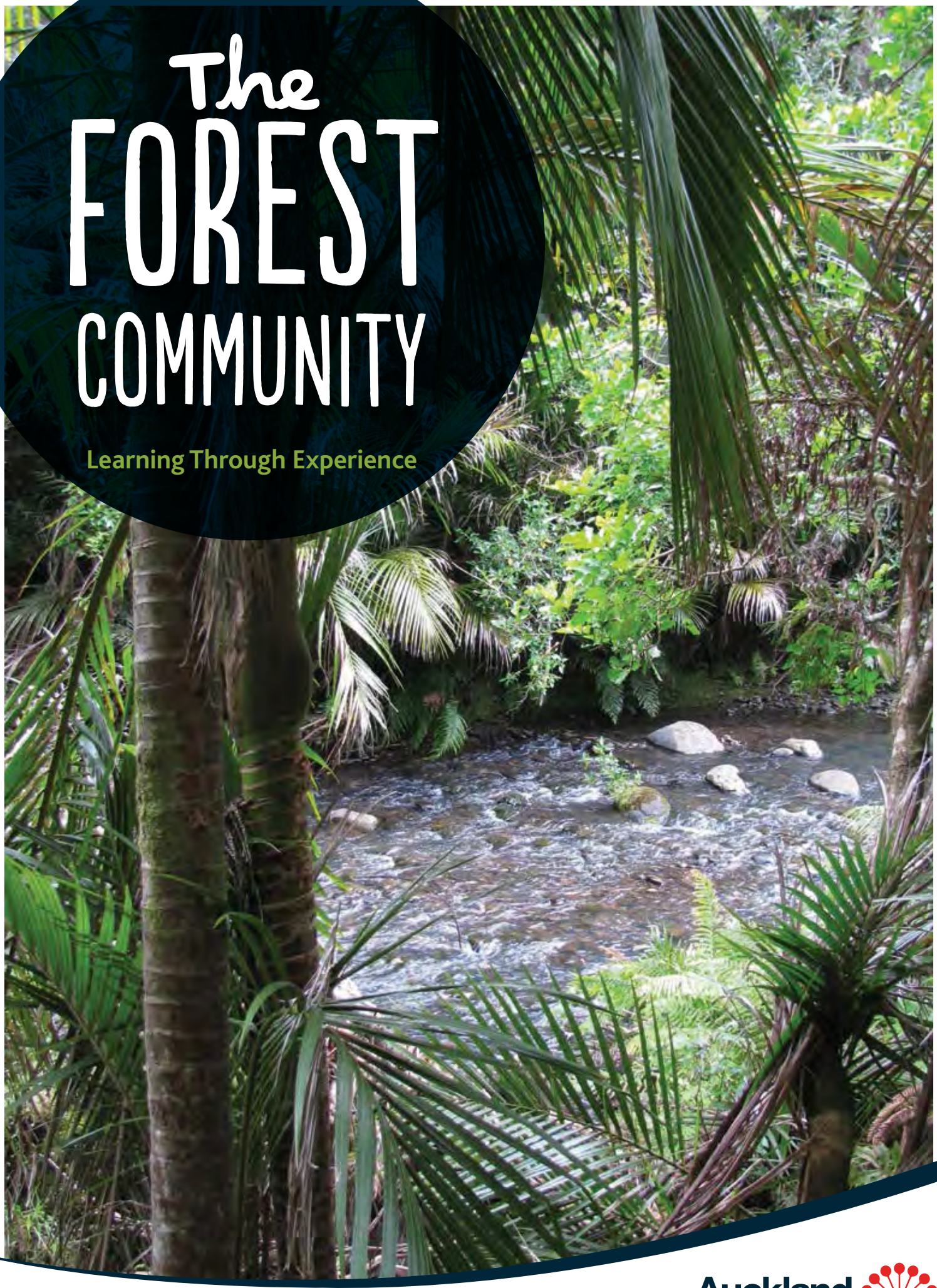
BCS101

The FOREST COMMUNITY

Learning Through Experience



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ABOUT THIS RESOURCE

This resource is designed to support a visit to our regional parks as part of a Learning Through Experience (LTE) programme.

It contains background information about our New Zealand native forest biodiversity as well as curriculum links and ideas for teaching and learning designed to motivate and engage students.

Learning Through Experience programmes are provided by Auckland Council's Education for Sustainability team. The programmes are delivered in the rich and diverse environments of Auckland's regional parks, by experienced teachers and park rangers. LTE provides students with experiential learning opportunities in the environment and teachers with a range of supporting curriculum resources.

Auckland Council provides more than 50 LTE programmes that enable students to learn in, about and for their environment. A range of other Education for Sustainability programmes and services; including professional development opportunities for teachers is also provided.

Visit us online and discover how Auckland Council supports young people in creating a sustainable future for Auckland.

Aucklandcouncil.govt.nz/educationforsustainability

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The FOREST COMMUNITY

Big ideas

- The relationships between living and non-living things that maintain the health and balance of our native forests
- Plants and animals have special features (adaptations) that help them to survive in their habitat.

Big experiences

- Nutrient cycle
- Photosynthesis
- Food chains/webs
- New Zealand's unique forest biodiversity.

Each curriculum based programme will

- Provide hands-on experiences
- Provide authentic contexts to explore future-focused issues such as sustainability
- Develop values and key competencies in social contexts
- Address Nature of Science achievement aims
- Are led by experienced educators – teachers and park rangers
- Inspire children to make a difference for their environment.

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LEARNING THROUGH EXPLORING THE ENVIRONMENT

Our Learning Through Experience programmes provide hands-on experiences and important information to help students form a basis for further work and exploration of their inquiry.

Students should be given time to explore their local environment and to make their own observations of the biodiversity of the area, that is, the interactions between plants, fungi, animals and non-living things. Essential skills of observing, classifying, predicting, inferring and hypothesising can develop as time is spent investigating. Questions can be asked, reframed, and extended as students become familiar with concepts related to their inquiry. Individual research and investigation can be built on initial exploration.

Taking care out there

It is vital that students are aware of the need to explore the environment carefully. For example, when leaf litter is examined it should be gently scooped and carefully replaced after investigation. Every attempt should be made not to damage or destroy the habitats of invertebrates and native seedlings. This message must be reiterated and reinforced throughout their learning.

Hochstetter's frog

Links to the New Zealand Curriculum

Vision	
Our vision is for students to be	
Connected	To our native forests
Lifelong learners	Critical and creative thinkers Informed decision makers Active seekers, users and creators of knowledge
Actively involved	Participants in a range of life contexts

Principles	
Encourage students to look to the future by	
Future focus	Sustainability: In nature nothing is wasted. Learn from nature how everything has a purpose and works together to create a sustainable environment

Values	
Students will be encouraged to value	
Ecological sustainability	The interdependent relationships between living and non-living things in our native forests that keep them healthy and in balance

Key competencies	
Students are given opportunities to become competent at	
Using language, symbols and text	Using new language including: nutrients, photosynthesis, carbon dioxide, native, oxygen, nutrient cycle, invertebrates, canopy, forest floor, recycling, fungi, bacteria, decomposition, interconnected. Using text and symbols to create the nutrient cycle
Thinking	Thinking critically and solving problems related to the environment. Actively seeking new knowledge to inform students, 'What do I need or want to learn next?'
Relating to others	Being an active listener, sharing ideas, cooperating with their peers
Managing self	Following instructions, knowing when and how to act independently

Science – Living World	
Life processes	**Level 1 & 2:** Recognise that all living things have certain requirements **Level 3 & 4:** Recognise that there are life processes common to all living things and that these occur in different ways
Ecology	**Level 1 & 2:** Recognise that living things are suited to their particular habitat. **Level 3 & 4:** Explain how living things are suited to their particular habitat and how they respond to environmental changes, both natural and human-induced
Nature of Science	**Level 1 & 2:** Understanding about science, Investigating in science Communicating in science, Participating and contributing **Level 3 & 4:** Communicating in science, Participating and contributing.

