Department of
Education

GOVERNMENT OF
WESTERN AUSTRALIA

Year 12 Science General Integrated Science

Unit 3 Earth systems/cycles in nature

Topic 1: Ecosystem Characteristics and Abiotic Factors

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Year 12 General Integrated Science

Unit 3 Earth systems/cycles in nature

Topic 1 Ecosystem Characteristics and Abiotic Factors

Instructions to Students

This resource package provides you with learning materials for the General Integrated Science Year 12 course. The package focuses on the Unit 3 Earth systems/cycles in nature, Topic 1 Ecosystem Characteristics and Abiotic Factors. This package is designed to support the program you are completing at your school. If feedback is required when completing this package, you should consult your teacher.

It is recommended that you further investigate concepts covered in this resource package by conducting your own research using the text/s that you use at school or the internet.

Syllabus Points Covered

Earth systems/cycles in nature
Science Understanding

- differences in **geographical and physical conditions** result in a wide variety of **ecosystems**
- **abiotic factors**, including **temperature, pH, salinity, light, water** and **atmospheric gases**, impact on the survival of organisms within the environment
- there is **interaction** between organisms, **biological communities** and the **abiotic environment** in which they live

Science Inquiry Skills

- propose hypotheses; and predict possible outcomes
- represent data in meaningful and useful ways; organise and analyse data to identify trends, patterns and relationships; qualitatively describe sources of measurement error and use evidence to make and justify conclusions

Science as a Human Endeavour

- scientific knowledge can enable scientists to offer **valid** explanations and make reliable predictions

Ecosystem Characteristics and Abiotic Factors

Unit 3 of your Integrated Science course explores the concept of **ecosystems**. During this unit we will be looking at what ecosystems are, the components of ecosystems and the way in which matter and energy move throughout an ecosystem. Although we will be looking at ecosystems in general we will be paying particular attention to freshwater wetland ecosystems and their importance within the Australian environment.

What is an ecosystem?

The **biosphere** describes our living world, from the upper areas of the atmosphere to the depths of the ocean. **Biodiversity** is a term used to describe all the living organisms that make up the biosphere from microscopic bacteria to a naked mole rat! As the biosphere is too big scientists study smaller parts called ecosystems.

An ecosystem is formed by the living organisms of a community **interacting** with each other and with their non-living environment. A **community** is a population of different species living together in a particular area. They can be considered the living components of an ecosystem. For example, a freshwater community may contain a number of different organisms such as reeds, water lilies, algae. frogs, fish and bacteria

The relationship that each organism has with their environment is unique. Indigenous Australians explain the relationship between organisms and the Sun through Dreamtime stories. Through stories the Indigenous Australians explain the seasons and the importance of night.

There are many different types of ecosystems throughout the world. Some ecosystems are marine, others freshwater and others are terrestrial (land based). **Ocean ecosystems** are most common on earth as oceans and the living organisms they contain cover 75% of the Earth's surface. **Freshwater ecosystems** are the rarest covering only 1.8% of the Earth's surface. **Terrestrial ecosystems** cover the remainder of Earth.

Some ecosystems found here in Australia include a **Spinifex Grassland, Marine Ecosystem** and a **Wandoo Woodland.**

Examples of Australian Ecosystems

Spinifex grassland is a desert ecosystem **dominated** by spinifex grass in the dry interior of Western Australia. A desert receives less than 250 mm of rainfall per year. Animals living here include termites, lizards and small marsupials.

Image:
https://www.agric.wa.gov.au/rangelands/hard-spinifex-plain-pastures-kimberley-western-australia

Ningaloo Reef is located off the coast of Western Australia near Exmouth. Ningaloo Reef is 300 km long and only 100 m offshore in some areas, such as Coral Bay. The Reef supports many species of fish, corals, molluscs and other marine life.

Image
https://parks.dpaw.wa.gov.au/park/ningaloo

The largest section of **Wandoo woodland** remaining in Australia is found in the Dryandra State Forest, South-East of Perth. These dry woodlands are home to many plants, birds, insects, reptiles and mammals like the kangaroo and numbat.

Image
https://en.wikipedia.org/wiki/Dryandra_Woodland
Public Domain

Notice that often (but not always) when we name ecosystems that it is usual to use two names. For example, Spinifex grassland. Spinifex is the dominant plant species while grassland is used to describe canopy cover being less than 10%.

Activity – Ecosystem Examples

1. Look at the different types of ecosystems listed below. For each one write 3 words that you think would describe this ecosystem or words that come to mind when visualising these ecosystems. Try to think of words that would help another person also visualise this ecosystem.

Desert:
Rainforest:
Coral reef:
Eucalyptus forest:
African savannah:
Mangrove:

2. Now look at the photos shown below. Identify what type of ecosystem each picture represents. If you are unsure about the type of ecosystem you are looking at think about what you can see (or don't see), and what that tells you about the ecosystem.

Image:https://upload.wikimedia.org/wikipedia/commons/4/4c/Sahale_Peak.jpg

a. Ecosystem Name

Image: https://simple.wikipedia.org/wiki/Savanna#/media/File:Serengeti-African-Elephants.JPG

b. Ecosystem Name

Image: https://commons.wikimedia.org/wiki/File:Eucalyptus_saligna_Black_Bulga_forest.JPG

c. Ecosystem Name

Image: https://en.wikipedia.org/wiki/River_ecosystem#/media/File:Stream_in_the_redwoods.jpg

d. Ecosystem Name

Image:
https://en.wikipedia.org/wiki/Ecological_values_of_mangroves#/media/File:Mangroves_in_Puerto_Rico.JPG

e. Ecosystem Name

3. Choose one of the ecosystems shown in the pictures (a-f) and answer the following questions about it. Aim for two points for each question.

a) Describe how people use your chosen ecosystem.

b) Describe how your chosen ecosystem may be damaged.

c) How can people help the ecosystem remain healthy?

Types of Ecosystems

There are three main types of ecosystems:

- natural ecosystems
- agricultural ecosystems
- urban ecosystems

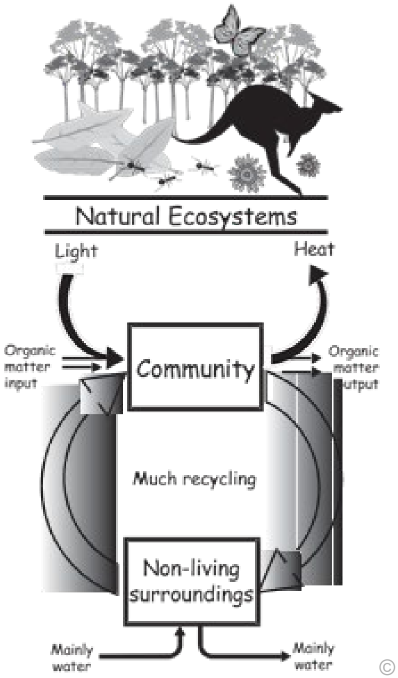
In any ecosystem there will be:

- matter and energy such as organic matter, heat and light which enter the ecosystem. These are known as inputs.
- matter and energy such as gases, heat and organic matter which leave the ecosystem. These are known as outputs.
- recycling where elements such as carbon, oxygen and nitrogen are reused throughout the ecosystem.

