4th Class
AGES 9–10

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SCIENCE: A STEM APPROACH

Living Things

Energy and Forces

Materials

Earth and the Environment

Foreword

Science: A STEM Approach (Infants to 6th Class) is a series of copymasters written to support the science curriculum, while offering a way to introduce a STEM Project based on the concepts taught.

Each book is divided into sections on Living Things, Energy and Forces, Materials, and Earth and the Environment. Linkage between the sections is present, where relevant. The last section, Earth and the Environment, recognises the close integration between the science curriculum and the geography curriculum. Content for this section in particular adheres to the SESE principle that "much learning in science, geography and history will take place through the integrated themes or topics that teachers use to organise their work" (Primary Science Curriculum, Introduction, page 9).

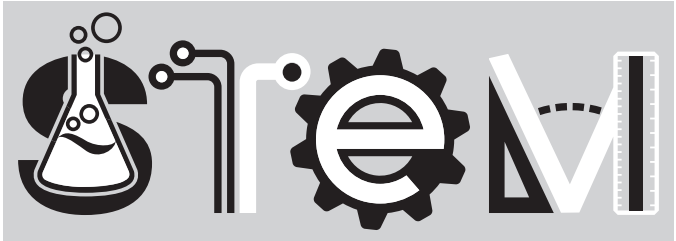
The STEM Project at the end of each section also develops this integrated, cross-curricular approach, drawing on skills and understanding from other curricular areas (such as geography, mathematics, SPHE and visual arts).

Contents

Introduction

What is STEM?

STEM is the integration of science, technology, engineering and mathematics concepts using project-based and cooperative learning. Teachers have been integrating learning areas since the beginning of time, so although the idea behind STEM is not new, this series aims to make it easier for you to execute learning integration in the classroom.



There has been much discussion about the importance of STEM skills, both in Ireland and around the world. The future workforce will require current pupils to be creative and critical thinkers who can collaborate and design solutions to problems. The skills utilised in STEM have never been more valued.

STEM education aims to prepare pupils for the roles of the future with skills such as innovation, creativity, reasoning, problem-solving and technical science skills such as questioning, observing, systematic experimentation, and analysis and interpretation of data.

Format of this Book

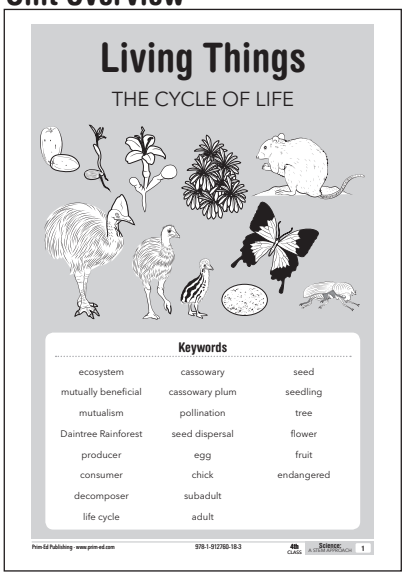
This series focuses on delivering a comprehensive and contemporary science programme, culminating in a STEM project which applies the scientific knowledge acquired during the science lessons. The series incorporates the use of online resources, digital devices and tablet computer applications where appropriate, in order to enhance the use of information technology in the classroom.

The Units

This book is divided into four units: Living Things, Energy and Forces, Materials, and Earth and the Environment. At the start of each unit, keywords, a unit overview and a curriculum scope and sequence chart are provided, as shown below.

Each unit contains six lessons, a summative assessment of the science knowledge with teacher notes, and a **STEM Project**.

Unit Overview


Living Things
THE CYCLE OF LIFE
Keywords
ecosystem, cassowary, seed, mutually beneficial, cassowary plum, seedling, mutualism, pollination, tree, Daintree Rainforest, seed dispersal, flower, producer, egg, fruit, consumer, chick, endangered, decomposer, subadult, life cycle, adult
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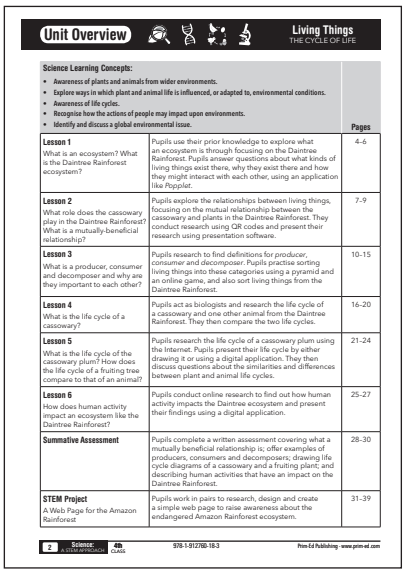
Title Page


Unit Overview — Living Things THE CYCLE OF LIFE
Science Learning Concepts:
- Awareness of plants and animals from wider environments.
- Explore ways in which plant and animal life is influenced, or adapted to, environmental conditions.
- Awareness of life cycles.
- Recognise how the actions of people may impact upon environments.
- Identify and discuss a global environmental issue.

		Pages
Lesson 1 What is an ecosystem? What is the Daintree Rainforest ecosystem?	Pupils use their prior knowledge to explore what an ecosystem is through focusing on the Daintree Rainforest. Pupils answer questions about what kinds of living things exist there, why they exist there and how they might interact with each other, using an application like *Popplet*.	4–6
Lesson 2 What role does the cassowary play in the Daintree Rainforest? What is a mutually-beneficial relationship?	Pupils explore the relationships between living things, focusing on the mutual relationship between the cassowary and plants in the Daintree Rainforest. They conduct research using QR codes and present their research using presentation software.	7–9
Lesson 3 What is a producer, consumer and decomposer and why are they important to each other?	Pupils research to find definitions for *producer, consumer* and *decomposer*. Pupils practise sorting living things into these categories using a pyramid and an online game, and also sort living things from the Daintree Rainforest.	10–15
Lesson 4 What is the life cycle of a cassowary?	Pupils act as biologists and research the life cycle of a cassowary and one other animal from the Daintree Rainforest. They then compare the two life cycles.	16–20
Lesson 5 What is the life cycle of the cassowary plum? How does the life cycle of a fruiting tree compare to that of an animal?	Pupils research the life cycle of a cassowary plum using the Internet. Pupils present their life cycle by either drawing it or using a digital application. They then discuss questions about the similarities and differences between plant and animal life cycles.	21–24
Lesson 6 How does human activity impact an ecosystem like the Daintree Rainforest?	Pupils conduct online research to find out how human activity impacts the Daintree ecosystem and present their findings using a digital application.	25–27
Summative Assessment	Pupils complete a written assessment covering what a mutually beneficial relationship is; offer examples of producers, consumers and decomposers; drawing life cycle diagrams of a cassowary and a fruiting plant; and describing human activities that have an impact on the Daintree Rainforest.	28–30
STEM Project A Web Page for the Amazon Rainforest	Pupils work in pairs to research, design and create a simple web page to raise awareness about the endangered Amazon Rainforest ecosystem.	31–39

