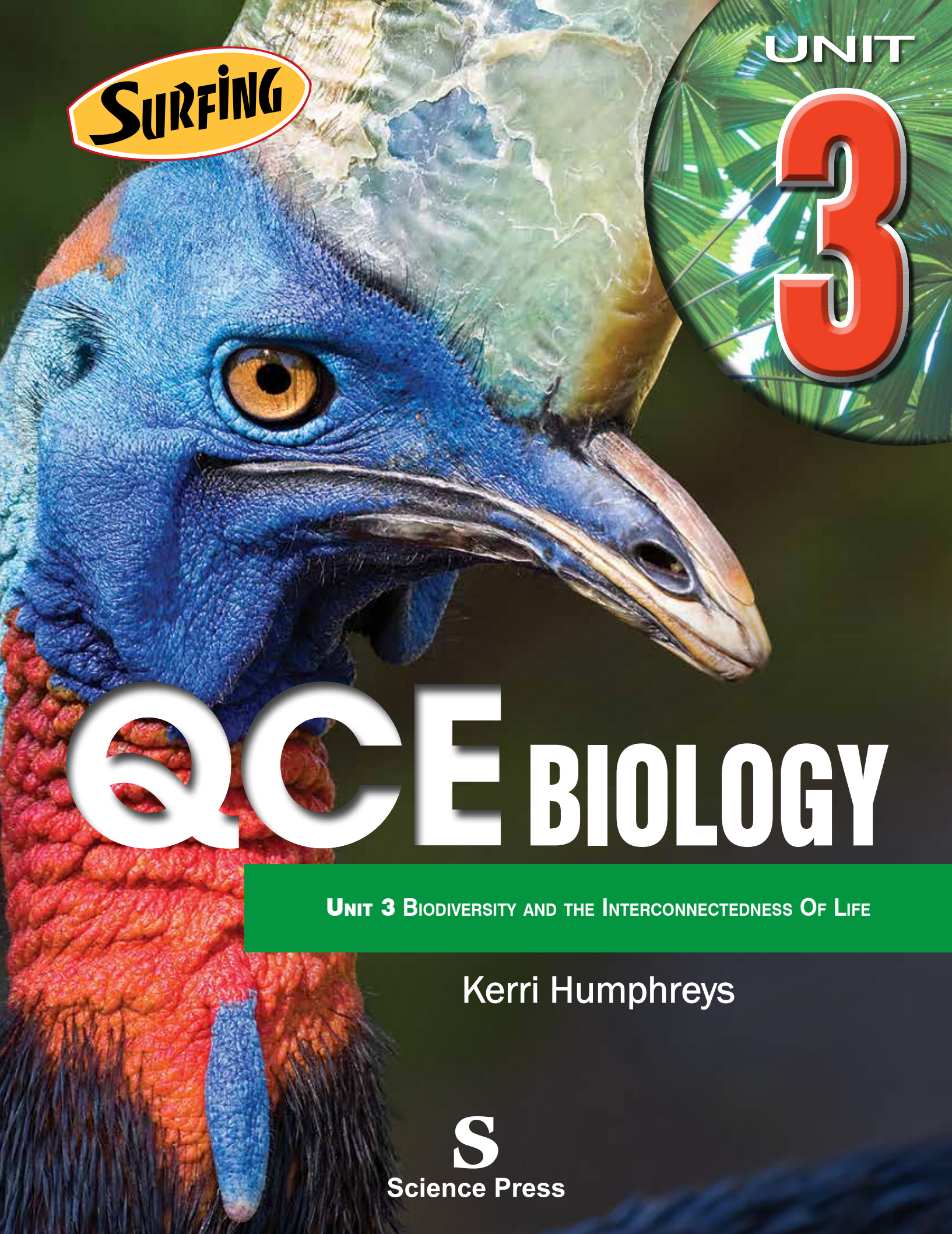
SURFING
UNIT
3
QCE BIOLOGY
UNIT 3 BIODIVERSITY AND THE INTERCONNECTEDNESS OF LIFE
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# Contents

## Topic 6 Ecosystem Dynamics

# Introduction

This book covers the Biology content specified in the Queensland Certificate of Education Biology Syllabus. Sample data has been included for suggested experiments to give you practice to reinforce practical work in class.

Each book in the *Surfing* series contains a summary, with occasional more detailed sections, of all the mandatory parts of the syllabus, along with questions and answers.

All types of questions – multiple choice, short response, structured response and free response – are provided. Questions are written in exam style so that you will become familiar with the concepts of the topic and answering questions in the required way.

Answers to all questions are included.

A topic test at the end of each topic contains an extensive set of summary questions. These cover every aspect of the topic, and are useful for revision and exam practice.