TEACHING and LEARNING SUGGESTIONS

GETTING STARTED

Gathering before views

- Gather lists of plants known to students or provide images of different plants. Can they group them in particular ways e.g.
  - native vs exotic
  - flowering vs non-flowering
  - How are these trees and plants the same or different? What features do they have in common?
- Draw a picture of a (native) tree, label parts and write all the things already known about trees
- Complete 'I think ….' activity (page 37)
- Complete "Nutrient Cycle" (page 25)
- Collect (for further discussion and comparison):
  - vein patterns, leaf tracings (to show veins and outline), bark rubbings, observations about colours and patterns of branches and leaves, different varieties of leaves
- Take a long look at leaf litter! Take the time to smell it. Find evidence and examples of invertebrates living in it (page 29)
- Make a list or draw all the things you found in leaf litter
- Compare these:
  - leaves on three different kinds of trees
  - a young tree and an old one
  - two different insects
  - an insect and a spider
  - a trodden part of the school ground and one that is not used very much
  - the two sides of a leaf
- Discuss and record initial ideas about what happens to plants and animals that have died
- Draw (or make a list of) as many different types of fungi as possible
- Depending on the focus of your inquiry complete a PMI (Positive, Minus, Interesting responses) for the statement "A world without fungi or A world without plants".
- Use rating cards for students to respond to statements such as:
  - all fungi are harmful
  - without fungi the world would be buried under dead animals and plants
  - everyone should be made to have compost heaps
  - without fungi the cycle of life and death would not be complete
  - worms are worthless
  - trees should not be cut down
  - some trees are more valuable than others
  - we cannot live without plants
  - people are making too much fuss about cutting down trees – there are heaps of them

Gathering before views continued

Teacher prepares rating cards with:

Strongly agree

Agree

Strongly disagree

Not sure

Disagree

- Cards are placed in different places around the room
- Make a statement to the children e.g. "We cannot live without plants"
- Students place themselves according to their opinion
- Each group holds a discussion and then appoints one person to report to the class
- Students are then given the opportunity to change their opinion based on what they have heard from others.

IT IS IMPORTANT students have an opportunity to revisit their views towards the end of their inquiry. They should have the opportunity to make changes and add/or subtract from work previously done. A number of the suggested tasks can be used for assessment both at the beginning and conclusion of the inquiry.

CURRICULUM ACTIVITIES

Science

- Investigate what these cycles are and their significance to the environment and to us:
  - water cycle
  - carbon cycle
  - nutrient cycle.
- Explore trees in the environment to find examples of:
  - insects using leaves as their habitat
  - plants using bark as their habitat
  - animals using branches of trees as their habitat
  - plants using branches of trees as their habitat.
- Learn about forest food chains and food webs.
- Explore leaf litter. What can you see? Group leaves according to the level of decay. What is helping them to decay/breakdown?
- Experiment what conditions cause leaves to decay (page 27).
- Complete a study of a dead tree. What roles do fungi, bacteria and invertebrates (FBI) play in helping to break down the dead tree?
- Create food chains that show the recycling of nutrients.
- Investigate camouflage, lifestyles of predators and decomposers, their role in the breakdown of material.
- How does recycling by people compare to recycling by nature?
- Check out **compostcollective.org.nz** to discover how you can mimic nature - recycle your food/garden waste into nutrient rich soil to feed your plants.
- Go on a photo hunt for different types of fungi. (Some grow as parasites on living branches and trunks of trees, others on dead stumps and fallen branches, some grow in soil, on plant debris and buried roots, some have a close relationship [symbiotic] with tree roots and are 'host specific'.) Use your images to identify their name and function in nature.
- Write and draw definitions of the following terms:
  - hyphae
  - mycelium
  - hypha
  - fruiting bodyphytes
  - humus
  - parasite
  - sapromoulds.

Science continued

- Investigate what fungi 'eat' and what and who eat different types of fungi. Find out how fungi are used by people, e.g. yeast in bread making, the production of vegemite and soy sauce. Find out which fungi are poisonous.
- Grow fungi. What sorts of conditions are needed to do this? Find out how fungi reproduce.
- Photosynthesis – what is it?
- Grow some tree seedlings. Plant them out, watch them grow, care for them.
- Discover the different functions of tree parts (page 21).
- Design and carry out experiments to investigate the needs of plants. Vary amounts of water, light, soil when growing seeds.
- How have plants adapted to different environments: desert, aquatic, polar, tropical.

English

- Gather a list of words relevant to your inquiry. Learn their meanings and spelling.
- Write poems, descriptions, personal experiences involving your forest experiences.
- Get involved in proactive writing. Encourage others to learn from nature i.e. 'There is no waste in nature.' Why is this important? How can we mimic nature?
- Creative writing: Write about a day in the life of an invertebrate surviving in their underground world.
- Write a letter of support to conservation groups.
- Read for information - develop skills of skimming, scanning, note-taking.
- Retell myths and legends related to trees, invertebrates, birds of the forest and their special relationships.
- Interview "experts" to gain information.

Maths

- Sort and measure leaves. Find the area using graph paper.
- Measure the girth of a range of trees. Graph results.
- Estimate the height and ages of trees.
- Complete surveys about the variety of trees in school and at home and in the bush.
- Complete a survey about who recycles what at home and at school.
- Sort invertebrates according to color, number of legs and type (herbivores, carnivores, scavengers).
- Measure the growth rate of trees and plants.

Music

- Compose a rap or a song about the essential interdependent relationships within a forest, for example, forest floor invertebrates recycling leaf litter into nutrient rich soil for plants to use. Or a food chain.
- Make up a melody using wooden blocks.
- Use instruments to imitate the sounds of a forest area.
- Make up rhythms and chants using the names of native trees, birds, invertebrates and fungi.
- Complete a study of instruments made from wood.
- Movement and drama
    - The growth of a tree
    - Food chain in action
    - Nutrient cycle – FBI (fungi, bacteria, invertebrates)
    - Photosynthesis

Art

- Sketch a tree from 30 metres, 10 metres, 2 metres. Sketch details, shape, outlines, leaves, roots, lichens, fungi, mosses.
- Collect bark rubbings.
- Make charcoal drawings of trees.
- Make leaf print collage and/or design wrapping paper.
- Make 3D models of invertebrates (use chicken wire, mesh, newspaper or clay).
- Make leaf/fungi prints and imprints.
- Create models, murals, mobiles using recycled materials.
- Paint/crayon/pastel trees, experimenting with shades of green and brown. Capture autumn change.

Technology

- Design a trap to stop possums from getting into our trees.
- Design a costume for camouflage in the forest. You can use only natural materials.
- Collect different samples of wood - hardwoods, softwoods, balsa, ones with interesting grains etc. Design experiments to find out about their properties and why different woods are used for specific purposes.
- Invite a builder to talk to the class about making/using wood for construction.
- Try changing paper to pulp and then to a solid material. Experiment with making paper with fibres straight from a tree. Try different methods in breaking them down.
- Design and construct a strong structure out of paper. Which shape is the strongest?
- Design ways of moving large logs out of a forest. Compare past technologies with those used now.

Social Sciences

- Investigate the use of forest and bush areas today.
- Draw a map of New Zealand and show where the Regional and National Parks and Reserves are located.
- Tourism and trees - write about it!
- Explore conservation issues...stating opinions and justifying their points of view.
- Investigate the size and age of New Zealand's largest kauri tree – Kairaru. Now create a timeline noting significant historical events/technologies during its lifetime.
- Discuss how the New Zealand forest has changed since people arrived here and how it could change in the future. What impact has this had on New Zealand's biodiversity?
- Look at New Zealand's logging history and the uses of wood in the past, present and future. What have been the consequences for New Zealand's biodiversity?
- Consult the local historic society, older people, old photos to find out where the bush was growing in particular areas in the past. Present findings on a timeline.
- Find out what is meant by a sustainable forest.


Water
Carbon Dioxide
Sun

Student ACTIVITIES

WHICH NATIVE TREE AM I?

ONE

- I am one of the most famous trees in New Zealand
- My trunk is enormous
- As I grow I shed my bark
- You won't find flowers on me, but I do have cones
- In earlier times I was often cut down for my wood
- It's too cold for me to live south of Hamilton, I prefer the north.

Answer

TWO

- My name means yellow in Māori
- When I'm in flower you can't help but notice me
- My seeds are held in long, strange-looking pods
- In the wild I'm normally found along streamsides and in coastal places
- Birds love to eat the nectar in my flowers.

Answer

THREE

- I'm well known around the coast
- I put on a great show of brilliant red flowers around Christmas time
- Possums love to eat me. I'm one of their favourite foods
- You may like to picnic beneath me, or climb me at the beach
- My leaves are thick and leathery to touch
- My trunk may be short but I have huge branches.

Answer

FOUR

- My leaves are shaped like feathers
- I'm probably one of the best known ferns
- I can grow as tall as a one storey house
- I'm named after the colour of the underside of my ferns
- You'll see my frond on the uniform of some sports teams.

