



Answers Ecosystems

Year 9 Science

Chapter 3

p49

- 1 SWATS = Soil, Water, Air, Temperature, Sunlight is sometimes used to describe an ecosystem's **abiotic** factors.
- 2 Briefly describe the importance of each of the following abiotic factors:
 - a) Light. Because **light** is required for photosynthesis, many plants need strategies to cope with varying amounts of light.
 - b) Oxygen. Because **oxygen** is required for respiration, the availability of oxygen is a critical factor for plants and animals in many ecosystems. Warm water has less oxygen than cold water, waterlogged soil reduces the availability of oxygen.
 - c) Water. The viability of many terrestrial ecosystems is dependent on available **water**. Generally, the lower the availability of water the smaller the populations of plants and animals.
 - d) Temperature. **Temperature** is a critical factor in many ecosystems. Plants will generally grow faster in warmer temperatures - animals tend to migrate from colder temperatures to warmer temperatures.
 - e) Soil type. The **soil type** is a critical factor for many organisms. Clay soil can contain more water but less oxygen. Sandy soil can contain more air but less water and less nutrients.
- 3 Briefly describe predation and give five examples.

Predation is a predator-prey relationship where one organism, the predator, kills and eats another organism, the prey.

Examples:

 - Spiders catch and eat insects.
 - Owls catch and eat mice.
 - Whales catch and eat plankton.
 - Lion catch and eat zebra.
 - Bears catch and eat fish.
- 4 Briefly describe parasitism and give five examples.

Parasitism is a relationship where one organism, the parasite, feeds on or in another organism, the host. The parasite usually harms the host but rarely kills the host.

Examples:

 - Mosquitos feed on humans.
 - Fleas live on and feed on furry animals.
 - Mistletoe live and feed on trees and shrubs.
 - Tapeworms live in and feed on many animals including humans.
 - Ticks live and feed on many animals including humans.
- 5 What features do the magpie have that allows it to be able to catch prey? A magpie has a beak which is able to effectively snatch prey and has wing that allows it to be agile.
- 6 What features do the magpie have that helps it avoid being eaten? A magpie uses its wings to evade predators.

- 1 Briefly describe mutualism and give five examples.
Mutualism happens when both organisms in a relationship benefits from the relationship. Sometimes neither organism can survive without the other.
Examples
- A lichen is the term for fungus and algae living together.
 - Pollination of flowers by bees.
 - Bacteria in the human large intestine.
 - Birds eating parasites from the backs of herbivores.
 - Sea anemones and anemone fish protect each other from predators.
- 2 Briefly describe commensalism and give five examples.
Commensalism happens when one organism in the relationship benefits, and the other organism neither benefits nor is harmed.
Examples
- Barnacles on whales.
 - Orchids on trees (Tree used for habitat).
 - Birds living in holes in trees.
 - Mites on beetles (used for transport).
 - Birds eating the insects flushed from vegetation by grazing animals.
- 3 Briefly describe competition and give five examples.
Competition happens when organisms require the same resource (food, water, habitat, etc) in the same location at the same time.
Examples
- The tallest plants in a forest get more light.
 - Cattle competing with each other for grass.
 - Vultures competing for a carcass.
 - Mating behaviour: A male kangaroo keeping other male kangaroos from mating females.
 - Territorial behaviour: A group of kookaburras will protect their territory from other kookaburras.
- 4 The above symbiosis diagram uses faces to describe benefit, harm, and nil effect.
 What two faces would you use to describe competition?



Competition

- 5 Classify each of the following interactions between organisms as predation, parasitism, mutualism, commensalism, or competition.
- Barnacles on mangrove roots = Commensalism.
 - Kookaburra eating a worm = Predation.
 - Wedge-tailed eagles nest in trees = Commensalism.
 - Protozoans eating wood inside a termite = Mutualism (protozoan-termite relationship).
 - Cattle eating grass = Predation.

p53

- 1 Births affect population size by increasing the population size.
- 2 Deaths affect population size by decreasing the population size.
- 3 Immigration affects population size by increasing population size.
- 4 Emigration affects population size by decreasing population size.
- 5 Indicate four ways in which population size can be calculated.
 - The entire population may be counted.
 - A part of the population may be counted and the population size then estimated.
 - Animal droppings or nests may be counted and then the population estimated.
 - Organisms may be captured, marked, released, and then recaptured.
- 6 20 fish are captured, tagged, and released. A fortnight later, a sample of 60 fish are captured, 5 of them were previously tagged. Estimate the population size of the fish in the dam.

$$\begin{aligned}\text{Population} &= \frac{\text{sample} \times \text{total tagged}}{\text{tagged in sample}} \\ &= \frac{60 \times 20}{5} \\ &= 240\end{aligned}$$

There are about 240 fish in the dam.

