Collins

Cambridge IGCSE™

Geography

STUDENT'S BOOK

Also for Cambridge O Level and Cambridge IGCSE™ (9–1)

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Population dynamics

Learning objectives:

- describe and give reasons for the rapid increase in the world's population
- show an understanding of over-population and under-population
- understand the main causes of a change in population size
- give reasons for the contrasting rates of natural population change
- describe and evaluate population policies

Why are some families larger than others?

Population growth

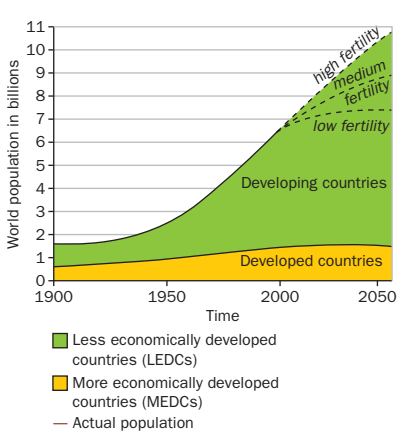
In the last 50 years, the world's population has grown faster than ever before. This happened so quickly, it is known as the **population explosion**. Graph **C** shows how the world's population has changed over the last 150 years. It also shows that most of this increase took place in poorer countries. For a long time the graph line is almost level and then it suddenly becomes much steeper. This is the point when the population explosion took place. Graph **D** shows the points when global population increased by another billion (one thousand million).

Halbi! My name is Kadlin. I live in Svelvik, a small town not far from the capital city, Oslo. I live with my parents and my grandmother. Like many children in Scandinavia, I'm an only child. I often wonder what it would be like to have even one brother or sister. When I asked Mum about this, she told me, 'Your father and I wanted you to have the best – and a chance to go to university. That's very expensive, so we decided not to have any more children.' Mum also said she needed to get a good start to her career before she settled down – she was 31 before she and Dad got married.

A *Kadlin and her family live in Norway, one of the richest countries in the world*

B *Daksh's family live in India, which has many poor people*

Namaste! I'm Daksh and I live in Nindar, Jaipur. My father wanted to follow the local tradition of having sons to help him on the farm. After I was born, though, my four sisters arrived before a brother came along – so now there are six of us. I used to dream of going to university and becoming a doctor, but I left school at 14 and now do much of the work in the fields because father is getting older and isn't well.



C *World population change, 1900–2050*

Skills link

Graphs **C** and **D** are different types of line graph. Learn more about line graphs in Topic 4.3 page 251.

Fantastic fact

Every minute of every day, the world's population increases by at least 150 people!

Topic link

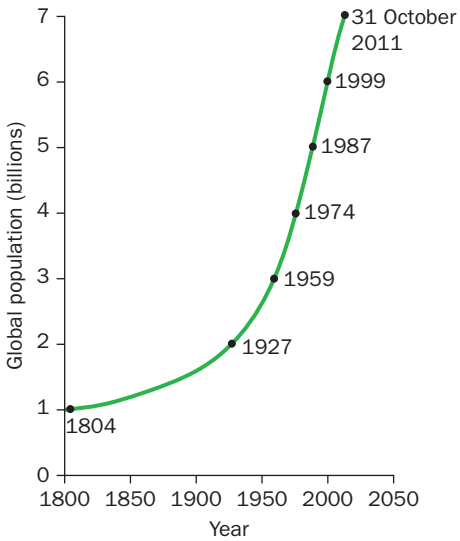
You can learn more about over-population in Topic 1.1 pages 8–12.

Effects of population growth on people

Population increase affects people and places in different ways. A population can grow so rapidly that there are no longer enough essential resources such as food and water. This is called **over-population**.

An increasing population can also have economic benefits:

- There are more customers to buy locally made goods. This creates jobs close to where people live.
- Manufacturing large quantities means goods can be made more cheaply, so more people can afford to buy them.
- Cheaper goods means they are easier to sell abroad, which earns extra money for the country.
- More jobs means less unemployment, which enables more parents to provide their children with a better standard of living.



D *World population 1800–2011: the 'billion-person points'. World population reached 7.5 billion on 24th April 2017.*

More people ⟶ more workers ⟶ increased output ⟶ more to sell ⟶ greater wealth

Now Investigate

1. What are some factors that influence family size? How many people are there in your own family?
2. The world's population increases by at least 150 people every minute. Use a calculator to work out how many million extra people there are in a year.
3. **a)** Copy and complete the table below, using information on graph **D**.
   b) What does your table tell you about how quickly the world's population increased after the year 1900?

Billion-people points		Number of years between these two points
First	Second	
Second	Third	
Third	Fourth	
Fourth	Fifth	
Fifth	Sixth	
Sixth	Seventh	

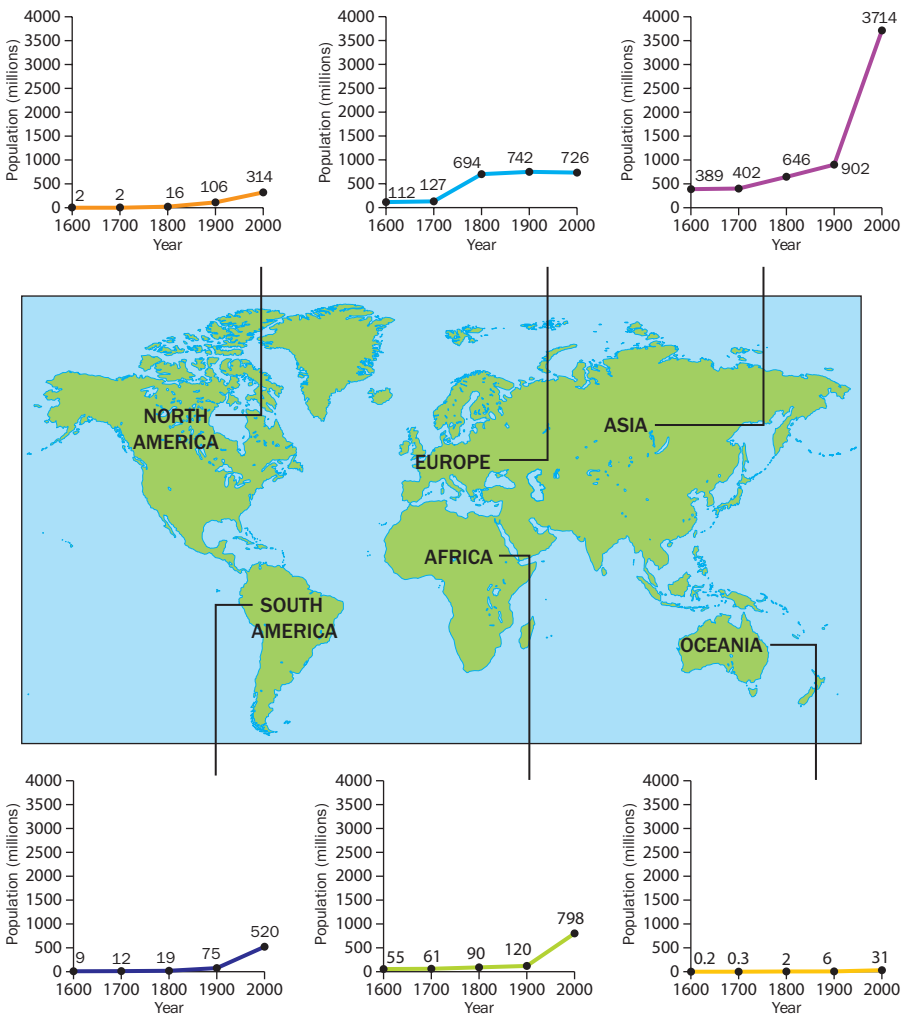
4. Referring to graphs **C** and **D**, select the correct number from those shown in brackets.
   a) The world's population in 1800 was about (*10/100/1 000/10 000*) million people.
   b) The world's population in 2010 was about (*6/7/8/9*) billion people.
   c) In 2000, most people lived in (*developed/developing*) countries.
   d) With low or medium fertility, the rate of world population growth is (*slowing down/speeding up/staying about the same*).
   e) Using the high fertility prediction, the global population in 2050 is predicted to be about (*7.5/8.5/9.5/10.5*) billion people.

Why did the population explosion happen?

The 'population explosion' took place in two stages. The first was in the earliest industrialised countries like the UK. The second was much later, in poorer, mainly agricultural countries (map/graphs **A**). This later stage is continuing in some parts of the world.

There were four main reasons for the population explosion:

- **Economic** Children can be an important source of income. In the poorest communities, every contribution, however small, is vital to the family budget. A child's income can mean the difference between starvation and survival for a family (photo **B**).
- **Care of the elderly** Older children can support the family by looking after elderly parents, or parents whose working lives are cut short by illness or accidents. Children may be the only support in countries that don't provide pensions or care facilities for the sick and elderly.
- **Infant mortality** Parents want to make sure that at least some of their children will survive and become adults. In poor societies, where medical facilities are limited, there is a high **infant mortality rate**. Having a large family provides security against the problems of old age.
- **Life expectancy** People are now living longer because of improved medical knowledge and treatment. Better farming methods have increased crop yields so there



A *The population explosion happened in different places at different times*

B *Children at work*

C *Modern machinery helped to increase global cereal production by over 250% in the late 20th century*

is more food and a more nutritious diet (photo **C**). At school, children learn how to stay healthy for longer. The average life expectancy of the world's population is now approximately 70 years, compared with only 40 years two centuries ago.

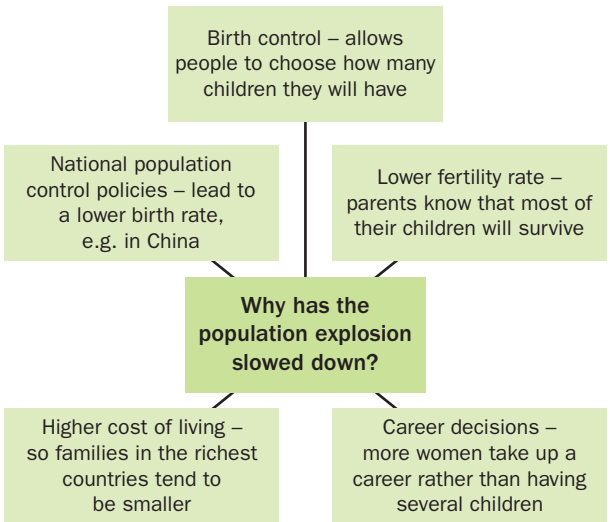
Stages of the population explosion

- **Stage one** In the 18th and 19th centuries, the development of industry led to rapid population growth, especially in Europe. The new factories needed large numbers of workers. Many people moved into the towns from surrounding rural areas. More children survived infancy, so the **fertility rate** increased.
- **Stage two** In the 20th century, improved medical facilities worldwide increased the life expectancy of ordinary working people. There was now a much greater difference between the **death rate** and the **birth rate**.

  Diagram **D** explains why the rate of population growth has slowed down in recent years. In fact the world's fertility rate is now 2.4 children, half what it was in 1950.

Fantastic fact

In the UK, it can cost over £200 000 to bring up one child from birth to age 21. This is an increase of 63% since 2003!



D *Declining rate of population growth*

Now Investigate

1 **a)** One way of remembering facts is to use letters that stand for key words. These words can then be joined to make a simple phrase that is easy to remember. Try doing this with the four reasons for the population explosion (E C I L). You can put them in a different order, if this helps!

b) Now think of another way to remember facts, and use this to help you remember the information in diagram **D**.

2 Match each of the following key terms with the correct definition:

Key term	Definition
1 Birth rate	**a** the average number of children women have in their lifetime
2 Death rate	**b** the average number of deaths in a year (for every 1000 people)
3 Fertility rate	**c** the average number of live births in a year (for every 1000 people)
4 Growth rate	**d** the average number of years people can expect to live
5 Infant mortality rate	**e** the difference between the birth rate and the death rate
6 Life expectancy	**f** the proportion of children dying at birth or before their first birthday

3 **a)** Name the continent that was most affected by the first stage of the population explosion.

b) Name three continents that experienced the second stage of the population explosion.

c) Which of these three continents was most affected by the second stage of the population explosion?

d) Write a few sentences about how quickly population has increased in the continents you have named.

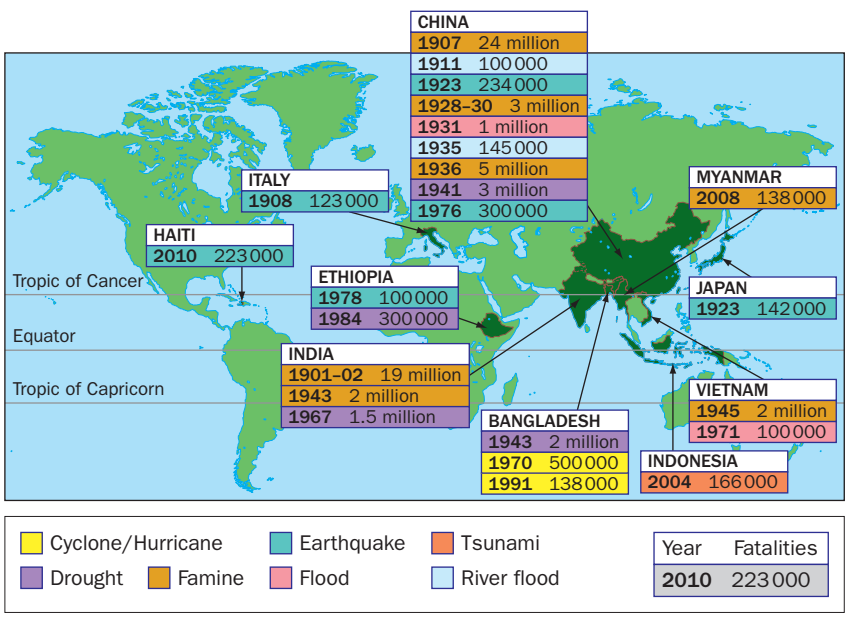
Why do populations grow at different rates?

As in any country, the rate of population growth in your country is due to changes in three variables:

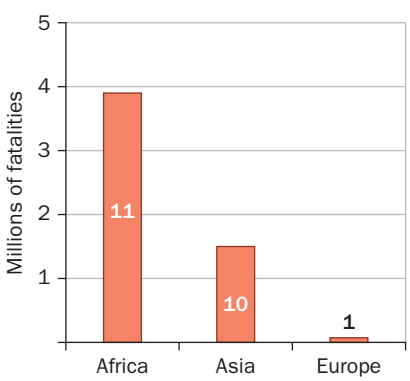
- birth rate
- death rate (including the infant mortality rate)
- international migration.

The infant mortality rate is usually the most important of these. Parents may be aware that some of their children are likely to die before they reach adulthood, because of a lack of a good diet or poor healthcare, and they may have this in mind when deciding how big their family should be. This topic explains why children's survival is so important to the future of many families in less economically developed countries. Apart from old age, the main causes of death are:

- diseases and infections such as cholera and typhoid



A *Natural hazard events since 1900 that killed over 100 000 people*



The number on each column represents the number of events involved.

B *Conflict events since 2000*

Topic link

- Look back at Topic 1.1 pages 2–5 to remind yourself about population growth.
- You will learn more about international migration in Topic 1.2 pages 21–26.

Fantastic fact

Locusts can make famines much worse. A swarm of 80 million locusts can eat 160 tonnes of cereal and fresh fruit *every day*!

- natural hazards, especially earthquakes and floods
- human conflict.

Human conflicts and natural hazards can have a serious impact on a country's population (map **A** and graph **B**). However, there can be significant differences in their long-term effects on population change.

For example, a natural hazard such as a tsunami or powerful earthquake may sweep away almost everything and everybody in the area (photo **C**). That place may be abandoned, or be re-populated. The main impact of such events is on the *total* population; they do not differentiate between individual age and gender groups.

C *The Japanese tsunami, 2011, which devastated the nuclear plant at Fukushima*

Human conflict has a similar effect. It can involve the death and injury of hundreds and even thousands of people, as for example in Bosnia-Herzegovina in Europe (1992–95), Darfur in Sudan (2003–06) and Syria (2011 onwards).

Armed fighters in the 20–45 year age range are most likely to die in such conflicts. However, modern warfare can affect people of any age, and can have a long-lasting effect on a country's total population (photo **D**).

D *When there is conflict in a country, people often lose their homes and their land*

Topic link

You can learn more about famines – a widespread shortage of food – in Topic 3.2 pages 163–170.

Topic link

To learn more about the 2011 Japanese earthquake, look at Topic 2.1 on pages 77–79.

Topic link

Look at Topic 2.5 pages 128–135 to learn more about how people are affected by natural hazards.

Further research

Find out what events may have influenced the death rate in your own country or continent in recent times.

Now Investigate

1 **a)** Describe the global distribution of each type of natural hazard shown on map **A**.

b) Try to identify any world regions where there appear to be 'clusters' of similar events.

2 **a)** Draw a scatter graph to plot the numbers of fatalities in the six famines shown on map **A**, then add a best-fit line to highlight the trend it shows.

b) What trend in the number of famine casualties does your line graph show?

c) Suggest possible reasons for the trend.

3 Study graph **B**.

a) Which continent has been most affected by human conflict during the 21st century, in terms of:

i) the number of events

ii) the total number of fatalities?

b) Using your answers to question (a), suggest the long-term effects of conflict on the populations of continents.

How are population growth and resources linked?

Over-population

If the number of people living in an area cannot be supported by the resources in that area and enjoy a reasonable standard of living, it is **over-populated**. Regions like the African deserts may be over-populated, even though very few people live there (they are **sparsely populated**), because the land cannot support the number of people who live there.

However, just because many people live in an area (that is, it is **densely populated**), that does not always mean a place is over-populated. Some of the most densely populated places on Earth are well resourced. For example, Japan is not over-populated, because it has many profitable industries which provide jobs and income through the country's exports. Those items that cannot be produced in their own country can be bought from abroad using money earned from these exports.

Under-population

If the number of people living in an area is fewer than the number that can be supported by the resources in that area, then it is **under-populated**. For example, Canada has many resources which are under-used. Many more people could live there and enjoy a high standard of living.

Fantastic fact

Just 29% of the world's surface is land, but only about 40% of this is suitable for food production.

Resources and population

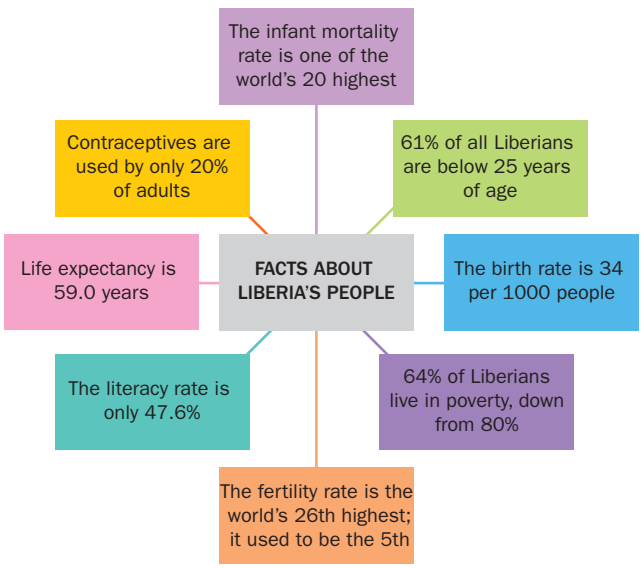
There are two questions to ask when deciding whether a country is over-populated or under-populated:

- Do people have what they need in order to stay alive and to provide for their families (diagram **C**)?
- Are the country's resources sufficient to support its population?

CASE STUDY

Liberia – a country with a high rate of natural population growth

Table **A** shows that Africa is predicted to have the greatest natural population growth (NPG) of all the continents for the foreseeable future. Liberia is one of Africa's smallest countries, with only 4.3 million people; it once had the continent's highest NPG rate (over 4.5%); but, by 2017, this had fallen to 2.4%. It remains one of the world's poorest countries, mainly due to its recent civil wars which killed over 250 000 people and ruined the economy. Unemployment remains very high (85%) and almost three-quarters of its workers depend on agriculture for a living. Diagram **B** provides more information about Liberia.



