Teacher Notes

Themes

- Biodiversity
- Conservation
- Research collections
- Taxonomy

Key learning outcomes

- Understand how researchers rely on well-managed collections of once-living specimens for study
- Learn about the role diverse plants, fungi, microbes and animals play in keeping ecosystems healthy
- Recognise the goals of research and the tasks scientists undertake in order to discover more about nature
- Explore diverse natural and unnatural phenomena that affect biodiversity in positive and negative ways

Key curriculum areas

- **Science:** Science Understanding (Biological sciences), Science as a Human Endeavour, Science Investigation
- **English:** Language, Literature, Literacy
- **Mathematics:** Measurement and geometry
- **Cross Curriculum Priority:** Sustainability

Publication details

AmAZed! CSIRO's A to Z of Biodiversity
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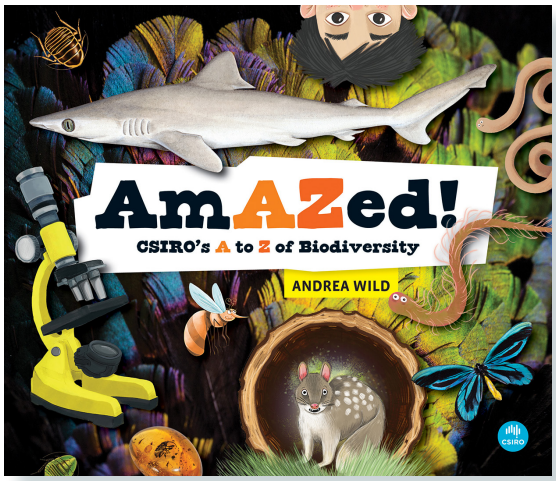

AmAZed!

CSIRO's A to Z of Biodiversity

Andrea Wild

About the book

Prepare to be *AmAZed!* on this wild ride through Australia's biodiversity from A to Z!

Go on an amazing scientific journey through 100 topics inspired by the specimens and stories from CSIRO's National Research Collections Australia. This book is filled with fabulous facts about plants, animals, microbes and the scientists who study them.

Find out how new species get their names and discover an orchid that grows underground, identify a fly that looks like a bee, and explore strange fish that live in the deep sea.

AmAZed! CSIRO's A to Z of Biodiversity covers Australia's natural wonders and impressive discoveries for each letter of the alphabet, accompanied by engaging photos and illustrations. Get ready to encounter the Lost Shark, the phenomena of sea sparkle and zombie worms!

Recommended for

Primary school readers

CSIRO PUBLISHING

Teacher Notes

About the author

Andrea Wild is a science writer at CSIRO. She works with the National Research Collections Australia, home to more than 15 million natural-history specimens, from tiny mosquitoes to huge sharks. Andrea's work helps publicise the scientists' important work. She has two sons, one who loves nature and one who loves experiments.

Pre-reading questions or activities

To prepare students for reading *AmAZed!* invite them as a group to create their own 'A to Z' list of plants, animals and fungi in their surroundings. Divide the list between members of the class and ask them to come up with short descriptions, illustrations and even photographs of the entries.

Discuss with the class how each living thing on their list affects its habitat and wider environment, and what might change if it vanished locally, or even globally. Annotate their 'A to Z' list with notes or codes to signify risks each organism faces, such as loss of habitat, use of pesticides or competition from introduced species.

Under some of the letters, add the names of important communicators and researchers – in their school, local community or elsewhere in the world – working on promoting and preserving biodiversity. Ask students to generate a list of questions they'd use in an interview with these people.

Discussion questions

Science

1. *AmAZed!* features descriptions of a wide variety of collections featuring animals, plants, fungi and microbes. Ask students why they think it might be important to curate physical examples of natural items, rather than just take photographs and detailed descriptions. How do they feel about removing specimens from the wild? How might researchers ensure what they take has little impact and a lot of benefit for the environment?
2. Under 'C', the author describes 'the Lost Shark' *Carcharhinus obsoletus*. Read the entry, then invite students to find another entry of an extant (known to still be living) organism in the book. Ask them if their chosen organism was to go extinct, how might they ensure future generations know as much about it as possible? Encourage students to get creative, beyond photographs and written descriptions.

