

# Native plants, native places

Explore the ecology of Canterbury's  
native plants and animals

MOTUKARARA NURSERY EDUCATION RESOURCE 2008



Department of Conservation  
*Te Papa Atawhai*

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## CURRICULUM LINKS

### Environmental education

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Key concepts: interdependence, sustainability, biodiversity, personal and social responsibility for action.

### Science

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#### Living World

Level 2: **Life processes** – Recognise that all living things have certain requirements so they can stay alive.

Level 3 & 4: **Life processes** – Recognise that there are life processes common to all living things and that these occur in different ways.

Level 2: **Ecology** – Recognise that living things are suited to their particular habitat.

Level 3 & 4: **Ecology** - Explain how living things are suited to their particular habitat and how they respond to environmental changes, both natural and human-induced.

Level 2: **Evolution** – Recognise that there are lots of different living things in the world and they can be grouped in different ways.

Level 3 & 4: **Evolution** – Begin to group plants, animals and other living things into science-based classifications.

### Social Sciences

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#### Social Studies

Level 2: Understand how places influence people and people influence places.

Level 3: Understand how people view and use places differently.

Level 3: Understand how people remember and record the past in different ways (reserves and protected areas)

Level 4: Understand how people pass on and sustain culture and heritage for different reasons and that this has consequences for people.

Level 4: Understand that events have causes and effects.

### Mathematics

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#### Geometry and Measurement

Level 2: **Measurement** – Create and use appropriate units and devices to measure length, area, volume and capacity, weight (mass), turn (angle), temperature and time.

Level 3: **Measurement** – Use linear scales and whole numbers of metric units for length, area, volume and capacity, weight (mass), angle, temperature, and time.

Level 4: **Measurement** – Use appropriate scales, devices and metric units for length, area, volume and capacity, weight (mass), angle, temperature, and time.

Level 2: **Shape** – Sort objects by their spatial features, with justification.

Level 3: **Shape** – Represent objects with drawings and models.

### Statistics

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Level 2: **Statistical investigation** – Plan and conduct investigations using the statistical enquiry cycle:

posing and answering questions;

gathering, sorting, and displaying category and whole-number data;

communicating findings based on the data.



Level 3: **Statistical investigation** – Plan and conduct investigations using the statistical enquiry cycle:

gathering, sorting and displaying multivariate category and whole-number data and simple time-series data to answer questions;

identifying patterns and trends in context, within and between data sets;

communicating findings, using data displays.

Level 4: **Statistical investigation** – Plan and conduct investigations using the statistical enquiry cycle:

determining appropriate variables and data collection methods;

gathering, sorting and displaying multivariate category, measurement, and time-series data to detect patterns, variations, relationships and trends;

comparing distributions visually;

communicating findings, using appropriate displays.

## Health and Physical Education

### Healthy Communities and Environments

Level 2: **Societal attitudes and values** – Explore how people's attitudes, values and actions contribute to healthy physical and social environments.

## English

### Listening, Reading and Viewing

Levels 2, 3 & 4

### Speaking, Writing and Presenting

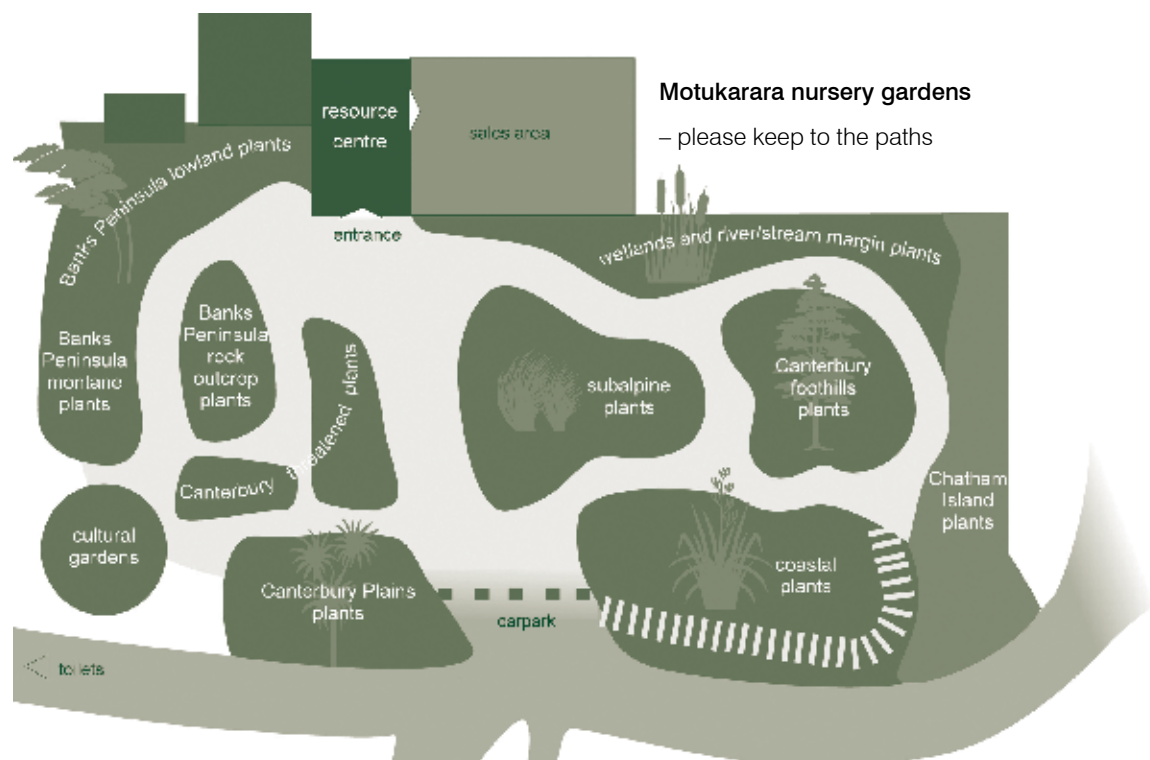
Levels 2, 3 & 4

## The Arts

### Developing Ideas

Level 2: **Visual Arts** – Investigate and develop visual ideas in response to a variety of motivations, observation, and imagination.

