Level

F	1	2	**3**	**4**	5	6	B6

Interactions in the environment

Strand
Life and Living

Key concept
Environments are dynamic and have living and non-living components which interact.

Purpose

Activities in this module are designed to help students understand the interactions occurring between living and non-living parts of the environment. Students have opportunities to:

- collect information about different living things in various habitats;
- identify and describe the non-living components of various habitats;
- examine the interactions that take place between non-living parts of ecosystems;
- use collected information to construct food chains and food webs that describe feeding relationships between living things;
- analyse interactions between living things;
- explore and elaborate ideas about how living things use non-living components of the environment to meet their needs.

Overview of activities

The following table shows the activities in this module and the way in which these are organised in **introductory**, **developmental** and **culminating** phases.

Introductory ►	Developmental ►	Culminating
Components of habitats	Soil, sunlight, wind and water	Interactions
The needs of plants	Interactions between living things	
	Food webs	
	Competition	
	Plants and sunlight	

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Core learning outcomes

This module focuses on the following core learning outcomes from the Years 1 to 10 Science Syllabus:

Life and Living

3.3 Students describe some interactions (including feeding relationships) between living things and between living and non-living parts of the environment.

4.3 Students make generalisations about the types of interaction which take place between the living and non-living parts of the environment.

Core content

This module incorporates the following core content from the syllabus:

Life and Living

Natural relationships

- interactions between living things — food chains/webs, competition for resources
- interactions between living and non-living things to meet needs
- interactions between non-living things — effects on environments

Ecosystems

- roles of organisms — producer, consumer, decomposer

Assessment strategy

Suggestions for gathering information about student learning are provided in each of the activities in this module. Once sufficient information has been collected, judgments can be made about students' demonstrations of outcomes. Typical demonstrations of this module's intended outcomes are provided here to indicate the pattern of behaviour to look for when making judgments.

Life and Living

3.3 Students describe some interactions (including feeding relationships) between living things and between living and non-living parts of the environment.

Students may:

- recognise that plants and animals co-exist in a particular place;
- describe some interactions between non-living things in an environment;
- construct food chains after collecting information about organisms living in various habitats.

Life and Living

4.3 Students make generalisations about the types of interaction which take place between the living and non-living parts of the environment.

Students may:

- conclude that non-living things interact with each other — for example, sun heats water, water evaporates, water washes away soil when it rains;
- generalise about the interactions between living and non-living components of an ecosystem;
- construct food webs after collecting information about organisms living in various habitats;
- analyse the interactions between living things in an ecosystem.

Background information

Current scientific conceptions

An **organism** is any living thing. The terms 'organism' and 'living thing' can be used interchangeably.

A **habitat** is the living place of organisms.

A **population** is a group of organisms of the same species living in a given area at the same time.

A **community** is a number of populations of different organisms living in the same habitat.

The term **environment** refers to the conditions of the area in which an organism lives.

An **ecosystem** is a community of organisms interacting with one another and with the environment in which they live. It consists of living and non-living components. There are many different types of ecosystems — for example, rainforest, marine, rocky shore, pond, roadside, grassland, farmland and home garden. The animals, plants and micro-organisms living in each ecosystem are different, as are the non-living components. For example, a pond ecosystem has living components such as algae, pond weeds, shrimps, toads, crabs, insects, tadpoles, small fish and micro-organisms; and once-living components such as dead leaves and waste products of animals. The non-living components include air, rocks, clay, sand, gravel, silt, water and sunlight. A grassland ecosystem has living components such as grass, small plants, earthworms, grasshoppers, birds, caterpillars, fungi and micro-organisms; and once-living components such as the remains of dead plants and animals and animal waste. The non-living components include air, water, sunlight, rocks and the inorganic constituents of soil, such as sand, gravel, silt and clay.

Three important relationships occur in an ecosystem:

- Non-living components interact with each other.
- Living components interact with non-living components.
- Living components interact with each other.

Interactions between non-living components

In nature, soil, sunlight, air and water interact with each other — for example:

- Water in rivers and seas gets heated by the sun and evaporates.
- Soil is washed away by rain.
- Wind blows dust/dirt away exposing rocks, which are broken down by heat and water.
- Gases from the air dissolve in water.

Interactions between living and non-living components

There are many ways in which living and non-living components of an ecosystem interact — for example:

- Animals drink water, and plants take in water through their roots.
- The wastes produced by plants and animals go into the soil.
- Earthworms aerate the soil.
- Plants and animals need oxygen from the air, and green plants need oxygen and carbon dioxide from the air.
- The roots of plants help to stabilise soil and thus prevent erosion.

