KEEP KAURI STANDING!

KAURI DIEBACK SCHOOL RESOURCE

KEEP KAURI STANDING
STOP KAURI DIEBACK DISEASE SPREADING
KIA TOITU HE KAURI

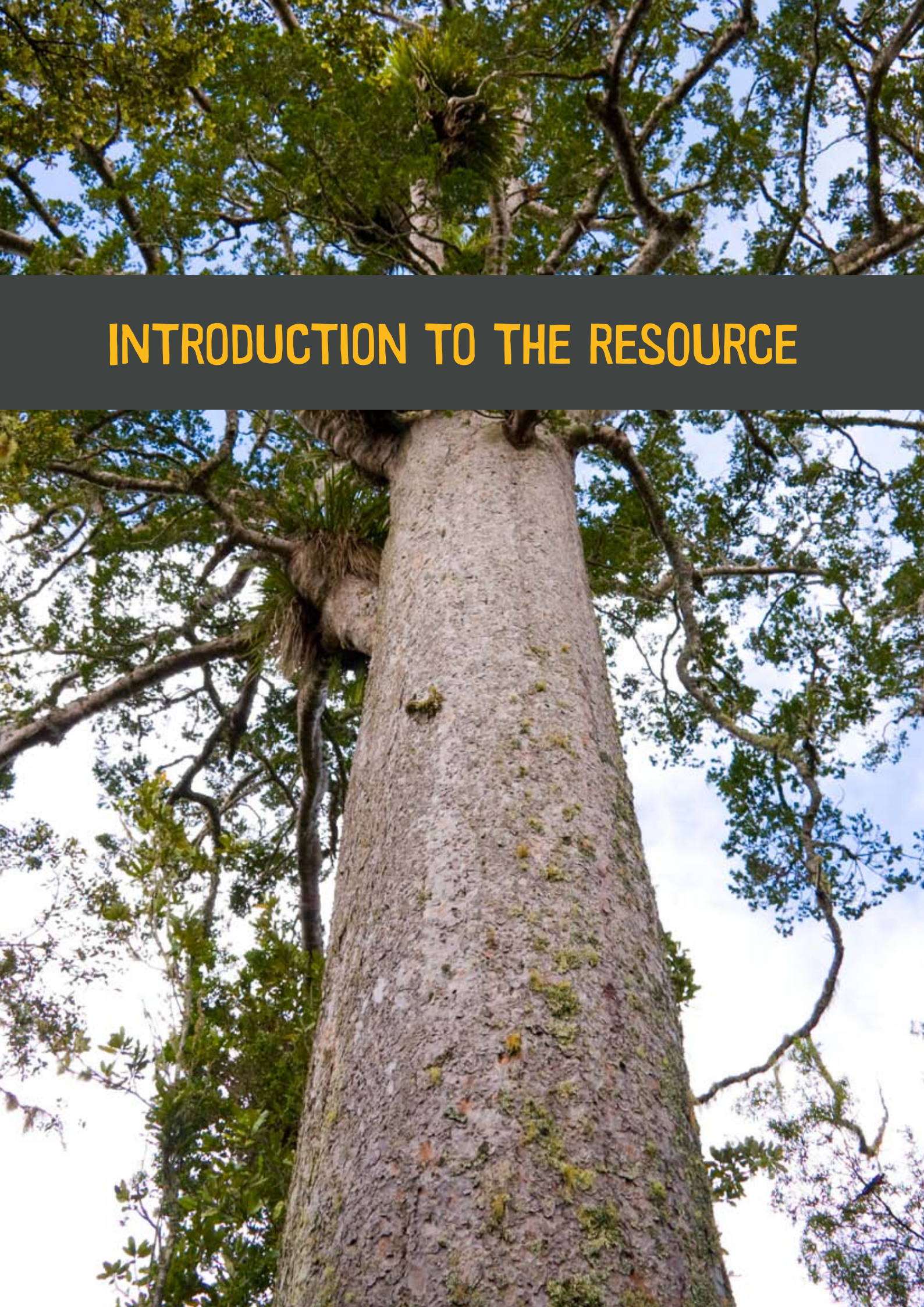
Ko te rakau e tupu ana, e taea te whakahoki, ki te one i tupu ake ai

It is possible to trace a growing tree to the soil from which it grew.

Te Roroa, Waipoua Forest
This proverb relates to people as well as trees – a child's environment determines the adult that they will grow into.

CONTENTS

INTRODUCTION TO THE RESOURCE



INTRODUCTION

Kauri are the kings of the forest, a true taonga (treasure). They provide home and shelter to many of New Zealand's native animals and plants and have supported people throughout their time here.

Kauri played an important role in many aspects of early Māori culture, shown by their inclusion in creation mythology, rituals, war, art and everyday life. To European pioneers, kauri provided an industry for a growing population with wood milled for timber, furniture and boat masts, and gum for varnish.

Kauri ancestors grew on Gondwana, an ancient landmass or "supercontinent" which existed between 500 and 180 million years ago and included most of today's southern hemisphere countries. Plant and animal species that developed during this time are now often found in these countries that used to be joined.

Today kauri are reminders to us all, of New Zealand's past connection to Gondwana and our own connections and responsibilities to the land.

These ancient trees are now under threat of extinction from a microscopic disease new to our country - kauri dieback disease.

This resource kit is designed for teachers and students of levels one to five. The activities in this resource are designed to create awareness and extend understanding of the threat to kauri trees from kauri dieback disease, the loss we face if kauri became extinct, and what we can do to protect kauri.

This resource kit contains background information and provides activities for use both inside and outside of the classroom with links to the New Zealand curriculum.

Objectives

A To increase awareness and understanding of:

- the uniqueness of the New Zealand kauri *Agathis australis*
- what kauri dieback disease is and how it is spread
- how species become threatened
- the implications of the loss of a species (the interconnectedness of forest ecosystems)

B To create reflection and promote personal action to protect and sustain living kauri.

HOW TO USE THIS RESOURCE

The resource is split into learning levels though you may wish to select and modify activities from other levels. A range of activities is suggested at each level.

Activities are split into three categories:

1. Pre-visit activities are designed to introduce concepts to students and provide minimum knowledge before visiting an area where kauri trees grow.
2. Field visit activities aim to encourage students to be observers in a forest, to get a sense of the interdependence of organisms in a kauri forest, and an awareness of their own responsibilities and capabilities as kaitiaki (guardians) of these forests.
3. Post-visit learning experiences may be used as pre or post-visit but are designed to promote reflection and personal action in the individual.

Additional worksheets are included at the end of each learning level; suggested timing is included but may be modified.

OPTIONAL EXTRAS:

A copy of the DVD "Save Our Kauri Forests: Kia Toitu He Kauri" can be supplied on request via the kauri dieback website **www.kauridieback.co.nz**

The Kauri Dieback Management Programme also has a number of kauri dieback experts you can call (leave a message with 0800 NZ KAURI). A video-conference with the class or a class visit can be arranged on request.

LINKS TO THE NZ CURRICULUM

Students will gain ecoliteracy, community involvement and action competence by:

VISION, VALUES AND PRINCIPLES:

Envisioning a sustainable future which includes thriving kauri forest.

Being connected to and actively involved in issues affecting their communities.

LEARNING AREAS:

Science: Nature of Science, Living World

Social Science: Social Studies – Place and Environment, Continuity and Change

English: Speaking, Writing, Presenting

Maths: Geometry and Measurement

The Arts: Visual Art- Understanding the Visual Arts in Context

EfS: Sustainability, Guardianship, Interdependence, Responsibility for Action, Biodiversity

KEY COMPETENCIES:

Understanding language, symbols and text: in a range of curricula through research and practical applications.

Relating to Others: understanding individuals connection to other people and the environment.

Participating and Contributing: being involved in actions and decision making that will positively impact on kauri and educate others about kauri dieback disease.

Thinking: critically thinking about the issues surrounding kauri dieback and the changes individuals can make to enable a future for kauri and the species dependent on kauri.

Managing Self: being involved in experiential activities and evaluating ways in which students personally can act to protect kauri and its environment

KEY CONCEPTS AND VOCABULARY

Biodiversity - *the variety of all forms of life on earth or in a certain area*

Conservation - *protecting the natural environment*

Ecosystem - *a group of living and non living features that interact together in a specific area*

Endemic - *species found only in New Zealand e.g. kiwi*

Extinction - *the process of a species no longer existing*

Habitat - *where an organism lives*

Introduced - *species brought to New Zealand by humans e.g. possums*

Kaitiakitanga - *guardianship and responsibility for the care of a particular rohe (area) or species. The person acting as a guardian is a kaitiaki*

Native - *species that live and breed in New Zealand which weren't introduced by humans, their presence has occurred by natural processes (blown, flown or floated) eg. pukeko*

Sustainability - *acting in ways that help protect the environment, people, the planet*

Taonga - *a treasured object, species, language*

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The Kauri Museum **www.kauri-museum.com**

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BACKGROUND INFORMATION

KAURI, AGATHIS AUSTRALIS

WHAT

Kauri are one of the largest and longest-lived trees in the world. They can grow to more than 60 metres high and live for 2000 years or more.

WHERE

New Zealand kauri are endemic: they only grow naturally in northern New Zealand (north of Kawhia-Hamilton-Tauranga).

NEEDS

Kauri need warmth, moisture, light and space to grow. They have shallow feeding roots which can easily be damaged.

Kauri cones - note round female cones and thinner male cones.

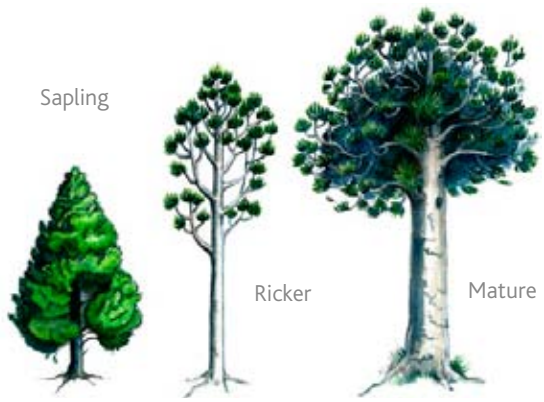
LIFE-CYCLE

Kauri trees start growing cones from 15-30 years of age. Kauri are monoecious, i.e. they have both male and female cones on the same tree. Male cones produce pollen, female cones produce seed. Each seed has a thin wing that fits between the layers of the female cone. When the cones are ripe they break up, releasing the seeds into the wind. The wing on each seed helps catch the wind and disperse the seed.

Kauri seedlings can be green or red-bronze in colour before growing into evergreen cone-shaped saplings.

Saplings drop their lower branches as they grow into young kauri trees or 'rickers' (30-100 years old). Rickers are thin with long pole-like trunks and cone-shaped crowns.

Mature kauri (100+ years) grow up and out. Adult kauri tower above the forest canopy with wide spreading crowns supported by huge branchless trunks. Most kauri will live between 600 and 1200 years, but some can live up to 2000 years or more.



DID YOU KNOW..?

Kauri family history

- Kauri forests are among the most ancient in the world. The kauri forefather lived alongside dinosaurs, appearing during the Jurassic period (between 190 and 135 million years ago).
- Kauri are 'Gondwanan originals' – the kauri tupuna (ancestors) were growing in New Zealand when it was still joined to other countries as part of Gondwana .
- There are 20 other species of 'kauri' (in the Agathis genus) found in Fiji, Australia, New Caledonia and other countries that were once part of Gondwana (see map on page 10).

Growth and adaptations

- Kauri bark looks like it has been hit by a hammer. To prevent climbing plants clinging on and smothering the tree, the bark of kauri continuously flakes off. This forms a pile at the bottom of the tree which over time, breaks down and helps feed it.
- In forests, the lower branches drop off as they become shaded. This means the tree can put more energy into growing upwards and into the light. These branches are dropped in an unusual process that leaves no sign (or knots) in the rest of the trunk.
- Kauri leaves are thick and leathery to prevent animals eating them. They are also slightly acidic, so when they drop on the ground they can change the pH of the soil. Some plants have trouble growing in the acidic soils around kauri.
- Our tallest tree is Tāne Mahuta in the Waipoua forest. It is more than 50 metres tall, measures 13.7 metres around its trunk and is estimated to be between 1200 and 2000 years old.
- Kauri are awesome recyclers – their relationship with a particular fungi (living in nodules on their roots) help them make more wood, leaves and cones from the nitrogen in the soil than most other forest trees. NB. This example shows that some microbes can be beneficial for plants - not all are destructive like kauri dieback.
- Kauri gum helps to seal wounds in the tree so that fungi and insects can't enter and cause damage.
- Kauri grew throughout northern New Zealand (north of Kawhia/Tauranga) both within broadleaf forests and as thick groves for thousands of years before the arrival of humans.

DID YOU KNOW..?

In the past: *Milling and clearance*

- The straight branchless trunks of kauri made them ideal for long straight planks and posts to build ships and houses in the 19th and early 20th century. Early pioneers cut down almost all of the original kauri forests for timber and land clearance for farms and more trees were lost through uncontrolled fires. Less than one per cent of the original kauri forest now remains.
- Kauri are slow growing (unlike other forest species) so even if we replanted these areas now, it would take hundreds of years to replace the large trees that we've lost.

Now: *Threatened by disease*

- Kauri dieback disease is killing trees of all ages. The disease is spread by tiny soil-borne spores that attack the roots and trunk of kauri. When a spore infects the root, it grows threads (or 'mycelium') which damage the tissues in the tree that carry water and nutrients to the canopy. The infected root tissues rot over time and the disease moves up into the trunk. Kauri dieback starves the tree to death because it cannot move water and nutrients from its roots to the leafy canopy. See the 'How Does Kauri Dieback Disease Kill Kauri?' worksheet (page 25, 45 and 61).
- So far this disease seems to be is specific to New Zealand kauri; we don't know yet if kauri species in other countries are affected. People can spread this disease by tracking spores from forest to forest on their boots, gear and equipment.
- This disease is specific to New Zealand kauri; kauri species in other countries don't seem to be affected. Thousands of our kauri have died from kauri dieback in the last 10 years – the species may be facing extinction.

How Can You Help?

Remember to always clean your shoes at home before and after visiting kauri forest.

Many of our popular tracks in kauri forest also have cleaning stations. If you come across a cleaning station remember the "3 S's":

- **S**crub your shoes
- **S**pray your shoes (with the disinfectant)
- **S**tay on the track.

Spread the word! There is no way to treat this disease so we have to stop it spreading to healthy kauri forests. Some people haven't heard of kauri dieback disease and are spreading it without knowing.

Tell your friends and family about kauri dieback disease and how to stop its spread.

WHERE CAN YOU VISIT A KAURI FOREST?

Listed below are some areas where kauri grow naturally. There may be smaller areas closer to your school, contact your local council for more information.

Northland: — KAURI DIEBACK DETECTED

- Waipoua Forest
- Trounson Kauri Park

Northland: — KAURI DIEBACK FREE

- AH Reed Memorial Park

Auckland North: — KAURI DIEBACK FREE

- Parry Kauri Park
- Tawharanui Regional Park
- Wenderholm Regional Park

Auckland West: — KAURI DIEBACK DETECTED

- Waitākere Ranges Regional Park

Auckland South: — KAURI DIEBACK FREE

- Hunua Ranges Regional Park

Waikato/Bay of Plenty: — KAURI DIEBACK FREE

- Coromandel Ranges
- Kaimai Ranges
- Hakarimata Scenic Reserve

NB. Some tracks in the Waitākere Ranges and Hunua Ranges are closed to protect healthy areas of kauri. See www.aucklandcouncil.govt.nz for more information on track closures.

WHERE CAN I SEE KAURI?

ECOLOGICALLY, ECONOMICALLY AND CULTURALLY IMPORTANT

KAURI ECOLOGY

Kauri give shelter and home to many species of plants and animals. They provide ideal conditions for a special ecosystem, with a unique mix of plant species only found around them. Some kauri 'associates' are very rare, for example the kauri greenhood orchid o are only found in kauri forests.

More than fifty species of plants (ferns, orchids, lilies, shrubs and tree saplings) grow high up in kauri branches where there is better light than the forest floor. Some insects and lizards may spend their whole lives up in the branches of a kauri and never see the ground.

To learn more about the biodiversity in a kauri forest, use the species cards provided in the additional resources section.

