OXFORD

BIOLOGY

FOR QUEENSLAND

AN AUSTRALIAN PERSPECTIVE

UNITS
3 & 4

STUDENT WORKBOOK

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SAMPLE CHAPTER

UNCORRECTED PAGE PROOFS

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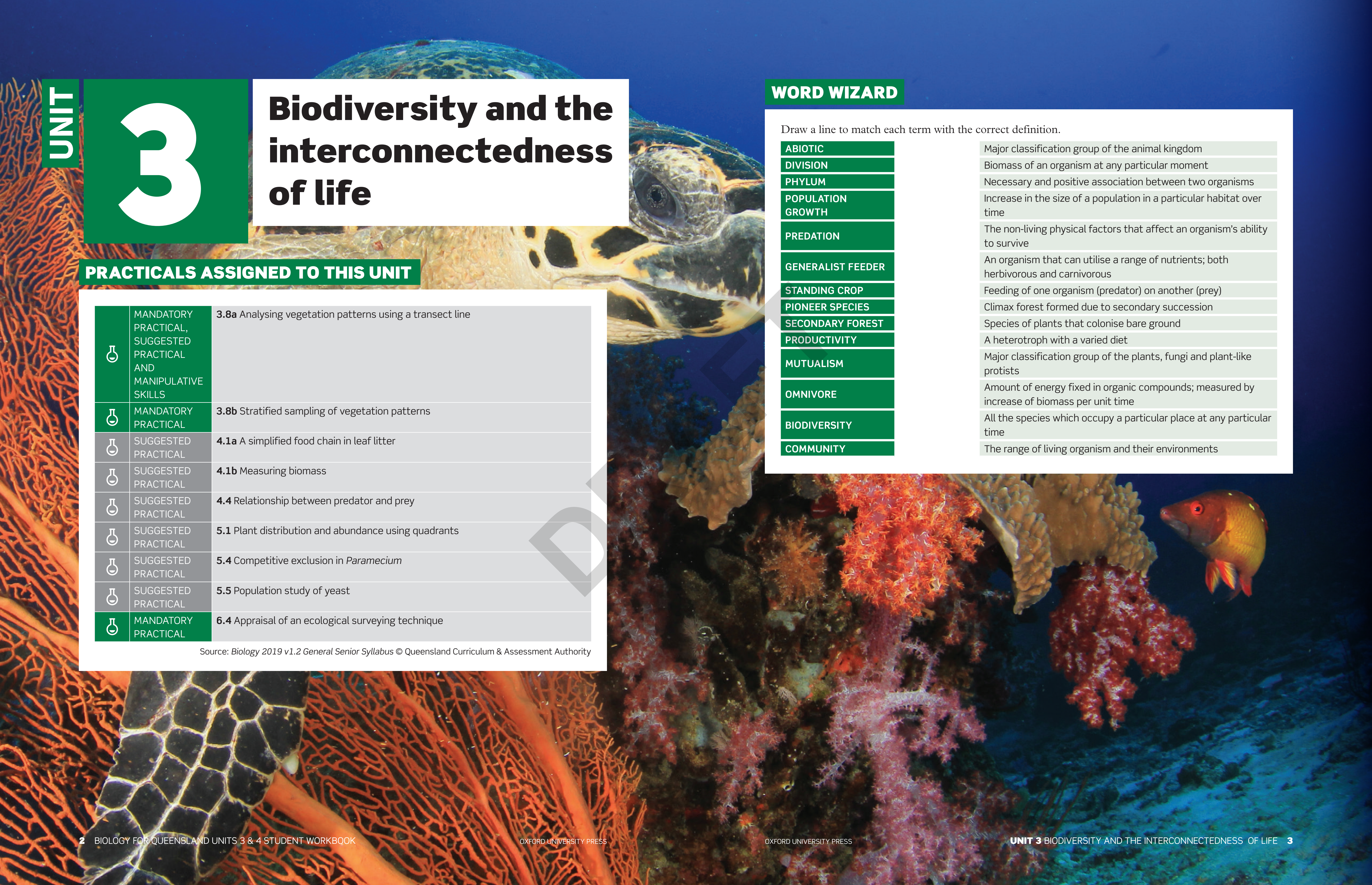

UNIT 3

Biodiversity and the interconnectedness of life

PRACTICALS ASSIGNED TO THIS UNIT

⚗	MANDATORY PRACTICAL, SUGGESTED PRACTICAL AND MANIPULATIVE SKILLS	**3.8a** Analysing vegetation patterns using a transect line
⚗	MANDATORY PRACTICAL	**3.8b** Stratified sampling of vegetation patterns
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⚗	SUGGESTED PRACTICAL	**5.4** Competitive exclusion in *Paramecium*
⚗	SUGGESTED PRACTICAL	**5.5** Population study of yeast
⚗	MANDATORY PRACTICAL	**6.4** Appraisal of an ecological surveying technique

Source: *Biology 2019 v1.2 General Senior Syllabus* © Queensland Curriculum & Assessment Authority

WORD WIZARD

Draw a line to match each term with the correct definition.