Interactions between living components

The following are some examples of ways in which living components of an ecosystem interact:

- Plants are sources of food, oxygen, carbon dioxide and shelter for living things.
- Animals are sources of food and carbon dioxide for living things.
- Some animals are agents of pollination and seed dispersal. For example, when bees are drawing nectar from flowers, pollen on their bodies may come into contact with the stigma, and pollination may occur. Migrating birds can carry seeds in their feathers, their digestive systems and the mud on their feet and thus contribute to seed dispersal.
- Decomposers such as bacteria use wastes of plants and animals.
- Living things often compete for the same resources.
- Various feeding relationships exist between animals.

A **food chain** is a way of showing the feeding relationships between organisms. It represents the way in which food and the energy stored within it are transferred through an ecosystem — for example:

green grass → grasshopper → bird → cat

Each living thing is the food of the next living thing in the chain. The arrows indicate the direction in which the energy moves from organism to organism.

A **food web** is a way of showing a number of interconnected food chains. It represents the feeding relationships and transfers of energy that occur between producers and consumers, including decomposers.

Food webs are dynamic; they undergo continual change due to particular species leaving the area, the addition of new species and the population patterns of each species. Changes in physical factors will also affect the food web — for example:

- changes in the acidity of soil and water, in the contents of soil and water, and in the amount of water available;
- changes in humidity and temperature caused by climate changes;
- changes caused by erosion and human intervention.

Changes to the number of one type of organism may affect the entire food web.

Green plants such as grass, eucalyptus trees and pond weeds are **producers**. They convert the sun's light energy into food (stored energy) by the process of photosynthesis. All food chains start with a producer.

Consumers are living things that depend on other living things for food. First-order consumers feed on producers, and second-order, third-order and other higher-order consumers feed on lower-order consumers. First-order consumers are known as herbivores; second-order, third-order and other higher-order consumers are called carnivores. Consumers that feed on both producers and other consumers are known as omnivores.

Decomposers are consumers that obtain nutrients by breaking down biological waste and dead organisms into simple chemical substances. Examples are bacteria, fungi and some small animals such as insects and earthworms. In terrestrial environments, decomposition results in nutrients being deposited into the soil and gases being added to the air.

Competition occurs when individual living things or groups of living things compete for the same resources — for example, food and nesting sites.

Students' prior understandings

Students' prior understandings may differ from current scientific conceptions in a range of ways.

Some students may think that:

- plants and animals are the only components of ecosystems;
- plants, animals and micro-organisms do not depend on each other for survival;
- there is no interrelationship between living things and non-living components of the environment;
- non-living components of environments do not change;
- changes in the number of one type of organism in a food web will affect some organisms but not others;
- decomposers are not living things and are not an important part of an environment;
- food chains do not necessarily start with a producer. For example, they may not realise that bread comes from flour which is obtained by processing wheat (a green plant), or that cheese is made from milk produced by a cow that has fed on grass.

Teachers can help students to expand their conceptual understandings by:

- posing questions that help them to realise there are micro-organisms, air, water, sunlight and soil in ecosystems;
- encouraging discussion about the need of living things for oxygen, carbon dioxide, water and sunlight;
- sharing examples of food chains and food webs in different ecosystems;
- tracing the changes that take place throughout the whole food web;
- encouraging discussion about the role of decomposers in ecosystems and what happens to the waste products of living things and to living things when they die.

Terminology

Terms associated with interactions of living and non-living things in an environment are essential to the activities in this module — for example:

carnivore	dispersal of seeds	food web	omnivore
competition	ecosystem	herbivore	photosynthesis
consumer	environment	interactions	pollination
decomposer	food chain	micro-organism	producer

Students may already be familiar with some of these terms and understand their meanings and use in scientific contexts. If so, the activities in this module will provide opportunities for them to evaluate current usage. If not, these activities will provide opportunities for students to develop their understandings.

Cooperative learning — working in groups

Many of the activities in this module are best conducted in small groups. When students are working in groups, there should be a focus on cooperative learning. Information about cooperative learning is provided in the sourcebook guidelines, appendix 2.

School authority policies

Teachers need to be aware of and observe school authority policies that may be relevant to this module.

Safety policies are of particular relevance to the activities that follow. It is essential that demonstrations and student activities are conducted according to procedures developed through appropriate risk assessments at the school.

In this module, teachers need to consider safety issues relating to:

- observing and handling biological material, including live animals and plants;
- conducting excursions to field study sites;
- using electrical appliances;
- using potting mix.

Teachers also need to consider policies related to the ethical use of animals in the learning environment.

Support materials and references

Clark, H. 1993, *Science Directions*, *Book 2*, Pearson Education, Melbourne.

Watson, G. 1995, *Science Works*, *Book 2*, Oxford University Press, Melbourne.

ACTIVITY

Components of habitats

Introductory

Focus

This activity provides opportunities for students to observe a variety of habitats and to collect information about the living and non-living components of these.