B *Facts about Liberia's people*

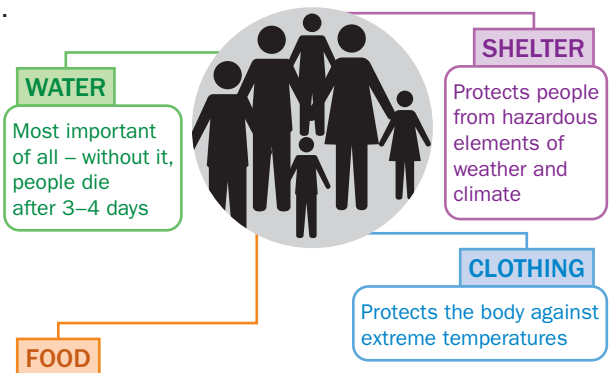
Years	Africa	The Americas	Asia	Europe	Oceania	World
1950–2000 (Actual)	253	148	137	33	139	143
2000–2050 (Prediction)	204	45	42	–3	84	59
2050–2100 (Prediction)	77	0	–7	–9	25	15

A *Global percentage population changes, 1950–2100*

Too many people, too few resources

There are a number of reasons why a place may not be able to support a large number of people – that is, why it may be over-populated. For example:

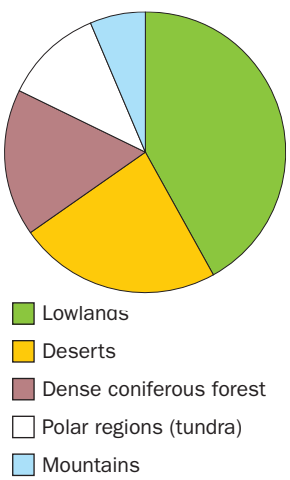
- **A lack of clean water** may force people to use polluted sources and possibly fall ill with diseases, many of which are life-threatening, especially for the very young and old.
- **Droughts** are becoming more frequent and severe due to climate change. They increase the risk of starvation in already over-populated countries.
- **Loss of jobs** – when valuable natural resources become exhausted, workers are no longer needed and will not be able to support their families.
- **Population growth** – when there is rapid population growth, or an increase in immigrants, a country may be less able to provide for its people.
- **Clearing of forested areas** can result in families not having the fuel they need for cooking, heating and washing.
- **Natural disasters** such as earthquakes and floods often deprive local communities of the resources they need, for example water, food and shelter.



C *People's basic needs*

Now Investigate

1. a) Do you think your country is sparsely populated or densely populated?
   b) Is it over-populated or under-populated?
2. a) Use Table **A** to compare Africa's natural population growth (NPG) trends with those of the other continents and the world as a whole.
   b) Suggest reasons why Europe's NPG rate is predicted to decline – and at an increasing rate.
3. Write all the information in Diagram **B**, and the data in the paragraph about Liberia in a table. Use the headings: Information about Liberia's population change rates; Reasons for these rates of population change; Other information about Liberia.



D *Environments of the world's land areas*

Over-population and under-population

Both large and small countries can be under-populated and over-populated. On these pages we look at one very large country, in terms of area, which has a relatively small population and another which has one of the largest and fastest growing populations in Africa. Canada is under-populated because it has an advanced industrialised economy and so many valuable natural resources that it could easily provide extra people with a high standard of living. Tanzania is an over-populated country; the information on these two pages will allow you to understand why and how Tanzania differs from Canada.

CASE STUDY

Canada – an under-populated country and Tanzania – an over-populated county

Canada is a huge country – the second largest in the world after Russia. Vast stretches of the nation are almost totally uninhabited (photo **B**). Significantly, though, GDP per capita for the country is high.

Table **A** summarises information about the populations of Canada and Tanzania. Figure **C** looks at Canada's resources of which its greatest natural assets are its mineral resources such as oil and gas. Many of these are found in remote, wilderness areas.

Fact	Canada	Tanzania
Area (km²)	9 984 670 (2)	947 300 (31)
Population (millions)	35.4 (32)	52.5 (27)
Average population density (people per km²)	4.0 (232)	62.0 (153)
Annual population growth rate (%)	0.7 (146)	2.8 (11)
Net migration (per 1000 inhabitants)	5.7 (20)	–0.5 (128)
Infant mortality rate (per 1000 live births)	4.6 (179)	41.2 (48)
Fertility rate (average number of children per woman)	1.6 (183)	4.8 (17)
Life expectancy (years)	81.9 (19)	62.2 (193)
Literacy (% of population)	99 (36)	67.8 (179)
GDP per capita ($)	46 200 (32)	3 100 (190)
GDP annual growth rate (%)	1.2 (169)	7.2 (9)
Access to safe drinking water (%)	99.8 (40)	55.6 (178)
Human Development Index	0.92 (10)	0.5 (151)
Population in poverty (%)	9.4 (143)	67.9 (50)
Value of exports ($ billion)	402.4 (12)	6.0 (108)
Value of imports ($ billion)	419 (9)	10.0 (96)

A *Factfile for Canada and Tanzania – the figures in brackets indicate the world rankings of both countries*

Fantastic fact

Canada has a land area 14 325 times larger than Singapore, one of the smallest countries in the world, but its population is only 6 times bigger!

Topic link

Topic 3.1, pages 136–40 explains how GDP, the Where-to-be-born Index and the Human Development Index are calculated.

B *Canada occupies most of the North American continent above latitude 41°North*

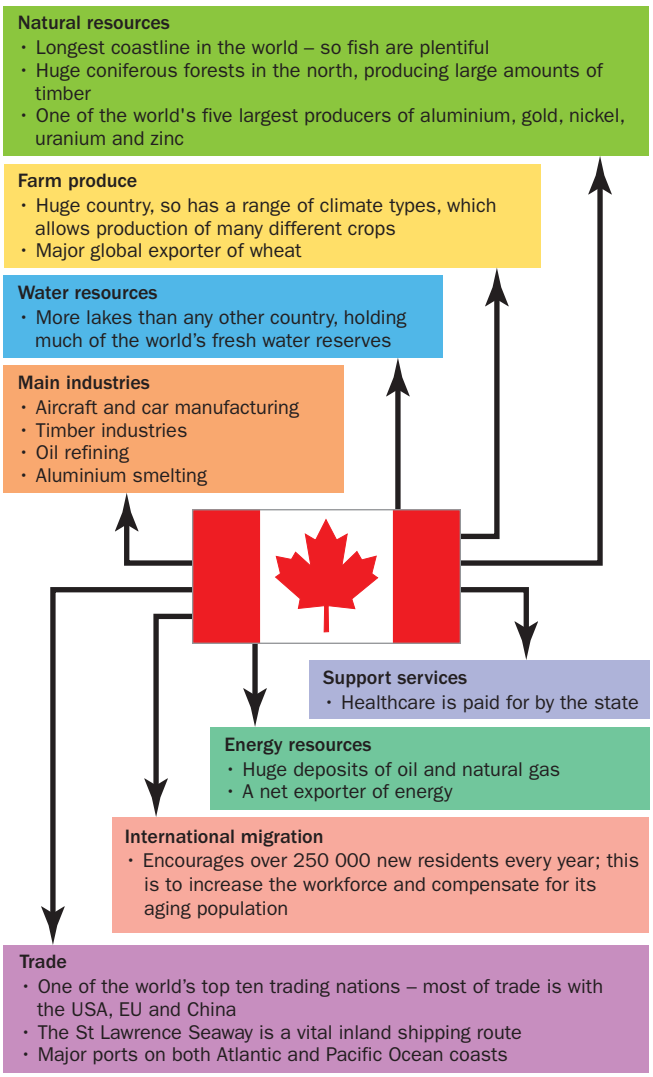
The figures in factfile **A** and photograph **B** clearly show that Canada is under-populated:

- The infant mortality rate is very low and life expectancy is high – this suggests that there is adequate medical care.
- Literacy rates are high – this shows that education facilities are well funded and effective.
- Unemployment rates are very low – which means that most people are able to find suitable paid work.
- The Where-to-be-born Index rating of 9, is high by global standards, showing that most people in Canada are generally content with their standard of living.

In many ways, Tanzania is similar to several other African countries. It has high youth unemployment and most of its families depend on agriculture for their survival; also, AIDS and under-nourishment mean that few people live beyond 65 years of age. Tanzania is certainly a country with great potential, but rapid population growth makes it very difficult to improve its people's standard of living.

Topic link

This topic has links with Topic 3.2 pages 163–164



C *Canada's resources*

Now Investigate

1. What evidence in table **A** and figure **C** proves that Canada is *under*-populated? Include reasons for your answer.
2. **a)** Write full sentences to discuss the significance of at least six of the data comparisons in Table **A**.

b) Use the information in Table **A** to explain why Tanzania is over-populated. You could discuss this information under sub-headings such as Access to safe drinking water, Education and The economy.

3 Suggest reasons why rapid population growth makes it difficult to improve people's standard of living.

Diseases are deadly!

Death rates across the world have decreased significantly over the last 50 years, largely due to improvements in healthcare, although the cause of death is noticeably different in different parts of the world (graphs **A** on page 14). Reasons for this decline include:

- increased medical knowledge
- more effective medicines and healthcare
- education about the importance of a balanced, nutritious diet.

However, many diseases are still major killers. For example, malaria kills at least 1 million people every year. Most deaths from malaria occur in tropical countries, where breeding conditions for mosquitoes are ideal. Even now, one in every five childhood deaths in Africa is due to this disease. Diagram **B** on page 14 explains how people are infected with malaria.

A **pandemic** is an outbreak of an infectious disease so widespread that it kills millions of people in a very short time. There have been several pandemics in the past, for example:

- The so-called 'Black Death' of the mid-14th century, which we now know was spread by rat-born fleas, killed over 75 million people in Europe. It had a significant impact on the global population at that time.
- The 'Spanish Flu' pandemic of 1918–20 that killed a similar number of people. It was probably so deadly because many people had already been weakened by the effects of the First World War (1914–18).

HIV/AIDS is the most recent pandemic. It is particularly widespread among people under 60 years of age. Since it was first identified in 1981, it has caused an estimated 36 million deaths – equivalent to the population of Canada, Morocco or Uganda. HIV and AIDS are very closely linked, but are not the same! HIV (human immunodeficiency virus) is a *virus infection*, transmitted by the exchange of bodily fluids, usually through sexual activity. It reduces the body's resistance to illness and other infections and, so far, has no known cure. AIDS (acquired immune deficiency syndrome) is the *medical condition* of a person in the later stages of HIV, when victims become weak, lose weight and develop flu-like symptoms which can prove fatal.

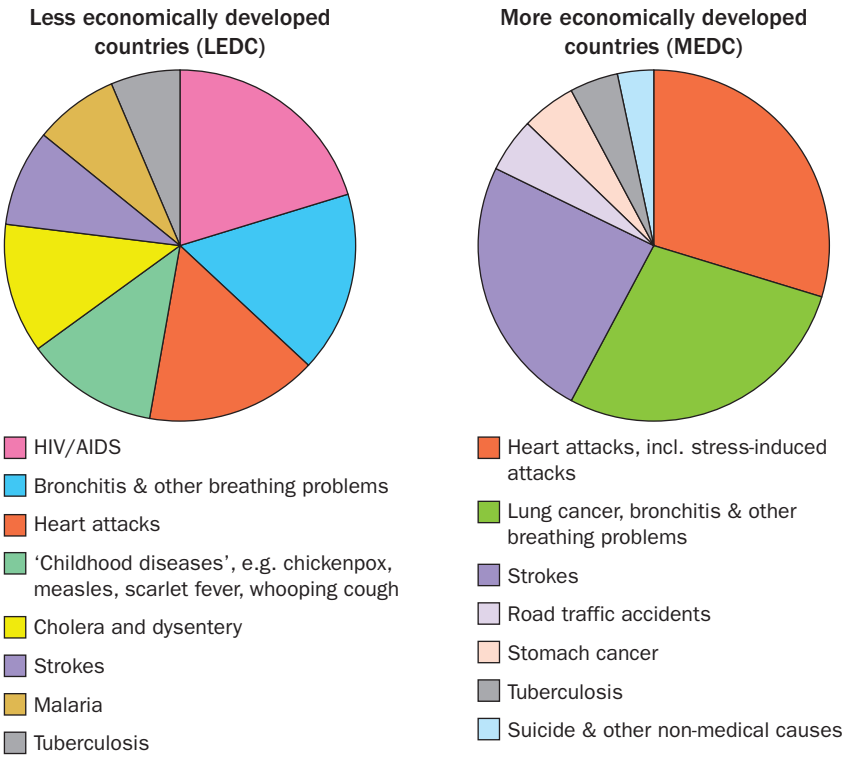
Further research

Use the internet to create table **A** and figure **C** for your country. (If you live in Canada, investigate another country.) Use the information to decide whether your country is over-populated or under-populated.

Further research

Use information from the internet to create a factfile on a widespread disease like cholera or typhoid. Include details about:

- what causes it, and how its spreads
- what medicines are available to treat it
- those parts of the world where it is still a common cause of death
- especially serious outbreaks: when and where they took place, and how many people died.

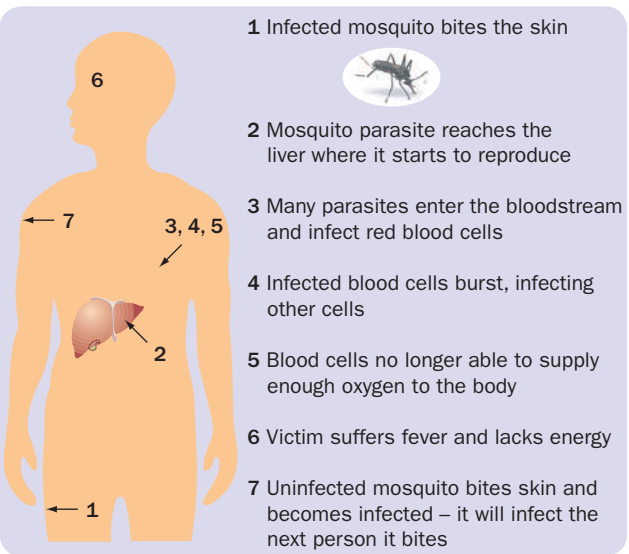


A *The main causes of early death (that is, not due to old age) in LEDCs and MEDCs*

The number of people living with HIV continues to rise, in spite of advances in medical knowledge. Sub-Saharan Africa is the most affected region, but Botswana, Lesotho and Swaziland have the highest rates, with 22–29% of their total populations being infected (table **C**). Many African countries now use the 'ABC' slogan to advise people on how to avoid HIV/AIDS:

- **A** stands for *abstinence* (from sexual activity)
- **B** means *be monogamous* (have only one sexual partner)
- **C** stands for *contraception*.

This advice has helped African countries like Kenya and Uganda to reduce their HIV infection rates (photo **D**). Scatter graph **E** presents a possible link between population infection percentages and GDP.



B *How malaria spreads*

Skills link

You can learn more about scatter graphs in Section 4.3 page 253.

	Botswana	World
Life expectancy (years)	54.5	69.0
Adults as % of total population	67.6	74.6
Average age	23.2	30.1
People living with AIDS	348 900	36.7 million
% of total population infected with AIDS	23.9	0.8
Children orphaned as a result of HIV/AIDS	Approx. 130 000	Approx. 17 million

Note: all figures are estimates

C *Botswana: some of the effects of HIV/AIDS*

D *A new AIDS hospital in Lusaka, Zambia*

Now Investigate

1 **a)** What is the most noticeable difference in the causes of early death shown for LEDCs and MEDCs in the two graphs in Figure **A**?

b) Suggest some reasons for these differences.

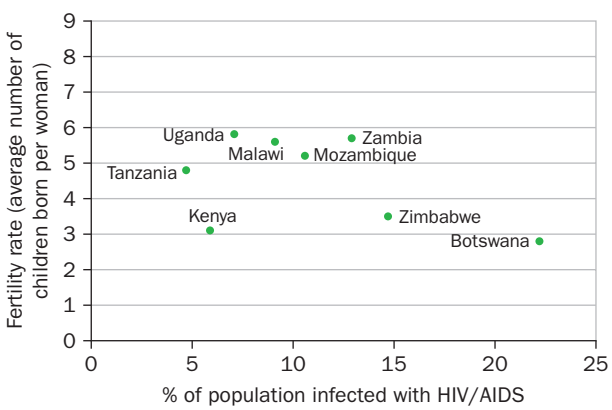
2 Using diagram B, the text and the internet, suggest how people can help to reduce the spread of malaria.

3 Study graph **E**.

a) Place a ruler or the edge of a piece of paper along the position of the best-fit line.

b) According to this line, what appears to be the general link between the fertility rate and HIV/AIDS infection rates?

c) How might the fertility rates be linked with the number of 15–49 year olds who are infected by HIV/AIDS?



E *Relationship between HIV/AIDS and fertility rates in eight East African countries*

Anti-natalist population policies

The governments of several countries have imposed direct laws, or policies, to control their population growth rates. This includes China, which has the largest population in the world.

CASE STUDY

China – a country with a low rate of natural population growth

A country like China needs to keep its population growth under control. The policies it has put in place in order to do this are described as **anti-natalist policies**:

- *anti* means to be against (or in disagreement with)
- *natalist* is anything to do with childbirth.

This term describes any policy that aims to control or limit a country's birth rate rather than stimulate it. China's strategy was the 'one-child policy', introduced in 1979.

Before 1979

After 1949, China experienced a population explosion, or 'baby boom'. The government decided to restrict family size and recommend that people married later in life. But between 1958 and 1961, droughts and floods caused the deaths of 2 million Chinese. Then the harvests returned to normal and the Chinese leader encouraged people to have as many children as possible, creating a second 'baby boom'. China's birth rate soared to 5.8 children per couple – well above the 2.1 needed to keep the population stable. This is known as the '**replacement level**'. In the 1970s, the Chinese government again wanted families to have fewer children. In 1979, it introduced its 'one-child policy'.

Did the policy work?

Family planning advice and contraceptives were made freely available, and a 'One-child Certificate' was awarded to families who had followed the policy. They were also entitled to extra benefits (diagram **A**), while those who had additional children were penalised (diagram **B**). Baby girls and second children were often abandoned, or secretly adopted by childless families.

The policy was generally more successful in the cities than in rural areas. In country areas, farming families needed a son to help work the land, so these families were usually allowed a second child if the first was a girl.

Fantastic fact

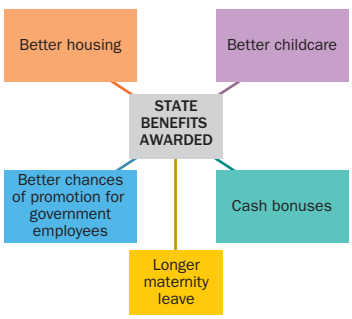
Two in every eleven people in the world today lives in China!

Topic link

Look back at Topic 1.1 pages 2–5 for more on the population explosion.

Topic link

For more details of China's current and predicted population structure look at Topic 4.3 on page 262.



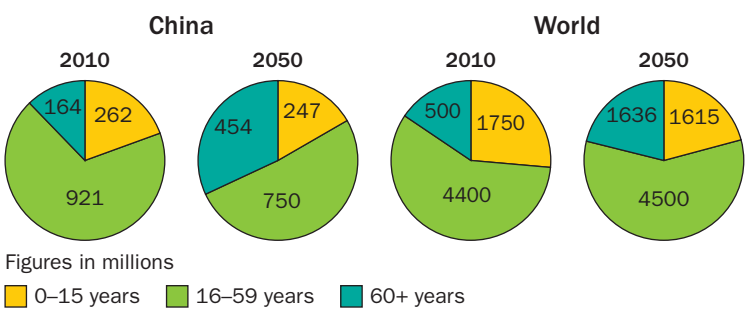
A *Benefits of being a one-child family*

Since 1979

In 1992, China relaxed the rules and adoption was legalised. In 2004, the city of Shanghai introduced a local law allowing divorcees who re-marry to have a second child without incurring the usual penalties. In 2008, the National Population and Family Commission stated that the one-child policy would continue for at least another 10 years. However, in 2015, the Chinese government announced a new two-child policy to help address its major demographic crisis, in which more and more elderly people are being supported by fewer and fewer workers.

10-year period between population census years	% population change in China	% population change in Asia	% population change in the world
1970–1980	20.0	23.7	20.5
1980–1990	14.8	22.0	19.6
1990–2000	10.8	15.7	15.2
2000–2010	5.8	12.1	12.9
2010–2015	2.5	5.4	6.5

D *Population trends in China, Asia and the World, 1970–2015*

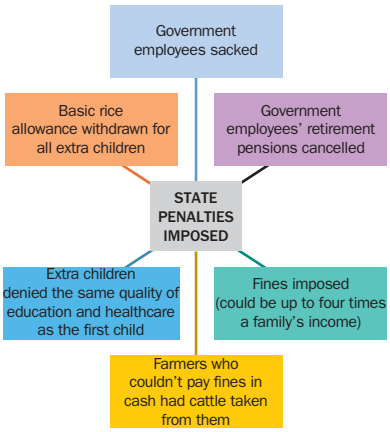


E *Age dependency in China and the world*

Problems of age dependency

China now has a very 'unbalanced' **population structure**, with more men than women – 117 men to every 100 women. Another concern is **age dependency** (graphs **E**), which means that the elderly population becomes dependent on the younger generations. It is described as China's '4-2-1 problem', because many single children (1) will become responsible for caring for their parents (2) *and* their four grandparents (4).