Level 3 & 4: **Visual Arts** – Develop and revisit visual ideas in response to a variety of motivations, observation, and imagination, supported by the study of artists' works.



## Motukarara nursery and gardens – where plants matter

### Did you know?

Native plants are adapted best to grow in their local conditions. The same species from different areas can differ in frost hardiness, drought tolerance, salt tolerance and pest resistance. When planting, it is important to use plants that are sourced from similar natural communities as close as possible to the planting site. This is called genetic sourcing.

The Department of Conservation's nursery and resource centre at Motukarara propagates over 120,000 plants each year. Most of these are pre-sold for government and community-based restoration projects. The plants grown are Canterbury and Chatham Island natives with an emphasis on growing plants from local natural seed sources.

Each year seed is collected from native plants natural to the different ecological areas across Canterbury and the Chathams. The seed harvest takes place from January to the end of June. About 200 different species are collected from 20 sites. Seeds are sown until September and propagated until the end of December. From January to April the seedlings are conditioned for the autumn or spring planting.

The display gardens are living examples of Canterbury plant communities. Each of the main habitat types found in Canterbury is represented, from coastal Banks Peninsula to dry Mackenzie Basin grasslands, to wetlands and foothill forests. There is also a collection of threatened plants and plants of cultural significance. People can use the gardens to see the forms that plants grow into, and which plants naturally grow together.



### What's a native corridor?

Native corridors (sometimes called green corridors) are plantings that connect existing native reserves and pockets of regenerating bush and scrub. These corridors provide a way for wildlife to travel from one pocket of bush to another. They are also nice places for people to visit!

### where in the wild?

From your neighbourhood waterway to the grand national parks along the Southern Alps/Kā Tiritiri o te Moana, there are plenty of places to visit these plants in the wild. Look out for the *where in the wild* headings to find out where you can visit to see plants and their communities living in the wild.

## At the gardens activity

### Build a tree

(adapted from Cornell<sup>1</sup>)

This is a great activity to help children understand how a tree works. You will need to find a dry spot big enough for the whole group to form a large circle.

1. Choose a child to stand in the centre of the circle. This is the **heartwood** of a tree. Explain: although heartwood is strong and by far the hardest and most durable part of a tree, it is also dead.

2. Around the outside of this core is the **xylem**. Place four or five students in a crouch position around the heartwood. They become the xylem and their job is to transport water from the roots to the top of the tree. As they move from a crouch to a standing position, they make a 'glug, glug, glug' noise.

*Explain: Xylem are like pipes and trees normally grow a new set each year giving the annual rings you can age a tree by.*

3. Below ground are the roots. Lie four or five students in a circle around the heartwood with their feet facing the xylem. They become the roots and their job is to suck water and nutrients from the groundwater and transport it to the xylem. They make a 'slurping' noise and move their fingers along the ground as they suck up the water and nutrients.

4. Around the outside of the xylem is the **phloem** (pronounced 'flow 'em'). The phloem brings the sugary food made by the leaves down to the tree. The remaining students join hands and make a circle around the heartwood, xylem and roots—being careful not to stand on the roots! They need to raise their arms to collect the food from the leaves and with a 'whooshing' noise bring the food down to the tree.

*Explain: This fluid is sometimes called sap, and it's what supplies all the living parts of the tree with energy.*

<sup>1</sup> Cornell, J.B. 1979: Sharing Nature with Children. Dawn Publications, Nevada City, California, USA

## Other activities

*Get students to:*

Draw a flow diagram to show how the nursery operation works, from seed collection to sales to planting.

Research what the grounds of your school may have looked like 150 years ago and what plants would have been growing there. The city council ecological district resources may be a useful.

Develop a restoration plan. Measure the area to plant and use the nursery resources to decide how many plants you need and what kinds. Present your work as a timeline that shows when each stage would need to be carried out. Think about how the land would need to be prepared for planting and who you could ask for help.

## So when is a native not native?

### Useful conservation words to know

**Native**—belongs in the New Zealand environment

**Exotic**—introduced from another country

**Introduced**—brought and put into the New Zealand environment

**Habitat**—place where plants and animals live... their home

**Ecosystem**—the interactions between plants and animals within an environment

**Biodiversity**—the variety of living things, bio=living and diversity = variety

Native means belongs in New Zealand, but it can also be used to explain when a plant is native to, or belongs in an area. Not all plants native to New Zealand grow, or should grow, in all places throughout the country, as many plants do not naturally occur in an area. For example, the pōhutukawa is called New Zealand's Christmas tree. Its crimson flowers make it a popular choice for coastal gardens throughout New Zealand—yet it is naturally found only in the North Island.

There are about 2285 native flowering and ferny plants in New Zealand. They all have their own likes and dislikes when it comes to growing conditions. Warm or cold, dry or water-logged, rich or poor soils, no two plants are alike. Individual plants adapt to certain areas and conditions that provide the right environment for them, and this is where they should be grown. Over time (millions of years), small differences occur even within the same species that are growing in slightly different environments, so they become special to an area.

Native plants are part of our unique natural heritage and regional identity. To recreate Canterbury's unique landscapes, it's also important to maintain the genetic purity of an area's native vegetation by using plants propagated from local sources. If locally sourced, the plants you plant are also more likely to survive.