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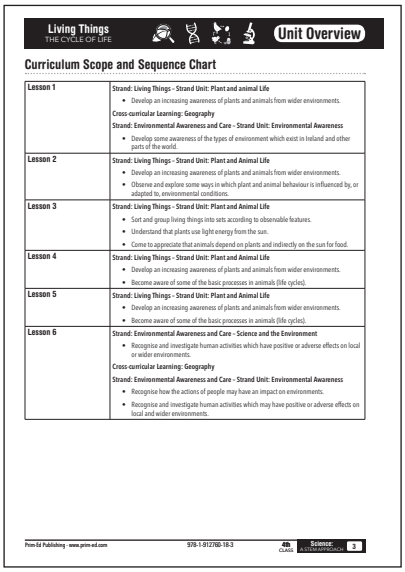
Unit Overview


Living Things THE CYCLE OF LIFE — Unit Overview
Curriculum Scope and Sequence Chart

Lesson 1	**Strand: Living Things - Strand Unit: Plant and animal Life** • Develop an increasing awareness of plants and animals from wider environments. **Cross-curricular Learning: Geography** **Strand: Environmental Awareness and Care - Strand Unit: Environmental Awareness** • Develop some awareness of the types of environment which exist in Ireland and other parts of the world.
Lesson 2	**Strand: Living Things - Strand Unit: Plant and Animal Life** • Develop an increasing awareness of plants and animals from wider environments. • Observe and explore some ways in which plant and animal behaviour is influenced by, or adapted to, environmental conditions.
Lesson 3	**Strand: Living Things - Strand Unit: Plant and Animal Life** • Sort and group living things into sets according to observable features. • Understand that plants use light energy from the sun. • Come to appreciate that animals depend on plants and indirectly on the sun for food.
Lesson 4	**Strand: Living Things - Strand Unit: Plant and Animal Life** • Develop an increasing awareness of plants and animals from wider environments. • Become aware of some of the basic processes in animals (life cycles).
Lesson 5	**Strand: Living Things - Strand Unit: Plant and Animal Life** • Develop an increasing awareness of plants and animals from wider environments. • Become aware of some of the basic processes in animals (life cycles).
Lesson 6	**Strand: Environmental Awareness and Care - Science and the Environment** • Recognise and investigate human activities which have positive or adverse effects on local or wider environments. **Cross-curricular Learning: Geography** **Strand: Environmental Awareness and Care - Strand Unit: Environmental Awareness** • Recognise how the actions of people may have an impact on environments. • Recognise and investigate human activities which may have positive or adverse effects on local and wider environments.

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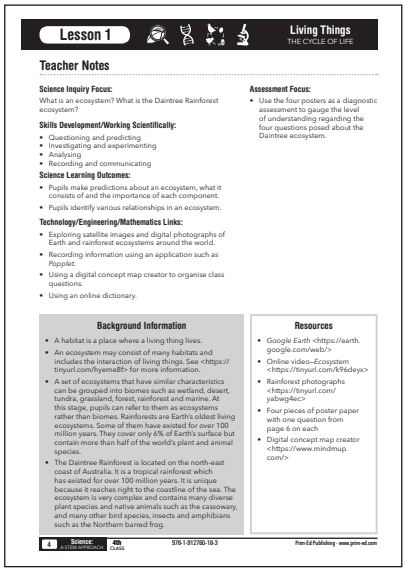
Curriculum Scope and Sequence Chart

Unit Description

Lessons

The lessons are based on scientific knowledge and skills and provide a wide range of opportunities for pupils to work scientifically. The lessons contain a page of teacher notes, outlining the inquiry questions, science strands and any links to technology and mathematics concepts followed by a suggested lesson plan. Any resource sheets required for the lesson follow on.


Lesson 1 — Living Things: THE CYCLE OF LIFE

Teacher Notes

Science Inquiry Focus:
What is an ecosystem? What is the Daintree Rainforest ecosystem?

Skills Development/Working Scientifically:
- Questioning and predicting
- Investigating and experimenting
- Analysing
- Recording and communicating

Science Learning Outcomes:
- Pupils make predictions about an ecosystem, what it consists of and the importance of each component.
- Pupils identify various relationships in an ecosystem.

Technology/Engineering/Mathematics Links:
- Exploring satellite images and digital photographs of Earth and rainforest ecosystems around the world.
- Recording information using an application such as *Popplet*.
- Using a digital concept map creator to organise class questions.
- Using an online dictionary.

Assessment Focus:
- Use the four posters as a diagnostic assessment to gauge the level of understanding regarding the four questions posed about the Daintree ecosystem.

Background Information
- A habitat is a place where a living thing lives.
- An ecosystem may consist of many habitats and includes the interaction of living things. See <https://tinyurl.com/hyemx8l> for more information.
- A set of ecosystems that have similar characteristics can be grouped into biomes such as wetland, desert, tundra, grassland, forest, rainforest and marine. At this stage, pupils can refer to them as ecosystems rather than biomes. Rainforests are Earth's oldest living ecosystems. Some of them have existed for over 100 million years. They cover only 6% of Earth's surface but contain more than half of the world's plant and animal species.
- The Daintree Rainforest is located on the north-east coast of Australia. It is a tropical rainforest which has existed for over 100 million years. It is unique because it reaches right to the coastline of the sea. The ecosystem is very complex and contains many diverse plant species and native animals such as the cassowary, and many other bird species, insects and amphibians such as the Northern barred frog.