Materials

For each student:

- disposable gloves

For each group:

- jars with lids (some ventilated)
- magnifying lenses

Teaching considerations

Choosing habitats

Provide opportunities for students to observe the features of two or more habitats. Types of habitats will depend on the local environment but could include:

- a grassy area in the school grounds;
- a pond, lake or creek;
- a rocky shore;
- wetlands;
- dry forest;
- rainforest;
- sand dunes.

It may be necessary to discuss what is meant by living and non-living components of habitats before students begin their observations.

Safety

Inspect study areas beforehand and inform students of potential risks and how to manage them.

Inform students about safe practices for investigating and handling plants and animals — for example:

- Identify plants and animals that may be dangerous or cause allergic reactions.
- Wear gloves at all times.
- Handle animals in a safe, gentle and non-threatening way.
- Minimise disturbance to animals and plants in the habitat.
- Do not lick or taste plant matter.
- Do not stand close to the edges of rivers or ponds.

When working outdoors, students should wear suitable footwear, protective clothing, hats and sunscreen.

Working scientifically

Time: 60 minutes

Collecting information
Identifying
Making observations
Creating diagrams
Describing

▶ Working in small groups, students observe different habitats and collect information about the living and non-living things present. The following are some ideas for guiding their observation:

- Describe the area being studied.
- Name, describe and/or draw the different types of animals present.
- Record and describe any evidence of the presence of other animals in the area even though they may not be there at this time — for example, tracks or droppings.
- Name, describe and/or draw the different types of plants present.
- Name, describe and/or draw any other living things present — for example, fungi (mushrooms, toadstools), lichens (white or green living material found on rocks and concrete).
- Record and describe any evidence of the presence of decomposers — for example, fallen trees that have spongy wood, bracket fungi on the trunks, or leaves that are soft and brown.
- Name and describe the non-living components of the habitat.
- Collect samples of soil or sand in a ventilated jar. Also collect samples of water from any ponds or creeks in the area. Inspect the samples with magnifying lenses to observe any living things present. Name and describe these.
- Draw a diagram of the area studied.

▶ Students record information in retrieval charts like the one below. They can display their charts and diagrams in the classroom and use these as a reference for later activities.

Habitat observed: _____

General description	
Animals present	
Evidence of other animals	
Plants present	
Non-living components	

▶ Students list two non-living things and three living things (at least one plant and one animal) from one of the habitats investigated. They then write about the relationships that exist between pairs of these things — for example:

- green plant needs sunlight to photosynthesise;
- magpie eats grub;
- ant lives in soil.

Gathering information about student learning

Sources of information could include:

- students' retrieval charts and diagrams;
- students' notes about relationships between things observed.

ACTIVITY

The needs of plants

Introductory

Focus

This activity provides opportunities for students to discuss their thinking about the needs of plants.

Materials

For each group:

- small green plant

Teaching consideration

Students may be able to bring plants from home for this activity. Any green leafy plant will do.

Working scientifically

Time: 60 minutes

Identifying
Making observations
Creating diagrams
Describing
Discussing thinking

▶ In small groups, students observe a plant. Individually or as a group, they draw a diagram of the plant, labelling the stem, leaves, flowers, fruits, seeds and roots (if visible).

▶ Students discuss their ideas about the needs of plants. Questions to guide thinking could include:

- What does a plant need to survive?
- From where do plants get water, oxygen, carbon dioxide, minerals, food (for energy) and sunlight?
- Which parts of the plant are used to obtain each of its needs?

▶ In the class group, students compile a list of the needs of plants. They then make links between each need and the part(s) of the plant through which that need is obtained. Students could do this in the form of a table or through annotations on the diagrams drawn earlier.

Gathering information about student learning

Sources of information could include:

- students' diagrams;
- students' contributions to discussions.

ACTIVITY

Soil, sunlight, wind and water

Developmental

Focus

This activity provides opportunities for students to investigate the interactions between non-living components of an ecosystem.

Materials

For each group:

- 6 metal or plastic trays (at least 15 cm x 15 cm with sides at least 3 cm high)
- fine dry soil
- measuring cup
- 500 mL measuring jug
- water
- spray bottle filled with water
- electric fan
- desk lamp (with electric light bulb)
- thermometer
- kitchen scales

Teaching considerations

Simulations

This activity involves simulating the interactions between non-living components of an ecosystem. For example, spraying water simulates rain falling, and shining a desk lamp simulates the sun shining. It may be necessary to perform some of the simulations outdoors to avoid making a mess in the classroom.

Safety

Inform students about safe practices for using electrical appliances.

Working scientifically

Time: 60 minutes

Performing experiments
Making observations
Measuring
Predicting
Constructing and using models
Discussing thinking

▶ Guided by the teacher, students discuss the term 'interaction'. They then discuss what is meant by interactions between living and non-living components of an ecosystem and identify some of the interactions that occur.

