

Biodiversity – real life science work

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Number of lessons: 4

Year Level(s): Year 9

Australian Curriculum content descriptions:

Year 9 Content Descriptions

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).

- investigating the interdependence of communities and the role of Aboriginal and Torres Strait Islander Peoples in maintaining their environment ([OI.2](#), [OI.5](#))

- examining factors that affect population sizes such as seasonal changes, destruction of habitats, introduced species
- considering how energy flows into and out of an ecosystem via the pathways of food webs, and how it must be replaced to maintain the sustainability of the system
- investigating how ecosystems change as a result of events such as bushfires, drought and flooding

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.

Year 10 Content Descriptions

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)

- investigating some of the structural and physiological adaptations of Aboriginal and Torres Strait Islander Peoples to the Australian environment (OI.3, OI.7)
- describing biodiversity as a function of evolution

Achievement standard:

By the end of Year 10, students analyse how the periodic table organises elements and use it to make predictions about the properties of elements. They explain how chemical reactions are used to produce particular products and how different factors influence the rate of reactions. They explain the concept of energy conservation and represent energy transfer and transformation within systems. They apply relationships between force, mass and acceleration to predict changes in the motion of objects. Students describe and analyse interactions and cycles within and between Earth's spheres. They evaluate the evidence for scientific theories that explain the origin of the universe and the diversity of life on Earth. They explain the processes that underpin heredity and evolution. Students analyse how the models and theories they use have developed over time and discuss the factors that prompted their review.

Students develop questions and hypotheses and independently design and improve appropriate methods of investigation, including field work and laboratory experimentation. They explain how they have considered reliability, safety, fairness and ethical actions in their methods and identify where digital technologies can be used to enhance the quality of data. When analysing data, selecting evidence and developing and justifying conclusions, they identify alternative explanations for findings and explain any sources of uncertainty. Students evaluate the validity and reliability of claims made in secondary sources with reference to currently held scientific views, the quality of

the methodology and the evidence cited. They construct evidence-based arguments and select appropriate representations and text types to communicate science ideas for specific purposes.

Unit Overview

Students will experience what it is like to be a scientist working in the field of ecology (definition: the branch of biology that deals with the relations of organisms to one another and to their physical surroundings). In particular, working as a Taxonomist (Taxonomy is the science of naming, describing and classifying organisms and includes all plants, animals and microorganisms of the world). They will understand what is meant by

biodiversity and will then measure and analyse the biodiversity levels within their school or a local ecosystem. The study of biodiversity provides students with a more complete explanation of the dynamic living environment than the study of isolated topics and issues related to ecology or endangered species. The students will then complete their inquiry by writing recommendations on how to increase local biodiversity by creating a project plan to be presented to school leaders.

The main student group this unit is aimed at is Year 9. The Year 10 content descriptors have been included to provide extension for higher ability students who will be able to use the scientific understanding in their analysis of results.

Lesson 1 – What is biodiversity and why is it important?

Context

Over the past 200 years there has been a significant loss in Australia's biodiversity. While students can not hope to tackle issues covering large areas of Australia, they can make a significant contribution to local biodiversity issues. The teacher will use biodiversity to engage students with real scientific challenges to empower students to take action to protect and restore local biodiversity.

Materials and equipment

- Laptop (Internet services and resources)
- Library

Safety Advice

See Worksafe Queensland <https://www.worksafe.qld.gov.au/> for advice on safe use of laptops.

Objectives

Learning Intention:

Students will understand what is biodiversity, how to measure biodiversity, its importance and threats to biodiversity.

Success Criteria:

You will be successful when:

- **describe** the shared common characteristics of living things
- **co-construct** a definition of biodiversity
- **explain** interlinking views of why biodiversity is important
- **draw** a timeline of events that identify key drivers of habitat loss
- **identify** scientific tools and methods used to measure biodiversity
- **compare** the English definition of biodiversity with Aboriginal Peoples concept of 'Country'

Introduction

The beginning of the lesson starts with watching David Attenborough explain the idea of 'Tree of Life'. The purpose of starting with a video is to encourage a greater depth of discussion in a Year 9 classroom. It will help students identify key prior understanding that they may have on the topic. Use the strategy RASAlert where students must write down 3 new pieces of information from the video.

Watch video – Explaining the Tree of Life

<https://www.youtube.com/watch?v=pktDqEy5lcE>

- This resource was produced by the BBC in 2016.
- It is 5 minutes and 24 seconds in duration.

Alternative video:

Watch video - Why is Biodiversity important?

- This resource was produced by Earth School in 2015 and can be found on TED talks and through Clickview.
- It is 4 minutes and 18 seconds in duration.

After the video, use the strategy THINK:PAIR:SHARE to ensure students have information to share as a whole group discussion to answer the inquiry question: How has time allowed for so many animals and plants on this planet?

After/during the discussion, teacher to co-construct with students a working definition for Biodiversity.

Core

Students will research and report on one (1) chapter from the CSIRO book 'Biodiversity'.

