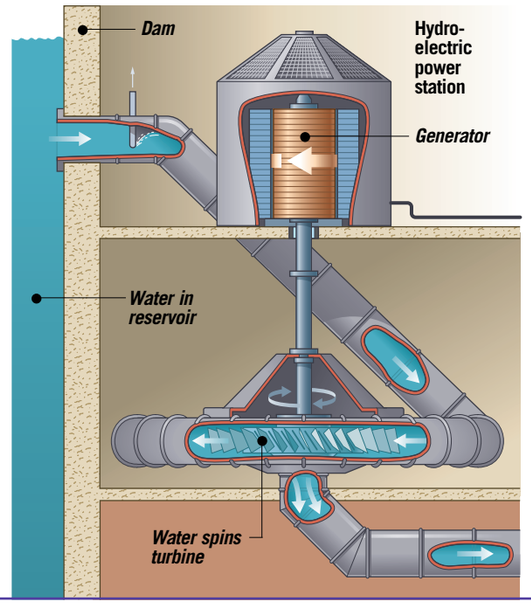


The steam from the boiling water rushes through pipes and turns a bladed wheel called a turbine. The turbine is connected to the generator, which consists of a huge magnet surrounded by copper wire. The turbine makes the magnet spin, thus producing an electric current in the wire.

The water can be heated by other means. The mineral uranium is the fuel used in a nuclear power station *(above)*. Everything on Earth is made up of very tiny particles called atoms. Splitting the atoms that make up uranium produces a very intense heat for creating steam.

Water for hydro-electric power is stored behind dams like the Hoover Dam on the Colorado River in the United States.

In a nuclear power station, energy is produced by creating a reaction in the nuclei (cores) of uranium atoms. Releasing energy by splitting atomic nuclei is called fission. Each nucleus contains particles called neutrons. Inside the reactor, these hit other nuclei, causing them to split and release more neutrons. This repeated process, called a chain reaction, produces immense amounts of heat energy. Water pumped around the reactor is heated.

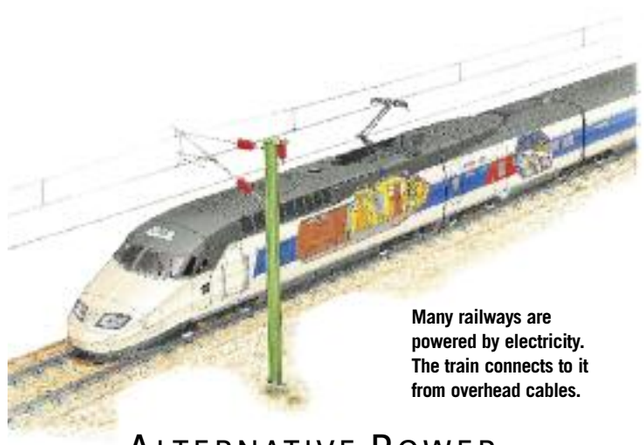


Hydro-electric power stations *(see illustration, below left)* use fast-flowing water to turn turbines. The water from rivers is stored in a reservoir behind a dam. The power station is located in front of the dam. Some of the water is allowed to rush out through pipes to make turbines spin and drive the generator.

SUPPLYING ELECTRICITY

The electricity is sent from the power station along thick wires called cables. They are supported above ground by tall pylons. The electric current is boosted by transformers along the way. The electricity goes to sub-stations from where cables carry it to houses, factories, shops and offices.

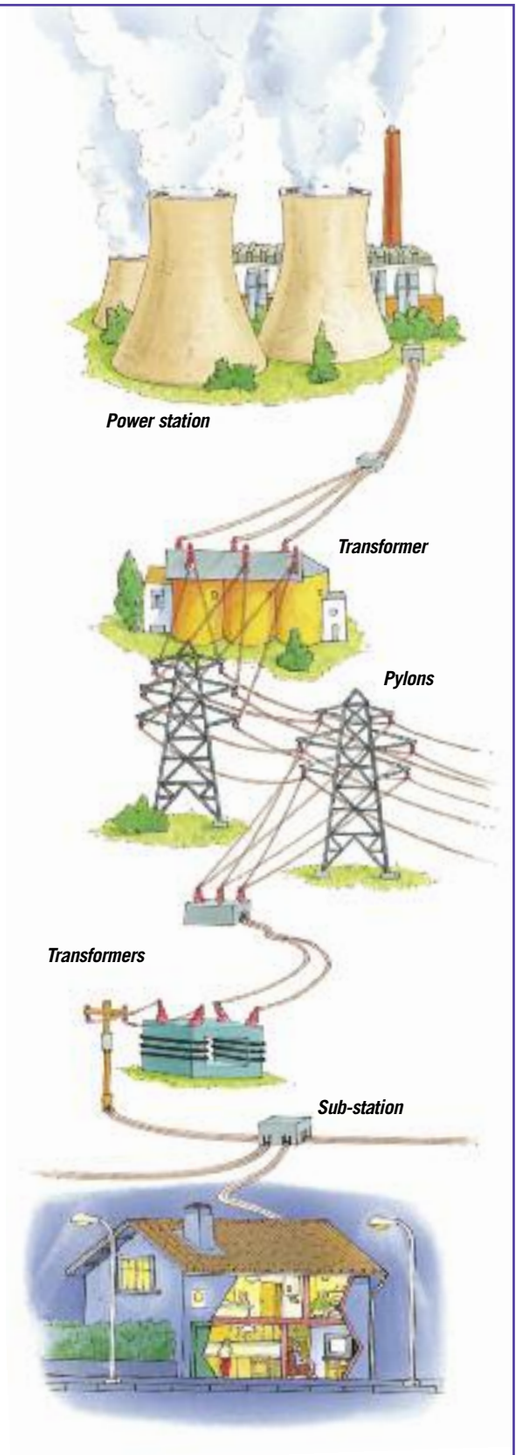
The cables from a power station are linked to form a country's supply network or grid. This allows electricity to be sent to wherever it is needed. Electricity cannot be stored, so a constant supply flows through the cables and wires.



Many railways are powered by electricity. The train connects to it from overhead cables.

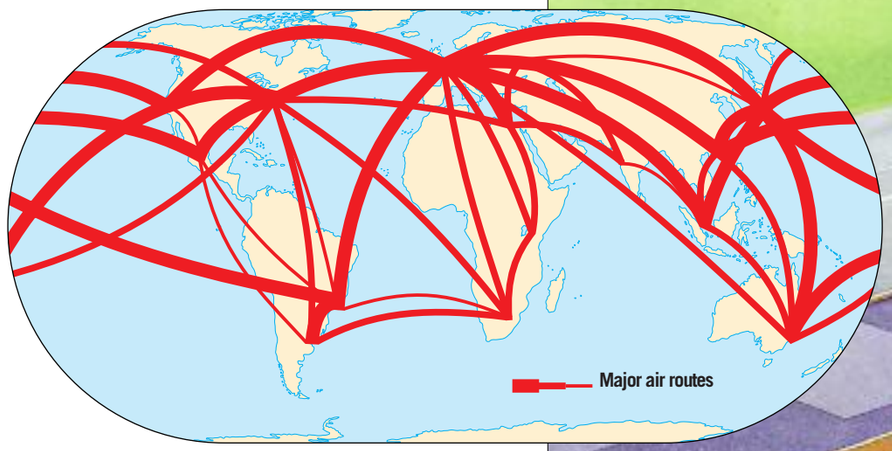
ALTERNATIVE POWER

Coal and oil-fired power stations cause pollution. Fossil fuels, once used up, cannot be replaced. Leaks of radioactivity from nuclear power stations is a potential hazard. So alternative methods for generating electricity are needed. Wind turbines on wind farms, solar power (in which solar panels store sunlight for conversion to electricity), tidal and wave power are all possibilities for the future.