China's fertility rate is now about 1.6, which is still above its official target. However, the one-child policy does seem to have avoided the financial burden of 400 million extra births, which has facilitated China's development as a global economic superpower.



B *Penalties for not following the one-child policy*

- *China had already achieved success in reducing its fertility rate in the 1970s – that is even before the introduction of its one-child policy! It had dropped from 5.8 children per woman in 1970, to only 2.7 in 1978.*
- *China's adult workforce is predicted to decrease by almost 10 million a year after 2025.*
- *Parents of only children who've died young have been demonstrating outside public buildings. They want compensation for financial hardship in their old age because no-one can look after them.*
- *More than 24 million Chinese men could find themselves without a wife by 2020. A major reason for this is the high number of sex-specific abortions, due to China's traditional bias towards male children. Ultrasound scans, first introduced in the late 1980s, have increased this practice. In some provinces (especially rural areas), 130 boys are actually born for every 100 girls.*

C *Recent media statements about challenges and changes in China.*

Now Investigate

1. Draw a timeline for population events in China since 1945. Add labels for the following years, giving details of what happened in each:

   1949, 1958–61, 1970, 1979, 1992, 2004, 2008, 2015.

2. **a)** Search the internet to find more media statements about China, similar to those in Figure C.

   b) Using pages 16 and 17, together with your own search results, evaluate the long-term effects of China's population control policies.

Pro-natalist population policies

Other governments have created policies to encourage people to have more children in order to boost their population growth rate. These are known as **pro-natalist policies** (*pro* means 'for'). In Western Europe, for example, between 1980 and 2016, no country had a fertility rate above the critical 2.1 **population replacement level** (table **A**). In fact, 47% of all the world's countries now have a fertility rate below 2.1. One reason for this is that, as countries become richer, women marry later in life and delay starting a family.

Skills link

See page 16 for an explanation of 'replacement level'.

Country	Fertility rate, 1980	Change in fertility rate, 1980–2016	Fertility rate, 2016
Austria	1.62	– 0.15	1.47
Belgium	1.68	+ 0.10	1.78
Denmark	1.55	+ 0.18	1.73
France	1.95	+ 0.12	2.07
Germany	1.56	– 0.12	1.44
Ireland	3.25	– 1.27	1.98
Italy	1.64	– 0.21	1.43
Luxembourg	1.49	+ 0.12	1.61
Netherlands	1.60	+ 0.18	1.78
Norway	2.10	–0.24	1.86
Portugal	2.18	– 0.65	1.53
Spain	2.20	– 0.73	1.47
Sweden	1.68	+ 0.20	1.88
Switzerland	1.80	–0.25	1.55
UK	1.90	–0.01	1.89
Western Europe	**1.88**	**–0.18**	**1.67**

= fertility rate 2.1 and above
= fertility rate below 2.1

A *Most fertility rates in Western Europe have stayed below 2.1 since 1980*

Fantastic fact

The world's average fertility rate is 2.42. In Western Europe it used to be 2.7, but is now only 1.67.

Topic link

Look back at Topic 1.1 page 5 for more about how fertility rates affect population growth.

Germany has the largest population in Europe, but it is still concerned about its declining fertility rate. New measures to increase the birth rate include subsidising childcare and contributing to parents' income while they are caring for infants.

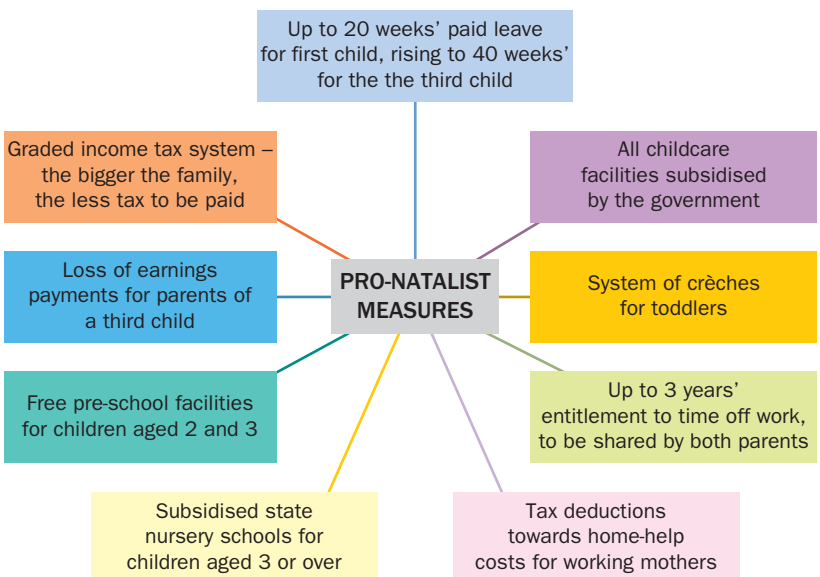
France: population strategies

France has some of the most extensive state-funded childcare facilities in Europe. Diagram **B** shows some of the ways France is encouraging people to have more children in order to maintain its fertility rate. Immigration from southern Europe and former French colonies in North Africa has contributed one quarter of all population growth in recent years, but the growth is due mainly to immigration, and not to a rise in the fertility rate.

France's pro-natalist policy has clearly been successful in restoring its fertility rate almost to the population replacement level (table **A**). One of the country's most popular strategies has been the *Carte Familles Nombreuses* ('Large Family Card'). This gives families with three or more children reductions on the national train network and half-price fares on the Paris Metro underground system. Families living in Paris, the French capital, also have a *Carte Paris-Famille* ('Paris Family Card'), which gives children free entrance to all swimming pools and subsidised entry to other sports facilities provided by the city.

Skills link

See Section 4.3 pages 251–252 to learn more about drawing bar graphs.



B *Pro-natalist measures taken by the French government, mainly to encourage more working women to have babies.*

Now Investigate

1 **a)** What do you think of the French 'Family Card' schemes?

b) Would your family, or any family that you know, qualify for this card if it was available in your country?

2 **a)** Use the data in table **A** to create a bar graph showing the fertility rates for each country, for 1980 and 2016. Shade the two bars for each country in different colours. Add an appropriate key to your graph.

b) Draw a horizontal line across your graph at Fertility Rate 2.1; annotate this line to explain its significance.

c) Comment on the success (or failure) of these countries in maintaining their fertility rate since 1980.

3 **a)** Make a copy of the following table. Complete your table with reference to diagram **B** and the text, putting ticks where appropriate in the last three columns.

b) From the results shown in your table, what kinds of benefit are most likely to persuade French parents to have a larger family?

Type of benefit	Economic	Educational	Recreational
Childcare facilities			
Crèches for toddlers			
Entitlement to time off work			
Graded income tax system			
Large Family Card			
Loss of earnings payments			
Maternity leave			
Nursery schools			
Paris Family Card			
Pre-school facilities			
State nursery schools			
Working mothers' tax deductions			
Total (ticks)			

Migration

Learning objectives:
- explain and give reasons for population migration
- demonstrate an understanding of the impacts of migration

Why, where and how do people move around?

People on the move

All over the world people are moving around. This is called **migration**. As geographers, we are concerned with how these movements take place both within a country, for example from rural areas to the city, and from one country to another. There are many different reasons why people need to move. Some of these are voluntary movements but there are also forced migrations when people have no choice but to flee their home.

The bright lights of the big city

In many parts of the world, life in rural areas can be very hard. For example, rural areas in less economically developed countries have very few services for local people. People in rural areas hear of the big cities where there are jobs and opportunities. Friends and family write letters telling them about freely available health services, housing and education (although this may not always be true). The factors that encourage people to move to towns and cities, in a process known as rural–urban migration, are shown in figure **A**. Things that make people want to leave are called *push* factors and those that attract them to a different area are known as *pull* factors.

Push factors	Pull factors
• Lack of running water • Lack of services • No local schools and hospitals • Lack of farm machinery • Unemployment • Population increases resulting in lack of food • Natural disasters	• Good education facilities • Better food supply • Available services • Entertainment • Variety of jobs • Medical care • Better quality of life

A *Migration push–pull factors*

B *The migration of Bagwis Manaloto (pictured right)*

The problem is that life in the city rarely turns out as well as people from rural areas expect it to be. Read about the experiences of Bagwis Manaloto, who moved from rural Luzon to Manila in the Philippines.

When my father died, our farm was divided between me and my brothers.

It was impossible to grow enough rice to feed my family.

I sold my land to one of my brothers and took my family to what I thought would be a better life in Manila.

But things are much worse here in the city. Thousands of people are arriving every month and the jobs have gone. We couldn't afford the high prices for a house so had to build one ourselves in the slums.

The water is dirty and makes us sick but we can't afford a doctor. It's hard enough finding money for food. I wish we'd stayed in the country.

The peace and tranquillity of the country

While cities in less economically developed countries are finding it hard to cope with all the extra people moving in, the opposite is happening in richer parts of the world. In many more economically developed countries, **counter-urbanisation** is taking place. People are getting fed up with crowded, polluted and congested towns and cities and are moving out into rural areas. There are a number of reasons why this type of migration is taking place:

- Many jobs are now found on the outskirts of cities. Commuting (daily travel) to these out-of-town areas is getting easier.
- As people get richer they want bigger houses with gardens – there is much more housing of this kind available in rural areas.
- Rural areas are often seen as a much safer place in which to raise a family, and they often have better schools.
- City centres may have higher crime rates, vandalism and social problems.

Counter-urbanisation in the capital of Scotland

Edinburgh, the capital of Scotland, has seen a lot of movement of wealthier families to surrounding rural areas. These families use local services and may save them from being closed down.

However, migration can also cause problems for the small rural towns, such as North Berwick, that they have moved to (photo **C**).

In recent years many people have been moving into Edinburgh – it is one of the UK's most popular cities. Many young people are taking advantage of the city's increasing job opportunities and entertainment facilities.

- Higher property prices mean local people can no longer afford houses in the area.
- Pressure on services such as schools and hospitals.
- Many new families commute to Edinburgh, shop in the city and bring little money into local businesses.
- Increased numbers of cars make roads dangerous for local children.
- Building new houses destroys the countryside and habitats for wildlife.
- Some recent arrivals do not mix well with the local people.

C *Problems of counter-urbanisation in North Berwick*

Now Investigate

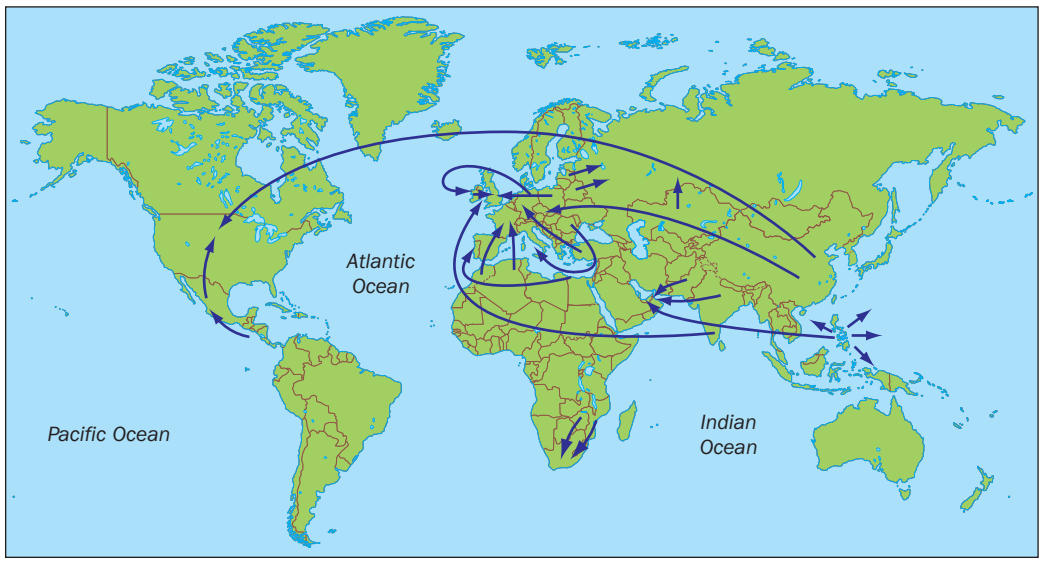
1. Have you moved around different places during your lifetime? Where did you move from? Where did you move to? What were the reasons for your migration?
2. What is the difference between:
   a) temporary and permanent migration
   b) voluntary and forced migration?
3. Using examples, explain in detail why people would want to move from:
   a) rural to urban areas
   b) urban to rural areas.
4. Think about the rural–urban migration taking place in your own country.
   a) Write down all the push and pull factors that might make somebody move to your country's main city.
   b) Would you prefer to live in the city or in a rural area? Explain your answer.

Fantastic fact

The greatest rural–urban migration is currently in China. Many cities are expanding their population by 10 per cent a year.

Moving from one country to another

Both migration within countries and migration between countries are extremely important on a global scale. **Emigrants** are those leaving a particular country and **immigrants** are those coming in. As with



A *Major global migration routes*

internal migrations, this can be either voluntary or **forced migration**. Some of the world's major migration routes are shown on map **A**.

Many people move to find a better life for themselves and their families. These people are known as **economic migrants** and they often want to return home when they have earned enough money. In the meantime many will send some of what they earn back to their families. Some may enter a country unofficially without making themselves known to the authorities – these are called **illegal immigrants**.

Forced migration on an international scale is much more serious and happens for a variety of reasons:

- when people are persecuted or threatened because of their religious beliefs
- as a result of war when people are forced to leave their homes
- when people are forced into slavery, again often as a result of war
- because of racial discrimination
- when famine strikes a country and the people have to move to find food
- because of natural disasters such as earthquakes, volcanic eruptions, floods or hurricanes.

People who are forced to move are called **refugees**. The United Nations estimates that there are over 65 million refugees in the world today. Many of these refugees are forced to live in poverty in camps with little food, water or access to healthcare and education (photo **B**).

Skills link

One clear way to illustrate information about migration on a map is to use arrows like those shown on map **A**. Some maps also use flow lines where the arrows are wider or thinner depending on the information they display. For more details, see Topic 4.3 page 257.

B *A refugee camp in Dabaab, Somalia*

Now Investigate

1. Using an atlas and map **A**, describe some of the major global migration routes. You should refer to specific countries in your answer.
2. Why might you want to migrate to another country? What might be the advantages of leaving? What things would you miss about your home?
3. Do people migrate to your country? What are the reasons for this immigration?
4. What are the main reasons for forced migrations? Can you think of any examples in the countries near where you live?
5. List all the advantages and disadvantages of migration for Senegal. Do you think it has a positive or negative effect for the country overall? Explain your answer.
6. What would be the possible impacts in France and other European countries of many people from Senegal migrating to them?

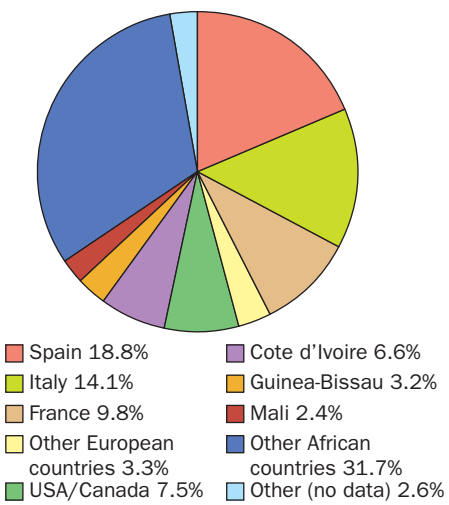
CASE STUDY

International migration: Senegal to Europe

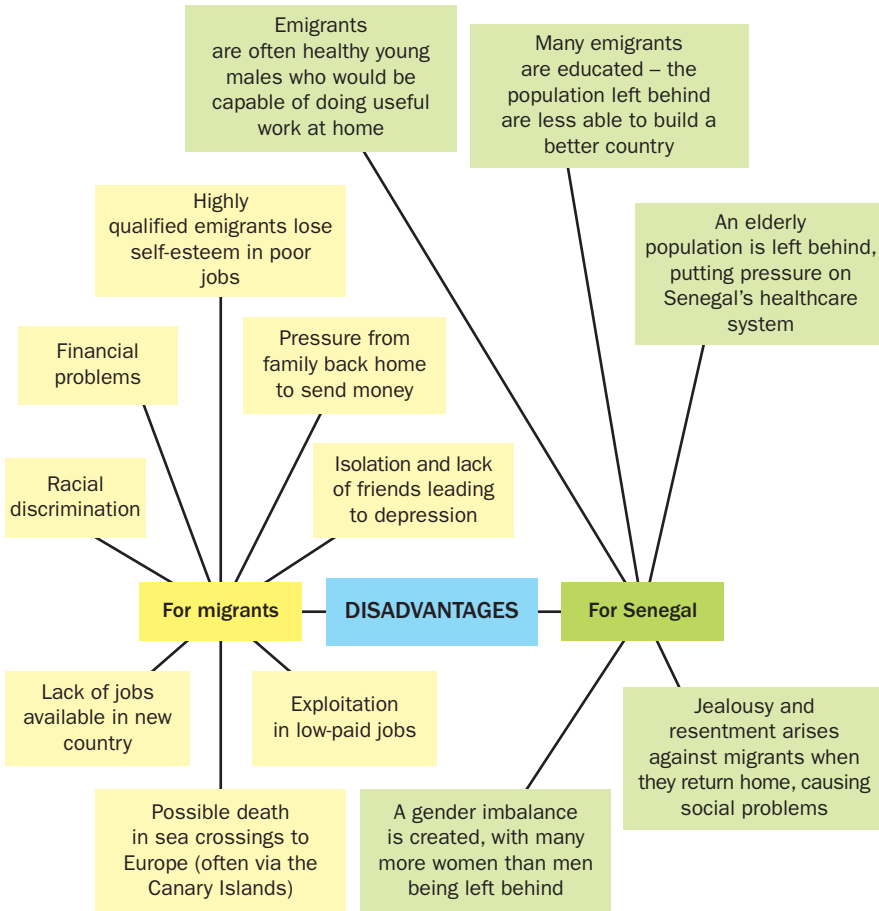
Senegal is a fairly small country (about one-third the size of France) in West Africa. It has a population of around 16 million, which is growing at a rate of just over 3 per cent each year. For many years after independence from France in 1960 it was the destination for immigrants from the rest of Africa. They were attracted by Senegal's stable government and opportunities there for jobs and setting up businesses. This has changed completely over the last decade for a number of reasons:

- An economic crisis from the 1990s onwards saw a huge drop in living standards.
- There was a big increase in unemployment and a lack of jobs even for educated people.
- Rapid population growth has meant competition for the few jobs available. It has also put pressure on resources such as food supplies.

Many young Senegalese males have decided to emigrate to find work to support their families. Originally, many of them went to France because of Senegal's links with that country – the old colonial power – and because they were attracted by images of life in Europe seen on the television and in magazines. More recently, increasingly large numbers have settled in Spain and Italy (diagram **C**).



C *The destinations of Senegalese migrants*



D *Disadvantages of Senegalese migration*

This migration has had a number of benefits for Senegal. Migrants send a total of US$2 billion to their families every year, contributing around 14 per cent of Senegal's total gross domestic product. They often return having learned new skills that can be put to use in developing their own country. The reduction in population also means a decrease in the demand for scarce resources. However, as diagram **D** shows, there are many disadvantages both for Senegal and for its emigrating population.

Despite the possible advantages of living abroad, many migrants are not happy. A large percentage of Senegalese migrants interviewed in Germany said they wished they had stayed at home.

Population structure

Learning objectives:
- identify and give reasons for and implications of different types of population structure

Why are there more older or younger people where you live?

Walk along a busy street in your local area, and guess the ages of the people you see. How many are elderly people? How many are young adults and children? If you recorded what you saw, the information wouldn't be very reliable, because many people could be indoors or in other places. A lot would also depend on the day and the time.

In order to find out about a country's population accurately, a **census** is taken. This is an official count of all the people living in a place (usually a country) at one specific time. People are asked questions about their age and gender. The data collected from the answers helps to monitor changes in the country's population structure and in its total population. A census can also investigate issues such as ethnic background and certain measures of the quality of life. Many countries carry out a census regularly, at 10-year intervals. Some countries are unable to conduct regular censuses, because they are expensive and difficult to organise, and people need to be able to read and write in order to answer the questions.

Census data is used to plan how many facilities will be needed in the future, such as schools and hospitals. It also provides a guide as to how many people of working age will have to support the very young and the elderly in the future. Age/gender census data is usually displayed as an **age/sex pyramid** (diagrams **A** and **B**).