# Words To Watch

**account, account for** State reasons for, report on, give an account of, narrate a series of events or transactions.

**analyse** Interpret data to reach conclusions.

**annotate** Add brief notes to a diagram or graph.

**apply** Put to use in a particular situation.

**assess** Make a judgement about the value of something.

**calculate** Find a numerical answer.

**clarify** Make clear or plain.

**classify** Arrange into classes, groups or categories.

**comment** Give a judgement based on a given statement or result of a calculation.

**compare** Estimate, measure or note how things are similar or different.

**construct** Represent or develop in graphical form.

**contrast** Show how things are different or opposite.

**create** Originate or bring into existence.

**deduce** Reach a conclusion from given information.

**define** Give the precise meaning of a word, phrase or physical quantity.

**demonstrate** Show by example.

**derive** Manipulate a mathematical relationship(s) to give a new equation or relationship.

**describe** Give a detailed account.

**design** Produce a plan, simulation or model.

**determine** Find the only possible answer.

**discuss** Talk or write about a topic, taking into account different issues or ideas.

**distinguish** Give differences between two or more different items.

**draw** Represent by means of pencil lines.

**estimate** Find an approximate value for an unknown quantity.

**evaluate** Assess the implications and limitations.

**examine** Inquire into.

**explain** Make something clear or easy to understand.

**extract** Choose relevant and/or appropriate details.

**extrapolate** Infer from what is known.

**hypothesise** Suggest an explanation for a group of facts or phenomena.

**identify** Recognise and name.

**interpret** Draw meaning from.

**investigate** Plan, inquire into and draw conclusions about.

**justify** Support an argument or conclusion.

**label** Add labels to a diagram.

**list** Give a sequence of names or other brief answers.

**measure** Find a value for a quantity.

**outline** Give a brief account or summary.

**plan** Use strategies to develop a series of steps or processes.

**predict** Give an expected result.

**propose** Put forward a plan or suggestion for consideration or action.

**recall** Present remembered ideas, facts or experiences.

**relate** Tell or report about happenings, events or circumstances.

**represent** Use words, images or symbols to convey meaning.

**select** Choose in preference to another or others.

**sequence** Arrange in order.

**show** Give the steps in a calculation or derivation.

**sketch** Make a quick, rough drawing of something.

**solve** Work out the answer to a problem.

**state** Give a specific name, value or other brief answer.

**suggest** Put forward an idea for consideration.

**summarise** Give a brief statement of the main points.

**synthesise** Combine various elements to make a whole.

SURFING

# QCE BIOLOGY

UNIT 3

## UNIT 3

### Biodiversity and the Interconnectedness Of Life

In this unit you will:

- Explore the ways biology is used to describe and explain the biodiversity within ecosystems, a range of biotic and abiotic components, species interactions, adaptations of organisms to their environment and principles of population dynamics.
- Understand how classification systems are used to identify organisms and aid scientific communication.
- Appreciate the structure of ecosystems, the processes involved in the movement of energy and matter in ecosystems and how environmental factors limit populations.
- Measure abiotic factors, population numbers and species diversity.
- Interpret interactions between species making spatial and temporal comparisons between ecosystems.
- Carry out field work to understand the interconnectedness of organisms, the physical environment and the impact of human activity.
- Apply scientific knowledge and understanding to offer valid explanations and reliable predictions.
- Analyse data and develop ecological models to describe and explain the diversity and interconnectedness of life on Earth.

SURFING

# QCE BIOLOGY

UNIT 3

## TOPIC 5

## DESCRIBING BIODIVERSITY

In this topic you will:

- Describe and explain biodiversity.
- Investigate how species diversity is determined for a group of organisms based on a given index.
- Describe different classification systems.
- Investigate the use of stratified sampling to collect and analyse primary biotic and abiotic data in classifying ecosystems.
- Interpret cladograms and infer evolutionary relationships.
- Recognise there are multiple definitions of species with each having limitations.
- Classify ecosystems.

# 1 Assumed Knowledge Topic 5

## QUESTIONS

1. Distinguish between biotic and abiotic factors.
2. What is meant by the 'physical conditions' of the environment?
3. Many species compete for resources. What is meant by 'resources'?
4. The diagram shows the photic zone in a body of water.

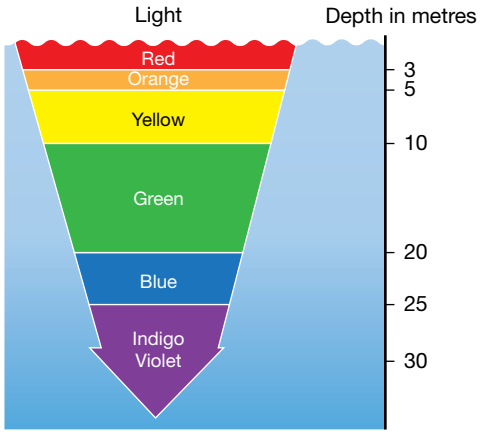



**Figure 1.1** Photic zone in water.

   (a) What is meant by the photic zone?
   (b) Outline the importance of the photic zone.
5. Discuss how abiotic factors can lead to desertification.
6. Define an adaptation.
7. Use an example to show how a named adaptation assists in a specific environment,
8. What is meant by the habitat of an organism?
9. The diagram shows the red kangaroo, *Macropus rufus*.

**Figure 1.2** Red kangaroo, *Macropus rufus*.

   (a) How does the binomial system help identify this kangaroo?
   (b) Describe one adaptation of the red kangaroo to its environment.
10. What is meant by topographic factors?
11. What conditions occur in Australia with El Nino?
12. Define speciation.
13. What is biodiversity?
14. Define an ecosystem.
15. Define symbiosis.
16. Distinguish between abundance and distribution of a population.
17. The diagram shows a cane toad. Outline why there is concern in Queensland and the Northern Territory about the spread of cane toads across the land.

**Figure 1.3** Cane toad.

18. Define producer, consumer and decomposer.
19. Define an ecological community.
20. What is stratified sampling?
21. Distinguish between qualitative data and quantitative data.
22. Distinguish between primary data and secondary data.
23. Figure 1.4 shows how habitats vary from the pole to the equator as well as from sea level to the top of tall mountains.

