Ecosystems

Year 9

Learning area: Science

Science Understanding (sub-strand):   
Biological sciences

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**Comments and inquiries on this document should be addressed to:**

Great Barrier Reef Marine Park Authority

2-68 Flinders Street   
PO Box 1379   
TOWNSVILLE QLD 4810   
Australia   
Phone: (07) 4750 0700   
Fax: (07) 4772 6093   
info@gbrmpa.gov.au

<http://www.gbrmpa.gov.au>

Ecosystems — Year 9

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# Unit overview

| Unit title | Ecosystems |
| --- | --- |
| Learning Area | Science |
| Science Understanding (sub-strand) | Biological sciences |
| Year level | 9 |
| Duration | Approximately six weeks\*  *based on 2 – 3 lessons of science per week for Year 9 (50 minutes per lesson)*  *\*This mini unit provides a Great Barrier Reef perspective to the understanding of ecosystems and aspects of Science as a Human Endeavour. An alternative to teaching this unit is to incorporate lessons into pre-existing Year 9 units.* |
| Unit description | In this mini unit, students will investigate starch production in leaves and understand how plants use the sunlight energy to produce food. Students will explore energy flow in food webs within ecosystems. Students will identify the biotic and abiotic components of ecosystems and understand how these interact and relate to energy flow. Students will investigate how changing abiotic factors impact ecosystems and understand how natural and human events also impact ecosystems. |

# Teacher information

## Safety and risk management

You will need to identify safety issues and conduct your own curriculum activity risk assessments for all activities and excursions in this mini unit.

For advice and documents, please refer to the Department of Education and Training Curriculum Activity Risk Assessment Guidelines*:* <http://education.qld.gov.au/health/safety/hazards/curriculum-activities.html>

The actual risk level for activities in this mini unit will vary according to the specific circumstances of the activity, and your school and classroom context. You must consider all specific circumstances when you complete a risk assessment. Examples of considerations include, but are not limited to:

* Is the activity occurring within, or outside school grounds e.g. an excursion?
* How will students be supervised during the activity?
* What will students do during the activity?
* Are there any special student considerations e.g. medical, behavioural or special needs?
* What hazards do you need to take into account e.g. hazardous substances – flammable liquids? Hazards relating to tools or equipment?

## Unit details

The Great Barrier Reef Marine Park Authority (GBRMPA) Ecosystems mini unit is a Year 9 Science unit of work. The content descriptors for this mini unit are from the Australian Curriculum: Science (Version 7.4 dated 30th March 2015 <http://www.australiancurriculum.edu.au>).

The mini unit follows the inquiry-based 5Es approach to teaching science. The inquiry questions that underpin the mini unit are:

* What makes an ecosystem?
* How do energy flows through an ecosystem maintain the sustainability of the system?
* What happens when components of an ecosystem are changed?
* Are there far-reaching effects of changes in ecosystems? What kind of scale might you measure this in?
* How are scientific models used to track and predict these effects?

## Time allocation

The mini unit is based on 2 - 3 lessons of science per week for Year 9 students. Each lesson is approximately 50 minutes long, with some lessons requiring more time to allow further depth of study e.g. Internet research, or time for excursions.

The overall mini unit, or the individual lessons, can be extended or shortened to cater for individual classes as deemed necessary by the class teacher.

## Unit aims

The lessons are structured to build students’ knowledge of the components of ecosystems to gain an in-depth understanding of the energy flow through ecosystems and how this can be affected by both nature and humans. The health of ecosystems is vital to the overall sustainability of biodiversity around the globe.

Understanding the flow of energy through ecosystems and how changes to this energy flow can impact the biodiversity of specific ecosystems, such as the Great Barrier Reef, will build students’ environmental knowledge and encourage their understanding of sustainability and stewardship.

For more information on ecosystems and the Great Barrier Reef, see the section ‘Background information – ecosystems’ and also <http://www.gbrmpa.gov.au>.

Key threats to the Reef

GBRMPA encourages teachers, students and communities to follow the main aim of Reef Guardians – to be custodians of their local ecosystems and stewards of the Reef. In the Great Barrier Reef Outlook Report 2014, the key threats to the Reef are identified as climate change; land-based run-off; coastal development; and other direct impacts such as unsustainable fishing activities and marine debris. (See <http://www.gbrmpa.gov.au> for more information on the Outlook Report 2014).

In this mini unit, students will explore the threat of catchment run-off.

## Stewardship

The Reef Guardian Schools Program encourages responsible use and protection of the Great Barrier Reef ecosystems. Schools are encouraged to take ownership of conservation activities and on-ground projects that involve students, teachers and their local communities. These environmental actions foster a greater appreciation and understanding of the Great Barrier Reef and empower students to become lifelong stewards.

The following are examples of stewardship activities that relate to the learning experiences of this unit:

* Engage students in activities where they learn how to use scientific equipment in the field. Consider inviting local experts e.g. via NRM (see the section ‘Building Partnerships’ for more ideas).
* Students measure the carbon storage of a local wetland or school forest. The following carbon calculator is one example you can use: <http://www.northsydney.nsw.gov.au/carbon/carbon.html>
* Can students improve the biotic factors in a local ecosystem e.g. plant endemic trees or remove weeds?
* Students create a physical or computer model of the local catchment that includes potential changes to the catchment if, for example, projected sea level rise (future scenario modelling).
* Students compare historical to current catchment maps. Use GIS or other software to produce maps to illustrate change in the next 50 years based on the current rate of change.
* Students choose a human impact on ecosystems not discussed in the unit and determine ways to have a positive effect on it.

## Citizen science participation

Citizen science is scientific research conducted by non-professionals – in this case by students, teachers and communities. Schools can participate in the collection and submission of scientific data to local management authorities including GBRMPA, local councils and local Natural Resource Management agencies where the data can be used to inform sustainable ecosystem management decisions.

Specific examples of citizen science participation are provided in the lesson plans of this mini unit which are found in the section ‘Teaching sequence’.

## Building partnerships

Delivery of this mini unit can be enhanced by building partnerships within the school and wider community.

Partner organisations could include the following:

* local council
* Local Marine Advisory Committees (LMAC)
* your nearest natural resource management organisation (NRM): <http://www.nrm.gov.au/regional/regional-nrm-organisations>
* conservation groups
* other schools
* Wetland Care Australia: <http://www.wetlandcare.com.au/index.php/>
* Queensland Parks and Wildlife Services:  
  <http://www.nprsr.qld.gov.au/contactus/regionalqpws.html>
* Department of Agriculture and Fisheries: https://www.daf.qld.gov.au/

Background information – ecosystems

### What is an ecosystem?

An ecosystem consists of all the interacting living elements (biotic) in an area together with the non-living elements (abiotic) of their environment. The Millennium Assessment Report (<http://www.millenniumassessment.org/en/index.html>) uses the definition *"An ecosystem is a dynamic complex of plant, animal and microorganism communities and the non-living environment interacting as a functional unit."*

### Great Barrier Reef ecosystem

The Great Barrier Reef can be compared to a large city with lots of diverse and interesting inhabitants. The Great Barrier Reef hosts communities of creatures who all work together in such a way to make the Reef a sustainable complex environment. As the world’s largest coral reef ecosystem, the Great Barrier Reef supports:

1625 species of fish, including 1400 coral reef species

More than 3000 species of molluscs (shells)

630 species of echinoderm (starfish, sea urchins)

14 breeding species of sea snakes

215 species of birds including 22 species of seabirds and 32 species of shorebirds

Six of the world's seven species of marine turtle

30 species of whales and dolphins

One of the world's most important dugong populations

133 species of sharks and rays

While coral reef communities initially made the Great Barrier Reef famous, the area also includes:

mangroves and estuaries

sandy and coral cays

continental Islands

seagrass beds

algae and sponge gardens

sandy and muddy seabed communities

continental slopes and deep ocean trenches.

### Importance of biodiversity in ecosystems

Biodiversity is a term used to describe the variety of life on Earth at all its levels, from genes to ecosystems, and the ecological and evolutionary processes that sustain it. Our world relies on biodiversity; from animals, plants and fungi, to the micro-organisms too small for the eye to see.

