# Geographical inquiry and skills

CHAPTER 1

In Geography we use an inquiry approach to make meaning of the world around us. This involves finding answers to the questions we have about the things we observe in the biophysical, managed and constructed environments.

Our developing geographical knowledge and understanding informs the investigations we undertake in Geography. Geographical knowledge is made up of the facts, generalisations, principles, theories and models developed in Geography.

This knowledge is dynamic and its interpretation can be challenged. Geographical understanding is the ability to see the relationships between elements of knowledge and construct explanations to account for these relationships. It is also the ability to apply this knowledge to new situations or to solve new problems.

When undertaking a geographical inquiry we start with geographical questions and proceed through the collection, evaluation, analysis and interpretation of information to the development of conclusions and proposals for actions. Our inquiries may vary in scale and geographical context. Geographical skills are the techniques we use in these investigations, both in fieldwork and in the classroom.

In this chapter we focus on the analysis of topographic maps, the use of flowline maps and diagrams, population pyramids and photographs. We also examine the steps involved in undertaking a geographical inquiry.



## INQUIRY QUESTIONS

- What information can we gain from an analysis of topographic maps?
- How does the drawing of cross-sections, and the calculation of gradient and local relief, enhance our understanding of relief?
- How do flowline maps and diagrams enhance our understanding of the links between places and elements of processes?
- How can photographs inform our understanding of types of agriculture?
- What do population pyramids tell us about the demographic structure of countries?
- What are the key stages in a geographical inquiry?

## GLOSSARY

| | |
|---|---|
| **cross-section** | a side view, or profile, of a landscape, providing a visual impression of the shape of the land |
| **flow diagram** | an illustration showing the interactions that occur within and between the biophysical, managed and constructed environments |
| **flowline maps** | maps drawn using statistics of actual movements that have occurred, demonstrating the main patterns and linkages |
| **geographical inquiry** | an investigation that starts with geographical questions and proceeds through the collection, evaluation, analysis and interpretation of information to the development of conclusions and proposals for actions |
| **gradient** | the steepness of a slope, road or river |
| **local relief** | the variation in elevation or height over a relatively small, defined area |
| **location** | the place where something is or where something is occurring |
| **population pyramid** | a graphical representation of a population's age and sex structure |
| **relief** | the shape, height and steepness of the land |
| **topographic map** | a detailed, large-scale representation of part of the earth's surface |
| **transect** | a straight line or narrow section through a natural feature or across the earth's surface, along which observations are made or measurements taken |

1.0 Geologists study a graphical display of oil- and gas-bearing rock.

1.1

# Analysing topographic maps

## Topographic maps

A **topographic map** is a detailed, large-scale representation of part of the earth's surface. Topographic maps show selected features of the biophysical, managed and constructed environments: the height, relief and slope of the land; drainage patterns and vegetation; and a range of human features including agricultural landuses, settlements and transport linkages.

## Analysing maps

Interpreting and analysing topographic maps allows you to:

- locate and describe the biophysical environment
- recognise, describe and explain elements of the managed and constructed environments, for example settlement patterns, patterns of transport infrastructure, and the distribution of agricultural and industrial landuses
- identify, describe and explain the relationship between biophysical features and the managed and constructed elements of environments
- determine the distance between places, and the area of features such as lakes, using a linear scale.

## 'Reading' the landscape

**Relief** is a general term describing the shape of the land, including height and steepness. The main techniques used to show relief are spot heights and contour lines and patterns. Layer colouring and landform shading are also used.

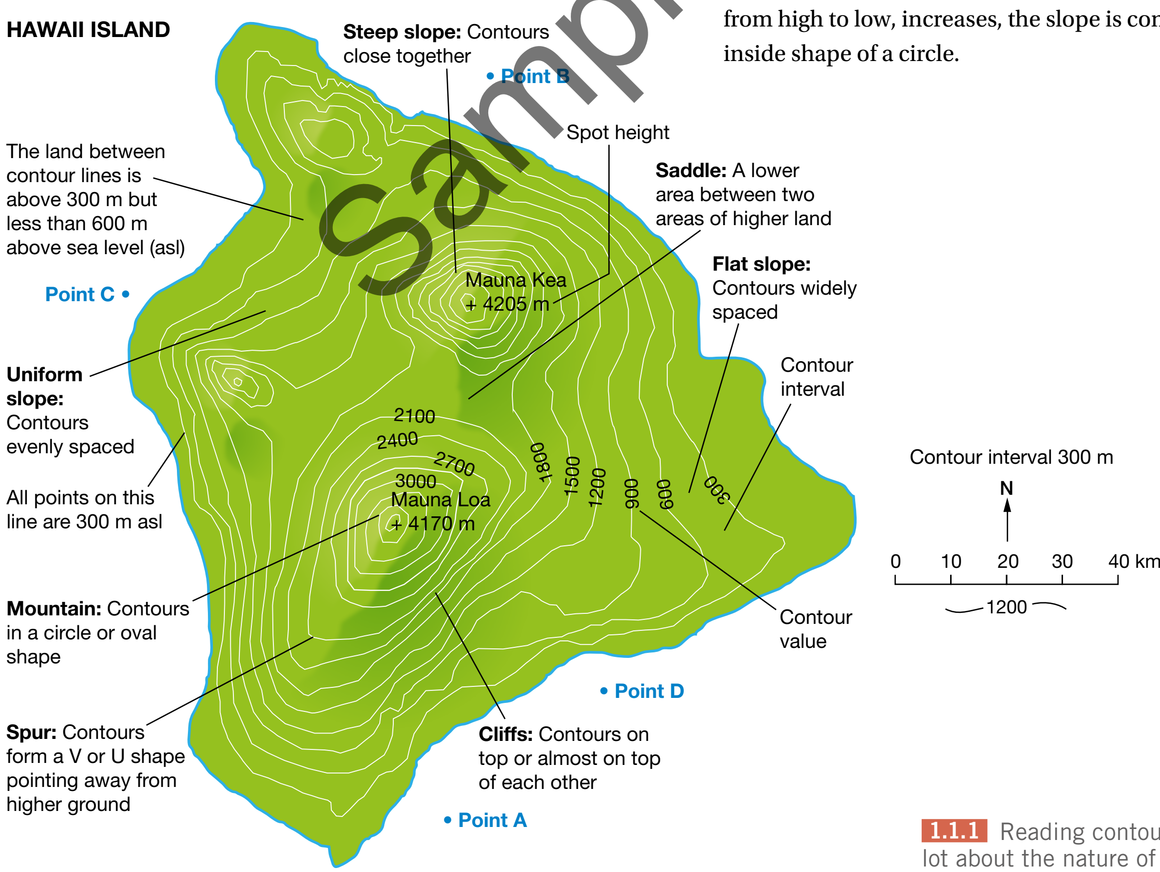
The elevation of a prominent landform feature is often shown using a spot height—a black dot or cross with the height written next to it. Spot heights give the exact height above sea level of the particular **location** or feature.