Resources
- *Google Earth* <https://earth.google.com/web/>
- Online video–Ecosystem <https://tinyurl.com/k96c6eyx>
- Rainforest photographs <https://tinyurl.com/yabwg4ec>
- Four pieces of poster paper with one question from page 6 on each
- Digital concept map creator <https://www.mindmup.com/>

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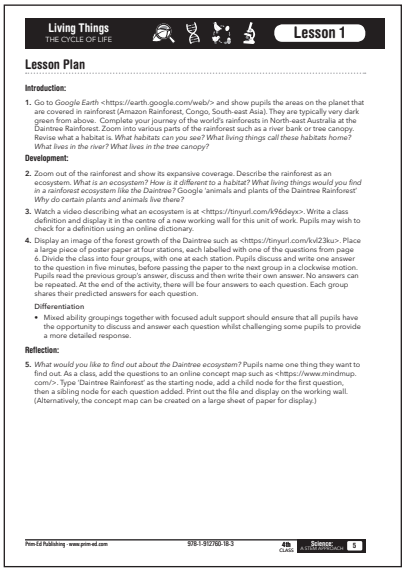
Teacher Notes


Living Things: THE CYCLE OF LIFE — Lesson 1

Lesson Plan

Introduction:
1. Go to *Google Earth* <https://earth.google.com/web/> and show pupils the areas on the planet that are covered in rainforest (Amazon Rainforest, Congo, South-east Asia). They are typically very dark green from above. Complete your journey of the world's rainforests in North-east Australia at the Daintree Rainforest. Zoom into various parts of the rainforest such as a river bank or tree canopy. Revise what a habitat is. *What habitats can you see? What living things call these habitats home? What lives in the river? What lives in the tree canopy?*

Development:
2. Zoom out of the rainforest and show its expansive coverage. Describe the rainforest as an ecosystem. *What is an ecosystem? How is it different to a habitat? What living things would you find in a rainforest ecosystem like the Daintree?* Google 'animals and plants of the Daintree Rainforest' *Why do certain plants and animals live there?*
3. Watch a video describing what an ecosystem is at <https://tinyurl.com/k96deyx>. Write a class definition and display it in the centre of a new working wall for this unit of work. Pupils may wish to check for a definition using an online dictionary.
4. Display an image of the forest growth of the Daintree such as <https://tinyurl.com/kvl23ku>. Place a large piece of poster paper at four stations, each labelled with one of the questions from page 6. Divide the class into four groups, with one at each station. Pupils discuss and write one answer to the question in five minutes, before passing the paper to the next group in a clockwise motion. Pupils read the previous group's answer, discuss and then write their own answer. No answers can be repeated. At the end of the activity, there will be four answers to each question. Each group shares their predicted answers for each question.

Differentiation
- Mixed ability groupings together with focused adult support should ensure that all pupils have the opportunity to discuss and answer each question whilst challenging some pupils to provide a more detailed response.

Reflection:
5. *What would you like to find out about the Daintree ecosystem?* Pupils name one thing they want to find out. As a class, add the questions to an online concept map such as <https://www.mindmup.com/>. Type 'Daintree Rainforest' as the starting node, add a child node for the first question, then a sibling node for each question added. Print out the file and display on the working wall. (Alternatively, the concept map can be created on a large sheet of paper for display.)

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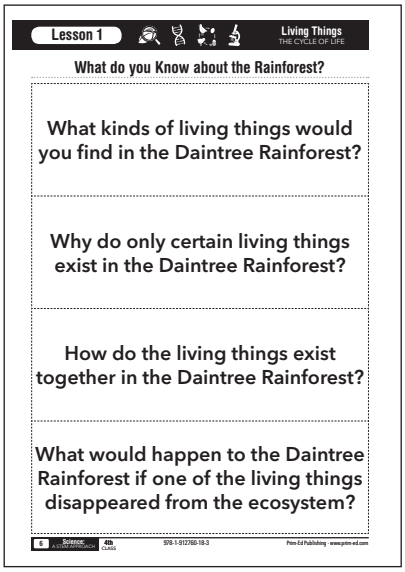
Lesson Plan


Lesson 1 — Living Things: THE CYCLE OF LIFE

What do you Know about the Rainforest?

What kinds of living things would you find in the Daintree Rainforest?

Why do only certain living things exist in the Daintree Rainforest?

How do the living things exist together in the Daintree Rainforest?

What would happen to the Daintree Rainforest if one of the living things disappeared from the ecosystem?

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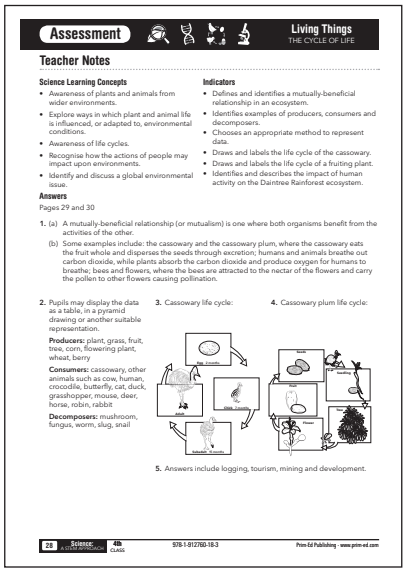
Resource Sheets

Assessment

A teacher page is provided outlining the assessment indicators and answers for the following assessment pages. The assessment pages cover the science knowledge explored in the previous pages.


Assessment — Living Things: THE CYCLE OF LIFE

Teacher Notes

Science Learning Concepts
- Awareness of plants and animals from wider environments.
- Explore ways in which plant and animal life is influenced, or adapted to, environmental conditions.
- Awareness of life cycles.
- Recognise how the actions of people may impact upon environments.
- Identify and discuss a global environmental issue.

Indicators
- Defines and identifies a mutually-beneficial relationship in an ecosystem.
- Identifies examples of producers, consumers and decomposers.
- Chooses an appropriate method to represent data.
- Draws and labels the life cycle of the cassowary.
- Draws and labels the life cycle of a fruiting plant.
- Identifies and describes the impact of human activity on the Daintree Rainforest ecosystem.

Answers
Pages 29 and 30

1. (a) A mutually-beneficial relationship (or mutualism) is one where both organisms benefit from the activities of the other.
(b) Some examples include: the cassowary and the cassowary plum, where the cassowary eats the fruit whole and disperses the seeds through excretion; humans and animals breathe out carbon dioxide, while plants absorb the carbon dioxide and produce oxygen for humans to breathe; bees and flowers, where the bees are attracted to the nectar of the flowers and carry the pollen to other flowers causing pollination.