Loss of biodiversity has the potential to impact directly on the ecosystem itself, the industries that rely on a healthy ecosystem for their operations, and the social values of that ecosystem. More importantly, threats to biodiversity can impact not only the ecosystem we see, use and value today, but also the ecosystem that will be seen, used and valued by future generations.

Conserving biodiversity is an essential part of safeguarding the Earth's biological life systems. All living creatures depend on these life support systems for the necessities of life, and collectively these are described as ecosystem services. Maintenance of biodiversity is critical for the provision of these ecosystem services. Therefore, biodiversity is not just desirable, it is essential. By protecting biodiversity, we are protecting our future and our children’s future.

Useful websites

* Gulliver Media Australia – Living Landscape – An Australian Ecosystems Series:  
  <http://www.gullivermedia.com.au/resources-for-schools/for-schools.php>
* Reef vid – a resource of free coral reef video clips:  
  <http://www.reefvid.org/>
* EcoKids:  
  <http://www.ecokids.ca>
* Great Barrier Reef Marine Park Authority:  
  <http://www.gbrmpa.gov.au>
* Middle School Science:  
  <http://www.middleschoolscience.com>
* The Biology Corner:  
  http://[www.biologycorner.com](http://www.biologycorner.com)
* Visit the Reef: Eye on the reef:  
  <http://www.gbrmpa.gov.au/visit-the-reef/eye-on-the-reef/get-involved-with-eye-on-the-reef>

# Curriculum intent

## Australian Curriculum: Science

## Year 9 Level Description

The science inquiry skills and science as a human endeavour strands are described across a two-year band. In their planning, schools and teachers refer to the expectations outlined in the achievement standard and also to the content of the science understanding strand for the relevant year level to ensure that these two strands are addressed over the two-year period. The three strands of the curriculum are interrelated and their content is taught in an integrated way. The order and detail in which the content descriptions are organised into teaching and learning programs are decisions to be made by the teacher.

Over Years 7 to 10, students develop their understanding of microscopic and atomic structures, how systems at a range of scales are shaped by flows of energy and matter and interactions due to forces, and develop the ability to quantify changes and relative amounts.

In Year 9, students consider the operation of systems at a range of scales. They explore ways in which the human body as a system responds to its external environment and the interdependencies between biotic and abiotic components of ecosystems. They are introduced to the notion of the atom as a system of protons, electrons and neutrons, and how this system can change through nuclear decay. They learn that matter can be rearranged through chemical change and that these changes play an important role in many systems. They are introduced to the concept of the conservation of matter and begin to develop a more sophisticated view of energy transfer. They begin to apply their understanding of energy and forces to global systems such as continental movement.

Content descriptions

This unit provides opportunities for students to engage in the following Australian Curriculum Content descriptions:

| Science Understanding (SU) | Science as a Human Endeavour (SHE) | Science Inquiry Skills (SIS) |
| --- | --- | --- |
| Biological sciences   * Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems [(ACSSU176)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSSU176) | Nature and development of science   * Scientific understanding, including models and theories, is contestable and is refined over time through a process of review by the scientific community [(ACSHE157)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSHE157) | Questioning and predicting   * Formulate questions or hypotheses that can be investigated scientifically [(ACSIS164)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS164)   Planning and conducting   * Plan, select and use appropriate investigation types, including field work and laboratory experimentation, to collect reliable data; assess risk and address ethical issues associated with these methods [(ACSIS165)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS165) * Select and use appropriate equipment, including digital technologies, to collect and record data systematically and accurately [(ACSIS166)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS166)   Processing and analysing data and information   * Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies [(ACSIS169)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS169) * Use knowledge of scientific concepts to draw conclusions that are consistent with evidence [(ACSIS170)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS170)   Evaluating   * Evaluate conclusions, including identifying sources of uncertainty and possible alternative explanations, and describe specific ways to improve the quality of the data [(ACSIS171)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS171)   Communicating   * Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations [(ACSIS174)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS174) |

Year 9 achievement standard

By the end of Year 9, students explain chemical processes and natural radioactivity in terms of atoms and energy transfers and describe examples of important chemical reactions. They describe models of energy transfer and apply these to explain phenomena. They explain global features and events in terms of geological processes and timescales. They analyse how biological systems function and respond to external changes with reference to interdependencies, energy transfers and flows of matter. They describe social and technological factors that have influenced scientific developments and predict how future applications of science and technology may affect people’s lives.

Students design questions that can be investigated using a range of inquiry skills. They design methods that include the control and accurate measurement of variables and systematic collection of data and describe how they considered ethics and safety. They analyse trends in data, identify relationships between variables and reveal inconsistencies in results. They analyse their methods and the quality of their data, and explain specific actions to improve the quality of their evidence. They evaluate others’ methods and explanations from a scientific perspective and use appropriate language and representations when communicating their findings and ideas to specific audiences.

General capabilities

This mini unit provides opportunities to address the following organising elements of the general capabilities:

| Literacy   * Composing texts through speaking, writing and creating * Text knowledge * Grammar knowledge * Word knowledge * Visual knowledge | ICT capability   * Applying social and ethical protocols and practices when using ICT * Investigating with ICT * Managing and operating ICT |
| --- | --- |
| Numeracy   * Estimating and calculating with whole numbers * Recognising and using patterns and relationships * Using special reasoning * Using measurement | Critical and creative thinking   * Inquiring – identifying, exploring and organising information and ideas * Reflecting on thinking and processes * Analysing, synthesising and evaluating reasoning and procedures |
| Personal and social competence   * Self-awareness * Self-management * Social awareness * Social management | Ethical understanding   * Understand ethical concepts and issues * Reasoning in decision making and actions |
| Intercultural understanding   * Recognising culture and developing respect | |

Cross-curriculum priorities

This mini unit provides opportunities for students to address aspects of the following cross-curriculum priorities:

| Sustainability  Students will:   * understand that all life forms, including human life, are connected through ecosystems and depend on healthy ecosystems for their wellbeing and survival. |
| --- |

Relevant prior curriculum

Students require prior experience from Year 8 with:

### Science Understanding

#### Biological sciences

* Multi-cellular organisms contain systems of organs carrying out specialised functions that enable them to survive and reproduce [(ACSSU150)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSSU150)

### Science as a Human Endeavour

#### Nature and development of science

* Scientific knowledge has changed peoples’ understanding of the world and is refined as new evidence becomes available [(ACSHE134)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSHE134)

Curriculum working towards

The teaching and learning in this unit works towards the following in Year 10:

### Science Understanding

#### Biological sciences

* The theory of evolution by natural selection explains the diversity of living things and is supported by a range of scientific evidence [(ACSSU185)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSSU185)

### Science as a Human Endeavour

Nature and development of science

* Scientific understanding, including models and theories, is contestable and is refined over time through a process of review by the scientific community [(ACSHE191)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSHE191)

# Feedback

## Supportive learning environment

| Differentiation  Consider the individual needs of your students including gifted and talented, ESL and students requiring additional support.  For information, refer to the Australian Curriculum, Assessment and Reporting Authority (ACARA) web pages on student diversity:  <http://www.australiancurriculum.edu.au/studentdiversity/student-diversity-advice>  Further information for Queensland state schools can be found as part of the P-12 curriculum, assessment and reporting framework and associated resources:  <http://education.qld.gov.au/curriculum/framework/p-12/> | Feedback to students  Teachers:   * plan opportunities for conversations to provide ongoing feedback (spoken and written) and encouragement to students on their strengths and areas for improvement * reflect on and review learning opportunities to individualise learning experiences required * provide multiple opportunities for students to experience, practise and improve knowledge, processes and skills.   Students:   * identify what they can do well and what they need to improve * provide feedback to a peer on interaction skills and suggest some strategies for improvement (written and spoken feedback). |
| --- | --- |
| Reflection on the unit plan  At the conclusion of the unit, teachers can reflect on it for future planning by answering the following questions:   * What worked well in this unit? * What was a stumbling block? * How would you refine it? * What trends and gaps in learning have you identified? * How will you build on these learning experiences next term and beyond? | |

# Assessment

Assessment is the purposeful, systematic and ongoing collection of information as evidence for use in making judgements about student learning and to support improving student learning.

