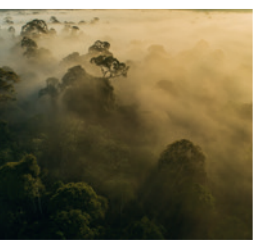
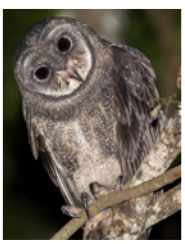
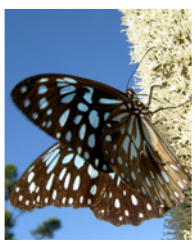
Jane Goodall's roots&shoots

Planet for Life

Action for a sustainable world

Teacher Resources




Jane Goodall Institute
Australia

Jane Goodall's roots & Shoots

The Jane Goodall Institute Australia acknowledge with deep respect the First Nations of this land we now call Australia.

We recognise their continuing connection to Country, and acknowledge that they never ceded sovereignty. We thank them for caring for our living landscapes since time immemorial.

We acknowledge and respect the continuation of cultural, spiritual and educational practices. We pay our respects to Elders past and present and emerging, and extend that respect to all First Nations people reading this resource.

Contents

About Roots and Shoots

Roots & Shoots (R&S) is a program designed to empower youth to be proactive in making a better world for animals, people and our shared environment. Join Roots and Shoots as an individual or group to make a difference in your community! Members receive the support from our team to participate in one of our programs, or to develop their own project.

Signing up is free!

Simply follow these three steps for your free membership today!

1. **Register:** Visit our website to sign up
2. **Select a program:** Decide on a project
3. **Make a difference:** Achieve results with R&S support

We offer several amazing Australian programs including:

- **ReWild your school:** A curriculum-aligned program to foster environmental champions
- **Pen pals:** An international letter exchange program to nurture diversity
- **Embrace the wild:** Tools and projects to support your local environment
- **National youth leadership program:** A program to equip16-25 years to lead environmental action
- **Mini grants:** Funding to boost your own project
- **Resource Box for Schools:** Free books and lesson plans designed to empower action

https://janegoodall.org.au/roots-shoots/

About the Resource Box

The Roots & Shoots Resource Box is designed for teachers and students in primary schools, or homeschoolers. As well as the four stunning books within, the Box offers several exciting learning opportunities and competitions to further foster optimism for our future. R&S are excited to be partnering with WOODiWILD to increase biodiversity. Woodiwild enables schools to join a national tree planting program – creating habitat and carbon storage - while also raising funds for their own school needs! To learn more about this fantastic initiative visit woodiwild.org

WOODiWiLD

This Teacher Resource

This resource aims to more deeply engage teachers and students with the amazing and inspiring content of the book *Planet for Life*. Moving beyond simply reading and viewing the beautiful pages of this book, through these learning sequences it is hoped all can feel more purposefully connected to nature and inspired to take action towards a better future.

Teachers can choose to undertake part, or all, of these learning sequences, however it is recommended to follow the complete sequence in order to achieve the best outcomes.

These learning sequences loosely apply the 5 E's instructional model– see page 2 for a more complete summary of these pedagogical approaches.

A digital edition of Planet for Life can be accessed here:

https://heyzine.com/flip-book/52a46c0692.html

We would like to thank Dr Eleanor Velasquez (Education and Training Manager, TERN Australia, University of Queensland) and Corrine Bowman for their contributions to these teacher resources.

All images from Planet for Life. *See image credits page* 184 *for details.*

Print edition of *Planet for Life* corrections: The text on page 111 should read 'Did you know that Australia has about 2000 species of native bees? 1400 species nest in the ground, along with many other beneficial insects.'

We are also aware of a couple of minor graphical errors in the print edition of *Planet for Life*. We apologise for any inconvenience.

The 5 E's

These learning sequences loosely follow inquiry-based learning into a modified 5Es instructional model (Bybee, 1997), with the five phases: Engage, Explore, Explain, Elaborate and Evaluate.

5E's	Main ideas / skills
Engage	Identifying and defining Connect past with present Create interest
Explore	Researching and planning Encourage creative thinking Give common set of experiences Challenge own ideas
Explain	Apply new vocabulary
Elaborate	Producing and implementing Apply to new experiences
Evaluate	Testing and evaluating. Have you changed your thinking?

Introduction to the Planet for Life Lesson Sequences

A word from the author

There are billions of reasons life can exist on this planet. Each species plays a part in a system that sustains life, otherwise known as the biosphere. Collectively, the biosphere is comprised of many different ecosystem types. These provide humans with beneficial ecosystem services that meet our needs for survival, either directly, such as food and oxygen, or as the support crew enabling life to flourish, such as the pollinators and nutrient recyclers.

And yet there is an enormous disconnect between our absolute dependence on nature to provide these services, and our human affinity to nature. We are literally destroying nature at an unprecedented rate, and with it our only home here on Earth.

Humans are facing some major issues. We have separated these issues into the categories of climate change, pollution, biodiversity loss, land clearing, exploitation and consumerism to name the headliners. But what we seem to disregard is that these issues are all inextricably linked. The future seems dire, and many fear for the world we are leaving our children.

Some may argue that being direct with children about the issues facing our planet is wrong. We may be placing an unfair burden on them, driving ecoanxiety, fear or despair.

But in business as usual we are continuing to repeat the past mistakes and neglecting the opportunity to give children the power to think and act sustainably immediately, and to adopt this behaviour for life.

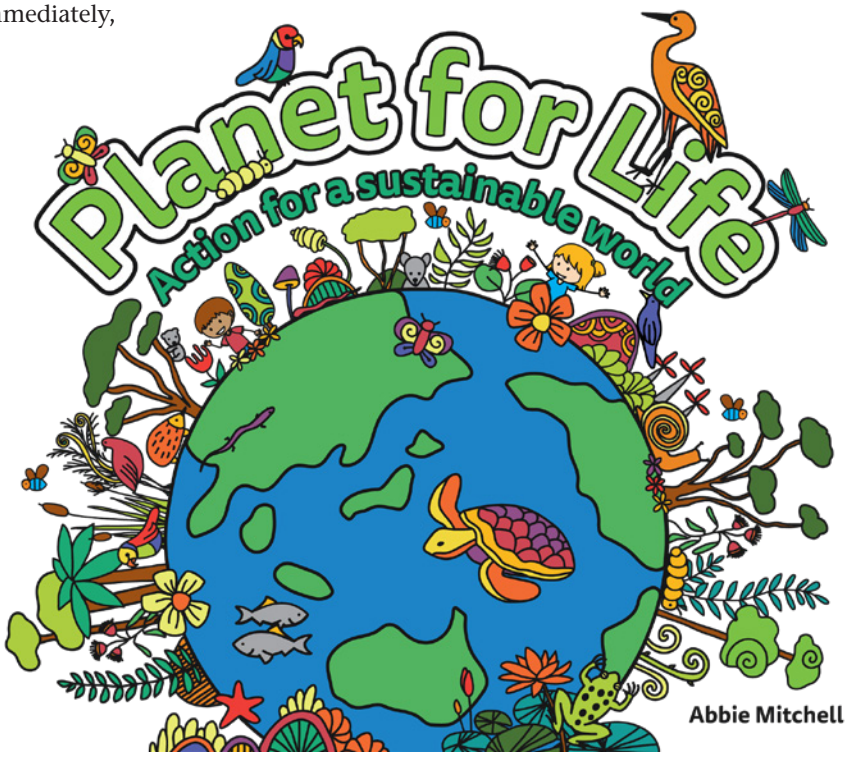
Planet for Life aims to address problems with solutions. But to understand the solution, firstly you need to understand the problem. Fundamentally this book strives to demonstrate the links between these individual issues and asks readers to apply critical thinking to understand that a holistic proactive approach is what is required to make positive change for Earth Positive.

Many questions about the state of our world fall to the teacher to explain, and sometimes this can be difficult. The book, *Planet for Life*, offers a tool to address these questions. These lesson sequences are created to enable educators a way to empower children. To develop the connection between cause and effect, and foster a collective shift to sustainable behaviour.

Many questions about the state of our world fall to the teacher to explain, and sometimes this can be difficult. The book, Planet for Life, offers a tool to address these questions.

We offer 6 sequences linked to the Australian curriculum. We acknowledge that there are some sophisticated concepts, and that not all people learn at the same pace. We invite educators to use this as a scaffold from which to explore the ideas in *Planet for Life*. Several of the sequences could easily be adapted for a different age cohort, or you may cherry pick ideas from across the range to develop your own. We hope you find these sequences beneficial to your teaching, and that together we can nurture the leaders for a green future.

Abbie Mitchell



Summary of Learning Sequences

All sequences contain 5-7 lessons

These lesson sequences are intended as a guide to further investigate the content in the book and how it can be applied within a local context. Many lessons are applicable across years and curricula. Main ACARA links are provided for each lesson.

Learning sequence	Learning intention	Examples of ACARA curriculum links	Main learning experiences	Page
1: **Clean waterways: The importance of clean water for our planet**	Explain how human induced changes in ecosystems affect living things	**Foundation:** **HASS Geography:** The features of familiar places they belong to, why some places are special and how places can be looked after (AC9HSFK03). **HASS: Geography:** Communicating shared narratives and observations, using sources and terms about the past and places (AC9HSFS05). **Year 1:** **Science Understanding: Biological science:** identify the basic needs of plants and animals, including air, water, food or shelter, and describe how the places they live meet those needs (AC9S1U01). **Science as a human endeavour: Use and influence of science:** Describe how people use science in their daily lives, including using patterns to make scientific predictions (AC9S1H01). **Science Inquiry: Communicating:** Write and create texts to communicate observations, findings and ideas, using every day and scientific vocabulary (AC9S1I06). **Hass: Knowledge and Understanding: Geography:** How places change and how they can be cared for by different groups including First Nations Australians (AC9HS1K04).	Investigating local waterways to determine if they are impacted by pollution Establishing what is considered rubbish and where it comes from Looking at fresh water animals and how they use waterways Looking at our own behaviour to minimise waste	7
2: **Linking thinking: Where do products come from?**	Deconstruct the steps from paddock to plate and how each may affect the planet	**Year 2:** **Science understanding: Chemical sciences:** Recognise that materials can be changed physically without changing their material composition and explore the effect of different actions on materials including bending, twisting, stretching and breaking into smaller pieces (AC9S2U03). **Science as a human endeavour: Use and influence of science:** Describe how people use science in their daily lives, including using patterns to make scientific predictions (AC9S2H01). **Hass: Knowledge and Understanding: Geography:** How places can be spatially represented in geographical divisions from local to regional to state/territory, and how people and places are interconnected across those scale (AC9HS2K03). **Year 4:** **HASS: Geography:** Sustainable use and management of renewable and non-renewable resources, including the custodial responsibility First Nations Australians have for Country/Place (AC9HS4K06). **Year 5/6:** **Knowledge and Understanding: Food and fibre production: Food specialisations:** Explain how and why food and fibre are produced in managed environments (AC9TDE6K03). **Knowledge and understanding: Technologies and society:** Explain how people in design and technologies occupations consider competing factors including sustainability in the design of products, services and environments (AC9TDE6K01). **Knowledge and understanding: Technologies context: Materials and technologies specialisations:** Explain how characteristics and properties of materials, systems, components, tools and equipment affect their use when producing designed solutions (AC9TDE6K05).	Investigating where food comes from and how it is packaged Considering the environmental footprint from paddock to plate Taking responsibility for our environmental footprint	13

Learning sequence	Learning intention	Examples of ACARA curriculum links	Main learning experiences	Page
3: **Healthy habitats: Life relies on both living and non-living things**	Discovering how living and non-living things interact	**Year 3:** **Biological Sciences:** Compare characteristics of living and non-living things and examine the differences between the life cycles of plants and animals (AC9S3U01). **Year 6:** **Science: Science understanding: Biological science:** Investigate the physical conditions of a habitat and analyse how the growth and survival of living things is affected by changing physical conditions (AC9S6U01).	Exploring different kinds of ecosystems Determining how we classify living and non-living things Investigating soil: Is it living or non-living? Understanding how beneficial insects are a natural pest control Investigating what beneficial insects need throughout their lifecycle	20
4: **Food chains: The impacts to food webs with a warming planet**	Exploring the complex relationships between different species and our environment	**Year 4:** **Science Understanding: Biological science:** Explain the roles and interactions of consumers, producers and decomposers within a habitat and how food chains represent feeding relationships (AC9S4U01). **HASS: Geography:** The importance of environments, including natural vegetation and water sources, to people and animals in Australia and on another continent (AC9HS4K05). **HASS: Geography:** Sustainable use and management of renewable and non-renewable resources, including the custodial responsibility First Nations Australians have for Country/Place (AC9HS4K06).	Understanding habitats and ecosystems Exploring microhabitats via conducting an invertebrate search Discovering the broad diets of local species Sorting local species into food chains, food pyramids and food webs Understanding why biodiversity is important Taking responsibility for our environmental footprint	26
5: **Light pollution: Looking after nocturnal animals**	Evaluating our local area for the impacts of light pollution and how it can be minimised	**Year 5:** **Biological Sciences:** Examine how particular structural features and behaviours of living things enable their survival in specific habitats (AC9S5U01). **Physical sciences:** Identify sources of light, recognise that light travels in a straight path and describe how shadows are formed, and light can be reflected and refracted (AC9S5U03). **Science as a human endeavour: Nature and development of science:** Examine why advances in science are often the result of collaboration or build on the work of others (AC9S5H01) and investigate how scientific knowledge is used by individuals *and* communities to identify problems, consider responses and make decisions (AC9S5H02). **Hass: Geography:** The management of Australian environments, including managing severe weather events such as bushfires, floods, droughts or cyclones, and their consequences (AC9HS5K05).	Investigating local nocturnal animals and what they need Surveying the school for light pollution Creating a sustainable habitat for nocturnal animals	34

Learning sequence	Learning intention	Examples of ACARA curriculum links	Main learning experiences	Page
6: **A sustainable Earth: Working towards Earth Positive**	Explain how human induced climate change affects all living things, and how we can reduce those impacts by promoting biodiversity and ecosystem services	**Year 6:** **Design and Technology: Knowledge and understanding: Technologies context: Materials and technologies specialisations:** Explain how characteristics and properties of materials, systems, components, tools and equipment affect their use when producing designed solutions (AC9TDE6K05). **Design and Technology: Knowledge and understanding: Technologies and society:** Explain how people in design and technologies occupations consider competing factors including sustainability in the design of products, services and environments (AC9TDE6K01). **Science: Science understanding: Biological science:** Investigate the physical conditions of a habitat and analyse how the growth and survival of living things is affected by changing physical conditions (AC9S6U01). **Science: Science as human endeavour:** Examine how advances in science are often the result of collaboration or build on the work of others (AC9S6H01). **Science: Use and influence of science:** Investigate how scientific knowledge is used by individuals and communities to identify problems, consider responses and make decisions (AC9S6H02).	Discovering how Earth's temperature is regulated Exploring how different surfaces contribute to local temperatures Understanding how nature can reduce global warming Investigating how climate change is impacting animals Understanding the importance of complex relationships within nature for providing ecosystem services Understanding the importance of interspecies relationships to maintain viable ecosystems Comprehending that the solutions to climate change, promote biodiversity, and nurture ecosystem services are all linked Understanding how changing individual behaviour can help reduce global warming, increase biodiversity and conserve ecosystem services	39

Across all sequences:

General Capabilities: Critical and Creative Thinking, Ethical Understanding, Personal and Social Capability, Literacy.