Topic link

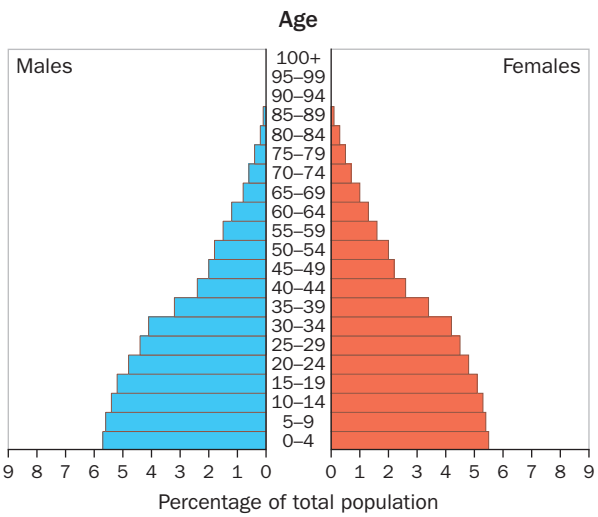
- Look back at Topic 1.1 page 17 to check on age dependency.
- See Topic 4.1 page 262 to learn more about how an age/sex pyramid is constructed.

Fantastic fact

On average, women live 4 years and 1 month longer than men.

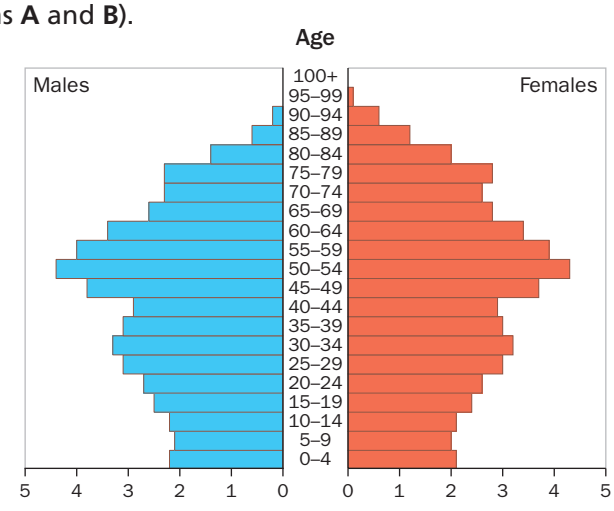
Further research

You will find population figures and pyramids for most countries on the internet. Type in the name of the country, 'age/sex pyramid', and the year you are investigating.



*Note the significant proportion of people under the age of 15.

A *Age/sex pyramid for Haiti, a typical less economically developed country*



*This pyramid has a much higher proportion of people over the age of 65 than pyramid **A**.

B *Age/sex pyramid for Germany, a typical more economically developed country*

Now Investigate

1. Carry out a class census, or one of your school year, to discover its gender structure. Then use your results to answer these questions:

   a) How many boys are there in your census group?

   b) How many girls are there in the group?

   c) What is the total number of students in the group?

   d) What is the percentage of boys in the group? Use this simple formula and a calculator to find the answer:

   $$\frac{\text{Number of boys}}{\text{Total number of students}} \times 100 = \ldots\ldots \%$$ of boys in the group

2. **a)** If you can, use the same formula for *all* the boys and girls in your school. Then write a statement comparing percentages in your class/year and the whole school.

   b) Find out the gender structure for your own country, and then compare it with that of your whole school.

   c) Suggest some reasons why the structures for your school and your country might be different.

3. List at least five ways in which census information might be useful to a country.

4. Use the data in the table below to create an age/sex pyramid. Refer to graphs **A** and **B** to see how the pyramid should be presented.

5. With reference to your age/sex pyramid, which of the following statements are true?

   a) There are fewer females than males over the age of 60.

   b) There are fewer elderly people aged 60 or over than young people in the 0–15 age range.

   c) The numbers of males and females are about the same in most 5-year age groups below 60 years.

   d) This graph shows the population structure of a typical less economically developed country.

6. Using arrows pointing to the appropriate places, add the *true* statements as labels to your pyramid. Then re-write any false statements about your pyramid to make them true, and add those as labels.

Male % of total population	Age range (years)	Female % of total population
1.5	Over 80	3.3
1.4	75–79	2.0
1.9	70–74	2.3
2.5	65–69	2.8
3.7	60–64	3.8
3.5	55–59	3.6
3.6	50–54	3.5
3.6	45–49	3.5
3.3	40–44	3.2
3.0	35–39	2.8
3.2	30–34	3.1
3.3	25–29	3.1
3.1	20–24	3.0
3.1	15–19	3.0
2.8	10–14	2.7
2.8	5–9	2.6
2.7	0–4	2.7

Changing stages of economic development

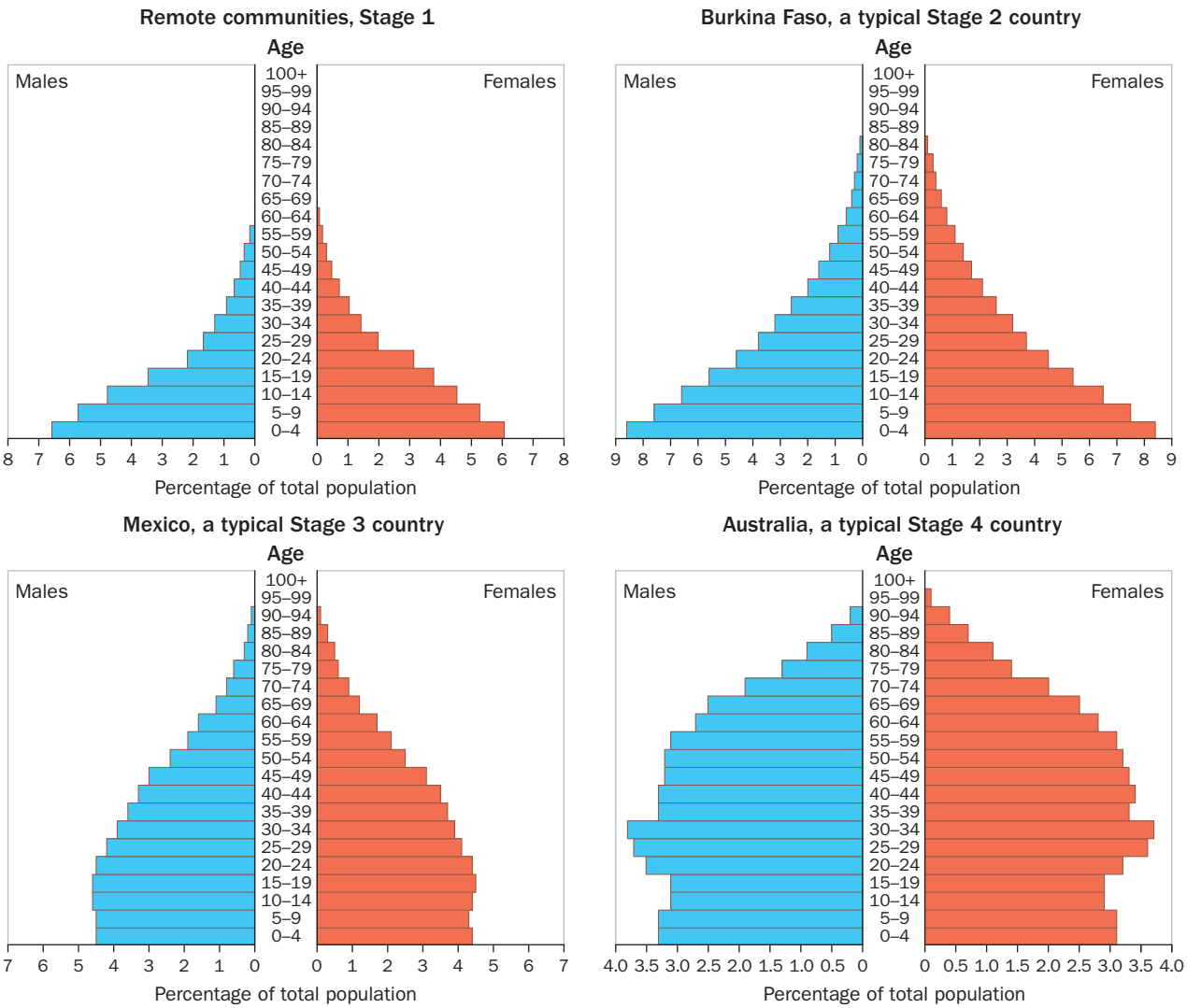
You learned (on pages 27–28) that the age/sex pyramids for more and less economically developed countries generally have different shapes – especially in the 'childhood' and 'elderly' age groups. The model is a way of showing how birth and death rates change as a country develops economically and progresses through several stages.

On these two pages are several age/sex pyramids typical of countries at each stage of economic development. These show how population structures are affected by changing birth and death rates.

The age/sex pyramids in diagrams **A** and **B** are examples of population structures for each of the five stages of economic development. There are now only a few remote communities at Stage 1 of economic development such as some tribes living in the tropical rainforest of the Amazon Basin in South America (map **C**).

Fantastic fact

There are no longer any countries at Stage 1 of economic development.

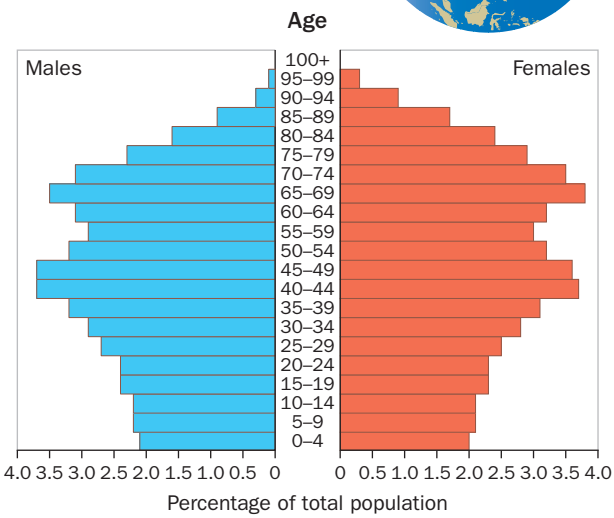


A *Age / sex pyramids for the first four stages of economic development*

CASE STUDY

Japan – a country with a large, ageing population

Japan is a prosperous, highly industrialised country, and success in their business lives leads many of its people to postpone both marriage and child-rearing. As a result, it now has a negative population growth rate of –0.2, compared to the world average of 2.42, and the critical replacement population level of 2.1. Also, its current life expectancy has risen to 85 years (world average 69). The result is an elderly dependency ratio 3.5 times higher than the global mean.

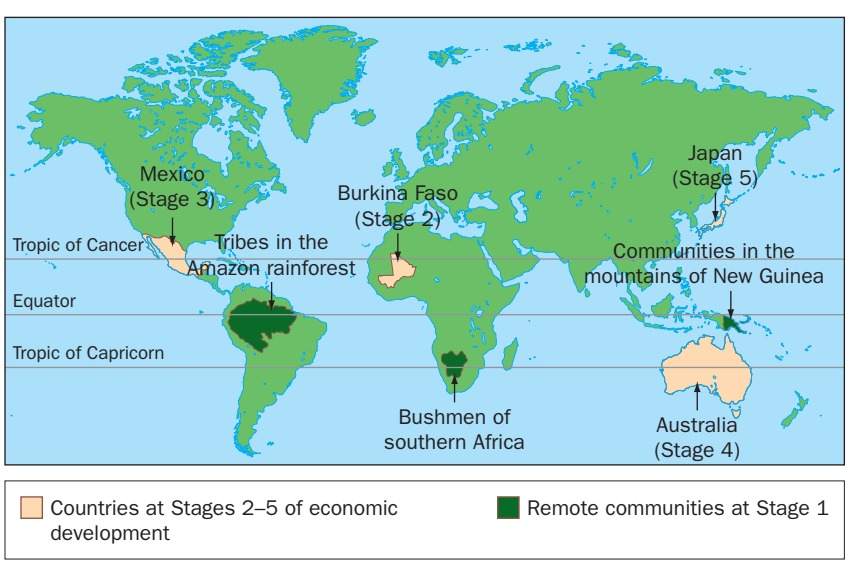


B *Age/sex pyramid for Japan, a typical Stage 5 country*

The consequences of these demographic trends include:

- a much greater national need for healthcare provision
- the financial challenge for caring for so many more older people; some pensioners are so desperate for basic support that they deliberately commit crimes that carry prison sentences
- the pressure on employees to work excessive overtime means that more of them are committing suicide or, quite literally, working themselves to death (a fate called *karoshi* by the Japanese).

Japan is one of the few countries that has progressed through all five stage of economic development. The shape of its age/sex pyramid today (diagram **B**) is typical of those at Stage 5 of the Demographic Transition Model.



C *Location of countries/places at different stages of economic development*

Further research

Use the internet to find and print out an age/sex pyramid for your own (or a neighbouring) country. Describe the main features of the population structure of your chosen country.

Topic link

What you have learned about population structure will help you when you study Topic 1.1 pages 2–20.

Now Investigate

1. How do governments in countries such as Japan respond to the issues which arise from the increasing percentage of older people?

Population density and distribution

Learning objectives:
- describe the factors influencing the density and distribution of population

Why do some people have more neighbours than others?

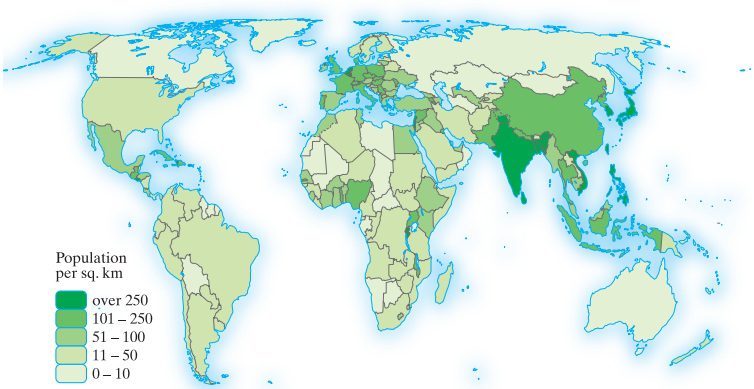
Many people are living very close together in the place shown in photo **A**. But the place in photo **B** is very different! Here there are very few people. Take a very good look at both of these places – perhaps one of them is like the place where you live.

Five key terms are used frequently in this topic. Some you may already know, but it is important that you understand what each one means:

- **Population distribution** – the way people are spread out over the Earth's land surfaces.
- **Population density** – how many people live in an area (usually one square kilometre or 1 km^2).
- **Densely populated** – describes places where many people live.
- **Sparsely populated** – describes places where very few people live.
- **Uninhabited** – describes places where nobody lives.

There are many reasons why people live where they do. Some people don't have a choice – a few countries never allow anyone to enter or leave. Fortunately, most countries do not impose such restrictions and their people are free to move elsewhere in search of a higher standard of living.

Map **C** shows that the world's population distribution is very uneven. One reason is that there is twice as much land in the northern hemisphere as there is south of the Equator. In this topic we look closely at the distribution of both sparsely and densely populated areas.



C *World population: distribution and density*

A *In cities, many people live very close together*

B *In other parts of the world, people are more scattered across the landscape*

Topic link

See Topics 2.1 and 2.5 to find out more about extreme environments.

Topic link

See Topic 1.2 pages 21–26 to learn more about why people migrate from one place to another.

Fantastic fact

Antarctica is the only continent where *everyone* is a visitor!

Challenges of extreme environments

Photos **D–G** show four particularly extreme environments which are either very sparsely populated or totally **uninhabited**.

D *A hot desert*

E *A dense forest*

F *A mountainous region*

G *A polar region*

Now Investigate

1. Which of the two places shown in photos **A** and **B** would you prefer to live in? Why?
2. Study photos **D–G**.
   - **a)** Explain why each of these regions is a challenging place for people to live.
   - **b)** Where would *you* prefer to live? What environments would be most and least attractive to you as places to live?
3. **a)** The following table lists the population and physical size of each continent. Calculate the population density of each continent. (To do this you need to divide the population for each continent by its area.)
   - **b)** Which are the most and least densely populated continents?

Continent	Total population	Total area (km²)	Average population density (people per km²)
Africa	1 216 000 000	30 065 000	40.45
Asia	4 436 000 000	44 579 000	
Oceania	40 000 000	7 687 000	
Europe	739 000 000	9 938 000	
North America	579 000 000	24 256 000	
South America	423 000 000	17 819 000	

4. With the help of an atlas, add the following information to an outline world map.
   - **a)** Shade in all the most sparsely populated areas shown on map **C** (<10 people per sq. km).
   - **b)** Locate and name at least five hot deserts and five mountain ranges.
   - **c)** Locate five large forested areas, adding names to them where possible.
   - **d)** Locate and name: (i) Antarctic wilderness (ii) north polar wilderness.
   - **e)** Give your completed map a suitable title and a key.

Areas of high population density

In some parts of the world, there are very good reasons why people live in certain places (photos **A**, **B** and **C**). For example:

- Flat or gently sloping land makes it possible to farm and build towns, roads and railways (**A**, **C**).
- Fertile soil is ideal for growing crops and rearing animals (**B**).
- When floods occur, most rivers deposit alluvium (silt), which is rich in the minerals needed by plants for growth (**B**).
- Climate – adequate, reliable rainfall and suitable temperatures are needed for crops to grow and ripen (**A**, **B**).
- Fossil fuels – resources such as coal, oil and gas can be used to generate electricity and meet transport needs (**C**).
- Mineral deposits provide essential raw materials, for example iron ore for industries such as steel-making and car manufacture (**C**).
- Fishing – coasts, rivers and lakes provide plentiful, nutritious food (**A**, **B**).
- Fresh water – rivers and lakes are a major source of fresh water, and some can be used to generate power (**B**).
- Coasts and other waterside locations can be developed into ports with trading links to other countries (**C**). Such places are also often popular with tourists and retired people (**A**).

Towns and cities grow rapidly at suitable settlement sites (photo **C**). They also provide employment opportunities for people. Migration of people from other, less favourable places also increases the size and density of the population.

B *A densely populated agricultural area along the Nile Valley, Egypt*

At present, 40% of all people on Earth live within 100 km of a coast. Photo **A** is a typical scene in many highly developed and densely populated coastal areas. The bullet points above suggest some of the reasons why this particular stretch of coastline has attracted so many people.

Topic link

- See Topic 1.2 pages 21–26 to learn more about migration.
- See Topics 1.5 and 1.6 pages 39–51 to learn more about the site and situation of settlements.

A *Many coasts are densely populated because they offer a wide range of opportunities for work and leisure*

Fantastic fact

The most densely populated areas of all are urban settlements such as towns and cities. At present, over 54% of the world's people live in urban areas.

CASE STUDY

Singapore – a densely populated country

Singapore is one of only 10 countries in the world that has all its people living in urban areas. It is a small island, but this in itself does not explain why it is so heavily urbanised. Its location at the most southerly tip of the Asian mainland means it is at a major shipping 'crossroads'. Ships sailing between Indian Ocean ports and the industrialised countries of China, Japan and Australia refuel and discharge or load their cargoes here, creating thousands of jobs for local people. Large, modern industrial estates employ many more, and are one of the main reasons why Singapore is so successful (photo **C**).

Only 2% of all adults of working age are unemployed in Singapore. Natural population increase and immigration bring a rise in the total population of almost 5% every year. Providing homes for so many people in such a small area has led to the building of 28 new towns – four of these have over 200 000 inhabitants each. Two-thirds of all Singaporeans now live in new towns.

C *Singapore is a busy international port*

Now Investigate

1 **a)** Would you describe the place where you live as an area of high or low population density?

b) Which of the reasons for settlement listed above applies to the place where you live?

2 The list of bullet points on page 34 explains why people live in particular areas. Use this information to suggest which annotations could be added to photo **C**. You should enhance your annotations in order to develop each idea.

Note: Annotating is *not* the same as labelling! Labels only identify what is there; annotations explain *why* places are important. See Topic 4.4 pages 263–268 to learn more about annotation.

3 **a)** Find several photographs of densely populated countries (they should look different from photo **C**).

b) Annotate copies of these photographs to explain why the places are densely populated.

4 With the help of an atlas, add the following information to an outline world map.

a) Shade in all the most densely populated countries shown on map **C** on page 32.

b) Name all of the countries you have shaded (those with a population per sq. km >101).

c) Make sure your map includes the Equator and the two Tropics. These should be named, and labelled with their latitude (in degrees).

d) Give your completed map a suitable title and a key.