Monitoring student learning

Student learning should be monitored throughout the mini unit. Each lesson in this mini unit provides opportunities for monitoring learning and for gathering evidence of student progress. For examples of ways to monitor learning, refer to each of the lesson plans under the section ‘Teaching sequence’.

## Assessing student learning

| Summative assessment task: | Ecosystems – model and report (Lesson 11–14) |
| --- | --- |
| Description: | Students will create a visual representation that shows the impacts of an extreme weather event on the local environment (e.g. a poster, a 3D model, a simple animation or computer model). Students will write a report outlining the impacts of your chosen extreme weather event on your chosen local environment, making reference to the model. |
| This assessment task provides opportunities to gather evidence of student learning in: | Science Understanding Biological sciences  * Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems [(ACSSU176)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSSU176)   Science Inquiry Skills Communicating  * Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations [(ACSIS174)](http://www.australiancurriculum.edu.au/curriculum/contentdescription/ACSIS174) |

**See Resource section: Resource 8 for the Student task sheet and the Guide for making judgements for the assessment task: Ecosystems – model and report.**

# Sequencing teaching and learning

A suggested learning sequence for this unit is summarised below. For detailed information for each lesson in this sequence, go to the section ‘Teaching Sequence’.

| Inquiry phase | Lesson | Purpose |
| --- | --- | --- |
| Engage | **Lesson 1:** What is an ecosystem? | To capture interest and discover what students know and want to know about ecosystems, the components of ecosystems and how these comportments interact. |
| Explore | **Lesson 2:** What is photosynthesis? | To test for starch in the leaves of plants and identify if photosynthesis has taken place. |
| **Lesson 3:** How does energy flow through an ecosystem? | To explore energy flow from sunlight, to plants and through a food web in an ecosystem. |
| Explain | **Lesson 4:** What are biotic and abiotic components of ecosystems? | To identify and define the biotic and abiotic components in an ecosystem and link these to energy flow. |
| **Lesson 5 - 6:** Can you use models to predict change? | To recognise the abiotic and biotic components in catchment to reef ecosystems. To analyse a sedimentation model and predict potential impacts on the ecosystems involved including energy flow. To understand the benefits and uses of scientific models. |
| Elaborate | **Lesson 7 - 8:** What happens when things change? | To design, plan and conduct an experiment to investigate how changing abiotic factors can affect living things in an ecosystem. |
| **Lesson 9:** How can natural events impact ecosystems? | To analyse results and draw conclusions about the investigation into abiotic factors. To use a futures circle to understand the impacts of a natural event on an ecosystem. |
| **Lesson 10:** How do humans impact ecosystems? | To investigate how humans impact local ecosystems. To use a futures circle to understand the impacts of a human event on an ecosystem. |
| Evaluate | **Lesson 11 - 14:** Reflections and assessment task | To review and reflect on learning and introduce and complete the assessment task. |

**TOTAL: 14 Lessons *(50 minutes per lesson)***

# Making judgements

## Achievement standard

In this unit, assessment of student learning aligns to the following components of the Year 9 achievement standard:

By the end of Year 9, students explain chemical processes and natural radioactivity in terms of atoms and energy transfers and describe examples of important chemical reactions. They describe models of energy transfer and apply these to explain phenomena. They explain global features and events in terms of geological processes and timescales. They analyse how biological systems function and respond to external changes with reference to interdependencies, energy transfers and flows of matter. They describe social and technological factors that have influenced scientific developments and predict how future applications of science and technology may affect people’s lives.

Students design questions that can be investigated using a range of inquiry skills. They design methods that include the control and accurate measurement of variables and systematic collection of data and describe how they considered ethics and safety. They analyse trends in data, identify relationships between variables and reveal inconsistencies in results. They analyse their methods and the quality of their data, and explain specific actions to improve the quality of their evidence. They evaluate others’ methods and explanations from a scientific perspective and use appropriate language and representations when communicating their findings and ideas to specific audiences.

## Guide for making judgements

**See Resource section: Resource 8 for the Student task sheet and the Guide for making judgements for the assessment task: Ecosystems – model and report.**

# Teaching sequence

Engage

Explore

Explain

Elaborate

Evaluate

**Lesson 1:** What is an ecosystem?

**Duration:** 50 minutes

**Lesson objectives**Students will:

identify and communicate what they know and want to know about ecosystems, the components of ecosystems and how components interact.

Suggested learning sequence

**Introduction** – Brainstorm

1. Have a range of pictures of different ecosystems e.g. reef, wetlands, rainforest, desert, bushland, ocean or any other ecosystems in which you can use pictures to stimulate discussion (see **‘useful web links’** for ideas).
2. Use images in the 2012 Reef Beat –posters to generate discussion about reef ecosystems and biodiversity (see **‘useful web links’** for links to posters).
3. As a class, look at some of the different ecosystems in the images and ask students:

What they think an ecosystem is?

What an ecosystem is made up of?

What makes different ecosystems unique?

1. Brainstorm with students on what an ecosystem is, the components of ecosystems and how they all link together to make the ecosystem work.
2. Draw this brainstorm on the board for students to see as they come up with ideas.
3. As a class, use the brainstorming to create a definition of an ecosystem to use throughout the unit. Research in books and on the Internet if necessary. Display this definition in the classroom.
4. Identify questions students may have about ecosystems, record these questions and try to answer them as students progress throughout the unit.

**Activity** – Food web game

1. Explain to the students they are going to play a game to learn more about the components of ecosystems.
2. Follow the instructions in *Resource 3 – Food Web String Activity.* You may choose a specific ecosystem to represent the first time the students play the game so they understand what to do, and then they could choose themselves what they will be to make the game more complex.
3. Once the game is complete, identify as a class the importance of different parts of the ecosystem. Also discuss the interactions that can take place and those that cannot.
4. Discuss what would happen if a component of the ecosystem is impacted e.g.

If the water dried up or became so polluted the fish could not live there anymore what would happen?

If the fish could not survive, what food will be available for local animals and people who catch fish as a part of their job?

1. Reflect back to the definition of an ecosystem the students came up with in the first part of the lesson. Is it okay or do they want to change it? Do they need to add more to it?
2. Review with students the scientific vocabulary pertinent to this lesson (See *Resource 1– Word bank* for suggested terms).
3. Start a science journal with the students to record their learning and reflections after each science lesson. (See *Resource 2 – Student reflections* for examples of sentence starters you can use to guide student reflections).

Citizen Science participation

Students can learn about, study or take measurements of local ecosystems during this unit e.g. engaging in a water quality or biodiversity study.

 Science journal

A science journal is a record of observations, experiences and reflections. It contains a series of dated, chronological entries. It may include written text, drawings, labelled diagrams, photographs, tables and graphs. The science journal can be used as a part of student assessment.

Opportunities to monitor student learning

**Diagnostic assessment opportunities:**

Observe students’ responses during the lesson to determine their awareness and understanding of an ecosystem and its components.

Resources

Useful web links

Photos of different ecosystems e.g. from books, Internet or posters. For a list of terms to help search for types of ecosystems go to ‘Different types of ecosystems’:  
<http://www.ecosystem.org/types-of-ecosystems>

Gulliver Media Australia. Look at the image galleries associated with each video:  
<http://www.gullivermedia.com.au/resources-for-schools/for-schools.php>

Reef Beat posters 2012 – ‘Bursting with biodiversity’. All posters found at:  
<http://elibrary.gbrmpa.gov.au/jspui/handle/11017/2777>

ReefVid – a resource of free coral reef video clips:  
<http://www.reefvid.org/>

**Hint:** Access and pre-load video clips before the lesson so that you can play them immediately for students when required.

Great Barrier Reef Outlook Report 2014

Access the report at: <http://elibrary.gbrmpa.gov.au/jspui/handle/11017/2855>

Useful information for this lesson can be found on:

page 18: Figure 2.3: Major habitats of the Great Barrier Reef region

page 47: Figure 3.1: Major physical, chemical and ecological processes.