Contour lines are lines joining points of equal height above sea level. Every point along the line has the same elevation. Contour lines provide geographers with information about the shape and slope of the land and the height of features above sea level. The contour interval, or vertical interval, is the difference in height between two adjacent contour lines. This interval is normally stated in the map's legend or near the edge of the map.

Each type of topographic feature is represented by its own distinctive contour pattern, such as the shield volcano depicted in Figure 1.1.1. Figure 1.1.2 is an example of a topographic map.

When the spacing of contour lines, reading from high to low, decreases, the slope is convex; that is, curved like the outside shape of a circle. When the spacing of contour lines, reading from high to low, increases, the slope is concave; that is, like the inside shape of a circle.






1.1.1 Reading contour lines can tell us a lot about the nature of landforms.

## Cross-sections

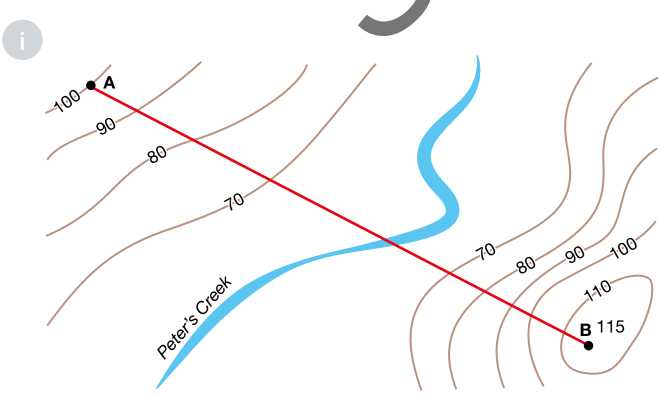
A **cross-section** is a side view, or profile, of a landscape and provides a visual impression of the shape of the land. Information about landuse, settlement, drainage and vegetation can be added to cross-sections. This provides a means of seeing how the shape of the land influences these features.

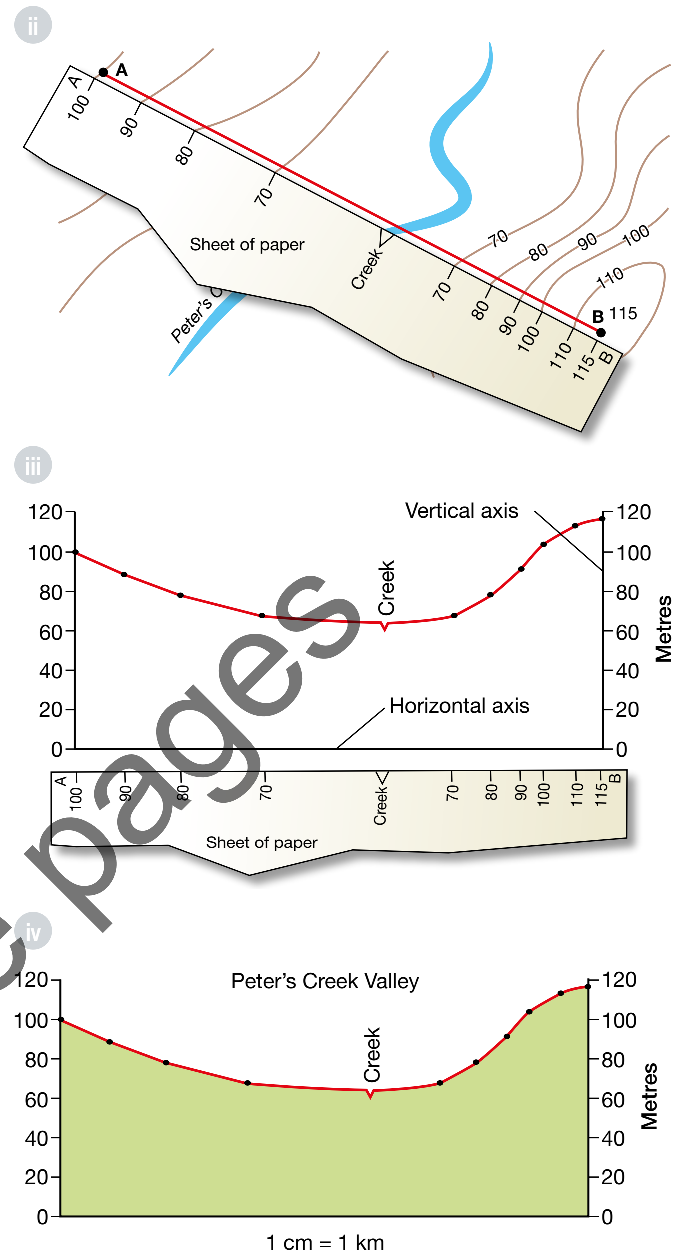
### Drawing a cross-section

To draw a cross-section, follow the steps below and refer to Figure 1.1.3.