### At the gardens activity

#### Adaptations to habitat

New Zealand's plants and wildlife have evolved special physical attributes to help them get the most from the environment in which they live. Some animal examples are:

- serrated edges on the soles of fur seals'/kekeno flippers to give a secure grip clambering over rocks
- the curved beak and long tongue of the bellbird/korimako to reach in and drink nectar from flowers
- the large webbed feet of the blue duck/whio for swimming upstream in strong currents
- the speckled brown colours of wetland birds such as bitterns/matuku, so they are camouflaged against the tall rushes and grasses

Get students to:

Look at the plants in each garden. Think about the environment they live in and see if students can identify physical attributes that are adaptations to where they live. Think about what things might have an impact on them: wind, sun, too much or not enough water, animal browsing, and soil and seed distribution.

#### A tangled life

Take a look at the shrubs that have a real tangle of stems. These are called **divaricating plants**.

What is it about the way they grow that creates this tangled shape?

Would a deer today, or a moa in the past, prefer to eat an ordinary shrub with large juicy leaves or a divaricating plant with lots of twigs everywhere and small leaves? *Why?* Does this give you a clue as to why the plant grows in this way?

#### How do plants fight back?

1. Take a look in the gardens for leaves that have been nibbled, munched or have holes in them.

Look at leaf shapes, coverings and smell. Can you see evidence of healing and colour changes around the damage? In many cases this is where the plant is loading chemicals to repel herbivores (plant-eaters).

Back at school make a list of the sorts of adaptations plants use to avoid being eaten.



Bittern/matuku Photo: M F Soper



Divaricating plant – coprosma Photo: M Letnick

#### Did you know?

Divaricating plants have small leaves and the branches grow in a tangled interlocking way. They grow this way to make the leaves hard to reach for leaf-eating birds.



Illustrations: Ali Teo

## Plants are homes—living habitats

Plants are more than plants; they are homes too . . . but for whom? Plants provide habitat to many birds and insects.

### Plants for insects

Insects play a vital role in the biodiversity web of life. They provide food for birds and lizards, and pollinate native plants, but they need the right plants to call home. Shrubs, such as hebes or trees like tarata/lemonwood, that flower abundantly, provide an excellent habitat for insects. Planting these species is an excellent way to attract beneficial insects. Plants with small, open flowers tend to be more suitable as most native insects have short tongues. This is an adaptation to cater for the many native flowers that have short fused-together petals, such as hebes. The endangered Canterbury knobbed weevil likes to live inside the spiky spear-grass.

### Plants for native birds

Birds are another important part of the biodiversity jigsaw. Birds help pollinate flowers and spread seed, so new plants can grow. They feed on insects, berries, leaves, flowers and nectar (honey from flowers). But they also need plants to rest and nest in. Planting a wide variety of trees, shrubs and grasses provides all year habitat and food for birds and insects. Most native bush birds such as silvereye/tauhou, grey warbler/riroriro and fantail/piwakawaka eat insects. Even those that love nectar like the tūi and bellbird/korimako eat insects too. Kererū/wood pigeon and kākā feed on fruit and berries.

Some native birds such as the kererū eat berries and as they move to different places to feed and rest they spread digested seed . . . through their poo . . . which helps to spread seed and ensure the bush always has young plants growing. Some birds may visit places seasonally when a particular food is ripe, while others may stay permanently in one place. Corridors of plants in gullies or along streams offer a flight path for birds such as the bellbird and tomtit/miromiro which are often scared to fly over open ground.

### Plants for lizards

Lizards/ngārara are also part of New Zealand's special biodiversity. They help spread the seeds of some of our native plants. Divaricating shrubs and some vines are especially popular with lizards. These plants offer excellent cover, and, at the right time of year, a bountiful supply of tasty fruit. Tussocks are an excellent source of small (and possibly delicious!) insects.

Jewelled gecko/moko kākāriki  
Photo: R Morris



Coprosma berries – a favourite  
lizard snack Photo: M Lettink

## At the gardens activities

### Mini-beast hunt

Find out what insects live in the trees and bushes...you will be surprised! Millions of tiny creatures live in the bush, but we hardly ever get to see them because they are so skilled at camouflage.

*You will need:*

White cloths (a set is held at the nursery)

Pencil and paper

An insect identification book such as *Life-sized NZ insects* by Andrew Crowe or similar.

1. Students should be in groups of four to six. Each group takes a white cloth and chooses a different tree or bush.
2. Place the cloth under a tree branch or bush. If the tree is quite tall, four of the students in the group should hold a corner of the cloth so it is stretched out just under the branch.
3. Gently shake the branch or bush over the cloth. You will notice things dropping onto the cloth.
4. Carefully place the cloth on a flat piece of ground and all look carefully to see what is on it. If it is autumn, you may need to remove some of the leaves so you can see the insects... but be careful not to miss insects that are hiding in the leaves.

Try to identify at least five insects that you see.

Why do you think these animals like to live on this plant?

Banks Peninsula tree wētā Photo: G Sherley







## Banks Peninsula

### Podocarp, podo-what?

Podocarps are types of native trees that bear fruit but do not flower, such as kaikahikatea (kahikatea), tōtara and rimu.

Podocarps occur on fertile valley floors; podocarp/hardwood forest on lower slopes; mountain tōtara grows above 500 metres. Coastal forest (including the warmth-demanding species like ngaio and nīkau palm) and open tussockland occur on drier, north-facing slopes.



Banks Peninsula is almost an island . . . in fact in the past it was an island. It is a steep and dramatic landscape with rugged high cliffs and about 270 km of coastline. Special plants live in the coastal environment including salt-marsh ribbonwood, sea rush, native ice-plant and Cook's scurvy grass/nau, to name a few.