Great Barrier Reef Strategic Assessment Report 2014

Access the report at: <http://elibrary.gbrmpa.gov.au/jspui/handle/11017/2861>

Useful information for this lesson can be found at:

* chapter 4 - page 37 (4-37) - Figure 4.14: Key environmental processes of the Great Barrier Reef Region

Printable resources

*Resource 1 – Word bank*

*Resource 2 – Student reflections*

*Resource 3 – Food Web String Activity*

Engage

Explore

Explain

Elaborate

Evaluate

**Lesson 2:** What is photosynthesis?

**Duration:** 50 minutes

**Lesson objectives**Students will:

test for starch in the leaves of plants and identify if photosynthesis has taken place.

Suggested learning sequence

**Introduction** – Investigation set up

1. As a class, read *Resource 4 – Finding starch investigation.* Discuss the steps and identity the safety points in the procedure. Remind students to answer the questions provided in their journal as they progress through the investigation.
2. Ask students if they can explain what photosynthesis is and why it is so important. If students are unsure, ask them to use the experiment to try to work out what photosynthesis is.
3. Demonstrate to the class a starch test by testing a small sample of potato starch in a petri dish with iodine solution. Discuss the colour change and what it is demonstrating. Students will need to know this test before they begin the investigation.

**Activity** – Finding starch investigation

1. Complete the finding starch investigation and have students answer the questions. This will build students’ knowledge of energy flows through ecosystems.
2. Discuss the investigation and the results. You may wish to follow up with the starch animation that shows another version of this experiment (See **‘Useful Web links’** for the animation).
3. Review with students the scientific vocabulary pertinent to this lesson (See *Resource 1– Word bank* for suggested terms).
4. Students add their learning and reflections to their science journal. (See *Resource 2 – Student reflections* for examples of sentence starters you can use to guide student reflections).

Citizen Science participation

Students can study the photosynthetic processes in seawater e.g. phytoplankton.

Opportunities to monitor student learning

**Formative assessment opportunities:**

Use students’ answers to questions to identify their knowledge of plants.

Observe students to assess their developing science inquiry skills.

Resources

Useful web links

An animation of another version of this starch investigation can be viewed at Starch in leaf test:  
<http://www.footprints-science.com/index.php?module=1&type=Starch%20in%20leaf%20test&section=Section1&info=4>

Printable resources

*Resource 1 – Word bank*

*Resource 2 – Student reflections*

*Resource 4 – Finding starch investigation*

Great Barrier Reef Outlook Report 2014

Access the report at: <http://elibrary.gbrmpa.gov.au/jspui/handle/11017/2855>

Useful information for this lesson can be found on:

page 52: The effect of light and turbidity on photosynthesis.

Other resources

Equipment listed in *Resource 4 – Finding Starch Investigation*

Engage

Explore

Explain

Elaborate

Evaluate

**Lesson 3:** How does energy flow through an ecosystem?

**Duration:** 50 minutes

**Lesson objectives**Students will:

explore energy flow from sunlight to plants and through a food web in an ecosystem.

Suggested learning sequence

**Introduction** – Review

1. Discuss and review where plants get their energy from and where that energy goes.
2. Display a diagram like below and discuss with students what will go in the blanks:

Diagram - energy input and energy output

1. Discuss the diagram with students. Questions might include:

Is it the same for all plants?

What about humans or animals?

1. Ask students if they can draw a similar diagram of where humans get energy from and what the energy is used for.

**Activity** – Food webs

1. Tell students they are going to determine how energy flows through food webs in an ecosystem.

Show images or video clips of different food webs in ecosystems as stimulus (See **‘Useful Web links’** for links).

**Note:** You may decide to focus on a food web in specific ecosystems or view a range of different ecosystems depending on the needs of the class. You may also go outside and use the local school environment to identify food chains and food webs in local ecosystems.

1. Discuss with students the different parts of the food web in an ecosystem:

Identify the producers.

Identify the consumers (primary, secondary etc).

Are people producers or consumers?

What about decomposers?

Can a food web exist without the sun?

Can a food web exist without plants?

1. Explain how energy is flowing though the food web. Ask students to provide different examples of energy flow in the provided food web.
2. Ask students to draw a simple food web for a specific ecosystem. The class could do one together and then students do one each. Alternatively, students could do simple food chains for a certain ecosystem and these could be linked up to create a complex food web.
3. Ask students to identify the producers and consumers in their food web.
4. Ask students to identify energy flows through the food web of an ecosystem then share this with the class.
5. Discuss with students how energy ‘loss’ occurs in the food web. Is the food web sustainable?
6. Remind students of decomposition of animals and the role they play in the sustainability of food webs.
7. Review with students the scientific vocabulary pertinent to this lesson (See *Resource 1 – Word bank* for suggested terms).
8. Students add their learning and reflections to their science journal. (See *Resource 2 – Student reflections* for examples of sentence starters you can use to guide student reflections).

Opportunities to monitor student learning

**Formative assessment opportunities:**

Use students’ responses and food webs to assess their developing knowledge of energy flow in ecosystems.

Resources

Useful web links

Energy flow in food chains and food webs

The Food Chain: <https://www.youtube.com/watch?v=0ZOvqYypOuo>

The Food Web: <https://www.youtube.com/watch?v=MGODmyXkkPU>

How energy flows through a food chain that is part of an ecosystem:

Fabulous Food Chains: Crash Course Kids #7.1  
<https://www.youtube.com/watch?v=MuKs9o1s8h8>

Gulliver Media Australia. Each video explores an ecosystem in detail and the videos are accompanied by many images of animals and plants in each system:  
<http://www.gullivermedia.com.au/resources-for-schools/for-schools.php>

**Hint:** Access and pre-load video clips before the lesson so that you can play them immediately for students when required.

Printable resources

*Resource 1 – Word bank*

*Resource 2 – Student reflections*

Engage

Explore

Explain

Elaborate

Evaluate

**Lesson 4:** What are biotic and abiotic components of ecosystems?

**Duration:** 50 minutes

**Lesson objectives**Students will:

identify and define biotic and abiotic components in an ecosystem and link these to energy flow.

Suggested learning sequence

**Introduction –** Food webs review

1. Ask students to form pairs or groups to draw their own food web or review ones from the previous lesson.
2. Ask student groups to present to the class how the energy flows through food webs in an ecosystem.

**Activity** – biotic and abiotic

1. Explain to students that biotic means the living parts of an ecosystem.
2. Divide students into pairs or groups to choose an ecosystem they are familiar with.
3. Each group needs to identify the biotic components of their ecosystem, create a diagram/drawing to represent the ecosystem and label the biotic parts. This could be as simple as a lake, park, the school yard or their backyard.
4. Ask students to think about what abiotic means and discuss their ideas.
5. Create a definition of abiotic with students.
6. Ask students to label all abiotic components of their ecosystem. Students share their drawings/diagrams with the class.
7. Discuss how biotic and abiotic parts of an ecosystem relate to the flow of energy through a system. Ask students to explain how abiotic parts of an ecosystem might help or hinder the flow of energy.
8. Review with students the scientific vocabulary pertinent to this lesson (See *Resource 1 – Word bank* for suggested terms).
9. Students add their learning and reflections to their science journal. (See *Resource 2 – Student reflections* for examples of sentence starters you can use to guide student reflections).

Citizen Science participation

Students can study a fish (or other animal) population that is affected by artificial barriers. Feed the results back to your local NRM. For example: [*http://www.dpi.nsw.gov.au/fisheries/habitat/threats/barriers*](http://www.dpi.nsw.gov.au/fisheries/habitat/threats/barriers)

Opportunities to monitor student learning

**Formative assessment opportunities:**

Use students’ labelled diagrams to assess their developing knowledge of biotic and abiotic components of ecosystems.

Resources

Useful web links

Gulliver Media Australia. Each video explores an ecosystem in detail and the videos are accompanied by many images of animals and plants in each system:  
<http://www.gullivermedia.com.au/resources-for-schools/for-schools.php>

The abiotic and biotic components in an ecosystem: What Is An Ecosystem?  
<https://www.youtube.com/watch?v=aYmdrJWLQ4Y>

**Hint:** Access and pre-load YouTube clips before the lesson so that you can play them immediately for students when required.