Cross-curriculum priorities:

Systems: The interdependence of Earth's systems (geosphere, biosphere, hydrosphere and atmosphere) that support all life on Earth, and social and economic systems.

World views: The role of world views (sets of attitudes, values and beliefs) that shape individual and community ideas about how the world works and our role in the world.

Design: The role of innovation and creativity in sustainably designed solutions, including products, environments and services, that aim to reduce present and future impacts or to restore the health or diversity of environmental, social and economic systems.

Futures: Ways of thinking and acting that seek to empower young people to design action that will lead to an equitable, sustainable and inclusive future.

Access the *Planet for Life* eBook to share on the smart board or across multiple devices:
https://heyzine.com/flip-book/52a46c0692.html

CLEAN WATERWAYS:
The importance of clean water for our planet

Overarching Inquiry Question:

What is the impact of pollution on our waterways and where does it come from?

Learning Intentions:

Explain how human induced changes in ecosystems affect living things.

Success criteria:

I can investigate the physical conditions of a waterway and how pollution threatens living things in that ecosystem.

I can determine what is water pollution and where it comes from.

I can identify ways that I can change my own behaviour to reduce the waste that I generate.

KEY WORDS

Consumer
Environment
Habitat
Invertebrate
Pollution
Waste
Waterways

Main Outcomes:

Foundation:

HASS Geography: The features of familiar places they belong to, why some places are special and how places can be looked after (AC9HSFK03).

HASS: Geography: Communicating shared narratives and observations, using sources and terms about the past and places (AC9HSFS05).

Year 1:

Science Understanding: Biological science: Identify the basic needs of plants and animals, including air, water, food or shelter, and describe how the places they live meet those needs (AC9S1U01).

Science as a human endeavour: Use and influence of science: Describe how people use science in their daily lives, including using patterns to make scientific predictions (AC9S1H01).

Science Inquiry: Communicating: Write and create texts to communicate observations, findings and ideas, using every day and scientific vocabulary (AC9S1I06).

Hass: Knowledge and Understanding: Geography: How places change and how they can be cared for by different groups including First Nations Australians (AC9HS1K04).

Cross-curriculum priorities:

Systems: The interdependence of Earth's systems (geosphere, biosphere, hydrosphere and atmosphere) that support all life on Earth, and social and economic systems.

World views: The role of world views (sets of attitudes, values and beliefs) that shape individual and community ideas about how the world works and our role in the world.

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Futures: Ways of thinking and acting that seek to empower young people to design action that will lead to an equitable, sustainable and inclusive future.

Lesson 1 – **Clean waterways:** The importance of clean water for our planet

Content	Teaching Ideas	Resources
Engage: **Why is clean water important?**	**Read:** • Nature's community: (Inquiry question: What is a habitat?). Pages 14-15. • Crystal Clear: (Inquiry question: How does nature help to purify water?). Pages 54-55. • Changing our ways: Littering (Inquiry question: How can we take responsibility for natural places?). Page 91. **Activity:** • Use the book to find some images of clean waterways and the animals that use them. • Search the internet or other sources to find images of dirty waterways. **Questions:** • Have you ever visited a beach or creek? • What do you love about these types of waterways? • Why are waterways important to us? • What sort of animals live in waterways? • What do the animals need from their environment? • How do you feel when you see dirty waterways? • What do you think happens to animals in dirty waterways? • Who do you think puts the rubbish in the waterways?	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html) • Internet access

Lesson 2 – **Clean waterways:** The importance of clean water for our planet

Content	Teaching Ideas	Resources
Explore: **Investigating our local waterways**	**Activity:** Either go on an excursion to a local waterway (E.g. creek, river, wetland), or view images from local waterways. Take photos of the waterway to refer to later. **Questions:** • Can you see any rubbish in the waterway (or have you seen rubbish in waterways before?). • Can you see any living things in the waterway? (animals or plants). • Can you see any non-living things that might help clean the water (or change the flow)? • How might pollution affect the animals in the waterways? (E.g. rubbish, chemicals). • How might pollution in the waterways impact humans? • How do you feel about this? • Where might the water in the local area end up? • What could we do to stop the rubbish going into the waterway? **Options:** • Contact a local environmental education centre about their aquatic waterways excursions. • Ask a local ecologist or bush care volunteer to visit (or join the excursion) to talk about how to manage habitats in waterways to meet the needs of animals. • Some invertebrates are more tolerant of polluted water than others and the presence/absence of certain species can help determine water quality. Conduct an aquatic macroinvertebrate survey and use the Water Watch Detective Guide to determine water quality based on the species presence/absence. You will need some nets, white trays or jars and magnifying glasses. See the (Appendix 2) for a copy of the guide. Alternatively teachers may wish to pre-collect some invertebrates to show in the classroom, or your local environmental education centre may be able to assist with this too.	• Excursion to waterway or various images of a waterway **Options:** • Guest speaker • Water Watch Detective Guide (Appendix 2) • Trays • Magnifying glasses • Nets

Lesson 3 – **Clean waterways:** The importance of clean water for our planet

Content	Teaching Ideas	Resources
Explain: **Where does water flow?**	Explain that waterways are at the lowest point in the environment and the runoff from streets and drains will eventually end up in the waterways – connecting from creeks to rivers as they flow along – and eventually to the sea. **Activity:** Determine where the local drainage flows. Using a map (E.g. Google Maps) follow the path of the local waterways from where it begins to where the water ends up. Identify where on the map your school community lies and other known landmarks such as the shops or a park. Explain that rubbish on the ground, from our community, is often washed into these waterways too. **Questions:** • What is rubbish? Where does it come from? • Who is responsible for creating rubbish? • Who is responsible for cleaning up rubbish? **Option:** Make a diorama of a catchment or waterway in a tray or sandpit using sand and stones. Students could also add cardboard animals attached to sticks along the waterway. Pour some water at one end to represent rainfall and throw small pieces of rubbish in to see where it ends up.	• Digital or paper map of the area **Option:** • Tray of sand or sandpit • Art materials • Waste paper • Watering can of water

Lesson 4 – **Clean waterways:** The importance of clean water for our planet

Content	Teaching Ideas	Resources
Elaborate: **How can we reduce the rubbish that washes into the local waterways?**	**Read:** • Chapter 5: Select some examples of how we can reduce waste in our daily lives (E.g. Refuse: We say no!, Reuse: Creative solutions, Recycle: Bin right). (Inquiry question: How can we reduce waste?). Pages 150-177. **Activity:** We can minimise waste in two main ways – by being careful what we buy, and by being careful how we dispose of it. Present some products and consider them in the context of these two points. 1. Being careful of what we buy: E.g. Could we have chosen products with less packaging, or that use more sustainable materials? (E.g. paper products made from recycled paper, avoiding individual packets of snack food and using reusable containers to carry snacks disseminated from a larger packet, avoiding single use plastics including drink containers). 2. Being careful about how we dispose of products: E.g. What goes to landfill? What can we reuse or recycle? **Read:** • Celebrate our waterways: (Inquiry question: How can we work with nature to create clean beautiful places for animals, people and our shared environment?). Pages 124-125. List some species and features that you have seen in local waterways including any observed from the excursion or in family outings E.g. fish, dragonflies, ducks, crayfish, frogs, reeds, rocks, branches. You could also revisit any photos from earlier or view species online. **Questions:** • What are some of the species (animals and plants) that use local waterways? • How are these species helping to keep the water clean? • What might these animals need to be able to survive there? **Activity:** Reimagine and create a poster promoting clean waterways. Using examples from this lesson, and the book, students draw and label a poster to promote clean waterways. The drawing should include: • A title: E.g. We all need clean water! • Images: Local animals and plants (E.g. ducks, dragonflies, reeds, waterlilies), other features that help purify the waterways (E.g. rocks, logs). • Labels: Names of plants or animals • A call to action: E.g. Don't let your rubbish wash down the drain!	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html) • Selection of packaged products • Internet access (optional) • Art materials

Lesson 5 – **Clean waterways:** The importance of clean water for our planet

Content	Teaching Ideas	Resources
Evaluate: **Taking responsibility for personal waste**	**Watch:** • Search for a video/photo online showing a marine turtle eating a jelly fish. If possible also view a marine turtle eating a plastic bag. Note how similar they look. **Questions:** • Why do you think the marine turtle is eating the plastic bag? • Where did the plastic bag come from? • What happens if a fish eats plastic, and we eat the fish? • What can we do to reduce the rubbish that ends up in our waterways? **Activity:** Reducing the waste that we create is a great way to also reduce the amount of waste that ends up in waterways. Use the 10 R's poster (Appendix 4) and worksheet (Appendix 5) to encourage sustainable habits. Each chart has space for the names of students. Print as many as required for the class. Over the course of the term, have students work towards actioning each of the 10 R's. You may wish to focus on one at a time, or randomly complete them opportunistically. Verify actions with regular class check-ins. Remind the students that an example of the final R (Reimagine) has been achieved when they reimagined a local clean waterway by making a poster!	• 10 R's poster (Appendix 4) • 10 R's worksheet (Appendix 5)

LINKING THINKING:
Where do products come from?

Overarching Inquiry Question:

What is the impact of consumerism and how can we reduce our personal impact?

Learning Intentions:

Deconstruct the steps from paddock to plate and how each may affect the planet.

Success criteria:

I can investigate the steps from paddock to plate.

I can consider which products have greater environmental impact.

I can identify ways that I can change my own behaviour to reduce the waste that I generate.

Main Outcomes:

Year 2:

Science understanding: Chemical sciences: Recognise that materials can be changed physically without changing their material composition and explore the effect of different actions on materials including bending, twisting, stretching and breaking into smaller pieces (AC9S2U03).

Science as a human endeavour: Use and influence of science: Describe how people use science in their daily lives, including using patterns to make scientific predictions (AC9S2H01).

Hass: Knowledge and Understanding: Geography: How places can be spatially represented in geographical divisions from local to regional to state/territory, and how people and places are interconnected across those scale (AC9HS2K03).

Year 4:

HASS: Geography: Sustainable use and management of renewable and non-renewable resources, including the custodial responsibility First Nations Australians have for Country/Place (AC9HS4K06).

Year 5 & 6:

Knowledge and Understanding: Food and fibre production; Food specialisations: Explain how and why food and fibre are produced in managed environments (AC9TDE6K03).

Knowledge and understanding: Technologies and society: Explain how people in design and technologies occupations consider competing factors including sustainability in the design of products, services and environments (AC9TDE6K01).

Knowledge and understanding: Technologies context: Materials and technologies specialisations: Explain how characteristics and properties of materials, systems, components, tools and equipment affect their use when producing designed solutions (AC9TDE6K05).

KEY WORDS

Biodiversity
Consumer
Ecosystem service
Environment
Manufacturing
Non-renewable
Renewable
Resources
Sustainability

Cross-curriculum priorities:

Systems: The interdependence of Earth's systems (geosphere, biosphere, hydrosphere and atmosphere) that support all life on Earth, and social and economic systems.

World views: The role of world views (sets of attitudes, values and beliefs) that shape individual and community ideas about how the world works and our role in the world.

Design: The role of innovation and creativity in sustainably designed solutions, including products, environments and services, that aim to reduce present and future impacts or to restore the health or diversity of environmental, social and economic systems.

Futures: Ways of thinking and acting that seek to empower young people to design action that will lead to an equitable, sustainable and inclusive future.

Lesson 1 – **Linking thinking:** Where do products come from?

Content	Teaching Ideas	Resources
Engage: **What does nature provide humans?**	**Read:** • Nature's services: (Inquiry question: What does nature provide for humans?). Pages 28-29. Take time to look at the ecosystem services and discuss examples of some. Specifically, highlight the provisioning services of food, fuel and raw materials which are the focus of this lesson sequence. • Providing the basics: (Inquiry question: How do we rely on provisioning services to produce, manufacture and deliver products?) Food: Pages 34-35; • Making stuff: Pages 38-39; Power to go: Pages 40-41. **Questions:** • What is a resource? • What is the difference between a renewable and non-renewable resource? • What is a consumer? What is consumerism? • Are all products equally important?: I.e. What is a want and what is a need? **Activity:** Complete the ecosystems worksheet (Appendix 7).	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html) • Ecosystem services worksheet (Appendix 7)

Lesson 2 – **Linking thinking:** Where do products come from?