Natural ecosystems

A natural ecosystem is known as a stable one. This simply means that it is able to easily regulate the flow on energy and matter through it. The majority of energy that enters a natural ecosystem comes from the sun in the form of light energy. Producers (plants) convert this energy into chemical energy during photosynthesis. Matter is recycled through the food chains and webs. When organisms die, the organic matter is broken down by decomposers to release minerals into the soil which can then be taken up again by other producers.

From the diagram below you can see that there is a great deal of recycling in a natural ecosystem. Only very small quantities of non living factors enter or leave the ecosystem, with the main factor being water.



© SIDE & Westone

All of the photos that you labelled in the previous activity contain only natural ecosystems!

Natural Wetland Ecosystems

Wetlands are everywhere in Australia, from the man-made ponds of your suburb, and the rivers that criss-cross the continent, to vast floodplains in central Australia that only see water every few years. We often pass them unnoticed and without a thought to the important jobs they perform each day.

The term ‘wetlands’ encompasses a vast range of water based areas including swamps, marshes, billabongs, lakes, salt marshes, mudflats, mangroves, and coral reefs. Wetlands are an important part of the Australian landscape. They act as filters for our waterways, breeding sites for hundreds of Australian animals and recreational centres for many communities. They protect our shores from wave action, reduce the impacts of floods, absorb pollutants and improve water quality. They provide habitat for animals and plants and many contain a wide diversity of life, supporting plants and animals that are found nowhere else in the world.

Wetlands are vital habitats for international migration by birds, demonstrating how habitats around the world are connected.

Because of their unique ability to trap sediments and filter nutrients, wetlands have been likened to a cleansing ‘kidney’ within the river systems. They are essential for sustaining healthy rivers, on which communities throughout Australia depend.

All Australians rely on water and the quality of our waterways to sustain life. Whether it’s water for our households, industries or ecosystems, wetlands play a central role and their conservation should be a priority for all Australians.

Have a look at the following video from Australia's amazing wetlands, World Wetlands Day 2012, which explains the types of wetlands found in Australia.

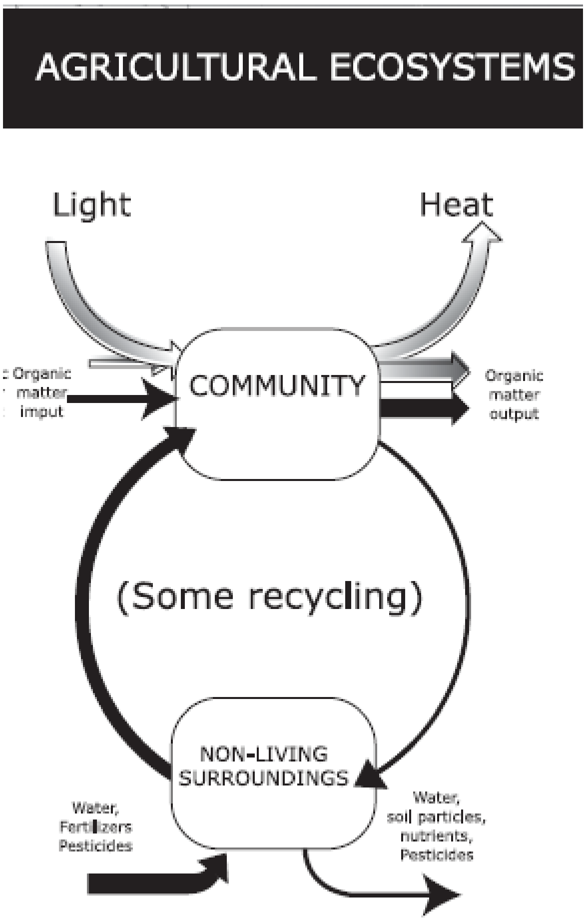
https://www.youtube.com/watch?v=eotxzebGLQw

Agricultural ecosystems

An agricultural ecosystem is designed to produce organic matter for sale or for consumption elsewhere. Much of the organic matter produced within this type of ecosystem leaves which results in very little recycling of matter back into the soil.

To compensate for this lack of recycling considerable inputs must be made to the non-living components of an agricultural ecosystem. Australian soils in particular are usually poor in nitrogen and phosphorous so fertilisers need to be added to the soil. Other inputs to the nonliving surroundings would include water and pesticides. This can often cause problems when they leave the ecosystem and enter the rivers and lakes.

Crop production requires large amounts of fossil fuels (e.g. for the production of fertilisers). However, the majority of energy that enters an agricultural system is still in the form of light energy. Much of this energy is lost from the ecosystem as heat and a lot is lost as chemical energy stored in the organic matter (produce) that is sold.



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Urban ecosystems

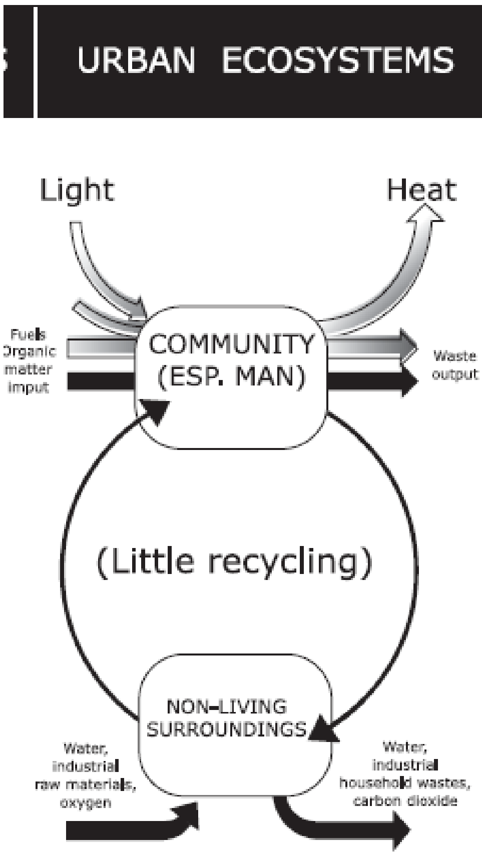
Urban ecosystems are designed to support a large population of humans. They are the most unstable of the ecosystems as they require large inputs, have large outputs and very little recycling in between.