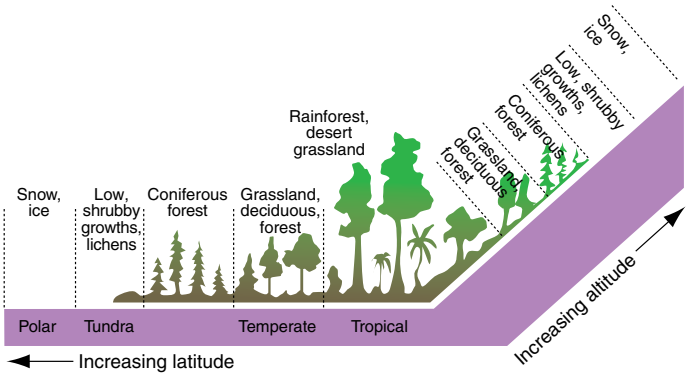



**Figure 1.4** Changes in habitat with altitude and latitude.

   (a) Use this diagram to list the changes in habitat from the pole to the equator.
   (b) Compare the change in habitat as you move from the equator to the poles with the change in habitat as you move from sea level to the top of a high mountain.
24. What is meant by binomial nomenclature?
25. The diagram shows two types of ecosystems.

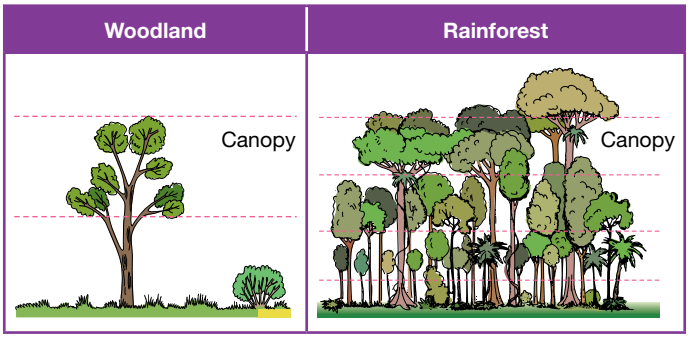



**Figure 1.5** Two types of ecosystems.

Use the diagrams to suggest factors that are used to classify ecosystems.

## 2 The Biosphere

The **biosphere** is the total of all areas where living things are found, i.e. the sum of all ecosystems. The biosphere extends from the equator to the polar caps. Since the discovery of microbes deep in the Earth's crust, in the upper layers of the atmosphere and deep in oceanic trenches, it is hard to estimate the thickness of the Earth's biosphere.

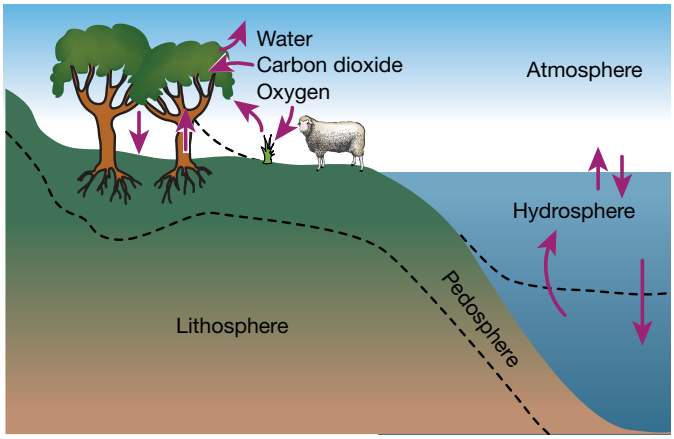



**Figure 2.1** Interaction of biosphere, lithosphere, hydrosphere and atmosphere at pedosphere.

Processes and interactions occur between the biosphere, hydrosphere lithosphere and atmosphere. Living things interact with the non-living things in their environment – they use air, water, soils and sediments in their daily struggle for survival. The **lithosphere** is the outer, rigid solid shell of rock on Earth consisting of the crust and part of the upper mantle. The **hydrosphere** is the combined mass of water found on, under and over the surface of the Earth. It includes the water in oceans, rivers and lakes and the water in the air.

The **atmosphere** is the body of air surrounding the planet. The **pedosphere** is the outermost layer of the Earth where the lithosphere, hydrosphere, atmosphere and biosphere interact to form soil. It is the sum total of all organisms, rock, air and water interacting in a dynamic way to form soil.

The **biosphere** has three important functions:

- It converts energy from either the Sun or chemical sources to organic material.
- It harvests essential elements and minerals from the atmosphere, hydrosphere and lithosphere to maintain life.
- It responds to changes by altering food webs when geological, cosmic or dynamic Earth movements occur.

A **biome** is a large geographical area that has a specific climate and sustains distinctive communities of plants and animals and can be any of the world's major ecosystems, e.g. tundra, desert, grassland, desert and tropical rainforest.

### QUESTIONS

1. Define biosphere.
2. What is the difference between the lithosphere, the hydrosphere and the atmosphere?
3. Define pedosphere.
4. Outline the three important functions of the biosphere.
5. Define biome.
6. Name three biomes found in Australia.
7. Which biomes would you expect to have the following conditions?
   (a) Dry and cold.
   (b) Wet and hot.
   (c) Dry and hot.
   (d) Fairly dry and warm.