Areas of low population density

North Africa is one of the most sparsely populated regions on Earth. It is also over-populated in many ways, because there are too many people for the few resources available to them. The main reason is that the Sahara, the world's largest hot desert, occupies most of the region. The area to the south of it is experiencing increasingly severe famines.

Topic link

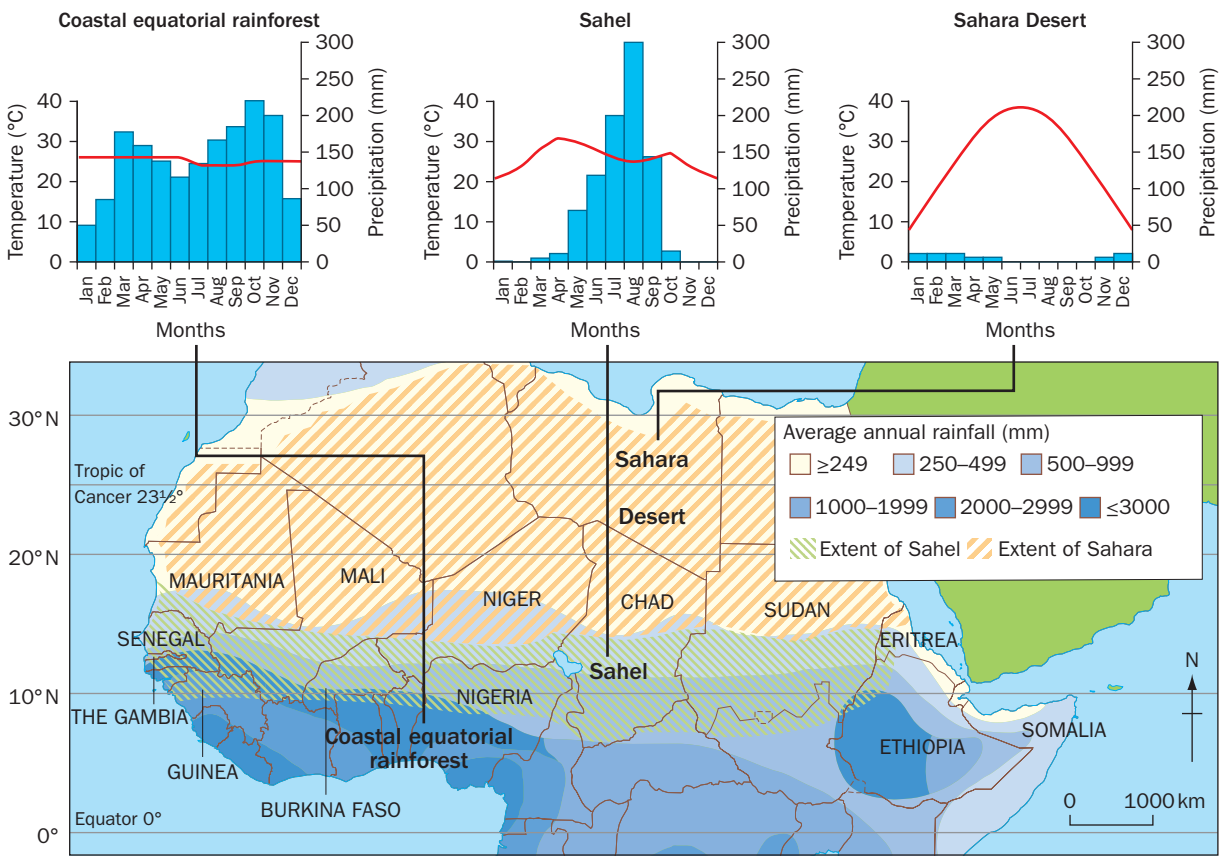
See Topic 1.1 pages 8–12 to learn more about over-population.

CASE STUDY

The Sahel – a sparsely populated area

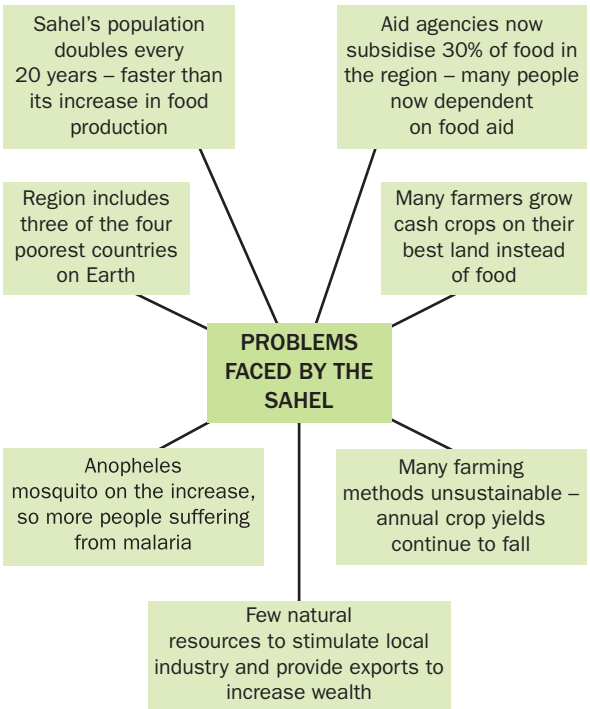
The area to the south of the Sahara is called the Sahel (map **A**). Diagram **B** highlights reasons why the Sahel today is known as Africa's 'famine belt'.

Farming is the main economic activity in the Sahel. Dry-land crops such as millet, sorghum and cowpea are the main food crops. The main cash crops are groundnuts (peanuts) and



A *Climate in the Sahel region*

cotton. Most farmers are nomadic herders, who migrate northwards during the wet season, then return when that area becomes too dry. Many farmers now use cell phones to get weather forecasts and move their animals to places where rain is predicted to fall. Some water is available where there are rivers and lakes but, in many areas deep wells are the only reliable source of water. During the worst famines, many cattle die as much from starvation as from thirst, because there is not enough water to irrigate fodder crops to feed them.



B *Why the Sahel is sparsely populated*

Now Investigate

1. Describe how the natural environment of North Africa changes from north to south. You should include changes in both climate and natural vegetation in your answer. Hint: use an atlas and the internet to help you.

2. Imagine you are a farmer in the Sahel. You have received a letter from a friend who lives far away and has no idea what farming in your area is like. Your friend blames you and other farmers for all the recent problems of the Sahel region. Write a reply explaining why many of the problems in the Sahel are beyond the farmers' control.

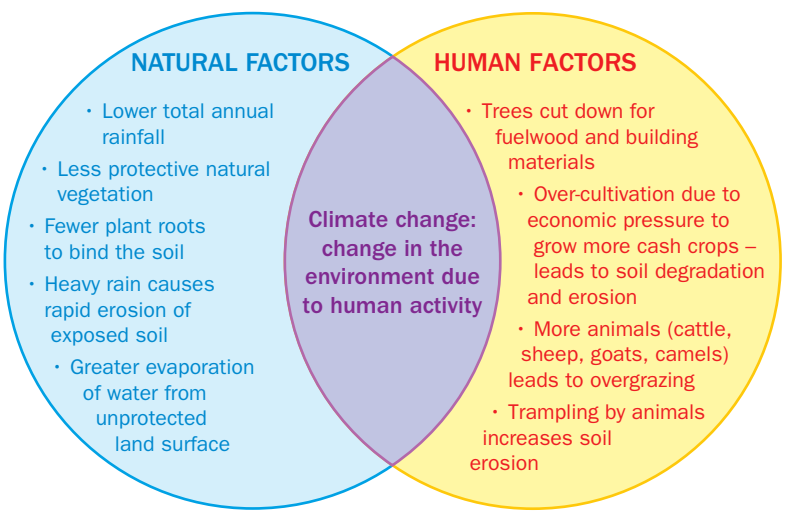
Fantastic fact

The largest desert in the world took its name from the Arabic word for desert: *sahara*. *Sahel* is another Arabic word, meaning 'on the edge' of the desert.

Soil degradation

A major problem faced by farmers in many parts of the world is **soil degradation**. This is the process of the soil becoming less fertile. It can happen in three different ways:

- **Erosion** Soil can be eroded and carried elsewhere by strong winds. Over-grazing by cattle is a common cause of soil erosion.
- **Salinisation** In a hot, dry climate, where evaporation rates are high, the salts (minerals) in water can build up in the soil, causing it to become toxic (poisonous) to plants.



C *Factors in the process of desertification*

- **Leaching** Soil is leached when heavy rain dissolves valuable plant nutrients (food) in the topsoil, then washes them downwards below the depth that plant roots can reach.

Desertification

Desertification is the process by which semi-arid environments become desert-like. It is *not* the spread of true deserts, but rather what happens to the areas next to them. In the Sahel, for example, 80 000 km^2 become too dry and infertile every year for farming as a result of desertification. Desertification is clearly a global problem:

- One-third of the world's total land area is already desertified or is under serious threat of becoming so. Climate change is a major natural cause of desertification because it raises global temperatures and changes seasonal rainfall patterns (diagram **C**).
- Twenty per cent of the world's population lives with the constant threat of desertification.
- An estimated 850 million people are directly affected by desertification, mostly in Africa.

Topic link

- See Topic 3.7 pages 213–226 to learn more about human activity and the environment.

Settlements and service provision

Learning objectives:
- explain the patterns of settlement
- describe and explain the factors which may influence the sites, growth and functions of settlements
- give reasons for the hierarchy of settlements and services

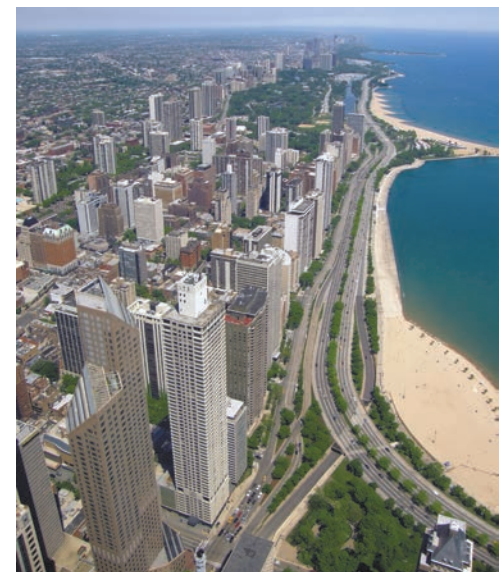
Why do people live in the countryside?

Do you live in the countryside (a rural area)? Or in a town or city (an urban area)? Do you know *why* you live where you do? Perhaps it is because the family members who support you have lived there for a long time, or maybe you moved there because of personal circumstances. Geographers like to ask questions, and to find out the reason for the locations of towns and villages. There are many reasons why people first create a settlement in a particular place.

Every **settlement** is different. Your own village, town or city will have its own unique arrangement of roads and buildings. How it looks today depends on how old it is, the shape of the land it is built on, and what has happened there in the past. In fact, history is a good place to start when investigating places, because most settlements, however large they are now, started off very small in what were then completely rural areas (photo **B**). Just a few places don't develop in this way, because they are planned and built as complete '**new towns**'.

Deciding where to build a new settlement is very important, because it may only become successful if it is built in an appropriate location. Diagram **C** lists the main village site **factors**, and explains why each one is so important to the success of a new settlement. **Site** is the land on which the first part of a settlement is built. The more beneficial site factors a settlement has, the more likely it is to flourish, to have more **functions** (activities) and to grow in size and importance.

Accessibility, or the ability to reach places, is one of the most important of these factors, because people need to trade with other people and places. Other key factors in the early growth of settlements include the availability of water, food and basic raw materials such as wood and stone.

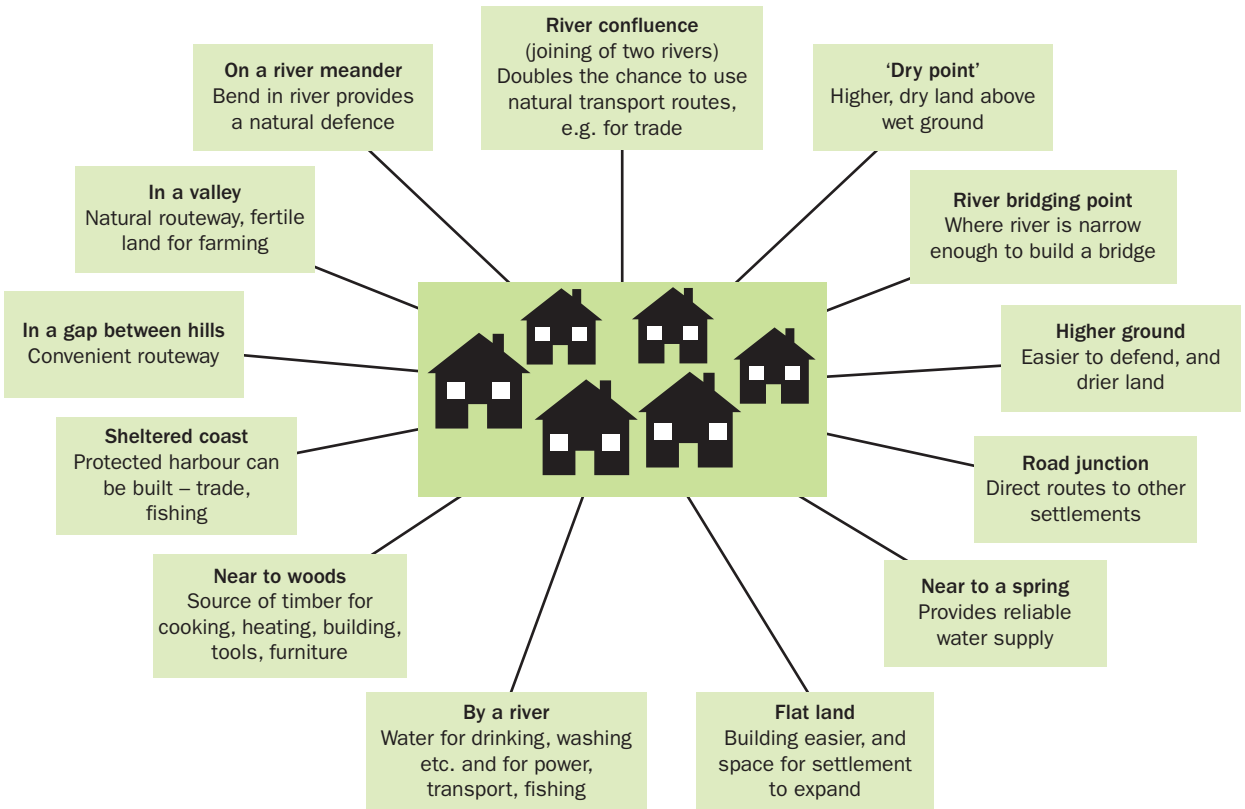


A *Most towns and cities began as small villages*

B *A small village in a rural environment*

Topic link

What you learn in this topic about rural settlement will help you when you study Topic 1.6 pages 50–63, on urban settlement.



C *Settlement site factors and their advantages*

Now Investigate

1 Investigate the location of a settlement you know well, then list all the factors in diagram **C** that help to describe its site.

2 **a)** Re-arrange the site factors in diagram **C** into three groups according to how important you think they are:

- **i)** must-have
- **ii)** good to have
- **iii)** could do without

b) Explain your selection of the 'must-have' site factors.

3 **a)** Suggest some site factors that are likely to *hinder* the growth of settlements. Try to think of up to five factors.

b) Explain why each of these factors is a disadvantage for a settlement.

Topic link

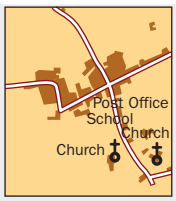
You can learn more about meanders in Topic 2.2 page 86.

Rural settlements on Ordnance Survey maps

Over time, villages often develop quite distinctive shapes and patterns. The three most common types are: **dispersed**, **linear** and **nucleated** (table **A**). Many villages have combinations of two or more of these basic patterns.

Topic link

See Topic 4.1 pages 235–237 to help you answer the questions on this page.

Dispersed settlement	Linear settlement	Nucleated settlement
		
Individual farms and houses are widely scattered over a rural area (countryside) and are linked by a network of tracks and minor roads.	Linear settlements are long and narrow, with most of their buildings along a road, river bank or shoreline.	Buildings are tightly clustered around a road junction, church or bridge. Nucleated settlements are about the same distance across in different directions.

A *Different settlement types*

Now Investigate

1 **a)** Find the following places on map **C** on page 42. A four-figure or six-figure grid reference is given for each settlement. Note that not all settlements are named.

- **i)** Almondale 1249
- **ii)** Cabiche 140480
- **iii)** east side of 1451
- **iv)** Grande Rivière 1351
- **v)** La Feuillet 1453 and 1454
- **vi)** north-east part of 1352
- **vii)** west side of 1149

b) Which type of settlement pattern – dispersed, linear or nucleated – does each of these places have?

2 Look for the following settlements on map **C**, and list the advantages of the *site* of each settlement:

a) Bois d'Orange 1153 **b)** Grande Rivière 1351

c) Gros Islet 1356.

B *St Lucia airport, Castries*

Rural settlements in St Lucia

Only 19 per cent of the population of the island of St Lucia lives in an urban area. The Ordnance Survey (OS) map extract **C** shows clearly the many small settlements in this part of the island and two larger places. Port Castries is the largest settlement on the island, and the capital of St Lucia.

C *Ordnance Survey map extract of part of St Lucia, 1:50 000 scale*

Life in rural areas

Worldwide, 37 per cent of all people live in villages and work on farms. In India, though, the figure is much higher – 52 per cent. So even in this rapidly industrialising country, rural areas are still very important.

Chembakolli – a village in southern India

Chembakolli is one of 200 villages in southern India inhabited by the Adivasi tribe (map **A**). *Adivasi* is a local word meaning 'the people of the forest' – a good name for them because the forest used to provide all the food they needed as well as materials for building huts. The forest still provides fuelwood for cooking and for heating water for washing, although many of the trees have already been cleared to create extra farmland. The forest also provides a habitat for deer, rabbits and wild boar which are hunted by the Adivasi.

Most of Chembakolli's 50 families are farmers. Their main crops are rice, onions, tomatoes and peppers. These are all **subsistence crops** (grown to feed the local people), but some farmers have started growing tea as a **cash crop**, which they can sell to earn money for themselves. Every member of a Chembakolli family helps to grow these crops, and the women and older children are usually also responsible for looking after the goats and chickens. Only the better-off villagers can afford to buy a cow. Most people work very hard just to survive, and rely on the summer monsoon rains for the success of their crops (graph **C**).

All the farmwork is done by hand (photo **B**), although elephants are used to help with heavy tasks such as moving logs from the forest. Some of the men add to their family's income by working on the tea and ginger estates owned by more wealthy farmers. This helps to buy materials the children need for school.

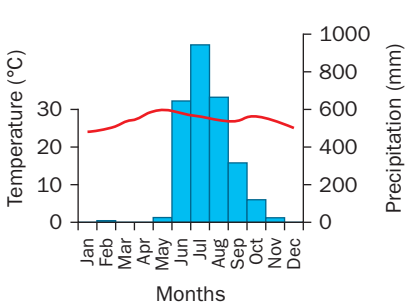
Map **D** shows that the village now has a range of basic facilities, and a school for the younger children. It does not yet have an

Fantastic fact

India has the world's second largest population, but it is sometimes called the country of 800 000 villages.

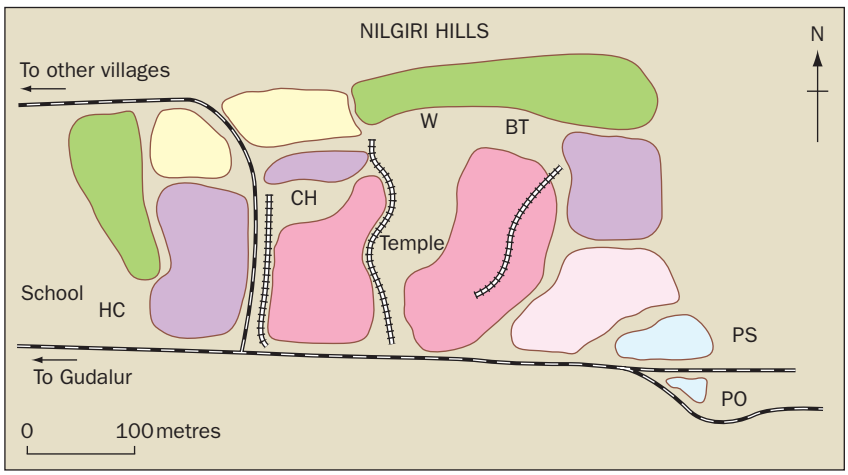
A *Location of Chembakolli in southern India*

B *Farming by hand is hard work*



C *The monsoon climate has a dry season as well as a very wet season*

electricity supply. The village well is used for washing cooking pans and for drinking water. Typhoid is a common, life-threatening illness because the well is also used by animals. Diarrhoea is another common symptom, which can be fatal, especially for children and old people. The village now has a small clinic, and a doctor makes regular visits.