ABIOTIC	Major classification group of the animal kingdom
DIVISION	Biomass of an organism at any particular moment
PHYLUM	Necessary and positive association between two organisms
POPULATION GROWTH	Increase in the size of a population in a particular habitat over time
PREDATION	The non-living physical factors that affect an organism's ability to survive
GENERALIST FEEDER	An organism that can utilise a range of nutrients; both herbivorous and carnivorous
STANDING CROP	Feeding of one organism (predator) on another (prey)
PIONEER SPECIES	Climax forest formed due to secondary succession
SECONDARY FOREST	Species of plants that colonise bare ground
PRODUCTIVITY	A heterotroph with a varied diet
MUTUALISM	Major classification group of the plants, fungi and plant-like protists
OMNIVORE	Amount of energy fixed in organic compounds; measured by increase of biomass per unit time
BIODIVERSITY	All the species which occupy a particular place at any particular time
COMMUNITY	The range of living organism and their environments

CHAPTER

4 Functioning ecosystems

This chapter begins with a discussion of the transfer and transformation of solar energy into biomass as it flows through the biotic components of an ecosystem. The conversion of solar energy into chemical energy through photosynthesis highlights the role of the producers, the plants, in ecosystems. Food webs are used to represent that transfer of energy from the producers to the higher order consumers. It also highlights the role of the decomposers and detritivores.

Ecological pyramids are another method used to represent the number of organisms and the amount of biomass or energy at each trophic level. They are useful for making predictions about the health and future of an ecosystem.

Biogeochemical cycles describe the movement of elements through the biosphere as well as the multiple transformations and transfers they undergo. Elements are constantly exchanged between the environment and organisms. When in balance – that is, when the element is returned to the environment as rapidly as it is removed by living organisms – it is said to be a perfect cycle. This chapter explores water, oxygen, carbon and nitrogen cycles in depth.

Finally, the role of keystone species, umbrella species and flagship species – and the role of conservation groups who aim to protect them – are highlighted as a success story in humanity's pursuit to preserve functioning ecosystems.

CHAPTER CHECKLIST

Read this checklist before you complete this chapter's activities and then return to it to check your understanding before your assessments.

Once you have completed this chapter, you can use the 'I can …' statements to assess your understanding and rate yourself by ticking the appropriate box in the 'rating' column.

I can …	Confidently	Partially	Not really
… understand the different sources of energy in ecosystems			
… construct ecological pyramids			
… explain different biogeochemical cycles			
… define a keystone species			

DATA DRILL 4

Constructing ecological pyramids

The Daintree rainforest in far north Queensland is a biodiverse tropical ecosystem. Many species of birds, reptiles, mammals and invertebrates are found nowhere else in the world.

A study was undertaken in a small section of the Daintree rainforest: within a 1 km^2 area, the following organisms were counted.

Organism	Number	Average weight of each individual	Biomass
Flowering plants/trees	120	1000 kg	
Butterflies/moths	9000	5 g	
Insectivorous bats	400	25 g	
Snakes	5	1 kg	
Owls	1	1.5 kg	

1 a **Construct** a pyramid of organism numbers in the space below.

b **Calculate** the biomass of organisms in this food chain and add your calculations to the table above. Hint: Convert all units to the same when calculating biomass.

c **Construct** a pyramid of the biomass of the organisms in the space below.

EXPERIMENT EXPLORER 4

Troubleshooting an experiment

Detecting errors in an experiment are important when assessing the validity of the method, data, and subsequent conclusion. The scientific method has many in-built checks to make sure an experiment is valid, and these are continually assessed.

1 **Discuss** why each of the following guidelines of an experiment is necessary.

Guidelines	Why this is necessary
Use SI units only	
A hypothesis cannot change once the data are collected	
Where possible, take multiple samples or run multiple tests on the same sample	
Experiments should be repeatable under similar conditions	
Results should be presented on a table or graph	
Positive and negative controls should be used where possible in experiments	
Only change one variable at a time	

RESEARCH REVIEW 4

Reading abstracts

An abstract is a brief summary at the start of a scientific report that explains the aim, method and results of an investigation. This is valuable for other researchers to quickly determine whether reading the entire report would be useful for their current studies.

Consider the following abstract:

Reduced pesticide use increases the abundance of invertebrate predators in a monoculture cropping system.

Author: Dr A, Dr B and Dr C

Publication: *Nature Science* January 2020

Abstract: The extensive use of pesticides has vastly decreased the numbers of invertebrates present in monoculture crops. Cotton, corn and soybean crops are regularly afflicted with aphid infestations (corn aphids on corn, cotton aphids on cotton and so on). Our study follows 12 sites that have reduced or halted use of pesticides from 2015 to 2019 (six corn crops, two cotton crops and four soybean crops). Initially there was an increase in the abundance of the different pest aphid species. This has seen a marked increase in the number of arthropod predators, mostly ladybirds, spiders and lacewings. The numbers of aphids decreased dramatically, and is now at manageable levels, with little damage and little loss of yield.