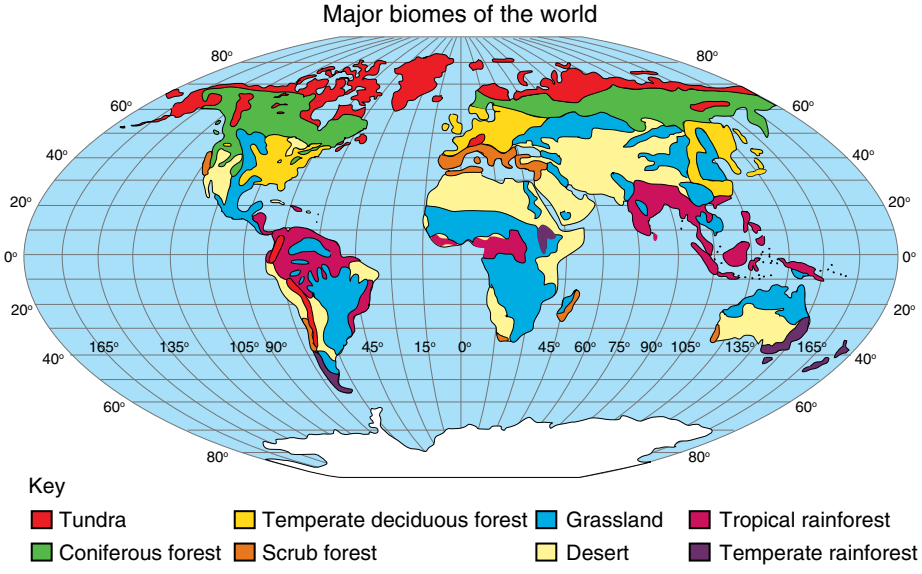



**Figure 2.2** Major biomes of the world.

# 3 Biodiversity

**Biodiversity** refers to the amount of variation in a group. In biological terms biodiversity can be divided into three levels – ecosystem diversity, species diversity and genetic diversity. The interrelatedness of all life forms and their interaction with the physical environment means that conservation of all types of biodiversity is needed for a sustainable future for life on Earth.

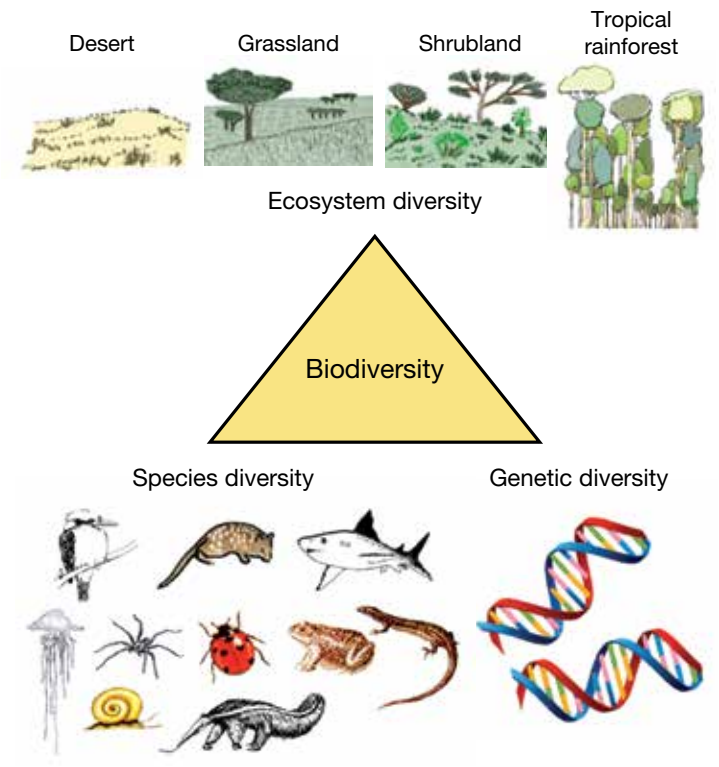



**Figure 3.1** Three types of biodiversity.

## Australia's biodiversity conservation strategy

Under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) the Australian government is responsible for biodiversity conservation.

In 2010 Australia's Biodiversity Conservation Strategy 2010-2030 (the Strategy) was released by the Australian government. The aim of this strategy was to engage all Australians in conservation, protect biodiversity and build ecosystem resilience. Required reports with information from biodiversity monitoring show the state of biodiversity for each level. A revised strategy, called Australia's Strategy for Nature 2018-2030: Australia's biodiversity conservation strategy and action inventory, was formulated after a review on the operation of the Strategy since implementation in 2010.

Details on these strategies can be found on the Australian government website.

**Conservation management zones** have been established to help understand the dynamics in natural environments so that suitable support procedures can be devised and implemented for each area. A large number of the zones are in Queensland, e.g. Northern Australian Tropical Savanna, North Eastern Australia Tropical Rainforests, Mitchell Grasslands, Eastern Australia Tropical Forests and Woodlands, Arid Shrublands and Desert, Eastern Australia's Mulga Shrublands, Brigalow Woodlands, Eastern Australia's Woodlands and Eastern Australia Temperate and Subtropical Forests. For example, The Border Ranges North and South (Queensland and New South Wales) are considered to be the most biologically diverse area in southern Queensland and New South Wales. The area has wide ecosystem diversity with pockets of rainforest, sclerophyll forests, woodlands, scrubland and rocky outcrops. Endangered species in the area include Coxen's fig parrot, long nosed potoroo, spotted tailed quoll, Hastings River mouse and Fleay's frog.

## Australia's megadiversity under threat

Due to its long period of isolation Australia has a wide range of unique species that are not found elsewhere in the world of both plants and animals. However, since European contact and settlement with the introduction of many invasive species many native species have become extinct or are on the endangered list.

The Australian government has identified 15 **National Biodiversity Hot Spots** including in Queensland Einasleigh and Desert Uplands, Brigalow North and South (Queensland and New South Wales) and the Border Ranges North and South of the Queensland, New South Wales border.

## QUESTIONS

1. Define biodiversity.
2. Identify the three types of biodiversity.
3. Why is there a need for biodiversity conservation?
4. What legislation is involved in biodiversity and biodiversity conservation?
5. (a) What is the Strategy?
   (b) What was the aim of this Strategy?
   (c) What action has followed the implementation of this Strategy?
6. List eight conservation management zones in Queensland.
7. Identify National Biodiversity Hot Spots in Queensland.
8. In the Einasleigh and Desert Upland region there are important wetlands, e.g. Lake Buchanan and Lake Galilee and the Australian government lists 22 rare or threatened animals in the Desert Uplands, e.g. masked owl and Julia Creek dunnart. Explain why there needs to be a comprehensive range of assessment and monitoring methods for collecting information of this region.