Villagers' huts	Village market	Wood	Road
Rice fields	Tea plantations	Coffee plantations	Track
CH Community hall	HC Health centre	PO Post Office	
PS Police station	BT Bathing tank	W Well	

D *Chembakolli is a nucleated settlement, clustered around the temple*

Chembakolli is linked by bus to other villages and the nearest large town, Gudalur, which has a population of 49 500.

Gudalur is a different world: it has supermarkets, cinemas and a hospital. Some people in Chembakolli have never travelled along the road to the town, even though it is less than 20 km away!

E *A typical street scene in a rural town in the Tamil Nadu region of southern India*

Now Investigate

1 How is life in Chembakolli village different from your own? Use the following headings to structure your answer:

- Food and water
- The work that people do
- Health problems and medical support

2 **a)** Describe the monthly temperature and rainfall patterns shown in graph **C**.

b) How do these patterns compare with those for your own region?

c) What problems is Chembakolli's climate likely to cause for:

i) farmers

ii) other village people?

Topic link

To learn more about climate graphs, see Topic 4.3 page 251.

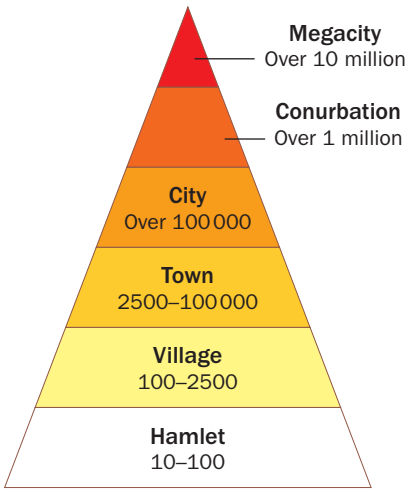
Further research

Study maps of your local region and try to identify examples of the different types of settlement: dispersed, linear and nucleated. You might take photographs or obtain pictures of your chosen examples. You could then produce a display of all the resources you have collected, annotating them to highlight their main features.

The settlement hierarchy

All settlements can be arranged according to their functions and size of population. This is called a hierarchy. Diagram **A** shows a **settlement hierarchy** based only on population size. Its levels range from isolated buildings such as farmhouses, to the world's 31 **megacities**, each having over 10 million inhabitants. It is impossible to give precise ranges for some of the settlement 'layers' because definitions of towns and cities vary widely from country to country. For example, Swedish cities must have at least 50 000 people, but Romanian cities need only 5000.

Settlement hierarchies can also be based on functions (table **B**). These are the services a settlement provides for its inhabitants and for people living within easy travelling distance. Clusters of houses called 'hamlets' are too small to support any permanent facilities such as shops and schools; their only service provision is likely to be a bus stop.



A *A settlement hierarchy based on population size*

Settlements at the top and bottom of the settlement hierarchy	Educational facilities	Shopping facilities	Transport facilities
Megacity	University	Out-of-town regional shopping centre	International airport
	College	Specialist shops	Regional airport
		Department stores	Major rail and road 'hub'
	Secondary school	Supermarket	Railway station
		Local row of shops	Bus station
	Infant/ primary school	Local general store	Taxi rank
Isolated farm or house			Bus stop

B *Function hierarchies based on service provision*

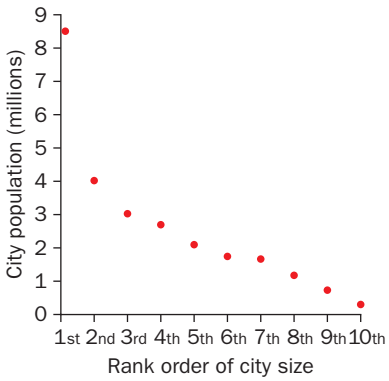
Settlements at the top of a hierarchy fulfil a wide range of functions. Castries, the capital of St Lucia, is a good example of this. Although its population is only 20 000, it is the largest settlement and has many of the functions of megacities. Two of the main functions of Castries are as a port and a centre for sports. Photo **C** shows the main harbour at Castries, with its quays at full capacity with large visiting cruise ships.

Fantastic fact

The smallest 'city' in the world is believed to be Hum, in Croatia (in Eastern Europe) – a 900-year-old hill-top community with only 23 inhabitants.

C *Harbour at Castries with a large cruise ship at every quayside*

Many countries, especially less economically developed countries, are dominated by one very large, densely populated city. Graph **D** shows one way of plotting the populations of the 10 largest cities of a country to show their relative sizes.



D *City size rank order*

Now Investigate

1 **a)** What is the population of the settlement where you live?

b) What level of population settlement do you live in, according to the hierarchy shown in diagram **A**?

2 Create at least one hierarchy like those in table **B** for a place you know well, from this list of other settlement functions: entertainment facilities, medical facilities, sports facilities. Start with the smallest and the largest, for example a village football pitch (smallest) to an international stadium in a major city (largest).

3 Using the map extract on page 42, copy and complete the following table by adding:

a) the four- or six-figure grid references for its named features

b) the missing 'first' and 'second' features at the grid reference positions shown.

Function	First feature grid reference	First feature	Second feature grid reference	Second feature
Administration	082482		–	–
Culture	085475	Caribbean Museum	–	–
Education		St Mary's College	083472	
Health	077490		099496	Health Centre
Hotels		La Toc Hotel	085483	
Industry		Industrial area	106494	
Leisure	084494		106511	Halcyon Beach Club
Places of worship	091485			St Joseph's Convent
Public buildings		Police HQ	089487	
Public utilities	092485			Reservoir
Residential	082500		098486	Rose Hill residential area
Sport		Golf course	096480	Stadium
Transport	092498			Anchorage for ships

c) Study photo **C** to locate the main quays in Castries Harbour on the map extract, then write their six-figure grid reference positions on the last line of your table.

4 **a)** Using graph **D** as your guide, plot these urban populations onto two separate graphs.

City rank order	Urban area populations in France, a more economically developed country		Urban area populations in Peru, a less economically developed country	
First	Paris	12 341 000	Lima	7 737 000
Second	Lyon	2 214 000	Arequipa	841 000
Third	Marseilles	1 727 000	Callao	813 000
Fourth	Toulouse	1 271 000	Trujillo	747 000
Fifth	Lille	1 166 000	Chiclayo	577 000
Sixth	Bordeaux	1 158 000	Iquitos	438 000
Seventh	Nice	1 005 000	Huancayo	377 000
Eighth	Nantes	898 000	Piura	325 000
Ninth	Strasbourg	769 000	Chimbote	317 000
Tenth	Rennes	690 000	Cusco	312 000

Note: These are the populations of urban conurbations, not just the cities at their centres.

b) Compare your two graphs, and highlight any similarities and differences between them.

Service provision in an area

All settlements perform at least one function for the people who live there, or are within easy travelling distance. For example, an isolated house fulfills a function as a home for those who live there. Functions will only be provided if there is sufficient demand for them. For example, a cake shop can only survive if there are enough people who:

- like eating cakes
- can afford to buy that shop's cakes
- are within easy travelling distance of the cake shop.

Online shopping is increasingly important to many businesses – but probably less so for cake shops and other businesses selling perishable food.

The number of people needed to support a business or service is called its **threshold population**. The size of a threshold population is closely linked to the needs of that particular activity. For example, a secondary school needs a cluster of primary schools to provide enough students to make it viable (table **A** on page 48). Graph **B** presents suggestions for population threshold requirements for some non-educational services.

Fantastic fact

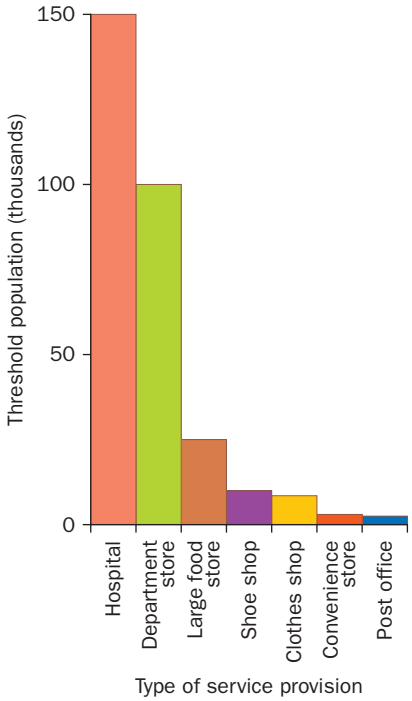
The catchment area for the highest-quality jewellery sold in central London is the whole of the British Isles!

Facility	Threshold population
Small village primary school	500
Pre-school nursery	1000
Town primary school	3000
Secondary school	10 000
College	50 000
University	100 000

A *Population thresholds in the educational hierarchy*

Care needs to be taken when using population threshold data. For example:

- Some communities are wealthier than others, and better-off people can afford to buy more goods or services, so fewer people are needed to make the same service viable.
- Not all people share the same interests or needs. For example, in a community where many retired people live, a shop selling football kit would be less likely to succeed than one specialising in aids for the elderly!
- Communities often have very different preferences and traditions. In France there is a long tradition of eating hand-crafted bread, so a baker's shop in that country can thrive in a community of only 600 people. However, in Britain, where more mass-produced bread is eaten, the population threshold of a similar shop would have to be three times greater.



B *Population thresholds vary widely between different services*

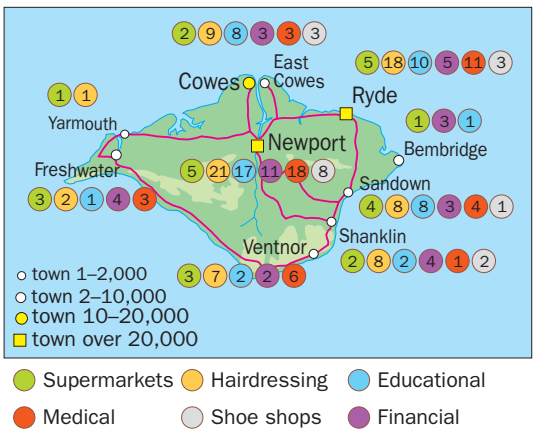
CASE STUDY

Isle of Wight – service provision on a small island in southern England

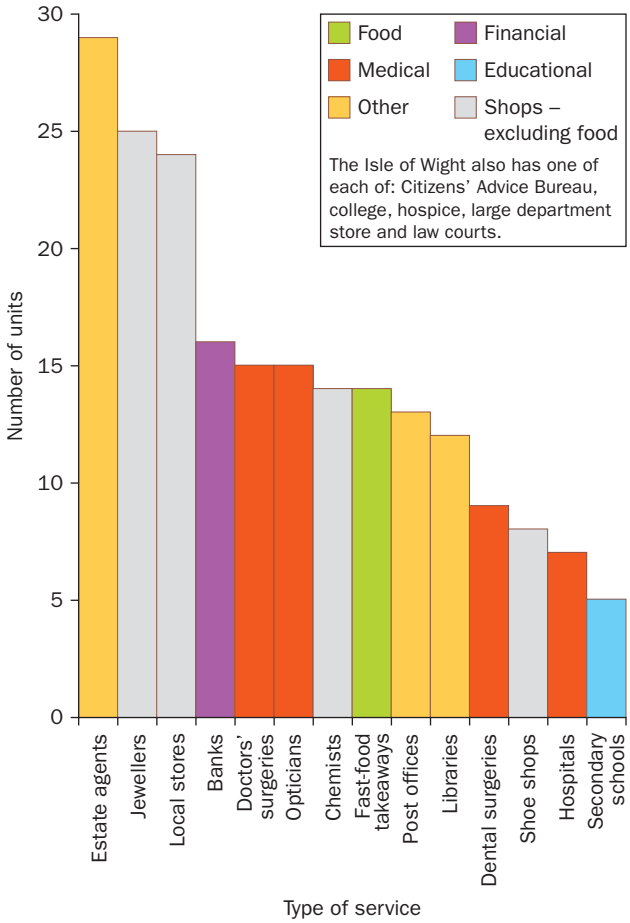
A good way of comparing the population thresholds of different services is to carry out a land use survey. Figure **D** and graph **E** show results of a survey of service provision for the Isle of Wight, which has a population of 139 000. Its largest town, the coastal holiday resort of Ryde, has 24 000 inhabitants. Photo **C** shows the town of Ryde.

Because each type and level of service has its own population threshold, it also requires a minimum area from which enough people can be drawn. This is called its **catchment area**. Low order goods such as bread and newspapers, which are cheap and bought frequently, have much smaller catchment areas than high order (expensive) items like beds and cars. Another term for 'catchment area' is **sphere of influence**.

C *An aerial view of Ryde*



D *Distribution of services on the Isle of Wight*



E *The number of businesses in some of the Isle of Wight's different kinds of services*

Now Investigate

1. List 10 items owned by your family. For each one, find out how far away from your home it was bought.
2. Imagine that you have been given the job of planning a new leisure centre to meet the recreational needs of your local community. What criteria (for example transport and threshold population) will you need to consider to make sure that the new centre will be a success?
3. Suggest why the threshold population of a doctor's surgery might be different from that of a dentist's surgery.
4. Look at map **D** and explain why Newport has more services than Ryde.

Urban settlements

Learning objectives:
- describe and give reasons for the characteristics of, and changes in, land use in urban areas
- explain the problems of urban areas, their causes and possible solutions

What kind of settlement do you live in?

Pedro lives in a large city, while Maria's home is in a small town. (figures **A** and **B**).

I live in a big city. It's got everything – including crime! All the big department stores are here, and the latest fashions. My Dad's mad about cars and there are showrooms here selling every make you can think of. There's a great social scene, with plenty of discos, nightclubs and cinemas. There are theatres and museums, too, as well as colleges, universities and hospitals ...

A *Pedro*

B *Maria*

My town is quite small. Its shops sell the basics like food, of course, but not much else. You can get second-hand cars and vans here, but anyone who can afford to buy a new car has to go to the city. There isn't much for young people to do in the evenings, so we find our own amusement – and that sometimes gets us into trouble! I can't wait to move to the city when I leave school.

The previous topic introduced the idea of a settlement's site – the small area where its first buildings were built. Here we look at **situation** – the position of a settlement within a much larger region. Site and situation are both about places – the difference between them is scale and distance. To grow, and move up higher in the settlement hierarchy, a hamlet or village needs both a site and a situation with many advantages.

Paris: location and growth of a capital city

Both the site and the situation of Paris have many advantages. It has an ideal island site (map **C** and photo **D**), and a situation in the centre of the most fertile region in France, an area known as the Paris Basin (map **E**). Having an abundant supply of food, and being at the centre of road and later railway networks, helped Paris to grow faster than any other French city. Today it is a huge

Fantastic fact

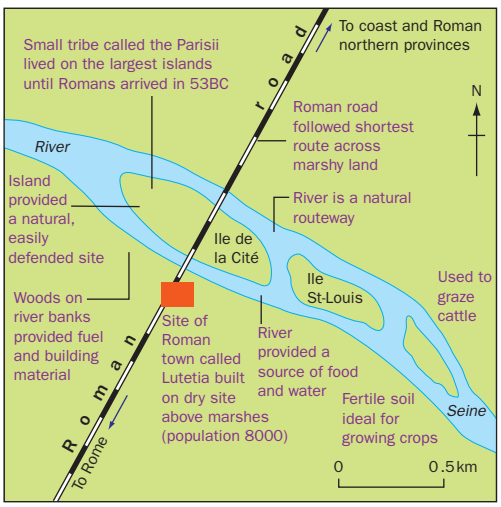
One in every five French people lives in the Paris conurbation.

built-up area, known as a **conurbation**, which includes many settlements that were once separate towns.

The population of Paris is now almost six times greater than France's second biggest settlement, Lyon (graph **F**). Much of the population increase in Paris has been due to the migration of people from the poorer regions of France.

Skills link

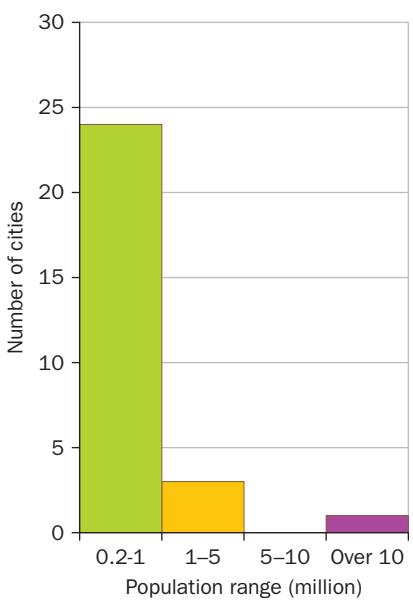
See Topic 4.4 pages 265–267 to learn more about how to draw and annotate a sketch map.



C *The site: the oldest part of Paris is built on two islands – the Romans used the Ile de la Cité as a river crossing-point along a military road*

E *The situation of Paris, which is an important focus of European road and rail links*

D *Ile de la Cité is now dominated by important buildings such as Notre Dame cathedral*



F *French cities with populations greater than half a million*

Now Investigate

1. Do you live in a large city, a town, or a smaller settlement? Compare your own settlement with those of Pedro and Maria. Does it have more or fewer advantages than theirs?

2 Using information on these two pages, and the internet, state whether each of the following statements is *true* or *false*. Re-write any false statements to make them true.

i) Early settlers had a plentiful supply of water and fish from the river Seine.

ii) One of the islands provided an easy crossing point of the river.

iii) The land on the banks of the river Seine is steep and difficult to build on.

iv) The river made transportation by boat very difficult.

v) The original site of Paris consisted of two islands in the river Seine.

vi) Islands in the river Seine provided a safe, easily defended site for early settlers.

vii) Paris is about 175 km upstream from the mouth of the river Seine – which is located on the Channel coast; it is also approximately 300 km by land from the port of Le Havre.

viii) The general relief of the Paris Basin (i.e. the height and relief of its land area) is low; it is undulating land surrounded by escarpment-shaped ridges.

3 Describe the location (situation) and main functions of Paris. Use information from map **E** – together with any you obtain from an internet search and any other resources that are available to you.

i) The size of the Paris conurbation, from north to south and east to west

ii) Rail and road links (national and regional)

iii) Location of international airports

iv) Any nearby industrial areas

v) Land use in the Paris Basin

4 Using both the Ordnance Survey map on page 42 and map **E** on page 51 as a guide, draw a sketch map to show the location of Castries, the largest settlement on the island of St Lucia. Base your map on the area within the grid lines 47–52 and 7–13; annotate your map to show the advantages of both the site and the situation of the town.

How does urban land use change, and why?

The *proportion* of the world's population living in urban areas has been growing for the last 200 years. This process is called **urbanisation**.

Keetan lives in Kolkata, one of the largest cities in India. Read what Keetan has to say about the place he calls home (figure **A**).

A *Keetan, a resident of Kolkata in India*

Hi! I'm Keetan. My dad is a taxi driver. Sometimes he takes me with him so I can get to know my city.

Yesterday we started off in Howrah, in the northern part of the city. There are lots of squatter settlements here – we Indians call them bustees! Dad usually has to drive around these areas, because there aren't many proper streets between the houses – just narrow dirt tracks, which become flooded in the heavy monsoon rains. We then drove south, through the textile area, where thousands of small businesses make all kinds of clothing. Then 1 km further on is the city centre, with its huge, modern office blocks and hotels and some fine old stone buildings from when India was a British colony. Nearby are the docks, on the east bank of the Hooghly river, with lots of factories nearby.

We came back home through the area where the better-off people live. This is quite close to the city centre where there are big stores which have everything you could ever dream of!

Two models can help us understand how towns and cities develop. These are based on the location of **land use zones**, areas which have one or more important urban functions – commercial, industrial, residential, recreational – as well as facilities such as roads and schools which form the **infrastructure**. These make it possible for a place to function effectively.

The land use model in diagram **B** shows a series of concentric circles, all of them sharing the same centre point. This theoretical model applies to a town that has grown at exactly the same rate in every direction.

The model in diagram **C** is more realistic, because it allows for growth at different rates in all directions. It also shows that functions can extend to the edge of the built-up area. For example, industrial developments often follow canal, road and railway routes linking the city centre and the countryside. Also wealthier people try to build their houses where they won't be affected by industrial pollution.