1. Locate the two points on the map between which the cross-section is to be made. Label these points ‘A’ and ‘B’ (see drawing i).
2. Place the straight edge of a piece of paper along an imaginary line joining points A and B. Mark points A and B on your paper (see drawing ii).
3. Mark the position where your paper crosses each contour line. Write the value of each contour line on your piece of paper (see drawing ii).
4. On graph or squared paper, draw the horizontal and vertical axes for your cross-section (see drawing iii). The length of the horizontal axis should equal the distance between A and B. The vertical axis should use a scale that does not over-exaggerate your vertical scale.
5. Place your piece of paper along your horizontal axis. Lightly plot, in pencil, the contour points and heights as if you were drawing a line graph (see drawing iii).
6. Join the dots with a fine, single, smooth curved line.
7. Label any features intersected by your cross-section.
8. Finish off your cross-section by:
   a. shading in the area below the landform
   b. labelling the scale on the horizontal and vertical axes
   c. giving it a title.

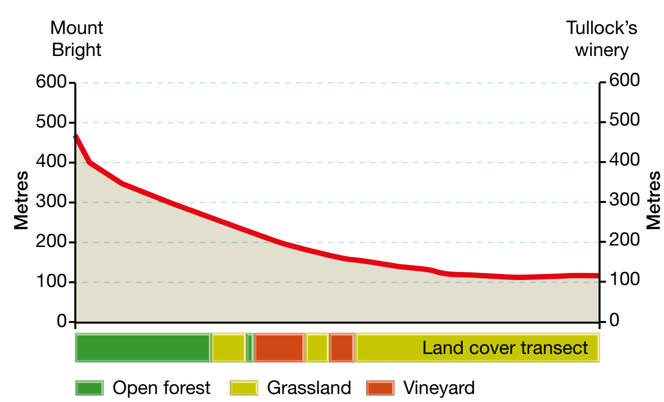





1.1.3 Steps involved in constructing cross-sections

1.1.4 A cross-section from Mount Bright to Tullock’s winery (GR402704) and an associated land cover transect



# Transects

**Transects** are used to demonstrate the relationship between different features of the biophysical, managed and constructed environments along a cross-section or line of latitude (see Figure 1.1.4).

## Drawing a transect

To draw a transect, follow these steps.

1. Identify the two points between which you will use to construct your transect. It may be along a cross-section.
2. Decide on the element of the biophysical, managed or constructed environments you wish to highlight on your transect.
3. Place the edge of a piece of paper along the line of the proposed transect on the topographic map. Mark on the spread of the selected element.
4. Draw in the distribution of the feature along your transect.
5. Label each area or construct a legend that identifies the features numbered or shaded on your transect.
6. Give your transect an appropriate title.

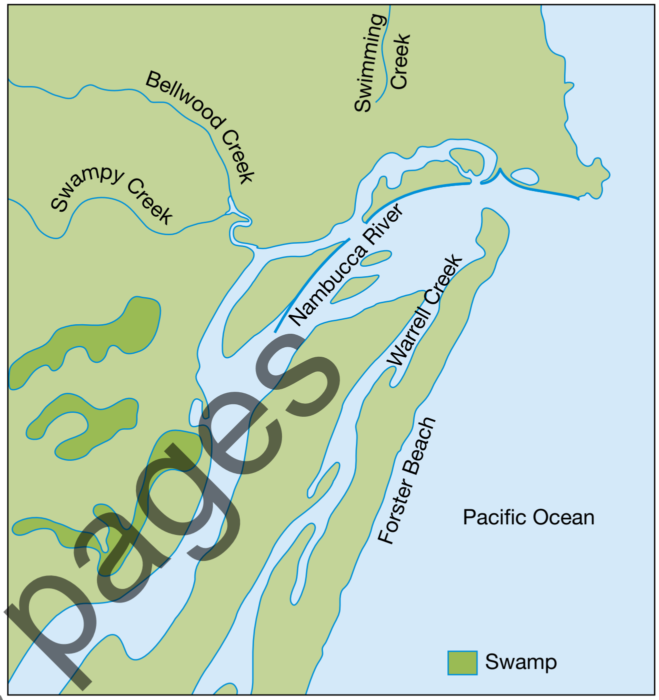
# Précis maps

A précis map (see Figure 1.1.5) shows the main features of a topographic map. By comparing précis maps it is often possible to identify the relationship between two features, for example between landform and settlement patterns. Précis maps are sometimes referred to as single-feature maps.

## Drawing a précis map

To draw a précis map, follow these steps.

1. Identify the feature or pattern to be studied, for example landforms, vegetation, settlement, transport or landuse.
2. Examine the distribution of the features on the map and the pattern created.
3. Draw in the distribution of the feature.
4. Label each area or construct a legend that identifies the features numbered or shaded on the map.




**1.1.5** Sample précis map showing the drainage pattern on the Nambucca Heads topographic map extract (drawn from Figure 1.1.2)



# ACTIVITIES

## Geographical skills

1. Study Figure 1.1.1. Construct the cross-sections A–B and C–D.
2. Study Figure 1.1.2 and do the following tasks.
   - a State the scale.
   - b State the contour interval.
   - c Identify the biophysical features at:
     - GR019093
     - GR981076
     - GR008096
     - GR017096
   - d Identify the managed or constructed features at:
     - GR986077
     - GR987102
     - GR995086
     - GR013096
   - e State the direction of the lookout (AR0109) from Belwood (AR9808).
   - f State the general direction in which Bellwood Creek flows in AR9809.
   - g State the bearing of the lookout (AR0109) from the bridge in AR9807.
   - h State the length of the up-stream breakwater.
   - i State the density of buildings in AR9807.
   - j State the vegetation type found in AR9909.
   - k State the elevation of the lookout in AR0109.
   - l Describe the nature of the riverine environment on the Nambucca Heads topographic map extract.
   - m Describe the nature of the coastal landscape to the north and south of the Nambucca River entrance. Identify the dominant coastal processes responsible for the formation of the landform features.
   - n Identify the main economic activity in the Nambucca River.
   - o Outline the ways in which people have modified the biophysical environment in the area covered by the Nambucca Heads topographic map extract.
   - p Construct a précis map showing the major transport links on the Nambucca Heads topographic map extract.