- Use a strategy to allocate students to chapter, for example, a random generator online tool
 - <https://www.gigacalculator.com/randomizers/random-name-picker.php>
- Chapter 1 would have been covered by the Teacher
- Depending on lesson time (some schools have less than 70 minutes) the minimum to summarise would be: Chapters 2, 3, 4, 5 & 6
- Prior skills required – skim reading and note taking [ensure your students have skills before this unit]

Display timer on board so students know how long they have before they need to share with the whole class their summary.

Use a Collaboration tool where students can share their work for all to access.

Conclusion

Use a Check for Understanding strategy to ensure you know if your students understand biodiversity.

- Exit ticket; OR
- Some informal questioning to receive feedback on student progress and to help you, if required, to modify the next sequence of learning

Resources

Digital:

Worksheet:

Useful links:

<https://www.publish.csiro.au/book/6967>

This resource is free. The pdf is able to be downloaded within minutes.

Lesson 2 – Measuring biodiversity

Context

Science inquiry questions –

- What abiotic factors of the habitat affect the survival of plants and animals?
- How much has the habitat changed from its natural state?
- What are the food sources available for animals?

Make a hypothesis: a statement about a relationship you think exists in the study area, which can be tested.

The following will require either an incursion or an excursion variation to school routine procedure. For best results this lesson should be conducted over one (1) day. If you are unable to have a full day, please modify the task by breaking it up into achievable tasks.

Materials and equipment

PART A: Data Collection

Section A. Assess the habitat - Abiotic factors

Measure a range of conditions - Use Activity Sheet 2. Page 6.

- Temperature (thermometer)
- Humidity (hygrometer)
- Moisture content of soil (Moisture probe)
- Light (LUX meter)
- Wind (Anemometer)
- pH (meter or test kit)
- soil type (plastic zip lock bags – physical analysis in-situ or back in lab)

Section B. Biotic factors

- Plants including habitat description – Use habitat identification Activity Sheet 1, Page 4 and Activity Sheet 3, Page 8.

<https://www.qm.qld.gov.au/~media/Documents/Learning+resources/QM/Resources/Microsites/Wild+Backyards/backyard-explorer-user-guide.pdf>

- Vertebrates (observation only) – Develop a site-specific worksheet.
 - Birds
 - Reptiles
 - Amphibians
 - Mammals
- Invertebrates (collection) – Collection results Sheet 3, Page 15.
 - Spiders
 - Insects

For pitfall trap:

- 1L or 2L ice cream container with lid with large central hole cut
- Trowel
- A piece of Perspex roofing or chicken wire cut to size to cover the trap, refer to the Terrestrial Invertebrate Status Review
- Water with a little detergent (makes trapped insects sink)
- Specimen jars
- Sieve

For collecting in the leaf litter:

- Garden rake
- Specimen jars, labels etc.
- Methylated spirit
- White sheets of paper, a white tote box or a beating cloth made from calico
- Several pairs of gloves

For Netting:

- Butterfly or sweep net
- Specimen jars
- Methylated spirit (optional)
- Labels
- Pencil

For Beating:

- A piece of solid dowel (a broom handle is good)
- Large sheet of white paper, beating trays or a sheet of calico
- Specimen jars
- Methylated spirit (optional)
- Paper and pencil for labels
- Hand lenses

Ensure all equipment is packed according to task, in separate labelled containers. The tasks could be divided into group work where students don't collect data for every task but only on the task/s they have been assigned. Once back in the classroom the data can be shared with all students.

PART B : Identification

- Laptop or iPad to access online identification tools
- <https://support.ala.org.au/support/solutions/articles/6000195859-how-do-i-identify-a-species->
- Hand lenses
- Identification books (The Australian Bird Guide; Field Guide to Spiders of Australia; Mangroves to Mountains)

Safety Advice

Each educational setting will have their own risk assessment and management rules and guidelines. The following is a basic overview.

- Medium Risk level - Action by administration to mitigate risk – interim controls to be identified to reduce risk
 - Sun safety requirements: sunscreen, long sleeve shirt, wide brimmed hat, access to water, sunglasses and access to shade <https://www.qld.gov.au/health/staying-healthy/environmental/sun/how>

Ensure there will be sufficient adult supervision.

Objectives

Learning Intention:

Students will be able to collect relevant and reliable data; and will be able to identify plants and animals.

Success Criteria:

You will be successful when:

- **create** a hypothesis
- **collaborate** to collect data
- **identify** plants and animals using identification keys
- **record** data accurately

Introduction

Before running this lesson, as the responsible teacher, finalise your equipment and methods. A suggestion is to create your own work booklet that will contain all the data table/s for each method and provided to each student. An excel spreadsheet for each method can then be created back in the classroom for the collection of the whole class data.

At the site, either at the school grounds or a local area of interest, please give verbal instructions about safety and how to use equipment before students break into their groups.