Great Barrier Reef Outlook Report 2014

Access the report at: <http://elibrary.gbrmpa.gov.au/jspui/handle/11017/2855>

Useful information for this lesson can be found on:

page 165, 288 and 292: Artificial barriers to flow

Printable resources

*Resource 1 – word bank*

*Resource 2 – Student reflections*

Engage

Explore

Explain

Elaborate

Evaluate

**Lesson 5 and 6:** Can you use models to predict change?

**Duration:** 1 hour 40 minutes

**Lesson objectives**Students will:

recognise the abiotic and biotic components in catchment to reef ecosystems

analyse a sedimentation model and predict potential impacts on the ecosystems involved including energy flow

understand the benefits and uses of scientific models.

Suggested learning sequence

**Introduction** – Catchment to reef

1. Look at the Catchment to Reef Poster 2006 at: [*http://rrrc.org.au/wp-content/uploads/2014/05/c2r\_poster\_small.pdf*](http://rrrc.org.au/wp-content/uploads/2014/05/c2r_poster_small.pdf)(See **‘useful web links’** for the location of this poster).
2. Identify and discuss biotic and abiotic features, food webs and energy flows within the ecosystem.
3. Provide pairs or groups of students with a black and white copy of the poster and assign a colour for biotic and a colour for abiotic.
4. Students then circle or mark the features with the appropriate colour and compare their findings with the rest of the class in a discussion.
5. Alternatively, if possible, display the poster onto an interactive whiteboard and students can circle the features with the appropriate colours on the whiteboard.

**Activity –** Sedimentation model

1. Look at the Sedimentation model from the Great Barrier Reef Outlook Report 2009 (See *Resource 6 - GBRMPA Sedimentation Model* or 2009 Outlook report 2009 page 41, Fig 3.7) and read the matching section 3.2.4 on sedimentation.
2. Display this model e.g. on an interactive whiteboard so the model can be written on and interacted with.
3. Discuss what the model is showing (changes in exposure to sediment, Great Barrier Reef). Ask students the following questions:

What is the model telling us?

Is it a natural impact or the cause of increase in population along the coast?

Why has GBRMPA identified this as an area of concern?

What will an increase in sediment do to the energy flow through an ecosystem?

What changes does the model show?

How can the model be used to predict further changes?

1. Use information in the ‘Catchment to Reef’ poster 2006 to help answer these questions.
2. Draw a conclusion as a class about why scientists use models. Are there other examples of how we could use them?
3. Generate a simple class model to predict trends in the class e.g. how many students exercised over the past five days? Discuss this model e.g.

What can we predict about exercise patterns in the class?

Does this model tell us anything about the health of the class (given that we know to maintain health we should be doing 30 minutes of activity per day)? This concept could be related to energy output.

1. Review with students the scientific vocabulary pertinent to this lesson (See *Resource 1– Word bank* for suggested terms).
2. Students add their learning and reflection to their science journal. (See *Resource 2 – Student reflections* for examples of sentence starters you can use to guide student reflections).

Opportunities to monitor student learning

**Formative assessment opportunities:**

Use discussion responses and participation to assess students' developing knowledge of science understandings and human endeavour.

Resources

Useful web links

Catchment to Reef Poster (2006) at:  
<http://rrrc.org.au/catchment-to-reef-publications/>

Or direct link to this poster at:  
<http://rrrc.org.au/wp-content/uploads/2014/05/c2r_poster_small.pdf>

Great Barrier Reef Outlook Report 2014

Access the report at: <http://elibrary.gbrmpa.gov.au/jspui/handle/11017/2855>

Useful information for this lesson can be found on:

page 151 Figure 6.1: Drivers of change

page 50 Section 3.2.4: Sedimentation.

Printable resources

*Resource 1 – Word bank*

*Resource 2 – Student reflections*

*Resource 6 – The Great Barrier Reef Marine Park Sediment Model.*

Engage

Explore

Explain

Elaborate

Evaluate

**Lesson 7 and 8:** What happens when things change?

**Duration:** 1 hour 40 minutes

**Lesson objectives**Students will:

design, plan and conduct an experiment to investigate how changing abiotic factors can affect living things in an ecosystem.

Suggested learning sequence

**Introduction** – What happens when things change?

1. Explain to the class they are going to design their own investigation to find out how changing abiotic components in an ecosystem can affect living things in that ecosystem.

**Activity –** Running the investigation

**Set up Notes:**

Students could work in pairs or individually.

You may choose for all students to do the same investigation and collaboratively design the investigation as a class, or let students design their own experiment. This will depend on the needs of the class and available equipment etc.

Living things that could be investigated include plants, such as water plants, or brine shrimp living in simple set-ups for the ecosystem e.g. test tubes or beakers.

Abiotic variables that can be changed include temperature, fertiliser/nutrient level, sediment level in water, temperature or pollutants in water.

The Investigation Planner (Resource 5) could be used by students as a guideline.

Identify with students what they will measure in their investigation.

Identify with students what variables they will control throughout their investigation.

Ensure students identify safety concerns and precautions for their investigation.

Given the nature of the investigation, students will most likely only be able to start observing their results in the next few science lessons (lesson 8 and lesson 9). View lesson 9 for the analysis of results and drawing conclusions.

1. Ensure to follow The Animal Care and Protection Act 2001 and The Australian Code of Practice for the Care and Use of Animals for Scientific Purposes, 2013, 8th Edition in accordance with Education Queensland Guidelines when choosing if you investigate with living things. See <http://education.qld.gov.au/curriculum/area/science/animals-ed.html> for more information.
2. Discuss with students what resources are available, how they might set up their investigation, time frames for their investigation and what the expectations are.
3. Guide students to write up the experiment using the Investigation Planner (see Resource 5). Ensure they complete the prediction before they start.
4. Discuss ethical considerations with students in relation to investigating with living things.
5. Once students have written up their investigation planner and you have viewed and agreed on their procedure, provide them with the resources to set up their investigation.
6. Have students set up their investigation and monitor it as required.
7. Review with students the scientific vocabulary pertinent to this lesson (See *Resource 1 – Word bank* for suggested terms).
8. Students add their learning and reflection to their science journal. (See *Resource 2 – Student reflections* for examples of sentence starters you can use to guide student reflections).

Citizen Science participation

Students can study and compare the water quality in local stormwater drains or creeks both in dry times and when it has been raining.

**Safety considerations:** You will need to conduct your own curriculum activity risk assessment for any activities related to being near stormwater drains. See the ‘Safety and risk management’ section in this unit for more information.

Opportunities to monitor student learning

**Formative assessment opportunities:**

Use students’ investigations to assess their science inquiry skills and their science understandings.

Resources

Handout references

*Resource 1 – Word bank*

*Resource 2 – Student reflections*

*Resource 5 – Investigation Planner*

Great Barrier Reef Outlook Report 2014

Access the report at: <http://elibrary.gbrmpa.gov.au/jspui/handle/11017/2855>

Useful information for this lesson can be found on:

page 46: 2014 Summary of assessment (GBR health).

Other resources

You will need to determine resources needed for the student investigations.

Engage

Explore

Explain

Elaborate

Evaluate

**Lesson 9:** How can natural events affect ecosystems?

**Duration:** 1 hour 40 minutes

**Lesson objectives**Students will:

analyse results and draw conclusions about the investigation into abiotic factors

use a futures circle to understand the impacts of a natural event on an ecosystem.

Suggested learning sequence

**Introduction –** What happens when things change?

1. Have students review their investigation from Lesson 7 and 8 and record results. Discuss as a class the following:

What do their results show?

How will they display their results?

What conclusions can they draw about how changing the abiotic factor affects living things in their ecosystem?

What challenges did they face in their investigation and what improvements do they suggest?

Are there any follow-up investigations that would be beneficial if they could continue?

**Activity –** Cause-and-effect

1. Display a futures circle (See *Resource 7 – Futures circle* for an example) and use it to discuss and identify how an ecosystem changes due to natural events e.g. flooding, bushfire, drought, severe storm etc.
2. In your class discussion consider:

**Natural** effects on the ecosystem e.g. changes to populations of different plants or animals, which will affect the energy flow through the ecosystem and the ecosystem’s sustainability

**Economic** effects on industries reliant on the health of the ecosystem e.g. farming, tourism

**Social** effects on how people will use the ecosystem. Will the same activities still take place?

**Who will fix it?** – Does the ecosystem need help or should it be left to its own devices? How will the ecosystem recover? How can we build resilience for ecosystems so they are able to adapt to threats?