3. Many of the entries in *AmAZed!* feature organisms that are shocking, gross or a touch scary. Ask which students would want to study flies? Or blob fish? Or beetles that roll poo into balls? Invite them to find the weirdest, grossest or ugliest thing in the book, and discuss why it's important – or unimportant – that these organisms are studied and saved.
4. In the biodiversity entry on page 14, the author describes the importance of biodiversity in protecting ecosystems. She uses the word 'endemic' to describe living things that have lived in a specific environment for a long time. For example, kangaroos are endemic to Australia's grasslands. Read through the entry on invasive species with students (page 45), then discuss how sometimes bringing new species into an environment could push out endemic organisms, and how this might change an ecosystem.
5. The Loch Ness monster (page 56) and the yowie (page 107) are two examples of mythological organisms we tell stories about, but aren't recognised as classified organisms. Discuss with the class how 'evidence' means 'observations that make us think an idea is more, or less, true', and how some forms of evidence (like physical materials) are more convincing than others (like reported sightings). Ask them what it might take for biologists to classify the Loch Ness monster as an animal.
6. Discuss with students how many have had relatives research their family tree, inviting them to share their stories on their ancestry. Read about the origins of life on page 67 and use the information to discuss the idea of 'common ancestors' – how we humans share not just common human ancestors with each other, but how species share them with each other as well.
7. Many examples of past organisms only exist as skeletons, fossils or preserved inside amber. Read examples of past remains (pages 88 and 98), and discuss with students the challenges researchers might face in piecing together how organisms behaved, reproduced or even what they looked like from such remains. How might they go about the task?
8. Insects play vital roles in our ecosystems. Read 'Vanishing insects' (page 95) and ask students to find other insect-related entries in the book. Discuss with them the importance of insects in ecology. Point out examples of insects we consider dangerous, invasive or 'pests' to agriculture. Discuss the challenges that might be involved in keeping some insect populations down without damaging others.
9. Bacteria, viruses and even many species of fungi are so small they can only be seen with a microscope. But being tiny doesn't mean unimportant. Invite students to share what they know about viruses and bacteria, writing short descriptions on a whiteboard or poster. Ask them to search *AmAZed!* for entries involving microorganisms, such as on antibiotics (page 12), germ theory (page 35), golden fungi (page 36) and influenza virus (page 41). Read to them the section on biodiversity (page 14) and discuss how little we know about microbes in our world.

10. *AmAZed!* features five entries on CSIRO scientists: Bryan 'the Fly Guy' Lessard (page 16), Cindy Bessey (page 19), Luana Lins (page 57), Will White (page 101) and Xiao Deng (page 102). Invite students to read each entry and discuss what a day in the life of each of the scientists might look like. What problems might they be solving or discoveries are they trying to make?

English

1. *AmAZed!* is full of amazing species of plant, fungi and animal. Each one has a scientific name consisting of two words, typically used for classification. Ask the students to try to pronounce the name. Ask the students why they think the words are so unusual. Read the entry 'Kingdom Animalia' (page 52) and discuss how the scientific language of naming makes classifying easier.
2. It can be hard remembering names for things sometimes. Languages often use some clever tricks to help, such as rhyming (Bry the Fly Guy) and acronyms (DNA and CSIRO). Ask the students what the acronyms stand for. Can they find any other examples in the book? (RV *Investigator*, UNESCO, and UV are some other examples)

Mathematics

1. Read the entry on the insect collection at CSIRO (page 43). The first paragraph gives readers an appreciation of just how big 12 million is. Ask the students to come up with other ways to imagine seriously big numbers by dividing them into units we can easily interpret. Read 'Origins of life' (page 67). How long do they think it would take to count to 3 billion?
2. Read the entry on rats (page 78). Ask the students to compare the mass of the Timor-Leste giant rat with other familiar objects. How much do they think a common rat weighs today? Find other examples of measurements in *AmAZed!* to discuss with students.

Activities

Science

Preserving plants

Many plants can be kept intact by pressing them between sheets of paper. Read the entry on plant collection (page 72) and encourage students to preserve their own specimens.