2. Pupils may display the data as a table, in a pyramid drawing or another suitable representation.
Producers: plant, grass, fruit, tree, corn, flowering plant, wheat, berry
Consumers: cassowary, other animals such as cow, human, crocodile, butterfly, cat, duck, grasshopper, mouse, deer, horse, robin, rabbit
Decomposers: mushroom, fungus, worm, slug, snail

3. Cassowary life cycle:

4. Cassowary plum life cycle:

5. Answers include logging, tourism, mining and development.

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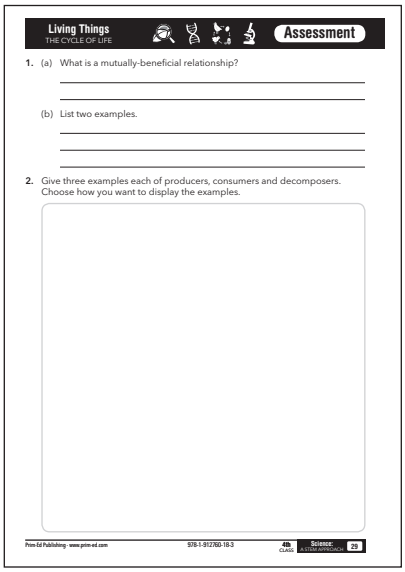
Teacher Notes


Living Things: THE CYCLE OF LIFE — Assessment

1. (a) What is a mutually-beneficial relationship?

(b) List two examples.

2. Give three examples each of producers, consumers and decomposers. Choose how you want to display the examples.

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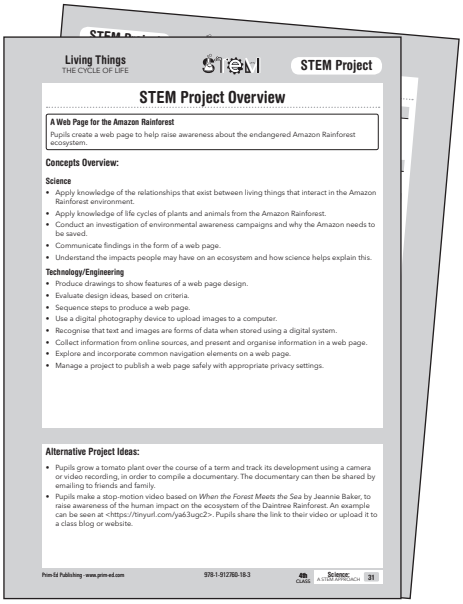
Assessment Page(s)

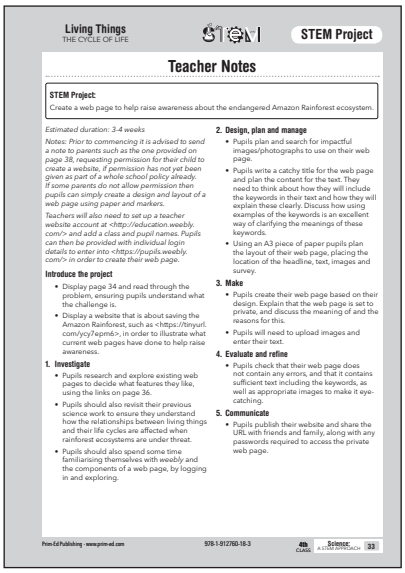
Unit Description

STEM Project

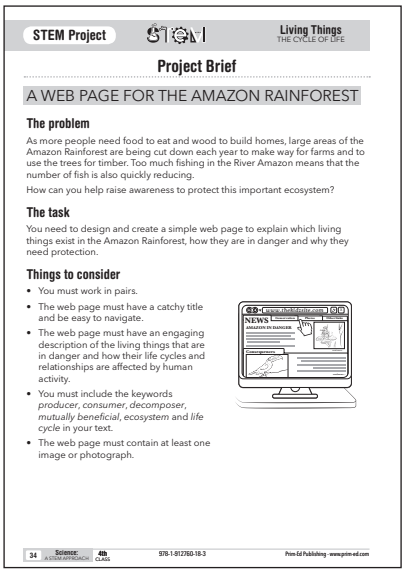
The STEM Project provides pupils with the opportunity to apply what they have learned in the previous science lessons while incorporating cross-curricular concepts where possible. The project entails group collaboration and an extended learning period of between three and four weeks. This gives pupils a real-life experience of working with 'colleagues' to share ideas and test various solutions. Each STEM Project contains a complete overview of what the project entails, teacher notes, a group assessment rubric, and a project brief and checklist for pupils. Any resource sheets required are also provided, as well as a self-assessment sheet.