1 **Summarise** the main points in the abstract.

-
-
-
-

2 Assume a 10% biomass transfer between trophic levels. **Construct** a biomass pyramid between the cotton crop, cotton aphids and ladybirds, with the cotton aphids' mass at 150 kg.

EXAM EXCELLENCE 4

Multiple choice – circle the correct answer

1 Identify the type of energy in ecosystem food webs sourced from photosynthesis in plants.

- **A** Solar energy
- **B** Chemical energy
- **C** Heat energy
- **D** Nuclear energy

2 On a food chain and food web, arrows are used to represent relationships between organisms. Which of the following is true?

- **A** Arrows are used to show which organism consumes which, e.g. frog → fly.
- **B** Arrows are used to show the movement of energy through a food web, e.g. fly → frog.
- **C** Arrows are used to show which organisms are decomposers.
- **D** All arrows originate at the decomposers.

3 Which of the following is true for the pyramid by numbers to the right?

- **A** The primary producer is very large.
- **B** There are no tertiary consumers in this ecosystem.
- **C** The primary producer is most likely grasses.
- **D** This is most likely a desert ecosystem

4 Which of the following is **not** a role of bacteria in the nitrogen cycle?

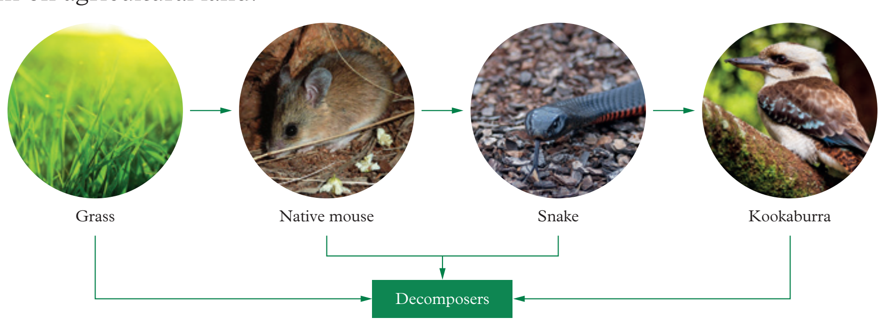
- **A** Converting free nitrogen (N_2) into nitrates (NO_3)
- **B** Removing oxygen (O_2) from nitrates (NO_3)
- **C** Converting ammonia (NH_3) into nitrites (NO_2)
- **D** Converting free nitrogen (N_2) into ammonia (NH_3)

5 A campaign to make the bilby Australia's alternative to the Easter bunny (Easter bilby) helps to raise funds and awareness for its conservation. What kind of category does this species represent?

- **A** Keystone species
- **B** Umbrella species
- **C** Flagship species
- **D** Predatory species

Short answer

6 In the food chain below, the population of native mice declines rapidly due to a nearby baiting program on agricultural land.



Note: The direction of the arrows indicates

a **Determine** what effect a decline in the native mouse population would have on the grasses.

____

____

b **Determine** what effect a decline in the native mouse population would have on the snake population.

____

____

7 On a coral reef, there are 1 000 000 free-swimming multicellular algae. They are autotrophs and gain their energy from the sun via photosynthesis. For every 10 000 units of energy they gain, 2500 are used for growth and repair, and 7500 are lost as heat. The total weight of the algae in this area is 500 kg.

50 000 zooplankton graze on the algae. They weigh 0.5 g each. Of the 500 units of energy they consume, only 100 are used in growing, and the rest is lost as heat. A school of 100 fish feed on the zooplankton. They consume 10 units of energy, 5 of which are lost as heat. The fish weigh 50 g each. An octopus that lives in the coral reef weighs 1 kg. It feeds on the fish in the area. Of the 2 units of energy it consumes, 1 is lost as heat and the other is used on growing.

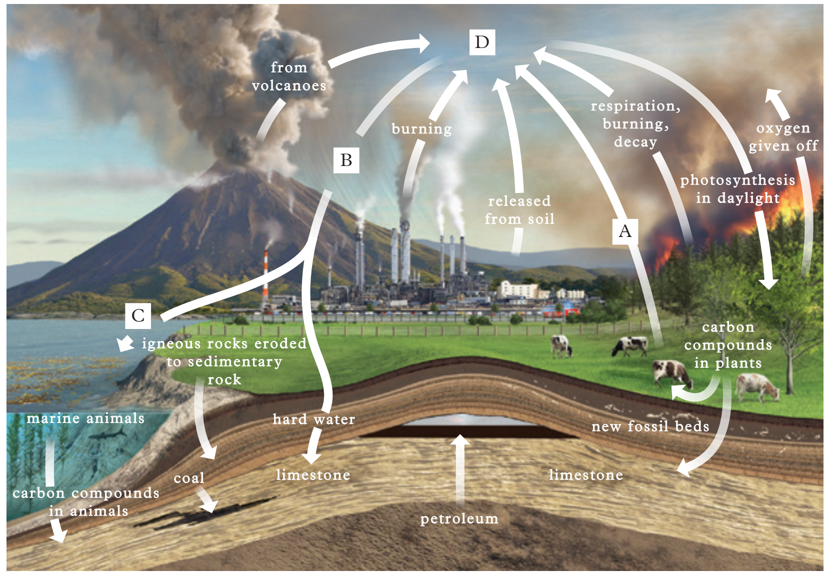
In the space below, **sketch** the:

a pyramid by numbers **b** biomass pyramid **c** energy pyramid.

8 Macronutrients cycling through ecosystems have two phases, a reservoir pool and a cycling pool. **Organise** the information below by drawing lines to connect the nutrients with their reservoir and cycling pools.

Reservoir pool	Nutrients	Cycling pool
Metallic compounds	Water	Photosynthetic – respiration
Deep-sea sediments	Oxygen	Nitrogen fixation – denitrification
Phosphate rock; deep-sea sediments	Carbon	Erosion – uptake – phosphating
Artesian; glacier; polar ice caps	Nitrogen	Respiration – photosynthesis
Fossils; peat; coal; oil and gas; trees	Phosphorus	Transpiration – evaporation – precipitation – uptake

9 Review the diagram of the carbon cycle below. **Determine** the missing items at points A–D:



A ______________________

____

B ______________________

____

C ______________________

____

D ______________________

____

10 The southern cassowary, flying fox and northern quoll are considered keystone species in their ecosystems.

a **Define** the term keystone species. ______________________

____

____

b In the space below, **explain** what makes each species a keystone species.

Southern cassowary	Flying fox

UNIT 3 ASSESSMENT

Biodiversity and the interconnectedness of life

Throughout the chapters, you have practised analysing and recording data, conducting research and modifying an experiment.

In this section, you will compete one of each of the following internal assessments:

- the Data test (10%)
- the Student experiment (20%)
- the Research investigation (20%; assessed in Unit 4)

Unit 3 Data test

Dataset 1

A survey of the brown antechinus, *Antechinus stuartii*, was undertaken in the rainforest of Mt Glorious (south-east Queensland) over a period of 6 months. Two hundred traps were randomly placed in a 1 km^2 quadrat on the first weekend of each month. All new captured individuals were marked with a spot of waterproof, non-toxic paint on the back of the neck at each trapping. The experimenters recorded the gender and weight of each individual caught. The population size (N) after each trapping was calculated using the Lincoln Index

$$N = \frac{M \times n}{m}$$

where M = number of individuals marked

n = total number of individuals captured at that time

m = number of recaptured (marked) individuals.

The results of the study are shown below.

TABLE 1 Number of *Antechinus stuartii* captured over a 6-month period at Mt Glorious

	June	July		August		September		October		November	
		M		M		M		M		M	
Males											
Mean weight (g)	40		45		60		65		35		-
New	20		15		10		2		1		0
No. individuals marked (M)		20		35		45		47		48	
Recaptured (m)			10		20		25		0		0
Total caught (n)	20		25		30		27		1		0
Females											
Mean weight (g)	30		35		35		35		35		35
New	15		10		15		10		5		6*
No. individuals marked (M)		15		25		40		50		55	
Recaptured (m)			10		10		15		30		35*
Total caught (n)	15		20		25		25		35		41*
N males			50		52				0		0
N females			30		62				58		64
N total			79		66				120		120

*All females with young in pouch.

Item 1 (apply understanding)

- Calculate the population density for September of:

3 marks

a males

b females

c total individuals.

Item 2 (interpret evidence)

- Using the data, draw conclusions about this population.

2 marks

Item 3 (interpret evidence)

- Infer the proportion of males and females present if trapping was performed in the following March.

2 marks

Dataset 2

A study was made of the distribution of bell miners, *Manorina melanophrys*, around Enoggera Reservoir (in south-east Queensland). These are aggressive birds that actively drive other birds out of their area. They feed on lerp, a sugary protective casing deposited by the sap-sucking psyllid insect, *Cardiaspina fiscella*. Both of the dominant eucalypts in the area (*E. propinqua* and *E. drepanophylla*) harbour psyllids. In order to look at factors that could influence the distribution of the bell miner, 100 m × 5 m transect surveys were conducted through vegetation typical of that in which bell miners were and were not present. Both areas had the same soil type and were the same distance from the edge of the reservoir. Grasses and herbs were found throughout both transect lines. Two measures were made of the percentage of foliage cover – one by measuring the diameter of the canopy (as plotted on the diagrams below) and the other by using a cross-wire tube and recording the number of foliage sites of the trees as a percentage of the total number of observation sites.