1. Students work in groups to research a particular natural event that has impacted an ecosystem and then complete their own futures circle on this event. You may allocate events or students may be able to use local examples.

**Optional higher order thinking activity**

Use wave tanks to demonstrate how sand flows through different ecosystems. Analyse what this might mean for an ecosystem during and after severe storms.

1. Review with students the scientific vocabulary pertinent to this lesson (See *Resource 1– Word bank* for suggested terms).
2. Students add their learning and reflection to their science journal. (See *Resource 2 – Student reflections* for examples of sentence starters you can use to guide student reflections).

Opportunities to monitor student learning

**Formative assessment opportunities:**

Use students’ investigations to assess their science inquiry skills and their science understandings.

Use students’ review of experiments to assess their science inquiry skills.

Use students’ futures circle to assess their science understandings and human endeavours.

Resources

Useful web links

Coastal flood impact – Catalyst episode at:  
<http://www.abc.net.au/catalyst/stories/3480317.htm>

The impact of big bush fires on ecosystems – short video at:  
<http://www.abc.net.au/catalyst/stories/3480317.htm>

Drought impacts – information summary at:  
<http://drought.unl.edu/DroughtforKids/HowDoesDroughtAffectOurLives/TypesofDroughtImpacts.aspx>

Extreme weather impacts on the Great Barrier Reef (also view the left menu for links to communities and industries impacted by extreme weather and dugong and turtle strandings): Managing the Reef: 2010-11 extreme weather event  
<http://www.gbrmpa.gov.au/managing-the-reef/threats-to-the-reef/extreme-weather/ecosystem-impacts>

**Hint:** Access and pre-load YouTube clips before the lesson so that you can play them immediately for students when required.

Handout references

*Resource 1 – Word bank*

*Resource 2 – Student reflections*

*Resource 7 – Futures circle*

Other resources

Images, books or articles about various natural events that have impacted different ecosystems for students’ futures circle research.

Engage

Explore

Explain

Elaborate

Evaluate

**Lesson 10:** How do humans impact ecosystems?

**Duration:** 50 minutes

**Lesson objectives**Students will:

investigate how humans impact local ecosystems

use a futures circle to understand the impacts of a human event on an ecosystem.

Suggested learning sequence

**Introduction –** defining human impacts

1. Discuss with students the different ways humans can impact ecosystems.
2. Create a list of impacts and beside each suggestion, provide an example of how that impact affects an ecosystem e.g. building roads destroys habitat.
3. Students may have very specific examples of impacts and effects and others may be more general. Students will use these examples later in the lesson.
4. If you can, obtain aerial photos of your local area as this will provide good discussion about how humans have impacted the local environment. Aerial photos are also a good example of how photos can be used to predict what might happen if development continues in certain areas.
5. If photos are unavailable, discuss human impacts by viewing the Catchment to Reef Poster 2006 at: [*http://rrrc.org.au/wp-content/uploads/2014/05/c2r\_poster\_small.pdf*](http://rrrc.org.au/wp-content/uploads/2014/05/c2r_poster_small.pdf)(See **‘useful web links’** for the location of this poster).

**Activity –** Cause-and-effect

1. Use a futures circle (see *Resource 5 – Futures circle*) to predict human impacts on the local ecosystem, referring to the impacts identified at the beginning of the lesson.
2. In your class discussion consider:

**Natural** effects on the ecosystem e.g. changes to populations of different plants or animals which will affect the energy flow through the ecosystem and the ecosystem’s sustainability

**Economic** effects on industries reliant on the health of the ecosystem e.g. farming, tourism

**Social** effects on how people will use the ecosystem. Will the same activities still take place?

**Who will fix it?** Does the ecosystem need help or should it be left to its own devices? How will the ecosystem recover? How can we build resilience for ecosystems so they are able to adapt to threats?

1. Review with students the scientific vocabulary pertinent to this lesson (See *Resource 1 – Word bank* for suggested terms).
2. Students add their learning and reflection to their science journal. (See *Resource 2 – Student reflections* for examples of sentence starters you can use to guide student reflections).

**Optional or additional activity** – Visit an ecosystem as part of a larger catchment.

Visit a local ecosystem e.g. creek, to identify how it has been affected by both natural elements and humans.

Use aerial maps to view the inter-connection between this local ecosystem and other parts of the catchment.

Predict the flow-on effects of the impacts on this ecosystem to other areas of the catchment.

How does it affect the ecosystems found further along the water course and out into the ocean?

What might happen to the ecosystem in the future given current impacts and what could be done to improve the health of the catchment area?

**Optional higher order thinking activity**

Find a recent environmental issue in the local news e.g. pollution, fires or development and identify how it might affect the energy flows in the local ecosystems and work out a way to solve it.

Citizen Science participation

Students can investigate land use changes in local catchments at the basin scale over the last 50 years.

Students can study human impacts on a local ecosystem and put a case forward to council as to why they should protect this ecosystem.

Opportunities to monitor student learning

**Formative assessment opportunities:**

Use students’ futures circle to assess their science understandings and human endeavours.

Resources

Useful web links

Aerial photos of the local area e.g. from Google Earth, the Department of Agriculture, Fisheries and Forestry, local council websites or the Wet Tropics Management Authority.

Catchment to Reef Poster (2006) at:  
<http://rrrc.org.au/catchment-to-reef-publications/>

or direct link to this poster at:  
[*http://rrrc.org.au/wp-content/uploads/2014/05/c2r\_poster\_small.pdf*](http://rrrc.org.au/wp-content/uploads/2014/05/c2r_poster_small.pdf)

Wet Tropics Management Authority:  
[*http://www.wettropics.gov.au/home*](http://www.wettropics.gov.au/home)

Australia's tropical land and sea e-Atlas (includes maps):  
[*http://e-atlas.org.au/*](http://e-atlas.org.au/)

Great Barrier Reef Outlook Report 2014

Access the report at: <http://elibrary.gbrmpa.gov.au/jspui/handle/11017/2855>

Useful information for this lesson can be found on:

page 58-59: Clearing of coastal and terrestrial habitats and changes to Great Barrier Reef connectivity

page 255-256 and figure 9.3: Highest risk threats.

Handout references

*Resource 1 – Word bank*

*Resource 2 – Student reflections*

*Resource 7 – Futures circle*

Engage

Explore

Explain

Elaborate

Evaluate

**Lesson 11 - 14:** Reflections andassessment task

**Duration:** 2 hours thirty minutes – 3 hours thirty minutes

Suggested learning sequence

**Introduction –** Reflections and task introduction

1. As a class, reflect on what has been learned throughout the lessons.
2. Explain to the students that they are going to begin their final assessment project. Present them with the task sheet and the Guide for making judgements *(Resource 8 – Student task sheet and Guide for making judgements).*
3. Read through the task sheet and Guide for making judgements together and identify all the requirements of the task.
4. Discuss available resources (identify all the work done throughout the unit that will help the students complete the task).
5. Set out a plan for time management and resource management.

**Activity –** Prepare models and reports

1. Allow students time to research and prepare their models and reports.
2. Students may need scaffolding for different parts of the report writing; this will depend on the needs of the class.
3. How much time students are able to spend preparing their reports will depend on the needs of the class and the length of time available in the school term.

Opportunities to monitor student learning

**Summative assessment opportunities:**

Student reports can be used to assess students’ knowledge and understanding of science understandings, science as a human endeavour and science inquiry skills.