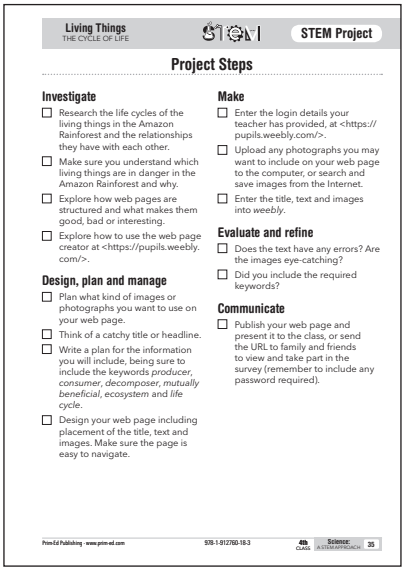
STEM Project Overview



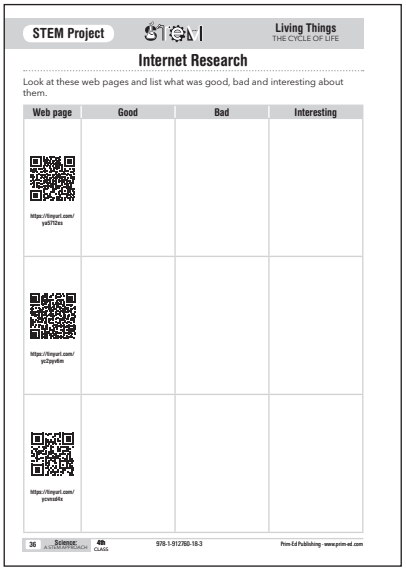
Teacher Notes



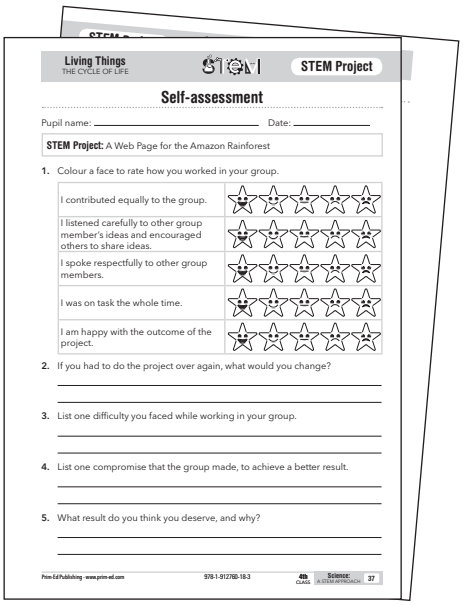
Pupil Brief



Project Steps



Resource Sheets



Self-assessment and Group Assessment Rubric

STEM Teaching

Teaching for STEM can be achieved through a cross-curricular approach to existing subject areas of the Irish curriculum. While science provides the dominant focus here, other curricular areas can be used to enhance pupil learning and reinforce concepts. Despite the fact that, at present, neither 'Technology' nor 'Engineering' are discrete subject areas in the Irish curriculum, teachers are constantly incorporating these areas in an informal fashion. Tablet computers, digital cameras and the Internet are commonly used by teachers in their classrooms to keep teaching and learning up-to-date with a constantly changing technological society.

Mastery of a STEM Approach to Science

A mastery curriculum is based on the fundamental belief that all pupils are capable of learning anything if the learning is presented in the right way. Many pupils will experience barriers to learning that might prevent them from achieving the learning goal. A mastery approach allows teachers to really challenge pupils to solve problems whilst supporting them to overcome barriers in their way.

Throughout this book, the term differentiation is used to provide guidance to teachers on different approaches to accommodate different abilities and learning preferences. Differentiation is not about lowering expectations of what 'less able' pupils can achieve, about simplifying activities or removing the challenge, it is about ensuring that all pupils have equal and fair access to the curriculum. Pupils who readily achieve the learning goal can be encouraged to work at greater depth through further research, learning and challenging activities.

Some strategies for differentiation in this book include:

- Changing the way pupils need to show their observations or their learning.
- Using a range of different resources to overcome pupil difficulties.
- Learning through collaboration, enabling pupils to support each other in the learning process.
- Recognising that pupils have different ways in which they learn.
- Coaching children through questioning, providing clues or comments, and enabling them to reveal their own knowledge, skills and understanding.
- Ongoing assessment that allows the teacher to adapt and modify activities to ensure maximum learning growth for all.

Children learn most effectively when their experiences are based around their interests and are filled with activities that are both relevant, engaging and meaningful. This book aims to ensure that by providing such activities, teachers are able to support pupils to achieve mastery of science, technology, engineering and mathematics.

Science Floor Books

Each unit of work contains many opportunities for practical learning and for working scientifically. They challenge pupils to apply their science skills, knowledge and understanding to a STEM Project. We recommend that each class creates a 'Floor Book' that acts as a record of the whole class learning in science and the STEM subjects. It can record the practical activities and investigations that are a key part of the series. In addition, there are many opportunities for activities to be photographed and drawings to be labelled. Pupils are involved in producing a range of tables, charts and graphs. All these can be included in a floor book. If updated regularly, it provides a running record of evidence of learning in these subjects. At the end of each year, pupils will have created their own STEM textbook to showcase their learning.

Working Walls

There are many references throughout each unit to the creation and development of a working wall in science. Each classroom should have a focus science area that contains books about the unit of work being studied and a working wall. Working walls are interactive science displays that can be used to record, visualise and assist learning. A key component of effective teaching and learning in science is to build upon and consolidate previous learning. A working wall can contain keywords and vocabulary, mind maps, concept cartoons, photographs and diagrams as well as records of previous work and investigations. Part of the working wall can be a WAGOLL (What A Good One Looks Like) where exemplar work and learning can be displayed. Pupils should be encouraged to use the working wall as a source of information as each unit progresses, particularly during the STEM Project at the end of each unit.

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Science Learning Concepts:

- **Awareness of plants and animals from wider environments.**
- **Explore ways in which plant and animal life is influenced, or adapted to, environmental conditions.**
- **Awareness of life cycles.**
- **Recognise how the actions of people may impact upon environments.**
- **Identify and discuss a global environmental issue.**

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Curriculum Scope and Sequence Chart

Lesson 1	**Strand: Living Things – Strand Unit: Plant and Animal Life** • Develop an increasing awareness of plants and animals from wider environments. **Cross-curricular Learning: Geography** **Strand: Environmental Awareness and Care – Strand Unit: Environmental Awareness** • Develop some awareness of the types of environment which exist in Ireland and other parts of the world.
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Teacher Notes

Science Inquiry Focus:

What is a producer, consumer and decomposer and why are they important to each other?

Skills Development/Working Scientifically:

- Questioning and predicting
- Investigating and experimenting
- Analysing
- Recording and communicating

Science Learning Outcomes:

- Pupils describe the relationship between living things in an ecosystem.
- Pupils discover that humans are living things that may have an impact on the delicate balance of relationships in an ecosystem.

Technology/Engineering/Mathematics Links:

- Using QR code readers and technology to conduct research.
- Viewing and sorting data from an online game.

Assessment Focus:

- Observe pupils' verbal responses to Step 7 as a formative assessment of the understanding of the relationship between producers, consumers and decomposers.
- Use page 13 as a formative assessment of pupils' understanding of what a producer, consumer and decomposer are.

Background Information

- Decomposers are considered nature's recyclers; they process dead materials and turn them into nutrients; for example, earthworms take in dead leaves and soil, and churn out nutrient-rich waste which promotes soil health, which in turn supports plant growth. Decomposers enable producers to live.
- Producers are living things that make their own food. This includes plants, flowers, trees, fruits and vegetables. They produce their own food using sunlight and the process of photosynthesis. Consumers that eat producers are called herbivores.
- Consumers are living things that eat plants or animals to obtain energy and nutrients. Consumers can be herbivores, carnivores or omnivores.
- Decomposers, producers and consumers have an interdependent relationship. If one dies out, then the whole ecosystem is thrown out of balance and can disappear. If there are competing consumers, then the less able consumer is also at risk of dying out.