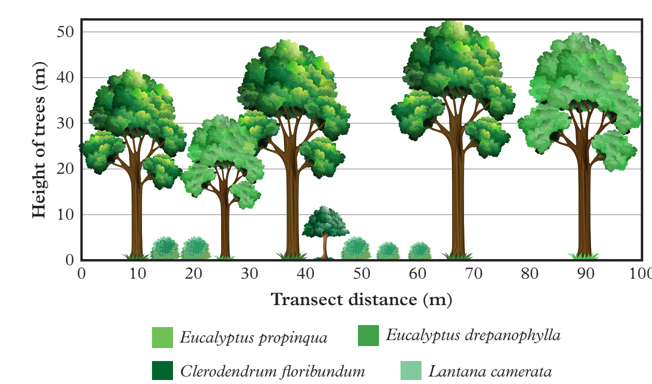


FIGURE 1 Transect A – bell miners present

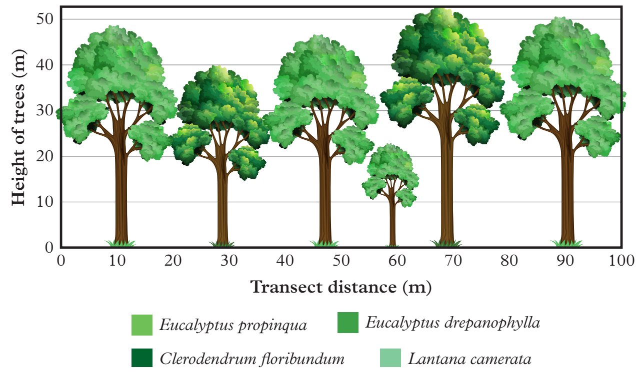


FIGURE 2 Transect B – bell miners absent

TABLE 2 Cross-wire tube recordings

Distance from start of transect (m)	Transect A	Transect B
10	Leaves	Leaves
20	Sky	Sky
30	Leaves	Leaves
40	Leaves	Sky
50	Sky	Leaves
60	Sky	Leaves
70	Sky	Sky
80	Leaves	Leaves
90	Sky	Leaves
100	Leaves	Leaves

Item 4 (applying understanding)

- Determine the percentage of foliage cover for each transect using both methods.

1 mark

Item 5 (applying understanding)

- Recognise the type of trees present and determine which of the two methods for calculating percentage of foliage cover is more reliable.

2 marks

Item 6 (analyse evidence)

- Using Specht's structural classification of Australian vegetation, classify the vegetation in each transect.

1 mark

TABLE 3 Specht's structural classification of Australian vegetation

Growth form of tallest stratum	Foliage cover by the tallest stratum			
	>70%	30–70%	10–30%	<10%
Tall trees (>30 m)	Tall closed forest	Tall open forest	Tall woodland	
Medium trees (10–30 m)	Closed forest	Open forest	Woodland	Open woodland
Low trees (<10 m)	Low closed forest	Low open forest	Low woodland	Low open woodland
Tall shrubs (>2 m)	Closed scrub	Open scrub	Tall shrubland	Tall open shrubland
Low shrubs (<2 m)	Closed heath	Open heath	Low shrubland	Low open shrubland
Hummock grasses			Hummock grassland	
Tufted/tussock grasses	Closed tussock grassland	Tussock grassland	Open tussock grassland	Dense open grassland
Graminoids	Closed sedgeland	Sedgeland	Open sedgeland	
Other herbaceous species	Dense sown pasture	Sown pasture	Open herb field	Sparse open herb field

Item 7 (interpret evidence)

- Compare the vegetation of the two transects.

3 marks

Item 8 (interpret evidence)

- Deduce the distribution of bell miners around Enoggera Reservoir.

1 mark

Dataset 3

An energy flow model of a food web in a lawn ecosystem was constructed as shown below.

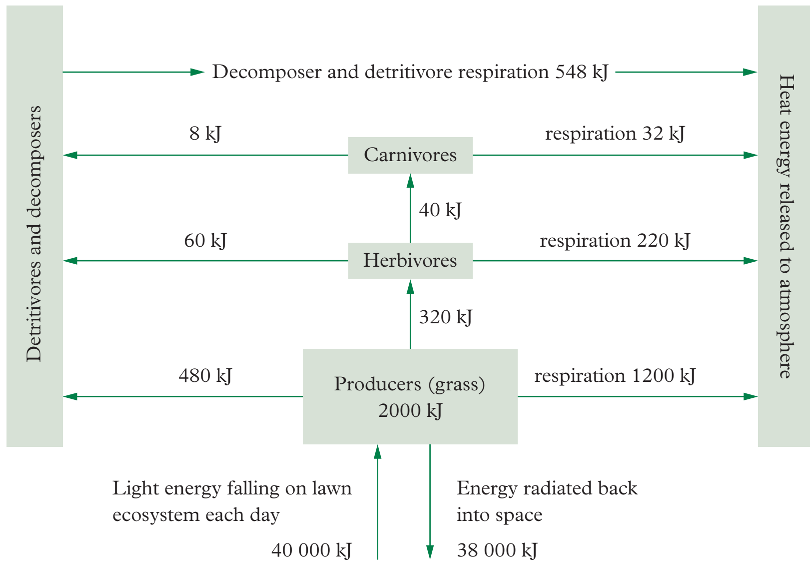


FIGURE 3 Energy flow model of a food web in a lawn ecosystem

Item 9 (interpret evidence)

- Compare, with reasons, the percentage heat loss by producers and carnivores.