Answer

FIVE

- My leaves feel prickly to touch
- My leaves might be droopy but it doesn't mean I'm tired
- I can grow taller than you, maybe up to 50m in height
- As I grow older my bark might look like thick flakes
- I only grow seeds every 5 to 6 years.

Answer

SIX

- When I'm young I can bend my trunk like a fishing rod
- When I'm young my leaves look like swords and feel like leather
- My leaves change very dramatically as I grow up
- My fruit is purple/black in colour and is very popular with tui and kereru
- My flowers aren't very obvious, but bees notice me easy enough.

Answer

SEVEN

- My leaves are small and prickly to touch
- You'll easily notice my white flowers in late spring
- My tiny seeds are held in small capsules
- Old time settlers made brooms from my twigs
- I'm useful in helping the forest to grow back again as I shelter plants beneath me
- I burn well but please don't cut me down for firewood.

Answer

EIGHT

- I can usually grow taller than other native trees
- When I'm young I am shaped like a cone
- My leaves change their shape as I grow older
- Kereru think my red and black fruit are yummy
- I prefer to live around swampy places. The base of my trunk is 'buttressed'.

Answer

CREATIVE CHALLENGE

Colour in the shapes as you complete each challenge

Write down three ways to complete this sentence:

Leaf litter is important because...

Write down six really interesting facts about native trees

The answer is fungi!

What could the question be? Work with two other people to see how many questions you can record!

Record five weird and wacky adaptations that help invertebrates survive in their environment.

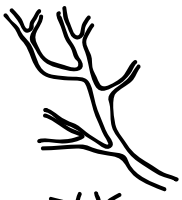
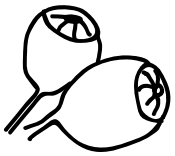
Collect leaf and bark rubbings of five different school trees – see if a friend can identify which trees they came from.

Draw a native tree showing the relationships it has with living and non-living things in a forest.

WHAT'S MY ROLE?

Match the tree part with the correct picture and its function (what it does).

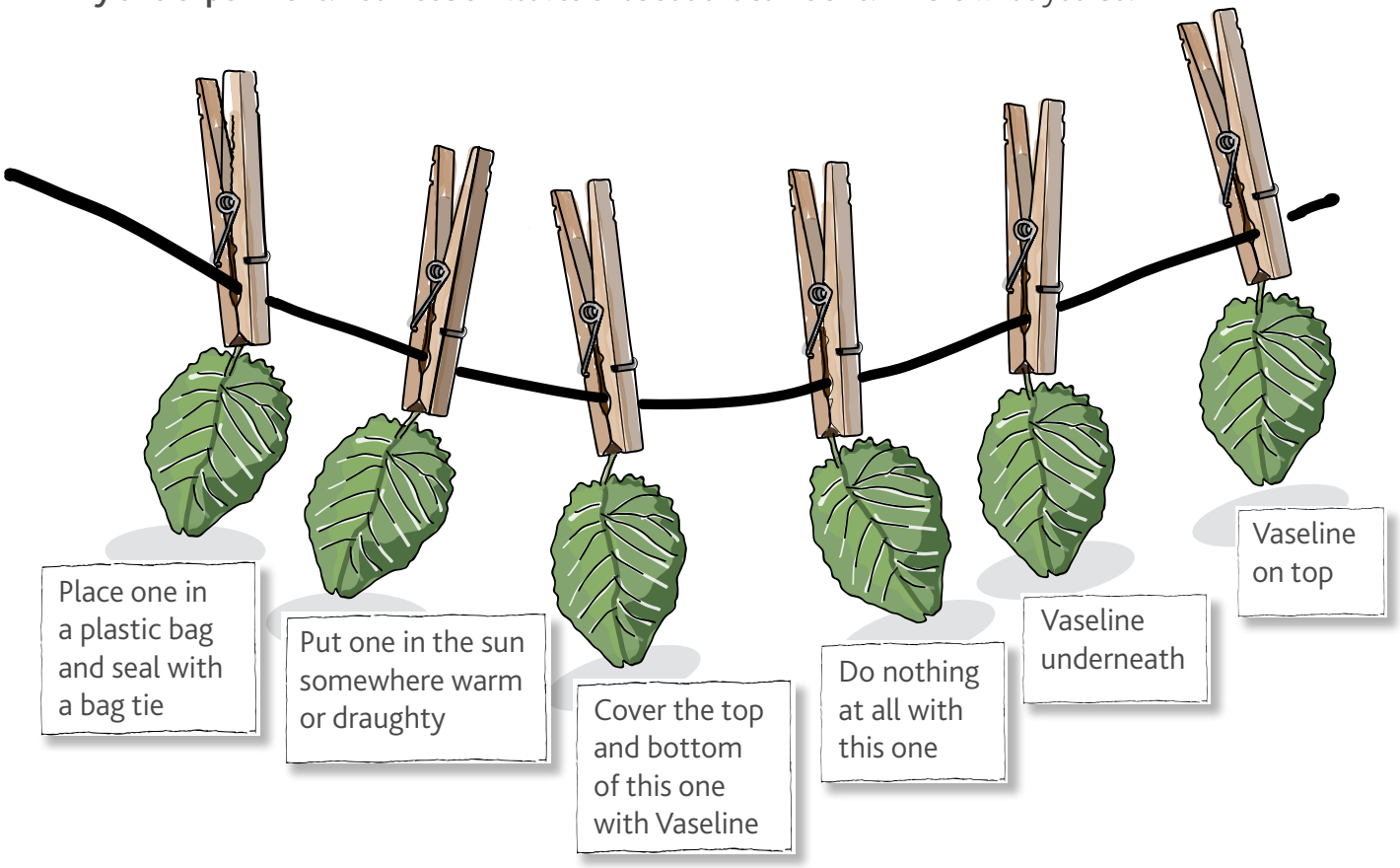
One is done as an example for you.

Leaves		Attracts insects and birds to help with pollination
Flowers		Provides food and shelter for tiny animals and as it decays away, it adds nutrients to the soil
Fruit		Makes the food for the tree through photosynthesis
Bark		Provides strength and structure for the tree
Fallen branches		The outer protective layer of wood
Branches		Slowly rots away but provides homes for lots of animals
Trunk		Helps spread the leaves out so they can reach the light
Leaf litter		This protects the seeds while they develop and grow

THIRSTY TREES

A tree drinks thousands of litres of water a day. Where does it all go?

Try this experiment. You need six leaves of about the same size. This is what you do:



Leave them for several days but look at them every day to see if there are any changes.

Now answer these questions…

1. Which leaves shrivelled and dried first?
2. The stomata are tiny holes through which the leaves lose water. Which side of the leaf are they on?
3. Explain what happened to the leaf covered in Vaseline on both sides.
4. Explain what else was in the plastic bag as well as the leaf. Why?

BREATHE IN, BREATHE OUT

DID YOU KNOW? HUMANS CAN ONLY BREATHE AIR THAT IS MADE UP OF:

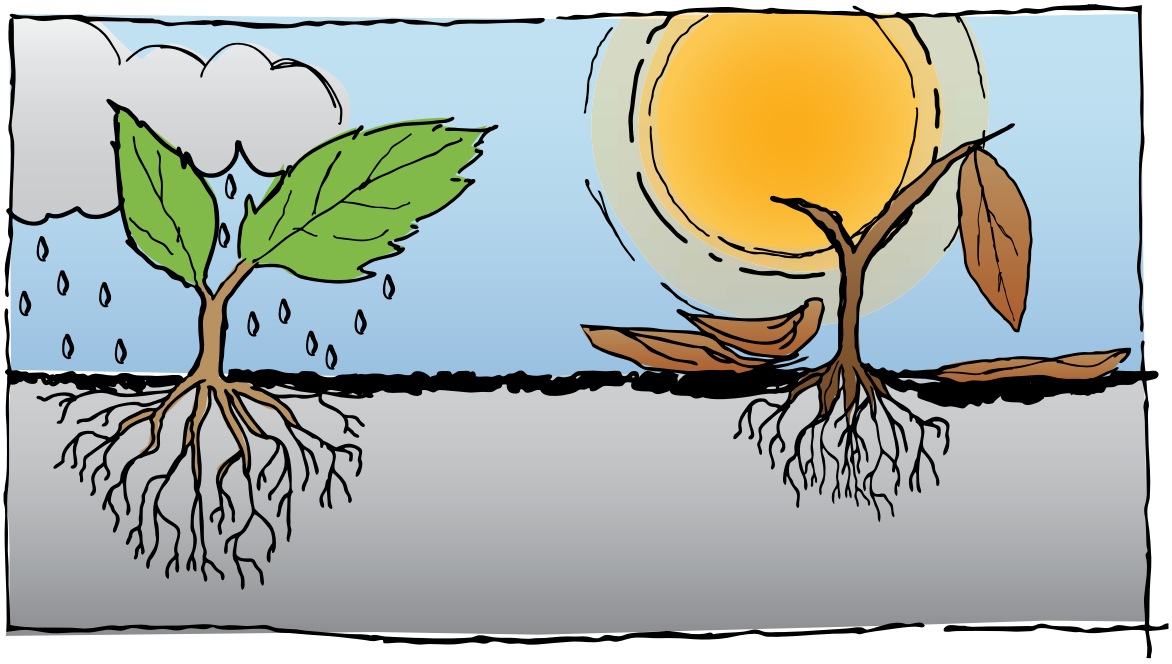
21% oxygen, **78%** nitrogen, **1%** other gases and solids.