In small groups, students discuss interactions between soil, sunlight, wind and water in an ecosystem. Questions to guide discussion could include:

- Humans and other animals can move soil. What are some other ways that soil is moved from one place to another?
- What causes the amount of moisture in soil to vary?
- What causes the level of water in a pond or lake to vary?
- The temperature of water in a pond or lake varies. What causes this?
- What are some of the causes of landslides, floods and droughts?

► Students predict what they think will happen in each of the following simulations. In groups, they perform each one and record their observations and results.

- Place a shallow layer of dry soil in a tray. Water lightly using the spray bottle.
- Place a shallow layer of dry soil in a tray. Pour one to two cups of water down one edge of the tray.
- Place a shallow layer of dry soil in a tray. Blow air onto the soil using a fan.
- Pour 500 mL of water into a tray and measure its temperature. Blow air onto the water for 10 minutes using the electric fan and then measure the temperature and volume. Repeat this simulation several times, measuring temperature and volume on each occasion.
- Pour 500 mL of water into a tray and measure its temperature. Shine the lamp on the water for 10 minutes and then measure the temperature and volume. Repeat this simulation several times, measuring temperature and volume on each occasion.
- Place some dry soil in a tray. Use the scales to measure and record the combined mass of the soil and the tray. Spray the soil with water until it is completely damp and then measure and record the mass. Shine the lamp on the damp soil for 20–30 minutes. Measure and record the mass every 5 minutes. Compile the results in a table and present these as a graph.

► Students write about what happened during the simulations. They should:

- compare their observations with their predictions and note any differences;
- explain their observations;
- explain the results obtained.

Gathering information about student learning

Sources of information could include:

- students' contributions to discussions;
- students' predictions;
- students' observations and recording and presentation of data;
- students' explanations of observations and results.

ACTIVITY

Interactions between living things

Developmental

Focus

This activity provides opportunities for students to develop an understanding of feeding relationships between living things in an ecosystem.

Students construct a food chain to represent feeding relationships.

Materials

- retrieval charts from the activity 'Components of habitats' (see pp. 7–8)
- resources about ecosystems and food chains

Teaching consideration

Students will be able to use their prior knowledge and experience to make decisions about the eating habits of some living things. There will also be some information that they need to research. Allow time for this research and for helping students to find and use appropriate resources.

Working scientifically

Time: 60 minutes

Looking for patterns
Making links
Creating diagrams

▶ Using a table like the one below, students list living things in the habitats studied in the first activity of the module and record:

- what these things eat or how they get their food;
- what eats them.

Students should use a separate table for each habitat and, at this stage, complete only the first three columns.

Grassy habitat

Living thing	Eats/gets food by . . .	Eaten by . . .	Producer/consumer
Green plant (nectar, leaves, fruit, seeds)	Photosynthesis	Butterfly, honeyeater, possum	
Skink	Mosquitoes, spiders	Magpie, domestic cat	

▶ Students discuss their ideas and/or use resource material to come to an understanding of the terms 'producer' and 'consumer' in relation to living things. They then identify each of the living things in the tables as either a producer or a consumer and enter this information in the last column.

▶ Students discuss the term 'food chain'. A key point that should be made during discussion is that all food chains start with a producer organism.

▶ The teacher models the construction of some simple food chains based on information in the tables. Students then construct several food chains for each of the habitats studied. They could make cards for each living thing (using names or drawings) and paste these in their notebooks to form their food chains.

Additional learning

► Students investigate other relationships between living things in the habitats studied — for example:

- how one living thing provides shelter for another;
- how animals are agents of pollination and seed dispersal.

Gathering information about student learning

Sources of information could include:

- students' tables and food chains;
- students' contributions to discussions.

ACTIVITY

Food webs

Developmental

Focus

This activity provides opportunities for students to enhance their understanding of feeding relationships between living things in an ecosystem.

Students construct food webs to represent feeding relationships in a rainforest ecosystem.

Materials

For the teacher and/or students:

- Resource Sheet 1, 'Constructing food webs'
- Resource Sheet 2, 'Food webs: Pond, grassland'
- Resource Sheet 3, 'Food webs: Mangrove, farmland'
- Resource Sheet 4, 'Rainforest ecosystem'

Teaching considerations

Resource Sheets 1–3

Students will need to observe food webs being constructed and look at examples of food webs. See Resource Sheet 1 for a guide to one way of constructing a food web and Resource Sheets 2 and 3 for examples of food webs.

During discussion, introduce students to the terms 'first-order', 'second-order' and 'third-order' consumers (see p. 5).

Working scientifically

Time: 60 minutes

Identifying
Making plans
Predicting
Dealing in an orderly manner with the parts of a complex whole
Making links
Synthesising
Constructing and using models
Discussing thinking

▶ Students observe the teacher constructing a food web and look at examples of food webs (Resource Sheets 2 and 3). They then construct food webs showing the feeding relationships between living things in the rainforest ecosystem outlined on Resource Sheet 4. They could make cards for each living thing (using names or drawings) and paste these in their notebooks to form their food webs.