Most homes are connected to mains electricity via an electricity grid. Electricity runs from power stations along cables boosted by transformers. When we plug in an electric appliance, it connects to mains electricity.

TRANSPORT



AIR TRAVEL

AIR TRAVEL has grown enormously since World War II. Until then, only the wealthy travelled by air. The development of the jet airliner in the 1950s made it possible for everyone to fly to destinations across the world. As the map *(above)* shows, air routes now link all major cities.

The world's busiest airport is Atlanta Hartsfield Jackson near Atlanta in the United States, with an average of one take-off or landing every 33 seconds and nearly 77 million passengers a year. Many of these flights are for people travelling within the United States—about 85 per cent of people travelling within the United States go by air. London's Heathrow Airport handles more international traffic than any other airport with more than 62 million international passengers a year.

A large modern airport employs thousands of people. Air traffic controllers work in a control tower, directing all aircraft to and from runways and deciding when it is safe to take off or land. They have powerful radar equipment to keep watch over the whole airspace around the airport.

Baggage handlers load and unload suitcases from the aircraft. Once passengers have disembarked, ground crew prepare the aircraft to fly out again, and refuel it while firefighters stand by.

In the terminal, the passengers collect their baggage and go through customs, where officials check that they are not carrying drugs or goods which require import or export tax to be paid.

Airports also handle goods (air freight) that are required to be transported quickly. Warehouses store goods before loading and after arrival, when they are inspected by customs officials.

Security officers use X-ray equipment to check passengers for bombs, guns and other weapons. International passengers also have to pass through immigration where they show their passports and any visas that are required to enter the country. Officials often stamp the passport to show that passengers are entering the country legally. Airports also have lounges and restaurants where passengers can wait for their flights.

KEY

1	*Radar*	11	*Escalators*
2	*Airliner landing*	12	*Check-in desks*
3	*Airliner taking off*	13	*Terminal building*
4	*Runway*	14	*Fuel tanker*
5	*Control tower*	15	*Baggage loading*
6	*Gangway*	16	*Fire engine*
7	*Waiting area*	17	*Airport bus*
8	*Moving walkway*	18	*Baggage trolley*
9	*Gate to gangway*	19	*Jumbo Jet (Boeing 747)*
10	*Security X-ray*	20	*Mobile stairway*

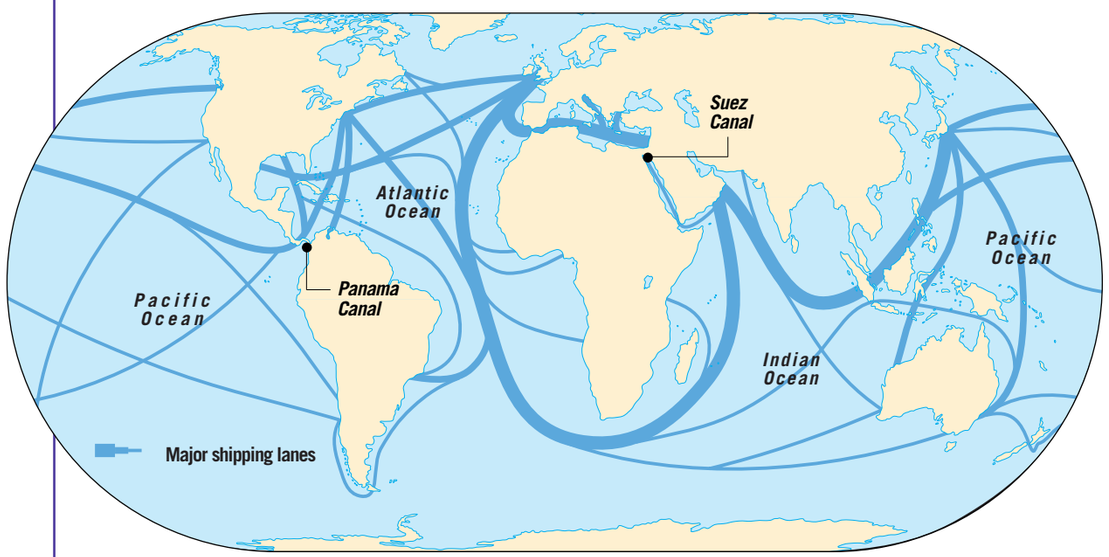
PORTS AND WATERWAYS

EVEN THOUGH aircraft now carry many of the world's passengers, shipping is still a vital link between countries, particularly for carrying cargo. The biggest vessels are called bulk carriers. They include oil supertankers, some of which are more than 450 metres long. Container ships carry general cargo stored in large steel boxes stacked up like building blocks. These can be unloaded directly on to trucks.

An icebreaker breaks up ocean pack ice so that other ships can sail through.

The River Rhine *(above)* rises in Switzerland and runs along the border between France and Germany, then on through Germany and the Netherlands, meeting the North Sea near Rotterdam. It is one of Europe's most important industrial waterways. As well as barges carrying cargo, river boats take tourists along the river to see the vineyards and ancient castles on its banks.

Ships cross the oceans on fixed routes called shipping lanes *(below).* The world's busiest shipping lanes link Europe and North America with the Middle East and East Asia. Ships go through the Suez and Panama Canals to shorten their journeys, although supertankers, being too large for the Suez Canal, still travel around the southern tip of Africa.



The Panama Canal cuts through a narrow neck of land called the Isthmus of Panama in Central America. Before it was built, ships had to negotiate the stormy seas around the southern tip of South America to get from the Atlantic to the Pacific Ocean. Opened in 1914, the Panama Canal is still one of the most important of the world's waterways. Small locomotives guide ocean-going ships through the locks in the canal. Canals for shipping are known as navigational canals.

Modern cargo ships are much larger than vessels of the past, and big, efficient ports with docks (enclosed areas of water) are needed so that their cargoes can be loaded and unloaded as quickly as possible. Some ships take cargoes inland along large rivers and man-made waterways called canals.

Two major canals, cut through narrow necks of land, provide much shorter routes between ports. They are the 165-kilometre Suez Canal in Egypt, linking the Mediterranean Sea with the Red Sea, and the 82-kilometre Panama Canal, connecting the Atlantic and Pacific Oceans.

Canals often link natural waterways and provide a transport route across a continent. The Main-Danube Canal, for example, allows the movement of goods between Eastern and Western Europe. The United States and Canada have more than 41,000 kilometres of waterways linked to the St. Lawrence and Mississippi rivers and their tributaries. The St. Lawrence Seaway connects the Great Lakes, and the cities of Chicago, Detroit, Cleveland and Toronto among others, with the Atlantic Ocean.

Cargo on inland waterways in industrial countries, for example, the River Rhine in Germany, is usually carried by barges which are towed by tugs. Sometimes several barges are strapped together. Barges carry cargoes along the Rhine to and from the port of Rotterdam in the Netherlands, the world's busiest port. Antwerp in Belgium is the largest inland port in the world. Even though it is 89 kilometres from the open sea, ships of all types load and unload cargoes there.