MĀORI CULTURE AND KAURI

The sight of mature kauri forests that greeted the first human arrivals to New Zealand must have been incredible. It's no wonder these great trees were revered by early Māori and became woven into their legends and whakatauki (proverbs). Some large trees were considered rakau rangatira, (chiefly trees) and even given names like Tāne Mahuta and Te Matua Ngāhere. These trees can still be found in Waipoua forest.

Northern iwi have a long and continuous association with Te Wao Nui a Tāne or the great realm of Tāne Mahuta that reaches back to the beginnings of time. Their understanding of Te Wao Nui and its association to everyday Māori life is well documented. The kauri tree is one of many associations Māori have with Te Wao Nui a Tāne, for food, recreation, medicines, shelter, resources etc.

In Māori tradition kauri and people are fundamentally linked: both were created by Tāne and will always be connected. Ancient karakia are still recited to this day to clear the pathways to Te Wao Nui and to get permissions from the forest gods to take leaves for medicines for example.

Waipoua Forest in Northland contains some of the oldest kauri forests in New Zealand. The Te Roroa iwi are the tāngata whenua (people of the land) of Waipoua and as such have strong connections to kauri. Will Ngakuru is from the Te Roroa iwi, in the kauri forests of Waipoua. Today Waipoua forest, his home and the home of his children, is under threat from kauri dieback disease. Will is working within the national Kauri Dieback Management Programme to find a way to manage this disease and save our kauri forests. He has provided the following whakatauki and creation story from Te Roroa:

Toi tu te whenua, Toi tu te Kauri

When the land prevails, Kauri prevails

Creation Story - Te Roroa, Waipoua Forest

For Māori the world began from Te Kore the nothingness; and from the dark came light. Ranginui (sky father) and Papa-tu-a-nuku (earth mother) gave birth to many children.

Trapped between their parents' embrace, Rongo-ma-tane (god of kumara) suggested to his siblings that because of their cramped conditions, their parents needed separating and so Tāne Māhuta (god of the forests) went to retrieve the axe called Te Awhiorangi. On Rongomatane's cue Tāne cut the pillars binding Ranginui to Papatuanuku, bringing light to the land and allowing the children to flourish.

Te Roroa tupuna say that the kauri are the ankles of Ranginui which remain on the land to cloak the earth.

Reference: above story as told by members of the Te Roroa iwi
for more information see Te Ara encyclopedia:
http://www.teara.govt.nz/ranginui-the-sky

Hori Parata is the kaumatua of the Kauri Dieback Management Programme and the Ngati Wai iwi.

Hori tells the legend of the kauri and the sperm whale below:

The Legend of the Kauri and Sperm Whale

In times long past a sperm whale came ashore and spoke to the kauri. "Kauri! Come with

me to the sea, which is fresh and cool."

"No!" said the kauri. "You may like the sea but I prefer to stand here with my feet in the soil."

"All right" said the whale. "Then let us agree to exchange our skins."

So that is why the bark of the kauri is thin and full of resinous oil.

Because of their huge size, both are regarded as rangatira of their respective realms. Moreover, their bark and skin show similarities of texture, while kauri gum is like the ambergris found in the intestines of the sperm whale.

In the Auckland region, the Waitākere Ranges are one of the largest areas of kauri forest close to the city. Many of these kauri areas are infected with kauri dieback disease.

Te Warena Taua of Te Kawerau ā Maki and the chair of the Te Kawerau Authority tells the history of this land:

"Te Kawerau ā Maki are mana whenua over the Waitākere Region or greater West Auckland, known to us as Hikurangi. The Waitākere Ranges form the heartland of our rohe. Our ancestor, the Turehu chieftain Tiriwa, lived throughout the extensive forest which once covered West Auckland, the remnant of which is now the Waitākere Ranges. It is from this ancestor that the traditional name for Waitākere, Te Wao nui a Tiriwa – the great forest of Tiriwa, comes.

Tiriwa is credited with amazing feats, including the ability to walk across the land in great strides and to change the landscape. In a Te Kawerau ā Maki tradition known as 'Te Unuhanga o Rangitoto', Tiriwa is credited with shifting Rangitoto Island from Mercer Bay at Karekare to its present position at the entrance to the Waitemata Harbour. Tiriwa and his many feats continue to be remembered by Te Kawerau ā Maki in tradition, song and carving."

Take a class visit to see the carved pou whenua representing the ancestry of Te Kawerau ā Maki outside the Arataki Visitor Centre in the Waitākere Ranges. Tiriwa, the oldest ancestor is at the top of the pou which is carved from kauri.

ECONOMIC VALUE IN THE PAST

Early European Pioneers

The Kauri Timber Industry: When Europeans first arrived in New Zealand in the 1800s, they needed wood for building. Kauri and many other trees that are only found in New Zealand were cut down. Today, less than one percent of the original kauri forest now remains.

Kauri rickers (young trees) have straight tall trunks which were valued for making ship masts. The large trunks of mature kauri could produce many long, wide flawless planks which were used for building houses, ships, fences, railway sleepers, dams and furniture. By the early 1880s, kauri timber was the most prized wood in New Zealand and our main export.

By the early 1900s, the kauri timber trade began to decline. The slow growth rate of kauri trees could not keep up with the rate that forests were being cut down.

Joanna Orwin's "Kauri in My Blood: The Diary of Laura Ann Findlay, the Coromandel, 1921-24" describes the clearing of the last remaining stands of kauri for farmland and timber in the Coromandel in the 1920s. This book is based on a true story told to Joanna Orwin by Ruth Mickey Murray and may be a useful reference for students.

Bushmen watching a large kauri fall, Dome Valley, 1952.

PHOTO: Tudor Collins The Kauri Museum

PHOTO: Tudor Collins The Kauri Museum

Tudor Collins scarfing a large Kauri, 1921.

PHOTO: Department of Conservation

Kaiaraara Kauri Dam.

The Kauri Gum Industry: Many settlers from Dalmatia (now Croatia) arrived in Northland to dig or bleed kauri gum. Kauri gum was valued as a base for hard varnishes, paints and for making linoleum ("lino", a floor covering).

Kauri naturally oozes gum to heal wounds. The gum (or resin) hardens when it is in contact with air, just like blood from a cut on a human body creates a scab. European settlers dug ancient gum out of the ground, but they also cut trees to 'bleed' the gum out, a practice that is now prohibited.

Today, synthetics are used instead of kauri gum to make varnishes, but kauri gum is still made into ornaments. Jewelry that has been made from kauri gum is often called amber.

Digging for gum.

KAURI TODAY

Today our remaining kauri forests are largely protected within reserves and logging is restricted on private land. Kauri have been such a large part of life in New Zealand that they have become an iconic symbol for many New Zealanders: part of our national identity.

Swamp Kauri

Swamp kauri comes from trees that have been buried underground and naturally preserved for thousands of years. Tannins (natural pigments) from the swamp often stain the wood , producing rich colours. This wood is valued by carvers and wood turners.

House in Trees, Titirangi 1953 by Colin McCahon

Colin McCahon (1919-1987) is one New Zealand's most famous painters. From 1953 to 1959 he lived with his family in French Bay, Titirangi, in the Waitākere Ranges. His cottage at 67 Otitori Bay Road has been restored and hosts guided visits. An additional house has also been built for visiting artists in residence.

Kauri were a major inspiration to McCahon in this period. Around 50 of his paintings have a link or focus on kauri. Today, the kauri McCahon painted at his cottage are dying from kauri dieback disease. These trees which should have stood for another thousand years may now only survive in these paintings.

KAURI HAVE GIVEN... HOW CAN WE GIVE BACK?

SOIL

It's easy to think of soil as 'just dirt' however under a magnifying glass this world comes alive. Soil is formed by environmental forces (e.g. erosion and weathering) and plant roots breaking up rocks and microbes breaking down dead plants and animals. An average soil sample is 45% minerals, 25% water, 25% air and 5% organic matter.

Find out more at **http://42explore.com/dirt.htm**

Online activities: **http://www.sciencekids.co.nz/gamesactivities/rockssoils.html**

See **www.soil-net.com** for factsheets and activities

SOIL MICROBES

Micro-organisms (or microbes) are tiny living organisms that can't be seen with the naked eye. These include viruses, bacteria and fungi. Some microbes are harmful (the flu) but some can be helpful (yeast). Within the soil, microbes help break down dead plant material – without soil microbes dead leaves and plants would pile up around us.

Fungi, like mould, spread through spores which are a lot like seeds. Spores can spread in soil, water or air depending on the microbe. Once it has landed in a new site, the spore will grow (often creating 'fruiting bodies' like mushrooms) and replicate to create many more spores. See the 'What Makes Mould Grow?" worksheet (pages 43 and 58).

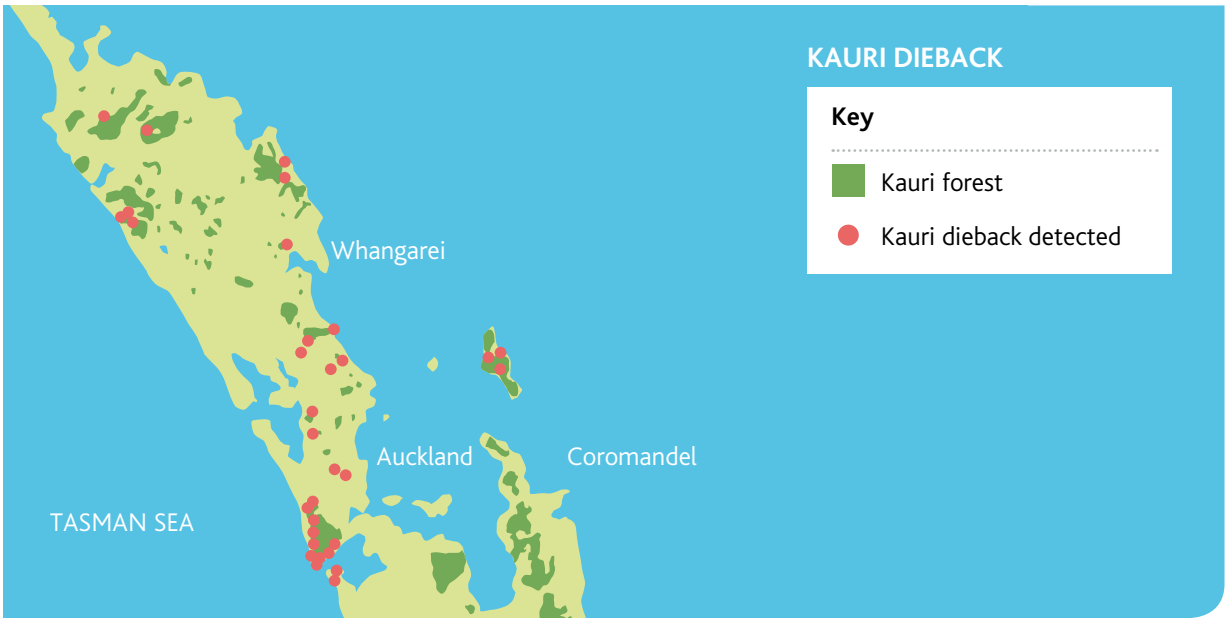
KAURI DIEBACK DISEASE

WHAT

Kauri dieback is caused by a microscopic fungus-like disease. This disease only affects New Zealand kauri and kills nearly every tree that it infects.

WHERE

It is found in some forests in the Northland and Auckland regions, including the Waitākere Ranges in Auckland. The Hunua Ranges and Coromandel forests are currently disease-free.



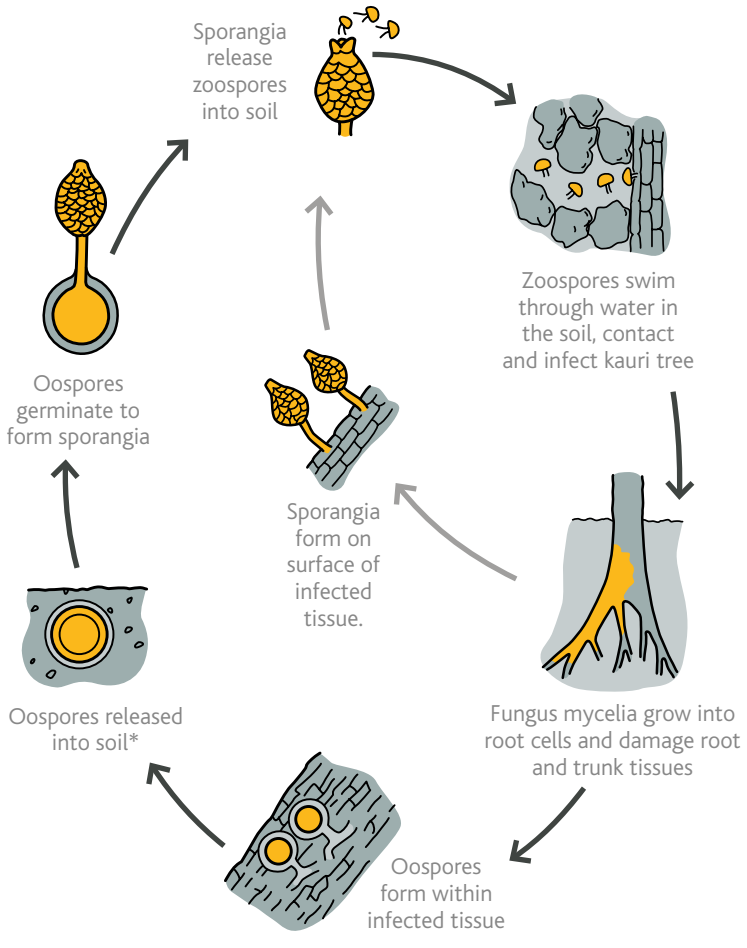
NEEDS

Kauri dieback needs soil to survive as dormant spores. To reproduce and spread, it also needs kauri trees, warmth, water and anything that can move the infected soil, such as shoes, tyres, dogs or equipment.

LIFE CYCLE

Kauri dieback spores are so tiny you need a microscope to see them. The spores spread in soil (these are called oospores) and in freshwater (these are called zoospores). Kauri dieback does not spread through the air.

Zoospores infect kauri through the roots (growing threads or 'mycelium' into the root tissues) and "eat away"/damage the tissues in the tree that carry water and nutrients to the canopy. Oospores are formed within infected trees. As the tree dies and starts to rot, these oospores are released into the soil where they can produce new zoospores or spread through soil movement.



*These spores can spread to other kauri areas via soil movement

WHAT DOES KAURI DIEBACK DO TO THE TREES?

Kauri dieback starves the tree to death by reducing the trees ability to move water and nutrients from the roots to the leafy canopy. See 'How Does Kauri Dieback Disease Kill Kauri?' worksheet (page 25, 45 and 61).

Kauri trees infected with kauri dieback can show these symptoms:

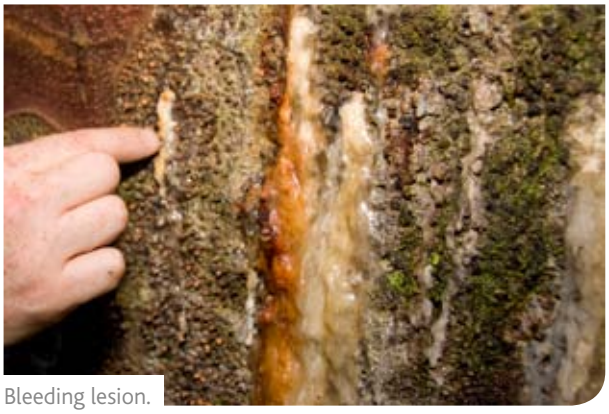
- **Lesions or blobs of gum** at the base of the trunk– sometimes the gum can circle the whole trunk. Infected kauri produce gum as a "defence response", to try to fight off the disease.
- **Yellow leaves and thinning canopies:** as nutrients and water from the roots to the canopy is reduced, the leaves start turning yellow and dying. Trees need healthy leaves to make food from sunlight (photosynthesis); with less green leaves, the kauri is further starved.
- **Dead branches** then tree death.

Infected tree with bleeding lesion.

DID YOU KNOW..?