Plants make the oxygen we breathe. The way plants make oxygen is called photosynthesis.

Plants absorb **energy** from the **sun, water** and **nutrients** from the ground, and **carbon dioxide** from the air, to produce their 'food'. As they do this, they give off oxygen into the atmosphere. The green colouring is called chlorophyll.

INSTRUCTIONS

Label the diagram below using the words highlighted in the paragraph above.



Humans and animals do the exact opposite of photosynthesis. They breathe in oxygen and breathe out carbon dioxide. This means that we give plants more carbon dioxide, and they give us more oxygen. Without plants we wouldn't be able to survive, but there is enough carbon dioxide in the atmosphere that plants would still exist without us!

THE TREE AS A HABITAT

Cut out the picture of the animals and paste them with the correct sentence.

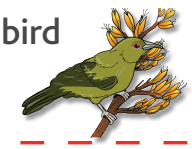
Nests in branches

Eats young leaves

Collects nectar from flowers

Hides under bark

bird



caterpillar

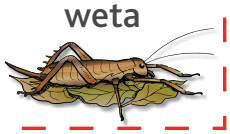
Eats leaves in the soil

Lives in dark places

bee

spider

weta



worm

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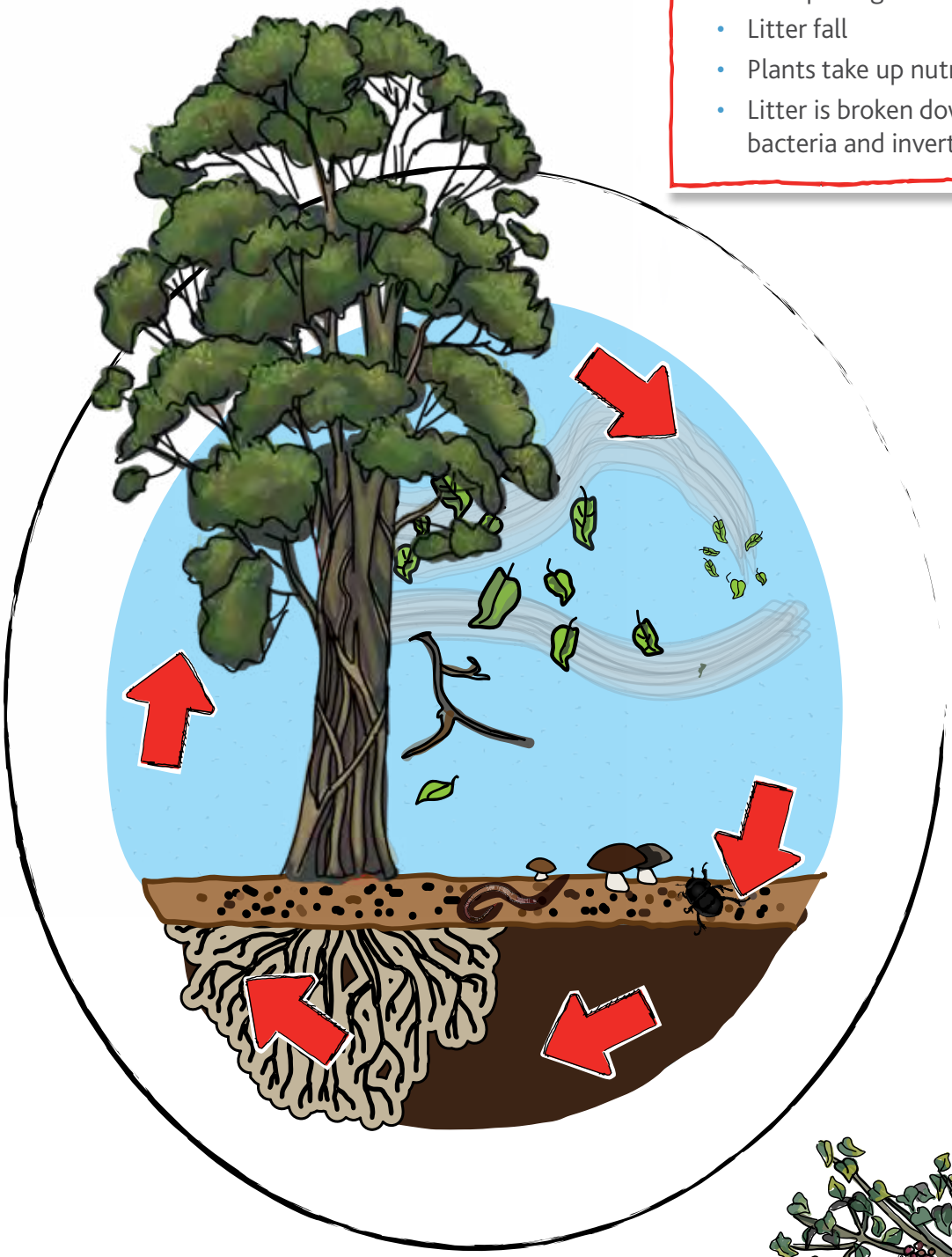
NUTRIENT CYCLE