# 1.2

# Working with topographic maps

## Topographic maps

### Aspect

Aspect refers to the direction in which a slope faces. The aspect of a particular slope can be determined by studying the height and pattern of the contour lines. For example, the slope in AR0782 on the Trial Bay topographic map extract (Figure 1.2.1) has a north-east aspect.

### Gradient

It is possible, using the contour lines and scale on a map, to calculate the average **gradient** (steepness) of a slope, road or river. A gradient is typically expressed as a fraction or ratio. It is calculated by dividing the difference in height (or vertical interval) between the two points by the horizontal distance between them.

Calculating the gradient between two points involves the following steps.

1.2.1 Trial Bay topographic map extract

### STEP 1

Identify the two pieces of information needed to complete the calculation.

1 The difference in height between the two points. This is called the *vertical interval*, or *rise*. Find this by subtracting the lowest point from the highest point.

2 The *horizontal distance* between the two points. This is sometimes referred to as the *run*. Find this by measuring the distance between the two points on the map and then using the scale to work out the actual distance.

### STEP 2

To calculate the gradient of a slope use the following formula.

$$\text{Gradient} = \frac{\text{vertical interval (rise)}}{\text{horizontal distance (run)}}$$

Note: Because the gradient of a slope is expressed as a ratio, the unit of measurement for the rise (numerator) and the run (denominator) must be the same, for example metres.

### EXAMPLE

Calculate the gradient of the slope between the summit of Big Smoky (AR0679) on Figure 1.2.1, the Trial Bay topographic map extract, and the camping ground at GR076085.

$$\text{Gradient} = \frac{\text{vertical interval (rise)}}{\text{horizontal distance (run)}}$$

$$= \frac{291\text{ m}}{1350\text{ m}}$$

Note that this is already expressed as a ratio. To simplify it you need a '1' on the top. To simplify the ratio, divide the denominator by the numerator.

$$= \frac{1}{4.6}$$

= 1 in 4.6 (or 1 in 5 rounded) or 1:4.6

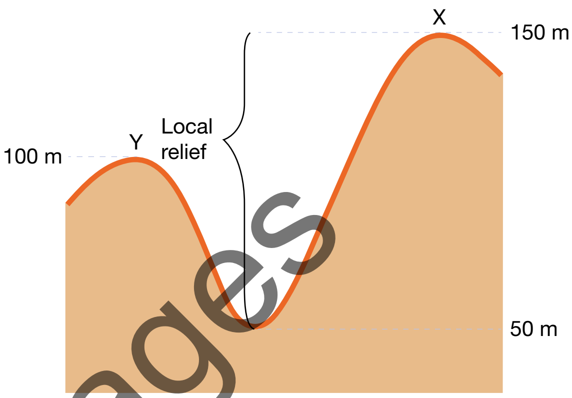
This means that for every 4.6 m travelled in a horizontal direction, you go up 1 m.

## Local relief

**Local relief** is the variation in elevation or height over a relatively small, defined area. It is determined by working out the difference in height between the highest and lowest points in the area.

### EXAMPLE

Calculate the local relief between points X and Y in Figure 1.2.2.




1.2.2 Calculating local relief

150 m (highest point: X) – 50 m (lowest point) = 100 m

Note: Always ensure you include the appropriate unit of measurement with your answer.



## ACTIVITIES

1 Study Figure 1.2.1 and do the following tasks.

a What type of wetland ecosystem lines Saltwater Lagoon?

b Name two vegetation types found in AR0681.

c Into what waterway does Saltwater Lagoon drain?

d Identify the feature of the biophysical environment found at each of the following grid references.

- GR069797
- GR045817
- GR074818
- GR040835
- GR043835
- GR077813

e Identify the feature of the constructed environment found at each of the following grid references.

- GR042831
- GR072828
- GR047818
- GR062824

f What is the direction of South West Rocks (AR0483) from the summit of Big Smoky (AR0679)?

g In what direction is Saltwater Creek flowing in AR0582?

h What is the bearing of the summit of Big Smoky from South West Rocks (AR0483)?

i What is the straight-line distance between the bridge at GR042831 and the bridge at GR053826?

j What is the elevation of Little Smoky (AR0781)?

k What is the difference in elevation between Big Smoky (AR0679) and Little Smoky (AR0781)?

l Using information from the map, account for the existence of wetlands in the area.

m Construct the cross-section from GR060820 to the summit of Little Smoky AR0781.

n Calculate the vertical exaggeration of the cross-sections you have drawn.

o Construct a précis map showing land cover found on the Trial Bay topographic map extract.

1.3

# Flow diagrams

## Using graphics

By its nature, Geography is a visual subject. Keen observers note the spectacular interactions of the natural and human elements of landscape. Graphics tools such as flowline maps and flow diagrams help us to understand the workings of both the natural and the human world. Such graphics capture and highlight the important patterns and links that exist. They are a visual representation of what is happening.

## Flowline maps

**Flowline maps** show movement between places, tracking the passage of goods, information and people. Lines or arrows link the place of origin with the destination, and the quantity that is moved is indicated by their width or thickness, as is illustrated in Figure 1.3.1.

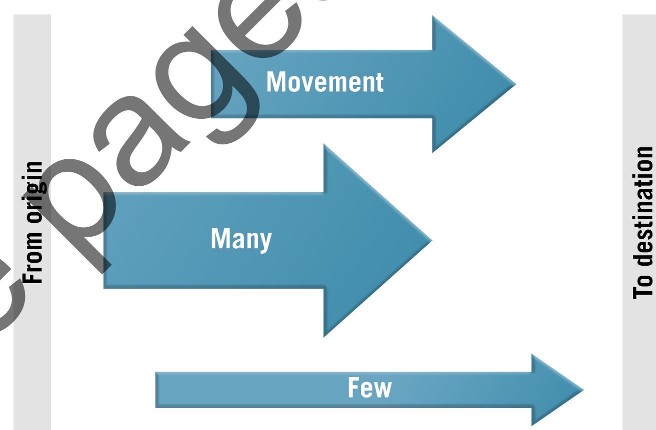
Flowline maps are drawn using statistics of actual movements that have occurred, for the purpose of demonstrating the main patterns. Trade statistics, showing the export of Australia's wheat in 2013–14, are represented in Figure 1.3.2. It is clear that the majority of it goes to feed people in East and South-East Asia.