Resources

- Digital copy of pages 12 and 15
- Online video–*Decomposers* <https://tinyurl.com/n53qxrb>
- Sufficient copies of page 13
- Tablet computer with QR code scanner
- Copies of page 14 (optional)
- Website to research decomposers, producers and consumers (linked to first QR code on page 13) <https://tinyurl.com/bmca32>
- Decomposers, producers and consumers game (linked to second URL on page 13) <https://tinyurl.com/avcxuf>

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Lesson Plan

Introduction:

1. Display a digital copy of page 12 on the whiteboard. *What is this person eating for lunch? What does the cow eat? How does the corn get food? What job does the worm do?* There is a flow of energy in every ecosystem. Where things get their energy from depends on whether they are a producer, consumer or decomposer.
2. Write the terms 'producer', 'consumer' and 'decomposer' on the board or working wall. In small groups, pupils discuss what they think these terms mean. *Can you guess what the cow is, or what the corn is, or the human or the worm?*

Development:

3. As a class, watch the video *Decomposers* at <https://tinyurl.com/n53qxrb>.
4. Individually, pupils go to <https://tinyurl.com/bmca32> or scan the QR code on page 13 to research and write a definition for *producer*, *consumer* and *decomposer*. Pupils can also confirm which living things from the image shown in Step 1 are consumers, producers and decomposers, as well as list other examples on the resource sheet.
5. Individually, or in pairs as digital equipment allows, pupils practise sorting producers, consumers and decomposers by playing the game at <https://tinyurl.com/avcxuf>. *Note: The URL is written at the bottom of page 13 and can only be used on a computer (this game is flash-based and will not work on an iPad®).* Alternatively, play the game as a class on the whiteboard.

   Differentiation

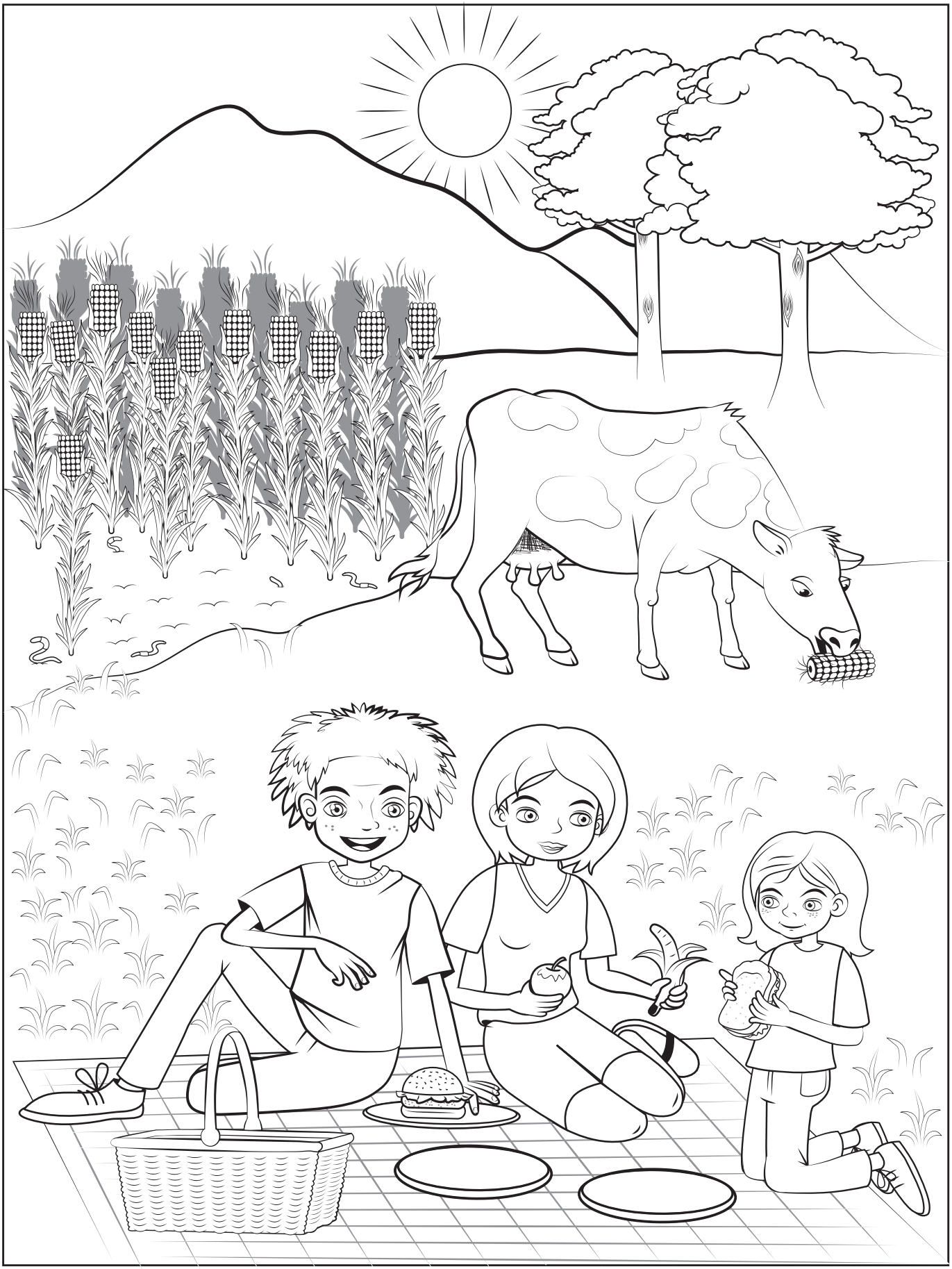
   - Pupils who require more practice identifying producers, consumers and decomposers can use page 14 to conduct a card sort.

6. As a class, discuss the importance of the components of an ecosystem in terms of producers, consumers and decomposers. *What would happen if one of these producers, consumers or decomposers died out from the ecosystem?* Draw the pupils' attention to a habitat they would have studied in 3rd Class - the woodland habitat - to further illustrate. Use the images of living things on page 15 to make a table and list the ones that are producers, consumers and decomposers based on the definitions and previous research.

Reflection:

7. Select pupils at random to name a producer, consumer or decomposer. Individually, pupils complete the sentence *If all decomposers died out in an ecosystem then …* in their science books or using digital technologies as appropriate. An agreed class definition can be added to the working wall.

Where do you get your Energy?