4 marks

Item 10 (apply understanding)

- Calculate the percentage of solar energy converted to chemical energy that is passed on to detritivores and decomposers during photosynthesis.

1 mark

Unit 3 Student experiment

Your task is to modify the following experiment. Please note that you must conduct a risk assessment before conducting this experiment. See page X. This is a requirement of the student experiment.

4.1B Measuring biomass

CAUTION: HEATING DEVICES CAN CAUSE BURNS – HANDLE WITH CARE.

Aim

To compare and contrast the wet and dry biomass of several samples of producers

Materials

- Five 27 × 35 cm snap seal plastic bags
- Digital scales
- Oven
- Paper
- Desiccator containing a drying agent (e.g. blue silica gel)
- Baking paper

Method

1. Completely fill each bag with green leaves from five different types of plant, immediately sealing the bag once it is full. Label each bag with the plant name and the number of plants from which the material was collected (e.g. with short grasses it may take 20 plants to fill the bag but only a couple for taller grasses or one plant if it is a tree or shrub).
2. Weigh and record each sample.
3. Compare the wet biomass (before drying) with the number of plants from which the leaves were collected. (This is a rough comparison only since it is unlikely that leaves from a shrub or tree would fit into one bag.) Also compare the wet biomass of the same volume for the different types of species present.
4. Carefully measure 10 g of material from each plant and place it onto individual pieces of paper. Spread the material out as much as possible. Label each with the plant name.
5. Place the plant material in an oven at 105°C on baking paper for approximately 24 hours. When the leaves are completely dry but not charred, remove them from the oven and place in a desiccator to cool to room temperature. Reweigh each sample. Record the weight.
6. Calculate the weight of the water (wet weight or 10 g minus dry weight) and percentage of water (weight of water divided by the fresh weight × 100) in each sample.
7. Compare the dry biomass of the different species.

Results

Plant	Wet biomass (A) in grams	Number of plants (B)	Dried biomass/10 grams wet biomass (C)	Mass of water in leaves (10 – C) in grams	Percentage of water in plant (10 – C)/C × 100
Correa sp.	252	5	7.6/10	2.4	3.1%
Anigozanthos sp.	512	1	6.5/10	3.5	54%
Eucalyptus sp.	458	1	6.8/10	3.2	47%
Lomandra sp.	1013	8	7.9/10	2.1	27%
Banksia sp.	1124	2	5.8/10	4.2	72%
Acacia sp.	882	1	7.0/10	3.0	43%

Modification of the original experiment

Note: This section provides prompts for your modification. You may require extra space to write your full practice assessment.

Aim

Research question

Background research

Methodology

Results

Discussion/rationale

Risk assessment

Student's name: ______________________________

Experiment: ______________________________

Note: Risks should be managed by use of personal protective equipment and/or specified control measures. Always consult your teacher before conducting an experiment.

Equipment required

____

____

____

____

____

____

____

____

____

Hazardous chemicals required/produced

Reactant or product name and concentration	GHS classification	GHS hazard statement	Control measures

Non-hazardous substances

Other hazards and possible risks

Protective measures

Lab coat	Safety glasses	Gloves	Fume cupboard	Other

Clean up and disposal of wastes

Teacher's signature: ______________________________

Student's signature: ______________________________

Date: ____________________

* This assessment is not valid until it has been completed and signed by your teacher.

Unit 3 Research investigation

Note: The Research Investigation Internal Assessment (IA3) is completed in Unit 4 and covers content from Unit 4. There is no assessable Research investigation during Unit 3. This Research investigation has been included to practice skills required for the Unit 4 assessment.

CASE STUDY

Climate change: natural or not?

Evidence of climate change has been confirmed all over the world. Earth's average surface temperature has risen by 0.9°C since the late 1800s, with records for highest temperatures being broken every year. Oceans absorb much of this extra heat, leading to an increase in the water temperature by 0.2°C. Ice sheets in Greenland and Antarctica have decreased in mass by 400 billion tonnes since 1993. This, combined with the increased water temperature, has seen sea levels rise by 20 cm in the last century. The acidity of the ocean's surface has increased by about 30%, leading to coral bleaching. Climate change has been linked to an increase in levels of carbon dioxide, methane and other heat-trapping greenhouse gases.