Consider the energy inputs of an urban ecosystem. As there are some producers in parks and gardens, then some of the energy input is in the form of light energy. The majority of the energy input is in the form of fossil fuels. Some energy would also enter the ecosystem trapped in the chemical bonds of the organic matter. The majority of the energy leaves the ecosystem in the form of heat. (Remember energy cannot be recycled).

Urban ecosystems also require large inputs of organic matter in the form of food. The majority of this is brought into the ecosystem from agricultural ecosystems. Very little of this organic matter is recycled throughout the ecosystem and a large proportion actually leaves the ecosystem as sewage.

Since urban ecosystems have very little recycling, they require large inputs of abiotic factors. Large amounts of oxygen are required for cellular respiration and the burning of fossil fuels. Raw materials are required for manufacturing and water is required for human consumption, gardens and factory processes.

Urban ecosystems also have large outputs of abiotic factors, many of which are harmful to the environment. For example, large amounts of carbon dioxide are produced from cellular respiration and the burning of fossil fuels. Another example is wastewater from houses and factories which may contain detergent and harmful chemicals. This is usually treated and then released in the oceans. Gases such as carbon monoxide are also released into the atmosphere from car exhausts.



© SIDE & Westone

Acitivity - Types of Ecosystems

Use the information and diagrams about the types of ecosystems to answer the following questions:

1. Explain how the energy inputs of an urban ecosystem differ to those of a natural ecosystem (consider both type and amount).

2. The outputs of non-living factors are greatest in an urban ecosystem. Name some of these outputs. Outline some potential problems these outputs could cause.

3. Explain why a natural ecosystem said to be “more stable” than an urban ecosystem.

Biomes

Terrestrial ecosystems can be grouped into broad categories called biomes. A biome is a large geographical area of distinctive plant and animal groups, which are adapted to that particular environment. The climate and geography of a region determines what type of biome can exist in that region. Major biomes include deserts, forests, grasslands, tundra, and several types of aquatic environments. Each biome consists of many ecosystems whose communities have adapted to the small differences in climate and the environment inside the biome. To understand a world biome, you need to know:

- what the climate of the region is like
- where each biome is found and what its geography is like
- the special adaptations of the vegetation
- the types of animals found in the biome and their physical and behavioural adaptations to their environment

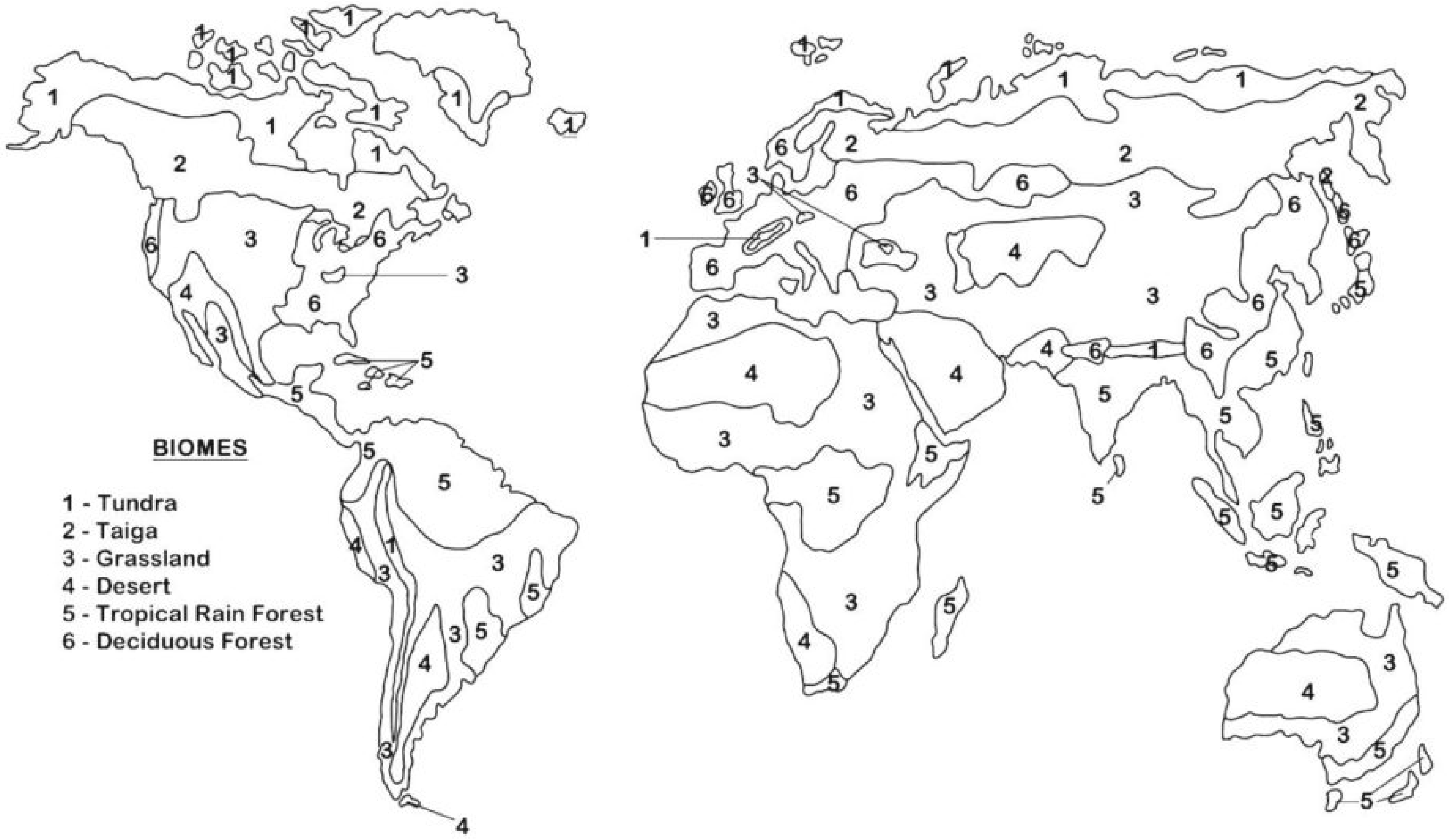
Ecological Relationships of Biomes

The survival and wellbeing of a biome and its organisms depends on ecological relationships throughout the world. Even changes in distant parts of the world and its atmosphere affect our environment and us. The eruption of a volcano in Mexico or Southeast Asia can bring the temperature of the whole world down a few degrees for several years.