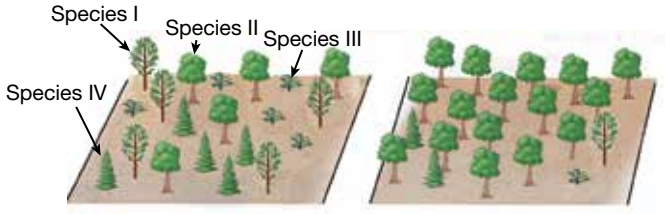
# 4 Biodiversity – Species Diversity

**Species diversity** refers to the variety of species in an area. It can be measured by counting the number of different species (**species richness**) in the area. High species richness is found in warm areas with high rainfall, e.g. the rainforests of the Atherton Tablelands, behind Cairns, Queensland is an area species rich in mammals. In marine ecosystems coral reefs and continental shelves have high species diversity, though deep sea communities near hydrothermal vents are also important. Land ecosystems such as small islands and high mountain tops have low species diversity with diversity decreasing with increasing altitude.

Species diversity can be related to the **number of possible ecological niches** available in the area. A complex community provides the possibility of more niches than a simple community. Organisms that migrate into a complex community can fill these potential niches making the complex community even more complex.

Species diversity can also be inversely compared to the **geographical isolation of a habitat** – the more isolated the community, the lower its species diversity. Island communities or high altitude communities can easily lose species due to random events and recolonisation is slow as many species cannot reach these isolated areas.

The relative abundance of each species in an area (**species evenness**) is also often used as a diversity index and in many instances both species richness and species evenness are taken into account when assessing the biodiversity of an area.




| Community A | | Community B | |
|---|---|---|---|
| Species I | 25% | Species I | 5% |
| Species II | 25% | Species II | 80% |
| Species III | 25% | Species III | 5% |
| Species IV | 25% | Species IV | 10% |

**Figure 4.1** Comparing species diversity in two communities.

Figure 4.1 shows two communities with four types of trees – species I, species II, species III and species IV. Although both communities have the same number and type of trees present, community A is considered to have greater species diversity as species diversity includes not only the number of different species in an area but also the relative abundance of each species.

Calculating species diversity provides information about structure of a community and indicates if conservation measures are needed.

Australia is a **megadiverse** country. Megadiversity is measured on the total number of species in a country and the number of endemic species. Australia is the fifth highest megadiverse country for the number of endemic vascular plants and is the most megadiverse country for non-fish vertebrate species. Isolation from other landmasses and adaptive radiation provided ideal conditions on Australia for speciation. Droughts, fires, floods and climatic cycles caused by El Nino Southern Oscillation (ENSO) put distinct selective pressures on different regions favouring plants and animals we now consider uniquely Australian. The large range of reptiles is significant in increasing species richness in Australia.

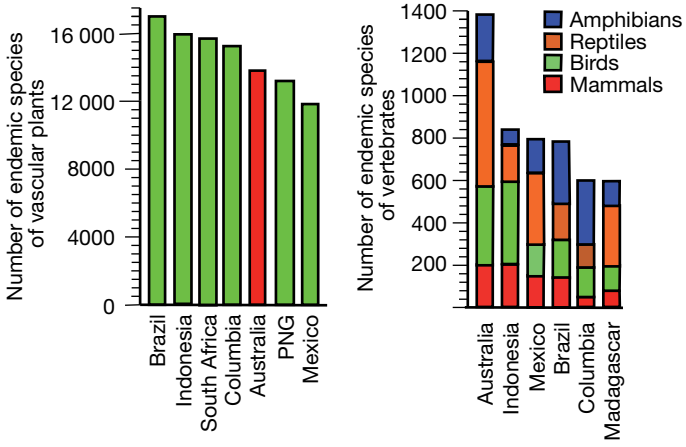



**Figure 4.2** Australia is a megadiverse country.

The Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (the EPBC Act) provides a legal structure to protect and manage plants, animals, ecological communities and heritage places. The Act aims to conserve Australian biodiversity. It regulates wildlife trade and lists threatened species as – extinct, extinct in the wild, critically endangered, endangered, vulnerable or conservation dependent. Areas with the highest number of threatened species of flora and fauna are the Murray-Darling Basin, the developed coastal areas of eastern and southern Australia, parts of Tasmania and south-west Western Australia.

## QUESTIONS

1. Define species diversity.
2. What is species richness?
3. Identify an area in Australia that has high species diversity.
4. How is species diversity related to the number of potential ecological niches in an area?

5. How can species diversity be related to geographical isolation?
6. What is species evenness?
7. How is species diversity determined for an area?
8. Why is species diversity calculated?
9. Why is Australia considered to be a megadiverse country?
10. Describe the historical reasons why Australia is megadiverse.
11. What is the EPBC Act?
12. Identify some areas in Australia that have high levels of threatened species.
13. Ecologists have noticed that species diversity is usually higher at the edges of a distinct community rather than in the centre of the community. This is called the *edge effect*. Suggest why border areas between two communities should have high species diversity.
14. From Figure 4.2 which group of Australian endemic vertebrates has the highest number of species?
15. The release of pollutants into the environment can affect species diversity in both the short term and long term. Explain how an oil spill such as the 2010 Deepwater Horizon explosion in the Gulf of Mexico can affect species diversity in the short term and the long term.
16. The *Australia State of the Environment Report 2001* provides the following global comparison of the number of freshwater fish species.

| Continent | Number of freshwater fish species |
|---|---|
| South America | 2200 |
| Africa | 1800 |
| Asia | 1500 |
| North America | 950 |
| Central America | 354 |
| Europe | 250 |
| Australia | 170 |
| New Zealand | 27 |

(a) Graph this data.
(b) The common carp, *Cyprinus carpio*, is a freshwater fish native to Asia. It has been introduced into Australia and is an invasive species. Carp are highly adaptable and can live in many habitats, e.g. still or flowing water, fresh or brackish water. The carp is considered to be a significant pest and is believed to have affected many Australian river systems, e.g. Murray-Darling River system. Suggest why carp is now the most widely distributed fish in the world and is affecting species diversity in Australia.