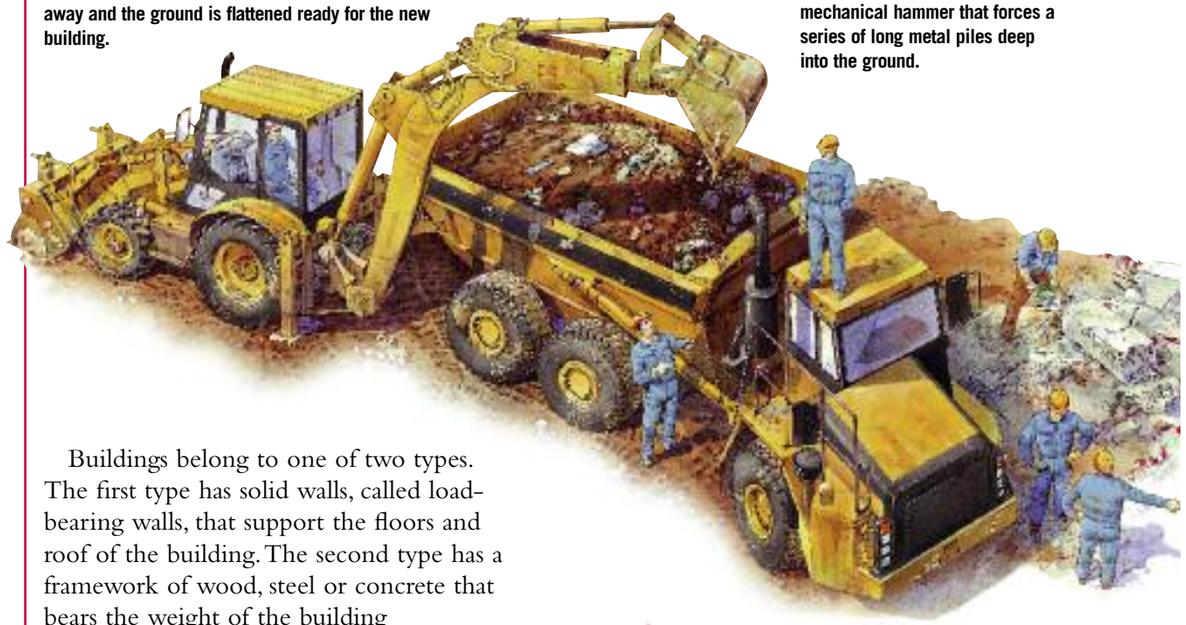
Rotterdam handles many goods being imported and exported to and from Western Europe (about 300 million tonnes annually). It is also a centre for refining oil *(see page 15).* Rotterdam's docks stretch along the 35-kilometre New Waterway canal linking it to the North Sea. Shipping traffic passing through the English Channel and the North Sea is among the busiest in the world.

BUILDINGS

PEOPLE have constructed buildings from ancient times as homes to provide shelter, monuments or places of worship. Earth, wood and stone have always been used as building materials. Bricks, hardened clay, were first used in the Middle East in about 3000 BC. Concrete is made by mixing sand, cement and water. Reinforced concrete dates from the late 1800s. Often used in modern buildings, it contains steel wires or rods to provide extra strength.

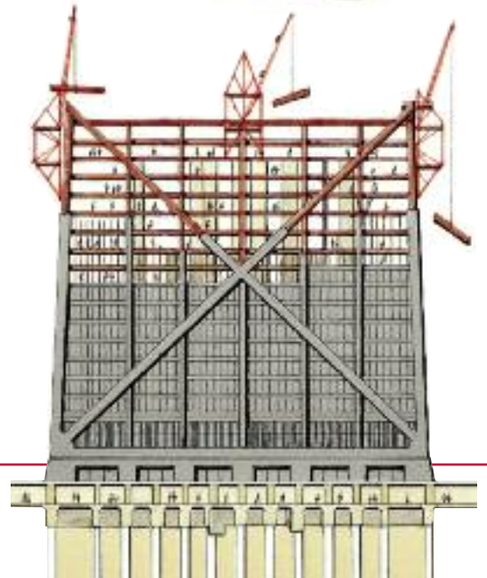
A pile-driver *(above)* is a huge mechanical hammer that forces a series of long metal piles deep into the ground.

Old buildings are demolished, the rubble is taken away and the ground is flattened ready for the new building.



Buildings belong to one of two types. The first type has solid walls, called load-bearing walls, that support the floors and roof of the building. The second type has a framework of wood, steel or concrete that bears the weight of the building

Most buildings need foundations (a solid base) to prevent them from sinking into the ground or falling over. Foundations can be footings (underground walls), flat rafts, or underground supporting pillars called piles that are driven into the ground.



Skyscrapers are usually supported on caissons, a type of pile in which a steel tube is driven into the ground and filled with concrete. When the caissons are in place, the thick concrete basement walls are built. The frame of the skyscraper is built up from this base. Tower cranes hoist steel girders into position and concrete lift shafts are put in place. As the frame is completed, glass and metal panels, known as curtain walls, are fixed to the outside of the building.