Kauri dieback

- It is not known how or when kauri dieback came to New Zealand, scientists believe it has come from overseas. The closest known relative is a disease that affects coconut palms in Hawaii.
- The soil-borne oospores can live for at least four years due to a protective outer shell - just like seeds have a hard outer shell to protect them until conditions are suitable for them to grow.
- The water-borne zoospores have a small tail to help them move through water. Zoospores are produced after heavy rain and only live for a couple of days.
- At the moment there is no known treatment or control for this disease. Scientists are studying a range of possible treatments but it'll be a few years before they finish this work. Research is also underway to find out if it is possible to breed kauri that are resistant to the disease.
- At this stage, containment is the only way to protect healthy areas of kauri from this disease. This means that any soil or plant material that is infected must stay where it is and not be moved to other places, in case it spreads the disease.
- Spread the Word! Many people still don't know about kauri dieback and are spreading it without knowing. We need to inform everyone and make sure they clean their boots between kauri forests, to stop the spread of this disease.
- The organism causing kauri dieback disease belongs to the Phytophthora group (genus) of water moulds (not a true fungus). Phytophthora literally means 'plant destroyer' in greek – this is a nasty group of organisms! Phytophthora species cause plant disease in both crops and natural environments: the best known of this group is *Phytophthora infestans* which caused the Irish Potato Famine.



Bleeding lesion.

HOW CAN YOU HELP?

Remember to always clean your shoes at home before and after visiting kauri forest.

Many of our popular tracks in kauri forest also have cleaning stations. If you come across a cleaning station remember the "3 S's":

Scrub your shoes

Spray your shoes (with the disinfectant)

Stay on the track.

Spread the word! There is no way to treat this disease so we have to stop it spreading to healthy kauri forests. Some people haven't heard of kauri dieback disease and are spreading it without knowing. Tell your friends and family about kauri dieback disease and how to stop its spread.

Always stay on the track and keep your dog on a lead so it stays on the track too.

Never remove any plant material or soil from a forest- this could spread the disease.

If you think a tree is showing symptoms of kauri dieback on your land, call the Kauri Dieback Hotline 0800 NZ KAURI (69 52874)

WHAT'S IN THE SPRAY BOTTLES AND BARRELS?

The liquid in the spray bottles and barrels is a disinfectant called Trigene. It is non-toxic so it will not harm you or any other animal (but it's not safe to drink or spray at people!)

Want to know more?

Check out the website **www.kauridieback.co.nz** for more information. This website has factsheets, i.d. guides, videos and a guide to planting and caring for kauri.

Ask an expert: the Kauri Dieback Management Programme has a number of kauri dieback experts that you can call (leave a message with 0800 NZ KAURI). A video-conference with the class or a class visit can be arranged on request.

LEVEL 1 AND 2

LEVEL 1 ACHIEVEMENT AIMS

SCIENCE:

- **Living World**
  Life Processes: Understand the processes of life and appreciate the diversity of life

  Ecology: Understand how living things interact with each other and the non-living environment

- **Nature of Science**
  Investigating in Science
  Participating and Contributing

LEVEL 2 ACHIEVEMENT AIMS

SCIENCE:

- **Living World**

  Life Processes: Recognise that all living things have certain requirements so they can stay alive

  Ecology: Recognise that living things are suited to their particular habitat

- **Nature of Science**
  Investigating in Science
  Communicating in Science
  Participating and Contributing

MATHS:

- **Geometry and Measurement**

SOCIAL SCIENCES:

- **Social Studies: Place and Environment, Continuity and Change, The Economic World**

EFS:

- **Responsibility for Action, Interdependence, Biodiversity**

LEVEL 1 AND 2 PRE- VISIT ACTIVITIES

Pre-visit activities are designed to introduce concepts to students and provide a minimum knowledge before visiting an area where kauri trees grow.

Kauri are an important part of an interdependent forest system: many plants and animals make up the forest. Kauri dieback disease is killing kauri: this disease is spread through tiny spores in the soil.

SCIENCE

- Sit under a tree and brainstorm – can students see any roots? Can they see a tree trunk, branches, leaves – what else can they see? What would this tree need to stay alive? Why do trees have roots? *(pre-visit or field trip activity)*
- Have students make a collection of things that they have found outside. Make sure that some are things that were once alive e.g. shells, leaves, and some that have never been alive. Let students classify them into whatever group they choose (it may be colour, size etc). Introduce the idea of living and non-living and discuss what all the living things might have needed to stay alive.
- Get some old shoes which students can put into paint or glue, then into sand or glitter. Make shoe prints on paper to show how shoes can move things on their soles from one place to another. Talk about kauri dieback and that this is one way it gets spread – spores are spread on people's shoes from forest to forest.
- 'How does kauri dieback kill kauri?" worksheet

MATHS/ VISUAL ARTS

- Make a collection of leaves that are from the same plant and measure the lengths of them. Use this data to create a collage tree with longest leaves at bottom, shortest at top.
- Make a kauri tree height chart and measure each student on it: check back at different stages in the year to see if there has been any growth. Pre-made height charts can be provided to classes on request.

SCIENCE/ MATHS/VISUAL ARTS

- Measure out a long roll of paper (Tāne Mahuta our tallest tree is over 50 metres) and draw a kauri tree on it. Students then turn the kauri tree into a habitat by drawing species such as kukupa (kereru), tui, geckos, morepork, weta, kauri snails, perching lilies, kiekie, kiwi etc which they then glue in, on or under the tree according to where that species lives. Also see the 'What Needs Kauri?" worksheet. (pre- or post- visit activity This activity could also be done after the field visit).
- Make a bark or leaf rubbing from material that has fallen off a range of trees to understand that trees have different bark patterns and leaf shapes.
- Soil isn't just dirt. Use magnifying glasses to look for things in soil and if possible have a microscope available in the classroom. How many things can they see with just their eyes? How many things can they see using the magnifying glass? Make a tally chart or write down the numbers. Discuss that the disease killing kauri is spread by spores so small that you can't see them without using a microscope. Visit soil-net.com as a class to do this activity with a virtual microscope online.

SCIENCE/ ENGLISH

- Turn your class or a corner of the class into a kauri forest (have a kauri tree image by the area to remind the students). Before they come into that area or the classroom, students must do what they have to do at the cleaning stations in kauri forests: Scrub their feet (wipe them on a door mat and have an old brush to help), Spray their feet (have an empty spray bottle), Stay on the track (mark off an area e.g. a mat or use tape that they have to walk on or between). Creation of the kauri forest may be done initially by the teacher to spark discussion or as a class as knowledge develops over time *(pre- or post-visit activity)*.
- Invite a Kauri dieback expert to join your class in person or via a video-conference/skype. Have the class 'interview' the expert.

MATAURANGA MAORI/SOCIAL STUDIES/ ENGLISH

- Read the creation story and create a class mural to illustrate this story.

ENGLISH

- Read "Kapai and the Kauri Trees" as a class and discuss how lots of plants and animals live with/near/on kauri.
- Read "Trev and the Kauri Tree" as a class; author Chris Gurney is available to visit classes through the Writers in Schools programme. See **www.bookcouncil.co.nz** for details on how to book a visit.

LEVEL 1 AND 2 FIELD TRIP ACTIVITIES

These are activities that can be done in any outdoor situation. They are designed to slow students down and become immersed in nature. They may be carried out in a forest (see background information 'Where Can I See Kauri'), under a tree in the school grounds, or at the Auckland Zoo Te Wao Nui Forest habitat where there are young kauri and a cleaning station.

Kauri are part of an interdependent forest system: many plants and animals make up the forest. Kauri dieback disease is killing our kauri but we can contain it to protect our healthy kauri forests.

- Close your eyes. What can you hear? What can you smell? Open your eyes what can you see? If you heard a bird singing, can you see the one that is singing? What is it?
- Stop at a cleaning station in the forest, or make your own in the school grounds. Practice using the 3 S's to keep kauri standing:
  - *Scrub your shoes*
  - *Spray your shoes*
  - *Stay on the track*
- Play 'I spy' as a class. "I spy something beginning with….": k = kauri or kukupa, t = tui, b = bark or branches etc.
- Select some leaves from plants in the area that you are in, before the students notice you doing it (preferably from off the ground). Ask the students to be plant detectives and see if they can match the leaf to the plant. If they find berries (don't touch to be safe) or petals on the ground get them to look up and see if the students can find the plant they might have come from.
- Take a class visit to see the carved pou whenua representing the ancestry of Te Kawerau a Maki outside the Arataki Visitor Centre in the Waitakere Ranges. Tiriwa, the oldest ancestor is at the top of the pou which is carved from kauri.
- Learning through Experience programmes: Book in for a guided walk down the Arataki Nature Trail to view a remnant kauri forest and enjoy their magnificent presence on our doorstep. Visit a cleaning station. Learn about the uniqueness of kauri, the logging history of the Waitakere Ranges and how it impacted on the biodiversity of the forest. Each guided walk can be tailored to suit specific learning needs. For more information about how to book and how our programmes below could fit your inquiry please call 817 0092 or email **arataki.schoolbookings@aucklandcouncil.govt.nz** or download our Learning through Experience programme booklet **www.aucklandcouncil.govt.nz/educationforsustainability.** Maori and the Forest (Years 4 – 8), Arataki Nursery Adventure (Years 2 – 8), Let's focus on trees (Years 0-4) and Forest Ecosystem (Years 3 – 8).

LEVEL 1 AND 2 POST-VISIT ACTIVITIES

Post-visit learning experiences are designed to promote reflection and personal action in the individual.

Many people still don't know about kauri dieback and are spreading it without knowing. We need to inform everyone and make sure they clean their boots between kauri forests, to stop the spread of this disease and save our kauri forests.

ENGLISH/SCIENCE/VISUAL ARTS/EFS

- Read Dr Seuss's "The Lorax". Talk about what is happening to the trees in this story and what is happening to kauri trees from being cut down in the past and now being infected by kauri dieback disease. Draw a tree trunk on a piece of paper and cut out kauri shape leaves for students to 'Speak for the Trees' and write a message about what they wish for kauri trees. Glue them onto the tree. Photograph the tree and put it in your school newsletter or website so students can share this with family.
- Construct a photo story of the day your class went to the forest and include quotes of what the students wish for kauri tree. Submit this to your school newsletter/website or send to **kauridieback@mpi.govt.nz** to submit to the kauri dieback website.
- Make a Scrub, Spray and Stay' poster for your room and school using photos of the students carrying out each stage at a cleaning station near a kauri tree or in a forest.
- Worksheets: What am I?, What lives in a kauri forest?, When I went to the forest..., Kauri Acrostic and Worrying times in Waipoua.

MATHS/ENGLISH/EFS

- Do a home survey and make a tally chart or graph as a class showing how many people have family members who had heard about kauri dieback disease and what they can do to stop the spread, and how many have not. Build on this by deciding and actioning ways that the class can help create more awareness.

WHAT NEEDS KAURI?

CONCEPTS Biodiversity, Interdependence

LEARNING AREAS Science, Visual Arts

CREATE A KAURI TREE BANNER OR WALL HANGING

- **Draw a kauri tree outline on a long roll of paper.** An outline is the resource section.
- **Students choose a species each (including humans) from the list below.** (Make sure you have a range). Use photos (e.g. those in the biodiversity sheets in the additional resources section) to see what this species looks like and why kauri are important to it.
- **Turn the kauri tree into a habitat by drawing the species and sticking them on to the part of the tree that it might be found on or in.** Optional: a speech bubble from each glued on species saying " I need kauri because…..".

SPECIES TO CHOOSE FROM:

tree weta | **kaka** | **kauri snail** | **silver fern** | **morepork**

kakariki | **perching lily** | **kiwi** | **gecko** | **kukupa (kereru)**

kauri greenhood orchid | **human**

PLAN OF MY DRAWING:

The species I am drawing is: _____

It needs kauri because: _____

SKETCH OF MY SPECIES:

Colours I will use:

HOW DOES KAURI DIEBACK DISEASE KILL KAURI?

CONCEPTS Life Processes, Decomposition, Communicating in Science

LEARNING AREAS Science

- **A kauri dieback spore infects kauri through the roots** (growing threads or 'mycelium' into the root tissues) and eats away the tissues in the tree that carry water and nutrients to the canopy. The disease moves up and around the tree eating into new tissue and leaving behind dead/rotting tissues. The tree can still absorb water and nutrients through other roots and remain alive as the disease grows but eventually the tree is starved.
- **This activity has the student experiencing the effect of the rotting of plant root tissue** on the ability of a plant to suck up water, simulating the unhealthy root by piercing the straw with a pin above the water line.

MATERIALS AND EQUIPMENT:

Plastic straws, Pins, Cups, Water or juice, Timers

ACTIVITY:

1. Watch the "Kauri dieback animation" on youtube **http://youtu.be/P9s87bROTHM** and discuss as a class.
2. Organise students into 5 groups. Each group is given a cup of juice and straw with a different number of holes in it (each group represents different stages of infection).
3. Race to suck up the same amount of water/juice. Compare the time taken to suck up all the juice.

Discuss how the holes in the straws/rotten tissues in the kauri affect water and nutrient uptake.

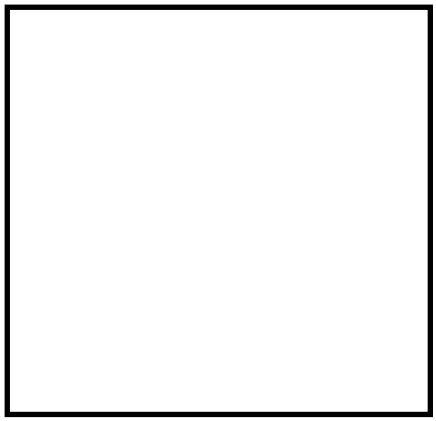
HOW LONG DO ROTTING ROOTS TAKE TO SUCK UP WATER?

Group	Number of holes in straw	Order to finish (fastest to slowest)
Group 1	Zero (healthy root)	1st
Group 2	10	
Group 2	20	
Group 4	30	
Group 5	40	

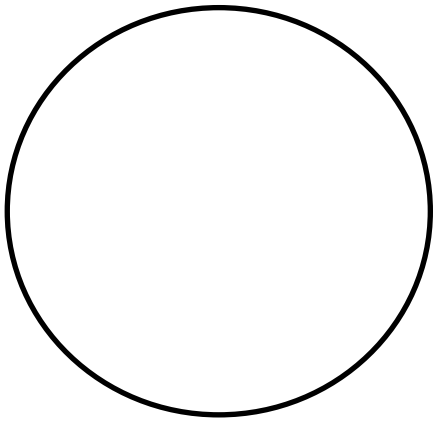
WHAT AM I?

What is your favourite plant or animal in a kauri forest?

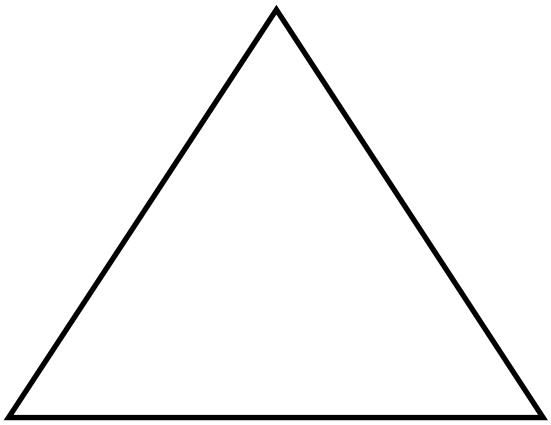
1. Draw it in the square (but don't write its name).



2. Write one thing it needs in the circle (but not its name).



3. Write something that will protect it in the triangle.



I am a... (write the name on the back or draw a picture on another sheet and staple it to this sheet to make a 'lift the flap')

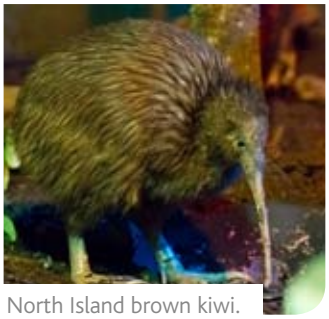
WHAT LIVES IN A KAURI TREE?

Use the photos to help students tell or write a story about one of the following New Zealand species:


Kukupa (kereru).


Kaka.


Forest gecko.


North Island brown kiwi.


Tree Weta.

SENTENCE STARTERS:

I live in or alongside a kauri tree I am a...

I eat...

Things that help me stay alive...

I need kauri trees because...

WHEN I WENT TO THE FOREST

I saw...

I heard...

I touched...

I liked...

My wish for kauri trees is...