- 7 Exponential population growth can happen when there are plenty of available resources. Why would it be expected that the population growth would eventually stop or collapse?

The population size will continue to increase until the population is not sustained by the available resources and may even exhaust the resources. The population growth will then stop or even collapse.

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- 1 **Seasonal changes** can affect populations in many ways. In winter, there is less light and lower temperatures, reducing the amount of available food. Also, some animals will migrate out of the ecosystem. Population numbers tend to reduce in winter through death and emigration.

In summer, numbers will tend to increase as available food and suitable habitat increases with increased warmth and light. Numbers are increased through birth and immigration.
- 2 **Destruction of habitat** can make a habitat unable to sustain an organism. The destruction will have removed food, shelter, and other assets. Population numbers will decrease through death and emigration.
- 3 **Introduced species** can reduce the population of some organisms. Competition may reduce the amount of available food, light, habitat, or other assets. An introduced species may also alter the current predator-prey balance. Population sizes can be reduced by death and emigration.
- 4 **Disease** can have severe effects on population numbers and can even lead to extinction. The pathogen, chlamydia, is causing conjunctivitis, pneumonia, urinary tract infection, and reproductive tract infections in Koalas. It is believed that the disease, with other factors such as habitat destruction and the introduction of species such as dogs and cats, is causing a decline in Koala numbers.
- 5 A tool such as a **quadrat** is often used to collect a sample count. A quadrat can be a square or a circle. The sample count is then used to estimate the population of the whole habitat or the whole study area.

Quadrats are suitable for sampling plants, some aquatic organisms, and slow-moving animals (such as insects).

- 6 A 1m by 1m quadrat was used to collect three random limpet counts (23, 36, 17) in a 10m by 10m study area. Estimate the total number of limpets in the study area.

Quadrat	Count	Quadrat area = 1m × 1m = 1 m ²
1	23	Study area = 10m×10m = 100 m ²
2	36	
3	17	
Total = 76		Thus multiply quadrat count by 100
Average = 32 ÷ 3		Estimated no. limpets = 10.7 × 100
Av = 10.7 per quadrat		Estimated no. limpets = 1070

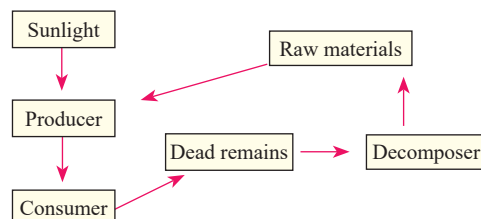
The study area is estimated to have 1070 limpets.

- 7 A 1m by 1m quadrat was used to collect five random insect counts (6, 12, 15, 8, 21) in a 5m by 8m study area. Estimate the total number of insects in the study area.

Quadrat	Count	Quadrat area = 1m × 1m = 1 m ²
1	6	Study area = 5m×8m = 40 m ²
2	12	
3	15	
4	8	
5	21	
Total = 62		Thus multiply quadrat count by 40
Average = 62 ÷ 5		Estimated no. insects = 12.4 × 40
Av = 12.4 per quadrat		Estimated no. insects = 496

The study area is estimated to have 496 insects.

- Matter such as food, gases, liquids, is used and recycled as it passes from organism to organism.
- True or false?
 - Matter flows through the ecosystem : True
 - Photosynthesis produces glucose : True
 - Respiration produces glucose : False
 - Photosynthesis produces energy : False
 - respiration produces energy : True
- Write in words:
 - the equation for photosynthesis. carbon dioxide + water → glucose + oxygen
 - the equation for respiration. glucose + oxygen → energy + carbon dioxide
- Copy and complete the following flow of matter diagram



p59

- 1 What is the name of the process that producers use to convert light energy to chemical energy?
Photosynthesis
- 2 What is the name of the process that producers use to convert the chemical energy in the food they make to energy for everyday living?
Respiration
- 3 What is the name of the process that consumers use to obtain the energy for everyday living from the chemical energy in their food?
Respiration
- 4 The transfer of energy from one trophic level to the next is often referred to as the '10% rule'. What do you think is meant by the 10% rule?
The 10% rule suggests that just 10% of input energy is used for growth and repair. 90% of the energy is lost as heat to the air.
- 5 For the following food chain, how much energy would the fox, 3rd trophic level, be expected to have available for growth and repair from the energy in 100 kg of grass?
grass → rabbit → fox
The rabbit would use 10% of the energy from 100 kg of grass = 10 kg
The fox would use 10% of the energy from 10 kg = 1 kg
- 6 Why is there a limited number of trophic levels in a food chain?
There is a limited number of trophic levels in a food chain because the energy available diminishes quickly as the number of trophic levels increase.