Most of Banks Peninsula was once almost completely covered in native forest, except places that were very steep and exposed, or too swampy to support trees. This forest was the result of many millions of years of land formation and evolution. Most of the forest was felled or burned during the first 50 years of European settlement. Today we can still see, in reserves and forest remnants, some of the plants that were once growing all over the peninsula, but, sadly, at least 15 native plant species have been lost from the peninsula.

The remnants we see of this ancient forest reflect their stage of regeneration and the local environment that they grow in, such as altitude, aspect, soil type and proximity to the coast. The trees and plants have adapted to a particular environment and that is the environment they are best suited to. For a dozen tree and shrub species Banks Peninsula is their natural southern limit—this means there are none growing further south. There are also endemic species (found only on the peninsula) of shrubs and herbs.

### where in the wild?

The brochure *Banks Peninsula conservation walks* covers all the reserves managed by the Department of Conservation. In it you will find out that you can see a large tōtara only a 10-minute walk into the **Montgomery Reserve Track**, and that the **Kaituna Valley** reserve has a stand of tītiki.

**Hinewai Reserve** is privately run by a trust but welcomes visitors to explore its many tracks and is a good place to view restoration in progress.

## Banks Peninsula

### Nurse what?

A nurse crop is a group of plants, growing together like a plantation, which protects and creates the right environment for native seedlings to grow. Gorse and mānuka/kānuka are good nurse crops.

### In the classroom activities

#### Plant discovery

Get students to:

Make sketches and bark and leaf rubbings.

Produce a mixed media work to reflect all the different shapes, patterns, colours and sizes of plants experienced.

#### Banks Peninsula timeline

Develop a timeline for the native plants of Banks Peninsula. They have evolved under the following conditions:

- it was an island for nearly all of its 15 million year existence
- ice ages two million years ago would have disrupted a more or less continuous forest cover
- human beings arrived about 1000 years ago, bringing with them Polynesian rats and dogs, and fire.
- the peninsula remained largely forested until the arrival of European people 150 years ago. Their impact was drastic and many species vanished, replaced by grasslands which dominated the landscape. The bush is regenerating in many places, often with the help of the 'weed' gorse, which acts as a **nurse crop**.

Get students to:

1. Draw up a timeline covering the last 1000 years on Banks Peninsula. Label one side of the timeline 'plant introductions', and one side 'plant extinctions'.
2. Research which plants and animals have become extinct or reduced in number over the last 1000 years. Show these on the timeline.
3. Make some projections into the future, based on the aims of the Department of Conservation, the Banks Peninsula Conservation Trust and other agencies working on the peninsula, of what the peninsula might look like in 50, 100 and 500 years. Don't forget to think about people and population increases.

### At the gardens activity

**Some leaves are like my hands** from Andrew Crowe

You will need pencils or crayons and paper for each student.

Use the gardens to find leaves:

- like hearts (kawakawa, whau)
- like hands (five-finger/whauwhapaku)
- like spikes or needles (bush lawyer/taramoa)
- like feathers (mataī, miro)
- like spears (lancewood/horoeka, cabbage tree/ti kōuka)
- with teeth like a saw (lace-bark/houhere, mahoe/whiteywood)

1. Do a leaf rubbing of each shape, then sort and mount these on a class chart back at school.

Identify a plant by its leaf

Leaves are usually arranged on a stalk in one of three ways:

- Hand-shaped – with three or more fingers (five-finger)
- Alternative – (e.g. tītoki, lacebark / houhere and mahoe / whiteywood)
- Opposite – in pairs; wineberry / makomako, kōwhai

Other ways to identify a plant are to look at its leaves:

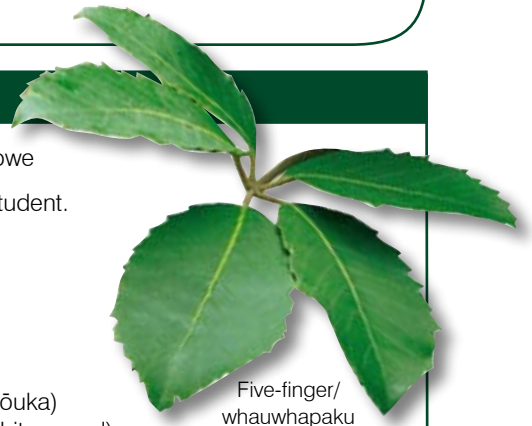
- Edges – toothed or smooth
- Shape – heart, ovoid, broad, narrow
- Size – big, small, long, short, thick, thin.

2. Using the nursery plant lists, the Andrew Crowe plant guide, or experts get students to identify three plants or trees. Students then sketch and label these plants.

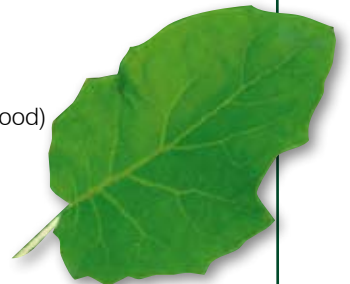
How do you think these plants have adapted to living in Canterbury?



Tōtara



Five-finger/  
whauwhapaku





## Canterbury Plains

Although you may not have noticed, the Canterbury Plains has a surprisingly diverse range of habitats moulded by the rivers, ocean and winds. These natural, and sometimes harsh forces continue to shape the land today, and over thousands of years native plants and wildlife have adapted to the environment and formed different habitats. From the sand-dune communities near the coast, to the magnificent kaikahikatea forests and dry grasslands of the plains, Canterbury once supported rich and varied communities.