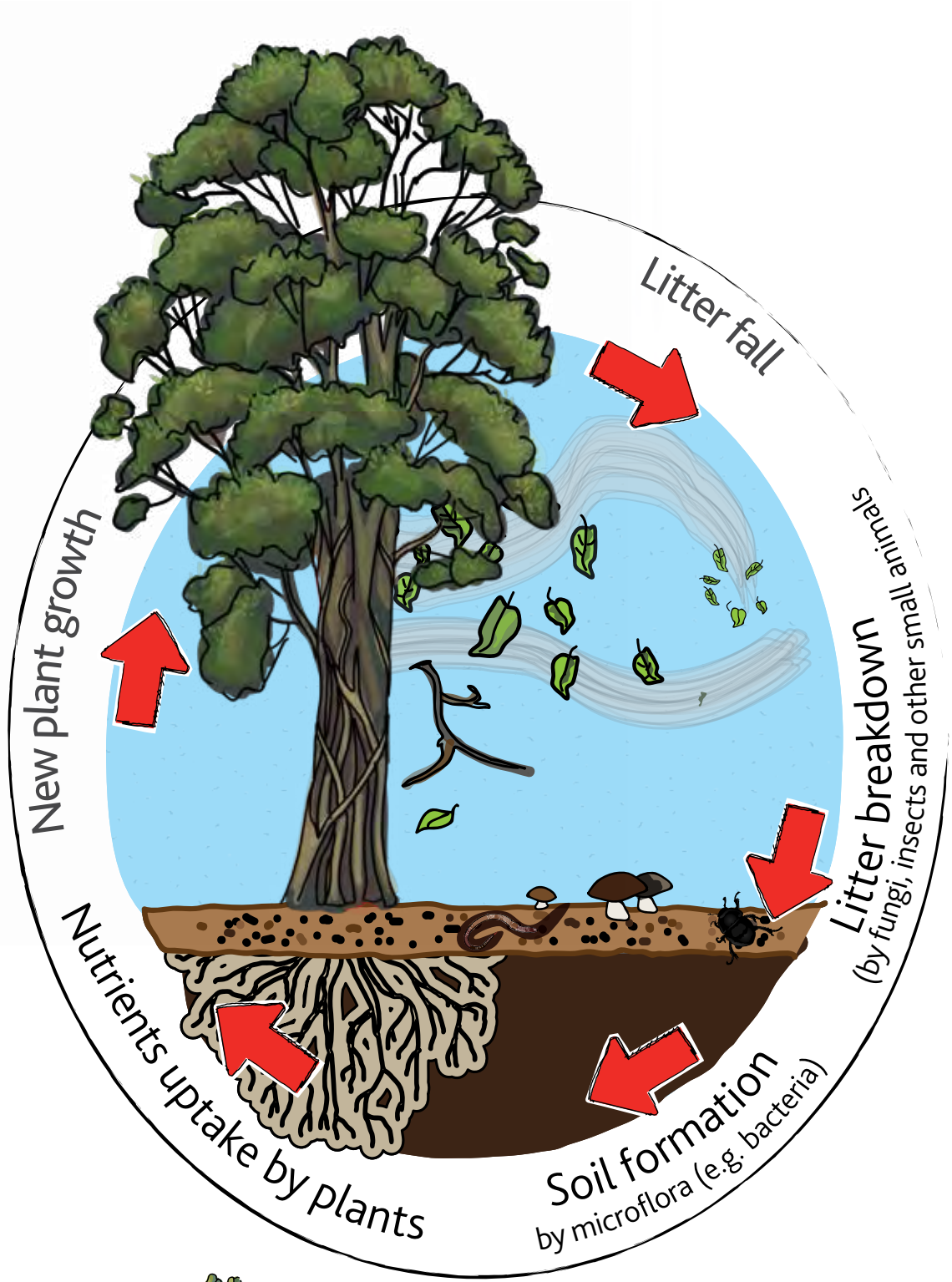
All about recycling nutrients

Look at the diagram below and select a statement from the box to record what is happening at each arrow.

- Soil is formed
- New plant growth
- Litter fall
- Plants take up nutrients (food)
- Litter is broken down (by fungi, bacteria and invertebrates).



NUTRIENT CYCLE - THE ANSWERS



EXPERIMENT TO FIND OUT WHAT CONDITIONS CAUSE DECAY

You need:

- Deciduous leaves (about 20)
- Four plastic bags
- Four ties to seal the bags

This is what you do:

1. Dry half the leaves on a sunny window ledge, then divide them into two, place in separate plastic bags and seal.
2. Take the remaining half of the leaves, make sure they are damp. Split them into two bags and seal.
3. You should now have four bags containing leaves - two dry and two damp. Take one of each type and place them in the fridge. Place the other two bags in a warm place.

   This will give you:

   - One bag of dry and warm leaves
   - One bag of dry and cold leaves (in fridge)
   - One bag of damp and warm leaves
   - One bag of damp and cold leaves (in fridge)

Leave all of them for a week then check to see which have started to decay. You can look again after two and three weeks.

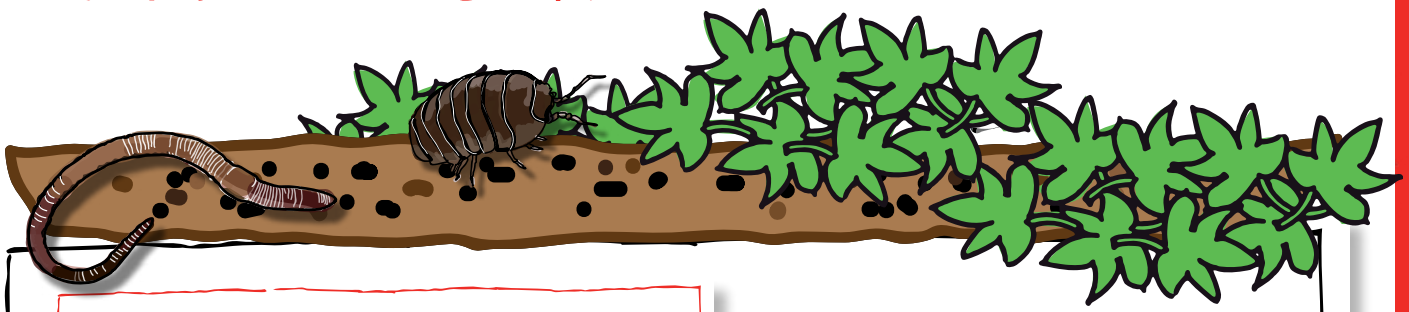
When you have discovered which conditions help decay, try the following experiment.

You will need:

- One bag of deciduous leaves
- One bag of coniferous leaves
- One bag of evergreen leaves

Place all of them in the best conditions for decay and look after one week to see which type of leaf decays fastest.

EXPERIMENT TO FIND OUT WHAT HELPS DECAY



You will need:

- Two margarine containers with lids
- Leaves (divided into two groups)
- Soil
- Invertebrates (include worms and slaters)

- First, have a really good look at the leaves and record what they look like
- Next, make small holes in both of the lids
- In one container place half the soil, invertebrates and damp leaves. Replace the lid
- In the other container place the rest of the soil and leaves and replace the lid
- Keep both containers somewhere that is warm (but not hot) for a week.

Then look inside

- Make sure the soil and leaves have not dried out
- Look carefully again at the leaves and record any changes. Repeat after the second week
- You could also try this experiment with coniferous, evergreen and deciduous leaves, to see if the invertebrates have a preference.

EXPLORING THE LEAF LITTER

Look closely at some leaf litter.

What is leaf litter made of?

Non-living conditions underneath the leaf litter

Circle the best description of texture, moisture, temperature and light conditions underneath the leaf litter.

Texture:	**Soft and decaying**		**Hard and coarse**	
Moisture:	Dry	Damp	Moist	Wet
Temperature:	Cold	Cool	Warm	Hot
Light:	Dark	Shaded	Part-shaded	Exposed

Animals of the leaf litter

Search through the leaf litter with the end of a pencil. If you find any small animal place it carefully in a small container.

Using a magnifying glass, observe and draw the animal then label its body parts. For example legs, wings, antennae and head.

This is a...

It eats...

It may be eaten by...

When you have finished making observations, return the animal to the leaf litter and return the leaf litter to its original place.

What will happen to the leaf litter over time?

LAYERS UPON LAYERS

This diagram shows the different layers you might find in a bush (forest) area. Follow the steps.

1. Visit a bush area and complete a pencil sketch of some of the different layers you see.
2. Try to identify different trees. Write their names on your sketch.
3. Now explore the forest floor and litter. Find out what is living there.
4. What do plants in the canopy layer protect plants from in the lower layers? How do they do this?