Acitivity - Biomes

1. Use appropriately coloured pencils to colour in the world biomes found on the map on the next page.

Map Image: https://biologycorner.com/worksheets/biome_map.html CC BY NC SA
Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License


BIOMES
1 - Tundra
2 - Taiga
3 - Grassland
4 - Desert
5 - Tropical Rain Forest
6 - Deciduous Forest

2. Choose ONE of the biomes and complete the information below.

The following links may assist you.

http://mbgnet.net/index.html

https://www.pbslearningmedia.org/asset/ess05_int_biomemap/

http://www.ucmp.berkeley.edu/glossary/gloss5/biome/index.html

For your chosen biome research the following:

a) Average daily temperature and annual rainfall

b) Main landforms present in the biome

c) Animals and plants found within the biome

d) List any significant adaptations any plants or animals need to survive in this biome?

Components of an ecosystem

An ecosystem is composed of:

- the living (**biotic**) community
- its non-living (**abiotic**) surroundings.
- **energy flow** and
- **matter recycling**

Abiotic factors in an ecosystem are also known as the non-living factors. These include:

- Energy in the form of heat and light from the sun
- Chemicals or matter such as inorganic substances like water, oxygen, carbon dioxide and nitrogen or organic substances such as protein, carbohydrates and lipids.
- **Physical factors** such as **temperature, light, soil, nutrients** and **pH.**

Energy

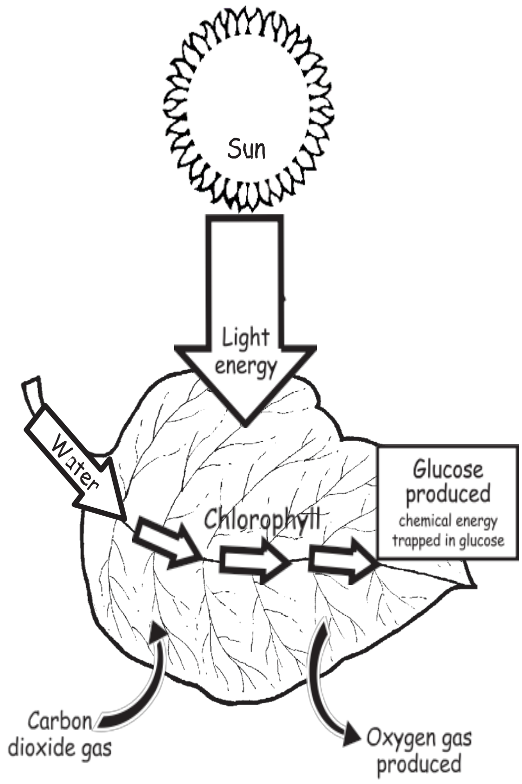
Energy cannot be recycled in an ecosystem. It can be **transformed** or changed from one form to another and can move through an ecosystem, but ultimately energy must be replenished by the sun. Energy flow throughout an ecosystem requires living organisms, and we will look at this in more detail later.

When we think about energy in an ecosystem the forms of energy that can move through an ecosystem include **chemical energy, heat energy** and **light energy.**

1. Chemical energy

This is the energy used to form chemical bonds between atoms. For example, glucose is a large molecule which contains the atoms carbon, hydrogen and oxygen joined together by chemical bonds. Energy is required to form these chemical bonds. Large molecules such as glucose contain more energy than small molecules such as carbon dioxide because glucose contains more chemical bonds. Chemical energy is stored in these chemical bonds. When these bonds are broken chemical energy is released.

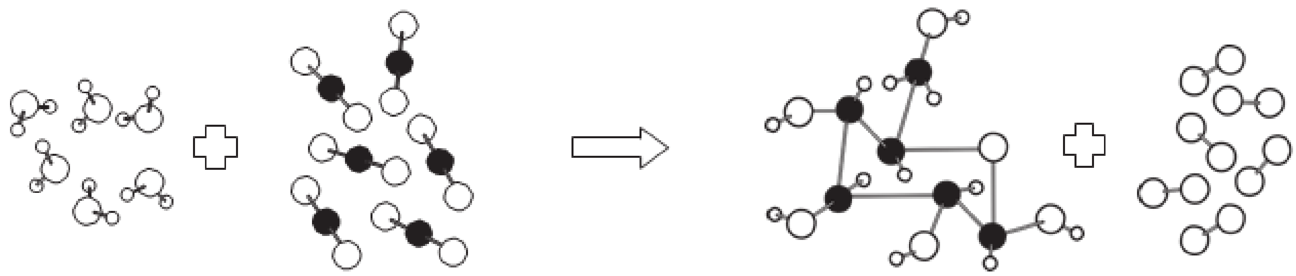
2. Light energy



In ecosystems the original source of energy is light from the sun. Only green plants which contain chlorophyll can trap light energy and convert this to chemical energy during the process of photosynthesis.

During photosynthesis a green pigment found in the leaves of plants (chlorophyll) absorbs the light energy and converts it into chemical energy. This chemical energy is used to join up atoms of hydrogen, carbon and oxygen to form glucose. This then traps the chemical energy inside the chemical bonds of the glucose molecule.

$$\text{Water} + \text{Carbon dioxide} \xrightarrow[\textbf{Chlorophyll}]{\textbf{Light Energy}} \text{Glucose} + \text{Oxygen}$$

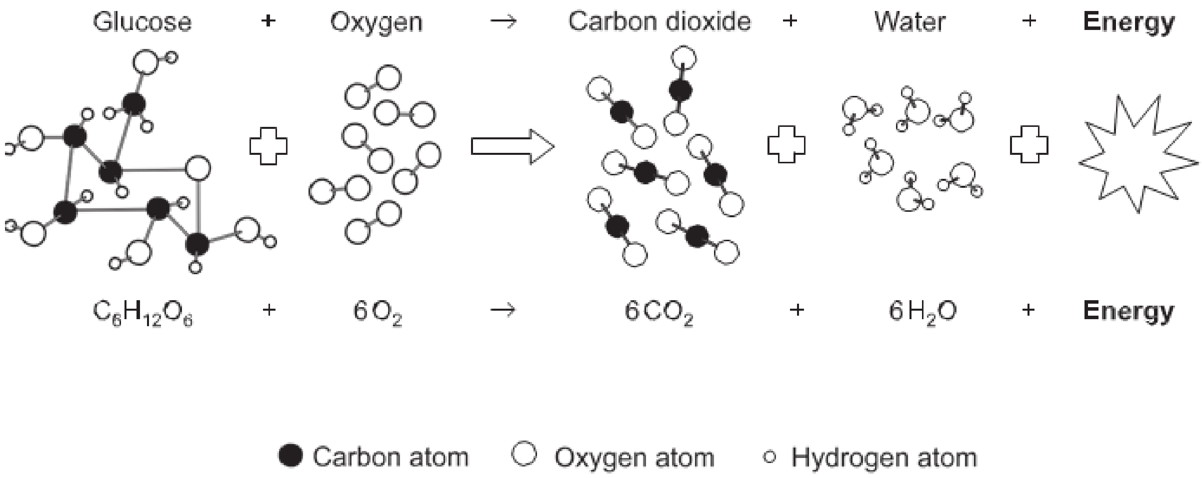


$$6H_2O + 6CO_2 \rightarrow C_6H_{12}O_6 + 6O_2$$

● Carbon atom ○ Oxygen atom ∘ Hydrogen atom

3. Heat energy

Energy is released from chemical bonds during **cellular respiration.** When chemical bonds between atoms are broken, energy is released. A large amount of the energy released is in the form of heat.