Content	Teaching Ideas	Resources
Explore: **Where does our food come from and how is it packaged?**	As a class select some favourite fruits. **Questions:** • Where does the fruit come from? A local farm? The supermarket? • Is the fruit packaged or are the items loose? (E.g. A punnet of strawberries compared with a whole watermelon). • Does the fruit have a sticker on it, a rubber band, a net or any other packaging/labelling? • How does the fruit get to the shop? • How far do you think the fruit may have travelled to the shop? • What happens if fruit is not sold before it spoils?	• Samples of different fruits (real or images especially showing different packaging techniques)

Lesson 3 – **Linking thinking:** Where do products come from?

Content	Teaching Ideas	Resources
Explain: **What does labelling tell us?**	Select some basic packaged food items and investigate their ingredients. Look up any unknown ingredients and or places of origin as a class. **Questions:** • How many ingredients do they have? • How does the manufacturer suggest the product be disposed of? • Where is the product made? (Is it an Australian or international product? How did it get to Australia?) • In preparation for the next activity include viewing the information on a tomato sauce label	• Examples of packaged goods with labelling (especially showing ingredients, origin and disposal)

Lesson 4 – **Linking thinking:** Where do products come from?

Content	Teaching Ideas	Resources
Elaborate: **The environmental footprint of paddock to plate**	This lesson is intended to demonstrate that all products, even humble tomato sauce, impacts the environment. The outcome is to influence good consumer choices in reducing our environmental footprint as much as possible. **Read:** • Linking thinking: (Inquiry question: What is the environmental footprint of food manufacture?). Page 97. **Activity:** Option to do this in groups or as a class: Create a mind map of the steps and needs involved in manufacturing tomato sauce (the journey of tomato sauce). On a large piece of butcher's paper or on the whiteboard, write each step in a separate circle and add the arrows to indicate the direction of the process: 1. Growing 2. Transport to the factory 3. Manufacturing into sauce 4. Packaging and delivery to suppliers 5. Purchase by the consumer At each of the 5 steps brainstorm as many processes or needs that may contribute to the environmental footprint of tomato sauce. You may wish to source a video that showcases the manufacturing of a similar food product for inspiration: 1. Growing: E.g. soil, water, space, fertiliser, machinery, erosion, habitat loss, chemical use. 2. Transport to factory: E.g. Cardboard boxes (paper, glue, dye), refrigerated trucks, fuel for trucks. 3. Manufacturing into sauce: E.g. Specialist machinery for washing, cooking and processing the tomatoes (and the materials used to make the machinery such as metals, plastics, rubber). Energy to run the factory. Other ingredients and the processes in their creation. 4. Packaging and delivery to the suppliers: E.g. Raw materials for bottles (plastic, paper, ink, glue, dye) and manufacturing machinery for filling the sauce bottles and printing and attaching the labels. Energy to make the packaging and put the sauce into the bottles. Packing of the bottles into cardboard boxes (made from paper, ink, glue), stacking on pallets (made from timber, nails). Delivery via trucks, trains or boats – energy to power these. 5. Purchase by the consumer: E.g. Fuel to get to the shop, bag to carry it home, refrigeration once open, disposal of packaging (recycling or landfill), disposal of food waste. Teaching ideas for this lesson continued on next page ▶▶	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html) **Option:** • Video showing the manufacturing process of a packaged food item • Butcher's paper and markers

Lesson 4 – **Linking thinking:** Where do products come from? (continued)

Content	Teaching Ideas	Resources
	Read: • Changing our ways: (Inquiry question: What are the impacts of manufacturing?) Select some of the following E.g. Clearing, exploiting, intensifying, eroding, draining, poisoning, littering, burning, wasting, spreading, billowing and chilling. Pages 88-93. **Questions:** What are some of the impacts tomato sauce manufacturing may have on: • Waste – E.g.: > How can the bottle be disposed of? (look at the label). > Why would recycling be better than sending the bottle to landfill? > What might be the steps in recycling the bottle (breaking down and recreating it into something else)? > Is any sauce wasted or is the bottle being discarded empty? (Introduce the idea of food waste and packaging waste). • Biodiversity – E.g.: > Could animal habitat have been cleared to create the tomato farm? > Could fertiliser be impacting microorganisms? > Could the farm be taking too much water from the environment? > Would organic tomato sauce have less impact than regular tomato sauce? • Sustainability (resource and energy use) E.g.: > How much fuel is used in the manufacturing process to power the factory, farm and transport? > Would renewable power be better than using fossil fuels? > How far did the tomatoes travel to the factory? > How far did the tomato sauce travel to the shops? > What proportion of the ingredients are locally sourced? > Would it be better to buy Australian made or from an international supplier? • People: E.g.: > Where was the tomato sauce manufactured? > Do you think people were paid fairly to grow, manufacture and transport the product? > What makes you think this? (E.g. Cost of the product, location it was made such as a developing country).	

Lesson 5 – **Linking thinking:** Where do products come from?

Content	Teaching Ideas	Resources
Evaluate: **Taking responsibility for our environmental footprint**	**Read:** • Part 5: The Planet Plan: (Inquiry question: How can we change behaviour to create a more sustainable planet). Pages 150-177. **Activity:** Reimagine: Create a poster or persuasive text that revisits the tomato sauce journey with sustainability top of mind and covering the 5 steps as per previously. E.g.: 1. Growing: Organically grown ingredients. 2. Transport to factory/store: Transported using green energy. 3. Manufacturing into sauce: Made from Australian sourced ingredients. 4. Packaging: Packaging made from recycled materials and label printed using non-toxic ink. 5. Purchase by the consumer: Selected Australian grown organic product. Carried home using own bag via public transport or green vehicle. Used the entire bottle of sauce. Recycled the container. Use the 10 R's chart (Appendix 4) and worksheet (Appendix 5) to encourage students to act sustainably. Each chart has space for the names of students. Print as many as required for the class. Remind students that they have achieved an example of one of the 10 R's when they reimagined a sustainable process for the paddock to plate of tomato sauce! Over the course of the term, have students work towards actioning each of the 10 R's. You may wish to focus on one at a time, or randomly complete them opportunistically. Verify actions with regular class check-ins.	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html) • 10R's poster (Appendix 4) • 10 R's worksheet (Appendix 5)

HEALTHY HABITATS:
Life relies on both living and non-living things

KEY WORDS

Beneficial insects
Biodiversity
Characteristics
Ecosystem
Ecosystem service
Environment
Invertebrates
Lifecycle
Nutrients
Pollinator
Soil
Sustainability
Vegetation

Overarching Inquiry Question:

How do living and non-living things interrelate?

Learning Intentions:

Discovering how living and non-living things interact.

Success criteria:

I can determine the difference between living and non-living things that make up ecosystems (Year 3). I can Identify how a change in physical conditions such as soil type affect biodiversity (Year 6).

I can consider the complex relationships between species.

I can identify ways that I can change my own behaviour to improve outcomes for biodiversity.

Main Outcomes:

Year 3 **Biological Sciences:** Compare characteristics of living and non-living things and examine the differences between the life cycles of plants and animals (AC9S3U01).

Year 6 **Science: Science understanding: Biological science:** Investigate the physical conditions of a habitat and analyse how the growth and survival of living things is affected by changing physical conditions (AC9S6U01).

Cross-curriculum priorities:

Systems: The interdependence of Earth's systems (geosphere, biosphere, hydrosphere and atmosphere) that support all life on Earth, and social and economic systems.

World views: The role of world views (sets of attitudes, values and beliefs) that shape individual and community ideas about how the world works and our role in the world.

Design: The role of innovation and creativity in sustainably designed solutions, including products, environments and services, that aim to reduce present and future impacts or to restore the health or diversity of environmental, social and economic systems.

Futures: Ways of thinking and acting that seek to empower young people to design action that will lead to an equitable, sustainable and inclusive future.

Lesson 1 – **Healthy habitats:** Life relies on both living and non-living things

Content	Teaching Ideas	Resources
Engage: **Do living things need non-living things to survive?**	**Read:** • Nature needs nature: (Inquiry question: What is an ecosystem?). Page 10 and pages 14-15. **Question:** • How many different types of ecosystems can you name? (E.g. Woodlands, heath, alpine, rainforest, desert). You may wish to look at images of ecosystems and discuss key differences between them. • What broad ecosystem is your school based in? (You can search online). **Activity:** Create a 3 columned table labelled: species, living and non-living. Add 5 local species known to students to consider as below. What living, and non-living, things would be required by each species to survive? (E.g. Blue tongue lizard – living: Food (invertebrates, fruits, seeds, flowers, fungi, eggs), shelter (grass tussocks); non-living (hollow logs, earth burrows, water). **Questions:** • Are non-living things important? • How should we categorise non-living things that were once living, such as a hollow log? **Read:** • Holding it all together and Crystal clear: (Inquiry question: How do living and non-living things work together?). Pages 50 and 54. Use the examples provided about erosion control and water purification to investigate how living and non-living things work together in an ecosystem. **Question:** • Reinvestigate any thoughts about the question 'Are living and non-living things important?'	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html) • Internet access

Lesson 2 – **Healthy habitats:** Life relies on both living and non-living things

Content	Teaching Ideas	Resources
Explore: **Is soil living or non-living?**	**Read:** • Dirty Tricks (Inquiry question: Is soil living or non-living?). Pages 62-63. **Question (This could also be a debate):** • Is soil living or non-living? **Activity:** One way that we can tell if soil is healthy is by the amount of life in it. As a class collect some soil from different parts of the school. Use a shovel to collect a specimen that includes soil from a little deeper down. Ideally you should collect soil from a barren area, a vegetable patch or active garden, from beneath leaf litter, beneath grass cover, and from a moist or shady area. You can also collect compost if you have some. Be sure to add each soil specimen to a different tray and note where it was from. Break the class into teams and issue each a magnifying glass to answer the following questions. (Alternatively you can do this with a smart phone projected onto a smart board, or simply using the naked eye). **Option:** You could also include an invertebrate search as part of the activity – see instructions on page 27 (Learning Sequence 4/Lesson 01/Activity). **Questions:** • Which soil holds the most/least moisture? • Can you see animals in the soil? (E.g. Earth worms or other invertebrates). • How many different types of animals can you count in each sample? (I.e. which is the most biodiverse)? • Is there any decaying plant matter? • What are the invertebrates eating? • Which soil appears to be the healthiest, and the least healthy? • What was on the ground above the soil? (E.g. Leaf litter, mulch, vegetation, nothing?) • Do you think all the soils are the same type? (Why /why not?). **Activity:** Determine the soil type using the soil chart in the (Appendix 1). **Question:** • Did the soil test correspond with your findings (I.e. was loam soil also the most biodiverse?)	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html) • Soil chart (Appendix 1) • Spade • Containers • Magnifying glasses • Student Presentation platform (E.g. PowerPoint) **Option:** • Invertebrate ID chart (Appendix 3) • Collection tray • Containers • Magnifying glasses

Lesson 3 – **Healthy habitats:** Life relies on both living and non-living things (continued)

Content	Teaching Ideas	Resources
Explain: **What are beneficial invertebrates?**	**Read:** • Farms for Life (Inquiry question: What do we need for sustainable farming?). Page 108. Make a point of the phrase 'beneficial insects'. • Awesome farm hands and Dirty deeds (Inquiry question: How can invertebrates assist our environment?). Pages 110-113. • ReWild – A life time of love (Inquiry question: How should we look after animals throughout their lifecycle?). Page 163. **Activity:** Many beneficial insects and other invertebrates have very distinct lifecycles where the young have different habitat or dietary needs from their parents. Create a table with the following headings for the roles of beneficial invertebrates: Pollinators, Nutrient recyclers, Pest controllers. These headings will assist students to think more broadly about the types of invertebrates that would fall into each category. Then brainstorm some beneficial invertebrates that would fall into each E.g.: • Pollinators: Bees, butterflies, moths, beetles, flies, lacewings, wasps. • Nutrient recyclers: Worms, cockroaches, beetles, flies. • Pest controllers: Spiders, praying mantis, lacewings, beetles, wasps. From the list assign student teams a beneficial invertebrate to research online or in books and create a short presentation (E.g. PowerPoint). Highlight which of these species has a distinct life stage that require a different food source and or habitat. Have each team present their findings to the class including a labelled lifecycle. Examples could include some of the following E.g.: • Butterflies: The larvae (caterpillar) requires the leaves from a specific host plant. Adults require nectar. (Note the caterpillars of some species can be agricultural pests). • Blue-banded bees (or another solitary native bee species of the 2000 species of native bees): The larvae of 70% of Australian native bees develop in a nest made by the mother in the ground (about 1400 species). The mother bee provides nectar and pollen for the larvae, and also eats it herself. • Green lacewings: Lacewing adults eat nectar. Lacewing larvae eat other insects. Both live on plants. • Lady beetles: Beetle larvae are fierce predators. Adults eat pollen and nectar and are pollinators. • Flower wasps: Adult wasps eat nectar and mostly roost on plants. Wasp larvae eat other insects that the mother has provided (paralysed). Flower wasps create a nest in the ground. • Hover flies: Hover fly larvae are predators. The adults are nectarivores and terrific pollinators. The lifecycle differs depending on the species. Many species migrate.	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html) • Internet access or books about invertebrate lifecycles • PowerPoint or other platform

Lesson 4 – **Healthy habitats:** Life relies on both living and non-living things