## Constructing a flowline map

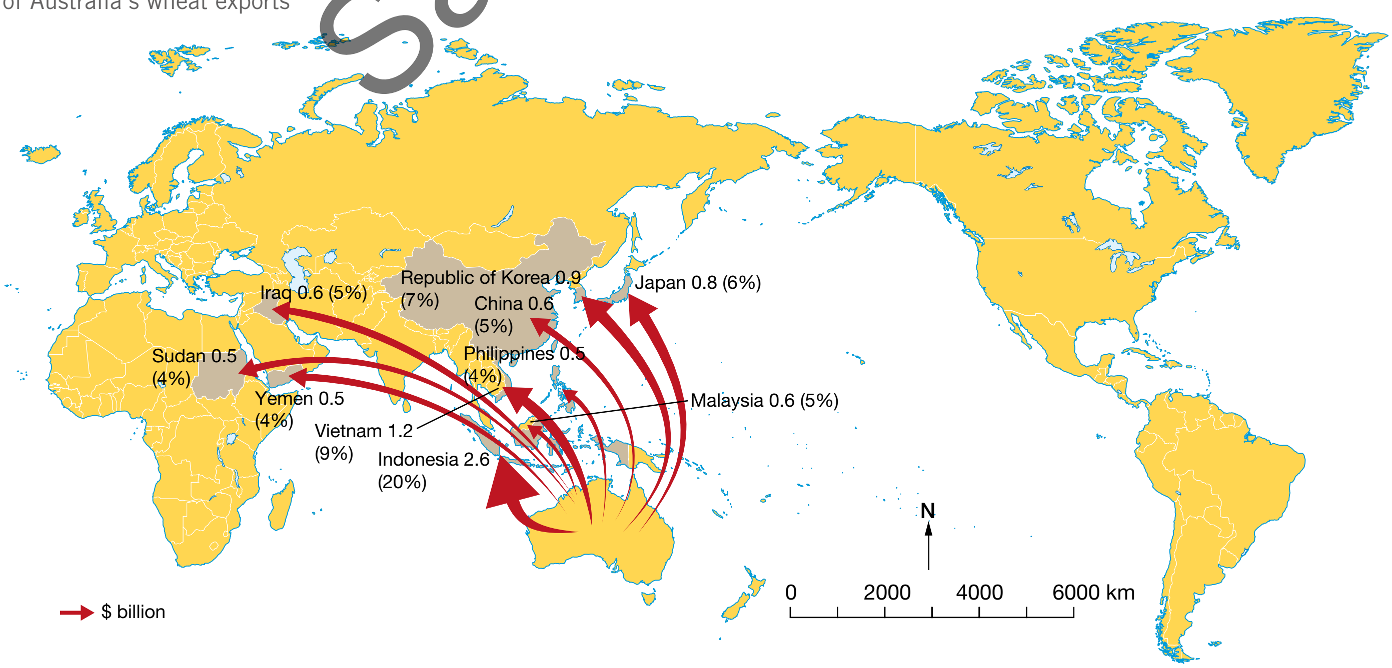
To construct a flowline map, follow these steps.

1 Select your statistics for flow or movement and arrange them from the smallest to the largest.
2 Find a suitable base map.
3 Decide on the various thicknesses of the lines to match the different categories of the sizes of flows that will be shown.
4 Draw in the lines of varying thickness and add an arrowhead to each to show the direction of the flow.
5 Add a key and give the map a title.