p61

- 1 Indicate some differences in the effects of a mild bushfire and the effects of a severe bushfire.
Mild to moderate bushfires can burn a forest understory and remove small trees and groundcover plants. **Severe** bushfires can burn into the crowns of trees and damage large trees as well as severely burning the understory.
- 2 How do bushfires affect abiotic factors?
Bushfires can affect abiotic factors in the ecosystem. The removal of vegetation can allow direct sunlight onto the soil. The soil can suffer high temperatures and become drier. The soil can be exposed to erosion through surface run-off from rain. Severe fires, through high soil temperature, can change the texture and structure of the soil.
- 3 What are some adaptations of eucalypts to bushfire?
Eucalypts have thick bark to insulate them from the heat of the fire. Eucalypts can quickly regenerate after a fire. This fast regeneration gives them a competitive advantage. Fire is needed by plants such as banksias to release seeds.
- 4 A **drought** is a prolonged dry period when there isn't enough water for the survival of many organisms.
- 5 Indicate three plant adaptations to help plants survive prolonged dry periods.
 - waxy surfaces to reduce water loss.
 - small narrow leaves to reduce water loss.
 - no leaves with photosynthesis occurring on the stems to reduce water loss.
 - silver reflective leaves.
 - absorb carbon dioxide during the night to reduce loss of water during the day.
- 6 Indicate three animal adaptations to help plants survive prolonged dry periods.
 - active at night and shelter during the day.
 - absorb dew through the skin.
 - hibernate in the soil during dry periods.
 - large ears to detect prey at night and to lose body heat during the day.
 - body stores fat as a food and water source for dry times.
 - tougher digestive system to widen the variety of food sources.
- 7 Why was the severe drought of 1896-1902 called the Federation Drought?
- 8 Who is Henry Lawson?
Henry Lawson was an Australian writer and poet from the colonial period. He is often referred to as Australia's greatest short story writer.

<p>p63</p>	<ol style="list-style-type: none"> 1 A flood is a temporary covering of normally dry land with water. Floods can be caused by excess water from rivers and lakes, persistent rain on saturated ground, large tidal flows, or tsunamis. 2 What are three negative effects of flooding? Floods can cause the death of organisms and cause severe ecosystem damage and disruption. Many organisms, covered in water, die due to lack of oxygen. The power of floods can wash away large amounts of plants and soil, reducing the food supply and shelter for many animals. 3 What are three positive effects of flooding? Floods can benefit ecosystems by cleaning away pollutants such as chemicals and salts. Floods can recharge the soil in runoff areas with moisture, and recharge underground water supplies, supporting population growth of many organisms. Floods can also deposit fertile soil and nutrients on vast flood plains where many organisms will breed and grow. 4 What are some adaptations of red river gums to flooding? Red river gums are adapted to regular flooding. Floods disperse their seeds and regularly supply them with fertile soil. Controlled use of the rivers for agriculture have reduced flood effects and endangered some river red gum forests. 5 How have other organisms adapted to flooding? Other organisms have adapted their life cycles to take advantage of flooding events. Some organisms, such as fish and frogs, time their reproduction to occur during flooding and to hibernate during dry periods. Other organisms, such as birds, are opportunistic and migrate to the flooded areas and migrate out of the area when it becomes dry.
<p>p66</p>	<ol style="list-style-type: none"> 1 Roadkill is an animal that has been hit and killed by a motor vehicle. Mammals (koala, kangaroo, wombats, possums, etc), birds, reptiles, amphibians, and insects are particularly susceptible to being killed on the roads. 2 Indicate two detrimental effects on habitats of building roads. <ul style="list-style-type: none"> • reduce habitat area. • prevent access to food and shelter on the other side of the road. • decrease populations by roadkill. • divide populations and reduce their ability to survive. 3 Which organisms benefit from roadkill? Scavengers such as crows, foxes, and eagles, are beneficiaries of roadkill. Scavengers are also at risk of being killed on the roads. 4 Wildlife crossings are an attempt to reduce roadkill. Can you think of two other possible ways of reducing roadkill? <ul style="list-style-type: none"> • Fit a device to vehicles that emits a piercing warning signal to animals. • Fencing roads may help reduce the movement of animals onto roads.
<p>p67</p>	<ol style="list-style-type: none"> 1 What is the purpose of controlled burning? Controlled burning or hazard reduction burning is used in farming and in an attempt to protect people from severe summer bushfires. 2 What are believed to be some benefits of controlled burning? It is believed that regular controlled burning reduces fuel loads and possible fire outbreaks, supports fire dependent species, improves native habitat, controls weed invasion, and controls tree disease. 3 What are some problems with controlled burning? Controlled burning produces smoke and other toxic gases and can quickly become uncontrolled. Fire outbreaks from controlled burning is not uncommon and has caused considerable damage. 4 What is the difference between a severe fire and a mild fire? Severe bushfires destroy human lives, native animals, and devastates large areas of land. Mild fires reduce fuel loads and possible fire outbreaks, supports fire dependent species, improves native habitat, controls weed invasion, and controls tree disease.