Resource Sheets 2–4

▶ In the class group, students discuss their ideas and if necessary refer to resources to develop an understanding of the terms 'herbivore', 'carnivore' and 'omnivore'. They then group the animals in the rainforest food web under these headings.

▶ In small groups, students discuss what would happen to each organism in the rainforest ecosystem if a particular species decreased in number or if one type of organism increased in number. Different groups could consider different species. Questions to guide discussion could include:

- Which organisms feed on . . . (the selected species)?
- What would happen to the numbers of the feeding organisms?
- What would be the flow-on effect of this change in numbers of organisms?
- What would happen to the numbers of organisms that the . . . (selected species) fed on?
- Besides changing feeding relationships, could reducing the numbers of . . . (selected species) have any other short-term or long-term effects on the ecosystem?

► Students use information from the food web constructed earlier to identify and record groups of living things that compete for the same food source. Students then suggest ways that animals living in the same habitat avoid direct competition for food. Some ideas to stimulate discussion include:

- time of day when animals are active;
- places where animals feed — for example, in the trees, on the ground.

Gathering information about student learning

Sources of information could include:

- students' food webs;
- students' lists of herbivores, carnivores and omnivores;
- students' contributions to discussions.

ACTIVITY

Competition

Developmental

Focus

This activity provides opportunities for students to investigate competition between living things.

Materials

For each group:

- 12 bean seeds (soaked overnight)
- 2 small pots
- potting mix or garden soil
- ruler or tape measure

Teaching considerations

Choosing and planting seeds

Suggestions are provided about the number and type of seeds to plant for this investigation. Any fast-growing plants are suitable. Vary the number of seeds as necessary to suit the size of the pot and the expected size of the chosen plants. The aim is to establish a situation where the plants are competing for resources. This occurs when the roots are filling the pot or when there are so many leaves that they are competing for light. The larger or deeper the pot and the more nutrients there are in the soil, the longer it will take to see the effects of competition.

Safety

Inform students about safe practices for handling commercial potting mix — for example:

- Check warnings on the packaging.
- Avoid breathing in dust and spores.
- Wash hands after using the mix.

Working scientifically

Time: 40 minutes plus 10 minutes per recording session each day

Collecting information
Performing experiments
Identifying
Making observations
Measuring
Seeking reasons
Inferring from data
Making comparisons
Describing
Summarising and reporting

▶ In the class group, students discuss the meaning of the term 'competition' and the resources that living things (particularly plants) might compete for in their environment.

▶ Working in small groups, students prepare and conduct their investigations according to the following directions:

- Place the same amount of potting mix or garden soil in two pots of the same size. Label one pot A and the other B.
- Make ten holes about 2 cm deep in the soil in pot A. Place one seed in each hole and cover with soil or potting mix. Plant two seeds in pot B in the same way.
- Lightly water the soil and place the pots side by side in a protected, sunny position.
- Water each pot lightly with the same amount of water once per day. Take care not to overwater the seeds. Too much water could cause them to rot.

- Check the pots daily and record observations over a period of two weeks. Observations could be made of the number and heights of seedlings and the number of leaves.

▶ At the end of the observation period, students discuss the following:

- How many of the seeds grew into seedlings?
- Suggest reasons why some seeds/seedlings did not grow.
- What is the average height of the seedlings in each pot?
- What is the average number of leaves on the seedlings in each pot?
- For what resources are the plants competing?
- Why might there be differences between the seedlings in each pot?

Each group summarises their results and conclusions and presents these to the class.

Gathering information about student learning

Sources of information could include:

- students' observations and answers to questions;
- students' presentation and interpretation of results;
- students' contributions to discussions.

ACTIVITY

Plants and sunlight

Developmental

Focus

This activity provides opportunities for students to develop an understanding of how plants depend on sunlight for survival.

Materials

Materials will depend on the method(s) of investigation chosen by students. This list is based on the sample investigation below.

For each group:

- bean seedlings
- 3 pots
- potting mix or garden soil
- 2 cardboard boxes tall enough to fit the plants inside and allow space for growth
- craft knife
- rulers or tape measures

Teaching considerations

Seedlings

Seedlings grown in the previous activity could be used for the investigation; however, these will need to be supplemented with others. The seedlings for each group should be generally similar in size and number of leaves.

Sample investigation

The following steps outline one way of conducting the investigation:

- Plant three similar seedlings in pots. Label the pots A, B and C.
- Lightly water the three plants.
- Place pot A inside one box and firmly close the lid so that no light can enter.
- Cut a window 10 cm x 10 cm in one side of the other box. (Light will be able to enter in one direction only.) Place pot B in this box and close the lid.
- Leave pot C uncovered. It will act as the control.
- Place the three pots next to each other in a protected, sunny position. The window in the box containing pot B should face towards the sun.