Teacher Notes

What you need

- Examples of plants, preferably with flowers and leaves intact (buy them from a florist, or find some in the school's gardens – with permission of course!)
- Scissors
- Sticky tape
- Pen
- 2 × A4 sheets of paper (blotting or butcher's paper works fine)
- 2 × A4 or larger cardboard pieces (old boxes cut into sections work fine)
- 2 × large rubber bands (large enough to wrap around one of the cardboard pieces)
- Stacks of books or similar weighted objects

What to do

1. Divide the plant specimens among the students.
2. Provide all students with two sheets of cardboard and two sheets of A4 paper.
3. Instruct the students to lay a sheet of A4 paper on one A4 cardboard piece.
4. Show the students how to spread their plant specimen across the A4 paper, ensuring the flower, stem, leaves and any other parts – such as seed pods – have plenty of space around them. If there are too many leaves, invite students to trim a few away with scissors. If the plant doesn't fit entirely on the sheet, they are welcome to trim off excess stem with their scissors.
5. Instruct the students to lay the second sheet of A4 paper on top of the plant specimen.
6. Instruct the students to lay the second A4 cardboard piece on top of the A4 sheet of paper.
7. Ask the students to slip two rubber bands around the plant-and-cardboard 'sandwich' to help keep them bound together. Tell them to label their bound plant specimen so they can recognise it.
8. Pile stacks of books or other weights on top of the bound plant specimens.
9. After a week, remove the weights from the bound plant specimens and ask the students to carefully remove the top sheet of cardboard and paper. Invite them to use sticky tape to hold down loose material.

What's happening?

Plants are largely made of fibrous materials based on long chains of carbohydrates, such as cellulose and lignin. Unlike the proteins and fats that make up animal bodies, these tougher molecules can last a long time if they're kept dry and away from animals that want to eat them.

Pressing the plants between sheets of paper draws moisture from their tissues, while squeezing them makes it easier to store in a collection and keeps their general shape and structure. This allows botanists to easily return to the preserved plants to compare parts of their anatomy when they need to identify another plant in the field.

A sock full of seeds

Hunting specimens for study – whether insects, plants or even microbes – can require thinking outside of the box. Read about tree seed collections (page 89), and discuss with students ways they might easily collect grass seeds.

What you need

- A pair of long, fluffy socks (old woollen ones are good, or cheap polyester works fine)
- Unmown meadow or field
- Shoes
- Tweezers
- Small sandwich bag

What to do

Instruct students to slide a pair of long, fluffy socks up over their shoes.

Take the students on a walk through an unmown meadow or field, taking care to avoid clear dangers such as snakes and wombat holes.

On returning to the classroom or a clear space, instruct students to use tweezers to remove plant material caught in their socks and place it into small sandwich bags for easy inspection.

Compare the different bits of material. Which bits seem to have hooks, spikes or sticky sap? Do any look like seeds?

What's happening?

To distribute themselves over a wide area, many grasses make use of the animals that move through them. Hooks and spikes covering their seeds can snag the fur of passing mammals, or even birds, to relocate to new environments.

In 1941, an inventor by the name of George de Mestral took inspiration from the hooks on grass seeds to come up with a product we commonly use today to secure materials together. The fabric adhesive Velcro® was based on a bur he found in his dog's fur!

Curating a classroom

Turn the classroom into a museum for a day. Invite students to bring from home an item such as a toy, book or even something impersonal like a cup or bit of cutlery.

Use these items as a basis for a display. Ask students how they might arrange the items for viewers to see and study them. Discuss what information they might provide alongside each item to give viewers an idea of its qualities, including its history. How will the items be tracked so they don't go missing?

Invite other students to walk through the classroom's collection of items and read the descriptions presented with each.

Mathematics

Markers of history

What you need

- Roll of toilet paper
- Dark markers
- Space outside

What to do

1. Read through *AmAZed!* and note down as many dates as possible, along with a short note on what it represents. They can be exact, like '1963: Queen visits Australia and uses Aerogard', or approximate, like '2000 years ago – Greek and Roman cultures record names for constellations'.
2. Finding a space outside, roll out a length of toilet paper so it stretches a good 20 metres or so (or longer!). You might need people to hold it down, or use weights, to stop it blowing around.
3. Explain to the students they will be writing dates on the paper, with 'today' at one end and the earliest date on their list near the other end.
4. Discuss with them how they might arrange the dates so they are in relative positions along the length of paper. Give them the opportunity to discover that some dates might not be feasible (such as '3.5 billion years ago').
5. Ask them to write down the dates on the sheet once they're confident of their arrangement and relative distances.
6. Try to work out when ancestors might have lived. Ask students when their grandparents were born. How many generations do they think have passed in '10 metres' of toilet paper?