Emergent

Canopy

Sub-canopy

Scrub layer

Forest floor/leaf litter

BUSH STRUCTURE

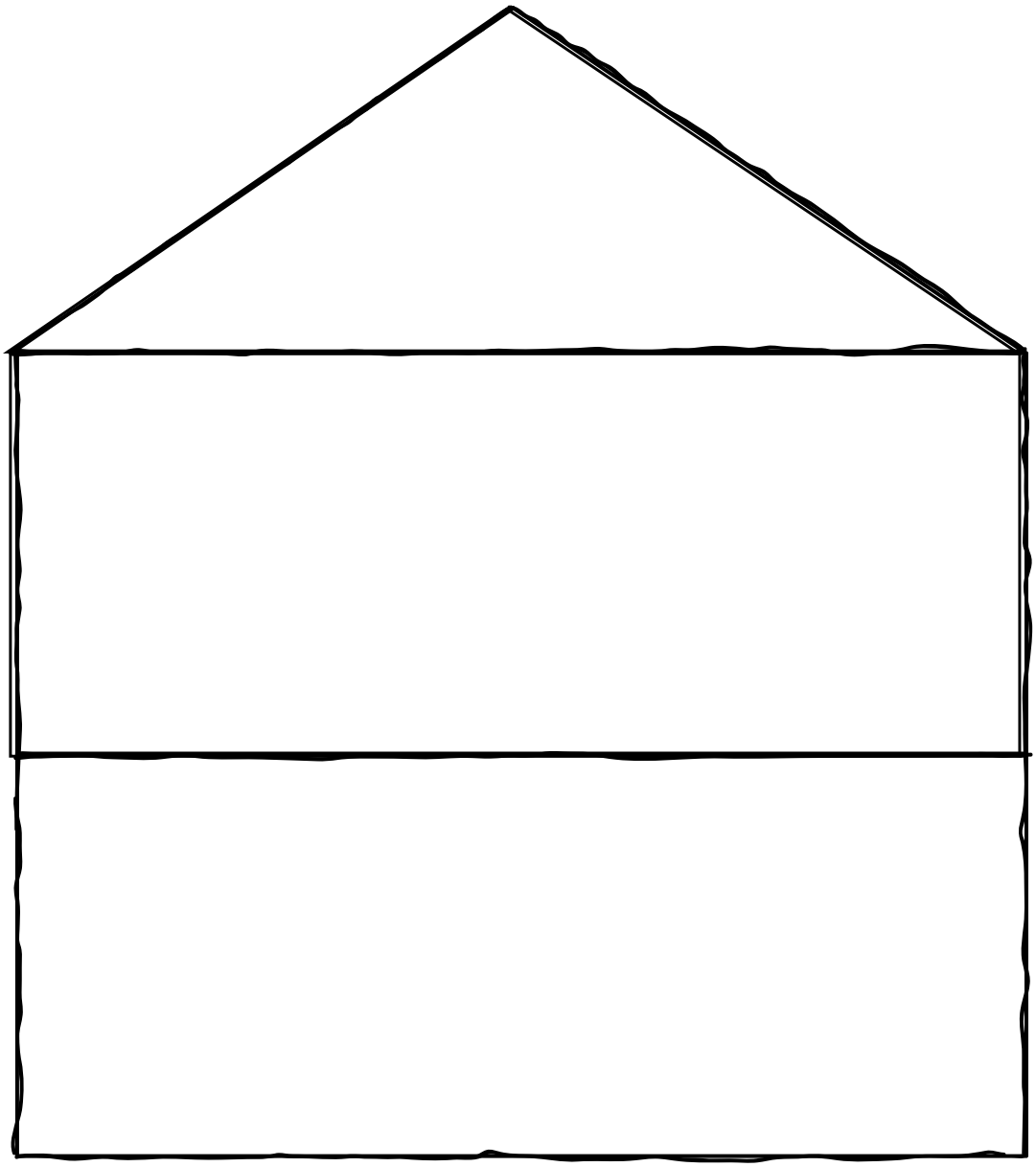
How the bush grows

Just as a house has a roof, ceiling, walls, stairs, carpet, pictures, furnishings and floor coverings, the bush has parts similar to these.

What plants and trees could you draw in to match these various parts?

Think of:

- tall trees
- perching plants
- vines
- medium trees
- shrubs
- ferns
- mosses
- lichen



PLANT ADAPTATIONS

Match the adaptation to the correct reason for the adaptation. (Remember an adaptation is a special feature that helps a plant to survive in their environment). One is done below as an example for you.

When you have completed this page about adaptations, use the teacher information sheets on page 38 to make up your own quiz to share with a friend.

Kahikatea – often found in swamp areas

Tall

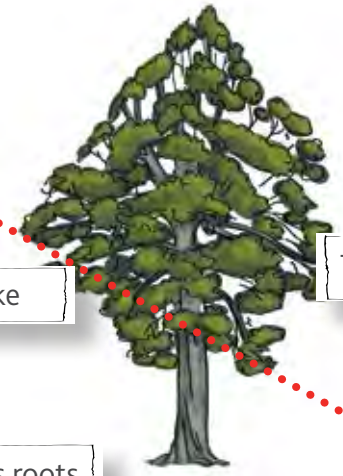
Buttressed roots

Shallow roots

Makes lots of berries that birds like

Ripe berries are bright red

Can put up with water around its roots



Often stands in water

Easy for birds to see

Makes sure seeds are spread

Top layers of soil aren't as waterlogged

Can get more light

Gives it stability in swampy ground

Kauri

Juvenile (young) and adult tree shape are very different

Side branches of a growing tree are self-pruning

Large size trunk

Shedding bark on trunks

Produces lots of gum

Seeds are winged

Makes lots of seeds

Provides strength and stability for a large spreading crown

Keeps trunk clear of vines and epiphytes and makes a rich humus layer

Increases the chance of finding a suitable place to land

Makes the most of available sunlight and space

Prevents unnecessary damage to tree

Helps stop timber-boring insects and seals wounds

Helps the seed to spread

GET GOING, GET BUSY, GET ACTIVE

By now you should have read, talked and thought quite a lot about special features of plants and animals and interdependent relationships between plants, animals and non-living things in a forest.

You will have spent time exploring the environment around your school, at home and in parks and reserves. You will have spent time observing and making new discoveries.

Hopefully, all your talking, thinking, reading, writing, drawing and finding out about this part of the environment has made you realise how important it is for us to look after what is around us - from the biggest tree to the tiniest invertebrate that spends its life munching through leaf litter and rotting logs. Don't just sit back and think it's up to other people to care for the environment - it's not! It's up to every individual.

It's time for action

Here are a few ideas about what you can do to help your environment.
Read them and decide which you would like to do first.
You might need to ask your teacher, family or friends to help.

- Make your own paper from recycled paper. Google 'Making paper for kids to discover how to do this. Now get creative - make birthday and gift cards from your homemade paper.
- When you're out shopping think about the problems that too much packaging can cause. Look at how things are packaged to make you want to buy them. Are you buying the package or the contents? Make a point of not buying things that have too much packaging. Better still, write to the manufacturers and tell them not to waste our natural resources on unnecessary packaging!
- Bring your lunch to school in a lunch box. If you need to wrap things use paper rather than plastic wrap, and then compost the paper.
- When you go to the supermarket don't use lots of plastic bags, use reusable bags. Create your own bag from an old singlet. Sew the bottom hems together for the base and use the straps as handles.
- Complete a waste audit on all your household rubbish. What are you sending to landfill that doesn't have to go there? Check out **aucklandcouncil.govt.nz** for ideas on diverting waste from landfill.
- Use your council recycling bins to divert waste from landfill. Be kind to insects. Watch them but don't squash them! Stop and think about how much they are helping the environment.

It's time for action continued

- Encourage birds, ladybirds, bees and other invertebrates to your garden. These animals are great at keeping pest insects to a minimum and play an important role in pollinating plants.
- Check out how with Auckland Council's 'Landscapes for life' brochure. Search **aucklandcouncil.govt.nz** for action.
- Use mulches instead of weed killers to suppress and kill weeds.
- Welcome earthworms to your patch of land! Tell everyone about what an amazing job they do!
- Experiment with 'companion' planting e.g. plant leeks, onions or garlic next to carrots.
- Create habitats to encourage insects e.g. swan plants for monarch butterflies, flowers for bees.
- Plant native trees in school grounds, at home, get involved in planting days in our regional parks.
- Start a compost, worm farm or bokashi bin to divert organic waste from landfill.
- Become a WasteWise School – check out **aucklandcouncil.govt.nz**, search WasteWise Schools.

Teacher RESOURCES

I THINK

Leaf litter is important because

Plants make food by

Plants are helpful to use because

Camouflage is

Recycling in the bush means

Earthworms are useful in the environment because

Fungi are different from plants because

Soil is

Nature's 'recyclers' are

Fungi get their food from

GENERAL INFORMATION SHEETS

Trees

- Clearance around the world could be changing the carbon dioxide and oxygen balance in the air. Forest clearance also causes the land to dry out and can create new desert areas
- Play a role in the water cycle. They bring water up from the ground and release it through the leaves into the air
- Bind the soil, protecting it from wind and water erosion
- Deep-rooting systems help to break down rock and raise water and valuable nutrients to the surface
- Produce more food per hectare than any other crop
- Provide shelter for livestock and crops
- Provide a barrier to street noises, lights and fumes produced by road traffic
- Canopies reduce the force of rain and tree trunks, stems and surface roots, check the downhill flow of water
- Protect nearby areas from extreme winds and temperature
- Provide shade and shelter for people. Shelter trees protect us from cold or hot winds and from rain, hail and frost
- Nurture and protect birds, animals, insects and other plants
- Support a wide range of living things
- Provide most of the material for the world's housing
- Provide natural products such as rubber, cork, gums, resins, tannins, glues, soaps, waxes, fibres, and cooking and lubricating oils
- Beautify our environment
- Are natural solar energy collectors. Energy can be obtained from trees through combustion (e.g. firewood and charcoal). Lack of firewood is causing an energy crisis in the world
- Are an important part of food chains, habitats and communities.

A word about falling leaves

DID YOU KNOW...? Fallen leaves of trees improve the quality of soil as they decompose. Small animals that live in the soil and leaf litter help to break down and recycle fallen plant matter. As they burrow through the soil, these creatures help to mix the plant matter with other soil particles. The burrows allow water and air easy access to parts of the soil where roots are growing.