Core

PART A: Data collection

PART B: Identification

Conclusion

Ask students to record a reflection about their experience in the student journal.

Resources

Digital:

Worksheet:

Useful links:

https://www.qld.gov.au/_data/assets/pdf_file/0029/68726/biocondition-assessment-manual.pdf

This resource is free. The pdf is able to be downloaded within seconds. It is a great resource for teacher education on the range of methods that could be used to sample for biodiversity (particularly in Queensland). It is the resource used by real life scientists.

<https://www.qm.qld.gov.au/~media/Documents/Learning+resources/QM/Resources/Microsites/Wild+Backyards/backyard-explorer-user-guide.pdf>

This resource is free. The pdf is able to be downloaded within seconds. It is a great resource for you as a teacher to develop resources and worksheets that will best meet the needs of your students.

Lesson 3 – Analysing and interpreting data

Context

Once all the raw data has been transferred to a central and open access point each student should save a personal copy for their manipulation.

Teaching the skills of creating data tables and graphs that can be analyzed and interpreted as evidence to address a question/s.

Materials and equipment

- Laptop (Excel)

Safety Advice

- See Worksafe Queensland <https://www.worksafe.qld.gov.au/> for advice on safe use of laptops.

Objectives

Learning Intention:

Students will be able to create visual representations of the collected data.

Success Criteria:

You will be successful when:

- **create** multiple graphs as evidence of data
- **write** an analysis under each graph, identifying trends and patterns in the data

Introduction

Prior to this unit please ensure you have a good understanding of the students' prior skill levels using excel.

Strategy - I do: we do: you do

I do – role model choosing raw data; applying any statistical/mathematical calculations to create a new table that will be used in the final report; how to turn table data into a graph in

excel. All the time talking about the trends and patterns in the data (and how to write the description under the graph).

<https://www.biointeractive.org/sites/default/files/media/file/2019-05/Statistics-Teacher-Guide.pdf>

- teacher reference book on Maths and Statistics in Biology

Core

We do – together choose another raw data set and create an excel graph. Once created have students identify and share the trends and patterns in the data and as a class write the description under the graph together.

You do – data collection groups to work together on the remaining data they collected. Once the group is happy with the graph and written analysis they will share on the collaboration space.

Conclusion

To receive feedback on student understanding collect the student reflection journals.

Resources

Digital:

Youtube channel – Technology for Teachers and students (excel)

Worksheet:

Useful links:

<https://www.biointeractive.org/sites/default/files/media/file/2019-05/Statistics-Teacher-Guide.pdf>

Lesson 4 – Restoring biodiversity

Context

Real life scientists give presentations on their investigation findings and make recommendations. Students will work in their groups to develop a plan to increase biodiversity levels within the school grounds. Students will present ideas.

Real life scientists give presentations on their investigation findings and make recommendations. Students will work in their groups to develop a plan to increase biodiversity levels within the school grounds. Students will present ideas.

To present the ideas the strategy of a 'gallery walk' can be used. Special guests could be invited, for example, the Principal, P&C members, grounds staff. They could then provide immediate feedback to the students.

Materials and equipment

- Laptop
- Butchers paper
- Pens

Safety Advice

- See your school's IT permissions for any app or software the students wish to use as parental permission is required for any new service.

Objectives

Learning Intention:

Students will be able to create a presentation on how to increase biodiversity locally

Success Criteria:

You will be successful when:

- **decide** format of presentation
- **create** visually engaging presentation
- **create** informative presentation
- **write** speech

Introduction

Prior to lesson: Teacher - Explore apps and software programs and choose a few options as a selection for your students to choose from, this list will be site specific due to permission levels.

Beginning of lesson – engage students by showing a range of science conferences in Australia. Explain how and why scientists need to be good communicators.

<https://allconferencealert.net/australia.php>

Core

Students to brainstorm in their groups using butcher's paper and pens to record all ideas.

Write on board each stage required and time allocated. Turn on timer, after each section have a 'check in' process to gain a quick understanding how all groups are progressing with the check list.

Checklist:

1. brainstorm ideas for increasing biodiversity on school grounds/local area (5 minutes)
2. choose agreed ideas (2 minutes)
3. review list of presentation options (5 minutes)
4. choose agreed presentation format (2 minutes)
5. create a list of tasks and student responsible for each task (2 minutes)
6. create presentation (20 minutes)
7. run through speech/es or words students will share as people walk around the gallery (5 minutes)

Gallery walk (25 minutes): - special guests (the Principal, grounds staff, P&C members), other Year 9 students walk around the classroom listening to presentations and providing feedback on ideas (using a criteria sheet).

Conclusion

Send all participants a survey to receive feedback on all aspects of the presentations including voting on the best ideas for improving biodiversity levels within the school grounds/local area.

Organise a meeting with the Principal for support to implement the student plans. Create an action committee to develop timeline of project implementation. There are grants available if funds are limited.

Resources

Useful links:

<https://visme.co/blog/best-presentation-software/>

<https://www.grants.gov.au/>