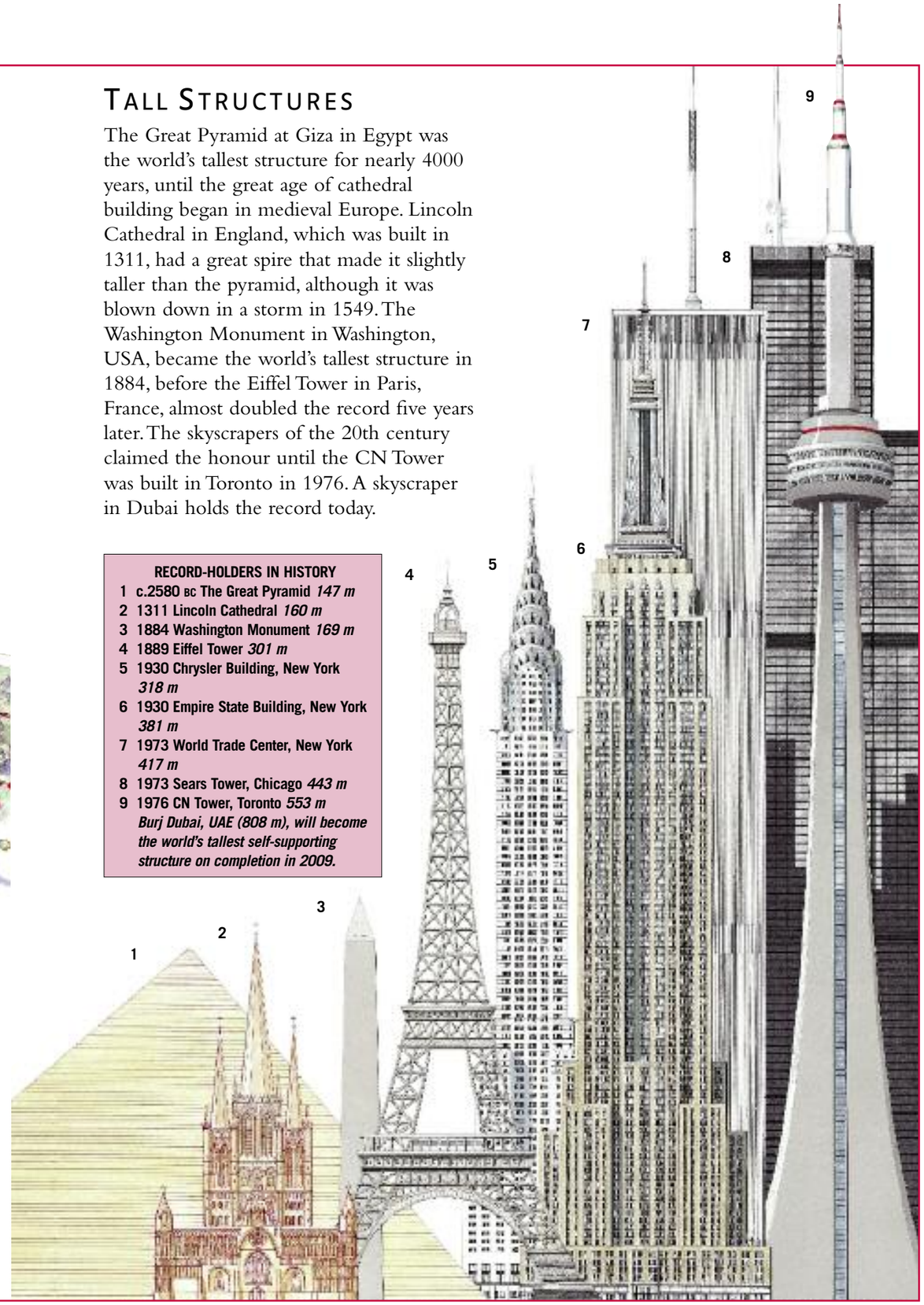
TALL STRUCTURES

The Great Pyramid at Giza in Egypt was the world's tallest structure for nearly 4000 years, until the great age of cathedral building began in medieval Europe. Lincoln Cathedral in England, which was built in 1311, had a great spire that made it slightly taller than the pyramid, although it was blown down in a storm in 1549. The Washington Monument in Washington, USA, became the world's tallest structure in 1884, before the Eiffel Tower in Paris, France, almost doubled the record five years later. The skyscrapers of the 20th century claimed the honour until the CN Tower was built in Toronto in 1976. A skyscraper in Dubai holds the record today.

RECORD-HOLDERS IN HISTORY

1 c.2580 BC The Great Pyramid *147 m*
2 1311 Lincoln Cathedral *160 m*
3 1884 Washington Monument *169 m*
4 1889 Eiffel Tower *301 m*
5 1930 Chrysler Building, New York *318 m*
6 1930 Empire State Building, New York *381 m*
7 1973 World Trade Center, New York *417 m*
8 1973 Sears Tower, Chicago *443 m*
9 1976 CN Tower, Toronto *553 m*

Burj Dubai, UAE (808 m), will become the world's tallest self-supporting structure on completion in 2009.



SKYSCRAPER

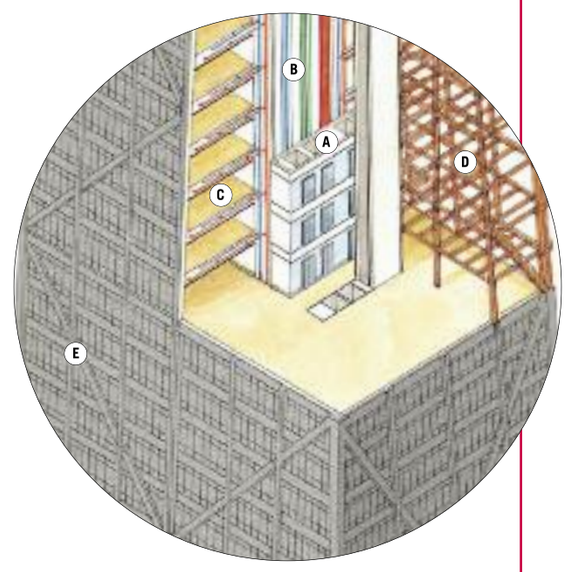
SKYSCRAPERS are very tall buildings, usually more than 20 storeys high. Their weight is supported by a steel frame rather than outside walls. They are a feature of many large cities, especially in North America and East Asia, where the high price of land leads developers to build tall, thin buildings that occupy the minimum amount of land space, rather than low-rise, sprawling ones.

The first skyscraper, the Home Insurance Building, was built in Chicago in 1884 following a fire that devastated the city. Soon, skyscrapers started to appear in New York as well as Chicago, often being built higher and higher in competition with one another. In recent years, China and the United Arab Emirates are among nations that have joined the race to build the world's tallest buildings.

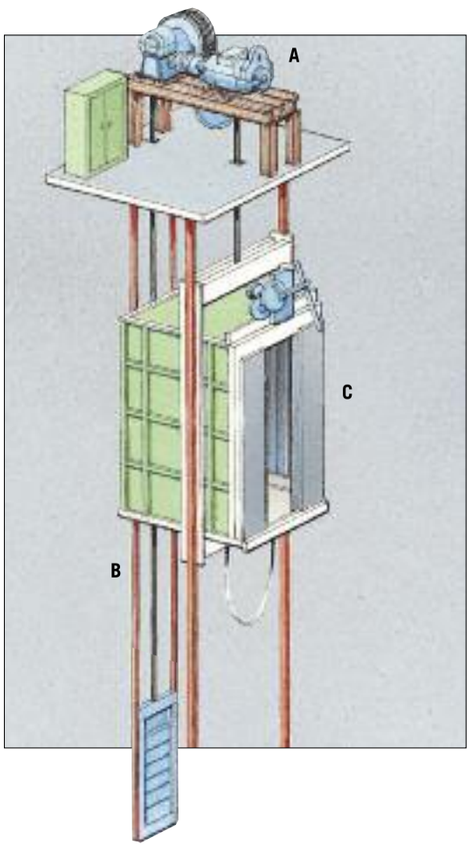
The John Hancock Center in Chicago, USA, was completed in 1968. A skyscraper with both offices and residential apartments, it is the tallest multi-purpose building in the world and the seventh tallest skyscraper of all. It is 344 metres high but its twin antennae add a further 105 metres, making it a total of nearly 450 metres. It has a hull and core construction—a strong central concrete core with an open space between it and the steel frame. The frame has a triangular grid to give the structure maximum strength.

KEY

1 *Antennae*
2 *Air conditioning*
3 *Water tanks*
4 *Restaurant*
5 *Observatory*
6 *Apartments*
7 *Swimming pool*
8 *Emergency staircase*
9 *Lifts*
10 *Offices*
11 *Car parking*
12 *Exhibition area*
13 *Lifts*
14 *Lobbies and shops*
15 *Steel frame holding caissons together*
16 *Lift buffers*
17 *Caissons*



A core of reinforced concrete runs up the middle of the skyscraper. It forms the lift shaft (A) of the building and provides a duct for air conditioning and other services (B). Concrete beams link the core to the outside wall and support the floors (C). The weight of the building is taken by the steel frame (D), strengthened by massive X-shaped girders (E).



Living or working in a skyscraper would not be feasible without an efficient lift system. The lifts in the John Hancock Center are winched up and down on a steel cable pulley by an electric motor (A). The motor is worked by computerized control gear. Guide rails (B) on either side of the shaft prevent the lift (C) from swaying. If the steel cable were to snap, automatic safety brakes would grip the guide rails to prevent the lift from falling.