17. Some biology students wished to work out species diversity in the school garden. Two groups studied rose bushes that had aphids feeding on them.

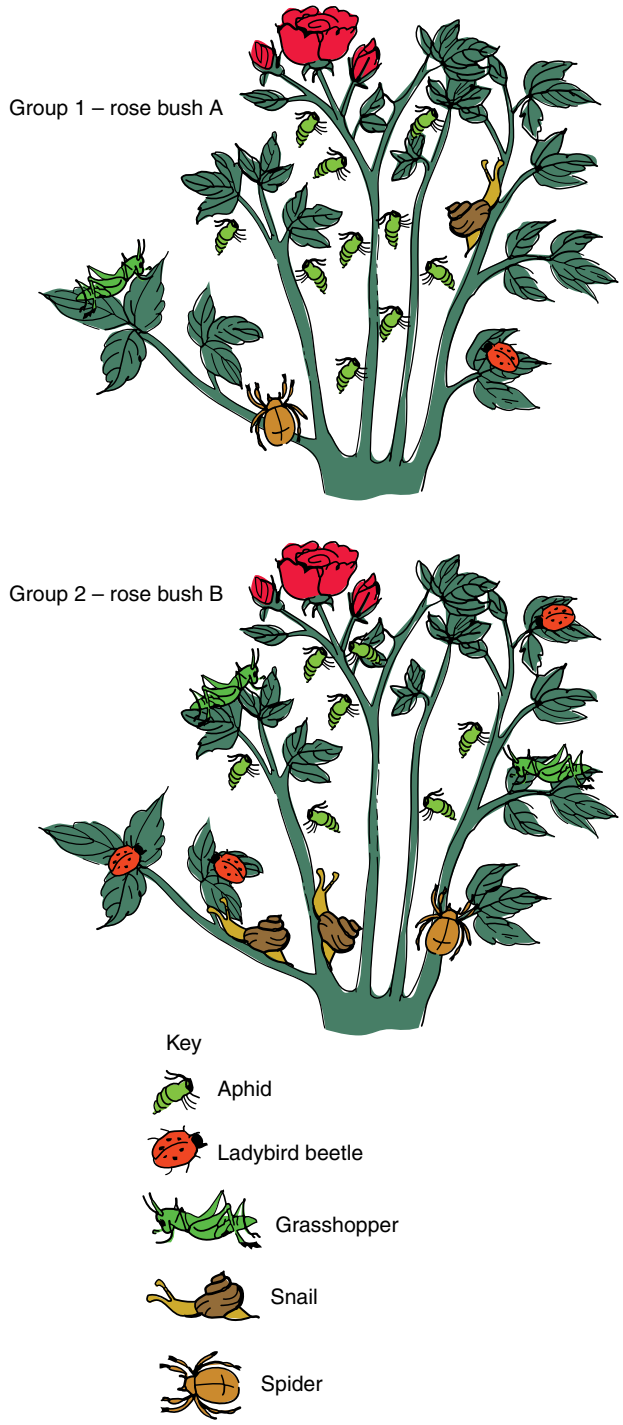



**Figure 4.3** Student results from a field study.

(a) Tally the number of organisms on each rose bush.
(b) Which rose bush had the greater species diversity? Explain your reasoning.

# 5 Insect Diversity

Insects are the largest and one of the most diverse groups of organisms. There are more than 100 000 species of Australian insects and globally there are more families of insects than species of mammals. Insect classification mainly relies on structural features. The majority of insects are herbivorous and they consume more plants than any other group on Earth.

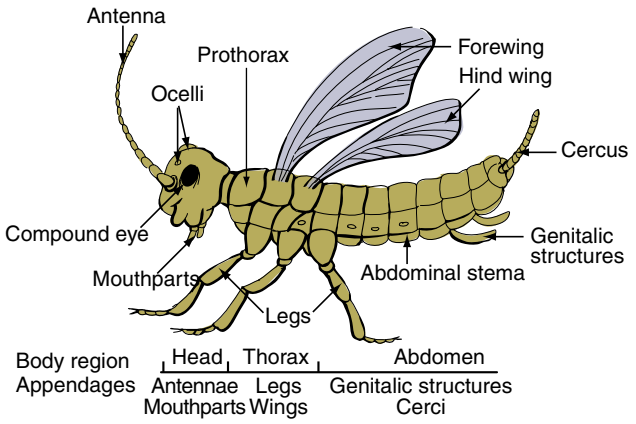



**Figure 5.1** Body parts of a typical insect.

## Insect body structure

The insect body is divided into three regions – the head, thorax and abdomen. The **head** region is specialised for feeding, e.g. specialised mouthparts and the senses, e.g. compound eyes, up to three pairs of simple eyes (ocelli) and a single pair of antennae. The **thorax** is specialised for locomotion, e.g. three pairs of walking legs and there may be no wings, one pair of wings or two pairs of wings. The insects are the only invertebrate with wings. The **abdomen** is specialised for reproduction.

Many insects undergo metamorphosis during development. Some undergo **incomplete metamorphosis** where the young **nymphs** are smaller versions of the adult often with different body proportions and no wings, e.g. grasshoppers. Some undergo **complete metamorphosis** with specialised **larval stages** for eating and growing that develops into a **pupa** from which the **adult** emerges. The adult is specialised for reproduction and dispersal.