Today's landscape has suffered 150 years of intensive modification. Farming has taken over the plains and the variety of habitats has now been largely reduced to one—pasture. European settlers worked hard to change the landscape to a more 'English' one . . . and they succeeded! They burned forests, introduced exotic (not native) trees, shrubs and grasses, and grazed, drained and cultivated the land. This has resulted in the Canterbury Plains being one of the most depleted regions in New Zealand, with native biodiversity reduced to extremely low levels. However, Canterbury remains an extremely important place for native plants and wildlife, with almost 25% of New Zealand's threatened flowering native plants species found here.

### where in the wild?

**Riccarton Bush**—this is a fine example of the tall podocarp/hardwood forest that once thrived on the swampy areas of the Canterbury Plains.

**McLeans Island**—this is a dry open woodland habitat and some of the plants that would have grown in this area can still be found, such as the kōwhai.

**Talbot Forest**—situated behind the township of Geraldine, this tiny remnant forest is a good example of mixed broadleaf/podocarp forest



Information panel at Talbot Forest, Geraldine

# Canterbury Plains

## At the gardens activity

### Sensory exploration

You will need a pencil and a small piece of paper for each student.

- **taste** – discuss what is okay to taste in the bush. How did people eat from the forest before there were shops? What might taste good to a wētā or tūi?
- **sniff tests** – get students to take a ‘smell’ walk through the garden, writing down anything they can smell. Get them to smell leaves by gently rubbing or pressing them and then sniffing (without breaking them off). Then smell bark and leaf litter (a good exercise to do just after rain). Do they all smell the same? Why do you think they have a smell?
- **touch test** – ask the nursery manager to help students collect some items from the garden or nursery area with different textures. Then...

1. Sit students in a circle, facing inwards with their hands cupped behind their backs. Place the different objects in the hands of some of the students. Ask them to describe what they feel – the objects shape, feel and what colour they think it is. Get them to pass it to the next two people and see what they think. Ask the students who have felt the object to guess what it is before showing it to the rest of the class or,

2. Get students to draw the object they have felt without looking at it. When they have finished, get them to see how closely it matches the object.

NB. When collecting items, don't break off living branches or leaves, but ask the nursery manager for some cuttings. Return all objects to where they were found.

### Reflect on using your senses

Ask students:

What did you find out from using your different senses?

Which ones do we usually use the most?

Which senses do you think animals in the bush use the most?



Illustration: Ali Teo

## In the classroom activity

### Dream forest recipe

Use some of the aims and concepts of the ‘Green Pathway’ project to help you with this exercise. Forests like Riccarton Bush and Peel Forest once covered much of lowland Canterbury. Now these are isolated fragments, clues to what was once here. A re-establishing forest goes through the process of ‘succession’ starting with pioneer species, which have relatively short but productive lives, followed by more permanent understorey species which, in turn, become gradually overtopped by the big canopy trees. A re-vegetation project is often planned to mimic this sequential pattern.

1. Starting with a flat piece of land, make up a recipe to create a ‘dream forest’. Like a cooking recipe, you need to list all of the basic ingredients, the method and the time needed.

2. Use the nursery garden plants lists and the restoration guide to help you.

Think about which plants would start the forest off, and which would follow (succession). Work out:

- if the forest was 100 metres square (1 hectare, or 10,000 m<sup>2</sup>), how many plants would we need of the different sizes? You might need to decide how many trees there will be per square metre.
- how much water to add?
- how long will it take to make it perfectly?

N.B. It is interesting to think that this is almost exactly what the designers of Te Papa had to do on the Wellington waterfront!





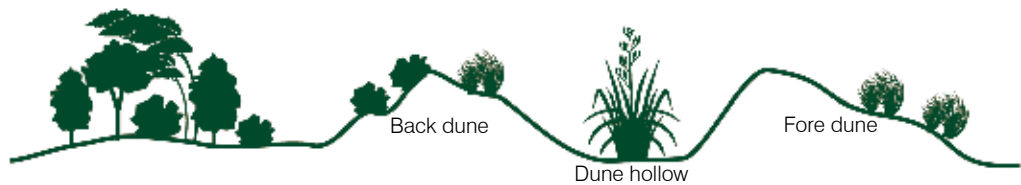
## Coastal area



Pīngao Photo: A Paltridge



Coastal forest – Nape Nape Scenic Reserve Photo: J Steven



*Craspedia* "Kaitorete"  
Photo: C Jensen

The coast, where land and sea meet, is a harsh environment. Specialist plants have adapted to tolerate the conditions and the variety of coastal habitats, such as coastal wetlands and dune systems. As the environments change the further you get from the sea, so too do the plants. Very little of Canterbury's original native coastal vegetation survives today, as farming and urban settlement have modified and destroyed natural coastal habitat and plant communities. Introduced plants, such as marram grass, lupins and pine trees, have replaced the natural vegetation of pīngao, flax/harakeke and ngaio.

Native species once grew on dry and unstable soils and sand dunes, where they provided shelter against strong, salt-laden winds, and habitat for native wildlife. Today only remnants of coastal broadleaf forests and undisturbed sand dunes remain.

Because of the weather extremes on the coast, native plants adapted to the environment are still planted. One of the most popular and successful trees is ngaio. It has bright shiny green leaves and is resistant to drought and salt winds.



Scarborough, Taylors Mistake, Ashley River/Rakahuri mouth and the Port Robinson Walkway are good places to see coastal habitat and native plants.

**Kaitorete Spit**—this is the largest remaining area in New Zealand of the native sand binder pīngao. Pīngao is a sand sedge and its bright orange colour makes it popular with weavers. Kaitorete is of national importance as there are a number of nationally-threatened plants still surviving there. The largest New Zealand population of the endangered shrub *Muehlenbeckia astonii*, the largest Canterbury population of the vulnerable sand tussock *Austrofestuca littoralis* and the only population of the endangered woolly head *Craspedia* "Kaitorete" exist at Kaitorete.