The John Hancock Center is like a city in a tower. It has shops, a bank, a post office, a restaurant, a swimming pool and a fitness centre. There are 50 lifts (it takes only 39 seconds to ascend to the 94th floor). A car park with spaces for 1200 cars takes up the first seven floors. Cars drive up a spiral ramp to get to it.

The building has more than 2000 kilometres of electric wiring, carrying enough electricity to supply the equivalent of a city of 30,000 people. More than 2.75 million litres of water are consumed each day. Computers warn of any fault in the skyscraper's service systems.

THE WORLD'S TALLEST BUILDINGS

1 Taipei 101, Taipei, Taiwan 508 m
2 Petronas Twin Towers, Kuala Lumpur, Malaysia 452 m
3 Sears Tower, Chicago, USA 443 m
4 Jin Mao Building, Shanghai 421 m
5 Two International Finance Centre, HK 414 m
6 CITIC Plza, Guangzhou, China 391 m
7 Shun Hing Square, Shenzhen, China 384 m
8 Empire State Building, New York, USA 381 m
9 Central Plaza, Hong Kong, China 368 m
10 Bank of China, Hong Kong 369 m

Burj Dubai, United Arab Emirates

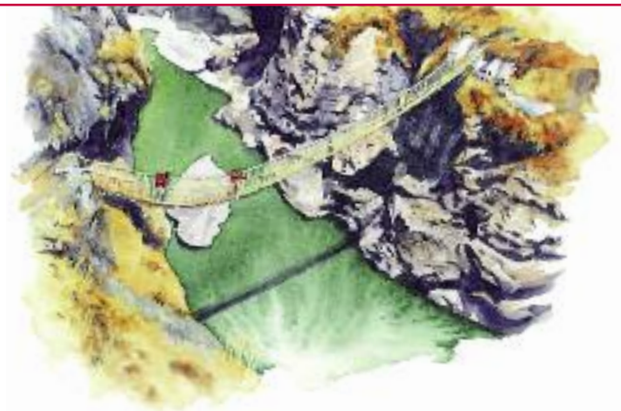
Burj Dubai, UAE, to be completed in 2009, will have a projected height of 808 m

BRIDGES

BRIDGES have been used since ancient times to span deep ravines, rivers and other stretches of water. Early bridges were made of wood which rotted easily and could not span great distances. In some parts of the world, people made bridges from wood and rope. They had walkways made of wooden slats and rope handrails. Bridges made of stone may last for centuries. However, stone is heavy to transport and long bridges need to have many sturdy supports.

During the Industrial Revolution, which began in the 18th century, engineers began to build bridges made from iron. These were much more durable than wooden bridges and could span longer distances than stone ones. The first iron bridge was built at Coalbrookdale, England, in 1779.

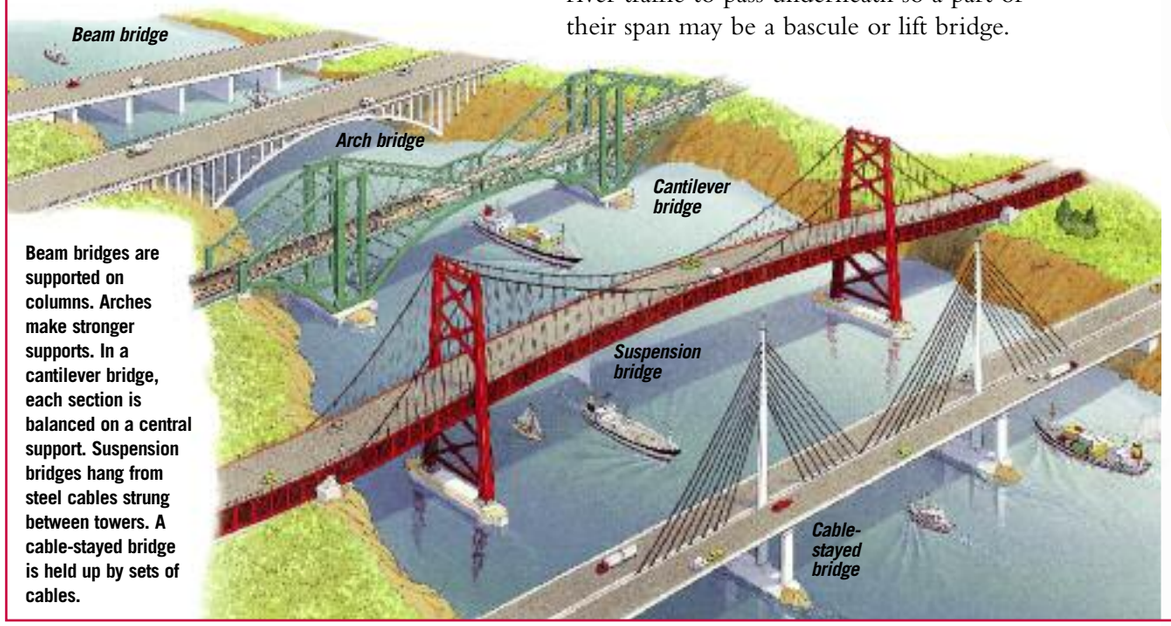
Modern bridges are built using steel and concrete. They may carry roads or railways over rivers, wide estuaries or high valleys, or above other roads and railways. There are a number of different kinds of bridge design available, each of which may be used in a modern bridge according to the type of crossing required.



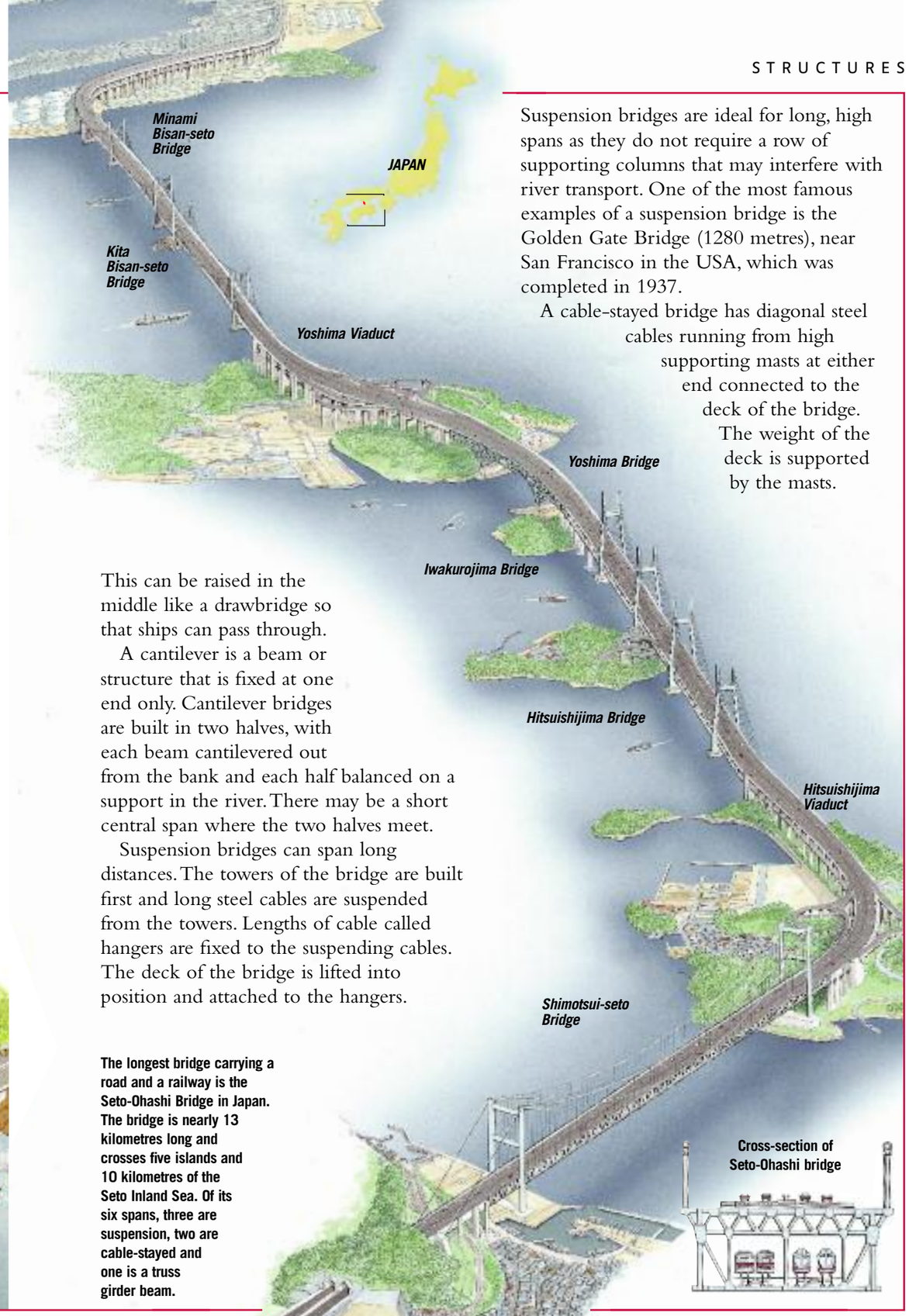
A rope bridge across a deep ravine in the Andes mountains in South America.