Content	Teaching Ideas	Resources
Elaborate: **What are some threats to beneficial invertebrates?**	**Read:** • Changing our ways: Clearing, Intensifying, Eroding, Draining, Losing, Spreading, Covering, Sparking (Inquiry question: How can we reduce the impacts to beneficial insects caused by human actions?). Pages 88-93. **Activity:** Create a mind map for each of the headings from the reading list above and consider positive actions we could make to improve habitats for beneficial invertebrates. Encourage thinking about it on different scales from a large industrial farm to a school, and in a personal backyard. Many of the solutions have previously been touched on in the reading list from Explain. **Activity:** Create habitat for beneficial invertebrates such as: • An insect hotel, a pollinator garden, compost heap, leaflitter. See project examples in our resource, *Embrace the Wild*. **Read:** • It's all important and The world wide web (Inquiry question: How do invertebrates support biodiversity?). Pages 16-19. • Nature's services: (Inquiry question: What is an ecosystem service?). Pages 26-31. **Activity:** Other than as a major contributor to the food web, ask students to use the book to find other examples of how invertebrates help our environment as part of free ecosystem services and then present these discoveries to the class. Other terms used to describe invertebrates include microorganisms, macroinvertebrates, bacteria and zooplankton. (e.g. Pages 52-53, 54-55, 58-59, 62-63, 66-67, 68-69, 83, 114, 125, 136, 139). **Question:** • What might happen if there were no invertebrates? **Activity:** Another major threat to invertebrates is intolerance by humans. We kill or displace invertebrates such as spiders because we are scared of them. Nominate some invertebrates that people are commonly scared of or do not like. Have the class provide some reasons why that invertebrate is important to ecosystem services and put forward a persuasive argument as to why that species should be tolerated. (Note for more information about what an ecosystem service is, see page 28-29) **Question:** • Ask students if this lesson sequence has changed their opinion about invertebrates. How?	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html) • *Embrace the Wild* resource (https://heyzine.com/flip-book/65c2ebb070.html) • *Note project needs will vary – see Embrace the Wild for details*

Lesson 5 – **Healthy habitats:** Life relies on both living and non-living things

Content	Teaching Ideas	Resources
Evaluate: **What are some other ways that invertebrates can benefit ecosystems?**	**Read:** • ReWild: Tiny space for tiny creatures, microforest, Checking in, The whole story, (Inquiry question: How can we promote habitat for beneficial invertebrates?) Pages 162-165 **Activity:** Create habitat for beneficial invertebrates such as: • An insect hotel, a pollinator garden, compost heap, leaflitter. See project examples in our resource, *Embrace the Wild*. **Activity:** Complete the Ecosystems worksheet (Appendix 7) by filling in the blank letter and icons. Explore some of the other ways that we can reduce our impact on the planet including reducing biodiversity loss. Use the 10 R's chart (Appendix 4) and worksheet (Appendix 5) to encourage students to act with sustainability in mind. Each chart has space for the names of students. Print as many as required for the class. Over the course of the term, have students work towards actioning each of the 10 R's. You may wish to focus on one at a time, or randomly complete them opportunistically. Verify actions with regular class check-ins. Congratulate students as an example of the final R (Reimagine) was incorporated recently when students created habitat for beneficial insects with sustainability at its core.	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html) • *Embrace the Wild* resource (https://heyzine.com/flip-book/65c2ebb070.html) • Note project needs will vary – see *Embrace the Wild* for details • Ecosystems worksheet (Appendix 7) • 10 R's chart (Appendix 4) • 10 R's worksheet (Appendix 5)

FOOD CHAINS:
The impacts to food webs under a warming planet

Overarching Inquiry Question:

What are the relationships between species and will climate change impact these relationships?

Learning Intentions:

Exploring the complex relationships between different species and our environment.

Success criteria:

I can determine the relationships between species based on their diet.

I can consider the complex relationships between species.

I can identify ways that I can change my own behaviour to improve outcomes for biodiversity.

Main Outcomes:

Year 4

Science Understanding: Biological science: Explain the roles and interactions of consumers, producers and decomposers within a habitat and how food chains represent feeding relationships (AC9S4U01).

HASS: Geography: The importance of environments, including natural vegetation and water sources, to people and animals in Australia and on another continent (AC9HS4K05).

HASS: Geography: Sustainable use and management of renewable and non-renewable resources, including the custodial responsibility First Nations Australians have for Country/Place (AC9HS4K06).

Cross-curriculum priorities:

Systems: The interdependence of Earth's systems (geosphere, biosphere, hydrosphere and atmosphere) that support all life on Earth, and social and economic systems.

World views: The role of world views (sets of attitudes, values and beliefs) that shape individual and community ideas about how the world works and our role in the world.

Design: The role of innovation and creativity in sustainably designed solutions, including products, environments and services, that aim to reduce present and future impacts or to restore the health or diversity of environmental, social and economic systems.

Futures: Ways of thinking and acting that seek to empower young people to design action that will lead to an equitable, sustainable and inclusive future.

KEY WORDS

Biodiversity
Carnivore
Climate change
Consumer
Decomposer
Ecosystem
Ecosystem service
Environment
Food chain
Food web
Habitat
Herbivore
Lifecycle
Predator
Producer
Sustainability

Lesson 1 – **Food chains:** The impacts to food webs under a warming planet

Content	Teaching Ideas	Resources
Engage: **Understanding habitats and ecosystems**	**Read:** • Nature needs nature (Inquiry question: What is an ecosystem?). Pages 10-11. • Nature's community (Inquiry question: What is a habitat?). Pages 14-15. **Question:** • What type of broad scale ecosystem is your school located in? (Search online). **Activity:** Ecosystems provide different habitats for animals and plants to live. However, within a habitat, you can have microhabitats – such as a shady log in the leaf litter, or an exposed rock. Conduct an invertebrate search to compare the number of different species in each microhabitat (E.g. worm, beetle, moss, slater, bee). The number of different species within a defined area is known as the species richness. You do not need to accurately identify each species, but rather be able to identify that they are different species. Create a table to contain the following information: Three-five different microhabitats within your school (E.g. leaf litter, dry garden bed, shady spot, vegetable garden); The characteristics of the microhabitats (cool, warm, wet, dry, shady, exposed etc); The species richness of each location. **You will need:** See the list in *Resources*. **Risk assessment:** Some invertebrates can bite or sting. To avoid incidents, conduct these activities with good adult supervision and use the equipment to ensure that direct contact does not occur. **Methods:** **Tree shake:** Place a large piece of white paper, or cloth, beneath a bush. You can also hold a container beneath the branch. Shake the plant vigorously and observe the species that fall onto the white sheet. Use a paintbrush to gently brush the invertebrate into a jar where it can be observed more readily with a magnifying glass. Use the ID chart (Appendix 3) to identify the group to which it belongs. **Leaf litter search:** Scoop some leaf litter into a container. Use the paint brush to gently investigate the leaf litter for small invertebrates, and collect as above to identify using the chart. Remember to return all invertebrates back to where they were found! Teaching ideas for this lesson continued on next page ▶▶	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html) • White paper or cloth • Magnifying glasses • Small paint brushes • Jars for collection • Container or tub • Trowel • Invertebrate ID chart (Appendix 3)

Lesson 1 – **Food chains:** The impacts to food webs under a warming planet (continued)

Content	Teaching Ideas	Resources
	Questions: • Why might each species be found in certain microhabitats? • What does each microhabitat offer? (food, shelter, water?). • What role does each species play in this environment? (E.g. decomposer, nutrient recycler, pollinator, seed dispersal?). • What does each species eat? • Do you think your invertebrates are a predator, or prey – or both? (Also consider the wider food chain). • Do you think each of these species would survive elsewhere in the school? • What sorts of adaptations does each invertebrate possess to live in its habitat? • Which species do you think is the most/least adaptable? • Why is it important that all invertebrates are returned to where they were found?	

Lesson 2 – **Food chains:** The impacts to food webs under a warming planet

Content	Teaching Ideas	Resources
Explore: **Getting to know our local animals**	**Read:** • It's all important (Inquiry questions: What is biodiversity?; What is a food chain?). Pages 16-17. **Activity:** In considering the food chains for animals species in the area, first, you need to determine what animal species exist in the area. There are three ways you may wish to do this: 1. Brainstorm a list of species students often see around the school and area. 2. If you want to investigate the specific species recorded for your area use the Atlas of Living Australia (www.ala.org.au.) Go to 'Explore your Area' and enter your location. A list of all species will be provided, and you can refine it by group. You can also tap on the species and open their profile to learn more. 3. Use the animal cards featuring the animals from the food web example in the book (Appendix 6) **Activity:** Following the above exercise, create a list of at least 10 species including mammals, birds, reptiles, invertebrates and plants and divide them into the following categories: Plant eaters (herbivores), meat eaters (carnivores), insect eaters (insectivores), plants, and decomposers.	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html) • Internet access • Animal cards (Appendix 6)

Lesson 3 – **Food chains:** The impacts to food webs under a warming planet

Content	Teaching Ideas	Resources
Explain: **Create a food chain or pyramid**	**Activity:** Using the diagram on page 17 of *Planet for Life* as a guide, order a simple food chain for some of the animals on the list. Then expand it into a food pyramid that includes all species on the list. Depending on the species selected, you may have 1 -3 levels representing the predators (secondary, tertiary and apex consumers). Note that a food pyramid or food chain will always differ depending on the types of species that you have in your area. For example, you may not have many large predators (such as a dingo) in your area, making smaller predators (such as a kookaburra) the apex predator of your local ecosystem. **Questions:** • What is the top predator in your environment? Why? • Do you think it would also be the top predator in a natural/ different environment? • If your pyramid has fewer consumer levels than is depicted in the book, hypothesise why this could be E.g.: > Reduced diversity of plants or decomposers to support consumers. > Reduced habitat offering less shelter/breeding options. > Lack of large predators. **Activity:** Brainstorm what could be done to encourage a more balanced food pyramid E.g.: • Provide areas of leaf litter for decomposers. • Plant a wider variety of plants for herbivores. • Conserve tree hollows or build nest boxes for birds, bees or microbats. • Create better connectivity with surrounding habitats. • Connectivity can be both horizontal and vertical. How might a more complex forest structure (E.g. ground layer, shrub layer, mid-story, canopy layer) influence the food pyramid? • Reduce chemical use. • Reduce competition from pest species. • Reduce threats from pets. **Read:** • Shifters and shapers, Better together (Inquiry question: What are ecosystem engineers and keystone species?). Pages 20-23. **Questions:** Have students work in teams to focus on one animal from your list and present their findings to the class: • Is this species an ecosystem engineers and/or keystone species? • What is its ecological role? • What other species may be reliant on the service provided by it? • What impacts may result if this species were no longer in the area? • Are there any threats to this species in your area? • What may be some positive actions to support this species?	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html) • Internet access and multiple devices **Option:** • *Embrace the Wild* resource (https://heyzine.com/flip-book/65c2ebb070.html) *Note project needs will vary – see Embrace the Wild for details*

Lesson 4 – **Food chains:** The impacts to food webs under a warming planet

Content	Teaching Ideas	Resources
Elaborate: **Food web game**	**Read:** • The World wide web (Inquiry question: What is a food web?). Pages 18-19. **Activity:** Investigate the complexities of a food web. Use the Animal cards provided (Appendix 6). These represent a sample of species found within a forest ecosystem on the east coast of Australia. You may also wish to repeat the exercise with your local species. **You will need:** See *Resources* **Instructions:** Assign each child a food web card and peg. Explain the categories on the back and have students read the text to learn about their species' needs. Use a peg to attach the card to the front of each child and have them stand in a circle. The idea is to make connections about the relationships between different species. This is complexed! For example, some species are preyed upon as young, but not as adults. So to start simply, agree all the animals in the circle are adults and ask for a specific connection between them, E.g. What does your species eat? Select any child to start. Provide them with the ball of string and ask that they hold one end. As each person identifies a relationship with another species they throw the string (or draw a chalk line) to the person holding that card. For example, Student 1 has the frog card, and knowing that their animal eats invertebrates they pass the string to Student 2 who has the beetle, and so forth. Build the complexity of the web by addressing different focus questions: • What species eats them? • Now imagine that all animals have young that may be predated – how does that change things? • What type of shelter does their species require? What other species is their species reliant on for their survival? (E.g. an ecosystem engineer such as a termite would create tree hollows used by a possum, a bee pollinates the flowers which result in seed formation for the rosella to eat). See if you can count how many connections were made in this exercise. You could also ask each cardholder to try to count how many species they have a connection with – either in relying on that species to provide them something or by how a predatory species may influence their behaviour. Teaching ideas for this lesson continued on next page ▶▶	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html) • 1 peg per person • Animal cards (Appendix 6) • A ball of string or some chalk • Internet access and multiple devices • Ecosystem services worksheet (Appendix 7)

Lesson 4 – **Food chains:** The impacts to food webs under a warming planet (continued)

Content	Teaching Ideas	Resources
	Read: • Comfortable living (Inquiry question: What is climate change?). Page 46. • Our changing climate (Inquiry question: How is climate change impacting biodiversity?). Page 100. **Activity:** How will climate change impact biodiversity? Students work independently or in teams to research a local animal or one from the web game to discover some of the impacts that climate change may have on it. Have students present their findings to the class. Create a list of some of the impacts (E.g. pollinators and flowers being out of sync, reptiles being more active with warmer temperatures, droughts or storms impacting plant growth). Revisit the food web and discuss how climate change may influence the relationships between species. **Extension option:** **Read:** • Nature's services: (Inquiry question: What is an ecosystem service?). Pages 26-31. **Activity:** Discuss some of the ways that healthy food chains contribute to ecosystem services (E.g. Microbats eat mosquitoes therefore acting as pest controls, bandicoots turn over soil as they look for invertebrates to eat). Use the Ecosystems services worksheet to consolidate learning (Appendix 7).	

Lesson 5 – **Food chains:** The impacts to food webs under a warming planet

Content	Teaching Ideas	Resources
Evaluate: **Why is biodiversity important?**	**Read:** • The crew (Inquiry question – how many different species are there?). Page 48. **Activity:** Discuss, debate or write a persuasive text: Is biodiversity important? **Read:** • Local knowledge (Inquiry question: How can we encourage greater biodiversity?). Page 96. • A place for nature (Inquiry question: How can we encourage greater biodiversity?). Pages 140-147. • Earth Positive (Inquiry question: What do we need to do to reduce climate impacts?). Page 102. • Part 5: Planet Green- The 10 R's (Inquiry question: What can individuals do to work towards a greener planet?). Page 150. **Activity:** Have students draw a sustainable habitat for some of the native species in your area. Label the species and habitat features. Add arrows to show the relationships between the species. Also include actions that can be made to reduce the threats to these species (E.g. Reduce chemical use, plant more trees, provide more flowers for pollinators, increase connectivity). **Option:** Create habitat for local animals. Use examples from the book for inspiration or explore the resource *Embrace the Wild* which offers habitat projects. **Activity:** Explore some of the other ways that we can reduce our impact on the planet including addressing climate impacts and biodiversity loss. Use the 10 R's chart (Appendix 4) and worksheet (Appendix 5) to encourage students to act with sustainability in mind. Each chart has space for the names of students. Print as many as required for the class. Over the course of the term, have students work towards actioning each of the 10 R's. You may wish to focus on one at a time, or randomly complete them opportunistically. Verify actions with regular class check-ins. Congratulate students as an example of the final R: Reimagine was incorporated into the last activity when students created a habitat with sustainability at its core.	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html) • 10 R's chart (Appendix 4) • 10 R's worksheet (Appendix 5) • Art materials

LIGHT POLLUTION: Looking after nocturnal animals

Overarching Inquiry Question:

What do nocturnal animals need?