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- 2 Briefly describe the importance of each of the following abiotic factors:
 - a) Light. Because **light** is required for photosynthesis, many plants need strategies to cope with varying amounts of light.
 - b) Oxygen. Because **oxygen** is required for respiration, the availability of oxygen is a critical factor for plants and animals in many ecosystems. Warm water has less oxygen than cold water, waterlogged soil reduces the availability of oxygen.
 - c) Water. The viability of many terrestrial ecosystems is dependent on available **water**. Generally, the lower the availability of water the smaller the populations of plants and animals.
 - d) Temperature. **Temperature** is a critical factor in many ecosystems. Plants will generally grow faster in warmer temperatures - animals tend to migrate from colder temperatures to warmer temperatures.
 - e) Soil type. The **soil type** is a critical factor for many organisms. Clay soil can contain more water but less oxygen. Sandy soil can contain more air but less water and less nutrients.
- 3 Briefly describe predation and give three examples.

Predation is a predator-prey relationship where one organism, the predator, kills and eats another organism, the prey.

Examples:

 - Spiders catch and eat insects.
 - Owls catch and eat mice.
 - Whales catch and eat plankton.
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Examples:

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Mutualism happens when both organisms in a relationship benefits from the relationship. Sometimes neither organism can survive without the other.

Examples

 - A lichen is the term for fungus and algae living together.
 - Pollination of flowers by bees.
 - Bacteria in the human large intestine.
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Commensalism happens when one organism in the relationship benefits, and the other organism neither benefits nor is harmed.

Examples

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 - Birds living in holes in trees.
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<p>p70</p>	<p>8 Briefly describe competition and give three examples. Competition happens when organisms require the same resource (food, water, habitat, etc) in the same location at the same time. <i>Examples</i></p> <ul style="list-style-type: none"> • The tallest plants in a forest get more light. • Cattle competing with each other for grass. • Vultures competing for a carcass. • Mating behaviour: A male kangaroo keeping other male kangaroos from mating females. • Territorial behaviour: A group of kookaburras will protect their territory from other kookaburras. <p>9 Classify each of the following interactions between organisms as predation, parasitism, mutualism, commensalism, or competition.</p> <ol style="list-style-type: none"> a) Barnacles on mangrove roots = Commensalism. b) Kookaburra eating a worm = Predation. c) Wedge-tailed eagles nest in trees = Commensalism. d) Protozoans eating wood inside a termite = Mutualism (protozoan-termite relationship). e) Cattle eating grass = Predation.
<p>p71</p>	<ol style="list-style-type: none"> 1 Births affect population size by increasing the population size. 2 Deaths affect population size by decreasing the population size. 3 Immigration affects population size by increasing population size. 4 Emigration affects population size by decreasing population size. 5 Indicate four ways in which population size can be calculated. <ul style="list-style-type: none"> • The entire population may be counted. • A part of the population may be counted and the population size then estimated. • Animal droppings or nests may be counted and then the population estimated. • Organisms may be captured, marked, released, and then recaptured. 6 Exponential population growth can happen when there are plenty of available resources. Why would it be expected that the population growth would eventually stop or collapse? The population size will continue to increase until the population is not sustained by the available resources and may even exhaust the resources. The population growth will then stop or even collapse. 7 Seasonal changes can affect populations in many ways. In winter, there is less light and lower temperatures, reducing the amount of available food. Also, some animals will migrate out of the ecosystem. Population numbers tend to reduce in winter through death and emigration. In summer, numbers will tend to increase as available food and suitable habitat increases with increased warmth and light. Numbers are increased through birth and immigration. 8 Destruction of habitat can make a habitat unable to sustain an organism. The destruction will have removed food, shelter, and other assets. Population numbers will decrease through death and emigration. 9 Introduced species can reduce the population of some organisms. Competition may reduce the amount of available food, light, habitat, or other assets. An introduced species may also alter the current predator-prey balance. Population sizes can be reduced by death and emigration. 10 Disease can have severe effects on population numbers and can even lead to extinction. The pathogen, chlamydia, is causing conjunctivitis, pneumonia, urinary tract infection, and reproductive tract infections in Koalas. It is believed that the disease, with other factors such as habitat destruction and the introduction of species such as dogs and cats, is causing a decline in Koala numbers. 11 A tool such as a quadrat is often used to collect a sample count. A quadrat can be a square or a circle. The sample count is then used to estimate the population of the whole habitat or the whole study area. Quadrats are suitable for sampling plants, some aquatic organisms, and slow-moving animals (such as insects).