All living things need energy for processes such as building complex molecules and cell division.

Chemicals or matter

Matter is a **finite quantity** on the earth and is trapped here. Atoms and molecules do not enter or leave the earth. Matter (chemicals) that are essential for life must be continually recycled.

If matter was not recycled most of the atoms would be locked away in the carcasses of dead animals and plants. So, to make these building blocks of life available to the new and growing organisms of the planet, dead bodies must decay. The key to this process is a group of organisms often called decomposers. These decomposers, bacteria, fungi and protozoans, play an important role in returning valuable material to the soil and atmosphere in a form that can be utilised by green plants once more. Chemicals such as carbon, oxygen, nitrogen, phosphorus, sulphur, potassium and calcium cycle between the biotic and abiotic environment.

We will look at the way in which matter is cycled through ecosystems later.

Physical/ Abiotic factors

Factors which may impact on an ecosystem (particularly a wetland one) include: temperature, turbidity, pH, dissolved oxygen, nitrate levels and phosphate levels. These non-living factors can have considerable impact on freshwater ecosystems, particularly if they impact on autotrophic organisms (also known as producers).

A summary of some abiotic factors that affect water ecosystems is found below.

1. Temperature

The overall climate of a region has a major influence on water temperature. Cooler temperatures reduce growth rates of organisms. Water temperature plays a role in the types of species found in different wetlands and it controls metabolic rate of fish species.

Organisms have an upper and a lower temperature limit beyond which growth and reproduction will stop. There is an optimum temperature range within which maximum growth occurs. Seasonal changes in water temperature is a cue for migration and spawning in some species, with reproduction in some fish species being associated with warmer temperatures to ensure higher food availability for the larvae and juveniles. Most local fish prefer temperatures of between 15 ^{o}C and 25^{o}C. Fish can survive warmer water but only for short periods of time.

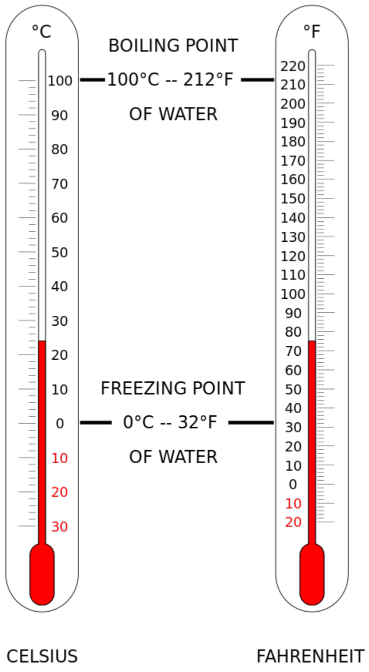
Temperature is a factor that affects the coral colonies of the Great Barrier Reef. Zooxanthella are photosynthetic algae that live protected in coral skeletons made of calcium carbonate. If water temperatures become too high, then the zooxanthella may detach from their coral skeletons and so the coral reef appears white, or bleached.

Left: Coral with brown zooxanthellae **Right: Coral without zooxanthella**

https://upload.wikimedia.org/wikipedia/commons/6/6a/CoralBleaching.jpg

Temperature can also affect other abiotic factors, such as the amount of dissolved gases that can be held within the water body.

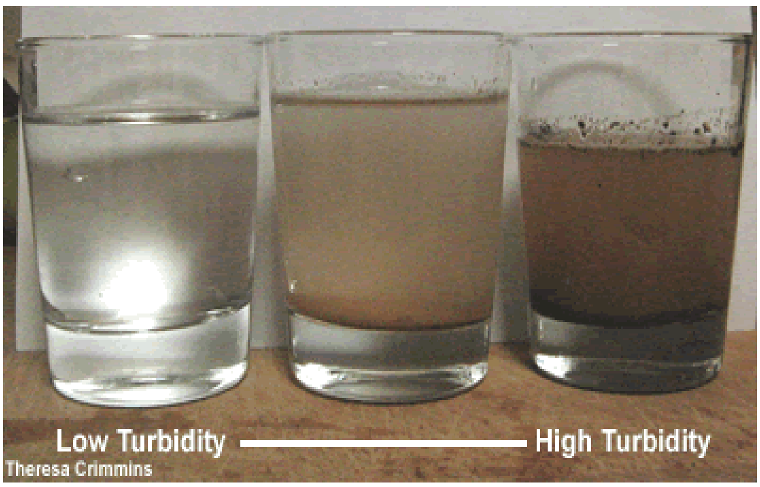
Temperature is measured with a thermometer



https://upload.wikimedia.org/wikipedia/commons/thumb/7/70/Thermometer_CF.svg/512px-Thermometer_CF.svg.png

2. Turbidity

Turbidity is the measure of the amount of finely divided solids suspended in the water. These suspended solids may consist of plankton, organic and inorganic detritus, sand, clay or silt. These occur naturally in bodies of water, but may be added to by human activity. Turbidity is recorded using units called Nephelometric Turbidity units. The word nephelometric refers to the way in which more specialised equipment that measures turbidity estimates how much light is scattered from suspended particles in the water.