1.3.1 Flowline map lines or arrows




1.3.2 A flowline map showing the main destinations of Australia's wheat exports



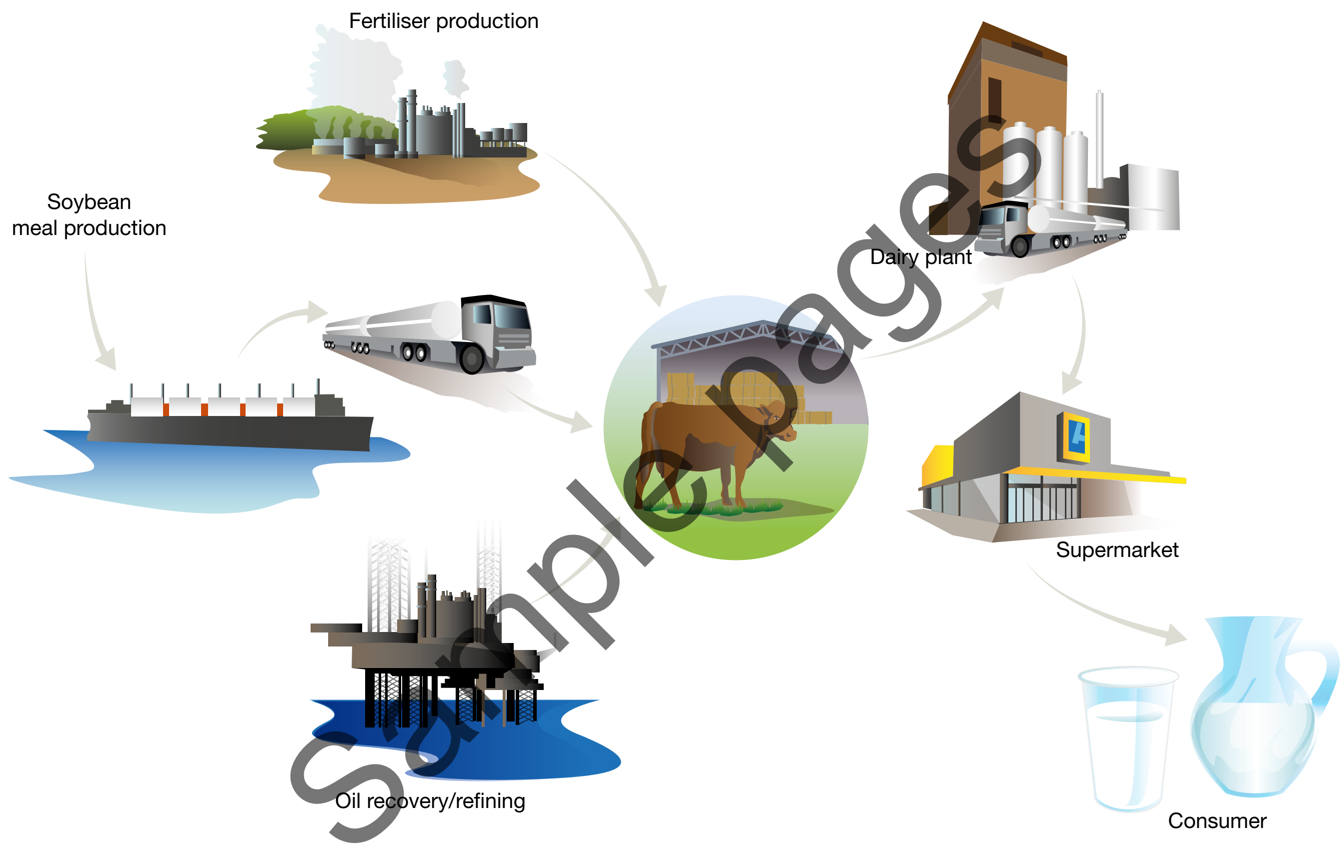
# Flow diagrams

Flow diagrams are used widely in Geography to illustrate how the world functions and in particular the interactions that occur within and between the physical and human environments. While flowline maps show a record of actual movement that has occurred, **flow diagrams** tend to be more generalised. They represent common flows that can occur in many places and they emphasise the processes and links involved. Annotations are often added to the picture to provide build a clearer understanding.

## Simple

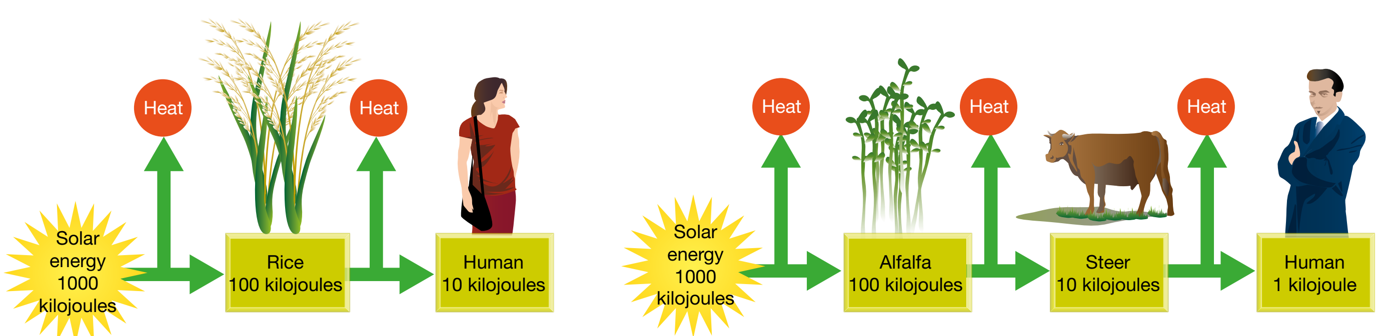
Some flow diagrams are quite simple, showing the clear stages of a process, such as the production of milk depicted in Figure 1.3.3. Others attempt to simplify the complexity of the real world by highlighting a simple progression, such as in Figure 1.3.4.