What's happening?

Large numbers can often be hard to put into context, especially when they relate to periods of time. Fifty years can seem like ancient history to young minds. Once dates can be visualised, ask students to judge when various events happened in relation to the ones they've written on their paper roll.

Australian Curriculum Links

Year level	Learning area: Science	Other learning areas
Year 3/4	**Science Understanding: Biological sciences** • Living things can be grouped on the basis of observable features and can be distinguished from non-living things (ACSSU044) • Living things depend on each other and the environment to survive (ACSSU073) **Science as a Human Endeavour** • Science knowledge helps people to understand the effect of their actions (ACSHE051, ACSHE062)	**English** • Understand how different types of texts vary in use of language choices, depending on their purpose and context (for example, tense and types of sentences) (ACELA1478) • Understand differences between the language of opinion and feeling and the language of factual reporting or recording (ACELA1489) • Understand how texts vary in complexity and technicality depending on the approach to the topic, the purpose and the intended audience (ACELA1490) • Understand how to use knowledge of letter patterns including double letters, spelling generalisations, morphemic word families, common prefixes and suffixes and word origins to spell more complex words (ACELA1779) **Mathematics** • Recognise, represent and order numbers to at least tens of thousands (ACMNA052, ACMNA072) • Compare objects using familiar metric units of area and volume (ACMMG290)
Year 5/6	**Science Understanding: Biological sciences** • Living things have structural features and adaptations that help them to survive in their environment (ACSSU043) • The growth and survival of living things are affected by physical conditions of their environment (ACSSU094) **Science as a Human Endeavour** • Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena and reflects historical and cultural contributions (ACSHE081, ACSHE098) • Scientific knowledge is used to solve problems and inform personal and community decisions (ACSHE083, ACSHE100)	**English** • Investigate how vocabulary choices, including evaluative language can express shades of meaning, feeling and opinion (ACELA1525) • Understand how to use phonic knowledge and accumulated understandings about blending, letter-sound relationships, common and uncommon letter patterns and phonic generalisations to read and write increasingly complex words (ACELA1830) **Mathematics** • Choose appropriate units of measurement for length, area, volume, capacity and mass (ACMMG108) • Pose questions and collect categorical or numerical data by observation or survey (ACMSP118)
All	**Cross Curriculum Priority: Sustainability** OI.2 All life forms, including human life, are connected through ecosystems on which they depend for their wellbeing and survival. OI.3 Sustainable patterns of living rely on the interdependence of healthy social, economic and ecological systems. OI.4 World views that recognise the dependence of living things on healthy ecosystems, and value diversity and social justice, are essential for achieving sustainability. OI.7 Actions for a more sustainable future reflect values of care, respect and responsibility, and require us to explore and understand environments.	

Related children's books from CSIRO Publishing

Ocean Animals: The Weirdest, Smartest and Sneakiest Sea Creatures (https://www.publish.csiro.au/book/7881)
Plantastic! A to Z of Australian Plants (https://www.publish.csiro.au/book/7956/)

Related identification books from CSIRO Publishing

A Guide to Native Bees of Australia (https://www.publish.csiro.au/book/7388)
Field Guide to the Frogs of Australia (https://www.publish.csiro.au/book/7897)
The Australian Bird Guide (https://www.publish.csiro.au/book/7906)

Other resources mentioned in *AmAZed!*

Atlas of Living Australia (ala.org.au)
Questagame (questagame.com)

Other CSIRO resources

CSIRO has developed and delivered a broad range of high-quality STEM education programs and initiatives for nearly 40 years. Our programs aim to inspire the pursuit of further STEM education among students and the community, to equip the emerging workforce with tomorrow's skill sets, and to strengthen collaboration between industry and classrooms across Australia. For more information visit: https://www.csiro.au/en/Education