WORRYING TIMES IN WAIPOUA

- **Will Ngakuru is from Te Roroa iwi, in the kauri forest of Waipoua.** Today Waipoua forest: his home, and the home of his children, is under threat from kauri dieback disease. Will describes the songs of Te Roroa as being "songs with the rhythm of streams".
- **Look at the photo of Waipoua Forest.** Imagine the sounds – the birds, the river, the raindrops falling off the kauri canopy. Imagine the smell of wet leaf litter on the floor of the forest. Imagine the feel of fern fronds brushing past your arms as you walk through the forest, the sight of an eel winding silently under the stream bank.
- **Now look at the photos on the bottom of the page and imagine walking around the skeletons of trees.** The birds have left – there is no food and shelter. Only the rain and the river remain.
- **The kauri are gone.**

DRAW A BEFORE AND AFTER KAURI DIEBACK PICTURE:

Show the richness of life in a kauri forest and what is left once kauri dieback infects the forest.

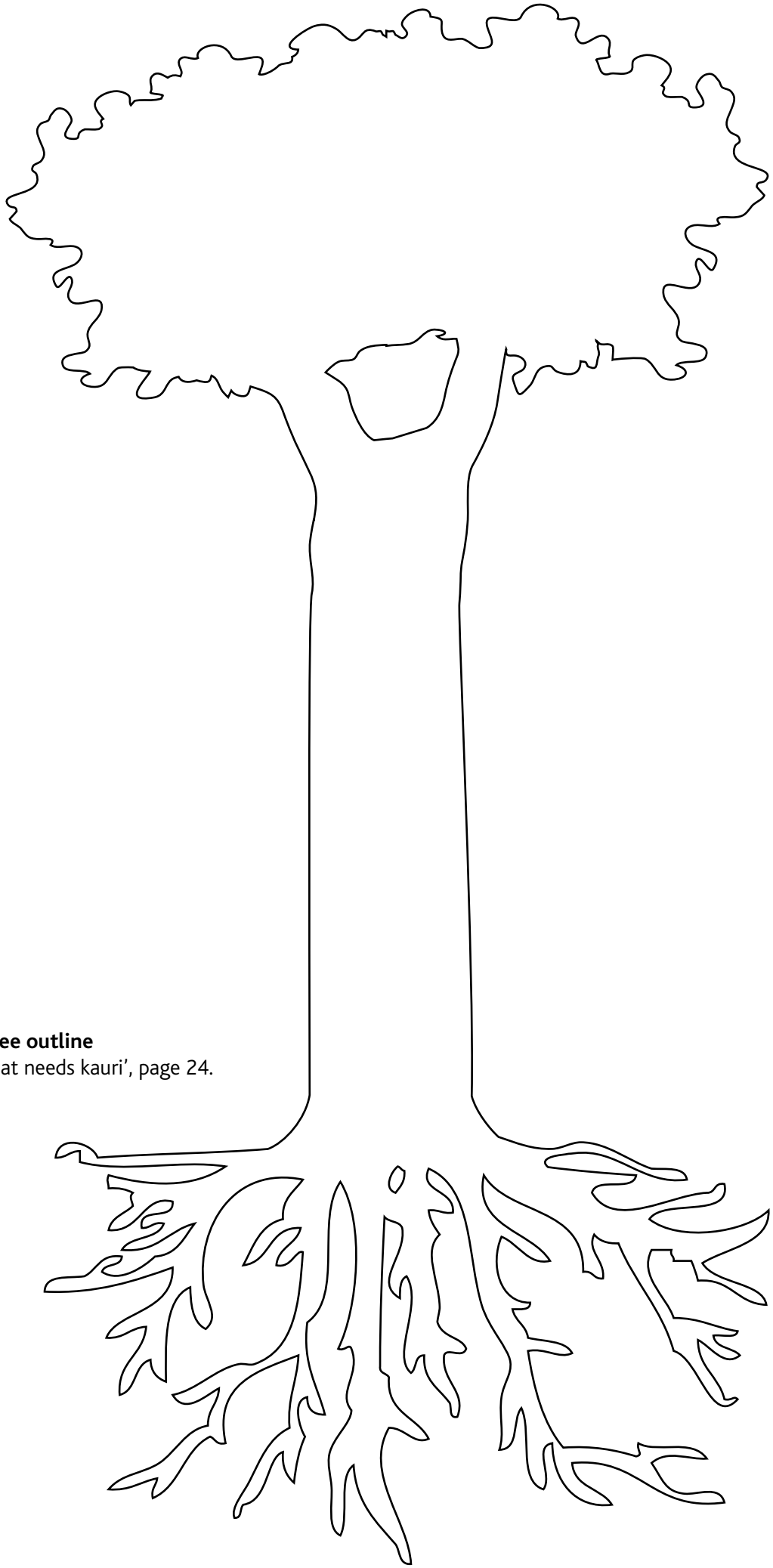
Before...

After...

WORRYING TIMES IN WAIPOUA CONT.

Waipoua Forest.

Dead kauri.



Kauri tree outline
See 'What needs kauri', page 24.

LEVEL 3 AND 4

LEVEL 3 AND 4 ACHIEVEMENT AIMS:

SCIENCE:

- **Living World**
  Ecology: Explain how living things are suited to their particular habitat and how they respond to environmental changes, both natural and human-induced.

  Evolution: Begin to group plants, animals and other living things into science-based classifications

  Explore how groups of living things we have in the world have changed over a long period of time and appreciate that some living things in New Zealand are quite different from living things in other areas of the world.

- **Nature of Science**
  Investigating in Science
  Communicating in Science
  Participating and Contributing

MATHS:

- **Geometry and Measurement**

ENGLISH:

- **Speaking, Writing, Presenting**

SOCIAL SCIENCES:

- **Social Studies: Place and Environment, Continuity and Change, The Economic World**

THE ARTS:

- **Visual Art- Understanding the Visual Arts in Context**

EFS:

- **Responsibility for Action, Sustainability, Interdependence, Biodiversity**

LEVEL 3 AND 4 PRE- VISIT ACTIVITIES

Pre-visit activities are designed to introduce concepts to students and provide a minimum knowledge before visiting an area where kauri trees grow.

Kauri are an important part of an interdependent forest system: many plants and animals make up the forest. Kauri dieback disease is killing kauri: this disease is spread through tiny spores in the soil.

SCIENCE

- Make a collection of objects found in the school grounds (the students could collect them) and play living versus nonliving (i.e. never alive). Discuss what makes a living thing living (or once alive) e.g. did it: move, have babies (reproduce), sense, grow, breath (respire), go to the toilet (excrete), eat (nutrition): link to MRS GREN. Advance this game by classifying the objects further into animal, plant, mineral.
- "Introducing biodiversity, habitats and ecosystems" worksheet.
- "Life cycle of a Kauri" worksheet
- Use the 'Biodiversity In A Kauri Forest' cards (see additional resources) to layout a food chain found in the forest. Start with a plant. How many foodchains can you make? What would happen if the kauri all died? What parts of these animals and plants help them survive in a forest? See also 'What needs kauri' and 'Kauri Forest Food Web' work sheet *(could also be post-visit activity)*.
- Get some old shoes. Have students put the sole into some water (or mud) then press it into an area under some trees until it picks up some material from the ground. Have students brush off the shoe (can use screwed up paper) onto a white piece of paper. Examine with own eyes and then use a magnifying glass to see what they have brought in on their shoes. Return everything (especially any living things) back to where it came from. Talk about kauri dieback and that this is one way it gets spread – spores are spread on people's shoes from forest to forest.
- If microscopes are available – examine parts of kauri cones and seeds. Look at a human hair under magnification and explain that at least 3 kauri dieback spores could sit side by side on the width of that hair.
- 'What makes mould grow?' worksheet.
- 'How kauri dieback kills kauri' worksheet.

SCIENCE/SOCIAL STUDIES

- Pin up a map of the North Island (or a map of the wider area that you are in). Students' research where there are kauri forests and make little kauri tree figures to put in the places that they are in. Find out what kauri dieback is, which forests have it and which do not.

SCIENCE/ENGLISH/EFS

- Create a kauri forest in your classroom. Pin two large hand drawn kauri (or large photos) near the entrance to set the scene. Lay down a mat to symbolize the track. Create a cleaning station outside the door. Students must replicate what they have to do at the cleaning stations in kauri forests: Scrub their feet (wipe them on a door mat and have an old brush to help), Spray their feet (have an empty spray bottle), Stay on the track (mark off an area e.g. a mat or use tape that they have to walk on or between for a metre or so). Creation of the kauri forest may be done initially by the teacher to spark discussion or as a class as knowledge develops over time (pre- or post-visit activity).
- Invite a Kauri dieback expert to join your class in person or via a video-conference/skype. Have the class 'interview' the expert.

MATAURANGA MAORI/SOCIAL STUDIES/ ENGLISH

- Read the Kauri and the Whale Story Talk about how skin and bark help to protect the body of the whale and the kauri. Discuss what happens to kauri when kauri dieback spores get under the bark. What would happen if something tiny, like kauri dieback spores got under the skin of the whale? Or under the students skin? Ask students to write alternative endings to the whale and the kauri story – what would they say to each other if they met again today?
- Read Joanna Orwin's "Kauri in My Blood: The Diary of Laura Ann Findlay, the Coromandel, 1921-24" (Scholastic 2007). Students can write a modern day short story equivalent based on kauri dieback disease, rather than the timber industry. Author Joanna Orwin is available to visit classes and talk to schools as part of through the Writers in Schools programme. See **www.bookcouncil.org.nz** for details on how to book a visit.

ENGLISH

- Ask students to read "The Life and Times of a Giant Kauri Tree" and create a class mural to show some of the events outlined in the book. Author Dave Gunson is available to visit classes through the Writers in Schools programme. See **www.bookcouncil.co.nz** for details on how to book a visit.

VISUAL ARTS

- Collect items from nature and make a collage 'forest'. Have students write the name of a plant or animal, or a statement that sums up how they feel about trees as part of their artwork.

LEVEL 3 AND 4 FIELD TRIP ACTIVITIES

These are activities that can be done in any outdoor situation. They are designed to slow students down and become immersed in nature. They may be carried out in a forest (see background information 'Where Can I See Kauri'), under a tree in the school grounds, or at the Auckland Zoo Te Wao Nui Forest habitat where there are young kauri and a cleaning station.

Kauri are part of an interdependent forest system: many plants and animals make up the forest. Kauri dieback disease is killing our kauri but we can contain it to protect our healthy kauri forests.

- Silent Forest Walk - If you have students that can do this, get them to walk in silence for 5 minutes (or more). If they hear or see something, they have to tap someone on the shoulder without talking, and point to show what they are interested in. This can be carried out anywhere - it does not need to be a forest, though in a forest there will be less other human-made sound. Talk about how they felt being quiet, what did they notice?
- Stop at a cleaning station in the forest, or make your own in the school grounds. Practice using the 3 S's to keep kauri standing:
  - *Scrub your shoes*
  - *Spray your shoes*
  - *Stay on the track*
- Take magnifying glasses and identification charts (like the Andrew Crowe series – see bibliography) out. Carefully look in the soil and leaf litter to find invertebrates etc that live in the forest. Look under logs etc. but remind the students that this is the animal's home – they can look but if they pick the animals up they might hurt them. Always put logs etc. back the way they found them. Discuss how insects are an important part of the web of life. Record what/how many invertebrates are found.
- How Does a Kauri Grow? As you walk, look for male and female cones . Can they see any baby kauri, any rickers, any adults? Can they see any evidence of kauri dieback disease? Ask students to make some observational drawings.
- Visit the McCahon House in Titirangi to see infected kauri and learn about Colin McCahon (http://www.mccahonhouse.org.nz/PlanaVisit/ForSchools.aspx).
- Join a community planting day in your area to learn about New Zealand plant species
- Take a class visit to see the carved pou whenua representing the ancestry of Te Kawerau ā Maki outside the Arataki visitor centre in the Waitakere Ranges. Tiriwa, the oldest ancestor is at the top of the pou which is carved from kauri.
- Arataki – Waitakere Ranges (6km's from Titirangi)
  - Take a class visit to see the carved pou whenua representing the ancestry of Te Kawerau a Maki outside the Arataki Visitor Centre in the Waitakere Ranges.
  - Learning through Experience programmes: Book in for a guided walk down the Arataki Nature Trail to view a remnant kauri forest and enjoy their magnificent presence on our doorstep. Visit a cleaning station. Learn about the uniqueness of kauri, the logging history of the Waitakere Ranges and how it impacted on the biodiversity of the forest. Each guided walk can be tailored to suit specific learning needs. For more information about how to book and how our programmes below could fit your inquiry please call 817 0092 or email arataki.schoolbookings@aucklandcouncil.govt.nz or download our Learning through Experience programme booklet www.aucklandcouncil.govt.nz/education-forsustainability. 1883 Bushcamp (Years 5 – 8), Tales of Timber Trickery (Years 5-8), Maori and the Forest (Years 4 – 8), Arataki Nursery Adventure (Years 2 – 8) and Forest Ecosystem (Years 3 – 8).

LEVEL 3 AND 4 POST-VISIT ACTIVITIES

Post-visit learning experiences are designed to promote reflection and personal action in the individual.

Many people still don't know about kauri dieback and are spreading it without knowing. We need to inform everyone and make sure they clean their boots between kauri forests, to stop the spread of this disease and save our kauri forests.

SCIENCE/ENGLISH

- 'Jack and the Kauri Tree' activity sheet
- "Spread the Word, Not the Spores": ask students to write a letter to their friends or family or make a video as a class explaining what you've learnt and telling people what they can do. Send videos to **kauridieback@mpi.govt.nz** to be loaded onto the kauri dieback website.

ENGLISH/SCIENCE/VISUAL ARTS/EFS

- Make a Scrub, Spray and Stay' poster for your room and school using photos of the students carrying out each stage at a cleaning station near a kauri tree or in a forest.
- Look at some of Colin McCahon's paintings from the Titirangi years 1953-1960 at **www.mccahon.co.nz.** Have the students choose one painting each, or select one that you wish to choose as a class. Ask the students to write down how this painting makes them feel. What does it make them think of? Make own drawings or paintings in the style of Colin McCahon. How might McCahon have shown his precious kauri dying? See the "McCahon Kauri" worksheet.
- "Worrying times in Waipoua" worksheet.
- Submit pictures to your school newsletter, take home to share with friends and family or send to **kauridieback@mpi.govt.nz** to be loaded on the kauri dieback website.

SCIENCE/SOCIAL STUDIES

- Create a visual 'Day in the Life of a Kauri' incorporating all the animals and other plants in its day, or create a 'Thousand Years in the Life of a Kauri' including being a cone, a small plant, a ricker, an adult, the impact of people and kauri dieback.
- Read the "The Life and Times of a Giant Kauri Tree" as a class. Construct a timeline (if possible make it 60m long – the height kauri can grow to). Start from zero AD and finish with today. Include important points in New Zealand's history starting with: close to Zero AD - Tane Mahuta (our tallest tree, and a kauri) is a seed. Other points could include: Lake Taupo eruption 181 AD (5m), Maori arrival 900-1200 AD (30m), Rangitoto erupts 1400 (41m), 1642 First Europeans see NZ (50m), 1769 Captain Cook arrives (53m), 1840 Treaty of Waitangi signed (55m), 1987 All Blacks win the first Rugby World Cup (59m) finishing with the years that students in the class were born. You could measure this timeline in a straight line out from your classroom door and mark these events with chalk. Alternatively, ask the students to measure out 60m on a field and photograph with a child at each milestone (on a 60m timeline, 1m = ~33.55 years). Discuss these events and how the world has changed within the lifetime of Tāne Mahuta.

MATHS/ENGLISH/EFS

- Do a home survey and make a graph of how many people have family members who had heard about kauri dieback disease and what they can do to stop the spread, and how many have not. Build on this by deciding and actioning ways that the class can help create more awareness.

INTRODUCING...

BIODIVERSITY

- **Working in pairs, students are provided with a letter from the word 'Biodiversity'.** At this stage don't tell them what the word actually is. Students create a biodiversity collage by covering each letter with pictures of native plants, animals and the places they live. Pictures can be obtained from newspapers, magazines, travel brochures and calendars or simply drawn onto the letters.
- **Ask the students to rearrange the letters from the collage to make a word.** What words can they create? Will they be able to make the word 'biodiversity'? you may need to provide clues like starts with a 'b' ends with a 'y' etc.
- **In small groups students use a dictionary to discover the meaning of the word 'biodiversity'.** The word may need to be separated into individual parts eg bio + diversity. Biodiversity is actually a contraction of 'biological' and'diversity'. Students write down their own definition of the word.