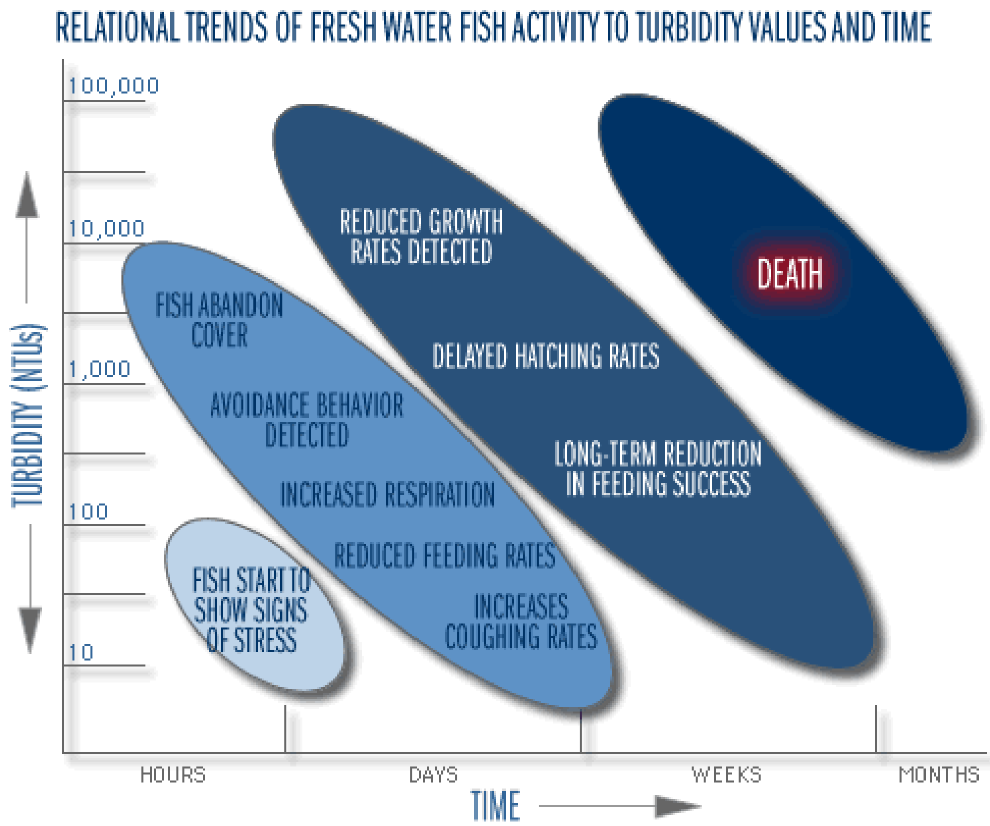
https://publiclab.org/wiki/turbidity CC BY SA 3.0 Creative Commons Attribution-ShareAlike 3.0 Unported License.

Increased levels of turbidity can affect aquatic organisms in several ways, for example:

a. Photosynthesis
Plants make their own food using light energy water and carbon dioxide. If turbidity is high, not enough of the green light wavelength can penetrate the water so plants cannot photosynthesis which can reduce plant growth or increase plant death.

b. Plant decay
If plants die, bacteria will break down the dead plant material. As there is more food for the bacteria they will increase in number and use up more oxygen. This means there will be less oxygen in the water for other animals.

c. Gas exchange
Many animals that live in water have external gills for breathing. If the turbidity is high the gills can become clogged and gas exchange between the water and the gills cannot occur leading to death.

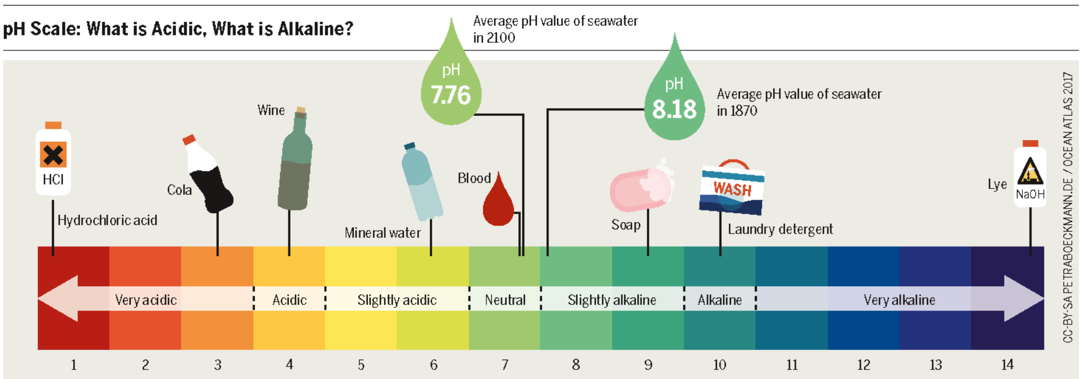


Schematic adapted from "Turbidty: A Water Quality Measure", Water Action Volunteers, Monitoring Factsheet Series, UW-Extension, Environmental Resources Center.
https://www.waterontheweb.org/under/waterquality/turbidity.html

Turbidity is measured with a turbidity tube and a secchi disk.

3. pH

pH is the measure of how acidic or basic a solution is. The normal range of pH in a freshwater system is between 6.0 and 9.0. A change in pH can have serious effects on the life in an aquatic ecosystem. It can cause the death of fish, larvae and eggs and it may also reduce the productivity of organisms. Higher levels of carbon dioxide in the water will lower the pH of the water, making it more acidic. The ideal range for freshwater aquatic organisms is between 6.5 and 8. pH is measured with universal indicator and a pH chart.



The difference may seem small, but the decline in the pH value from 1870 to 2100 would mean a 170 percent increase in acidity. Much smaller changes already pose problems for many sea creatures.

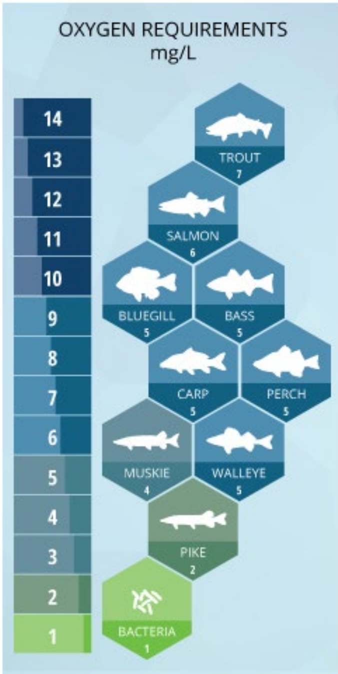
Image: https://upload.wikimedia.org/wikipedia/commons/0/0e/PH_Scale-_Acidic_vs._Basic_%28Alkaline%29.png

4. Dissolved oxygen

Most organisms require oxygen for survival. Oxygen is available in the water in a dissolved form. The oxygen is produced from photosynthetic activities of water-living autotrophs (producers), diffusion at the air-water surface and mixing by wind. The level of oxygen is also directly related to:

- temperature – as the temperature of the water rises, the **dissolved oxygen (DO)** level falls and, as the temperature of the water falls, the DO level rises
- the amount of living material in a water body – the more organisms, including bacteria and fungi, the higher the level of biochemical oxygen demand and the lower the level of dissolved oxygen. Organisms are particularly sensitive to oxygen levels in their juvenile stages.

DO is measured in units of mg/L. The ideal range of DO for stream fish is 7–11 mg/L.



Minimum dissolved oxygen requirements of freshwater fish

Fondriest Environmental, Inc. "Dissolved Oxygen." Fundamentals of Environmental Measurements. 19 Nov. 2013. Web.