A beam bridge is one of the simplest and oldest designs. The beam is supported at each end. The earliest bridges were tree trunks or stone slabs laid across a stream supported by the banks on either side. A clapper bridge is a type of beam bridge which is supported from beneath by several columns in the river bed or ground. The deck may be flat or made from a hollow girder (truss) containing the road or railway.

An arch bridge—a very strong type—has a deck supported on an arch fixed to the banks. Some arch bridges are too low for river traffic to pass underneath so a part of their span may be a bascule or lift bridge.



Beam bridges are supported on columns. Arches make stronger supports. In a cantilever bridge, each section is balanced on a central support. Suspension bridges hang from steel cables strung between towers. A cable-stayed bridge is held up by sets of cables.



Suspension bridges are ideal for long, high spans as they do not require a row of supporting columns that may interfere with river transport. One of the most famous examples of a suspension bridge is the Golden Gate Bridge (1280 metres), near San Francisco in the USA, which was completed in 1937.

A cable-stayed bridge has diagonal steel cables running from high supporting masts at either end connected to the deck of the bridge. The weight of the deck is supported by the masts. This can be raised in the middle like a drawbridge so that ships can pass through.

A cantilever is a beam or structure that is fixed at one end only. Cantilever bridges are built in two halves, with each beam cantilevered out from the bank and each half balanced on a support in the river. There may be a short central span where the two halves meet.

Suspension bridges can span long distances. The towers of the bridge are built first and long steel cables are suspended from the towers. Lengths of cable called hangers are fixed to the suspending cables. The deck of the bridge is lifted into position and attached to the hangers.

The longest bridge carrying a road and a railway is the Seto-Ohashi Bridge in Japan. The bridge is nearly 13 kilometres long and crosses five islands and 10 kilometres of the Seto Inland Sea. Of its six spans, three are suspension, two are cable-stayed and one is a truss girder beam.

Cross-section of Seto-Ohashi bridge

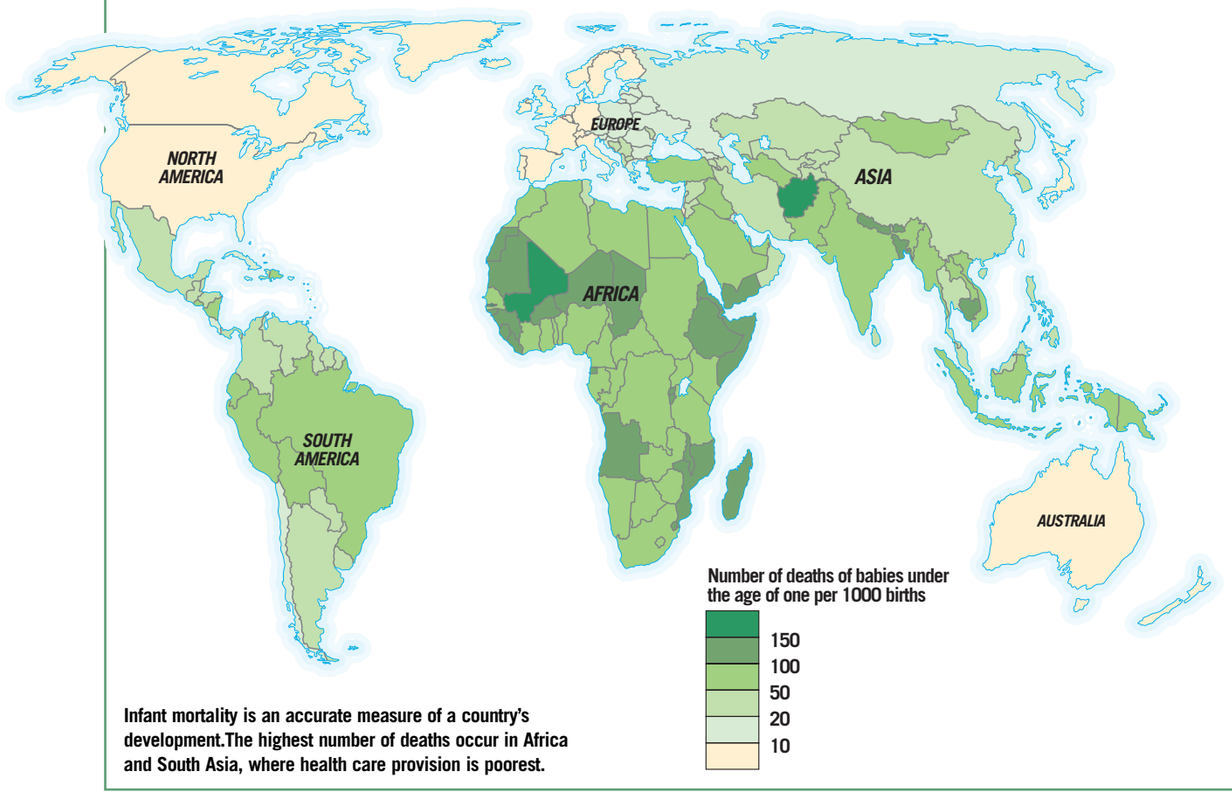
Wealth and Poverty

SOME NATIONS in the world are rich, while others are very poor. The gap between them seems to grow ever wider. Measured by the average income earned by people in the richest and poorest fifth of the world's nations, the gap has grown from 30 to 1 in 1960 to nearly 80 to 1 today. Within both rich and poor countries, there are also great contrasts in wealth.