Learning Intentions:

Evaluating our local area for the impacts of light pollution and how it can be minimised.

Success criteria:

I can consider what a nocturnal animal needs to survive.

I can consider the complex relationships between species.

I can identify ways that I can change my own behaviour to improve outcomes for biodiversity.

Main Outcomes:

Year 5

Biological Sciences: Examine how particular structural features and behaviours of living things enable their survival in specific habitats (AC9S5U01).

Physical sciences: Identify sources of light, recognise that light travels in a straight path and describe how shadows are formed, and light can be reflected and refracted (AC9S5U03).

Science as a human endeavour: Nature and development of science: Examine why advances in science are often the result of collaboration or build on the work of others (AC9S5H01) *and* investigate how scientific knowledge is used by individuals and communities to identify problems, consider responses and make decisions (AC9S5H02).

Hass: Geography: The management of Australian environments, including managing severe weather events such as bushfires, floods, droughts or cyclones, and their consequences (AC9HS5K05).

Cross-curriculum priorities:

Systems: The interdependence of Earth's systems (geosphere, biosphere, hydrosphere and atmosphere) that support all life on Earth, and social and economic systems.

World views: The role of world views (sets of attitudes, values and beliefs) that shape individual and community ideas about how the world works and our role in the world.

Design: The role of innovation and creativity in sustainably designed solutions, including products, environments and services, that aim to reduce present and future impacts or to restore the health or diversity of environmental, social and economic systems.

Futures: Ways of thinking and acting that seek to empower young people to design action that will lead to an equitable, sustainable and inclusive future.

KEY WORDS

Behaviour
Biodiversity
Citizen science
Climate change
Conservation
Ecosystem
Environment
Habitat
Lifecycle
Light pollution
Nocturnal
Sustainability

Lesson 1 – **Light pollution:** Looking after nocturnal animals

Content	Teaching Ideas	Resources
Engage: **What is a nocturnal animal and what does it need?**	**Read:** • Starry nights (Inquiry question: What is a nocturnal animal?). Page 128. • Marine managers: Fish ferries and hungry helpers (Inquiry question: Are marine species nocturnal?). Pages 136-137. **Questions:** • Why is it called light pollution? • When is it considered light pollution? • Where is light pollution? (E.g. Large cities such as Sydney emit light pollution on land and in the harbour). • How does light pollution affect nocturnal animals? • Does light pollution affect aquatic animals? **Activity:** Use an Internet search to find examples of exterior light use. Provide a scale of Dark, Medium and Bright and discuss which category students feel that the example belongs to. **Watch:** • *Lights off for bogong moths* https://www.australasiandarkskyalliance.org/videos	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html)

Lesson 2 – **Light pollution:** Looking after nocturnal animals

Content	Teaching Ideas	Resources
Explore: **What nocturnal species live in our area?**	**Watch:** • *Let's switch off light polllution together!* https://www.dcceew.gov.au/campaign/light-pollution Watch the video and explore some of the species featured on the web page. **Activity:** Make a list of nocturnal species that live in your area (E.g. possums, gliders, owls, tawny frog mouths, migratory birds, turtles, bandicoots, moths, and bats). You can use the Atlas of Living Australia to determine species that have been recorded in your area. Simply open (www.ala.org.au.). Go to 'Explore your Area' and enter your location. A list of all species will be provided, and you can refine it by group. You can also tap on the species and open their profile to learn more.	• Internet access

Lesson 3 – **Light pollution:** Looking after nocturnal animals

Content	Teaching Ideas	Resources
Explain: **How can we support local nocturnal species?**	**Read:** • How do we know?/Local knowledge (Inquiry question: How is scientific knowledge used by individuals and communities to identify problems, consider responses and make decisions). Pages 94-95. • Tackling threats: (Inquiry question: Is light pollution a threat to wildlife?). Pages 98-99. • Conservation status: (Inquiry question: What is conservation status and how is it assigned?). Pages 180-181. **Questions:** • Why is it important to share scientific knowledge? • What is citizen science and how can this be useful for building scientific knowledge? (E.g. the survey of the school in 'Elaborate' is a form of citizen science). • Are any of your local nocturnal species threatened and why? • How can reducing light pollution assist in reducing harm to local species? **Debate:** Is light pollution a form of habitat loss?	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html) • Internet access

Lesson 4 – **Light pollution:** Looking after nocturnal animals

Content	Teaching Ideas	Resources
Elaborate: **How bright is our school?**	There are a number of ways that light pollution can be measured. A simple scale is using the Bortle Scale. The scale ranges from Class 1 skies (the darkest skies on Earth) to 9 (inner city skies). The defining measure for this is based on how clearly we can see the stars from that location. In many urban areas there are very few stars visible due to the light pollution. **Activity:** As a class look up the Bortle Scale (E.g. Wikipedia) **Question:** • Where do you think the school would sit on the Bortle Scale? To discover the answer you can then either measure this yourself (see Option below) or use an App such as Clear Outside. This free App allows you to enter your location and will provide an average Bortle Scale based on the latitude and longitude. **Activity:** Examine the use of light in the school. What lights are left on at night? Is there an illuminated sign outside the school, are classroom lights left on, or are there lights illuminating walkways? If possible organise a night survey to establish this. Which of these lights are necessary and how can light pollution from the school be minimised? Take photographs (if you have access to a drone this may be really useful also) and or use a school map to indicate where the brightest lights are. Don't forget to look out for nocturnal animals in the school! Note if a class survey is not possible, take some photos to refer to. **Option:** Use the Dark Sky Meter App (iPhone only) or Loss of the Night App (Android only) to measure light pollution. These Apps also have a citizen science component with the option to contribute data. The Dark Sky Meter App uses the phone's camera to measure the illumination of lights to rate the location using the Bortle Scale. The Loss of the Night App uses guided observation for particular stars (using the naked eye) to rate light pollution. **Activity:** Investigate ways to reduce light pollution and how it can be applied in the school (E.g. Use of timers, turning lights off, using wildlife friendly globes, pointing lights downward or attaching covers to reduce light spray?). Helpful websites for this include *Let's switch off light pollution together:* https://www.dcceew.gov.au/campaign/light-pollution and *Australian Dark Sky Alliance: Best practice lighting* https://www.australasiandarkskyalliance.org/best-practice-lighting Put together a persuasive proposal for the principal asking them to reduce the light pollution being emitted by the school. Extend this by including a piece in the school newsletter to inform the community about the local nocturnal species and the ways we can all reduce light pollution from our homes and businesses.	• School map • Camera • Internet access

Lesson 5 – **Light pollution:** Looking after nocturnal animals

Content	Teaching Ideas	Resources
Evaluate: **Looking after local nocturnal species**	**Read:** • A place for nature (Inquiry question: How can we assist local nocturnal animals?). Pages 140-147. Other ways we could support wildlife are explored in the book as above. Which of these conservation measures may be applicable to support local nocturnal species? (E.g. Planting flowering plants to attract moths providing a food source for microbats, creating dense ground covers and shrubbery for bandicoots to hide, or building nest boxes for possums to shelter in). Select a class project to support a local species. Step-by-step projects can be found in *Embrace the Wild* (see Resources). **Activity:** Assign a nocturnal species to students and have them create a poster showing a sustainable habitat for that species. Label the features, in particular focusing on the ideal lighting conditions to support the species as well as other core habitat requirements. Explore some of the other ways that we can reduce our impact on the planet including addressing biodiversity loss. Use the 10 R's chart (Appendix 4) and 10 R's worksheet (Appendix 5) to encourage students to act with sustainability in mind. Each chart has the space for the names of students. Print as many as required for the class. Over the course of the term, have students work towards actioning each of the 10 R's. You may wish to focus on one at a time, or randomly complete them opportunistically. Verify actions with regular class check-ins. Congratulate students on achieving an example of the final R (Reimagine) which was incorporated into the last activity when students created a habitat for local nocturnal animals with sustainability at its core.	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html) • *Embrace the Wild* resource (https://heyzine.com/flip-book/65c2ebb070.html) • Art materials • 10 R's poster (Appendix 4) • 10 R's worksheet (Appendix 5)

SUSTAINABILITY: Working towards Earth Positive

KEY WORDS

Behaviour
Biodiversity
Carbon dioxide
Climate change
Conservation
Consumerism
Ecosystem
Ecosystem service
Environment
Global warming
Habitat
Responsibility
Sequester
Sustainability

Overarching Inquiry Question:

How will climate change impact sustainable environments for humans and animals and what actions can I take to minimise those impacts?

Learning Intentions:

Explain how human induced climate change affects all living things, and how we can reduce those impacts by promoting biodiversity and ecosystem services.

Success criteria:

I can consider how climate change will impact biodiversity.

I can consider the complex relationships between species.

I can identify ways that I can change my own behaviour to improve outcomes for biodiversity.

Main Outcomes:

Year 6

Design and Technology: Knowledge and understanding: Technologies context: Materials and technologies specialisations: Explain how characteristics and properties of materials, systems, components, tools and equipment affect their use when producing designed solutions (AC9TDE6K05).

Design and Technology: Knowledge and understanding: Technologies and society: Explain how people in design and technologies occupations consider competing factors including sustainability in the design of products, services and environments (AC9TDE6K01).

Science: Science understanding: Biological science: Investigate the physical conditions of a habitat and analyse how the growth and survival of living things is affected by changing physical conditions (AC9S6U01).

Science: Science as human endeavour: Examine how advances in science are often the result of collaboration or build on the work of others (AC9S6H01).

Science: Use and influence of science: Investigate how scientific knowledge is used by individuals and communities to identify problems, consider responses and make decisions (AC9S6H02).

Cross-curriculum priorities:

Systems: The interdependence of Earth's systems (geosphere, biosphere, hydrosphere and atmosphere) that support all life on Earth, and social and economic systems.

World views: The role of world views (sets of attitudes, values and beliefs) that shape individual and community ideas about how the world works and our role in the world.

Design: The role of innovation and creativity in sustainably designed solutions, including products, environments and services, that aim to reduce present and future impacts or to restore the health or diversity of environmental, social and economic systems.

Futures: Ways of thinking and acting that seek to empower young people to design action that will lead to an equitable, sustainable and inclusive future.

Lesson 1 – **Sustainability:** Working towards Earth Positive

Content	Teaching Ideas	Resources
Engage: **How is the Earth's temperature regulated?**	**Read:** • Comfortable Living: (Inquiry question: How is Earth's temperature regulated?). Pages 46-47. • Working towards Earth Positive: (Inquiry question: How have humans changed the Earth?). Pages 86-87. • Changing our ways: Particularly look at Clearing, Burning, Covering (Inquiry question: What can we do to reduce the impacts of climate change?). Pages 88-93. • Earth Positive (Inquiry question: What are the key solutions towards Earth Positive). Page 103. **Questions:** • Who has heard of climate change (or global warming)? • How do you feel about climate change? • What are some examples of solutions to reduce the impact of climate change that you know of (or can imagine?) • What are some examples that might link land clearing, biodiversity loss and climate change? (Note this will be the reoccurring theme for the lesson).	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html)

Lesson 2 – **Sustainability:** Working towards Earth Positive

Content	Teaching Ideas	Resources
Explore: **How hot is our school?**	Climate change will make summers hotter. At a local level, hot days can seem even hotter depending on the types of surfaces we have on the ground. Areas with shade will obviously be cooler. The slope of the ground and its orientation will contribute to the ambient temperature too. But most importantly, the material that the surface is made from will make the greatest difference to local temperatures. **Activity:** Before heading outside, ask students to predict which parts of the school are the hottest. Select some areas to measure such as: asphalt, concrete, artificial grass, sand pit, seating, natural grass, bare earth, beneath a tree, beneath shade cloth. For maximum results, do this exercise in the middle of a sunny day. **You will need:** See *Resources* **Instructions:** Point the infrared thermometer at the surface to be measured (check the manufacturer's instructions as to the distance it needs to be away from the surface). In the same location measure the air temperature using a thermometer taped to the 1m stick.	• An infrared thermometer • A mercury thermometer taped to a 1 m high stick • Compass (optional) • Clipboard, paper and pencils • Temperature chart (as per instructions)

Location	Material	Orientation/slope	Sun/shade	Temp ground level	Temp 1m above ground
Playground	Concrete path	Faces North-west Flat	Full sun	x °C	y °C

Plot the results onto a bar graph and analyse which surfaces are hottest. It should be apparent that man-made surfaces are hottest.

Brainstorm with the students what changes can be made to the school to reduce the local temperature. This may include installing shade cloths and planting trees and grasses or even removing some surfaces in favour of natural covering.