Image: https://www.fondriest.com/environmental-measurements/parameters/water-quality/dissolved-oxygen/ © Fondriest Environmental

5. Nitrate

About 80% of the air is nitrogen but most organisms cannot use it in this form. Nitrogen is needed to build proteins. Nitrogen found in the air can be converted into a useable form and released into the soil by organisms such as blue-green algae and some legumes. When an animal consumes a plant, it can then use this form of nitrogen. Nitrates contain nitrogen and usually enter aquatic ecosystems by the decomposition of dead plants and animals and their wastes. Humans introduce nitrates into these systems by sewage and excessive fertiliser use in gardens. The fertilisers end up in drains when sprinkler systems run onto roads and down drains. In some instances, it can lead to significant plant growth called algal blooms. These blooms initially produce greater quantities of DO; however, when they die, much more oxygen is consumed by the decomposers, leaving little oxygen available for other aquatic organisms.
Nitrate levels are usually less than 1 mg/L. Concentrations over 10 mg/L will have an effect on any freshwater environment.

Nitrate levels are measured by nitrate probes.

6. Phosphate

Plants and animals require small doses of phosphorus (phosphates) for healthy growth and development. Freshwater ecosystems have very low supplies of phosphates compared with other ecosystems. Problems arise when there is a slight increase in these levels as this can also lead to algal blooms. Large streams have levels of phosphates around 0.1 mg/L while smaller streams have levels of only 0.01 mg/L. The impact is, therefore, much greater in smaller streams.

Phosphate levels are measured by the *total orthophosphate* test. The sample is added to chemicals and allowed to react. The chemicals turn dark blue when phosphate levels are high. A lighter shade of blue would indicate less phosphate in the sample

Activity – Science Inquiry Skills

Aim of the investigation:
To find out the effect of different concentrations of carbon dioxide have on the growth of plant seedlings.

How the experiment was carried out:
Grass seeds were cultivated under exactly the same conditions of carbon dioxide concentration, light, water, nutrients and soil type. Two weeks after germination the seedlings were all 30mm high. Then they were subjected to differing concentrations of carbon dioxide. The final height was measured after one week and the results of this investigation are shown in the table below:

Results:

concentrations of carbon dioxide (%)	Average height of seedlings after one week (mm)			
	Trial 1	Trail 2	Trial 3	Average
0.01	30	31	29	
0.02	31	30	32	
0.04	41	39	40	
0.06	49	50	51	

1.Calculate the average heights for the grass plants after one week.

3. Name the i**ndependent** variable in this experiment. This is the variable that is being **manipulated or changed** during this investigation.

____

4. Name the **dependent** variable. This is the variable that is **responds** to the independent variable during this investigation.

____

5. Write a suitable **hypothesis** for this investigation.

____

____

6. **Graph** the average results shown in the table above.

7. **Explain** why you chose to draw this particular type of graph.

8. Use the data on the graph to write a **conclusion**.

9. **Explain** why during scientific investigations it would be more reliable to base your conclusions on average results rather than just one trial

10. **Explain** how to generate accurate results during scientific investigations.

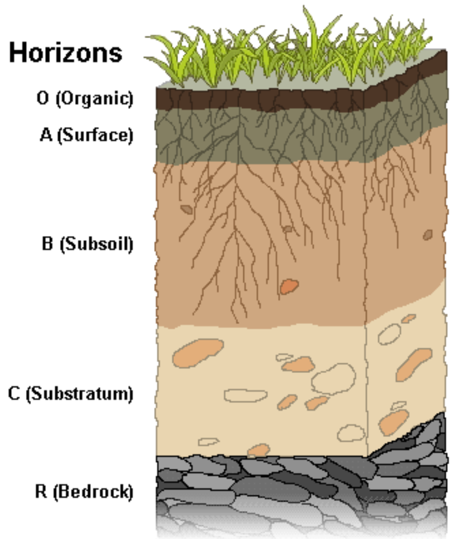
11. Use science principles to explain the results.

Other abiotic factors that impact on Ecosystems

On land as well as in water many physical factors can impact on the survival of both plants and animals and may help to produce the varied adaptations we see in the plant and animal kingdoms.

1. Air: In a terrestrial environment, air surrounds the biotic factors. Changes in the chemical composition of the air, like air pollution from cars or factories, impacts everything that breathes the air. Some organisms are more sensitive to changes in the air. For aquatic organisms, both the chemical composition of the air and water but also the quantity of air and water impact anything living in the water. For example, when algal blooms become excessive, the algae reduce the oxygen in the water, and many fish suffocate.

2. Soil or Substrate: Most plants need soil for nutrients and to hold themselves in place with their roots. Plants in areas with nutrient-poor soils often have adaptations to compensate, like the insect-capturing Cobra Lily and Venus Fly-trap. Soil or substrate also impact animals, such as the filter-feeding nudibranchs whose gills would be clogged if the substrate suddenly included fine particles of sand and silt.



By Wilsonbiggs - derived work from File:SOIL PROFILE.png by Hridith Sudev Nambiar at English Q52., CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=46207693

3. Water: Water is essential for life on Earth. Water is essential to the chemical reactions within living organisms, is one of the key components for photosynthesis and is the placeholder in cells. Water also serves as a living environment for aquatic creatures. As such, changes in quantity and quality of water impact living systems. Water also has mass, creating pressure in aquatic environments. Water's ability to hold temperature moderates' temperature changes within its mass and in nearby areas. For example, heat from the equator moved to higher latitudes by ocean currents results in milder climates for the affected areas. Differences in rainfall mean the difference between desert and forest biomes. Clouds can even be the controlling factor in some ecosystems, such as the cloud forests of the tropics where plants draw their moisture from the air.

https://upload.wikimedia.org/wikipedia/commons/e/ec/Waterfall_at_the_Polynesian.jpg

4. Light: Sunlight is the main source of energy on Earth, which makes it an extremely important abiotic factor. Sunlight is necessary for photosynthesis. Lack of light in the deeper ocean prevents photosynthesis, meaning that the majority of life in the ocean lives near the surface. Differences in daylight hours impact temperatures at the equator and the poles. The day-night rhythm of light impacts life patterns, including reproduction, for many plants and animals.

5. Salinity: Animals in the ocean are adapted to the salinity, using a salt renal gland to control the salt content of their bodies. Plants in high-salinity environments also have internal mechanisms to remove the salt. Other living creatures without these mechanisms die from too much salt in their environment. The Dead Sea and Great Salt Lake are two examples of environments where salinity has reached levels that challenge most living organisms.

6. Temperature: Is an abiotic factor that is strongly influenced by sunlight. Temperature plays an important role for animals that cannot regulate their own body temperature, such as reptiles. Unlike humans, whose normal body temperature is usually around 37ºC, reptiles (such as snakes and lizards) cannot maintain a constant body temperature. Reptiles are usually found in warm regions around the planet. To regulate their body temperatures, reptiles will sun themselves on rocks, which absorb heat from sunlight and then radiate heat back into the environment. Mammals have internal mechanisms to control their body temperature. Temperature changes, especially extreme and sudden changes, that go beyond an organism's tolerance will harm or kill the organism. Temperature changes can be natural, due to sunspots, weather-pattern shifts or ocean upwelling, or can be artificial, as with cooling-tower outfall, released water from dams or the concrete effect (concrete absorbing heat).