**1.3.3** A flow diagram showing the production of milk





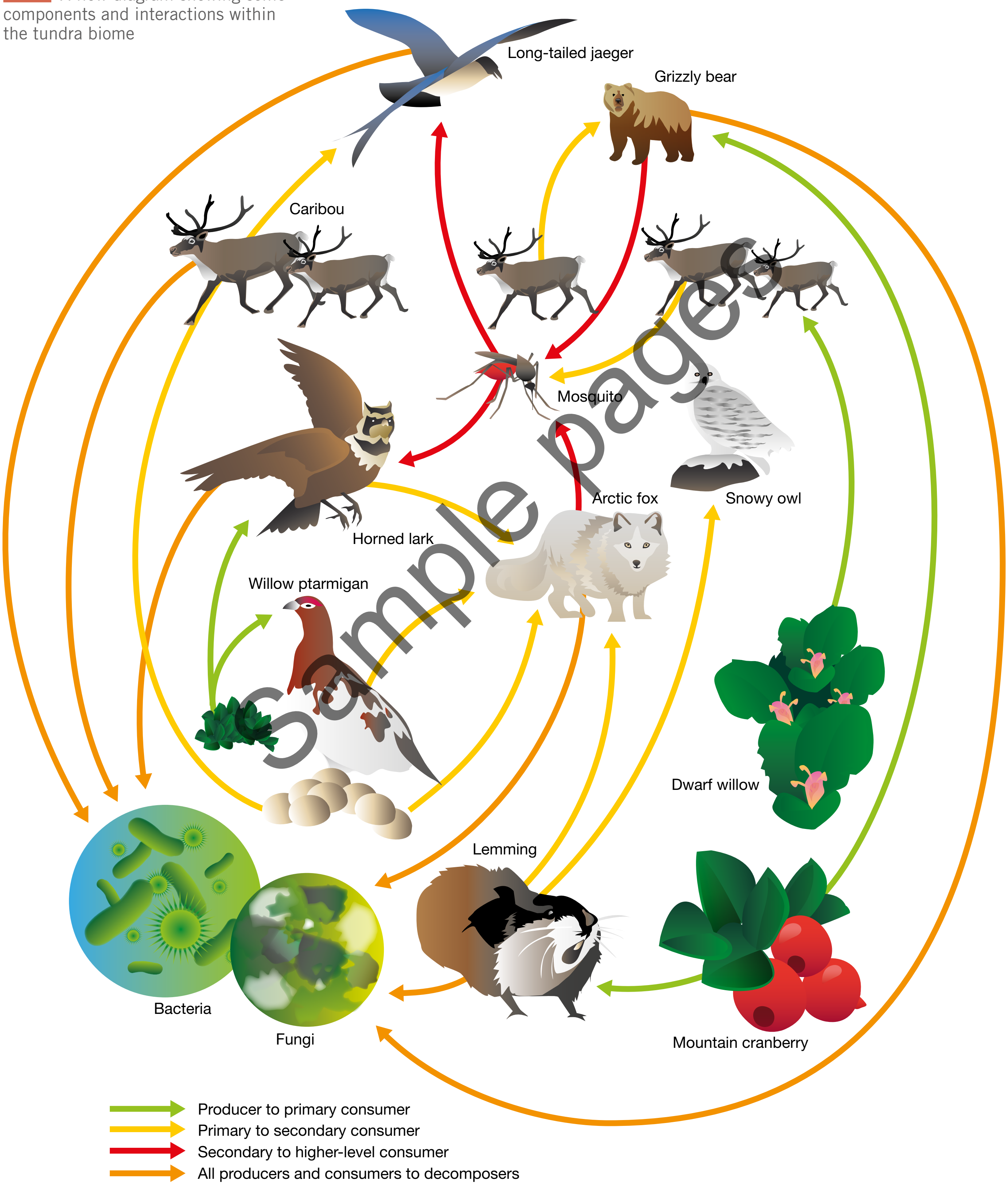

**1.3.4** A flow diagram showing how the energy gained from food decreases when meat is eaten

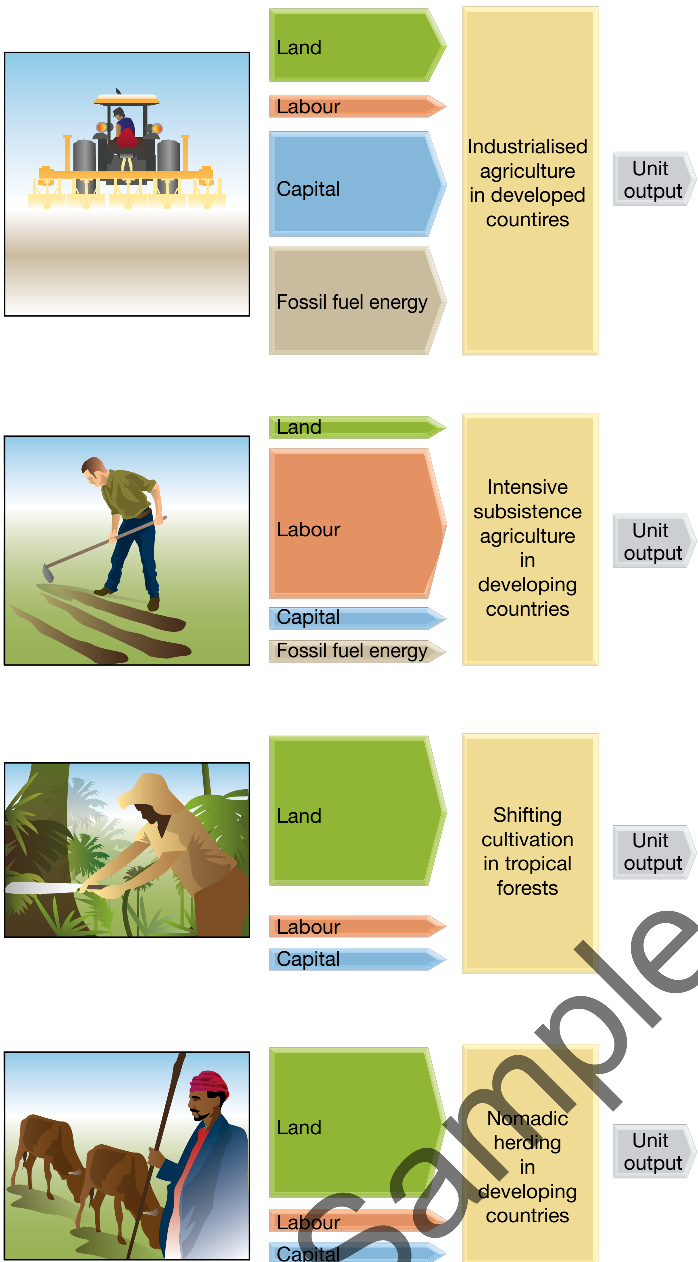


## Complex

When geographers want to reveal just how complex nature is, a flow diagram, such as the one in Figure 1.3.5, does this well. They are also useful in analysing human activities, as illustrated in Figure 1.3.6.

1.3.5 A flow diagram showing some components and interactions within the tundra biome






1.3.6 A flow diagram showing the relative inputs of land, labour, capital and fossil fuel energy into major types of agricultural systems

## DID YOU KNOW?

Since 1950, approximately 88 per cent of the increase in global food production has come from increased yields per hectare of land under cultivation.

# ACTIVITIES

## Knowledge and understanding

1 Give an example of when you would use a flowline map or flowline diagram.

## Geographical skills

2 Refer to Figure 1.3.2 and answer the following questions.
 a What was the value of exports to Vietnam?
 b What was the value of exports to Indonesia?
 c Suggest reasons why these countries import most of Australia's wheat.