Nations around the world are responding to climate change through two processes: mitigation and adaptation.

Mitigation involves reducing those factors that have been shown to cause climate change. It is an attempt to slow down and even halt the rapid rise of temperatures that we are seeing. Some forms of mitigation include planting trees to absorb carbon in the atmosphere, reducing the release of greenhouse gases, and switching to renewable energy wherever possible.

Adaptation relies on preparing civilisation to adjust to the future climate; this can be done by changing the agricultural and industrial practices we employ, how we process and use resources like water, and the way our cities are built. Most agricultural enterprises have some form of climate change policy available to help farmers adapt to climate change.

FIGURE 1 Greenhouse gases released from industry

Your task is to conduct a research investigation about the following claim which is related to the case study above:

> **Climate change is a natural cycle of planet Earth; in fact, Earth has gone through multiple warming and cooling periods. This is just another natural spike in temperature and is not caused by humans. Mitigation isn't necessary!**

Research question

Conduct research

Resource 1

Title:

Authors:

Source and credibility:

Publication date:

Aim:

Resource's research question:

Methodology

- What data were collected?

- How were the data collected?

Results

- Did the resource support your research question?

- Why does/doesn't it support the provided claim?

Resource 2

Title:

Authors:

Source and credibility:

Publication date:

Aim:

Resource's research question:

Methodology:

- What data were collected?

- How were the data collected?

Results

- Did the resource support your research question?

- Why does/doesn't it support the provided claim?

Planning your internal assessment

Note: This section provides space for you to summarise the key points of your research. You may require extra space to write your full practice assessment.

CHAPTER 16 Practical manual

The QCAA Biology General Senior Syllabus outlines a number of mandatory and suggested practicals for completion in Units 3 & 4. All practicals are included in this chapter.

Suggestions for methodology and materials have been supplied in this chapter. However, the following is not prescriptive; schools may complete mandatory or suggested practicals in any other form suited to their resources.

The experiments in this chapter have been trialled and cautions of obvious hazards given; however, it is the legal obligation of the individual teacher to carry out their own risk assessment prior to undertaking any practical activity.

If you are unsure of any procedures in the lab or need any clarification for a practical, consult your teacher and/or lab technician.

SAFETY IN THE LABORATORY

This chapter will highlight key safety concerns within each practical, but there are some general safety concerns to be considered before completing all practicals.

- Hair should be tied back.
- Do not eat or drink in the lab.
- Always be aware of your peers and act sensibly.
- Wear a lab coat, safety glasses, closed-toed shoes and gloves.
- Review the school's safety procedures and the location of eye wash, shower, spill kits and first aid kits.
- Handle all chemicals with care and consult your teacher and risk assessments for the hazards involved with each chemical.
- Keep open flames away from flammable materials.
- Handle hot materials with the appropriate equipment (i.e. heat-resistant gloves or tongs).
- Fieldwork should be completed in groups with a full risk assessment completed prior to the trip.

4.1A A simplified food chain in leaf litter

Study the abundance of each trophic level in a simple food chain.

Source: *Biology 2019 v1.2 General Senior Syllabus* © Queensland Curriculum & Assessment Authority

Aims

1 To collect and identify leaf litter organisms
2 To determine a simple food chain from the collected organisms
3 To determine the abundance of autotrophs, herbivores and carnivores in the selected food chain

Materials

- Four 25 × 25 cm quadrants (students can use straws and tape or sticks in the field)
- Garden gloves
- Four large zip-lock bags
- Light source
- Four Berlese-Tullgren funnels
- Four 500 mL collection jars
- Large sheet of paper
- Four Petri dishes
- Forceps and fine brush
- Sheet of photographs of common animals

Method

1 Select an area of undisturbed leaf litter 10 m × 10 m.
2 Four students, with backs facing this area, are to throw the quadrats into the sampling area. This will give a total sample size of 100 cm × 100 cm.
3 With gardening gloves on (spiders and centipedes may be present in the litter), carefully place all the litter within the quadrat into a plastic bag and seal it.
4 In the laboratory set up the Berlese-Tullgren funnels and light sources on the side benches where they will not be disturbed. Half-fill each collecting jar with preserving alcohol.
5 Leave the equipment set up for 24 hours to allow extraction of all litter organisms.
6 Turn off the light and spread the leaf litter from each sample separately onto a large sheet of paper. Count and record the number of