Check out the DOC Kaitorete Spit Supersite education resource.



*Muehlenbeckia astonii*

## Coastal area



Kaitorete Spit dunes

### At the gardens activity

#### The strength of roots

Coastal plants live in an unstable environment. They are constantly blown by salt-laden winds and freshwater can be scarce. Even when it rains, the water runs away through the sand or gravel much faster than it would in soil. Many coastal plants have developed large and quite fibrous (stringy) root systems that bind the sand and stones, stabilising the ground and trapping water. Some even grow fleshy leaves to store water in!

#### Recreate a coastal root system.

1. Form circles of about five to eight students facing inwards. Keeping their arms by their sides, ask the students to gently sway.

*Ask them:*

Can you move easily?

How far can you sway without falling over?

2. Next get everybody to put their hands in the middle and hold hands with two other people. They can't be hands from the person next to you or the hands of the same person. Ask them to gently sway again.

*Ask them:*

Does it feel different this time? Why?

Can you sway further than when you were not holding hands?

Is it stronger than swaying not holding hands?

What is making it strong?

This is how the roots of many coastal plants grow . . . in a strong tangle!

3. Now students can carefully try to disentangle themselves without letting go of the hands they are holding. They are allowed to shift their grip but not let go! They will end up as one large circle or two smaller often-interconnecting circles.



Katipo spider (female) Photo: R Morris

### In the classroom activity

#### Precious

Read the legend of pīngao below and discuss how culture and lore are used to explain and give value to nature.

#### Manākitia nga tukemata o Tane – *Caring for the eyebrows of Tane*

In the beginning of time there was a great conflict between Tane Mahuta, God of the Forest, and his brother Tangaroa, God of the Sea. Tangaroa was jealous of Tane Mahuta's success in separating Ranginui, the Sky Father from Papa-tu-a-nuku the Earth Mother. Tane Mahuta tried to end the warring between them and as a sign of peace plucked out his eyebrows and gave them to Tangaroa. Tangaroa's jealousy was so great that he could not find it in his heart to forgive Tane and threw the eyebrows back onto the shore. There they grow today as pīngao, the golden sand sedge, as the boundary between the forest and the sea; in his continuing anger, Tangaroa is still fighting against the domains of Tane Mahuta.

### Taking action activity

#### Growing pīngao

Growing pīngao by seed is more successful than growing it from cuttings. It is important to have the appropriate permissions before collecting seed. The Motukarara Conservation Nursery can give you good advice on when, where and how to plant pīngao.

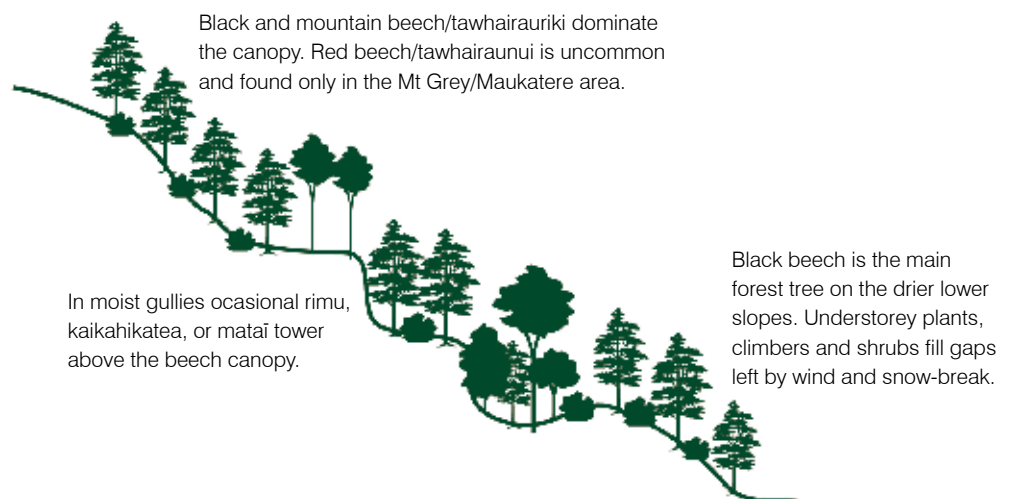


## Foothills forests



Beech/tawhai is the most common native forest in the Canterbury foothills. Black beech/tawhairauriki grows well on the lower slopes, while mountain beech/tawhairauriki prefers higher altitudes and more exposed harsh sites. Red beech is uncommon and found only in the Mt Grey/Maukaterere area.

Podocarp species, such as kaikahikatea, mataī, and rimu can be found on the slightly boggy lower slopes and moist gullies where they mix with beech. Southern rātā is rare on this side of the alps but can sometimes be found growing on bluffs and rock outcrops, for example in Alford Forest. A wide range of shrubs and fern species grow in the understorey. Some of the more common shrubs include *Coprosma/karamū*, lancewood/horoeka, marbleleaf/putaputāwētā and five-finger/whauwhapaku. Large areas of beech forest were burnt by Māori as they hunted moa and later settlers logged and cleared much of the remaining forest for farmland.



Southern rātā

### Rātā

In Canterbury a population of rātā exists in the Mt Ararat Rātā Reserve, near Omihi in the Hurunui District. The tiny reserve is less than two kilometres in size and completely surrounded by plantation forest. The rātā here are unusual, as they are growing far outside the known geographic and climatic range. They are healthy but stunted in comparison with other rātā and grow on a prominent crag of quartz sandstone. Despite possums, invading wilding pines and extreme weather, they are surviving. Although public access to the reserve is difficult, restoring and preserving the reserve is justified because of its scientific significance.