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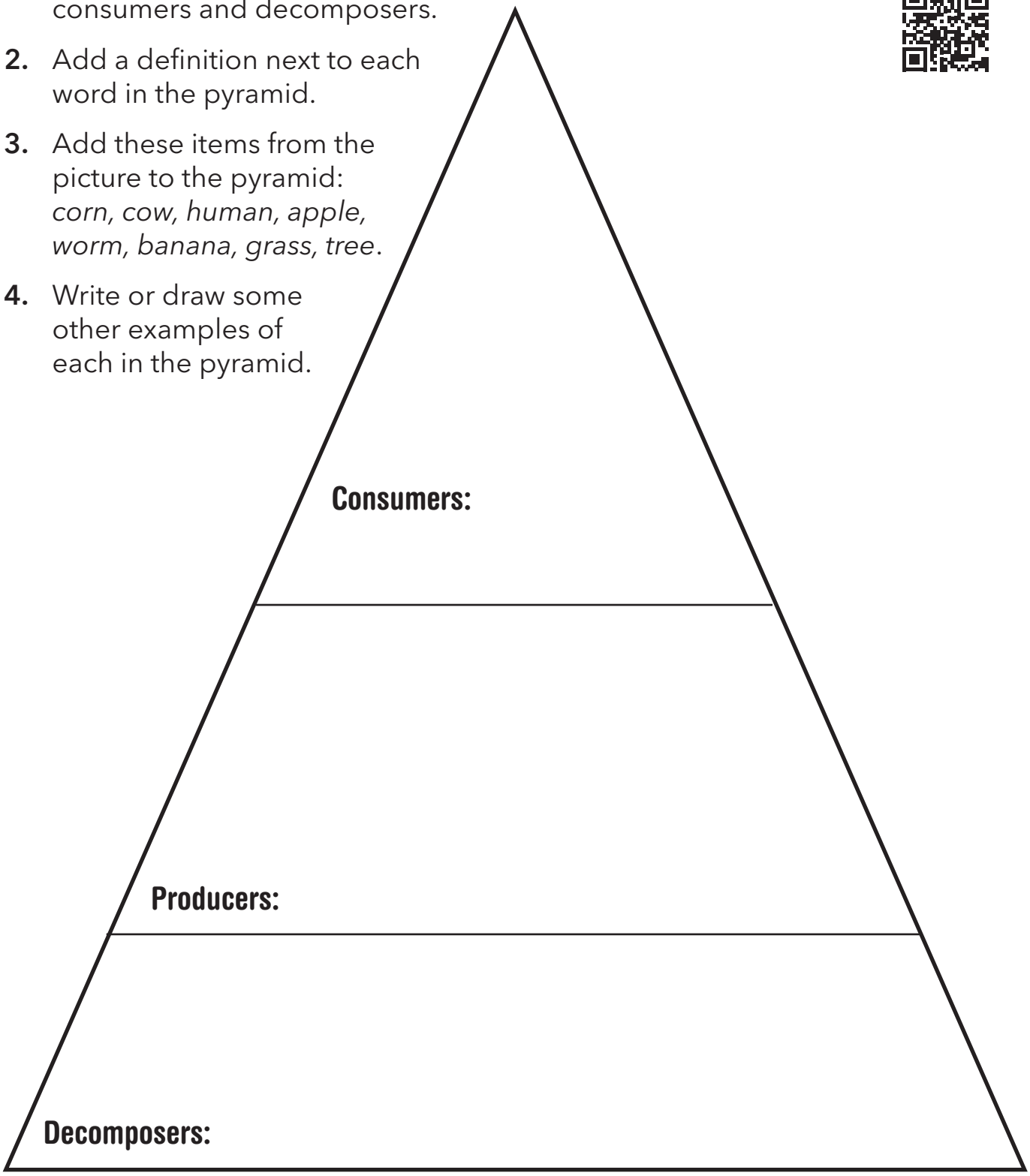
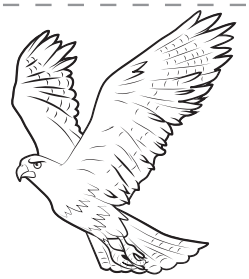
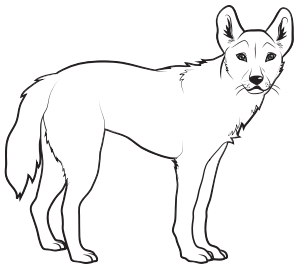
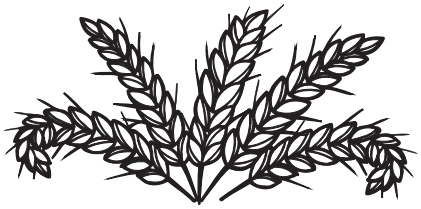
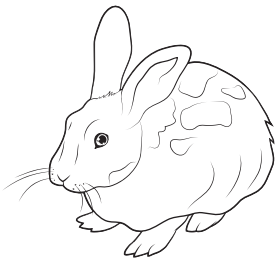
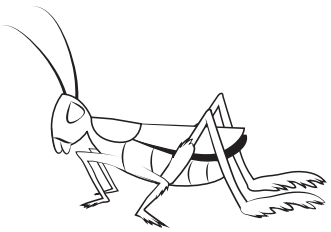
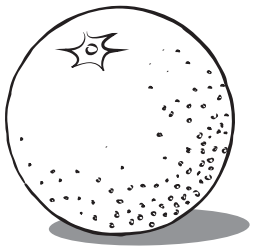
Producers, Consumers and Decomposers

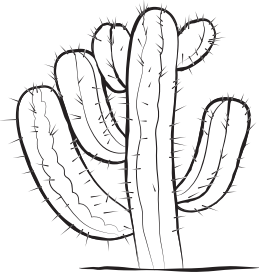
1. Scan the QR code or go to <https://tinyurl.com/bmca32> to read information about producers, consumers and decomposers.
2. Add a definition next to each word in the pyramid.
3. Add these items from the picture to the pyramid: *corn, cow, human, apple, worm, banana, grass, tree*.
4. Write or draw some other examples of each in the pyramid.