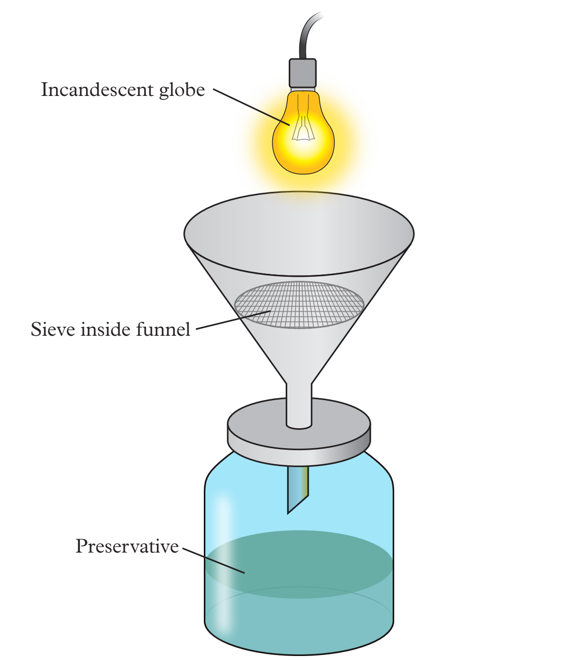


FIGURE 1 A modified Berlese-Tullgren funnel set up for litter extraction: A known volume of soil or litter is placed on the sieve in the funnel. When the light above the funnel is switched on, the organisms move downwards to avoid the light, heat and drying effects of the globe. In doing so, they fall into the jar containing preservative.

leaves present in the sample in Table 1. If any animals have died from dehydration before moving through the funnel, add these to the animal counts.

7 Decant off extra preservative from the collection beaker. Transfer the litter animals to a Petri dish.
8 Using the forceps or paint brush, carefully separate each type of animal into a group – ants in one group, centipedes into another group and so on. Count and record the number of each type in Table 1.
9 Identify each type of organism to genus level (http://anic.ento.csiro.au/insectfamilies/)
10 Research the food requirements of each organism (leaf eater, eats ants, eats slaters, etc.)
11 Discard any animals that do not form a simple food chain from the surveyed organisms (e.g. fungal eaters or bacterial eaters). Choose a maximum of five organisms.

TABLE 1 Organisms count in leaf litter

Organism	Count	Food requirements	Abundance (per 1 m^2)
Leaves			

Results

1 Draw the food chain.

2 Combine the scores of the selected organisms for the food chain and multiply by 1. This gives the total abundance per 1 m^2. Now divide the count of each organism by total abundance and multiply by 100 to calculate the percentage abundance of each organism. Record your results in Table 1.
3 Draw a pyramid of numbers for the food web.

Discussion

Write a discussion of your results including the following points:

- Describe the limitations of the method of collecting data.
- Name any difficulties encountered in constructing a food chain.
- Describe and explain the shape of the pyramid of numbers.
- From the data collected, is this a complete food chain? Justify the response.
- Suggest any impact on the food chain if the area had been regularly sprayed for weeds.
- Suggest possible improvements for collecting data.

Conclusion

Write a brief summary of your findings.

4.1B Measuring biomass

Measure the wet biomass of producer samples.

Source: *Biology 2019 v1.2 General Senior Syllabus* © Queensland Curriculum & Assessment Authority

Aim

To compare and contrast the wet and dry biomass of several samples of producers

Materials

- Five 25 × 35 cm snap seal plastic bags
- Digital scales
- Paper
- Oven
- Desiccator containing a drying agent (e.g. blue silica gel)
- Baking paper

Method

1. Completely fill each bag with green leaves from five different types of plant, immediately sealing the bag once it is full. Label each bag with the plant name and the number of plants from which the material was collected (e.g. with short grasses it may take 20 plants to fill the bag, but only a couple for taller grasses or one plant if it is a tree or shrub).
2. Weigh and record each sample in Table 1.
3. Compare the wet biomass (before drying) with the number of plants from which the leaves were collected. (This is a rough comparison only since it is unlikely that all the leaves from a shrub or tree would fit into one bag.) Also compare the wet biomass of the same volume for the different types of species present.
4. Carefully measure 10 g of material from each sample and place it onto individual pieces of paper. Spread the material out as much as possible. Label each with the plant name.
5. Place the plant material in an oven at 105°C on baking paper for approximately 24 hours. When the leaves are completely dry but not charred, remove them from the oven and place in a desiccator to cool to room temperature. Reweigh each sample. Record the weight in Table 1.
6. Calculate the weight of the water (wet weight minus dry weight) and percentage of water (weight of water ÷ wet weight × 100) in each sample.

7. Compare the dry biomass of the different species.

Results

TABLE 1 Samples and their biomass

Plant	Wet biomass (A) in grams	Number of plants (B)	Dried biomass	Mass of water in leaves (10 g wet biomass – C)	Percentage of water in plant (Mass of water / A) × 100

Discussion

Write a discussion of your results including the following points:

- Why is it important to know biomass of an organism in an area?
- Why should dry weight rather than wet weight be used to determine biomass?
- What is the relationship between biomass and productivity?
- How can this experiment be improved?
- Suggest a possible technique for determining biomass of small invertebrates (e.g. the number of ants or earthworms found in a 1 m^3 of soil).

Conclusion

Write a brief summary of your findings.