## Foothills forests



**Mt Grey/Maukatere**—an excellent example of red beech forest

**Mt Oxford, Glentui and Ashley Gorge**—at these sites you can experience beech forest close-up on a number of walkways.

### Lake Sumner Forest Park

**Peel Forest**—here you are able to see and walk through foothills forest that is not beech but podocarp kaikahikatea forest. It has huge fern diversity with over 68 species. From Te Wanahu Flat take *Fern Walk* (1.5 hours) and, to see large podocarps, take *Big Tree Walk* which takes 30 minutes. Both are suitable for students.

Interpretation panel on Big Tree Walk, Peel Forest



### Tōtara

with its royal red wood is another rakau rangatira. To Māori, red is a sign of high rank. War canoes/waka taua capable of holding 100 warriors were made from a single trunk. Tōtara can live for nearly 2000 years.

Come closer  
hold your eyes  
and feel my bark

It's so  
noisy  
warm



Adapted from illustrations by Ali Teo

## At the gardens activities

### Forest house

You will need a class set of mirrors (a set is held at the nursery)

1. In pairs or groups of three, get the students to explore the forest from a different perspective. The students stand behind each other with one hand on the shoulder of the person in front. With the other hand students hold the mirror level with the tip of their nose, the mirror side pointing skywards. Get them to walk along and see how the plants and forest look. Ask, what do you think?
2. A forest can be likened to a house with walls, roof, floor and a number of storeys. Discuss what the floor is made out of, is it carpet or vinyl? Do the walls have wallpaper and is there any artwork on the walls? What is the roof made from? Are there any exposed beams holding the roof up (branches)?
3. The water supply may seem a bit rough when it's raining, but the drainage is usually adequate! How good is the lighting, is it enough for the indoor plants? What colour is the roof, is it flat or pitched, does it have skylights? Are there any pets that come with the house?
4. Can you see windows in the house? How have they been made? (Broken branches, fallen trees?) What role do these windows play in the structure of the forest?

Explore the students' ideas.

## Subalpine



Korowai/Torlesse Tussocklands Park Photo: S Mankelow



Vegetable sheep!

Up in the mountains, but below the high shingle tops, is the subalpine region. A surprising variety of plants grow in this harsh environment that can be cold and wind-swept in winter and very hot in summer. Subalpine plants are naturally found above the tree line (around 1200 m). Lower down, forests once grew but were destroyed by Māori fires around 750 years ago. This was followed by European settlers developing farms and heavily grazing and burning so they could sow English grasses. Burning, especially in dry climates, resulted in subalpine plants spreading to lower altitudes with mainly snow tussock and turpentine scrub replacing forest cover.

Many species (different types) of snow tussock grow in the subalpine area, each adapted to different environmental conditions. The broad-leaved snow tussock prefers wetter sites, whereas the narrow-leaved snow tussock *wī kura* and the slim-leaved snow tussock prefer drier sites. Shrubs form large communities, commonly referred to as a subalpine shrub zone. Snow tōtara, mountain toatoa, turpentine shrubs and *Hebe*/koromiko, are common.

There are even plants that have adapted to living in the shade, under the shelter of tussocks and shrubs. Mountain daisies, gentians and mountain buttercups all survive and flower high up in the mountains. To withstand the high winds and harsh conditions, some plants have decided that growing low is the way to go. A vegetable sheep (yes this is really its name!) is a cushion plant and grows in a tight mat close to the ground. There are several threatened species found growing in the subalpine zone in Canterbury, including *Hebe* and *Pittosporum*.



Mt Cook lilies *Ranunculus lyalli*



Illustration: Ali Teo

### where in the wild?

The following places all have easy access and walking tracks where you can enjoy seeing subalpine plants in their natural environment.

- Korowai/Torlesse Tussocklands Park on SH 73 at Porters Pass
- Ruataniwha Conservation Park, Mackenzie Basin
- Lindis Pass Scenic Reserve, Otago
- Arthur's Pass National Park
- Aoraki/Mt Cook National Park

## Subalpine



*Hebe odora*



Spaniard spargrass/taramea

### At the gardens activity

#### Botanical treasure hunt

You will need to make up a checklist sheet for the students. As a variation you could make a sheet with a grid of large squares so students can draw into individual squares the plants listed.

Use the subalpine garden to find . . .

- a plant whose leaves have a sharp point
- a plant that has fragrant white flowers
- a plant named after a spiky animal
- a plant that possums really like to eat
- a tussock that grows as tall as you do
- a blue-green coloured tussock
- a tawny-coloured tussock
- a plant that has pinky-white berries
- a plant with inter-lacing branches and coppery leaves
- a plant with grey spines
- a tree with small leaflets
- a herb with round shiny leaves.

### In the classroom activities

#### Biodiversity brainstorm

Not all tussocks are the same—but how can you tell? How does retaining all the different types of tussock contribute to biodiversity? What might happen if we decided to protect only some species and not others?

#### Land use . . . what's the dirt?

'You can never put back what you have destroyed.' Has this been an issue of concern for the subalpine region? Compare impacts of different land users, past and present on the subalpine environment and vegetation.

#### Debate and discuss

1. Should we restore forest to the Waimakariri basin?
2. The role of fire in shaping the vegetation of the subalpine landscape.
3. What does 'nature conservation' mean to different people? Try to decide on a common definition which includes the points of view of different subalpine 'users'.