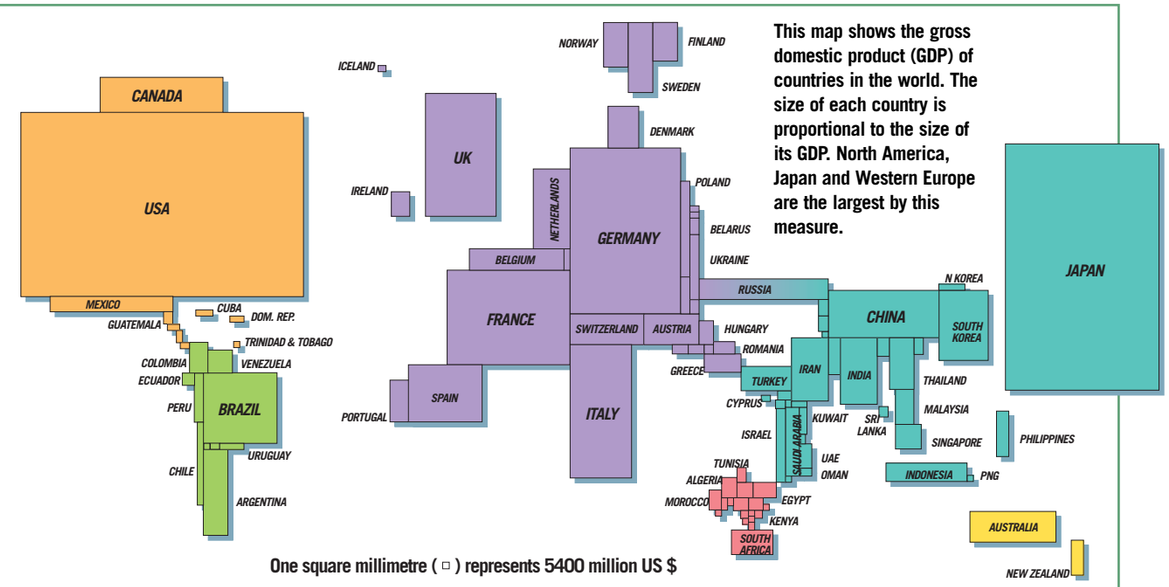
The wealthiest countries are those that have developed industries and services which can supply their own populations with all their needs. They do this either by producing these products and services themselves, or by importing them from other countries, paying for them by exporting goods. In poorer developing countries, people may produce only enough food to feed their families. Disease and climatic disaster may prevent even this.

People ride on the roof of a train in India. Annual income per person averages $1600 in India.

The population of developing nations has grown greatly in recent years. Their high birth rates means even more mouths to feed.



Infant mortality is an accurate measure of a country's development. The highest number of deaths occur in Africa and South Asia, where health care provision is poorest.



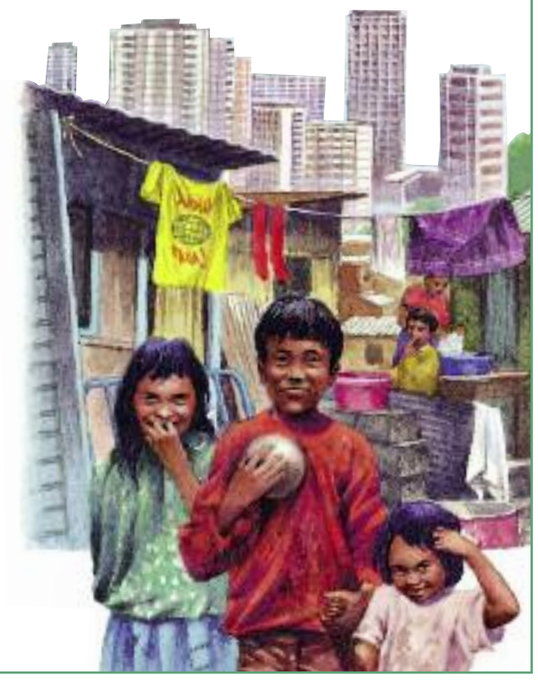
This map shows the gross domestic product (GDP) of countries in the world. The size of each country is proportional to the size of its GDP. North America, Japan and Western Europe are the largest by this measure.

One square millimetre (▫) represents 5400 million US $

South America has some of the fastest-growing cities in the world. They include the Brazilian supercities of São Paulo and Rio de Janeiro, both with populations of more than 10 million. People from the countryside flock to these cities to find work but there is nowhere for them to live. They build their own shantytowns (locally known as *favelas*) just outside the city by building shelters and shacks from any material that comes to hand *(right)*. People who live in shantytowns cannot find work easily and so they are forced to work for very low wages.

The wealth of a nation can be measured by its gross domestic product (GDP). This is defined as the value of all the goods and services produced there, including those produced by foreign-owned firms. The Group of Eight (G8) are the eight leading industrial nations of the world. These nations—the United States, Japan, Germany, France, the United Kingdom, Italy, Canada and Russia—account for more than 65% of the world's GDP. The country with the highest GDP per person in 2007 was Qatar ($80,900). In the same year, the figure for Rwanda in Africa was $900. More than 1.3 billion people around the world live on less than one dollar a day.

Wealthy nations such as the G8 lend money to developing countries. However, the developing countries often find that, because of their low GDP, they cannot repay the loans and a big debt burden builds up. The largest foreign aid donor in 2007 was the United States with aid amounting to more than $21.8 billion.



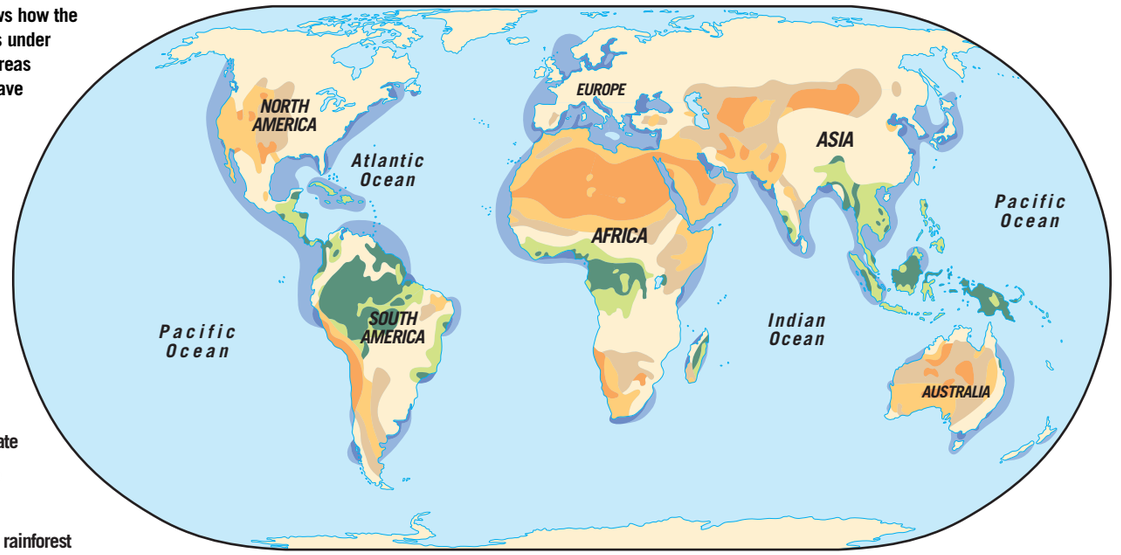
Environmental Threats

PEOPLE have made many changes to the world they live in and some of these have had harmful consequences. As the world population increases, there is more need for bigger cities, new towns and farming land. Land has to be cleared, destroying the habitats of many animals and plants. Some of these are now extinct and others are in danger of becoming so. Hunting has also put animals in danger.