  Bio = a prefix meaning life (plants and animals)

  Diversity = a variety of things (lots of different plants and animals)
- **Decide on a class definition for biodiversity.** For example biodiversity could be described as 'the different kinds of plants and animals and the places they live'. Refer back to the 'Biodiversity' collage to illustrate the components of biodiversity that are described in the definition.

HABITATS AND ECOSYSTEMS

- **This activity uses human settlement as an analogy to introduce the concept of habitats and ecosystems.** In this case a home is a habitat and a town is like an ecosystem, ie it is made up of lots of habitats and people that rely on interaction with one another for survival. A habitat is the specific place a plant or animal lives, eg under a rock, in a tree hollow, in a rotting log.
- **An ecosystem describes a community of plants and animals** interacting with each other and their surrounding environment eg a grassland ecosystem or woodland ecosystem.
- **To begin this activity ask the students to close their eyes and visualise what their home looks like.** How many windows does it have? What colour is it? What features does it have? etc. On a small piece of paper students draw the home they have just visualised. Once complete, students label the top of the paper with 'My Habitat'. Emphasise that the word habitat is just another word that describes the place a person or animal lives.

  Habitat = Home.
- **Ask students why their home or habitat is important to them.** With blu-tack students attach their drawings to the board or large sheets of cardboard. Arrange these homes so that they represent a town. Discuss what other features should be added to the town to make it complete – roads, parks, schools, shopping centres, creeks, bus stops, plants and animals. Draw in the missing features.

INTRODUCING... CONT.

Use the following discussion to help establish the analogy of a town operating like a natural ecosystem.

Ask the students to describe the ways people and places interact in the town, ie:

the habitats provide shelter and a safe place to live	**people move between habitats**
people move out of their habitat to find food	**people move out of their habitat to play**
some people have jobs that help other people	**some people have jobs that help keep the town healthy**

Emphasise the fact that the people in the town need their habitats and each other to survive. This is similar to what happens between animals, plants and their habitat in natural areas.

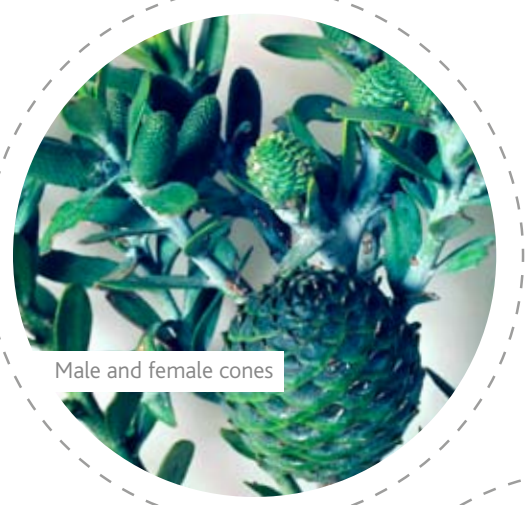
Introduce one of the ecosystem posters of your choice.

Discuss; we call some of the places we live town or cities, what do we call the place that plants and animals live? List these on the board. One word that can be used to describe the poster is 'ecosystem'. This word is used to describe natural places that have a variety of plants and animals that rely on each other and their habitats to survive.

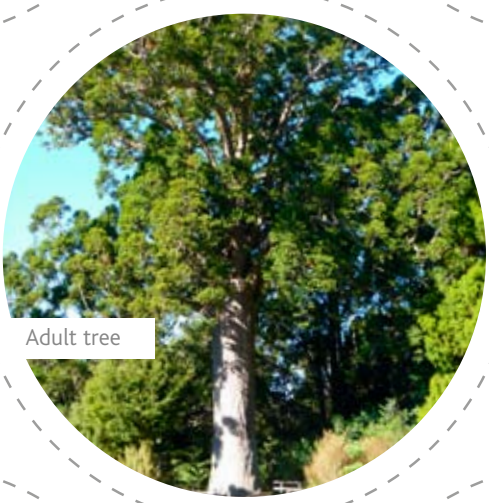
Emphasise that our cities, suburbs and towns are home to native plants and animals as well as people. We live in an 'urban ecosystem'.

LIFE CYCLE OF A KAURI TREE

Cut out these stages in a kauri tree's life. Put them in a lifecycle.


Male and female cones


Ricker


Adult tree


Seedling


Seeds

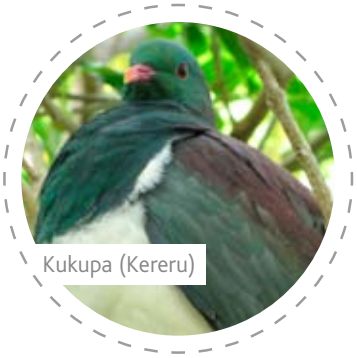
KAURI FOREST FOOD WEB

Create a food web by cutting out these pictures and connecting them with string. Draw more if you need. Put the kauri tree somewhere near the centre. What might happen to the food web if you removed:

1. The kiwi
2. The possum
3. The kauri
4. The kukupa


Forest Gecko


Sheet web spider


Kukupa (Kereru)


Earthworm


Tree Weta


Brown kiwi


Kauri Snail


Possum


Kauri


Nikau Palm


Kauri Greenhood Orchid

PHOTO: Eric Scanlen

WHAT MAKES MOULD GROW?

CONCEPTS Life Processes, Decomposition

LEARNING AREAS Science

One person can do all these experiments, or they can be spread throughout the class.
Try to get at least 3 repeats of the same experiment under the same conditions.

- **Bread mould is a living thing. It is a kind of fungus** (a bit like the disease killing kauri). It feeds on bread and decomposes, or rots, the bread.
- **Fungi do not have seeds like plants, but spread through tiny things called spores** (just like kauri dieback).
- **When fungi grow on bread and fruit, they look like fur.** They send thin threads (mycelia) into the thing they are growing in and spread by making fruiting bodies that have spores. We sometimes call these mushrooms or toadstools.
- **All living things need particular conditions to grow.** Some need light, some need dark. Some need hot or cold, others need dry or wet conditions. All of them need food and space.

Some people are allergic to bread mould (penicillin) – check first.

YOUR HYPOTHESIS (SCIENTIFIC GUESS):

I think that mould can spread through:

_____

I think that mould needs these things to grow on bread:

_____

TO DO THESE EXPERIMENTS YOU WILL NEED:

1. 4-8 slices of bread (if 4 then cut each in half – use the same type of bread for each slice)
2. Clean gladwrap
3. 4-8 paper bags or paper to wrap the bread
4. Plates to put bread on if you need to
5. A cold dark place (fridge)
6. A hot dark place (hot water cupboard or on top of the fridge)
7. Water and a water dropper or spoon
8. A dry dark place (use a paper bag on a windowsill)
9. A dry light place (a windowsill)
10. Light proof box
11. Magnifying glass

WHAT MAKES MOULD GROW? CONT.

EXPERIMENT 1: HOW DO MOULD SPORES SPREAD?

Place one slice of bread in air and another beside it but covered in clean gladwrap.
Leave for 1-2 weeks. Check every day. Write down your observations for each slice.

EXPERIMENT 2: DOES MOULD NEED WARMTH OR COLD?

Place one slice of bread in a paper bag and put it in the fridge. Place the other slice in a paper bag and place it on top of the fridge or on warm windowsill. Leave for 1-2 weeks. Check every day. Write down your observations for each slice.

EXPERIMENT 3: DOES MOULD NEED DRY OR WET?

Place one slice of bread in the air on a plate. Place the other slice beside it on a plate. Wet it with a dropper or spoon every day. Leave for 1-2 weeks. Check every day. Write down your observations for each slice.

EXPERIMENT 4: DOES MOULD NEED LIGHT OR DARK?

Place one slice of bread under a dark box. Place the other slice beside it in the light. Leave for 1-2 weeks. Check every day. Write down your observations for each slice.

EXTRA: Once you have grown mould place the mouldy bread by some new bread in the same conditions. What happens?

YOUR CONCLUSION:

What conditions makes mould grow?

What things would you change if you did this again?

How could you stop mould growing on food at home?

HOW DOES KAURI DIEBACK DISEASE KILL KAURI?

CONCEPTS Life Processes, Decomposition, Communicating in Science

LEARNING AREAS Science

- **A kauri dieback spore infects kauri through the roots** (growing threads or 'mycelium' into the root tissues) and eats away the tissues in the tree that carry water and nutrients to the canopy. The disease moves up and around the tree eating into new tissue and leaving behind dead/rotting tissues. The tree can still absorb water and nutrients through other roots and remain alive as the disease grows but eventually the tree is starved.
- **This activity has the student experiencing the effect of the rotting of plant root tissue** on the ability of a plant to suck up water, simulating the unhealthy root by piercing the straw with a pin above the water line.

MATERIALS AND EQUIPMENT:

Plastic straws, Pins, Cups, Water or juice, Timers

ACTIVITY:

1. Watch the "Kauri dieback animation" on youtube **http://youtu.be/P9s87bROTHM** and discuss as a class.
2. Organise students into 5 groups. Each group is given a cup of juice and straw with a different number of holes in it (each group represents different stages of infection).
3. Race to suck up the same amount of water/juice. Compare the time taken to suck up all the juice. OR can make it a bit of fun by having students with different numbers of holes in their straw representing different stages of infection, racing to suck up the same amount of water.
4. Draw up a class table and average the results. Ask students to graph these results.

Discuss how the holes in the straws/rotten tissues in the kauri affect water and nutrient uptake.

HOW LONG DO ROTTING ROOTS TAKE TO SUCK UP WATER?

Group	Number of holes in straw	Order to finish (fastest to slowest)
Group 1	Zero (healthy root)	1st
Group 2	10	
Group 2	20	
Group 4	30	
Group 5	40	

MCCAHON KAURI

Colin McCahon is one of New Zealand's greatest artists. For several years he lived in French Bay, surrounded by kauri. Around fifty of his works feature these trees within the painting, through words on the canvas or in the title. Today the very trees that have become famous through his paintings are dying from kauri dieback.

Find out what healthy and dead kauri trees look like at www.kauridieback.co.nz or during a field visit. See pictures of unhealthy kauri on page 16 of this kit.

Bush from the sun deck, Titirangi, 1956.

Kauri (unfinished) 1953.

Look at these paintings by Colin McCahon. Discuss what each of these paintings make you think of or feel.

1. Put yourself in the shoes of Colin McCahon viewing the dead kauri around his cottage.
2. Draw, or paint, something that will help tell people about kauri dieback disease.
3. Start with a sketch in the box below.

WORRYING TIMES IN WAIPOUA

- **Will Ngakuru is from Te Roroa iwi, in the kauri forest of Waipoua.** Today Waipoua forest: his home, and the home of his children, is under threat from kauri dieback disease. Will describes the songs of Te Roroa as being "songs with the rhythm of streams".
- **Look at the photo of Waipoua Forest.** Imagine the sounds – the birds, the river, the raindrops falling off the kauri canopy. Imagine the smell of wet leaf litter on the floor of the forest. Imagine the feel of fern fronds brushing past your arms as you walk through the forest, the sight of an eel winding silently under the stream bank.
- **Now look at the photo over the page and imagine walking around the skeletons of trees.** The birds have left – there is no food and shelter. Only the rain and the river remain.
- **The kauri are gone.**

DRAW A BEFORE AND AFTER KAURI DIEBACK PICTURE:

Show the richness of life in a kauri forest and what is left once kauri dieback infects the forest.

Before...

After...

WORRYING TIMES IN WAIPOUA CONT.

Waipoua Forest.

Dead kauri.

LEVEL 5

LEVEL 5 ACHIEVEMENT AIMS

SCIENCE:

- **Living World**
  Life Processes: Identify the key structural features and functions involved in the life processes of plants and animals.

  Ecology: Investigate the interdependence of living things (including humans) in an ecosystem.

- **Nature of Science**
  Investigating in Science
  Communicating in Science
  Participating and Contributing

ENGLISH:

- **Speaking, Writing, Presenting**

SOCIAL SCIENCES:

- **Social Studies: Place and Environment, Continuity and Change, The Economic World**

THE ARTS:

- **Visual Art- Understanding the Visual Arts in Context**

EFS:

- **Sustainability, Interdependence, Biodiversity**

LEVEL 5 PRE-VISIT ACTIVITIES

Pre-visit activities are designed to introduce concepts to students and provide a minimum knowledge before visiting an area where kauri trees grow.

Kauri are an important part of an interdependent forest system: many plants and animals make up the forest. Kauri dieback disease is killing kauri: this disease is spread through tiny spores in the soil.

SCIENCE

- Discuss the terms biodiversity, habitat and ecosystem as a class and explain how a natural ecosystem is balanced. The introduction of new species can cause an imbalance see 'Native, Introduced and Endemic' worksheet. Explain that kauri dieback is an 'introduced' species.
- Construct a food chain from the photos of some of the species found in a kauri forest (in additional resources section). Choose one of these species each and identify what parts of the animal and plant help them survive in a forest – i.e. identify the adaptations of that species. Which other species do they need to help them survive? Draw the food chain for this animal. See also 'Kauri Forest Food Web' worksheet.
- 'What makes mould grow?' worksheet. Discuss kinds of microbes and make a list of some that are harmful (include kauri dieback disease) and some that aren't. Brainstorm ways that diseases that affect humans can be spread? How might diseases that affect trees be spread?
- If you have microscopes in the class, study and measure a range of objects (strand of hair, pin head etc), under magnification. Kauri dieback spores are 30 microns in size, compare this with the other objects. Discuss fractions (eg. A kauri dieback spore is 30 microns, a human hair is around 90 microns wide, so a spore is 1/3rd of the size etc). Table and graph.
- 'How does kauri dieback kill kauri' worksheet
- Invite a Kauri Dieback Expert to join your class in person or via a video-conference/skype. Have the class 'interview' the expert.

SOCIAL STUDIES

- Pin up a map of the North Island or your local region. Students research where there are kauri forests and make little kauri tree figures to put in the places that they are in. Find out what kauri dieback is, which forests have it and which do not and which are closest to your school. Find out what measures are in place to protect these kauri and if you can help improve these.

VISUAL ARTS

- Look at some of Colin McCahon's paintings from the Titirangi years 1953-1960 see **www.mccahon.co.nz**. Have students choose one painting each and write down how this painting makes them feel. What does it make them think of? Have students make own drawings or paintings in the style of Colin McCahon. How might McCahon have shown his precious kauri dying? *(pre- or post-visit activity)*.

LEVEL 5 FIELD TRIP ACTIVITIES

These are activities that can be done in any outdoor situation. They are designed to slow students down and become immersed in nature. They may be carried out in a forest (see background information 'Where Can I See Kauri'), under a tree in the school grounds, or at the Auckland Zoo Te Wao Nui Forest habitat where there are young kauri and a cleaning station.

Kauri are part of an interdependent forest system: many plants and animals make up the forest. Kauri dieback disease is killing our kauri but we can contain it to protect our healthy kauri forests.

- Stop, Look and Listen. Close your eyes and try to identify as many sounds as possible. Open your eyes – can you see what was making those sounds? Record the **bird activity** in the area to understand how much life can be found in the forest. (**http://doc.govt.nz/getting-involved/for-teachers/outdoor-and-classroom-activities/recording-bird-information**)
- Silent Forest Walk – Yes – students can do this! Make the ones least likely to achieve this in charge of timing or keeping everyone quiet using finger to lip signals. Walk slowly in silence for 10 minutes (or more). If they hear or see something, they have to tap someone on the shoulder without talking, and point to show what they are interested in. This can be carried out anywhere - it does not need to be a forest, though in a forest there will be less other human-made sound. Afterwards, talk about how they felt being quiet, how they felt if they were disturbed by someone's sound, what they heard, new things they noticed.
- Use the cleaning stations if they are present and practice the 3 S's – Scrub, Spray and Stay on the track.
- Make a photographic record of your visit that can be used to make posters in the classroom later.
- How Does a Kauri Grow? As you walk, look for male and female cones. Can they see any baby kauri (seedlings, saplings), rickers or adults? Can they see any evidence of kauri dieback disease? What should they do if they think the kauri might have the disease? Ask students to make some observational drawings.
- Visit the McCahon House in Titirangi to see infected kauri and learn about Colin McCahon (**www.mccahonhouse.org.nz/PlanaVisit/ForSchools.aspx**).
- Arataki – Waitakere Ranges (6km's from Titirangi)
  - Take a class visit to see the carved pou whenua representing the ancestry of Te Kawerau a Maki outside the Arataki Visitor Centre in the Waitakere Ranges.
  - Learning through Experience programmes: Book in for a guided walk down the Arataki Nature Trail to view a remnant kauri forest and enjoy their magnificent presence on our doorstep. Visit a cleaning station. Learn about the uniqueness of kauri, the logging history of the Waitakere Ranges and how it impacted on the biodiversity of the forest. Each guided walk can be tailored to suit specific learning needs. For more information about how to book and how our programmes below could fit your inquiry please call 817 0092 or email **arataki.schoolbookings@auckland-council.govt.nz** or download our Learning through Experience programme booklet **www.aucklandcouncil.govt.nz/education-forsustainability**.