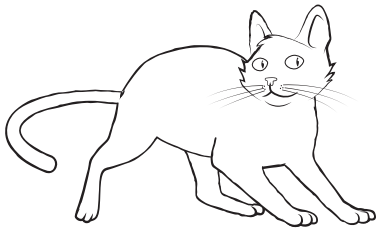
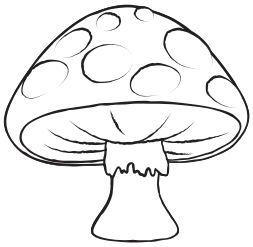
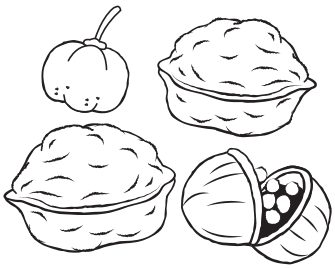


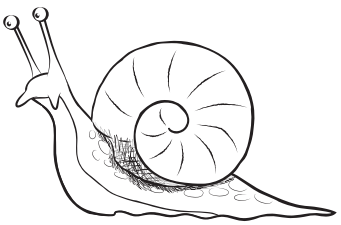
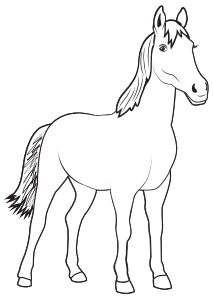
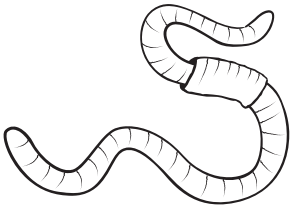
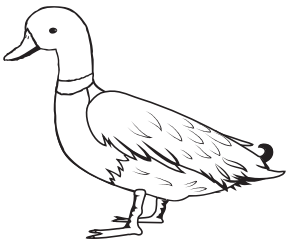
5. Now test your knowledge by playing a game! Using a computer, go to <https://tinyurl.com/avcxuf>.

Card Sort

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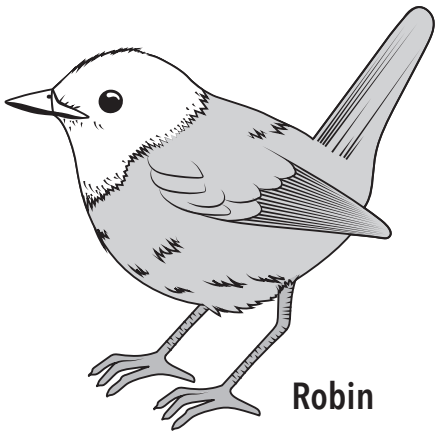
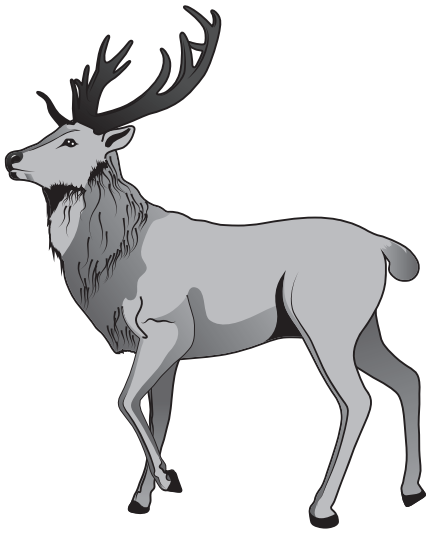
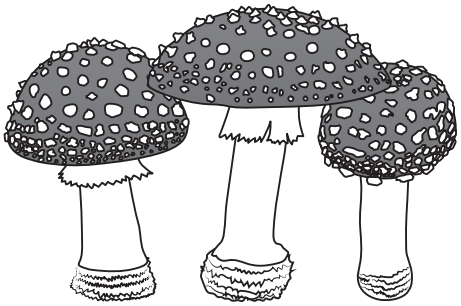
Woodland Producers, Consumers and Decomposers



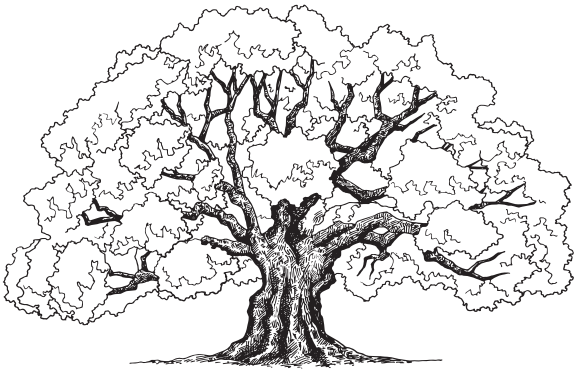
Robin



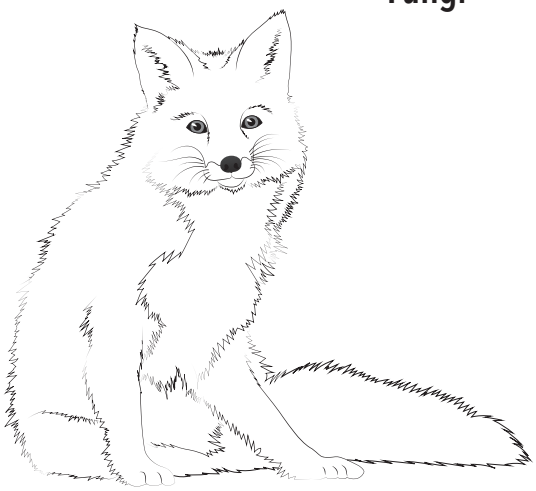
Deer



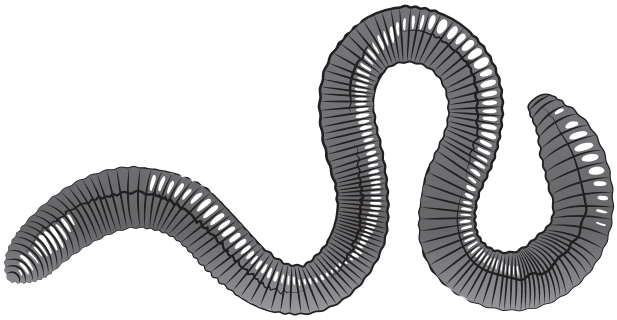
Fungi



Oak tree

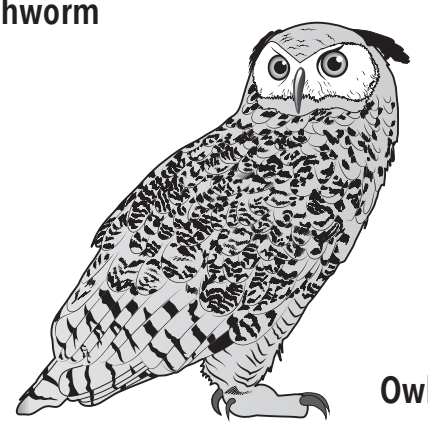


Fox



Earthworm

Grass



Owl

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