Activity – Ancient Australian Ecosystems

1. Click on the link below to visit the webpage **A Quick Lesson on Geological Time and Changes** for background information on this activity. https://integratedsciencegeneral11.weebly.com/geological-history-ecosystems-and-perth-basin-jcca-cliff.html

   ### Geological Time

   Geological time can be expressed in millions of years ago (ma).

   a) Draw the simplified Geological time scale

b) Scroll through the 7 points under the heading **Some changes through Geological Time.** Under each dot point draw or **describe** the information.

Some changes through Geological Time

1. The breakup of landmasses Pangea, Laurasia, Gondwana through geological time

2. Oxygen concentration in the earth's atmosphere

3. and 4. Atmospheric Carbon dioxide concentration and Global temperatures

5. Glacial and Interglacial Cycles

6. Changes to Sea Levels over geological time

7. Changes to Biodiversity over the last 540 million years

2. Rewilding a Jurassic World

This is background to the next Activity and gives rational for study of ancient ecosystems.

Click on the link http://www.georgialifetraces.com/2015/06/22/rewilding-a-jurassic-world/ **to visit the website** *Rewilding a Jurassic World - Life Traces of the Georgia Coast* **and continue reading**

> *Like many moviegoers this summer, I plan to watch Jurassic World. And because I'm a palaeontologist, I'll cheer for the movie's protagonists (the dinosaurs) and jeer at the villains (the humans). But no matter how thrilling this movie may be, one question will plague me throughout: where are the dung beetles?*

a) Justify why ancient ecosystems should be studied.

Australia's Ecosystems during the Geological Past

This task will allow you to apply what you have learned about present ecosystems to study ancient ecosystems from different Geological Periods in Australia.

Part A

Build a Storyboard of your Presentation.

This shows the images you will use and your script beside the image
Include references at the end
Save your document with your name in the file name.
Upload to Connect Submissions Folder
The Storyboard template follows these instructions.

Part B

iMovie/ PowerPoint Presentation.

Use the iMovie App and build a 3 minute iMovie.(or you may present your research as a very short PowerPoint). Your Audio-Visual Presentation should consist of;

- a few images that summarise the main points of your research and
- a short voice-over
- one question that results from your research
- acknowledgements and references
- music (optional)

Researching the Topic

This hyperlink to the **Melbourne Museum** website https://museumsvictoria.com.au/website/melbournemuseum/discoverycentre/600-million-years/ will help you start your research. You may need to navigate elsewhere to find suitable images.

Australia's Ecosystems during the Geological Past

Present the significant episodes that happened in Australia for the following periods. Significant events include: Major Events, Temperature, Atmospheric composition, Sea levels, Paleogeography, Ecosystems, including Fauna and Flora.

Geological Periods from which to choose

- Carboniferous Period (359.2 - 299 ma)
- Permian Period (299 – 251 ma)
- Triassic Period (251 – 199.6 ma)
- Jurassic Period (199.6 – 145.5 ma)
- Cretaceous Period (145.5 – 65.5 ma)

See the next page for a storyboard template

Storyboard Template for short Presentation

Title of iMovie/PowerPoint:

Student Name:

Date:

Image used in iMovie (sketch if you are writing this by hand)	**Script for this image**

References and acknowledgements:

Learning Tactic

Glossary – Ecosystem characteristics and abiotic factors

For each topic you need to build a glossary of key words, or terms. Key words and terms are used for concepts within the topic you are studying.

You need to use these key words and terms to demonstrate that you understand the concepts studied.

1. Find the objectives for this Topic. Key words have been written in **bold**.
2. List these bold words in the left-hand column of the Glossary Table below.
3. Use your text or the internet to write a definition and
4. Draw a diagram to help you remember this term
5. Continue working through this document and list other key wards and terms that appear in **bold** text. Repeat steps 3 and 4.
6. Re-read this document and add any other key terms that you do not understand yet.
7. Copy and paste the template below to complete your glossary.

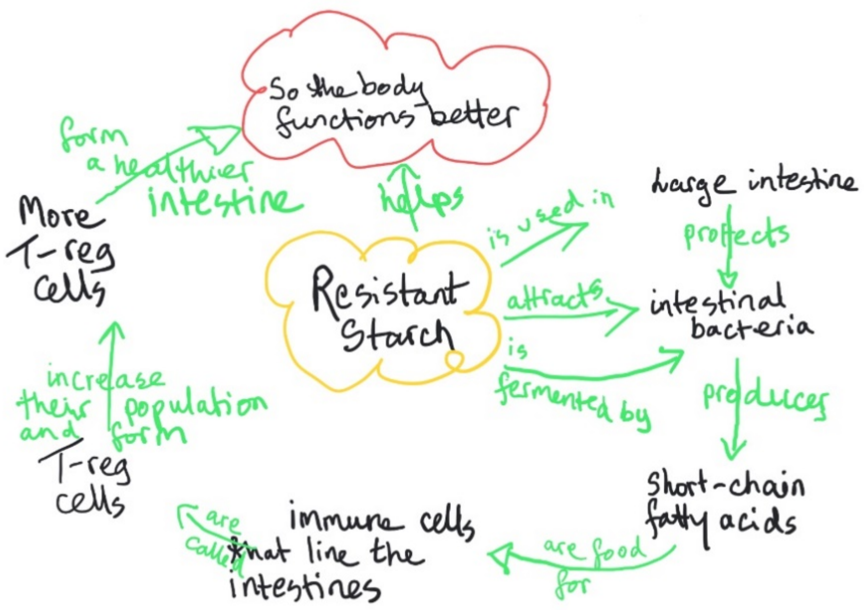
Concept, Term or Vocabulary	Description	Draw it / Apply it

Concept, Term or Vocabulary	Description	Draw it / Apply it

Learning Tactic

Concept Mapping – Ecosystem characteristics and abiotic factors

The Figure below shows an example of a concept map. It is a description of a nutrient called resistant starch. To read it start in the middle and read along each arrow in turn. You should be able to write a paragraph describing resistant starch.



Concept map made from reading text on resistant starch

Image Supplied by Catherine Morritt

Now you have a go at building a concept map for this topic.

1. Find the syllabus dot points for this Topic.
2. For each syllabus dot point:
   a) Write out the syllabus dot point
   b) Pick out the key terms, or concepts from the syllabus dot point and arrange them on a page.
   c) Draw arrows between the ideas that are related.
   d) Complete a sentence along the arrow to show the relationship between the key words or concepts.
3. When you have finished the concept map you should be able to write a paragraph, or two using it as a guide.