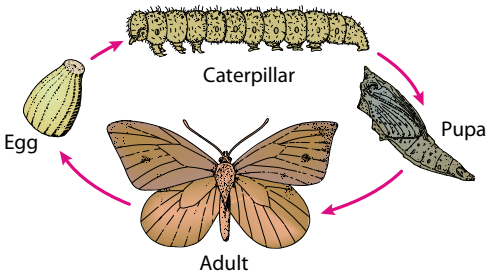



**Figure 5.2** Insect metamorphosis.

## Insect classification

The class Insecta is divided into different orders, e.g. using the presence of wings, the number of wings and the appearance of the wings. Figure 5.3 gives the general body shape for some of the insect orders. The orders are divided into families.

The beetles, order Coleoptera is the most species rich order of insects. Beetles have mouthparts adapted for biting and chewing and have two pairs of wings, one being thick and leathery and the other membranous. They undergo complete metamorphosis.

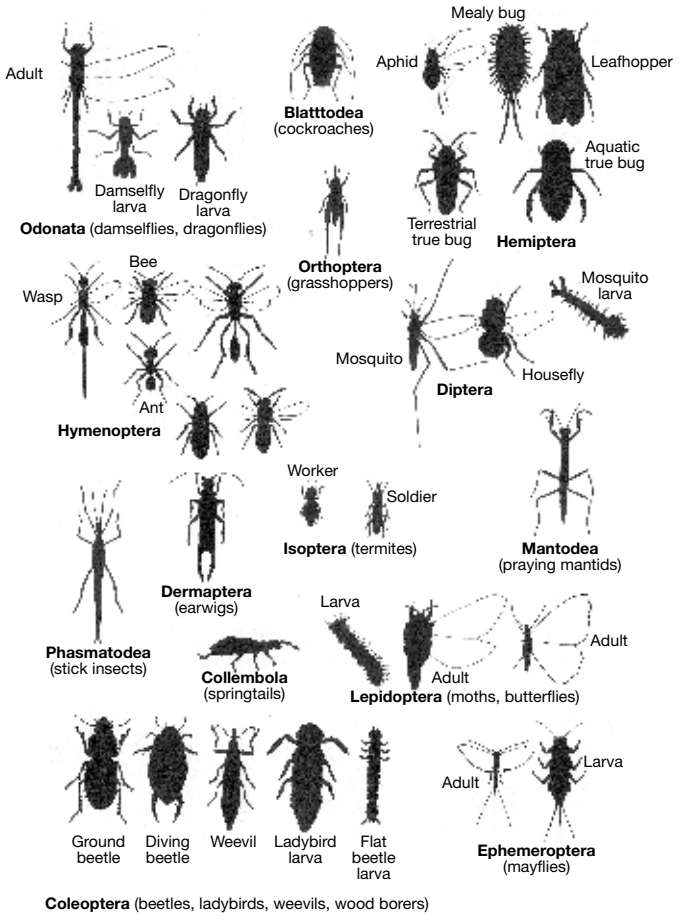



**Figure 5.3** Different insect orders.

## Success in diversification

The exact number of species of insects is still being determined as researchers study and classify the organisms in different ecosystems. About 97% of insects are terrestrial and the rest associated with fresh water.

Several features of insects increase their ability to survive, colonise new areas, adapt to changing conditions and remain a survival success – small size, fast reproduction rates, flight, body plan, metamorphosis, and social behaviour.

# Topic 6 Test

## Section A – Multiple Choice (20 marks)

1. Phytoplankton are microscopic photosynthetic organisms found in aquatic environments. Why are they found in the top few metres of water?
   (A) Light does not penetrate far into water.
   (B) They drift with ocean currents.
   (C) They feed on zooplankton which are found in that layer.
   (D) The top layer is the warmest layer.
2. The diagram shows part of a food web in an ecosystem.

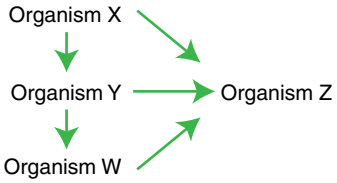



**Figure TT6.1** Food web.

What could you deduce from this food web?
   (A) Organisms X, Y, W and Z must all be producers.
   (B) Organism Y is the most adapted to its environment.
   (C) Organism X provides chemical energy to the other organisms.
   (D) The biomass of organism Z is greater than biomass of any of the other organisms.
3. Which of the following would cause the most damage to the ecosystem?
   (A) Using river water for human consumption.
   (B) Building a house on an open area of grassland.
   (C) Introducing a foreign plant species into a surburban garden.
   (D) Introducing a foreign species with no known predator into the bush.
4. The following food chain shows the relationship between four organisms.
   Grass → grasshopper → wolf spider → magpie
   If the grass has 100 units of energy, how much of this energy reaches the magpie?
   (A) 50% (B) 10% (C) 1% (D) 0.1%
5. Poisons, such as DDT and dieldrin, accumulate in the body tissues. Which of the following organisms is most likely to concentrate the highest levels of poisons in their body tissues?
   (A) Producers.
   (B) Herbivores.
   (C) Carnivores.
   (D) Decomposers.
6. The diagram shows a process that occurs in nature.

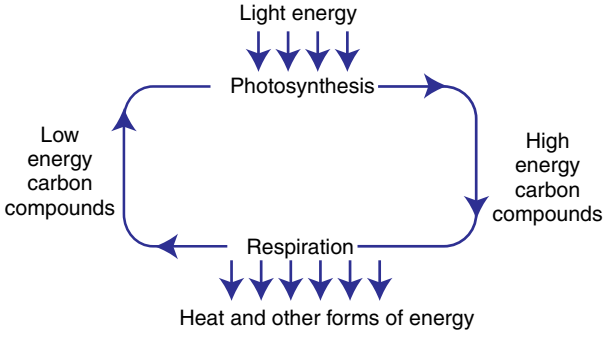



**Figure TT6.2** Process.

What is shown by this diagram?
   (A) The cyclic flow of matter and energy through an ecosystem.
   (B) The non-cyclic flow of matter and energy through an ecosystem
   (C) The cyclic flow of matter and non-cyclic flow of energy through an ecosystem.
   (D) The non-cyclic flow of matter and cyclic flow of energy through an ecosystem.