Fair tests

The investigation will prepare students for demonstration of Science and Society core learning outcome 4.2, 'Students use the elements of a fair test when considering the design of their investigations'. Suggestions for considering fair testing are provided in the sourcebook guidelines, p. 35.

Safety

Inform students about safe practices for handling commercial potting mix — for example:

- Check warnings on the packaging.
- Avoid breathing in dust and spores.
- Wash hands after using the mix.

Inform students about safe practices for using knives — for example:

- Cut on mats or thick wads of newspaper.
- Carry the knives in sheaths or retract the blades.

Working scientifically

Time: 60 minutes plus 5–10 minutes per recording session each day

Performing investigations
Making observations
Measuring
Predicting
Drawing conclusions
Making comparisons
Describing

▶ In the class group, students discuss how living things (particularly plants) use sunlight. They then consider ways of investigating the growth of seedlings in different conditions — for example, without sunlight, with sunlight on one side only and in full sunlight.

▶ Working in small groups, students decide how to conduct their investigations, record their plans and prepare the necessary materials.

▶ Students reflect on the structure of their investigations. The following discussion questions are based on the sample investigation. Adapt these as necessary to suit students' chosen method(s) of investigation:

- What is the purpose of the investigation?
- Why was a window cut in one box and not the other?
- What do you think will happen to the plant in the box without the window?
- What do you think will happen to the plant in the box with the window?
- Why was one plant left out in the open?
- What do you think will happen to the plant in the open?

▶ Students decide which measurements to make to record changes in the plants. They also determine methods of measurement, other observations to make and recording methods. Observations could include:

- height of plant from soil level to tip of shoot;
- length of stem between the second and third set of leaves;
- colour of leaves;
- number of leaves;
- angle at which the stem deviates from the vertical.

▶ Students observe each plant daily for one to two weeks, recording their observations. (Plants should be lightly watered each day to keep the soil moist. Overwatering will cause the soil to become waterlogged, and the roots may rot.)

▶ Students present the results of their investigations and describe differences between the three plants. They discuss these differences and use information gathered during the activity to draw conclusions about the plants' need for sunlight.

Additional learning

▶ Students discuss some of the ways that green plants maximise their exposure to sunlight — for example, leaf size and orientation, height of trees, growth habits of lianas and epiphytes.

Gathering information about student learning

Sources of information could include:

- students' answers to questions about the structure of the investigation;
- students' discussion about information to be collected and methods of collection;
- students' observations, recording of data and presentation of results and conclusions.

ACTIVITY

Interactions

Culminating

Focus

This activity provides opportunities for students to demonstrate their understanding of the types of interaction between the living and non-living parts of the environment.

Materials

- students' tables and food chains from the activity 'Interactions between living things' (see pp. 12–13)

Teaching consideration

Students could complete this activity for more than one ecosystem if they wish, or if they need more opportunities to demonstrate understandings.

Working scientifically

Time: 60 minutes

Forecasting
Identifying
Analysing
Dealing in an orderly manner with the parts of a complex whole
Generalising
Making links
Suggesting
Constructing models
Describing

▶ Students use tables and food chains from the activity 'Interactions between living things' to complete the following for one ecosystem investigated:

- Construct a food web to show the feeding relationships between the living things.
- List the living things that compete for the same food source.
- Identify and describe any other interactions that occur between the living things.
- List the herbivores, carnivores and omnivores.
- Identify the needs of each living thing that are supplied by non-living components of the environment.
- Describe the effect that the living things have on the non-living components of the ecosystem.
- Describe some interactions that occur between the non-living components of the ecosystem.
- Consider a situation where there is a change in the number of one type of living thing. Describe the effect of this change on each other living thing.
- Consider a situation where there is a change in the non-living environment — for example, water pollution. Describe possible effects of this change on living things in the ecosystem.

Gathering information about student learning

Sources of information include:

- students' food webs;
- students' analyses of interactions in the ecosystem.

Constructing food webs

The following steps describe one way of constructing a food web:

1. Create a table that lists:
   - all the living things in the ecosystem;
   - what they eat or how they get food;
   - what they are eaten by;
   - whether they are a producer, a first-order, second-order or third-order consumer, or a decomposer.

   This has been done for the living things in a **grassland ecosystem**:

Living thing	**Eats/gets food**	**Eaten by …**	**Producer** *or* **order of consumer** *or* **decomposer**
Green plant (flowers, fruits, leaves and seeds)	Photosynthesis	Mouse, stick insect, caterpillar/butterfly, seed-eating bird	Producer
Seed-eating bird	Seeds of green plant	Snake	First-order consumer
Mouse	Fruits, seeds of green plant	Snake	First-order consumer
Stick insect	Leaves of green plant	Spider	First-order consumer
Caterpillar/butterfly	Flowers, fruits, leaves of green plant	Spider, carnivorous bird	First-order consumer
Snake	Mouse	Carnivorous bird	Second-order consumer
Spider	Stick insect, caterpillar	Carnivorous bird	Second-order consumer
Carnivorous bird	Caterpillar, snake, spider, butterfly		Second- and third-order consumer
Fungus	Decomposition of wastes and dead organisms		Decomposer
Bacterium	Decomposition of wastes and dead organisms		Decomposer

(continued)

Constructing food webs *(continued)*

2. Place all producers on one line and all first-order consumers one line above the producers, leaving space to add arrows later. Place all second-order consumers one line above the first-order consumers, and all third-order consumers one line above the second-order consumers.