p71

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Total =	76
Average =	$32 \div 3$
Av =	10.7 per quadrat

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= 1m^2
Study area = $10\text{m} \times 10\text{m}$
= 100m^2
Thus multiply quadrat count by 100
Estimated no. limpets = 10.7×100
Estimated no. limpets = 1070

The study area is estimated to have 1070 limpets.

- 13 A 1m by 1m quadrat was used to collect five random insect counts (6, 12, 15, 8, 21) in a 5m by 8m study area. Estimate the total number of insects in the study area.

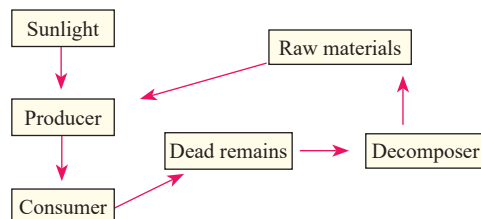
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Average =	$62 \div 5$
Av =	12.4 per quadrat

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= 1m^2
Study area = $5\text{m} \times 8\text{m}$
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Estimated no. insects = 496

The study area is estimated to have 496 insects.

p72

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p73

- 1** **1** The first step must be treasure-down.
The mass on the left is then $10\text{kg} + 25\text{kg} = 35\text{kg}$, the mass on the right is 10kg.
A difference of 25kg, this is OK because it isn't dangerous to the treasure.
- 2** T up, P down
This means Treasure back up ($10\text{kg} + 25\text{kg}$) and Princess down ($10\text{kg} + 40\text{kg}$)
- 3** Q down, P up
- 4** T down
- 5** T+Q up, K down
- 6** T down
- 7** T up, P down
- 8** Q down, P up
- 9** T down
- 10** T up, P down
- 11** T down
- 2** A solution
- $$\begin{array}{r} 38 \\ \underline{2} \times \\ 76 \\ \underline{14} + \\ 90 \end{array}$$
- 3** There are 24 cube faces.

- 1 Indicate some differences in the effects of a mild bushfire and the effects of a severe bushfire. **Mild** to moderate bushfires can burn a forest understory and remove small trees and groundcover plants. **Severe** bushfires can burn into the crowns of trees and damage large trees as well as severely burning the understory.
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p75

1 Population = $\frac{\text{sample} \times \text{total tagged}}{\text{tagged in sample}}$
 $= \frac{100 \times 50}{10}$
 $= 500$

c) There are about 500 snails.

2 b)

3 c)

p76

1 a) There is more oxygen in cold water.

b) On a hot day there would be more oxygen in a deep pool because the water would be cooler.

c) Colder water would sustain more freshwater animals through greater oxygen supply.

d) As the water heats up the oxygen is released into the atmosphere.

2 a) The oxygen decreases in the early morning before 6am because both plants and animals are respiring (using oxygen to produce energy). There is not enough light for the plants to photosynthesise and produce oxygen.

b) There are large amounts of light, plants are at maximum rates of photosynthesis and produce large amounts of oxygen.

3 a) Greatest rate of photosynthesis just after midday.

b) The rate of respiration, using oxygen to produce energy, is constant throughout the day.

c) The horizontal blue line represents the rate of respiration.

4 Graph B lags after graph A and represents the predator. The predator population is initially increasing while the herbivore population is decreasing - The predators have a plentiful supply of herbivores for food. Later the predator population sharply decreases when the herbivore population decreases to a point where there isn't sufficient food for the predators.

5 Generally, the higher up the foodchain the smaller the populations because the flow of energy sharply decreases from producers to higher order consumers. The shown energy pyramid shows a population of 1st order consumers with a smaller population of producers - This is very unlikely and would be expected to lead to a depletion of producers and a sharp decrease in 1st order consumers as their supply of energy decreases.