LEVEL 5 POST-VISIT ACTIVITIES

Post-visit learning experiences are designed to promote reflection and personal action in the individual.

Many people still don't know about kauri dieback and are spreading it without knowing. We need to inform everyone and make sure they clean their boots between kauri forests, to stop the spread of this disease and save our kauri forests.

ENGLISH

- 'Classroom discussion starters' worksheets, debate some of the issues around kauri dieback and visiting forests.
- Create a class video or song to explain why kauri are precious, what kauri dieback disease is and how we can all help stop the spread. You could do this from the viewpoint of kauri or another species that relies on kauri. Post these up on the school website, send to **kauridieback@mpi.govt.nz** to load onto the kauri dieback website or put up on YouTube.

ENGLISH/ SCIENCE/EFS

- 'Speak for the Trees' - read Dr Seuss's the Lorax for inspiration and write your own story or do a speech about the impact of kauri dieback.
- Construct a 'WHODUNNIT' play, poster or game where the victim is a kauri tree, the murderer is kauri dieback and the accomplices are anything that moves in a kauri forest e.g. people walking or on bikes, horse, dogs, water. A simple version of this activity could be a 'kauri killer' version of 'wink murder' : students could drop hand-cut leaves or simply fall down when they are infected.
- Add the web banner available at **www.kauridieback.co.nz** to your personal websites or blogs to help create awareness about this killer disease.
- 'Keep Kauri Standing' worksheet

SCIENCE

- 'Food chain reaction time' worksheet

VISUAL ARTS/ SCIENCE

- Design 'Keep Kauri Standing' or 'Save Our Kauri Forests' badges or t-shirt designs to help raise awareness.
- Design a poster to show what kauri dieback does and how we can stop the spread – you might be able to use the photos you took on your trip.
- 'McCahon Kauri' and 'Worrying Times in Waipoua' worksheets.

SOCIAL STUDIES/SCIENCE

- Create a board game or timeline showing stages in a kauri life, conditions that might speed up growth, setbacks like sawmilling, kauri dieback etc. Share these games with your buddy class or school library.
- 'Past, Present, Future' worksheet

SOCIAL STUDIES/ENGLISH

- Students can write a modern day short story equivalent based on kauri dieback disease, rather than the timber industry. The New Zealand Book Council website states that Joanna Orwin is available to talk to schools as part of the Writers in Schools programme. **www.bookcouncil.org.nz**
- Read Joanna Orwin's "Kauri in My Blood: The Diary of Laura Ann Findlay, the Coromandel, 1921-24" (Scholastic 2007).

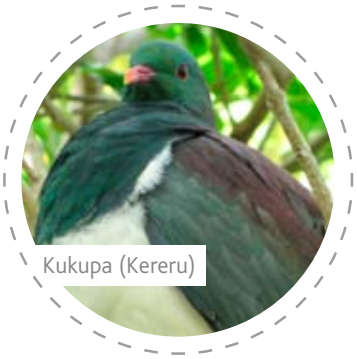
KAURI FOREST FOOD WEB

Create a food web by cutting out these pictures and connecting them with string. Draw more if you need. Put the kauri tree somewhere near the centre. What might happen to the food web if you removed:

1. The kiwi
2. The possum
3. The kauri
4. The kukupa


Forest Gecko


Sheet web spider


Kukupa (Kereru)


Earthworm

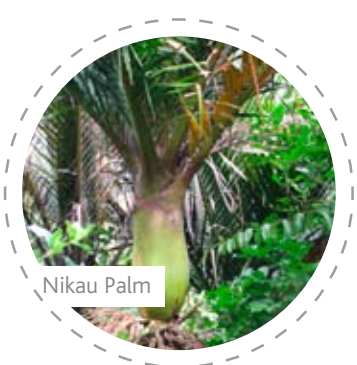

Tree Weta


Brown kiwi


Kauri Snail


Possum


Kauri


Nikau Palm


Kauri Greenhood Orchid

PHOTO: Eric Scanlen

NATIVE, INTRODUCED OR ENDEMIC

All the species in these pictures can be seen in a kauri forest. Use the biodiversity factsheets and/or internet research to group the species according to whether they are:

Endemic	**Introduced**	**Native**
found only in New Zealand	brought to New Zealand by humans	came to New Zealand by themselves (blown, flown or floated) and breed here

NZ Kauri:

Silver Fern:

North Island Brown Kiwi:

Eastern Rosella:

Tui:

Kukupa (kereru):

Possum:

Morepork:

Silvereye:

WHAT MAKES MOULD GROW?

CONCEPTS Life Processes, Decomposition

LEARNING AREAS Science

One person can do all these experiments, or they can be spread throughout the class.
Try to get at least 3 repeats of the same experiment under the same conditions.

- **Bread mould is a living thing. It is a kind of fungus** (a bit like the disease killing kauri). It feeds on bread and decomposes, or rots, the bread.
- **Fungi do not have seeds like plants, but spread through tiny things called spores** (just like kauri dieback).
- **When fungi grow on bread and fruit, they look like fur.** They send thin threads (mycelia) into the thing they are growing in and spread by making fruiting bodies that have spores. We sometimes call these mushrooms or toadstools.
- **All living things need particular conditions to grow.** Some need light, some need dark. Some need hot or cold, others need dry or wet conditions. All of them need food and space.

Some people are allergic to bread mould (penicillin) – check first.

YOUR HYPOTHESIS (SCIENTIFIC GUESS):

I think that mould can spread through:

I think that mould needs these things to grow on bread:

TO DO THESE EXPERIMENTS YOU WILL NEED:

1. 4-8 slices of bread (if 4 then cut each in half – use the same type of bread for each slice)
2. Clean gladwrap
3. 4-8 paper bags or paper to wrap the bread
4. Plates to put bread on if you need to
5. A cold dark place (fridge)
6. A hot dark place (hot water cupboard or on top of the fridge)
7. Water and a water dropper or spoon
8. A dry dark place (use a paper bag on a windowsill)
9. A dry light place (a windowsill)
10. Light proof box
11. Magnifying glass

WHAT MAKES MOULD GROW? CONT.

Place one slice of bread in air and another beside it but covered in clean gladwrap.
Leave for 1-2 weeks. Check every day. Write down your observations for each slice.

EXPERIMENT 2: DOES MOULD NEED WARMTH OR COLD?

Place one slice of bread in a paper bag and put it in the fridge. Place the other slice in a paper bag and place it on top of the fridge or on warm windowsill. Leave for 1-2 weeks. Check every day. Write down your observations for each slice.

EXPERIMENT 3: DOES MOULD NEED DRY OR WET?

Place one slice of bread in the air on a plate. Place the other slice beside it on a plate. Wet it with a dropper or spoon every day. Leave for 1-2 weeks. Check every day. Write down your observations for each slice.

EXPERIMENT 4: DOES MOULD NEED LIGHT OR DARK?

Place one slice of bread under a dark box. Place the other slice beside it in the light. Leave for 1-2 weeks. Check every day. Write down your observations for each slice.

EXTRA: Once you have grown mould place the mouldy bread by some new bread in the same conditions. What happens?

Use the observation sheet on page 59 to write down what you see. Then write down your conclusions below.

YOUR CONCLUSION:

What conditions makes mould grow?

What things would you change if you did this again?

How could you stop mould growing on food at home?

WHAT MAKES MOULD GROW? CONT.

OBSERVATIONS SHEET: WRITE DOWN WHAT YOU SEE.

Make eight copies of this sheet (two per experiment) per student.

Experiment number: ☐

Slice: ONE ☐ or TWO ☐ (Use one page per slice)

Day 1	Day 2	Day 3	Day 4

Day 5	Day 6	Day 7	Day 8

Day 9	Day 10	Day 11	Day 12

HOW DOES KAURI DIEBACK DISEASE KILL KAURI?

CONCEPTS Life Processes, Decomposition, Communicating in Science

LEARNING AREAS Science

- **A kauri dieback spore infects kauri through the roots** (growing threads or 'mycelium' into the root tissues) and eats away the tissues in the tree that carry water and nutrients to the canopy. The disease moves up and around the tree eating into new tissue and leaving behind dead/rotting tissues. The tree can still absorb water and nutrients through other roots and remain alive as the disease grows but eventually the tree is starved.
- **This activity has the student experiencing the effect of the rotting of plant root tissue** on the ability of a plant to suck up water, simulating the unhealthy root by piercing the straw with a pin above the water line.

MATERIALS AND EQUIPMENT:

Plastic straws, Pins, Cups, Water or juice, Timers

ACTIVITY:

1. Watch the "Kauri dieback animation" on youtube **http://youtu.be/P9s87bROTHM** and discuss as a class.

2. Students work in pairs (taking turns at sucking and timing) and are given a healthy root (straw) to suck up 250mls of water. Record time in table.
3. The root is then infected with dieback and tissues are rotted (pierce the straw many times with a pin above the water line). Then students are challenged to try and suck up the same amount of water. Compare the time taken.
4. OR can make it a bit of fun by having students with different numbers of holes in their straw representing different stages of infection, racing to suck up the same amount of water.
5. Here is also an ideal opportunity to run a more formal controlled scientific investigation. Discuss variables such as having different students sucking at different rates. You will still see a difference between the healthy and infected roots/straws. See table over for suggested numbers of holes for 250 ml water. Discuss repetitions/trials. Students can work out their average and graph their results.
6. Students write a statement about how the plant's water uptake is affected by dieback infection OR write a personal response to progressive infection as thought they were the plant struggling to get enough water.

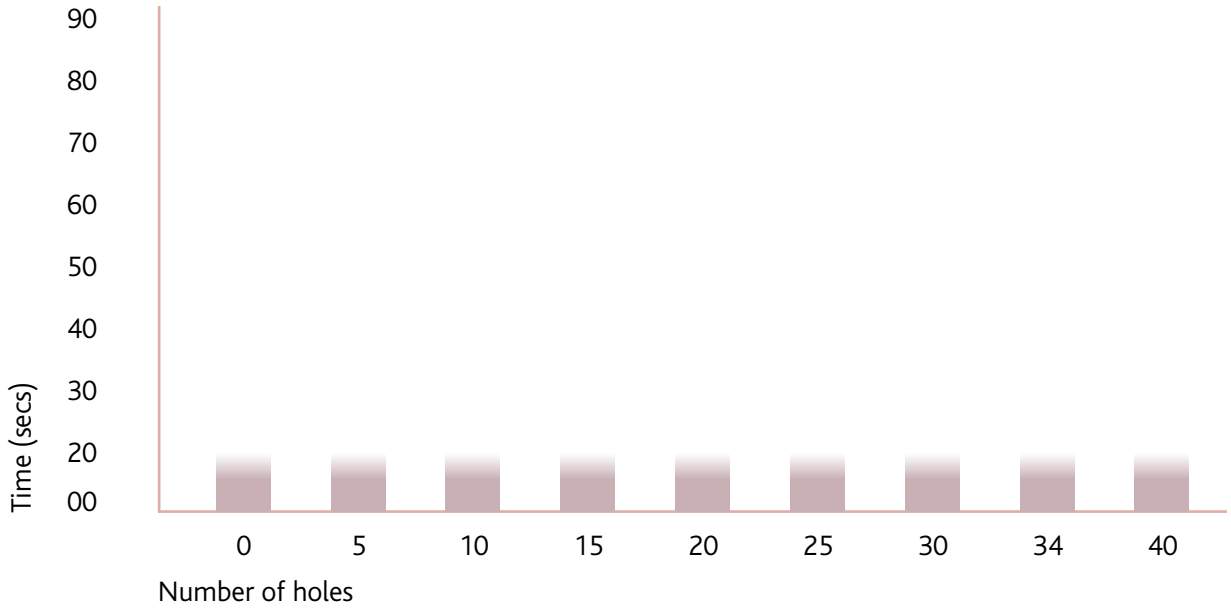
HOW DOES KAURI DIEBACK DISEASE KILL KAURI? CONT.

HOW LONG DO INFECTED ROOTS TAKE TO SUCK UP WATER?

Name:

Number of holes in straw	Time taken to suck up 250mls water (in seconds)			
	TRAIL 1	TRAIL 2	TRAIL 3	Average
Zero (healthy root)				
5 holes				
10 holes				
15 holes				
20 holes				
25 holes				
30 holes				
35 holes				
40 holes				

GRAPH THE RESULTS BELOW (USING THE AVERAGE):



CLASSROOM DISCUSSION STARTERS: WHAT WOULD YOU DO?

CONCEPTS Sustainability, Kaitiakitanga (Guardianship), Responsibility for Action, Interdependence

LEARNING AREAS Science | Social Science | English

1 **You live near some large kauri trees which escaped the logging carried out by early European loggers in the 1800s and early 1900s.** They used the wood to make ship masts and houses.

You have always played under the trees and now that you are older you like to walk and sit under them. Big kauri forests near you bring tourist dollars into your community.

You know that kauri have shallow feeding roots and can be killed by people or cars trampling the roots. Now you have heard that kauri trees in other areas are dying from something called kauri dieback disease. It is caused by a tiny microorganism like a fungus. Its spores are spread in water and soil and can kill trees in months and sometimes even weeks. People can spread the disease on their shoes when they go from an infected area into a forest without kauri dieback.

Some people in the community want to protect the forests and trees near you and keep people out (even you won't be able to visit).

Others say the community needs the money from tourism and people should keep visiting.

What would you do?

2 **Your family has been on holiday and you have visited Tane Mahuta, a kauri which is the tallest tree in New Zealand.** It is over 50 metres tall (that's over half the length of a rugby field) and more than 2000 years old.

Someone has told you that kauri are taonga (treasures). New Zealand kauri Agathis australis is endemic to New Zealand – it is only found in New Zealand though there are other kauri species in Australia, New Caledonia and a few other countries.

You want to grow kauri and collected seeds from female cones when you visited Waipoua Forest.

You know that kauri are very slow growing trees. They don't start producing cones until they are around 30 years and many of their seeds don't germinate so you collected lots of cones.

What would you do? Are you helping or harming kauri?

3 **You and your mates are going for a walk in a forest.** There are some kauri trees in it, but it isn't a forest. You know where the kauri trees are because there are cleaning stations either side of them. You are supposed to scrub your shoes to get old soil off in case it has kauri dieback spores in it, then spray your shoes with the trigene disinfectant in the bottle to clean your shoes, and stay on the track. You have to do it again once you've passed the tree.

One of your mates thinks it is cool that people are trying to protect kauri. Your other mate says what a waste of time and the spray just makes your shoes wet. This friend refuses to clean their shoes. Your mate's dog (which wasn't on a lead) has run off and into the bush away from the track. The friend that cleaned their shoes says they will go off the track and find the dog because their shoes are clean.

What would you do?

KEEP KAURI STANDING

UNDER EACH IMAGE WRITE WORDS, IDEAS AND FEELINGS THAT THE PHOTOS BRING TO YOUR MIND.

Write a message that will help educate visitors to a kauri forest about kauri dieback disease.

FOOD CHAIN REACTION TIME

- **Food chains show the pattern of eating and being eaten in an ecosystem.** Copy and cut out these names of species and roles in a food chain.
- **How quickly can you make a food chain?** Have a class competition! How many different food chains can you make?

PRODUCER

CONSUMER

DECOMPOSER

CARNIVORE

HERBIVORE

SCAVENGER

KAURI

CAT

KIWI

DOG

KUKUPA

EARTH WORM

MOSQUITO

LONG-TAILED BAT

KAKA

MOREPORK

KAURI GRASS

BRACKET FUNGUS

KAURI SNAIL

POSSUM

TUI

NIKAU PALM

LONG-FINNED EEL

RAT

MCCAHON KAURI

Colin McCahon is one of New Zealand's greatest artists. For several years he lived in French Bay, surrounded by kauri. Around fifty of his works feature these trees within the painting, through words on the canvas or in the title. Today the very trees that have become famous through his paintings are dying from kauri dieback.