In many ecosystems, some consumers feed from organisms at more than one level. These consumers should be placed at the highest level at which they consume. For example, the carnivorous birds in the grassland ecosystem are second-order and third-order consumers because they eat caterpillars (first-order consumers) and snakes and spiders (second-order consumers). They should therefore be placed above the second-order consumers in the food web.

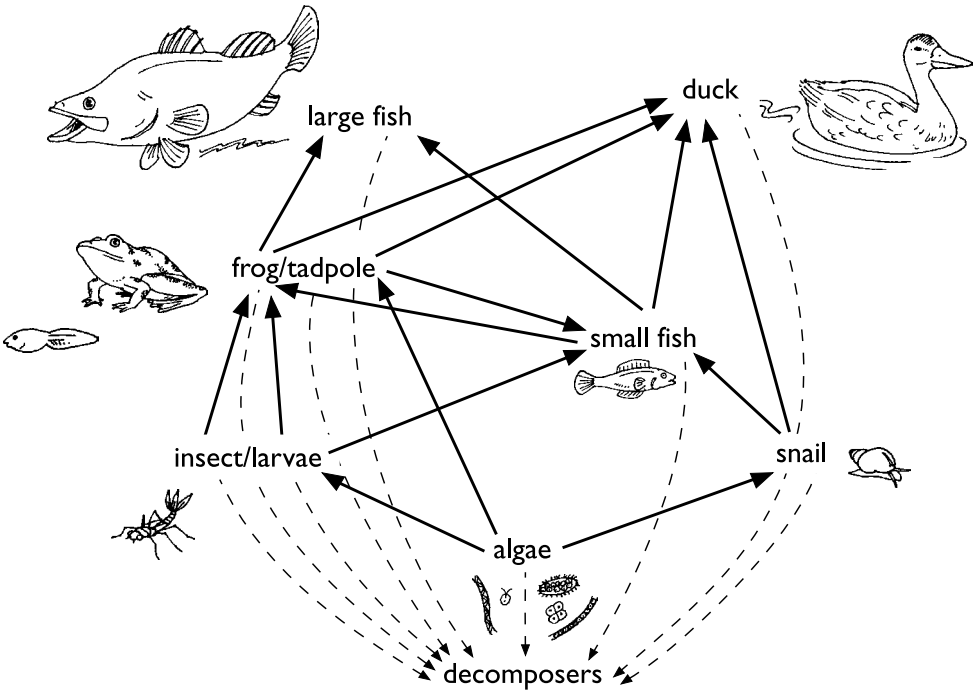
3. Place arrows between organisms to indicate that one of them feeds on the other. The arrow should always point towards the 'eater'. Each organism may have multiple arrows pointing towards it and/or away from it.

4. Place decomposers below the producer organisms. Add downward arrows with broken lines from organisms to represent decomposition of wastes and dead organisms.

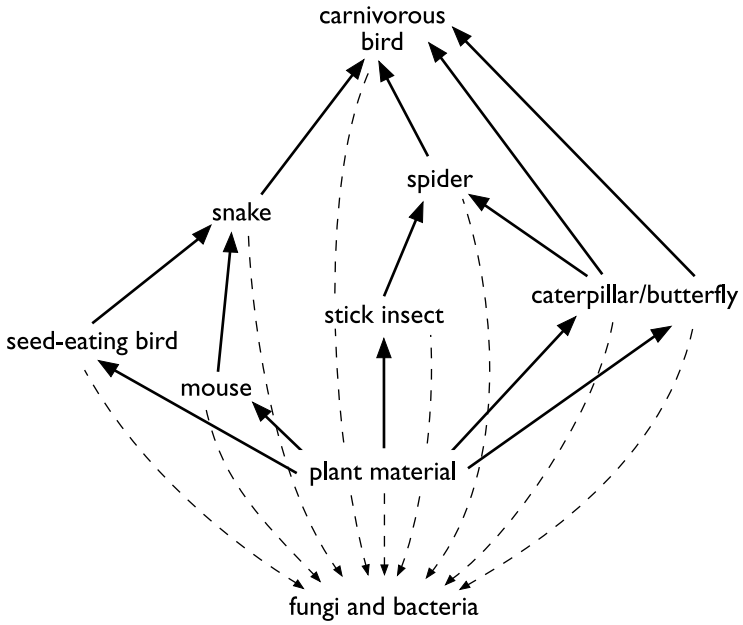
Refer to Resource Sheet 2 for an example of a grassland food web.