# Answers

## Topic 5 Describing Biodiversity

### 1 Assumed Knowledge Topic 5

1. Biotic factors refers to living things and abiotic factors refers to non-living things.
2. Physical conditions of the environment refer to features such as temperature, rainfall, humidity, topography and wind speed and direction.
3. Resources refers to anything that is used by the organisms, e.g. nesting material, food supply, water source.
4. (a) The photic zone is the top layer of a body of water where light can penetrate for photosynthesis.
   (b) The photic zone is highly important in aquatic ecosystems as the availability of light determines the distribution and abundance of photosynthetic organisms such as algae, water plants and cyanobacteria.
5. Desertification is the process when an area with good soil becomes a barren desert. Abiotic factors that can cause desertification include heavy rain and storm water washing down slopes and dry wind blowing fine particles of organic matter, silts and top soil from an area. This leaves large sandy particles and stones that will form the desert.
6. An adaptation is a characteristic which helps an organism survive in its environment.
7. The webbing between the toes of a frog is an adaptation for an aquatic environment to assist swimming in water.
8. The habitat is the small part of the ecosystem in which the organism lives.
9. (a) The binomial system uses the genus and species names, e.g. *Macropus rufus* to identify this particular species of kangaroo. This stops confusion which can be caused if common names are used and different areas have different common names for the same species.
   (b) A red kangaroo will lie down in the shade in the middle of a hot day to conserve energy and protect itself from the heat of the midday sun.
10. Topographic factors are abiotic factors that relate to features of an area such as the angle and aspect of a slope, altitude.
11. El Nino is warm water in the eastern Pacific and high air surface pressure in the western Pacific that bring drier conditions for the south-eastern states in Australia and weaker than normal easterly trade winds.
12. Speciation is the origin of a new species, e.g. due to natural selection and isolation.
13. Biodiversity refers to the genetic variety found in the different life forms on Earth.
14. An ecosystem is the interaction of living things with their environment and with other living things in an area functioning together to make an ecological unit.
15. Symbiosis refers to the relationship between different organisms in close physical association to each other.
16. Distribution refers to the region where population is found whereas abundance is the number of individuals in the population.
17. Cane toads are an introduced species. They release a toxin poison which kills many native Australian predators, e.g. red-bellied black snake and the toads outcompete native frog species to occupy suitable habitats.
18. A producer is an organism that can make organic compounds from inorganic raw materials. Consumers are organisms that need to use another living organism as a source of food. Decomposers are organisms that help break down dead bodies or wastes of other organisms, recycling nutrients to the soil.
19. A community is all the populations of organisms living in a particular area at a particular time.
20. Stratified sampling is a type of sampling in which a sample is taken of each strata of the population.
21. Qualitative data is information that is not numerical in nature while quantitative data is numerical information.
22. Primary data is data collected directly by a person or a group while secondary data is data collected by a person or group other than the person or group using the data.
23. (a) At the pole the habitat is snow and ice with little vegetation; this changes to low shrubs and lichens, then coniferous forest, then grassland and deciduous forest and then rainforest, desert and grassland.
    (b) As you go from the equator to the poles and from sea level up a high mountain there is a similar change in habitat. They both start with rainforest, desert, grassland and then change to deciduous forest, coniferous forest, low shrubs and lichen and then snow and ice. Differences would be shown from a careful study of individual species present rather than a broad category such as 'deciduous forest'. Each area would have species unique to that area. There would also be abiotic differences relating to the differences in altitude, e.g. lower air pressure and less oxygen available at the top of high mountains.
24. Binomial nomenclature is the convention that refers to species by their genus and species name, e.g. *Homo sapiens* for humans.
25. The two diagrams show that the height of the tallest stratum and foliage cover are used to classify ecosystems.

### 2 The Biosphere

1. The biosphere is the sum total of all areas including land, water and air where livings things are found.
2. The lithosphere is the outer, rigid solid shell of rock on Earth consisting of the crust and part of the upper mantle. The hydrosphere is the combined mass of water found on, under and over the surface of the Earth. The atmosphere is the body of air surrounding the planet.
3. The pedosphere is the outermost layer of the Earth where the lithosphere, hydrosphere, atmosphere and biosphere interact to form soil.
4. The three functions of the biosphere are: 1. The biosphere converts energy from sun/chemical sources to organic material. 2. Harvests elements and minerals essential for life from other spheres. 3. Responds to changes by adjusting food webs.
5. A biome is a large geographical area that has a specific climate and sustains distinctive communities of plants and animals and can be any of the world's major ecosystems.
6. Australian biomes include desert, grassland and temperate forest.
7. (a) Tundra is dry and cold.
   (b) Tropical rainforest is wet and hot.
   (c) Desert is dry and hot.
   (d) Grassland is fairly dry and warm

### 3 Biodiversity

1. Biodiversity refers to the amount of variation in a group.
2. Biodiversity can be divided into three levels – ecosystem diversity, species diversity and genetic diversity.
3. Biodiversity conservation is needed as the sustainability of life on Earth, as we know it, involves all ecosystems and species dynamically interacting in complex relationships. The removal of species and ecosystems disrupts the required flow of energy and matter which directly or indirectly affects all other living things and processes on Earth. Thus there is a high need for biodiversity conservation.
4. The Australian government is responsible for biodiversity conservation under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).