Resources

Printable resources

*Resource 8 – Student task sheet and Guide for making judgements*

Resources

Resource 1 – Word bank

| Ecosystem | Biodiversity | Interaction | Pollution |
| --- | --- | --- | --- |
| Photosynthesis | Starch | Glucose | Energy flow |
| Energy input | Energy output | Food chain | Food web |
| Producer | Consumer | Decomposer | Sustainable |
| Biotic | Abiotic | System | Scientific model |
| Catchment | Sedimentation | Impact | Ethical |
| Variables | Nutrient | Fertiliser | Pollutant |
| Natural events | Economic impacts | Social impacts | Resilience |

Resource 2 – Student reflections

Consider displaying sentence starters or questions such as below in the classroom. Alternatively, they could be turned into laminated thought bubbles that are passed to students directly. Students could choose two or three thoughts to complete in their journal then share their responses with the class.

| End of lesson reflections | | Guiding students to reflect on their own thinking | |
| --- | --- | --- | --- |
| Today I discovered …  I want to know more about …  Something new I found out was …  I am excited about …  Something I am finding interesting is …  The most challenging thing was … | I am most proud of …  I feel confident about …  I am enjoying … because …  I am confused by …  Today I asked …  A question I have is … | I am starting to think differently about …  I got stuck when … and I got back on track by …  I figured out that …  I solved a problem by …  I first thought … but then I realised that … | This idea is useful for …  Some things I didn’t understand are …  To help me understand better I will …  Before I didn’t know …  Now I realise/know … |
| Reflecting on stewardship and taking action | | End of unit reflections – *where I was and where I am now* | |
| This information can make a difference by …  It is important to know about this because …  Something I will now do as a result of my learning is …  Something I want to do next is … | Something I will now help others understand is …  I can make a difference by …  An action I/we can take is …  If we don’t … the consequences could be …  It is important to … because … | 1. I used to think … 2. Now I know … 3. This causes me to (re)think/ wonder … | * **Revisit** your first journal entry. What do you understand now that you didn’t back then? * **Review** your work so far. What has been the biggest discovery/learning/challenge? * **Reconsider** your initial ideas. Have your ideas changed? If so how? |
| 1. I didn’t know how to … 2. Now I can … 3. In the future I will … |

Resource 3 – Food web string activity

| Aim |
| --- |
| For participants to become aware of the different interactions taking place in an ecosystem. These interactions might be between living or non-living things. |
| Equipment per group |
| * A ball of string * Labels for each person (see below) |
| Procedure |
| 1. Each participant chooses something from the local environment they would like to be – sun, grass, rain, fish, cat, snake, water, tree, turtle, person, flower, soil. Each participant needs to be a different thing in the environment.  1. Label each participant so that everyone in the circle can see what they are. 2. Give the ball of string to the first participant. They hold onto the end and throw the ball to a thing in the environment they interact with saying this label ‘out loud’ as they throw the ball of string. 3. That new person then holds the piece of string and throws the ball of string onto something they can interact with to form a connection. Again, they say this label ‘out loud’ as they throw the ball of string. *For example, the fish can throw the string to the water, the water can throw the string to the tree, the tree can throw the string to the sun, the sun can throw the string to the flower, and the flower can throw the string to the bird.* 4. This process is repeated until all interactions within the circle have been used up. 5. The game can be replayed representing several different ecosystems. Teachers could also allow participants to choose what they will be, or teach participants about a specific ecosystem. Teachers could also assign each participant a set of living or non-living things from that ecosystem.   **Extension:**  To extend the activity, ask participants to state what the relationship or interaction is as they throw the ball of string (encourage the use of scientific language). For example, when the fish throws the string to the water, the fish states *’I need water to live in’,* and the water then states *’I give water to trees’* and throws the string to the trees and so on. This extension encourages participants to think about what the relationships and interactions are. |

Resource 4 – Finding starch investigation

*Adapted from Ash, M, 1999 Jacaranda Science 2, John Wiley, Brisbane.*

| Aim | |
| --- | --- |
| To test for starch in the leaves of plants to identify if photosynthesis has taken place. | |
| Equipment per group | |
| * One pot plant with plenty of leaves that has been kept in the sun for a few days * One pot plant with plenty of leaves that has been kept in the dark for a few days * A hotplate or Bunsen burner * Test tube holder * Forceps | * Line illustration - pot plantPetri dish * 500ml beaker of boiling water * Test tube of ethanol * Iodine solution * Pipette * Small sample of potato starch in a Petri dish * Safety goggles |
| Procedure | |
| 1. Put on safety goggles. 2. Fill a beaker with 500ml of water and heat it on a Bunsen burner or hotplate until the water is boiling. 3. Use forceps to remove a leaf from the plant that has been kept in the sunlight. 4. Dip the leaf into the boiling water for one to two minutes to soften it. 5. Place the leaf into a test tube of ethanol. **CAUTION:** Ethanol is flammable – do not place it near a naked flame. 6. Using a test tube holder, hold the test tube of ethanol in the beaker of boiling water and leave it there for ten minutes. **CAUTION:** Do not let the test tube touch the sides of the beaker or it may shatter. 7. Use forceps to remove the leaf from the ethanol and dip it into the hot water in the beaker again to remove any excess ethanol. ***Questions:*** *What has happened to the colour of the leaf? What do you think the ethanol did to the leaf?* 8. Place the leaf into a Petri dish and use the pipette to cover it with two drops of iodine solution. ***Questions:*** *Does the colour change on the leaf? Where on the leaf did the colour change?* 9. Repeat steps 1-8 for the leaf from the plant that has been kept in the dark.   **Answer the following questions:**   * Glucose is produced during photosynthesis and is then converted to starch and stored in the leaves of the plants. Did your test show any differences in starch production between the leaves exposed to the light and the leaves kept in the dark? * Why was one of the plants kept in the dark for a few days before completing this investigation? | |

Resource 5 – Investigation planner

Name: Date:

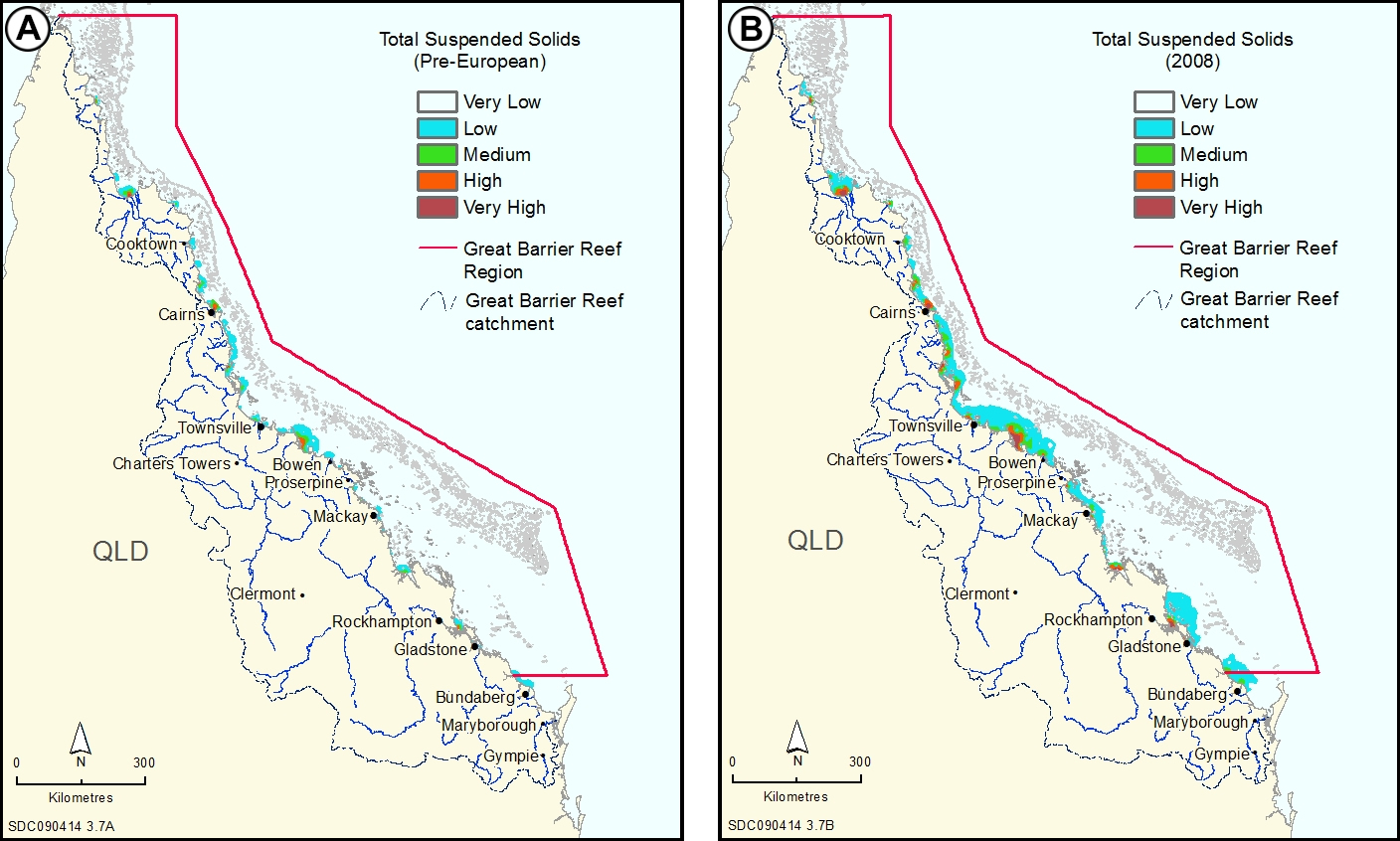
| Investigation question | | Prediction (I think … because …) | | |
| --- | --- | --- | --- | --- |
| *To make it a fair test, what are you going to do?* | | | | |
| Independent variable  Change? | Dependent variable  Measure? | | | Controlled variables  Keep the same? |
| Labelled Diagram | Equipment list | | Procedure  What are the steps to follow to do this investigation? | |