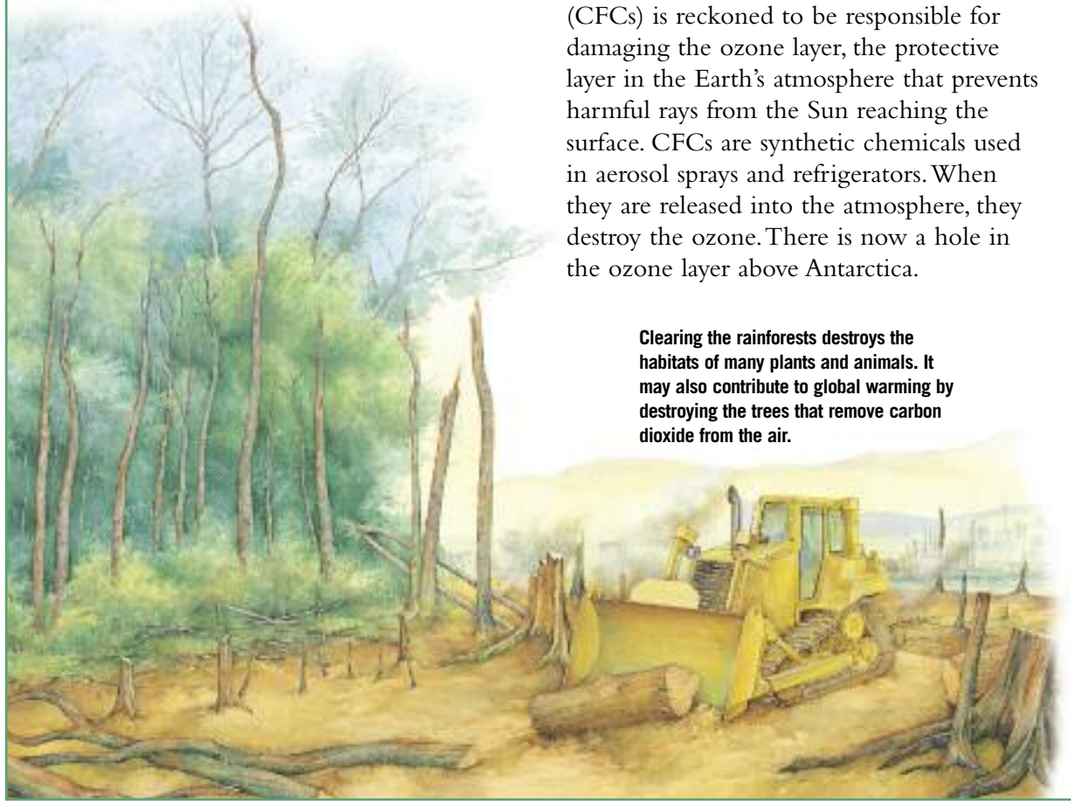
There is now nearly three times as much desert in the world as there was 100 years ago. This is partly due to farmers over-grazing their animals on the meagre grass and shrubs and to the clearance of woodland trees for firewood.

Industrialization is a major threat to the environment. Pollution is just one example. Factories discharge harmful chemicals into rivers and seas, killing fish and plants.

This map shows how the environment is under threat. Huge areas of rainforest have been cleared. Many coastal waters have been polluted, and the desert spreads yearly.



The production of chlorofluorocarbons (CFCs) is reckoned to be responsible for damaging the ozone layer, the protective layer in the Earth's atmosphere that prevents harmful rays from the Sun reaching the surface. CFCs are synthetic chemicals used in aerosol sprays and refrigerators. When they are released into the atmosphere, they destroy the ozone. There is now a hole in the ozone layer above Antarctica.

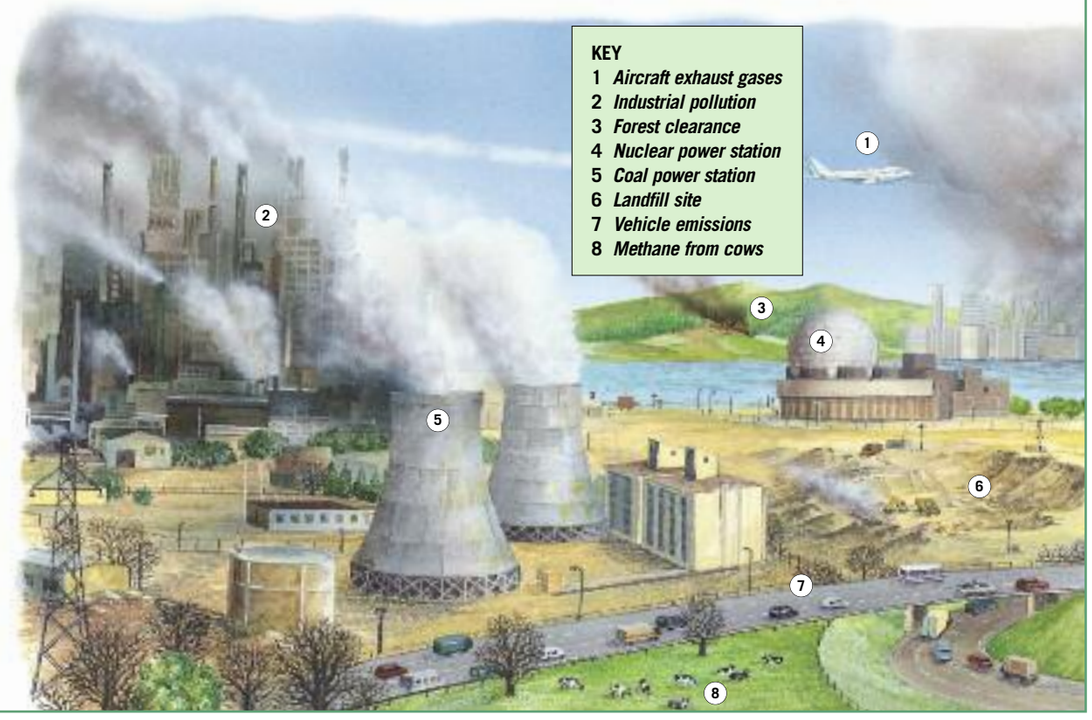


Clearing the rainforests destroys the habitats of many plants and animals. It may also contribute to global warming by destroying the trees that remove carbon dioxide from the air.

Air pollution is caused by fumes and smoke from vehicles, factory chimneys and power stations *(below)*. Poisonous gases, such as sulphur dioxide, mix with rain and mist to produce acids. When the acid rain falls, it kills plants over a wide area. Burning fuels also causes a build-up of carbon dioxide.

The waters of the Aral Sea in Russia are used to irrigate land for cotton cultivation. The lake has now partially dried up.

Carbon dioxide and CFCs are both greenhouse gases. In the right amounts, greenhouse gases in the atmosphere trap heat from the Sun so the Earth is not too hot or too cold. But if the greenhouse gases build up, too much heat is trapped and the Earth becomes warmer. This change in climate, known as global warming, could have disastrous effects. The ice in the polar regions may melt, causing severe flooding to low-lying areas. Changes in the climatic pattern worldwide could lead to violent storms and long droughts.



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