Lesson 3 – **Sustainability:** Working towards Earth Positive

Content	Teaching Ideas	Resources
Explain: **Nature can reduce the impacts of climate change**	Not only do natural surfaces such as vegetation and soil reduce the local temperature, but they also sequester carbon. Carbon dioxide is the primary gas contributing to climate change. **Read:** • Sinks of green and blue (Inquiry question: Where is carbon stored?) Page 132-133. • Super service (Inquiry question: How much carbon do trees capture?) Page 72. **Activity:** It is clear that large natural areas can sequester the most carbon. The average Australian household creates between 15-20 tonnes of carbon per year. So how many trees would be required to absorb the carbon created by one household? Calculate how many trees would be required to offset an average Australian household (see page 72 - you could use an average of 16 tonnes pa for easier calculations i.e. double the quantities provided in the book). However, trees offer much more than just being an offset for our lifestyles. What other services do trees provide for us and nature? **Read:** • More than just a tree (Inquiry question: What does a tree provide?). Page 73. • Millions of reasons you exist: (Inquiry question: What is an ecosystem service?). Pages 26-30. • Nature's services: (Inquiry question: What is an ecosystem service?). Pages 26-31. Teaching ideas for this lesson continued on next page ▶▶	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html) • Internet access and multiple devices • Ecosystems worksheet (Appendix 7)

Lesson 3 – **Sustainability:** Working towards Earth Positive (continued)

Content	Teaching Ideas	Resources
	Activity: Complete the Ecosystems services worksheet (Appendix 7) then have students work in pairs or small teams to each research one of the benefits offered by ecosystem services. These are all presented in the book within their section (I.e. provisioning, societal, regulating or supporting) and you may wish to research extra examples. Have each team provide a short presentation of their discovery to the class. As a class discuss which ecosystem service they think is the most important. **Activity:** Compare the diagram of the tree (page 73) with the ecosystem wheel (page 29). **Question:** • Which of the ecosystem services are also provided by a tree? **Optional Activity:** Debate or persuasive text: Is laying plastic grass a good solution for our environment? Artificial turf (plastic grass) is becoming more common in schools and sports field. Apart from the radiant heat it reflects, also examine other environmental impacts such as the toxic chemicals used in manufacturing and installing, run off (containing nano-plastics and toxic chemicals), smothering the ground (reducing habitat), and its inability to sequester carbon. Debate if these impacts are worth the benefits it may provide.	

Lesson 4 – **Sustainability:** Working towards Earth Positive

Content	Teaching Ideas	Resources
Elaborate: **We need to help nature help us**	The relationship between animals and their environment is a major contributor to the delivery of ecosystem services. **Read:** • It's all important (inquiry question: What is a trophic level?). Pages 16-17. • Shifters and Shapers (Inquiry question: What is an ecosystem engineer?) Pages 20-21. • Better together (Inquiry questions: What is a keystone species?). Pages 22-23. • Planet blue (Inquiry questions: How do trophic levels work in the ocean?) Pages 24-25. **Discussion:** Use some of the animal examples on pages 21 and 23 to discuss what students think the impacts may be to the animals' habitat if they were removed. E.g. If sharks were removed from the environment, fish would overgraze and destroy corals and seagrasses. Then read the following pages to further the discussion. **Read:** • Keeping order: Inquiry question (Inquiry question: How do trophic levels maintain order in ecosystems?). Page 138-139. In addition to animals providing and regulating ecosystem services they also store carbon in their body. It therefore makes sense that as well as promoting our vital ecosystem services that we should also be promoting wildlife to sequester carbon, and therefore assist to reduce global warming. **Read:** • Rewilding the planet: (Inquiry question: How do animals sequester carbon?). Page 134-135. • Marine managers: (Inquiry question: How do marine animals sequester carbon?). Page 136-137 Humans are not the only ones feeling the impacts of a warming climate. The science is clear that climate change is reducing biodiversity, and yet we need biodiversity to thrive to reduce climate change. Climate change is affecting ecosystem services including where animals can live and how they behave. **Read:** • Our changing climate (Inquiry question: How is climate change effecting animal behaviour?). Pages 100-101. Teaching ideas for this lesson continued on next page ▶▶	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html) • Art materials or digital platform (E.g. PowerPoint) **Option:** • *Embrace the Wild* resource (https://heyzine.com/flip-book/65c2ebb070.html)

Lesson 4 – **Sustainability:** Working towards Earth Positive (continued)

Content	Teaching Ideas	Resources
	In addition to this, animals are threatened for many other reasons as well. **Read:** • Tackling threats (Inquiry question: What are the biggest treats to biodiversity?). Page 98-99. (Note to learn more about conservation status see page 180). • Working towards Earth Positive (Inquiry question: How are threats to biodiversity interconnected?). Pages 86-87. • Our changing climate (Inquiry question: How is climate change impacting animals?). Pages 100-101. Each of the animal examples in Tackling threats has a symbol beside it indicating the threat mitigation most needed in saving the species. But as we are learning, usually it is rarely that simple and multiple factors are at play. As it says under the heading Action Plan 'Reducing pollution and climate change impacts is always beneficial'. **Questions:** • How might climate change be affecting threatened species? You could use the species depicted in the tackling threats page as case studies. (E.g. Making it too hot for them to live where they currently do, reducing water/food availability via droughts). **Activity:** Investigate the impacts of climate change on some local species and how that may change the ecosystem services being provided by nature in your area. (E.g. Fruit bats are susceptible to heat stress. These long-distance flyers are vital to provide pollination and seed dispersal services. Their loss would reduce these services across fragmented habitats such as urban areas and farmland). In summary, we have seen that climate change, ecosystem services and biodiversity are all interconnected. So all of these things should be addressed in the sustainable cities of the future. **Read:** • A place for nature (Inquiry question: How and why should we connect habitat for animals?). Pages 140-141. To extend this read to page 147. • My big, beautiful city (Inquiry question: How can we design sustainable cities?). Page 122. • How can we help nature? (Inquiry question: How can we provide sustainable habitats in our landscapes?). Page 13. **Activity:** On a large piece of paper, or using a digital platform, have pairs or teams design a sustainable city. Use labels to highlight the sustainable design features. Be sure to include how this city can be sustainably incorporated into the surrounding landscape (E.g. by addressing water runoff, wildlife connectivity, or light pollution). **Option:** Act on this knowledge by improving connectivity and habitats in your school and community. Use our resource *Embrace the Wild* for project ideas (see Resources), or undertake our term long unit ReWild Your School.	

Lesson 5 – **Sustainability:** Working towards Earth Positive

Content	Teaching Ideas	Resources
Evaluate: **What can individuals do to work towards Earth Positive?**	**Read:** • Part 5: Planet Green: The 10 R's (Inquiry question: What can individuals do to work towards a greener planet?). Pages 150-177. **Activity:** Explore some of the ways that individuals can reduce their impact on the planet including addressing climate impacts and biodiversity loss. Congratulate the students and point out that an example of the final R (Reimagine) has been fulfilled when they designed their sustainable city! What other ways can they reimagine the future with sustainability in mind? Create a wish list and discuss some of the steps that can be taken to create that future. Use the 10 R's chart (Appendix 4) and worksheet (Appendix 5) to encourage students to act with sustainability in mind. Each chart has space for the names of students. Print as many as required for the class. Over the course of the term, have students work towards actioning each of the 10 R's. You may wish to focus on one at a time, or randomly complete them opportunistically. Verify actions with regular class check-ins.	• *Planet for Life* book or eBook (https://heyzine.com/flip-book/52a46c0692.html) • 10R's poster (Appendix 4) • 10R's worksheet (Appendix 5)

Soil chart

How to determine your soil type

Follow the directions in the soil chart to find out what soil type you have!

START

Wet a scoop of soil and squeeze into a golf ball size. Roll it in your hand. Does it form a ball?

- NO → **SANDY SOIL**
- YES ↓

Can the ball be rolled into a sausage shape without breaking?

- NO → **LOAM SOIL**
- YES ↓

Can you polish the surface of the soil until it is smooth and shiny?

- YES → **CLAY SOIL**
- NO ↓ (back to **LOAM SOIL**)

What do the results mean?

SANDY SOIL is made from coarse fragments of decomposed rock. It contains minimal nutrients to support plant life. It does not hold water well making it hard for the plants roots to absorb water.

CLAY SOIL is made of fine particles that stick together when wet. It is dense and sticky making it hard for the roots of plants to penetrate it. Water has trouble moving through clay soil.

LOAM SOIL is a mixture of both sandy and clay soil. It has more organic matter in it too. It contains the most nutrients for plants to grow.

waterwatch NEW SOUTH WALES
Communities Caring for Catchments

WATER BUG DETECTIVE GUIDE

Macroinvertebrate sampling and waterway health

Sampling will reveal information about the abundance and diversity of macroinvertebrates and their tolerance to pollution: This will provide an indication of the health of the waterway.

ABUNDANCE = the total number of macroinvertebrates present

DIVERSITY = the number of different types of bugs present. Healthy streams usually have a greater diversity of bug types

POLLUTION TOLERANCE = the ability of macroinvertebrates to withstand pollution. This is reflected by its SIGNAL 2 score based on their sensitivity to pollution.

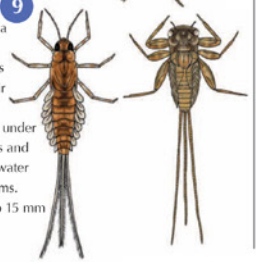
STREAM POLLUTION INDEX = calculation based on the abundance and diversity of bugs and their SIGNAL 2 score.

HEALTHY WATERWAYS = a high SIGNAL score and a large number of bug types

Very Sensitive Bugs - 10,9

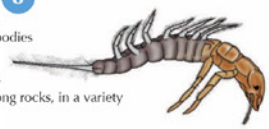
Stonefly nymph 10
Order: Plecoptera
Description: Two thin tails and gills extending from their abdomen.
Habitat: Found among stones or plants, in fast-moving waters.
Maximum size: 7-12 mm

Mayfly nymph 9
Order: Ephemeroptera
Description: Three long thin tails and gills along the sides of their bodies.
Habitat: Found on or under rocks or among plants and leaf litter in standing water and fast flowing streams.
Maximum size: Up to 15 mm



Sensitive Bugs - 8,7,6

Alderfly larva 8
Order: Megaloptera
Description: Their bodies are fleshy with a a hard-shelled head.
Habitat: Found among rocks, in a variety of flow conditions.
Maximum size: Up to 20 mm



Caddisfly larva 8
Order: Trichoptera
Description: They are often enclosed within a case of twigs and plant material or silk.
Habitat: Found among sediment and rocks in streams, ponds and lakes.
Maximum size: Up to 20 mm

Riffle beetle and larva 7
Order: Coleoptera
Description: Beetle-like, tiny and usually black. Larvae have circular stripes or rings.
Habitat: Fast moving water.
Maximum size: Up to 4 mm

Water mite 6
Order: Acarina
Description: Mites usually have simple rounded bodies with eight legs.
Habitat: Found among plants or stones on the stream bed in standing or slow-moving waters.
Maximum size: Up to 5 mm

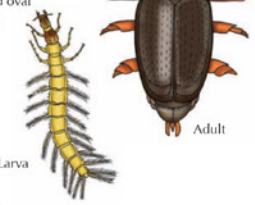
Tolerant Bugs - 5,4,3

Beetle larvae 5
Order: Coleoptera
Description: Larvae are usually elongated with well-developed legs and a large head.
Habitat: A variety of habitats including still waters or quiet areas of flowing water.
Maximum size: Up to 35 mm

Dragonfly nymph 4
Order: Odonata
Description: Stout bodies, no external gills and extendable mouth parts.
Habitat: Found within the substrate of rivers and streams.
Maximum size: 12-50 mm

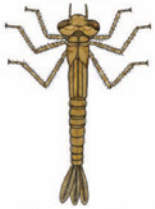
Water strider 4
Order: Hemiptera
Description: Flat spider appearance with long pairs of middle and hind legs.
Habitat: Found on the surface of slow moving rivers and streams.
Maximum size: 8-12 mm

Whirligig beetle and larva 4
Order: Coleoptera
Description: A streamlined oval beetle that swim in circles.
Habitat: Found on the surface around the edges of ponds an streams.
Maximum size: 5-25 mm

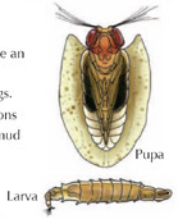


Freshwater yabby/crayfish 4
Order: Decapoda
Description: Fan tailed with well developed claws and prominent front end.
Habitat: Slow flowing and still waters and burrow into sediment.
Maximum size: Up to 400 mm

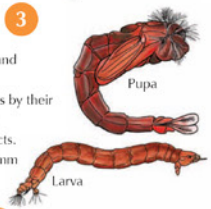
Damselfly nymph 3
Order: Odonata
Description: Nymphs have three gill structures extending from the tail.
Habitat: Found on plants, among rocks and leaf litter or burrowing into the sediments.
Maximum size: 16-33 mm



Fly larva and pupa 3
Order: Diptera
Description: Larva usually have an elongated body with a small head. They do not have true legs.
Habitat: Found in shallow regions of ponds and stream amongst mud and detritus.
Maximum size: Up to 30 mm



Midge larva and pupa 3
Order: Diptera
Description: Often small and C shaped.
Habitat: Attached to debris by their tiny legs and can be found anywhere that water collects.
Maximum size: Up to 50 mm



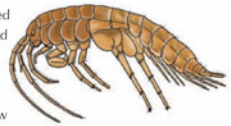
Freshwater mussel 3
Class: Bivalvia
Description: Freshwater mussels have paired hard shells (valves) with a fleshy body between them.
Habitat: Found in or on sandy or muddy stream beds.
Maximum size: Up to 150 mm

Produced by NSW Waterwatch and NSW Department of Environment, Climate Change and Water (2008), and artist Christine Rockley.