| Results | |
| --- | --- |
| When you changed \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ what happened? | |
| Why did this happen? | Was your prediction accurate? |
| What challenges did you have in doing this investigation? | How could you improve this investigation? (Fairness? Accuracy?) |

Resource 6 – The Great Barrier Reef Marine Park Authority Sediment Model

*Images and information sources form the Great Barrier Reef Outlook Report 2009, Great Barrier Reef Marine Park Authority, pp41-4.2*

### 3.2.4 Sedimentation

Inflow of sediments onto the Great Barrier Reef is a natural phenomenon which has been ongoing since modern sea level was reached approximately 6000 years ago. However, over the past 150 years, sediment inflow onto the Great Barrier Reef has increased four to five times, and five to ten fold for some catchments (see Section 5.4.1).

The coastal zone is clearly the part of the Great Barrier Reef most exposed to increased sedimentation, especially areas close to river mouths (see Figure 3.7). The area of the Great Barrier Reef affected by sedimentation is increasing substantially as a result of land management practises (Section 5.4.1), to the point where sediment is reaching mid-shelf reefs for the first time in their geological history (Figure 3.7).

***Figure 3.7* Changes in exposure to sediments, Great Barrier Reef**

Compared to likely condition prior to European settlement, development in the catchment has meant that the area of the Great Barrier Reef exposed to sediments has increased markedly. This map shows results of a model of the exposure of the ecosystem to total suspended solids before European settlement (A) and in 2008 (B).

Resource 7 – Futures circle

Students identify a certain event. As they move out of the circle, they define what gradually happens due to the event. For more advanced analysis of an event, students look at the N, S, E and W of an event - Natural, Social, Economic and Who did it? And/or who will fix it? Students could then go on to investigate how it could be fixed.

**N**atural impacts

**S**ocial impacts

**E**conomic impacts

**W**ho did it?

**W**ho will fix it?

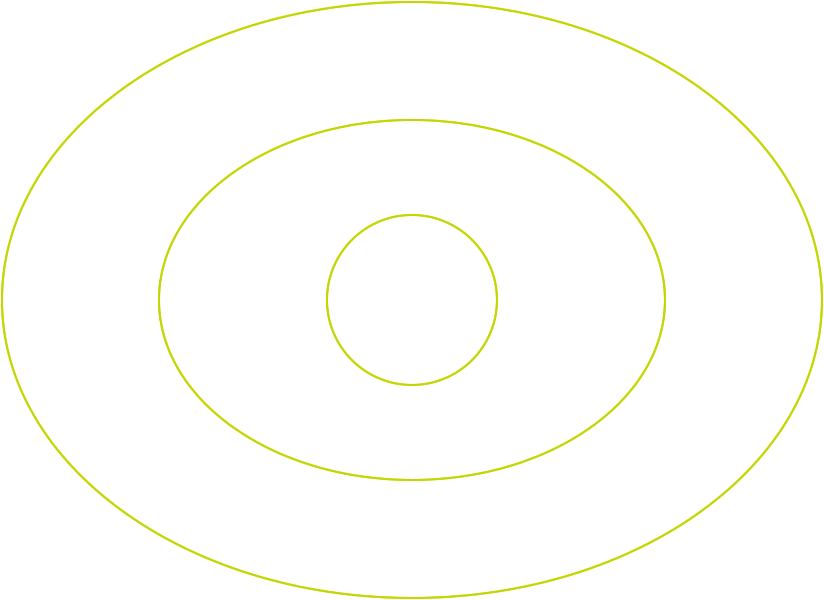
**EVENT**

**IMMEDIATE EFFECT**

An immediate result of the event

**SHORT AND LONG TERM EFFECTS**

Things that happen more slowly over time due to the immediate impacts



Resource 8 – Student task sheet and Guide for making judgements

### Ecosystems – Year 9 – model and report

### Your task:

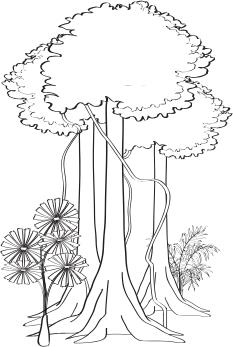
There are two parts to your final assessment:

#### Part A

You will create a visual representation that shows the impacts of an extreme weather event on the local environment (e.g. a poster, a 3D model a simple animation or computer model). You can choose the extreme weather event and the local environment that has been impacted. You might choose one small ecosystem (such as a park or creek) within the environment, or choose a broader part of the whole environment (such as a suburb).

#### Part B

You will provide a written report outlining the impacts of your chosen extreme weather event on your chosen local environment.

Your report will include:

* an explanation of the local environment and its features (food webs, habitats, animals found there, energy flows in the environment)
* an explanation of the extreme weather event (how it formed, environmental factors that led to it happening, weather patterns)
* an explanation of how the extreme weather impacted the local environment (long term and short term - animal populations, changes in the structure of the environment, changes in energy flows through the environment). You will need to make reference to your model to indicate how your model shows these impacts
* an explanation of how the local environment might recover from the weather event (link this to scientific knowledge about ecosystems).

|  |  |
| --- | --- |
| Year 9 Science: Ecosystems – model and report | Name: |

**Purpose:** Explains how an ecosystem functions and responds to an extreme weather event with reference to interdependencies between biotic and abiotic components of the ecosystem and energy flow. Explains how the local environment might recover from the weather event.

Explains how relationships with other living things and the [environment](http://www.australiancurriculum.edu.au/glossary/popup?a=S&t=Environment) assist or hinder its survival

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Science Understanding | | Science Inquiry Skills | |  |
| Biological sciences | | Communicating | |
| Explains how an ecosystem responds to an extreme weather event with reference to interdependencies between biotic and abiotic components of the ecosystem and energy flow. Explains how the local environment might recover from the weather event | | Communicates scientific ideas and information using appropriate scientific language, conventions and representations to suit the purpose | |  |
|  | Integrates all explanations with scientific knowledge |  | Uses concise and coherent scientific language and representations throughout to suit the purpose | A |
| * Links all explanations with scientific knowledge | * Uses coherent scientific language and representations throughout to suit the purpose | B |
| * Explains how an ecosystem responds to an extreme weather event with reference to interdependencies between biotic and abiotic components of the ecosystem and energy flow. Explains how the local environment might recover from the weather event | * Communicates scientific ideas and information using appropriate scientific language, conventions and representations to suit the purpose | C |
| * Partially explains how an ecosystem responds to an extreme weather event. Identifies biotic and abiotic components of the ecosystem and how energy flows | * Communicates using everyday language and representations | D |
| * Recalls some components of an ecosystem and facts about energy flow | * Fragmented use of language and representations to communicate ideas | E |
| Teacher feedback: | | | | |