Food webs: Pond, grassland

Pond food web

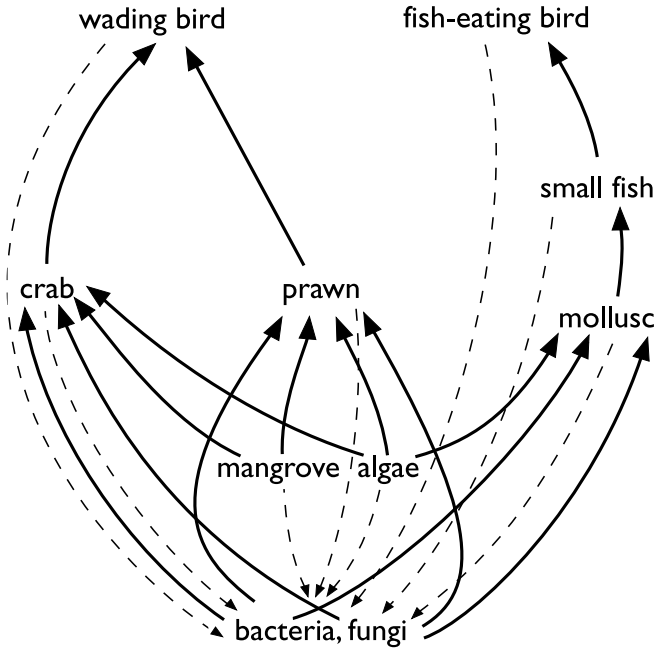


Grassland food web

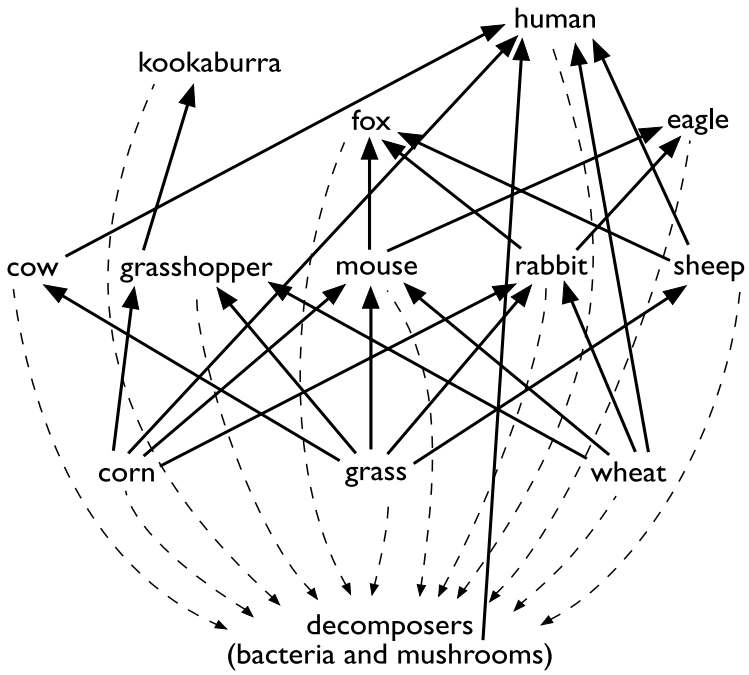


Food webs: Mangrove, farmland

Mangrove food web



Farmland food web



Rainforest ecosystem

Use the information in the table to create a rainforest food web.

Living thing	**Eats/gets food by . . .**	**Eaten by . . .**	**Producer** *or* **order of consumer** *or* **decomposer**
Green plant (fruits, leaves and nectar)	Photosynthesis	Marsupial mouse, flying fox, moth, caterpillar, honeyeater	Producer
Marsupial mouse	Fruits of green plant	Quoll, carpet snake	First-order consumer
Flying fox	Fruits of green plant	Quoll	First-order consumer
Moth	Nectar of green plant	Tree creeper, honeyeater	First-order consumer
Caterpillar	Leaves of green plant	Tree creeper	First-order consumer
Honeyeater	Nectar of green plant, moth	Hawk	First- and second-order consumer
Tree creeper	Moth, caterpillar	Hawk, carpet snake	Second-order consumer
Quoll (native cat)	Marsupial mouse, flying fox	Hawk	Second-order consumer
Carpet snake	Marsupial mouse, tree creeper	Hawk	Second- and third-order consumer
Hawk	Tree creeper, honeyeater, quoll		Third-order consumer
Bacterium	Decomposition of wastes and dead organisms		Decomposer

Acknowledgments

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This sourcebook module should be read in conjunction with the following Queensland School Curriculum Council materials:

Years 1 to 10 Science Syllabus

Years 1 to 10 Science Sourcebook: Guidelines

Science Initial In-service Materials

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