NEW ZEALAND FOREST PLANT ADAPTIONS

(SPECIAL FEATURES THAT HELP A PLANT TO SURVIVE IN THEIR ENVIRONMENT)

Bracken fern

- Adaption to living in open sunny locations
- Rapid growth of fronds – overcomes competition with other plants
- Spreads by production of spores and rhizomes
- Fern frond is harsh and firm to provide strength in exposed situation
- Fern frond is thick-skinned to avoid drying out in hot environments.

Tea tree (Mānuka)

- Adaptations to open, sunny locations
- Fast growing – overcomes competition
- Produces vast numbers of seeds/tree – ensures some seeds survive in tough habitats
- Seeds are lightweight and therefore spread easily by wind
- Seed capsules are hardy and woody – can survive forest fires
- Capsules may rupture following fire – ensuring head start above other plants
- Tolerant of many soil and climatical conditions – providing there is enough light
- Peeling bark – prevents growth of epiphytes on trunk
- Flowers prolifically – attracts numerous creatures thereby enhancing pollination
- Flowering begins at a very early stage.

Kahikatea

- Tolerates roots being submerged in water for long periods – an advantage in swampy habitats
- Buttressed roots – provides stability in swampy ground for tall tree
- Shallow roots – roots are therefore found in the more aerobic horizon of the swamp
- Tall – better advantage in competition for light
- Produces copious amounts of bright red berries attractive to birds – ensures seeds are spread
- Seeds resist digestion ensuring it is excreted intact.

Northern rata

- Produces vast amounts of light wind-blown seeds – increases chance of landing in a favourable place
- Establishes itself high up in the sun drenched canopy, upon other trees to obtain sufficient light
- Able to send down aerial roots to enclose host trunk to become a tree – assists plant in outliving its host tree
- Prolific conspicuous bright red flowers – attractive to many birds/geckos/insects for pollination
- Leaves are thick and leathery to withstand harsher climate conditions in canopy
- Ability to germinate on ground if conditions are right.

Perching lily – Kahakaha

- Seeds germinate on canopy tree branches to gain sufficient light
- Leaves are shaped like funnels to receive rain water
- Able to recycle products of their own decay
- Steady accumulation of dead matter encourages other plants and insects. Their subsequent death is utilised by the epiphyte
- Red coloured fruit – conspicuous to birds
- Although an epiphyte, it has the ability to continue growing on ground if dislodged from tree.

Miro

- Large crimson/purple coloured fruit – easily visible to birds such as kereru
- Berry smells strongly of turpentine – birds find it attractive
- Juvenile leaves differ from adult leaves – an adaption to different climate conditions between forest floor and canopy.

Kauri

- Juvenile and adult tree shape are very different – maximises use of available sunlight and space
- Side branches of growing tree are self-pruning – prevents unnecessary damage to tree
- Large size trunk provides strength and stability to large spreading crown
- Juvenile leaves differ from adults – maximises different climatic conditions
- Shedding bark on trunk – keeps trunk clear of epiphytes or vines – creates rich humus layer around shallow tree roots
- Exudes copious amounts of gum – assists in rapidly healing wounds, or repelling invasion of timber-boring insects
- Seeds are winged – assists wind in dispersing seeds
- Large numbers of seeds are produced – increases chance of finding a suitable place to land
- Ripe female cones are fragile, thereby shattering easily and ensuring seeds are dispersed
- Large amounts of pollen produced – assists pollination of female cone.

Clematis vine

- Produces a bold display of creamy white flowers in springtime – visible to animals to pollinate
- Produces sensitive leaf stalks that coil around branches to secure a hold, thereby helping it to climb up its host to the sunlight
- Tends to flower in mass over a short period – boosts the probability of successful pollination amongst its own kind.

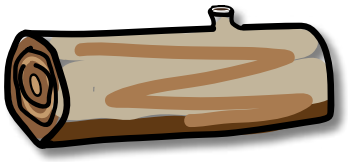
HOW TO CREATE A DECAY AREA AT SCHOOL

Creating your own decay area in the school grounds is easy and will provide you with a wealth of interesting activities to do throughout the year. If you have done some work on decay beforehand the students will be able to suggest ideas for what to have and where to put the decay areas.

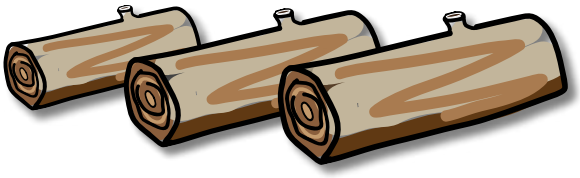
Choose a shady area and depending on the space available have one or more of the following:

NB: The more areas you have the better. Try to set up at least A, E and F.

A. Rotting log



B. A group of logs



C. A pile of logs to leave undisturbed

D. Compare the decay rates of different woods

E. A sheet of corrugated iron or steel which is placed on top of newspapers, glass, plastics, leaves, apple and banana skins and aluminium cans

F. A pile of leaves covered by netting

G. A compost heap: weeds, lawn clippings, garden waste, kitchen scraps, sticks and twiggy material.

HOW TO CREATE A DECAY AREA AT SCHOOL CONTINUED...

A and B.

The logs in A and B should be easily moveable and will provide an instant supply of mini-beasts from underneath or within them as decay progresses. Look on the surface of the log for fungi. Peel back a piece of bark to see the white fungal threads (or hyphae) which form 90% of the fungus. Remember to roll the logs back into their original location when you have finished looking at them. (How would you like the roof of your house to be removed by a giant!)

C.

These logs enable you to have a control. (Something left undisturbed to compare your other "areas" with.) Build the logs into something special, a miniature world, home to thousands of amazing creatures with fascinating lives! Record the date they were put there and look at them carefully every month with a magnifying glass to see if there are any changes. Make sure you record the results. It's a good idea to have something that the students leave undisturbed so that they can recognise the importance of this.

D.

You are likely to see a marked difference between the rates of decay between a hard and soft wood.

E.

Use this to compare the decay of natural and manufactured "rubbish", and to introduce recycling issues. Keep a regular, long-term record of what happens to each type of material. Which decays the fastest, which hardly changes, how long till the first thing disappears etc? What are the first signs of decay? Which benefits the soil? Compare the materials with rotting logs, leaves and compost. Make a study of how many rubbish bags are produced in a week by each student's family. Where does this rubbish go? Visit a refuse facility. Brainstorm ways of reducing rubbish at home and at school. Implement changes!

F.

The pile of leaves gives an easily accessible supply of leaves for experiments. Try to have deciduous, evergreen and coniferous leaves in the pile and compare what happens to them. Measure the height and temperature of the pile when it's first made. Take the measurements again two weeks later and then after a month. Beneath the pile should be another good supply of mini-beasts.

G.

The compost heap is a brilliant way of showing how natural materials rot down and change form. There are very good compact compost bins and worm bins on the market. Record the height, temperature and the appearance of the contents. There should be a difference between the temperature at the top, middle and bottom of the bin.

ESTABLISHING YOUR OWN FOREST

Planting seedlings with your class is an excellent activity. However, if you want to have a serious environmental impact on on the school grounds then consider making a long term commitment to the creation of a bush area. This will need the backing of the Board of Trustees and the whole staff, but you will get an area which can be used for cross-curricula studies throughout the year.

What to do

Decide on and define an area of ground. In the first year, grow a selection of trees chosen from these species: kānuka, mānuka, coprosma, koromiko, whau, akeake. All of these trees are easy to germinate and are fast growing. In three years a mānuka can reach two metres in height, so your bush area can become a visible reality within a short time and be rewarding for the students who sowed the seeds. The seeds from these trees are prolific and easy to collect.

In the second and following years, start to grow the larger forest species. Consider having students collect the seeds. This can be part of a topic on seed dispersal. Good trees to grow are: kohekohe, taraire, kauri and rewarewa because they are big seeds and easy to germinate. Grow them in pots until they are at least one or two years of age and then plant out amongst the existing bushes, which will now provide shade and shelter for them to become established. Do not plant the trees and forget about your planted area as you now have a very valuable resource. Enjoy the area and think about the long term benefits to the environment!

General points for tree planting success

1. Use potting compost.
2. (a) Fine seed – sow in large containers such as old polystyrene mushroom boxes. When the seed has germinated, has reached the two leaf stage and is about 3cm high, prick out into large containers. Consider buying some root trainers which, with care, can be used over and over again. The tree can go from the seed tray into the root trainers and then be planted out.