Bush from the sun deck, Titirangi, 1956.

Kauri (unfinished) 1953.

What do each of these paintings make you think of or feel?

1. Put yourself in the shoes of Colin McCahon viewing the dead kauri around his cottage.
2. Draw, or paint, something in the style of Colin McCahon that will help tell people about kauri dieback disease.
3. Start with a sketch in the box below.

WORRYING TIMES IN WAIPOUA

- **Will Ngakuru is from Te Roroa iwi, in the kauri forest of Waipoua.** Today Waipoua forest: his home, and the home of his children, is under threat from kauri dieback disease. Will describes the songs of Te Roroa as being "songs with the rhythm of streams".
- **Look at the photo of Waipoua Forest on page 63.** Imagine the sounds – the birds, the river, the raindrops falling off the kauri canopy. Imagine the smell of wet leaf litter on the floor of the forest. Imagine the feel of fern fronds brushing past your arms as you walk through the forest, the sight of an eel winding silently under the stream bank.
- **Now imagine walking around the skeletons of trees.** The birds have left – there is no food and shelter. Only the rain and the river remain.
- **The kauri are gone.**

Write a poem, or draw a before and after kauri dieback picture to show the richness of life in a kauri forest and the legacy (what is left) once kauri dieback infects the forest.

Before...

After...

WORRYING TIMES IN WAIPOUA CONT.

WAIPOUA FOREST

PAST, PRESENT FUTURE

CONCEPTS Time, Continuity and Change/ Place and Environment

LEARNING AREAS Social Science English

A TEXT INTERPRETATION EXERCISE:

This extract is from John Logan Campbell's memoir 'Poenamo'. He is seeing Auckland for the first time. Read the extract. Then answer the questions (you may wish to work with a partner).

"Ah! never can I forget that morning when I first gazed on the Waitemata's waters. The lovely expanse of water, with its gorgeous colouring, stretched away to the base of Rangitoto, whose twin peaks, cutting clearly into the deep blue sky, sloped in graceful outline to the shore a thousand feet below. ...How silent and peaceful were Waitemata's lovely sloping shores as we explored them on that now long long ago morning! As we rowed over her calm waters the sound of our oars was all that broke the stillness. No, there was something more - the voices of four cannie Scotchmen and one shrewd Yankee (the sum and substance of the first invading civilisation), loud in the praise of the glorious landscape which lay before them. On that morning the open country stretched away in vast fields of fern, and Nature reigned supreme. It is fern-clad no longer, but green fields gladden the eye; the white gleam of the farmer's homestead dots the landscape, there are villas on the height, and cottages on the shore."

John Logan Campbell.
Poenamo - Sketches of Early Days in New Zealand, 1881

What do you think John Logan Campbell was feeling when he wrote this?

What is John Logan Campbell known for?

PAST, PRESENT FUTURE CONT.

What might have existed on this land before the homesteads?

Where did the wood for these homesteads come from?

What sort of things would the people who lived in those homesteads have been doing?

If John Logan Campbell had arrived 50 years earlier, what might he have seen, heard and felt?

Imagine he is arriving in Auckland for the first time next week. Write a paragraph in a similar style, using the language of today and what he would be seeing, hearing and feeling.

Repeat the same exercise, but project John Logan Campbell 50 years into the future.

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

CONCEPTS Biodiversity, Interdependence

LEARNING AREAS Science

KAURI SNAIL Pupurangi, *Paryphanta busbyi*

WHAT

Giant carnivorous (eats meat) land snail.

WHERE

Endemic to New Zealand -now lives only in a few forested areas in Northland and Auckland, though was once more widespread. (There is also another species that lives on Hen Island).

NEEDS

Eat earthworms, slugs, snails and other invertebrates (animals without a backbone)/ lives in moist leaf litter in forests.

LIFE CYCLE

Adult snails lay eggs in moist covered holes in the ground.

The eggs take around a month and a half to hatch.

Baby snails called hatchlings Baby snails called hatchlings, spend their first few weeks underground feeding on small invertebrates.

RELATIONSHIP TO KAURI

Kauri snails live in the same areas as kauri, though they can also live in forests in this area that do not have kauri. The snails live in the moister areas of the forest.

DID YOU KNOW..?

- Kauri snails are top predators on the forest floor. They suck up earthworms like spaghetti! They kill their prey by suffocating them in goo.
- Giant kauri snails can live up to 20 years.
- They are nocturnal – on wet nights they can travel up to a metre a minute and have been known to move 10-15 metres in several nights.

DID YOU KNOW..?

- Kauri snails are an endangered species.
- Their forest habitat has been destroyed by forests being cut down and the land being turned into farms
- Introduced pests like rats, hedgehogs and possums love eating kauri snails. Possums eat the adults but rats prefer the babies.

How Can You Help?

You can help kauri snails by staying on the track when you walk in forests and watching where you put your feet – don't stand on them! If you find empty kauri snail shells, leave them there to allow the calcium to return to the ground– living snails get their calcium from the ground.

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

Kauri Snail, Pupurangi, *Paryphanta busbyi*

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

CONCEPTS Biodiversity, Interdependence

LEARNING AREAS Science

AUCKLAND TREE WETA Putangatanga, *Hemideina thoracica*

WHAT

Flightless, nocturnal insects.

WHERE

Endemic to New Zealand. Auckland tree weta found throughout the North Island apart from Wellington-Wairarapa region - lives in the Auckland region. There are other tree weta species in other parts of New Zealand.

NEEDS

Plant material to feed on (they will also scavenge dead insects)/ holes for sleeping and breeding in/ a predator-free environment.

LIFE CYCLE

Adult females lay eggs in the soil during autumn and winter – up to 300 over several weeks. The eggs hatch in spring.

Baby weta are called nymphs or juveniles and look just like little adults. They shed their exoskeleton up to 10 times as they go through their juvenile stages.

Tree weta are adult at around 2 years old. They can live another 10 months after that.

RELATIONSHIP TO KAURI

Tall trees like kauri and other forest trees provide a lot of homes for weta.

DID YOU KNOW..?

- Tree weta have ears on their knees.
- Weta have been around for 200 million years.
- Male weta have much bigger heads than females – they use their large palps (biting bits) to keep other males away from their females.
- Female weta look as if they have a sting, but this is just their ovipositor for laying eggs.
- Male weta make a 'tsit tsit' noise by rubbing their spiky back legs on their abdomen – this is called stridulating.

DID YOU KNOW..?

- Introduced species such as rats, cats and possums are all threats to weta because they hunt at night when weta are active.

How Can You Help?

Leave some old trees or branches on your plants – these make good weta holes. You can make weta hotels by hanging up sticks of hollow bamboo.

Keep your cats in at night. They hunt at night when weta are active. Cats do not need to eat weta, but moreporks do.

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

Auckland Tree Weta, Putangatanga, *Hemideina thoracica*

Female weta.

PHOTO: Landcare Research

Male weta.

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

CONCEPTS Biodiversity, Interdependence

LEARNING AREAS Science

MOREPORK Ruru, *Ninox novaeseelandia*

WHAT

Nocturnal bird of prey.

WHERE

Native to New Zealand - lives in forested areas especially where there are tree ferns.

NEEDS

Eat weta, moths, lizards, mice and other small nocturnal animals/ thick planted areas to sleep in during the day/ holes in trees for nesting in.

LIFE CYCLE

Adult females lay 1-3 eggs in spring. The egss are incubated for 25 days before hatching.

Baby owls are covered in soft grey down before being fully fledged (getting all their adult feathers) at about 35 days old.

RELATIONSHIP TO KAURI

Kauri forests provide shelter for tree ferns, which morepork love to roost in during the day.

DID YOU KNOW..?

- Ruru means big eyes.Morepork have big eyes which are important for hunting at night – they catch their food while they are flying.
- Moreporks can't move their eyes, but they can turn their heads 270 degrees (nearly ¾ of the way around).
- The name 'morepork' comes from the soft call they make. They also make a sharp 'creee' sound.
- Morepork can fly silently because their feathers have softened edges to help muffle sound. Even their legs are feathered.
- Their face is shaped like a disc which directs sound to their ears.

DID YOU KNOW..?

- Cats and rats eat weta – one of the morepork's food sources. Rats have also been known to eat the eggs and chicks of morepork.
- Habitat has been lost due to logging of bush.

How Can You Help?

Leave some old trees with holes in your gardens – these make good morepork nest sites.

If you see people cutting down trees, ask them if they have checked that there are no nesting birds in it first.

Keep your cats in at night. They kill morepork chicks and eat weta which is morepork food.

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

Morepork, Ruru, *Ninox novaeseelandia*

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

CONCEPTS Biodiversity, Interdependence

LEARNING AREAS Science

BROWN KIWI *Apteryx mantelli*

WHAT

Nocturnal, flightless bird.

WHERE

Endemic to North Island of New Zealand (there are other species of kiwi in other parts of New Zealand).

NEEDS

Eat invertebrates and fruit that they find in or on the forest floor/ large areas of bush and scrub as they have large territories/a predator free environment.

LIFE CYCLE

Adult females lay 1-2 eggs, around 30 days apart

The male incubates the eggs for about 75 days.

North Island brown kiwi chicks hatch fully feathered as the parents do not look after them after they have hatched.

Adult birds can live around 20 years but can even live up to 60 years in predator free areas.

RELATIONSHIP TO KAURI

Fallen branches and logs in kauri forests makes excellent kiwi habitat. A lot of insects that kiwi eat live in the leaf litter of the forest floor.

DID YOU KNOW..?

- Kiwi are the only bird in the world with nostrils at the very tip of the beak.
- Kiwi have tiny little wings (about the length of a matchstick).
- They have an excellent sense of smell. Whiskers help them feel their environment in the dark.
- Strong legs and claws help them dig burrows to sleep and nest in, and kick to protect themselves.
- A kiwi egg is one of the biggest eggs in proportion to adult female body size in the world.

DID YOU KNOW..?

- Around 90% of kiwi chicks die before they are 6 months old and only 5% make it to adulthood. Introduced species such as cats and stoats are responsible for many of those deaths.
- Dogs that are left to roam are the biggest threat to kiwi in Northland, where 1/3 of North Island brown kiwi live.
- Habitat has been lost due to logging of bush.

How Can You Help?

Keep your dog on a lead when walking in kauri forests or other kiwi habitat.

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

North Island Brown Kiwi, *Apteryx mantelli*

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

CONCEPTS Biodiversity, Interdependence

LEARNING AREAS Science

KAKA *Nestor meridionalis*

WHAT

Large forest parrot.

WHERE

Endemic to New Zealand- live in forested areas and sometimes seen in gardens or orchards.

NEEDS

Eat nectar, seeds, fruit and invertebrates/ forested areas to forage and sleep in/ holes in trees for nesting in/ a predator-free environment.

LIFE CYCLE

Eggs are laid in holes in trees (cavities) during Spring /Summer and take 3 weeks to incubate. The female does most of the incubation.

Kaka chicks stay in the nest for 2 months. Both parents feed the chicks, though the male does most of it.

Adults can live for over 20 years.

RELATIONSHIP TO KAURI

Kaka use their strong beaks to open kauri cones to get seeds and for pulling bark off tree trunks to find insects.

DID YOU KNOW..?

- Kaka have a brush-tipped tongue to help them get nectar from flowers like kowhai, puriri and flax. This means they are important pollinators of New Zealand plants.
- Kaka are browny- red with grey feathers on their heads.
- There are 2 sub-species of kaka, the North Island and South Island sub-species.
- Strong feet allow them to hang upside down to feed.
- Kaka are very noisy birds and make a wide range of sounds.
- The male feeds the female while she is incubating the eggs.
- Kaka are related to kea and kakapo.

DID YOU KNOW..?

- Kaka were once common throughout New Zealand. A lot of kaka habitat has been lost due to logging of bush.
- Chicks sometimes leave the nest before they can fly and introduced pests like stoats and cats kill them.
- Chicks and females have been killed on the nest by rats and stoats.

How Can You Help?

Plant a 'kaka kitchen' such as kowhai, rata and kauri. Kaka love to eat the seeds or flowers that these plants provide.

Keep a record of kaka sightings in your area –try and find out why they are coming at that time of the year.

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

Kaka, *Nestor meridionalis*

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

CONCEPTS Biodiversity, Interdependence

LEARNING AREAS Science

KAKARIKI Red-crowned Parakeet, *Cyanoramphus novaezelandiae*

WHAT

Small green parakeet.

WHERE

Native to New Zealand (also found in New Caledonia, Lord Howe and Norfolk Islands) – rare in forested areas on the mainland, largely restricted to offshore islands like Great Barrier. There are other kakariki species that are endemic to New Zealand.

NEEDS

Eat flowers, seeds, berries and insects/ forested areas to forage and sleep in/ holes in trees for nesting in/ a predator-free environment.

LIFE CYCLE

Eggs are laid in holes in trees (cavities) or in cliffs during spring /summer and take around 20 days to incubate. The female incubates the eggs.

Kakariki chicks are fed by both parents

Adults can live around 12- 15 years.

RELATIONSHIP TO KAURI

Kakariki use their strong beaks to open kauri cones to get seeds.

DID YOU KNOW..?

- Kakariki means green.
- They feed in trees but also forage on the forest floor more than other kakariki species.
- The male calls the female off the eggs to feed her when she is incubating them.
- Kakariki usually live alone or in pairs, but sometimes form flocks in autumn and winter.
- They make a k-k-k-k noise when they are flying.

DID YOU KNOW..?

- Kakariki were once so common in New Zealand that farmers considered them pests to their crop species. Many kakariki were shot.
- Kakariki females and chicks are often killed by introduced pests like rats and stoats that climb into their nest holes. Chicks are also killed when they are fed on the ground before they can fly.
- Their habitat has been lost due to logging of bush.

How Can You Help?

If there are kakariki in your area, plant flax and kauri to feed them.

If there are old trees with holes in them, tell people that these are good nesting sites for birds like kakariki, kaka and morepork.

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

Kakariki, Red-crowned Parakeet, *Cyanoramphus novaezelandiae*

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

CONCEPTS Biodiversity, Interdependence

LEARNING AREAS Science

FOREST GECKO *Hoplodactylus granulatus*

AUCKLAND GREEN GECKO *Naultinus elegans elegans*

WHAT

Lizards.

WHERE

Endemic to New Zealand- live in forested areas and scrub.

NEEDS

Eat berries, nectar and insects/ forested areas to forage and sleep in/ holes in trees for nesting in.

LIFE CYCLE

Even though geckos are reptiles, New Zealand geckos give birth to live young (usually twins) in autumn or early winter.

Adults can live for over 40 years.

RELATIONSHIP TO KAURI

Kauri trees provide a protective canopy for other plants that gecko can feed in.

FOREST GECKO

- Nocturnal (active at night)
- Brown markings help them camouflage on the bark of trees. They can darken or lighten their markings to help them blend in.

AUCKLAND GREEN GECKO

- Diurnal (active in the day)
- Green colour - sometimes with white blotches down their backs to camouflage them in leaves.
- Green geckos make a noise like a small bark.

DID YOU KNOW..?

- Lizards in New Zealand are either skinks or geckos. (Tuatara are not lizards).
- Geckos live in plants, have soft baggy skin, a neck that is clearly shaped, and they lick their eye balls to clean them. Skinks live on the ground, have a snake-like head and neck, and blink to clean their eyes.
- Hairs on their feet help geckos climb upside down on surfaces.
- Gecko tails can drop off to distract predators and give the gecko time to escape. The tail regrows over a few years.

DID YOU KNOW..?

- Both forest and Auckland green gecko are killed by introduced mammals like rats, stoats, possums and cats.
- Habitat has been lost due to logging of bush.

How Can You Help?

Create lizard gardens – rocks, stones and native grasses for skinks, shrubby branching plants (manuka, hebe, pittosporums, coprosmas)for geckos.

Keep your cat in at night. They hunt when geckos are active.

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

Forest Gecko, *Hoplodactylus granulatus*

Auckland Green Gecko, *Naultinus elegans elegans*

Forest Gecko.

Auckland Green Gecko.

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

CONCEPTS Biodiversity, Interdependence

LEARNING AREAS Science

LONG-TAILED BAT Pekapeka, *Chalinolobus tuberculatus*

WHAT

Small bat – about the size of a mouse.