It can be difficult to match these models to the towns and cities of today because:

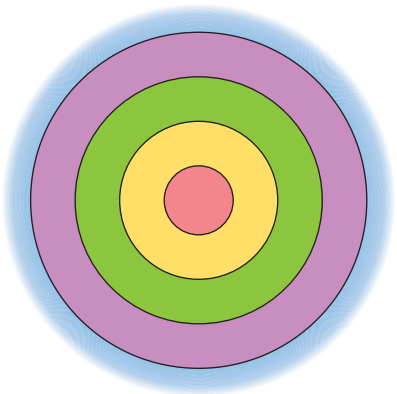
- many old inner city areas have been redeveloped and their original functions changed; for example, retail parks have replaced areas of poor-quality housing
- new by-pass roads around towns have attracted industrial and residential developments away from busy inner city areas
- both models assume that the oldest part of a town will always be in the middle, but many town and city centres are closer to one side of the urban area.

Fantastic fact

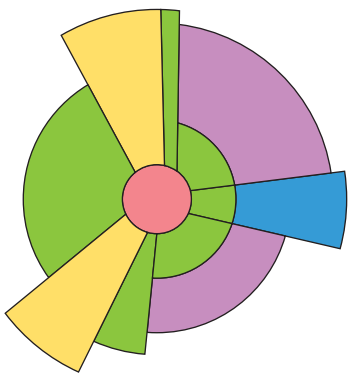
The annual rate of global urbanisation exceeds 2%.

Topic link

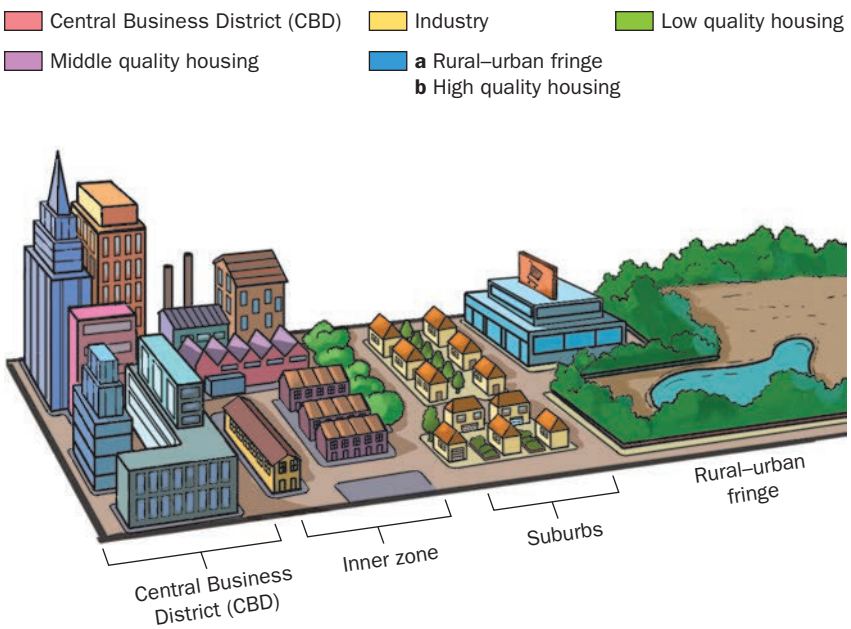
See Topic 1.2 pages 21–22 to learn why some cities are growing so fast.



B *The Burgess urban land use model*



C *The Hoyt urban land use model*



D *Transect across a typical city in a more economically developed country*

These models are based on urban areas in more economically developed countries, but most cities in developing countries share similar characteristics. Diagram **D** is a transect through a typical city in a more economically developed country, from its modern commercial centre to the outer edges. Cities in less economically developed countries have similar land use patterns, including a **Central Business District** or **CBD**, at their heart, although in some cities the suburbs have developed as squatter settlements.

> **Topic link**
>
> See Topic 1.7 pages 66–68 to learn more about squatter settlements.

Now Investigate

1. Imagine that, like Keetan, you have the chance to travel around a city or large town in your own region. Write about what you might see on the way, for example where there are different kinds of buildings and what they look like. How is your town or city similar to and different from Kolkata?

2. These questions are based on diagrams **B**, **C** and **D**.
   - **a)** Which urban zone is in the same central location in all of the diagrams?
   - **b)** Which model is more likely to show how a town's growth has been influenced by natural land and water features?
   - **c)** Which model recognises that people may have some choice in where they live?
   - **d)** Which model recognises the role of transport in urban development?
   - **e)** Explain how the zones in a more economically developed city might be different from those in a less economically developed city.

Urban zones

There are four main types of urban zone:

- the Central Business District or CBD
- the inner zone
- the outer zone (suburbs)
- the rural–urban fringe.

You will need to know the main characteristics of each zone, and be able to recognise each zone on photographs, maps and street plans.

> **Fantastic fact**
>
> Half of all people in the UK now live in the outer zone (suburbs) of a city.

Central Business District

The Central Business District (CBD) is the commercial 'heart' of a settlement and is easily recognised on photographs by its impressive buildings. The first large buildings were made of stone and designed to show the wealth and importance of a city. More recent big buildings are just as impressive, but are generally made of steel and glass (photo **A**).

A *Part of the CBD in Shanghai, China*

Although the CBD is smaller than the other zones, it is an economic centre of any major settlement. It is also the central meeting point for road and railway routes and has plenty of space for car parking. This good access makes the CBD an ideal place to locate banks, offices and large department stores and specialist shops selling **comparison goods** such as expensive furniture, watches and antiques. Major public buildings like cathedrals, theatres, hotels and museums often cluster around parks and gardens – the few open spaces that are not built on.

Only the rich can afford to buy spacious accommodation in the CBD, and many people rent small 'studio' apartments instead. They want to live in the centre because they like the excitement of city life and prefer to spend more money on rent instead of on high commuting costs. The street patterns in most European city centres developed in a random, irregular fashion – unlike the grid patterns of newer cities like Chicago and Detroit in the USA, and island capitals such as Castries in St Lucia and Port Louis in Mauritius.

The inner zone

In many more economically developed countries this zone dates from the 19th century, during the Industrial Revolution, when factories and houses were built next to each other and people worked long hours and walked to work. Much **redevelopment** has taken place in this zone to replace low-quality housing and remove old industries. They are replaced by inner ring roads, retail parks, recreational facilities such as multi-screen cinemas and extra car parking areas.

B *The old and the new in an inner zone*

In less economically developed countries, the inner zone often includes some high-quality housing close to the cultural and social attractions of the city centre.

The outer zone (suburbs)

In less economically developed countries, squatter settlements are very common (photo **C**). There are many challenges for the people living there, but they are very resilient and try hard to improve their quality of life. The location of such settlements means that the inhabitants can take advantage of employment opportunities in both the inner zone and on the rural–urban fringe.

In more economically developed countries, many families in the outer zone live on estates of large houses with gardens and garages, and many people commute daily to work. Retired people often live in single-storey bungalows. In other more economically developed countries, apartments, villas and condominiums are the more usual type of housing (photo **D**). The standard of living

C *Scene in the outer zone of a less economically developed country*

tends to be high, but there are generally few local facilities such as schools, health centres and shops, because most people have cars and are able to travel further.

Rural–urban fringe

This zone is where town and country meet. Photo **E** shows that it can be a very 'busy' area, in spite of its semi-rural location and appearance.

D *Suburban scene in a more economically developed country*

E *A typical rural–urban fringe landscape*

Now Investigate

1. **a)** Find at least one photograph of the CBD of a major city in your own country and annotate it to show its main land use functions.
   b) Do the same for a city in another, contrasting country.
   c) Compare *and* contrast the two scenes, referring to your annotations for each group of land use functions.
2. For this activity use the Ordnance Survey map on page 42. For Castries:
   a) write down the grid references for the squares in which the CBD is located
   b) list all the key buildings which indicate that it is a CBD.
3. Make a larger copy of the following table. Complete your table by writing in its correct column each rural–urban fringe activity you can see in photo **E**.

Agricultural	Commercial and industrial	Recreational	Transport	Other

The environmental impact of pollution

Our actions and behaviour can damage our local environment. The ways in which we harm our environment are known as pollution (diagram **A**).

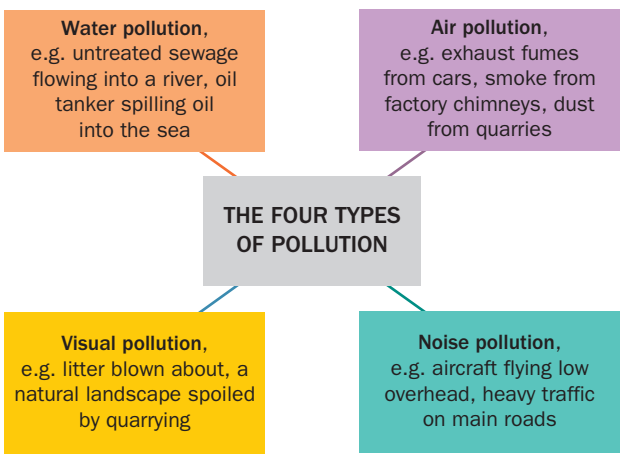
Pollution causes some measure of harm to the environment. Wherever people live, work or travel there is some form of pollution. Spend a few minutes thinking about your area – what people do there, and how their activities might pollute it. Consider all types of pollution – some are less obvious than others (take a careful look at items **A–D** on these pages).

Fantastic fact

When the Eiffel Tower was built in 1889, many French people thought it was the ugliest thing they had ever seen. Now the French love it, and 'their tower' has become one of France's best-known global images.

Air pollution

Air pollution is one of the most serious reasons for damage in the urban environment. It has many causes, including traffic exhaust fumes from air, road and rail traffic when gases such as sulphur dioxide are emitted. Air pollution is also caused by smoke from houses, factories and power stations. This type of pollution is often worst on very foggy or hot days (photo **B**), because that is when **smog** – a combination of *smo*ke and f*og* – is most likely to form. Smog is very dangerous to health, and can cause serious breathing problems in people, especially the young and elderly.



A *Types of pollution*

Other kinds of pollution

Other environmental problems in urban areas include:

- noise pollution – for example from passing traffic and aircraft taking off and landing (diagram **C** on page 58)
- water pollution – due to industrial and domestic waste and causing diseases such as bilharzia, cholera and typhoid
- visual pollution – people have different reactions to new buildings or other constructions, and may consider some of them to be offensive to the eye (photo **D**).

B *Smog over Tel Aviv, Israel*

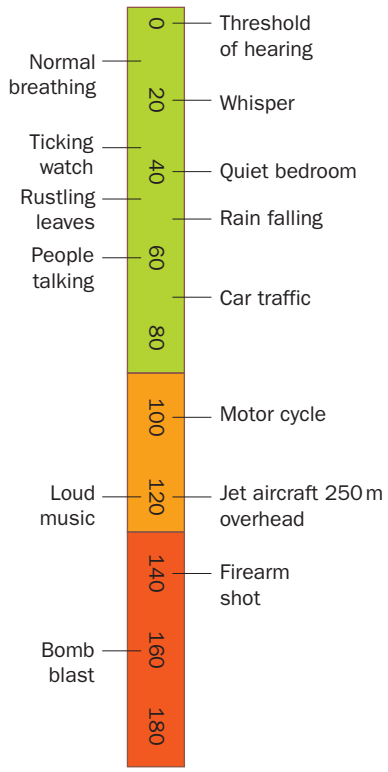
What makes a city 'green'?

Copenhagen, the Danish capital, is one of the world's 'greenest cities' and has received several major awards for its ecological achievements. It became the world's first 'Bike City' (2008–11),

was European Green capital in 2014 and was ranked first on the Global Green Economy Index in 2016 by Dual Citizen Inc. These facts explain why:

- Biomass and processed waste provide over 50% of the city's heating, with oil contributing only 5%.
- A new district cooling system takes cold water from the harbour, saving 70% of the energy used by traditional air conditioning.
- 45% of all domestic waste is recycled.
- It has reduced its water consumption by 26%.
- Its CO^2 emissions were reduced by 20% within 6 years; it is on-track to become completely carbon-neutral by 2025.
- It has 454 km of dedicated cycle lanes.
- 56% of Copenhageners commute to work or school by bicycle every day.
- The water in the Inner Harbour is so clean that people can swim in it safely.
- It hosted the 2009 United Nations' Climate Change Conference.

D *Would you like to have a working wind turbine near you?*



C *Levels of noise measured in decibels (dBA)*

Now Investigate

1 Write down at least five activities in your local community that might cause pollution. Suggest the kinds of pollution they are most likely to cause. You could display your ideas in several ways:

- as a table, with activities listed in the left column, and their effects described in four other columns – one for each type of pollution
- as a sketch map, annotated to show the location of each type of pollution
- as a series of annotated photographs, with each annotation describing a different cause or effect of pollution

or as a combination of these.

2 **a)** In your opinion, would a wind turbine in your own community be a beautiful (and useful) landmark – or an example of visual pollution?

b) Give reasons for your answer.

The effects of rapid urban growth on the rural–urban fringe

Topic link

You can learn more about counter-urbanisation in Topic 1.2 page 22.

Rapid urban growth doesn't just change the centres of towns and cities; it can also have major effects on nearby countryside. Urban areas expand to accommodate their increasing population – a process called **urban sprawl**. They can also 'urbanise' the rural areas near to them because people:

- have greater mobility, due to improved transport networks
- have more 'spare' money to spend on non-essentials such as holidays and recreational activities like camping and golf
- have longer holidays and more leisure time at weekends
- lead a hectic life working in the city and so prefer to live in a quiet, country village 'retreat'.

A *Why modern retail parks are located in rural–urban fringe areas*

It is not easy to limit the impact of rapid urban growth on rural–urban fringe areas, because these areas provide ideal locations for a wide range of land uses such as golf courses, power stations, modern industrial estates, retail parks and supermarkets (photo **A**). Fringe areas are also the kind of place where people seeking a better quality of life wish to live – even if that means having to spend more time and money commuting daily to work. This outward movement of people is called **counter-urbanisation**. It often results in small, traditional villages becoming more suburbanised in character.

In some places **green belts** around cities have helped to control urban sprawl, by limiting new residential and other developments in rural–urban fringe areas. Another strategy is to build new towns well away from a city's boundaries, which helps both to meet the need for more housing and reduce the rate of urban sprawl (photo **B**).

B *A new town*

Conflict in the rural–urban fringe

Each land use places a different demand on rural–urban fringe areas, often causing conflict between different groups of people. For example:

- a coal-burning power station creates air pollution, and this could increase the health problems of patients in a nearby hospital

- farmers are often involved in conflict because careless visitors can damage their crops or allow valuable animals to stray onto busy roads
- quarries are often sited in otherwise attractive areas of countryside, but the product (stone) has to be transported to where it is needed for building (houses and other buildings, roads), causing conflict among people living nearby (photo **C**).

Topic link

You can learn more about environmental issues in Topic 3.7 pages 220–226.

- Noise pollution: machinery in quarry, lorries transporting stone from quarry
- Air pollution: dust
- Visual pollution: dust, machinery, exposed rock faces
- Roads: congestion and vibration caused by lorries transporting stone
- Local settlements: affected by noise, air and visual pollution

C *Quarrying has many damaging effects on the local environment*

Now Investigate

1 **a)** Refer to the map extract of Port Louis in Mauritius, on page 312. Copy the table shown below. Complete your table by identifying the various land uses on the rural–urban fringe of Port Louis or by giving a grid reference for the land use stated in column 2. You may use four-figure grid references to complete each cell in the first column.

Grid references	Type of land use
971057 and 987066	
978067 and 978069	
972032 and 984053	
	Industrial estate
985069 and 997065	
	Power substation
	Race course
990038 and 984032	
990039 and 990047	
	Sports ground
964028 and 998022	

b) Use four colours to highlight the following land uses in the table:

Economic (including power generation) Recreation Transport Others

Include a key to show the meanings of your four chosen colours.

2 What activities take place in the rural–urban fringe of a large urban area in your own region?

3 **a)** Suggest reasons why the rural–urban fringe is the ideal location for at least five of these land uses:

fishing golf hospitals modern industrial estates power station reservoirs supermarkets

b) Pair-up at least eight land uses on the rural–urban fringe that are likely to be in conflict, and suggest why. You can use each type of land use more than once.

4 What kinds of pollution and other environmental problems are quarries likely to cause for people living in rural–urban fringe areas? Consider all sources and types of pollution.

Urban change

To understand what a modern city is like, you need to know how, when and where it started, and how it has since developed and changed.

CASE STUDY

London – an example of changing land use

The Romans first built Londinium beside the river Thames almost 2000 years ago (map **A**). This site was chosen because it was easily defended and the Romans knew that it could become an important route centre. The actual site is now occupied by London's financial district, between the areas now known as Westminster and the 'East End'.

From the earliest times, the western and eastern sides of London have developed in very different ways (photos **B** and **C**). The East End has always been heavily industrialised and housed many of London's poorly paid workers. By contrast, Westminster is well known for its royal palaces, government buildings, large houses and expensive shops.

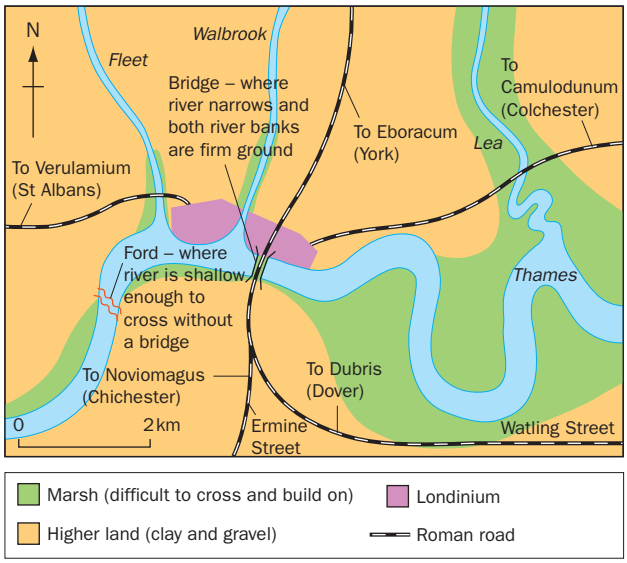
The East End developed first. Roman ships could not sail under London Bridge, the lowest bridging point across the Thames, so a port was established downstream of this.

Fantastic fact

In 1900, London was the world's largest city, with 6.5 million people.

Industries developed behind the quays, as well as low-quality housing for the dock and factory workers, many of them refugees who migrated here from mainland Europe.

Westminster developed later, around the 11th-century abbey and became the preferred location for royalty, the very wealthy, and the most influential people in government. One reason for them choosing Westminster to live was that the prevailing winds blow from the south-west, so any air pollution from the East End's industries blows towards the North Sea, well away from Westminster. The large parks in this part of the city were originally hunting forests for the nobility, and they have been

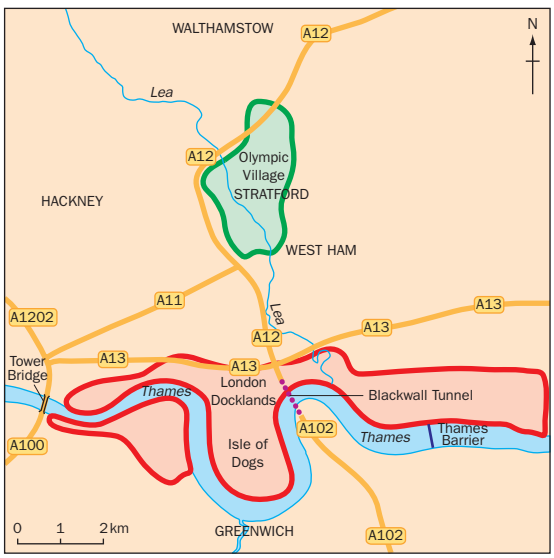


A *Original site of London*

B *London's East End*

C *Westminster*

D *London Docklands today*



DOCKLANDS

22 000 new homes, many in renovated warehouses
10 000 upgraded local authority houses
New shopping centres
New college/university campuses
Indoor sports centre and yacht marina
Docklands Light Railway – 10 minutes to central London
London City Airport – over 4 500 000 passengers a year
New road link to M11 motorway
43 000 new jobs
1500 new businesses

OLYMPIC VILLAGE

High-speed rail link to central London
Park and ride car parks
Wetland habitats restored
New bridges across main roads
Olympic Stadium – accommodates 80 000 people
Aquatics Centre – future training and competitive events
Velodrome – links to cycle circuit and cycle routes across London
Olympic Village – 3300 new homes, 30% affordable housing
370 000 m^2 for future business developments
Media centre – office facilities for 8000 people

E *Modern development of East London*

used as recreational areas ever since. It is quite unusual to find so much open space in the heart of a city, where the competition for land is intense.

By the 1980s, sea-going ships had become too big for the East End docks, so most of the industries that depended on them for imported raw materials had re-located elsewhere. The East End's economy had seriously declined and local unemployment had reached record levels. In 1981 The London Docklands Development Corporation was established to redevelop the whole area and give it a new lease of economic life. Photo **D** shows what this area looks like now.