   (b) Large seed – grow in individual containers.
3. Sow the seed at a depth equivalent to its size. Leave the really fine seed on top.
4. Avoid drowning or drying out your seeds. Cover your tray with a sheet of glass and a piece of paper until germination occurs. Uncover for about 30 minutes each day to stop them going mouldy. Warmth will promote faster growth.
5. Harden off young plants by putting them outside in a sheltered position, at least a couple of weeks before you intend to plant them.
6. Check on the right growing process for the seed type. Listed below are some of the easiest and most reliable seeds to grow and when to sow them.

Auckland Council
Te Kaunihera o Tāmaki Makaurau

Plant	Seed ripen	Growing method*	Growth rate	Mature height
Flax	February-May	4	Fast	2.5m
Akeake	March-April	1	Fast	6m
Kānuka	June-August	1	Fast	12m
Mānuka	June-August	1	Fast	4m
Koromiko	May-June	1	Fast	5m
Ngaio	March-June	5	Fast	10m
Kōwhai	July-October	2	Fast	10m
Karamū	February-April	4	Medium	4m
Pōhutukawa	March-June	1	Slow	22m
Tawa	August-Nov	3	Medium	24m
Cabbage tree	March-May	4	Medium	10m
Kahikatea	May	5	Medium	60m

***Seed growing methods (the number relates to the chart above)**

1. Small seed – if contained in a seed pod, pick before it opens and store the pod in a paper bag. Collect dandelion "look-a-likes" when the seed looks fluffy.
2. Hard seeds – dry and sow at any time of year but soak in boiling water overnight before sowing. Sow immediately.
3. Seeds with a fleshly covering – soak in cold water overnight and then rub in a sieve to remove outer covering. Sow immediately.
4. Soak and clean the seed as in 3, then mix with damp potting mix. Seal in a plastic bag with as much air squeezed out as possible and place in the fridge for about 6 weeks. Then remove, separate the seed and sow.
5. Sow immediately or keep dry and sow later.

INVERTEBRATES: ONE WAY TO GROUP THEM

Plant eaters


slug


millipede


hopper


bush cockroach


beetle larva


looper caterpillar


ground weta

Animal eaters


spider


kauri snail


tiger beetle


centipede


ground beetle

Scavengers


earthworm


hoverfly


earwig


slater


ant

Auckland Council
Te Kaunihera o Tāmaki Makaurau

A FOREST COMMUNITY

Producers | **Consumers**

plants

caterpillar

stick insect

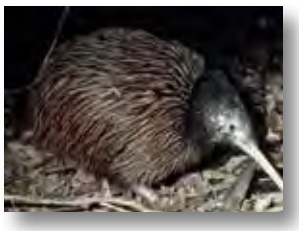
herbivores

Hochstetter's frog

fantail

carnivores

green gecko



kiwi

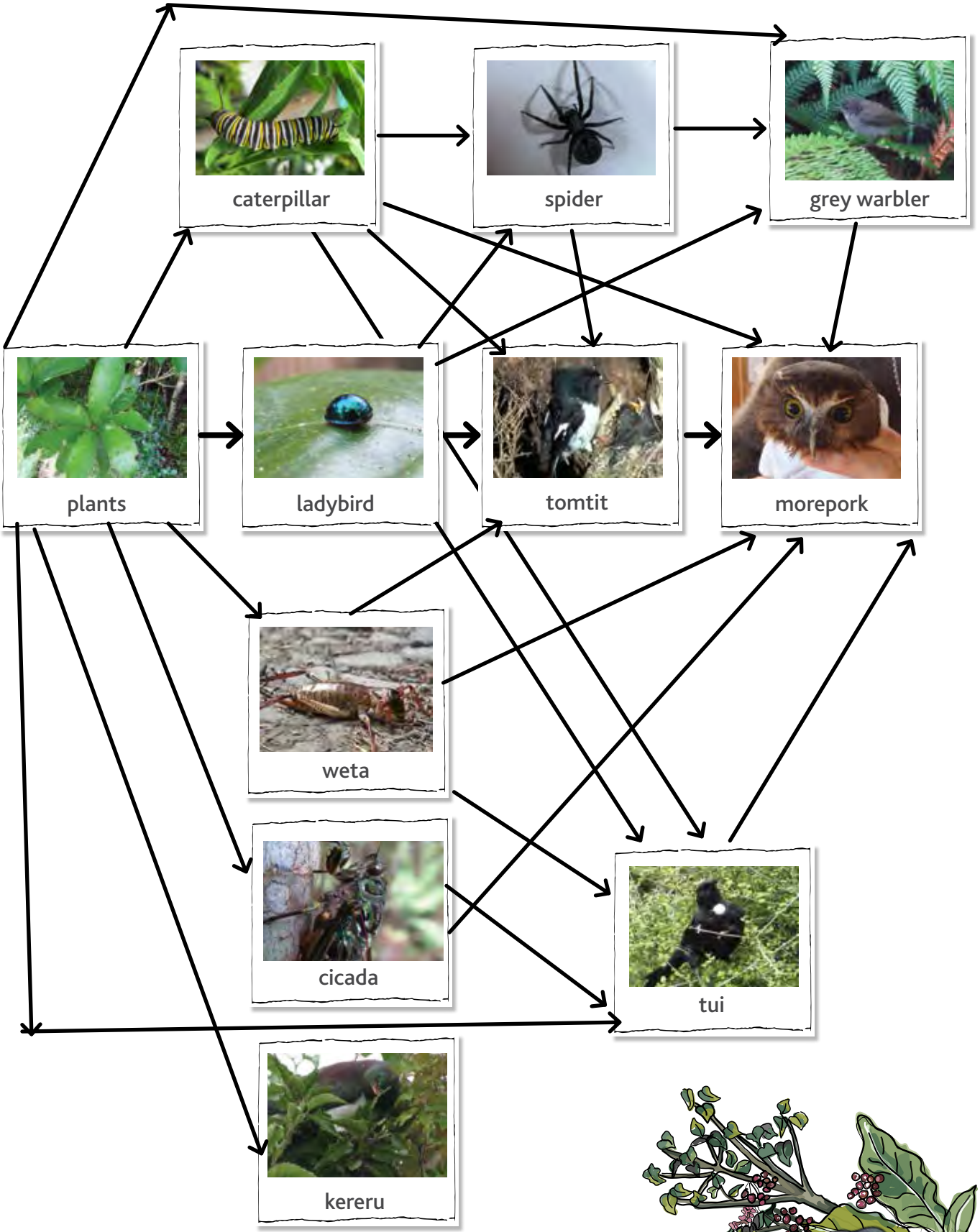
omnivores

earthworm

decomposers

slater

FOOD WEB EXAMPLE



FASCINATING FACTS AND INTERESTING IDEAS

Name

TAKE A LOOK AT OTHER PEOPLE'S WORK

Work looked at	What I liked about this work	Ways I think this work could be improved

MY WORK PLAN

Name: _____

Date work started: _____ Date work finished: _____

Main theme/inquiry: _____

My research/investigation/experiment will be about: _____

_____

_____

My main question is: _____

_____

_____

Other questions I need to ask are: _____

_____

_____

_____

_____

Some key (important) words I need to think about are: _____

_____

_____

_____

Things I plan to do to find the answer: _____

_____

_____

_____

I can get information and help from: (possible sources: people, written material, photographs, computer/electronic media etc.) _____

_____

_____

My work will be presented to: _____

_____

_____

I am going to present/share my work in the following ways: _____

_____

_____

Personal goals I have for this study are:

1. _____

2. _____

3. _____

Other ideas/plans/brainstorm

Work plan seen by:

Student:_____ Teacher:_____

Comments/suggestions given: _____

_____

_____

_____

_____

_____

MY LEARNING SUMMARY

My name is: _____

Date: _____

In this study I enjoyed learning about: _____

The most interesting fact I learned was:	I would like to find out more about:

Three new words and their meanings I have learned are:		
Word:	Word:	Word:
Meaning:	Meaning:	Meaning:

Some of the resources I used:

This illustration is important to my inquiry. It shows:

Teacher's comment:

HOW DID OUR GROUP DO?

Name: _____

Who was in the group? _____

_____

_____

Did you work well together? (Circle ONE word)

Yes Usually Sometimes No

Why? (explain your answer) _____

_____

_____

_____

How much of the task did you complete?

All Almost all Part None

Which part did you enjoy the most? _____

_____

_____

_____

Which part did you enjoy the least? _____

_____

_____

What did you learn from this activity? _____

_____

_____

_____

Find out more: phone 09 301 0101
or visit aucklandcouncil.govt.nz/educationforsustainability

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Te Kaunihera o Tāmaki Makaurau