WHERE

Endemic to New Zealand– found throughout New Zealand in forested areas (including the Waitakere Ranges).

NEEDS

Eat insects such as moths and mosquitoes/ forested areas with caves or holes in trees for nesting in/ a predator-free environment.

LIFE CYCLE

They are mammals – babies are born live (usually 1) and fed on milk.

Baby bats can fly at around 4-6 weeks of age.

Adults have been known to live more than 30 years but it is not yet known exactly how long they can live.

RELATIONSHIP TO KAURI

Kauri trees live a long time, as they get older holes form in the tree which provide good roosts for bats.

DID YOU KNOW..?

- There are only 2 endemic land mammal species in New Zealand and they are both bats - the long-tailed bat and the lesser short-tailed bat. (The short-tailed bat is unusual as it crawls over the ground as well as flies).
- Long-tailed bats have a longer tail and small ears.
- Long-tailed bats can fly at 60km/hour.
- They catch their food when they fly. They are most active just as it gets dark (at dusk) and use echolocation to find their food – they make high click sounds which echoes back off their prey and help the bat sense where the food is.
- Long-tailed bats have a very good sense of smell but poor eyesight.

DID YOU KNOW..?

- Bats of both species are often killed by introduced pests like rats, cats, possums and stoats.
- Roosting sites have been lost due to logging of bush.

How Can You Help?

If there are old trees with holes in them tell people that these are good nesting sites for bats and birds like kakariki, kaka and morepork.

If there are bats in your area, keep a record of sightings and numbers and keep your cat in at night.

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

Long-tailed Bat, Pekapeka, *Chalinolobus tuberculatus*

PHOTO: Dept of Conservation

Long-tailed Bat.

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

CONCEPTS Biodiversity, Interdependence

LEARNING AREAS Science

NIKAU *Rhopalostylis sapida*

WHAT

New Zealand's only palm tree.

WHERE

Endemic to New Zealand- grows in the North Island and on the coasts of the South Island to as far south as Punakaiki.

NEEDS

Warmth (no frosts), moisture, birds to distribute its seeds.

LIFE CYCLE

Long pink flower heads grow in summer. There are separate male and female flowers.

Red berries develop the year after the flowers have grown. Each berry has one seed.

Adults can take around 40-50 years to form a trunk and 200 years to get to full height (around 10 metres)

RELATIONSHIP TO KAURI

Kauri forests form protective canopies which shade plants like nikau. Nikau and kauri grow in similar areas because they both need frost-free environments.

DID YOU KNOW..?

- Nikau are the world's southern-most palm species.
- Tui love to feed on the flower nectar and the berries are a favourite of kukupa.
- Nikau leaves are called fronds.
- The rings on a nikau trunk are leaf scars, where old fronds have fallen off.
- Nikau are very slow growing. It is possible to roughly work out the age of a nikau by counting the leaf scars – about 2 fronds fall off every year. (remember to account for the time it takes before a trunk is formed too).

DID YOU KNOW..?

- Introduced pests like rats and possums eat the seed and kill them so they cannot germinate.
- Many forest habitats have been lost due to logging of bush.

How Can You Help?

If you have a nikau plant in your garden, collect its seed and grow nikau palms. Plant them around your neighbourhood where they will get a good water supply.

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

Nikau, *Rhopalostylis sapida*

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

CONCEPTS Biodiversity, Interdependence

LEARNING AREAS Science

PERCHING LILY Kahakaha, *Collospermum hastatum*

WHAT

A nest epiphyte- they grow on other trees and make big clumps that look like large bird nests.

WHERE

Endemic to New Zealand- grows in the North Island and in the north of the South Island.

NEEDS

Warmth, moisture, a tall tree (like a kauri) to grow on and get better light.

LIFE CYCLE

Yellow flower heads grow in summer. Male and female flowers are on separate plants.

Red berries develop on female flowers in autumn.

RELATIONSHIP TO KAURI

The angle where a branch joins the trunk of the kauri tree provides a place for perching lilies and other epiphytes to grow. Kauri trunk bark flakes off as the tree grows, to stop epiphytes from smothering it over its long life.

DID YOU KNOW..?

- Perching lilies long v-shaped leaves channel water into a leafy central reservoir for the plant to use. One of New Zealand's native mosquitoes breeds exclusively in these small reservoirs of water..
- Perching lilies were called 'widow makers' in the saw-milling days. Some plants get so big and hold so much soil and water that whole tree branches can break and fall on to whatever is below. This may have been the sawmillers – leaving their wives as widows if the sawmiller was killed.
- Birds eat and disperse the seeds.
- The base of a perching lily plant looks black from the old roots and leaves rotting and turning into soil.

DID YOU KNOW..?

- Introduced pests like rats and possums eat the seed and compete with endemic birds, so the seeds do not get spread.
- Many forest habitats have been lost due to logging of bush.

How Can You Help?

If you have a tall tree with a perching lily growing in it in your school or neighbourhood, show and tell people about it.

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

Perching Lily, Kahakaha, *Collospermum hastatum*

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

CONCEPTS Biodiversity, Interdependence

LEARNING AREAS Science

KAURI GREENHOOD ORCHID *Pterostylis agathicola*

WHAT

Ground orchid.

WHERE

Endemic to New Zealand- grows only in kauri forest.

NEEDS

Warmth, moisture, kauri trees to grow under.

LIFE CYCLE

Flowers have a top petal that curves like a hood and a bottom petal like a landing stage for insects.

Tiny seeds are wind dispersed.

The plant grows underground tubers. After flowering it dies back underground. The next year it grows a new tuber and flowers again. Sometimes tubers can spread to form new plants.

RELATIONSHIP TO KAURI

New Zealand orchid seeds will only grow into plants if they are in a symbiotic relationship with fungi which helps them extract nutrients from the soil. The young plants make food through photosynthesis and share it with the fungi. The kauri greenhood orchid is associated with a fungus which only lives in the leaf litter beneath kauri.

DID YOU KNOW..?

- New Zealand has around 130 orchid species – 7 of these are epiphytes on trees.
- The shape of the top petal of a greenhood orchid, is like a rain hood, protecting the reproductive parts from rain.
- The bottom lip petal snaps shut when an insect lands on it. This traps the insect which has to crawl out and up the middle of the flower, brushing on pollen as it moves. This helps pollinate the flowers.
- Tree orchid species have fragrant flowers to attract insects. Seeds are tiny and are spread by the wind.

DID YOU KNOW..?

- Many forest habitats have been lost due to logging of bush.
- Introduced pests such as possums live in the high branches of trees and eat endemic plants. Pigs uproot plants on the ground.

How Can You Help?

If you have a tall tree with an orchid growing under it, or a tree orchid growing in it (you might be able to smell the sweet-smelling flowers), show and tell people about it.

Talk to people about how important forests are – many plant and animal species live in and on the trees.

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

Kauri Greenhood Orchid, *Pterostylis agathicola*

PHOTOS: Eric Scanlen

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

CONCEPTS Biodiversity, Interdependence

LEARNING AREAS Science

SILVER FERN

Ponga, *Cyathea dealbata*

WHAT

Tree fern.

WHERE

Endemic to New Zealand- grows throughout North Island forests and in some areas of the South Island.

NEEDS

Warmth, moisture (though not as much as other tree ferns).

LIFE CYCLE

Ferns have 2 parts to their sexual life cycle. Ferns do not have flowers or seeds but grow from spores that fall off the underside of fertile fronds (leaves).

Young fern fronds are curled into koru shapes. Adult ferns can grow up to 10 metres tall.

Some ferns also reproduce asexually (without sex), with plants growing off root-like rhizomes or on adult fronds (like the hen and chicken fern).

RELATIONSHIP TO KAURI

Silver ferns and other tree ferns grow under the canopy of other taller trees such as kauri, which provide the shade that ferns need.

DID YOU KNOW..?

- The silver fern is named for the silver colour under mature fronds (on plants which are at least 2 years old) and at the base of the frond stems.
- Ponga is the name for several tree fern species.
- Tree ferns were around in the time of the dinosaurs (even before flowering plants evolved).
- Tree fern trunks are not made out of wood. They are made out of the base of old fern fronds (leaves). The true stem of the tree fern is inside this.
- The silver fern is a symbol on New Zealand sports team shirts (like the All Blacks) and the national netball team is called the Silver Ferns.

DID YOU KNOW..?

- Many forest habitats have been lost due to logging of bush.
- Introduced pests such as possums eat endemic plants, particularly new growth.

How Can You Help?

If you have a silver fern growing in it in your school or neighbourhood, show and tell people about it.

Find out how ferns grow. Propagate, grow and plant your own silver ferns.

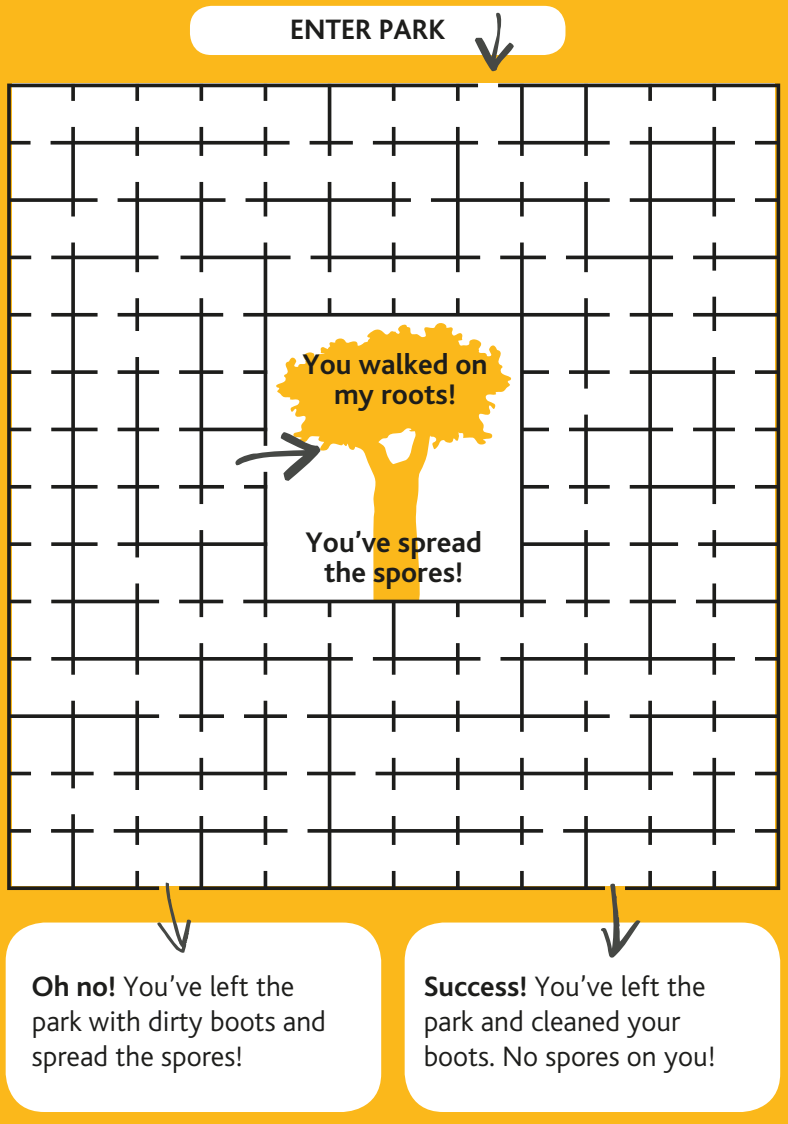
Talk to people about how important forests are – many plant and animal species live in and on the trees.

BIODIVERSITY IN KAURI FORESTS SPECIES CARDS

Silver Fern, Ponga, *Cyathea dealbata*

ACTIVITY FUN SHEETS

What can you do about kauri dieback? The important thing to remember is to stick to the track and clean your shoes when you're in areas with kauri! Practice through this parks maze...

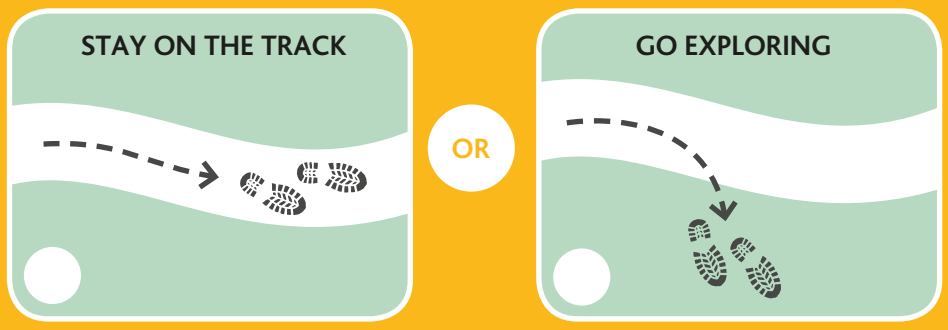


Oh no! You've left the park with dirty boots and spread the spores!

Success! You've left the park and cleaned your boots. No spores on you!

DID YOU KNOW?
Kauri can grow taller than a dinosaur!
DID YOU KNOW?

We need to stop the spread of kauri dieback! Next time you visit a park, do you think you should...



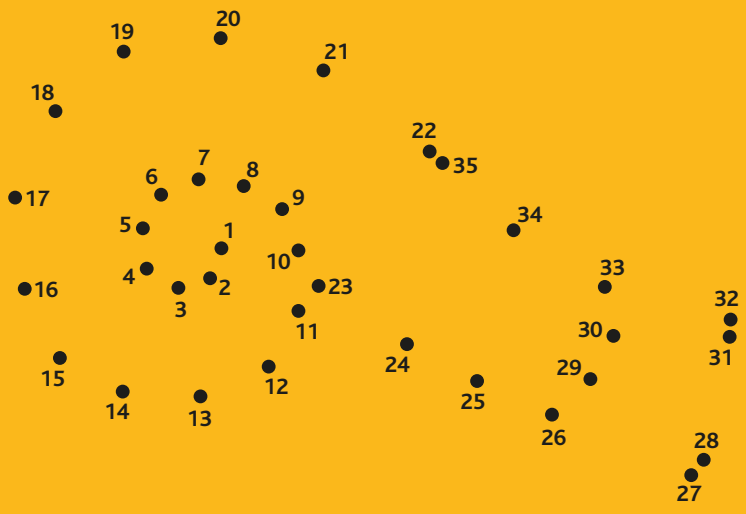
TICK THE CORRECT BOX

ANSWER

Stay on the track, that way you're less likely to spread spores around! And clean your boots between areas of kauri so you don't spread the disease as you walk...

ACTIVITY FUN SHEETS

The world of Kauri - Find out more about some of the remarkable creatures that share the forest with the kauri in the activities below...



These little creatures like to live in kauri forests...
Join the dots to discover their name...

KAURI _ _ _ _ _

Also known as PUPURANGI in maori!

Hidden in this **WORDFIND** are some of the animals that share the forest with kauri trees...
Can you find them all? Words are arranged up, down and diagonally.

- TIRAIRAKA
- KAKARIKI
- KOKAKO
- KIWI
- MOKO
- TUI
- KUKUPA
- PUPURANGI
- KAREAREA
- KAKA
- WETA

T	I	R	A	I	R	A	K	A	Q	K	H
Q	M	K	X	X	Z	Y	A	H	B	Y	K
K	O	K	A	K	O	A	K	Q	S	A	A
Y	K	B	Q	N	I	D	A	Z	D	X	R
A	O	A	V	S	J	W	R	W	A	V	E
P	X	W	K	G	T	F	I	S	Q	X	A
I	S	G	Q	A	R	Y	K	F	G	I	R
H	D	V	J	V	H	W	I	T	W	S	E
Z	N	S	Y	T	D	V	J	S	E	N	A
H	K	U	K	U	P	A	S	B	T	A	Q
K	X	Z	A	I	A	N	H	Y	A	Z	X
P	U	P	U	R	A	N	G	I	K	Q	H

Sometimes different maori words are used in different areas of NZ. The words above are the names used in most of northern NZ (where kauri grow). *Kukupa* means kereru or woodpigeon, *tirairaka* means fantail, *moko* means lizards and *karearea* is the name of the NZ falcon.

Cut out, copy or print the image (next page) and stick it up on your classroom wall. Have the students come up with a message that they think the kauri would like to share with everyone, if they could speak.