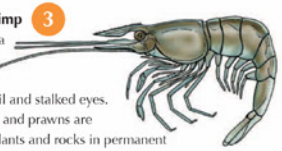
Tolerant Bugs - 5,4,3

Nematode 3
Order: Nematoda
Description: Thin elongated worms without segments and can look translucent.
Habitat: Burrow into the substrate.
Maximum size: Up to 12 mm

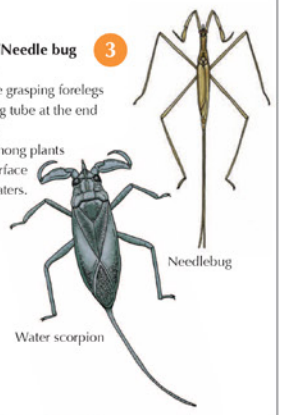
Freshwater sandhopper 3
Order: Amphipoda
Description: Slightly curled and flattened sideways and have hard segments each with a pair of legs for swimming or walking.
Habitat: The edges of slow moving water amongst plants and stones.
Maximum size: 6-20 mm



Freshwater shrimp 3
Order: Decapoda
Description: Covered by a shell, fanned tail and stalked eyes.
Habitat: Shrimps and prawns are found amongst plants and rocks in permanent slow-moving waters.
Maximum size: Up to 35 mm

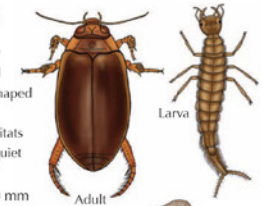


Water scorpion/Needle bug 3
Order: Hemiptera
Description: Large grasping forelegs and short breathing tube at the end of their abdomen.
Habitat: Found among plants or on the water surface of slow-moving waters.
Maximum size: Up to 50 mm



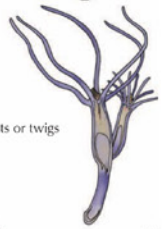
Very Tolerant Bugs - 2,1

Diving beetle 2
Order: Coleoptera
Description: Sleek, shiny beetles with hard-shelled body and hairy paddle-shaped hind legs.
Habitat: A variety of habitats including still waters or quiet areas of flowing water.
Maximum size: Up to 40 mm

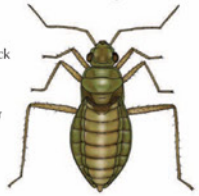


Flatworm 2
Class: Turbellaria
Description: Flat, thin, slow-moving worms with two simple eye spots.
Habitat: Found gliding over rocks and plants in a variety of flow conditions.
Maximum size: Up to 20 mm

Hydra 2
Class: Hydrozoa
Description: Hydras have a simple sack-like body with a mouth encircled by tentacles.
Habitat: Found attached to rocks, plants or twigs in fast flowing water.
Maximum size: Up to 30 mm

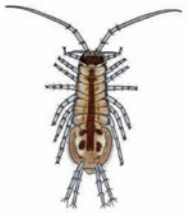


Water treader 2
Order: Hemiptera
Description: Long middle and back legs, and thick body
Habitat: Found on the water's surface of slow flowing pools near banks and plants.
Maximum size: Up to 5 mm

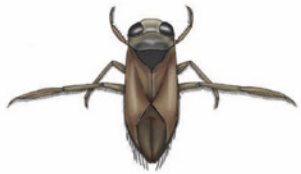


Freshwater worm 2
Class: Oligochaeta
Description: Segmented worms with rounded ends with no suckers or legs and usually coloured red or flesh coloured.
Habitat: Found in soft sediment rich in organic matter.
Maximum size: Up to 30 mm

Freshwater slater 2
Order: Isopoda
Description: Flattened from top to bottom with no body caraspace or shield.
Habitat: Found in still to slow-moving waters.
Maximum size: Up to 20 mm

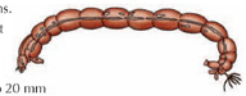


Waterboatman 2
Order: Hemiptera
Description: Boat-shaped with piercing mouth parts and boat shape appearance.
Habitat: Found among plants on the water surface or swimming freely in still to slow-moving waters.
Maximum size: Up to 10 mm



Backswimmer 2
Order: Hemiptera
Description: Curved back, large eyes, long hairy hind legs and swim on their backs.
Habitat: Found in standing water or slow flowing ponds.
Maximum size: Up to 11 mm

Bloodworm 1
Order: Diptera
Description: Worm-like and C shaped. Only the red ones are called Bloodworms.
Habitat: Found in soft sediment rich in organic matter.
Maximum size: Up to 20 mm



Leech 1
Class: Hirudinea
Description: Leeches are soft-bodied animals made up of 32 segments with a sucker on one or both ends.
Habitat: Found in standing or slow moving water.
Maximum size: 7-80 mm

Mosquito larva and pupa 1
Order: Diptera
Description: Thorax wider than the head and breathes through a long siphon at the end of the abdomen.
Habitat: Still water.
Maximum size: Up to 25 mm

Freshwater snails 1
Class: Gastropoda
Description: Snails are soft-bodied animals enclosed in a hard, protective, coiled shell.
Habitat: Found on plants and rocks in slow flowing or standing water.
Maximum size: Up to 25 mm

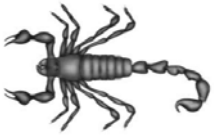
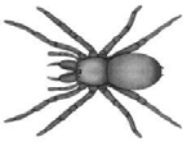
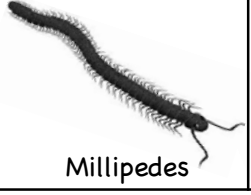
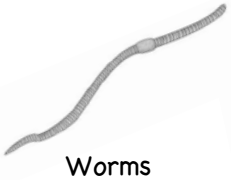
WATER BUG DETECTIVE GUIDE

Produced by NSW Waterwatch and NSW Department of Environment, Climate Change and Water (2008), and artist Christine Rockley.

Waterwatch NEW SOUTH WALES
Communities Caring for Catchments

Invertebrate identification chart

APPENDIX 3

Planet for Life – Action for a sustainable world		INVERTEBRATE IDENTIFICATION CHART		 Ants
 Bees	 Stylops	 Wasps	 Flies & mosquitoes	 Mayflies
 Alderflies & dobsonflies	 Scorpion flies & hanging flies	 Dragonflies & damselflies	 Sawflies	 Leafhoppers & cicadas
 Snails & slugs	 Psyllids, aphids, scale insects & whiteflies	 Lacewings	 Thrips	 Psocids & booklice
 Caddis-flies	 Grasshopper, crickets, katydids & locusts	 Praying mantids	 Earwigs	 Stick insects
 Butterflies & moths	 Beetles & weevils	 True bugs	 Cockroaches	 Slaters
 Silverfish	 Stoneflies	 Webspinners	 Lice	 Landhoppers
 Scorpions	 Pseudoscorpions	 Ticks & mites	 Springtails	 Spiders
 Fleas	 Termites	 Millipedes	 Worms	Centipedes

Images courtesy of © Australian Museum

This resource accompanies the book Planet for Life by Abbie Mitchell published by the Jane Goodall Institute Australia **www.janegoodall.org.au**

The 10 R's

Tick off these Actions as you work towards a more sustainable world

Planet for Life
Action for a sustainable world

TAKE ACTION towards a sustainable planet!

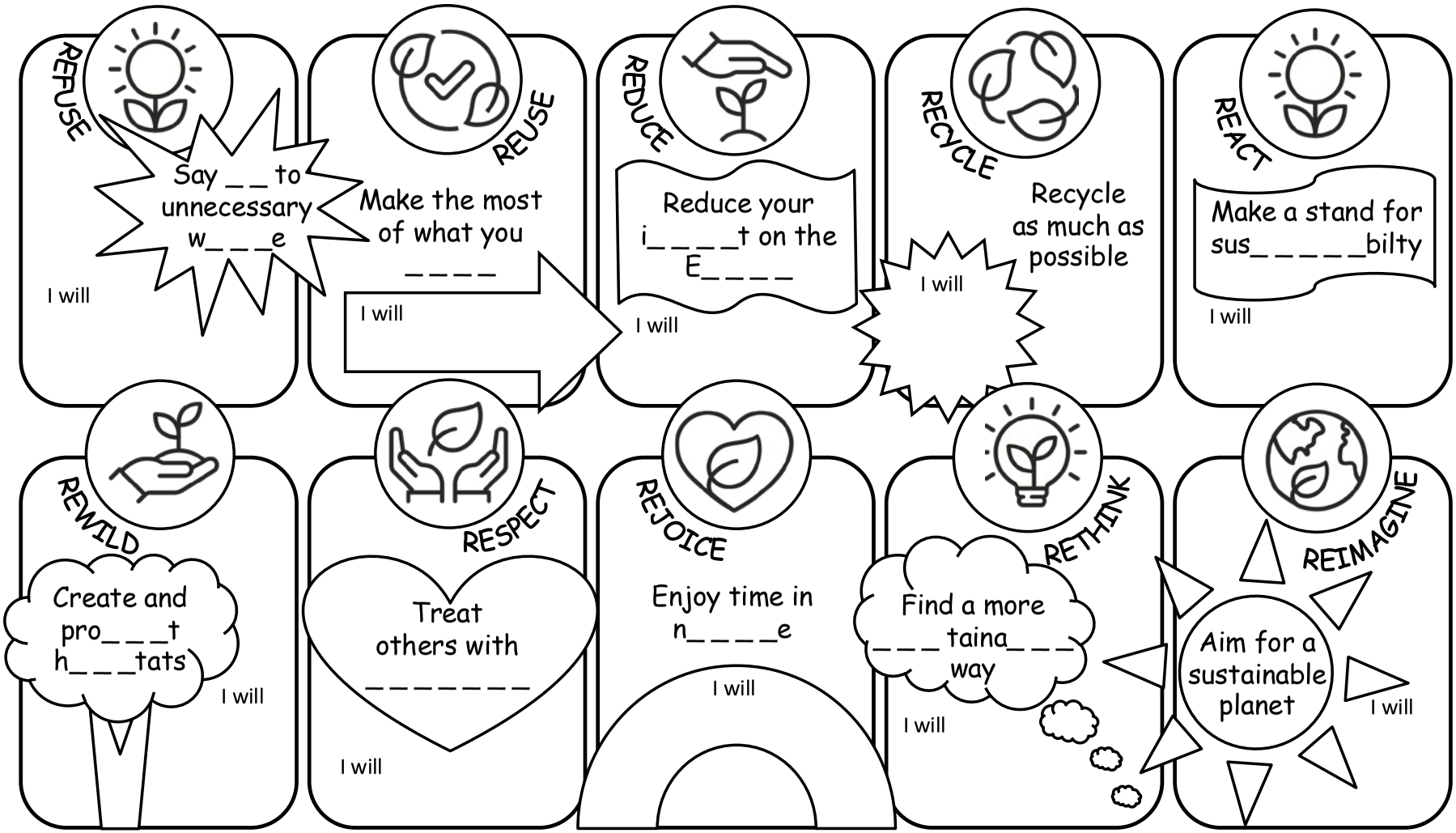
Name	Refuse	Reuse	Reduce	Recycle	React	Rewild	Rejoice	Respect	Rethink	Reimagine
	Say NO to unnecessary waste	Make the most of what you have	Reduce your impact on the world	Recycle as much as possible	Make a stand for sustainability	Create and protect habitats	Enjoy time in nature	Treat others with respect	Find a more sustainable way	Aim for a sustainable planet

This poster accompanies the book Planet for Life by Abbie Mitchell published by the Jane Goodall Institute Australia **www.janegoodall.org.au**

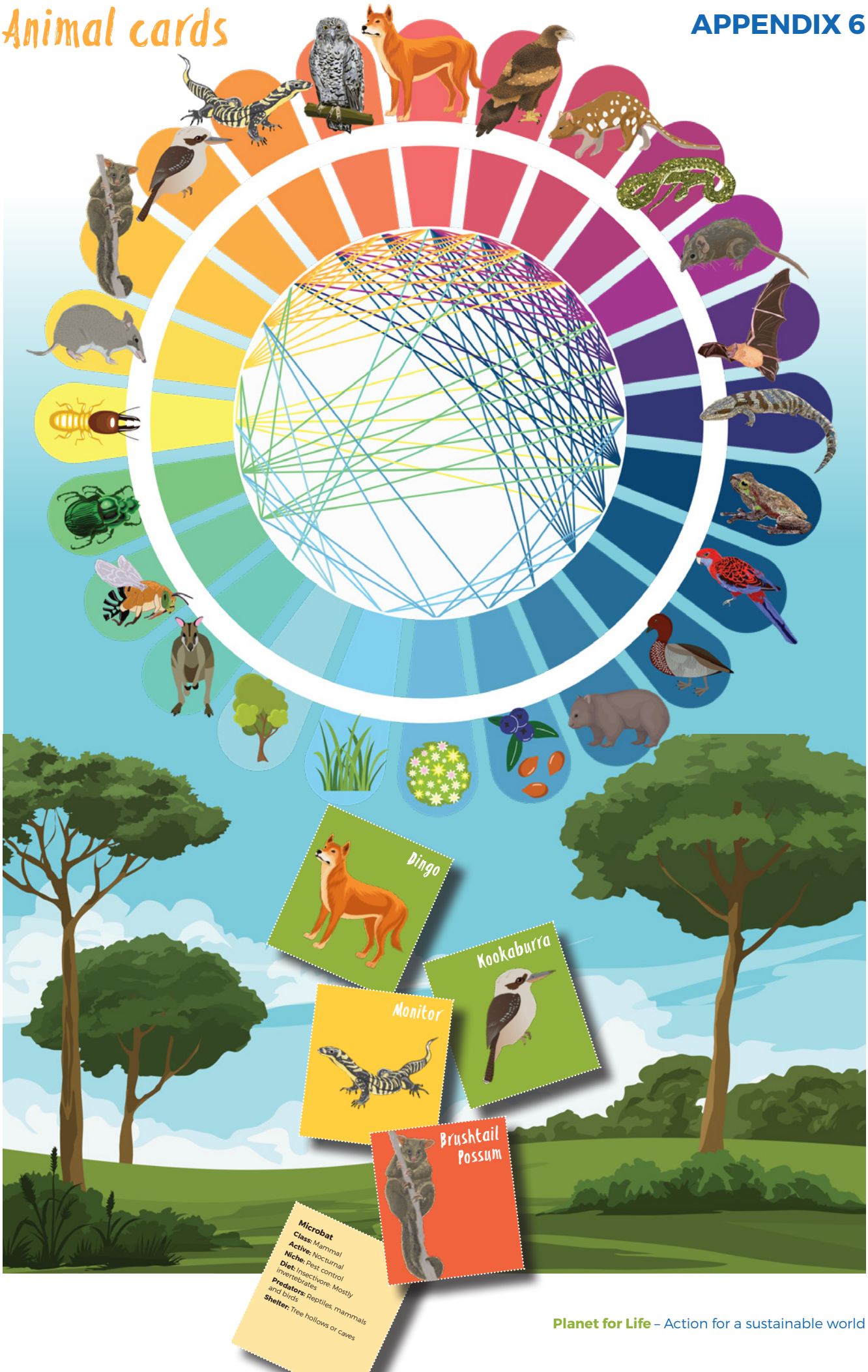
Planet for Life

The 10 R's

Take ACTION now for a sustainable planet!