3 Using the statistics below, construct a flowline map to show the destinations of Australia's beef exports in 2013–14.

| Beef (fresh, chilled or frozen) | A$ ('000) |
|---|---|
| USA | 2687.5 |
| Japan | 1625.4 |
| China | 935.3 |
| Republic of Korea | 903.0 |
| Middle East | 361.2 |

Source: Department of Foreign Affairs and Trade, 2015

4 Using the following statistics, construct a flowline map to show the destinations of Australia's major agricultural export markets in 2014.

| Primary products | A$ (million) |
|---|---|
| China | 8290 |
| USA | 4320 |
| Japan | 3992 |
| Indonesia | 3329 |
| Republic of Korea | 2602 |

Source: Department of Foreign Affairs and Trade, 2015

5 Conduct a survey of the suburbs/towns/areas that students in your year at school come from. Construct a flowline map to illustrate your results.

6 Study Figure 1.3.3. Construct a flow diagram to show the production of bread.

7 Study Figure 1.3.4. Explain why most of the people in the world survive on a grain diet.

8 Study Figure 1.3.6. Compare the relative inputs of land, labour, capital and fossil fuels to the major types of agricultural systems.

1.4

# Photograph interpretation: Agriculture

## Agriculture

Agriculture is the world's most important industry. It provides humans with essential supplies of food and many other raw materials. Agriculture accounts for more land than any other human activity and has a great impact on the biophysical environment. Soils, water, plants and other natural elements are important factors affecting the operation of a farming system.

## Types of agriculture

Figures 1.4.1 to 1.4.6 provide examples of different types of agriculture. The type of agriculture depends on physical, human and economic factors. Agriculture is often classified as either commercial or traditional, and intensive or extensive.

Commercial agriculture uses energy (mainly fuel oil for machinery), water and chemicals to produce huge amounts of food and other agricultural products, including fibres (such as cotton).

Traditional agriculture consists of two types: subsistence and intensive.

- Traditional subsistence agriculture involves people producing just enough food to meet their family's needs. Subsistence farmers rely on human labour and animal power. Examples are shifting agriculture in tropical forests and nomadic herding.
- Traditional intensive agriculture involves farmers using increased amounts of human and draught (animal) labour, fertiliser and water to increase the amount of food produced. If there is more food produced than can be used by the family, some may be sold at market. The intensive production of rice is an example of this type of agriculture. Traditional subsistence agriculture is practised by almost half the people on earth.

Extensive agriculture involves the farming of a large area with limited use of labour and capital, or with limited labour and high investment of capital and technology.

Intensive agriculture is the farming of a small amount of land by a large labour supply with limited technology and investment (for example rice growing in Bali) or a large amount of capital, labour and technology used in a relatively small area, as in horticulture.

1.4.1 Nomads grazing their livestock in the African Sahel: an example of traditional subsistence agriculture

1.4.2 Rubber plantations are an example of commercial agriculture. Most plantation crops are found in the tropics. Other plantation crops are cacao, copra, coffee, tea, pineapples and bananas.

1.4.3 The cultivation of rice is an example of traditional subsistence agriculture. It involves farmers using human and draught labour, fertiliser and water to maximise the amount of food produced.

1.4.4 Cattle grazing in the United States of America is an example of extensive commercial livestock production.

1.4.5 Grain production is an example of extensive commercial agriculture using high levels of capital investment and technology.

1.4.6 Grape growing is an example of intensive commercial agriculture. High levels of capital investment and technology are used to produce wine.



## ACTIVITIES

### Knowledge and understanding

1. Explain why agriculture is considered to be the world's most important industry.
2. List the elements that are important for farming.
3. Explain what is meant by the term 'commercial agriculture'.
4. Distinguish between traditional subsistence agriculture and traditional intensive agriculture.

### Applying and analysing

5. Create a Venn diagram comparing extensive and intensive agriculture.
6. Classify each of the following types of agriculture:
   - a the growing of rice in terraced paddy fields
   - b the combination of wheat and sheep production in Australia
   - c battery hen production
   - d dairying in Western Europe
   - e shifting agriculture in the Amazon Basin
   - f rubber plantations in Malaysia
   - g viticulture (the growing of grapes for wine production)
   - h cotton growing in north-west New South Wales.
7. Analyse Figures 1.4.1 to 1.4.6 and copy and complete the following table.

| Image | Type of agriculture | Scale of production |
|---|---|---|
| 1.4.1 | | |
| 1.4.2 | | |
| 1.4.3 | | |
| 1.4.4 | | |
| 1.4.5 | | |
| 1.4.6 | | |

1.5

# Population pyramids

## Using population pyramids

A **population pyramid** is a graphical representation of a population's age and sex structure. Geographers study such graphs to determine the age distribution of a population. They also tell us about the potential for future population growth. India and Australia have quite different-shaped population pyramids. Being able to read these pyramids tells us a lot about the demographic characteristics of the two countries.

## Interpreting population pyramids

A population pyramid is a special type of bar graph. The vertical axis of the graph shows the various age groups of the population, while the horizontal axis shows either the actual number or the proportion of the population for both males and females. Because each population pyramid represents 100 per cent of a particular population group, comparisons can be made with the population pyramids of other populations and of the same population over time.

The shape of a population pyramid is also important because it tells us a lot about the particular population. For example:

- if the base of the pyramid is wide, then the population is said to be 'young'
- if the upper part is relatively wide, then the population is said to be 'old' or 'ageing'
- fewer people than expected in a particular age group might indicate events such as war, famine, disease or large-scale emigration
- more people than expected in a particular age group might indicate the impact of a baby boom and/or immigration.

Figure 1.5.1 shows a series of pyramid shapes, with an explanation of conditions under which such population structures develop.

Populations are often divided into broad age groups based on their level of independence. The dependent parts of the population are usually defined as the '14 years and under' age group and the '65 years and over' age group. The changing proportion of the population in each age group provides us with valuable information about future population trends. If the proportion of the population aged 65 years and over is growing, the population is said to be ageing. If the proportion of the population aged 14 years and under is decreasing, the birth rate is declining, as is the rate of population increase.

## Population pyramids: Australia and India

The populations of India and Australia are different; the population structures are also different, as is illustrated in Figures 1.5.2 and 1.5.3. The projected population statistics in Figure 1.5.4 also show continued differences.



1.5.1 Common population pyramid shapes and the conditions under which they develop