The 2012 London Olympic Games were held in the valley of the River Lea, a northern tributary of the River Thames, just east of London Docklands. A major aim of the project has been to transform this area of dereliction and deprivation into one where people will want to live and work long after the games have finished. Map **E** shows what has been done to transform the whole of this area.

Now Investigate

1. Explain why Westminster developed in a very different way to that of London's East End.
2. **a)** Outline the reasons why it became necessary to regenerate both the London Docklands and the Lea Valley area.

   b) In what ways are the regeneration plans for both areas similar? Your answer could take the form of a comparison table.

Further research

Investigate the impact of a previous Olympic Games on its host city. For example, the 2004 Games was in Athens – you could find out how it stimulated economic growth and improved recreational facilities in that city.

Topic link

More detail about the environmental impact of rapid urban growth and its effects on the rural–urban fringe can be found on pages 57–60.

Urbanisation

Learning objectives:
- identify and suggest reasons for rapid urban growth
- describe the impacts of urban growth on both rural and urban areas, along with possible solutions to reduce the negative impacts

What problems are caused when cities grow?

People travel for a number of reasons, as shown in diagram **A**.

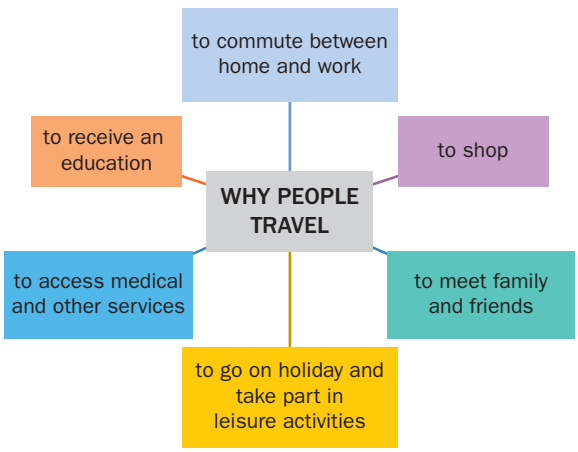
Commuting and going to school or college are the most common reasons for travel. These are also the main causes of traffic congestion because they peak at certain times on work days (graph **B**). The morning and late afternoon/early evening peak travelling times are often called 'rush hours', because of the usually frantic nature of travel at those times. Congestion is worst in the CBD, where many main roads meet, and some of the oldest roads are too narrow for modern traffic.

Rush hours are a very inefficient use of the resources both of a city and of individual families. Car ownership continues to grow in most countries (see graph **C**), and most commuters prefer to travel alone rather than car sharing. Young children are often driven the short distance to school, instead of walking to school.

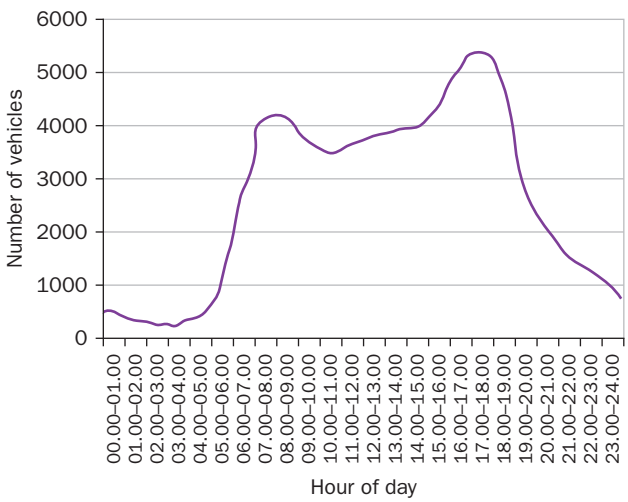
Traffic congestion wastes fuel and causes air pollution along busy routeways. It is now a common feature of most large settlements, but there are several ways in which it can be reduced, for example by:

Topic link

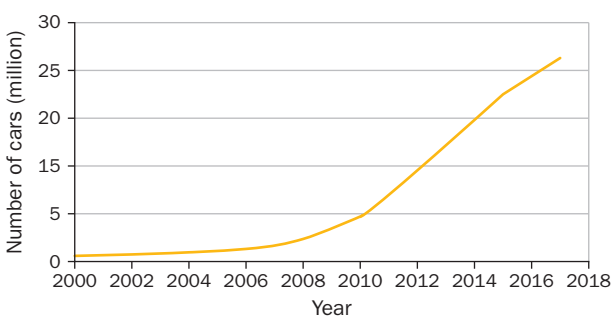
See Topic 1.6 page 57 and Topic 1.7 pages 70–72 to learn more about the effects of pollution in cities.



A *Why people travel*



B *The changing volume of road traffic on a typical work day*



C *Rising car ownership in India since 2000*

- making public transport services more frequent, affordable and reliable
- encouraging the use of public transport by imposing 'working-space levies' on companies offering free employee parking within inner city areas
- building **rapid transit systems** such as underground railways and surface city links (guided buses and trams) – photo **D**
- integrating transport systems so that train and bus timetables are linked, allowing passengers to transfer easily between different modes of transport and use inter-changeable tickets
- installing roundabouts and imposing speed restrictions to reduce road accidents which cause traffic hold-ups
- encouraging car-sharing, to reduce the volume of commuter traffic
- introducing traffic light systems which monitor flow and adjust signal timings to maximise traffic flow at peak times
- operating bus-only lanes on wide roads during rush hour periods
- making narrow roads one-way and restricting parking along busy (or narrow) roads
- pedestrianising busy shopping streets and building by-passes and ring roads to divert through-traffic away from city centres
- providing low cost park-and-ride facilities on city approach roads
- raising inner-city parking charges to discourage the use of private vehicles in city centres
- introducing **congestion charges** for vehicles entering the busiest city zones
- creating protected bike lanes to encourage cycle use
- incorporating bike hire into a city's integrated transport network.

D *A section of the Metro Monorail in Sydney, Australia*

Fantastic fact

Passenger vehicle ownership in India has nearly tripled in the last 10 years. It is predicted to increase by 775% by 2040!

Now Investigate

1. Is there a rush hour in your neighbourhood? What times of the day are the busiest?
2. **a)** If your family or a friend has a car, keep a week-long tally of how often it is used for each type of journey shown in the spider diagram.

   b) Display your tally-totals in the form of a bar graph, then comment on what your completed graph shows.

3 For each rush-hour period shown in graph **B**, write down its approximate:

- start time
- finish time
- peak traffic volume.

4 Quoting data from graph **C** as necessary, describe how car ownership in India has changed since 2000.

5 Using a street plan or Ordnance Survey map of an urban district you know well, annotate it to show examples of congestion reduction strategies. (Hint: Two of the more common strategies are traffic lights and roundabouts.)

Squatter settlements

As a visitor to any city centre in a less economically developed country, you might think that traffic and pollution were the only serious problems caused by urbanisation. Travelling beyond the centre would quickly change that first impression! This is because you would see huge areas of deprivation (see map **A**) – the **squatter settlements**, also known as **shanty towns** – where many people are unemployed and can't afford to live anywhere else. City authorities are aware of the conditions in these areas, but they can't afford to improve them all.

Two of the greatest challenges facing newcomers to less economically developed cities are getting a job and finding a place to live. The two problems are connected, because those lucky enough to be in full-time employment may only earn enough to provide food and shelter for their families. Wages are low, even for the employees of **transnational companies** such as clothes manufacturers. They are far below those earned in the **formal sector** of employment, by professional people like lawyers. Textile workers receive little money even though they spend many hours each day in difficult working conditions.

Education in rural areas is very basic, so many migrants are illiterate and lack the practical skills that employers look for. Many immigrant families are so desperate that children as young as 6 years old are sent out to earn money doing jobs like shoe-shining and peddling cheap goods on the streets.

Life in squatter settlements

In the world's fastest growing less economically developed cities like Dhaka, Kolkata and Mexico City, over half of the population are squatters. Some countries have so many squatter settlements that they have their own names for them: *barriadas* in Peru, *favelas* in Brazil, *bustees* in India and *bidonvilles* in north Africa.

Topic link

You can find out more about how people make a living from informal employment, in Topic 3.1 page 143 and Topic 3.3 pages 172–173.

Topic link

To learn more about rural to urban migration see Topic 1.2 pages 21–22.

Fantastic fact

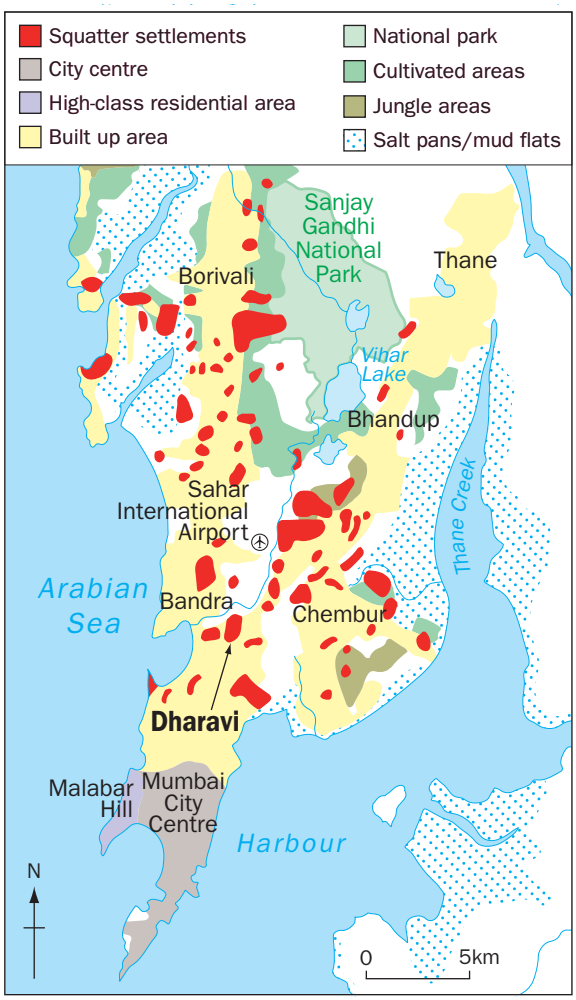
At least one in seven people on Earth now lives in slum conditions such as squatter settlements.

Topic link

See Topic 1.6 pages 52–56 to learn more about land use zones in cities.

CASE STUDY

Mumbai – a rapidly growing urban area



A *Many districts in Mumbai have over half of their people living in slum conditions*

Dharavi is often called 'the largest slum' in Asia' (photo **B**). It is huge – an area of over 2 km^2 on what used to be a mangrove swamp – right in the centre of Mumbai. It is one of many squatter settlements in this rapidly expanding city, whose population increased from 2.9 million in 1950 to 22 million in 2015. Every day, an average of 250 families migrate to Mumbai, which is partly why 62 per cent of its total population live in such settlements.

B *Dharavi in Mumbai, India – a typical squatter settlement*

Most of the dwellings in Dharavi have no water or electricity and families have to rely on other people to provide what they need – at a high price. In some streets, every household has its own tap, and these families take great pride in hosing down the street to keep it clean. Most workers have employment in the **informal sector**, such as recycling plastic bottles, oil drums and cardboard boxes. Textile workers cluster together in districts called *kaarkhanas*. People in both types of employment usually work from home, not in factories, so there is serious air pollution and constant noise in many residential areas.

Photo **C** on page 68 shows a typical squatter settlement in India. There are significant problems for people who live in areas like this:

- **Disease** As there are no effective sewage or household waste disposal systems and community taps may be shared by up to 50 families, disease is rife and life expectancy remains low.

- **Poor building construction** These settlements are illegal, so the city's minimum building and safety standards are not enforced (photo **B** on page 67).
- **Risk of fire** Fires can spread very quickly between the wooden shacks built so close together.
- **Unsuitable location** Shortage of land means that newcomers often settle in dangerous and unsuitable places, such as steep hillsides prone to landslides.
- **Crime and anti-social behaviour** Domestic stress levels are high, so family breakdown is common and many children are abandoned.
- **Lack of education** The city authorities do not recognise illegal settlements, so do not provide schools and health centres. This leaves migrant families at a great disadvantage, because almost 40% of all residents of Mumbai are recent immigrants, and 23% of them are children.

C *Shacks in squatter settlements are made of any available materials*

Further research

Use online resources to investigate ways in which people in squatter settlements are positive and do much to improve their quality of life.

Now Investigate

1 **a)** List the difficulties faced by shanty town squatters, under these three headings:

Environmental problems Social problems Economic problems

b) Now consider some of the possible good things about living in a shanty town, again listing your ideas under suitable headings.

2 Describe and suggest reasons for the distribution of Mumbai's bustees as shown in map **A**.

3 Major events such as football's World Cup have often led to squatter settlements being cleared, to provide extra land for the construction of sports and accommodation facilities. Imagine that you are a local newspaper or TV reporter and you have been asked to produce a report which contrasts the short-term needs of event organisers with the much longer-term effects on displaced squatter communities.

You will need to include suggestions about how the displaced people are likely to feel about the disruption to their lives, what kinds of places they could be relocated to, and ways in which their lives might improve after leaving the squatter settlements.

How will people in the favela feel? Where will they go? Are the authorities right to do this? Will the clearance improve people's lives?

Ways of upgrading residential areas

Pages 66–68 described the challenges faced by many families living in squatter settlements in less economically developed cities, and some of the ways in which they try to improve their quality of life. The following case studies provide information about two different strategies used by poorer countries to reduce the amount of low-quality housing in their cities. They are called **self-help** and **site and service schemes**.

A self-help scheme in Brazil

In this type of scheme, town and city authorities support families wishing to improve their homes. Grants, building materials and small cash loans are provided to help them to start work. Water and sanitation are vital to people's health, so **self-help schemes** often include standpipes which groups of households can share. People are often encouraged to buy their land, which makes them feel it is worth the effort of making improvements. Whole communities may also be assisted in building schools and health centres.

Roçinha in Rio de Janeiro is one of Brazil's largest *favelas*. It first developed on a steep hillside in the 1950s and now has 70 000 inhabitants, although some estimates put this figure as high as 300 000. Its early dwellings were small wood and canvas cabins, but most have since been enlarged and improved with bricks and tiles, and with vital help from the local authority (photo **A**). With its many shops and small businesses, most parts of Roçinha now look more like a well-ordered residential area than a poverty-stricken squatter settlement!

A *A self-help scheme in Roçinha, Rio de Janeiro*

A site and service scheme in Egypt

Site and service schemes are much more ambitious than self-help schemes because they need enough land to create whole new developments. Water, sanitation and electricity services are provided for each plot before any building starts. In small schemes, the people use the materials they can afford at that time; any improvements can made later, after the families have saved enough money to pay for them.

The 6th of October City near Cairo is a good example of such a scheme. This new town was founded in 1979 to relieve pressure on over-crowded Cairo. Many of its 500 000 inhabitants live in high-rise blocks of flats (photo **B**) and work on its large industrial estates. New whole-community facilities such as schools, shops, mosques and parks are included in all of Egypt's new towns, which were viewed as the best way of housing Egypt's rapidly expanding population.

B *High-rise flats in 6th of October City*

Housing problems are not confined to less economically developed countries. In the 19th century, during the Industrial Revolution in Europe and North America, millions of migrants from rural areas were accommodated in cheap, rapidly-built terraced houses. These now form the inner residential zone of some industrial cities in Europe and North America (photo **C**). By the mid-20th century, many of these needed to be **renovated** (upgraded) by re-wiring them and fitting new windows,

C *Low-quality terraced housing in Harlem, New York*

indoor bathrooms and toilets. Those that had deteriorated to become slums were demolished and replaced with completely new buildings – a more expensive process called **redevelopment**.

Many people displaced by redevelopment were re-housed in high-rise flats. These were welcomed at the time, because they offered a higher standard of accommodation – but in the process of moving many communities disappeared. These high-rise flats have since become much less popular due to the inconvenience of living in such tall buildings.

Another solution has been to build **new towns**. These provide all the facilities that people need – including recreational and employment opportunities. In the 1940s–60s, the UK built more than 30 new towns, most of them within 50 km of large, overcrowded cities. Singapore, which was a British territory until 1963, built 22 new towns during the same period (photo **D**).

D *A 'new town' area in Singapore*

Now Investigate

1. Define clearly the terms 'renovation' and 'redevelopment', to show that you understand the difference between them.
2. List up to eight possible disadvantages of living in a high-rise block of flats.
3. Write a brief 'revision summary' for each of the two urban renewal case studies.
4. Imagine that you are in charge of your local area's urban planning department. You have been given a grant of $250 million to improve the quality of life for people in your area. You must invest all of that grant in one of two ways:

   either redevelop just one part of your area, by building a complete new town on that site

   or

   renovate every dwelling in the whole of your local area, using both self-help and site and service schemes.

   a) Decide which option *you* would take.

   b) Give detailed reasons to justify your decision.

Fantastic fact

Each of Cairo's new towns houses more than 500 000 people – so they are really 'new cities'!

Further research

Identify a squatter settlement or other area of low-quality housing in an area of your choice. Produce a case study about that settlement, including a location map and some annotated photographs to describe it. Add as much detailed information as you can about its dwellings.

More sustainable cities

Rapid urbanisation creates many problems for the world's cities and the people living in them, but much can be done to make them more sustainable, or 'green'. Some strategies that aim to do this include:

- reducing all forms of pollution – especially air pollution due to emissions from vehicles and factories
- using fewer natural resources such as fossil fuels, for example by making vehicle engines more efficient and encouraging people to use public instead of private transport
- disposing of waste materials in environmentally less damaging ways – mainly by recycling
- improving the natural environment within urban areas by creating more recreational open spaces and planting more trees and other plants.

Curitiba – Brazilian city leads the way!

Curitiba provides a good example of what can be done to control some of the worst effects of urbanisation. It was a typical Brazilian city that originally developed due to its position on the main beef-cattle route to São Paulo. In the days before motor transport, herds of cattle were driven along this route.

When agriculture was mechanised during the 1950s, 60s and 70s, fewer farm workers were needed. People who lost their jobs migrated to cities like Curitiba, whose population grew by 6 per cent every year during those three decades. They created squatter settlements around the city and the population of the conurbation increased from 150 000 to almost 3.5 million. Today, however, the people of Curitiba say they live in the best place in the world! Here are some reasons why:

A *Industrial location on the rural–urban fringe of Curitiba*

- **In the 1960s:** Curitiba's new 'Master Plan' is approved. Its aim is to control urban sprawl, reduce city centre traffic congestion, provide affordable public transport and build more direct highways leading out of the city.
- **In the 1970s:**
  - city centre shopping streets are pedestrianised
  - bus-only lanes are introduced
  - many streets are made one-way
  - industrial areas are established on the city's outskirts, where air pollution is less likely to affect the main residential zones (photo **A**).
- **In the 1980s – Curitiba's 'Greenest Decade':**
  - urban 'green zones' are created to protect them from future unsustainable developments
  - the mayor, Jaime Lerner, allocates 1.5 million young trees to deprived neighbourhoods
  - 17 large urban parks are established, some of which deliberately celebrate different ethnic groups within the city's population (photo **B** on page 72).

- **In the 1990s:**
  - botanical gardens are created
  - buses capable of carrying 270 passengers are introduced on the busiest routes; high-speed bus stops called 'tubes' mean that buses have fewer emissions because they are designed to both discharge and embark passengers at the same time
  - the Bus Mass Transit system reduces car journeys by 70 per cent (a huge saving as cars emit twice as much carbon dioxide as buses).
- **Since 2000 – the success story continues:**
  - the city introduces sight-seeing buses for tourists, so they don't have to use taxis or their own cars
  - a new technology park is built with research facilities to develop non-fossil fuels
  - Curitiba now has the highest recycling rate in the world
  - buses in the city carry 50 times more passengers than they did 20 years ago
  - 150 km of urban pathways have been created, for use by walkers, cyclists and roller-boarders
  - a city-wide waste re-cycling programme is introduced
  - all bus routes are colour-coded and provided with the size of bus best suited to the needs of passengers using that particular route (photo **C**).

B *A park in the centre of Curitiba*

C *A three-section bus and 'tube' bus stop*

Fantastic fact

It is cheaper and more 'green' to use sheep instead of machines to cut the grass in Curitiba's parks! Their wool is sold to raise money for local orphanages.

Now Investigate

1. How has the city of Curitiba managed to fulfil each of the four sustainability strategies listed at the top of page 71? Your answer may take the form of a bullet-pointed list.
2. Investigate the environmental problems in a city of your choice (anywhere in the world), and the measures taken to reduce these problems. Three possibilities to consider are Cairo, Mumbai or Rio de Janeiro.

Topic link

You can learn more about sustainable development in Topic 3.7 pages 227–234.