Animal cards



Dingo

Wedge-tailed Eagle

Spotted-tailed Quoll

Diamond Python

Antechinus

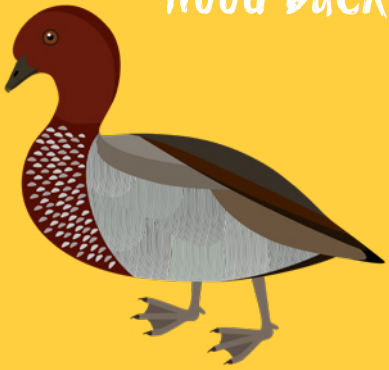
Microbat

Blue-tongue Lizard

Frog

Rosella

Wood Duck



Wombat

Fruit and Seeds

Dingo

Class: Mammal

Active: Both nocturnal and diurnal

Niche: Keystone species - Apex predator

Diet: Mostly carnivore – Mammals, birds, reptiles, amphibians, invertebrates, fruits

Predators: Adults – No predators, Pups – Large reptiles and birds

Shelter: Grasses, logs, caves

Wedge-tailed Eagle

Class: Bird

Active: Diurnal

Niche: Keystone species - Apex predator

Diet: Carnivore: Mammals, birds and reptiles

Predators: Adults – No predators; Chicks/eggs –Large reptiles, large mammals

Shelter: Trees

Spotted-tailed quoll

Class: Mammal

Active: Nocturnal

Niche: Predator

Diet: Carnivore: Small mammals, birds, reptiles, amphibians, invertebrates and fruits

Predators: Larger reptiles, birds and mammals

Shelter: Grasses, logs, caves, tree hollows

Diamond python

Class: Reptile

Active: Both nocturnal and diurnal

Niche: Predator

Diet: Carnivore: Mammals, birds, reptiles and amphibians

Predators: Adults – Larger mammals, reptiles and birds; Young/eggs – Medium mammals, reptiles and birds

Shelter: Grasses, logs, trees (including hollows), caves

Antechinus

Class: Mammal

Active: Nocturnal

Niche: Predator - Pest control

Diet: Carnivore and insectivore: Small reptiles, birds and mammals, and amphibians, invertebrates and eggs

Predators: Birds, reptiles and mammals

Shelter: Grasses, logs, crevices, tree hollows

Microbat

Class: Mammal

Active: Nocturnal

Niche: Predator - Pest control

Diet: Insectivore: Mostly invertebrates

Predators: Reptiles, mammals and birds

Shelter: Tree hollows or caves

Blue-tongue lizard

Class: Reptile

Active: Diurnal

Niche: Pest control

Diet: Omnivore: Invertebrates and plants (flowers and leaves)

Predators: Larger reptiles, mammals and birds

Shelter: Log hollows, crevices and burrows

Frog

Class: Amphibian

Active: Both nocturnal and diurnal

Niche: Predator (as adult), helps control algae (tadpoles)

Diet: Omnivore: Adults – Invertebrates; Tadpoles- Invertebrates and algae

Predators: Reptiles, mammals, birds

Shelter: Tree and log hollows, grasses, fresh water

Rosella

Class: Bird

Active: Diurnal

Niche: Seed dispersal

Diet: Granivore: Plants (Seeds, fruits, flowers, nectar)

Predators: Larger reptiles, mammals, birds

Shelter: Trees

Nest: Tree hollows

Wood duck

Class: Bird

Active: Diurnal

Niche: Granivore - Seed dispersal

Diet: Herbivore: Plants (Grass)

Predators: Adults/ducklings and eggs: Large reptiles, mammals, birds

Shelter: Trees

Nests: Tree hollows

Wombat

Class: Mammal

Active: Nocturnal

Niche: Ecosystem engineer/ keystone species – soil turnover, habitat creation, and controlling grass growth

Diet: Herbivore: Plants (Grass, roots)

Predators: Larger mammals, birds and reptiles

Shelter: Burrows

Fruit and Seeds

Class: Plant

Available: Seasonal

Niche: Food for animals

Diet: Autotroph (makes its food)

Foragers: Herbivores and omnivores - Birds, reptiles, mammals and invertebrates

Requires: Pollinators, seed dispersers, nutrient recyclers and decomposers

Grasses

Trees: Leaves and timber

Wallaby

Bees

Beetles

Termites

Bandicoot

Brushtail Possum

Kookaburra

Monitor

Powerful Owl

Pollen and Nectar

Grasses

Class: Plant

Available: Seasonal

Niche: Food and shelter for animals

Diet: Autotroph (makes its food)

Foragers: Herbivores and omnivores - Birds, reptiles, mammals and invertebrates

Requires: Pollinators, seed dispersers, nutrient recyclers and decomposers

Trees: Leaves and timber

Class: Plant

Available: All year round

Niche: Food and shelter for animals

Diet: Autotroph (makes its food)

Foragers: Herbivores, omnivores and decomposers – Reptiles, mammals and invertebrates

Requires: Pollinators, seed dispersers, nutrient recyclers and decomposers

Wallaby

Class: Mammal

Active: Nocturnal

Niche: Ecosystem engineer – spore transfer (from fungi), and controls plant growth

Diet: Herbivore: Grass, roots, fungi, leaves

Predators: Adult – Larger mammals; Joey – Large mammals, reptiles and birds

Shelter: Grasses

Bees

Class: Insect

Active: Diurnal

Niche: Ecosystem engineer/ keystone species – pollinator

Diet: Nectarivore: Nectar and pollen

Predators: Amphibians, small mammals and reptiles and invertebrates

Shelter: Grasses, trees (including hollows and borer holes), burrows

Beetles

Class: Insect

Active: Diurnal or nocturnal

Niche: Pollinators, nutrient recyclers or insect/plant controls

Diet: Herbivore, Nectarivore or Decomposer: Plants, pollen and nectar or dead timber, or dung (depends on species)

Predators: Amphibians and small mammals, reptiles, birds and invertebrates

Shelter: Grasses, trees, logs, shrubs, ground

Termites

Class: Insect

Active: Diurnal and nocturnal

Niche: Ecosystem engineers and keystone species - Nutrient recyclers (decomposers) and habitat creation (makes tree hollows)

Diet: Decomposer: Dead wood and dead grasses

Predators: Amphibians, mammals, reptiles, birds, invertebrates

Shelter: Trees, logs, ground

Bandicoot

Class: Mammal

Active: Nocturnal

Niche: Ecosystem engineers - Nutrient recyclers (via digging)

Diet: Omnivore: Invertebrates, tiny reptiles, amphibians , fruits and fungi

Predators: Large reptiles, birds, mammals

Shelter: Grasses, logs, under shrubs, ground

Brushtail possum

Class: Mammal

Active: Nocturnal

Niche: Controls plant growth

Diet: Herbivore (mostly): Plants (leaves but also fruits, flowers, pollen, nectar), eggs, invertebrates

Predators: Large reptiles, birds, mammals

Shelter: Tree hollows

Kookaburra

Class: Birds

Active: Diurnal

Niche: Predator

Diet: Carnivore: Invertebrates, tiny mammals and reptiles, amphibians

Predators: Large birds, mammals, reptiles

Shelter: Trees

Nest: Tree hollows

Monitor

Class: Reptile

Active: Diurnal

Niche: Keystone species – predator and scavenger

Diet: Carnivore: Invertebrates, mammals, reptiles, amphibians, birds, eggs, dead animals

Predators: Adults/Young – Larger reptiles, mammals and birds

Shelter: Trees, Tree hollows, burrows

Nest: Termite mounds or burrows

Powerful Owl

Class: Bird

Active: Nocturnal

Niche: Keystone species - Apex predator

Diet: Carnivore: Mammals, reptiles, birds

Predators: Adults – No predators; Chicks/eggs – Large reptiles and mammals

Shelter: Trees

Nest: Tree hollows

Pollen and Nectar

Class: Plant

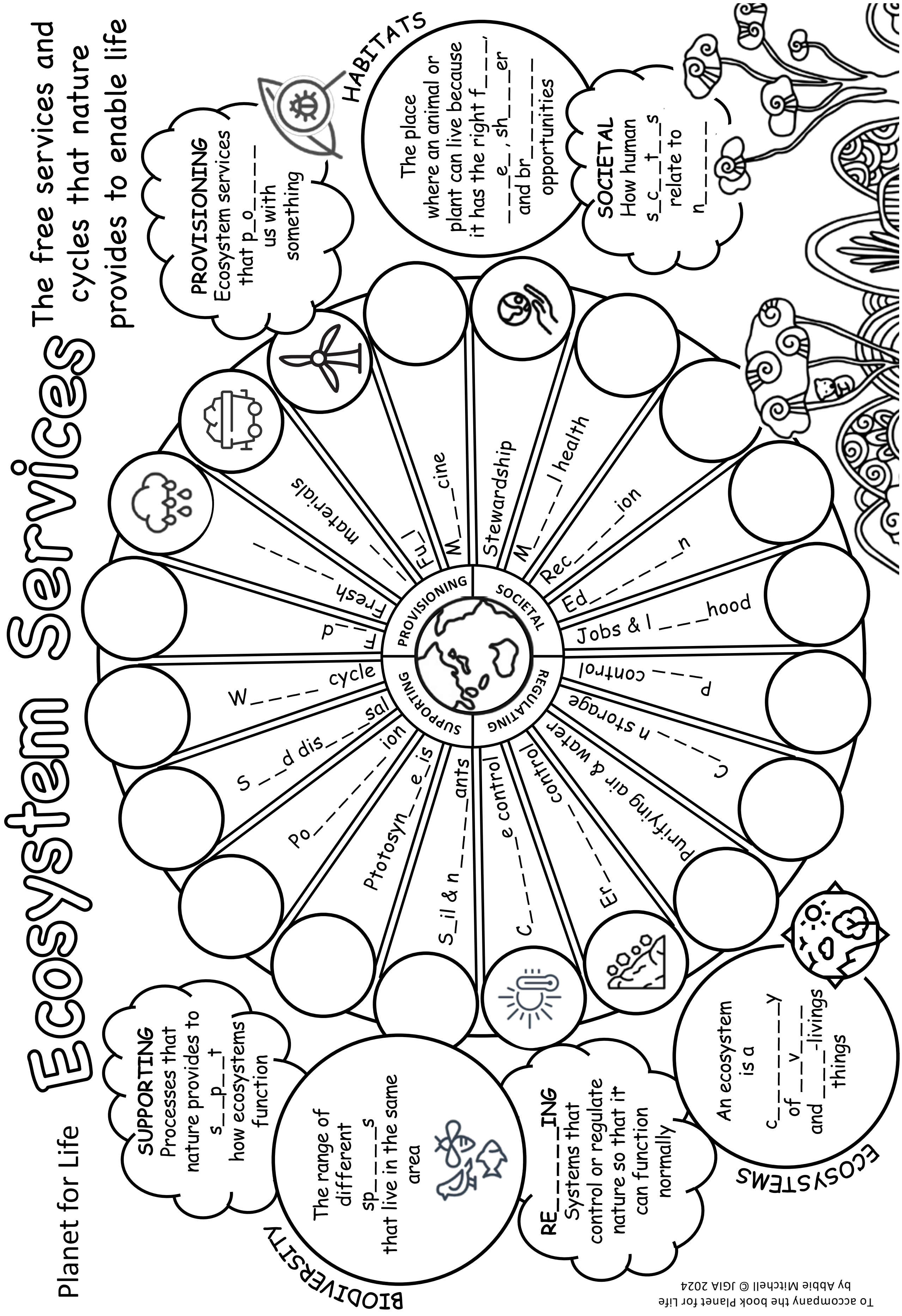
Available: Seasonal

Niche: Food for animals

Diet: Autotroph (makes its food)

Foragers: Nectarivores (pollinators): Certain birds, invertebrates, mammals and reptiles

Requires: Pollinators, seed dispersers, nutrient recyclers and decomposers



Ecosystem Services
The free services and cycles that nature provides to enable life
Planet for Life
PROVISIONING Ecosystem services that p_o_ _ _ _ _ us with something
HABITATS
The place where an animal or plant can live because it has the right f_ _ _, _ _ _e_, sh_ _ _er and br_ _ _ _ _ _ opportunities
SOCIETAL How human s_c_ _t_ _s relate to n_ _ _ _ _ _
SUPPORTING Processes that nature provides to s_ _p_ _t how ecosystems function
BIODIVERSITY
The range of different sp_ _ _ _s that live in the same area
RE_ _ _ _ _ _ING Systems that control or regulate nature so that it can function normally
ECOSYSTEMS
An ecosystem is a c_ _ _ _ _ _ _ _y of _ _ _v_ _ _ and _ _ _ _-livings things
PROVISIONING
SOCIETAL
REGULATING
SUPPORTING
Fu_ _l
M_ _ _ _cine
Stewardship
M_ _ _ _l health
Rec_ _ _ _ _ion
Ed_ _ _ _ _ _n
Jobs & l_ _ _ _hood
P_ _ _ control
C_ _ _ _ n storage
Purifying air & water
Er_ _ _ _ _ control
C_ _ _ _ _e control
S_il & n_ _ _ _ _ _ants
Photosyn_ _ _e_is
Po_ _ _ _ _ _ _ion
S_ _d dis_ _ _ _sal
W_ _ _ _ _ cycle
T_ _ _ p
Fresh _ _ _ _ _
_ _ _ _ _ materials
To accompany the book Planet for Life by Abbie Mitchell © JGIA 2024

Notes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