## Wetland and river/stream margins

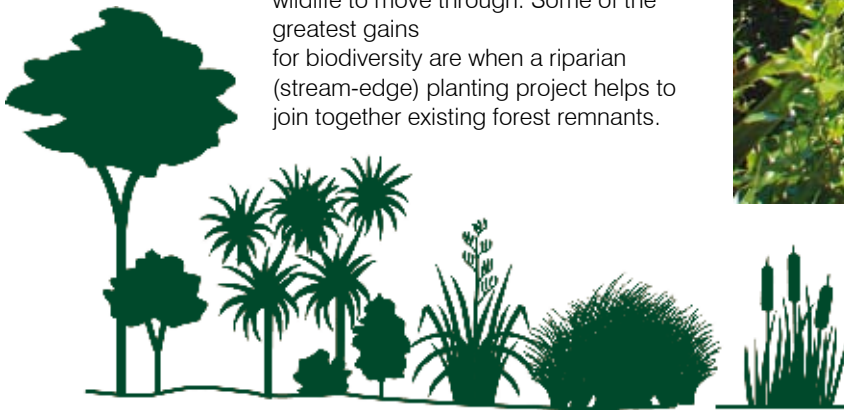


Wetland areas were once big in Canterbury . . . in fact Christchurch was built on a large open swampland! Low-lying areas in Canterbury were studded with lakes, lagoons and large swamps. Today, most of the wetland areas on the Canterbury Plains and coast have been drained for farmland and housing developments, but, despite this, some of the most important and internationally-recognised coastal wetlands survive, such as Te Waihora/Lake Ellesmere and Wainono Lagoon.

As Christchurch city grew, the wetland system was drained and gradually disappeared, except in gullies and along stream margins. Today, a change in our thinking is seeing a return of waterways and wetland areas to the city as these are recognised as part of the environment and our heritage. Restored waterways and planted native gardens provide stepping stones or corridors for wildlife to move through. Some of the greatest gains for biodiversity are when a riparian (stream-edge) planting project helps to join together existing forest remnants.



Ōtukaikino wetland, Christchurch



Canterbury mudfish/kōwaro Photo: A McIntosh

Native plants play a vital role in keeping our waterways clean and healthy. They provide habitat for native animals, regulate water temperature, and help protect water quality. They are also a key part of the defining character of New Zealand's diverse natural landscapes. Underneath the water surface, native aquatic plant communities create the base of the food web for most shallow lakes and rivers. Plants growing in streams provide breeding (spawning) habitat for some species including the threatened Canterbury mudfish/kōwaro.

*Ngā Pākihi Whakatekateka o Waitaha*—the swamp where flax stalks were collected—aptly describes Christchurch/Ōtautahi.



To experience the wonderful world of wetlands visit the following places:

**Ōtukaikino Reserve** (above)

**Travis Wetland**

**Bexley Wetland**

DOC has an education resource based around Ōtukaikino Reserve and Christchurch City Council has education programmes based at Travis Wetland.

## Wetland and river/stream margins

### At the gardens activities

**Shrinking wetlands** – modified from *Wild wonderful wetlands* Environment Canterbury, adapted from the Idaho Fish & Game and Idaho Project Wild website.

This activity highlights how wetlands have been reduced and lost due to human development activities.

*You will need* (the nursery will have this equipment):

- 4 boundary markers (cones)
- 1 soft dodgeball (primary), 2–3 for intermediate and senior students
- 3 wetland team armbands, 4 developer team armbands
- plant and animal labels
- stopwatch

#### Instructions:

Discuss wetlands and their value with the students. Brainstorm what lives in wetlands and what actions and/or pollutants could affect wetlands.

1. Get the students into two equal-sized teams.

*The wetland team* (three humans wearing armbands)

- 1 ecologist
- 1 conservation ranger
- 1 informed citizen

Remaining students each become a plant or animal and wear a label

*The developer team* (four humans wear armbands)

- 1 farmer
- 1 logger
- 1 urban developer
- 1 miner

Remaining students each become wetland contaminants and wear a label

#### Instructions:

1. Set the boundary for the game (the 'wetland' area) and an area for students to go when they are 'out'.
2. The developer team stands around the outside of the designated wetland area. It must try to hit members of the wetland team with the ball(s).
3. The wetland team must spread out inside the designated wetland area. The plant and animal members must try to dodge the ball. If they are hit, they must go to the 'out' area.
4. The human members of the wetland team must try to defend the plants and animals by trying to catch the ball. If they catch the ball the developer who threw the ball is out.
5. Start the activity. When a few members of the wetland team are out, STOP the game. Explain that with every plant and animal lost, the developers have reclaimed (drained and filled) a bit of the wetland. Adjust the boundary by getting the developers to take a step forward showing how the wetland area has got smaller. Play the game for the same length of time and continue to adjust the wetland until all the wetland members are out.

#### Questions/discussion

Discuss how many members of the wetland community went out each time.

Did the numbers change as the wetland became smaller?

What might this mean for a real wetland?

Does wetland size matter?

Where would 'out' wetland members go in a real wetland situation?

What would happen to the bittern? The kokopu?

If development continues near a wetland can the wetland survive? How?

Can the activity be played differently to show this?



Adapted from illustration by Ali Teo

Search for hiding places and habitat for:

- native fish
- insects
- birds.

Why do you think they have chosen those places?

## Wetland and river/stream margins

### In the classroom activity

#### *Ngā Pākihi Whakatekataka o Waitaha*—the swamp where flax stalks were collected

Choose one of the following topics and write a short essay:

- describe what Christchurch was like in the past
- say why wetlands are significant places, what their value is and whether they should be protected areas
- name several animals that live in a wetland and some of the factors they depend on to live successfully in one
- describe the relationships between plants and animals, and what the implications are for people living in and around a wetland
- identify actions you can take to help protect wetlands and other waterways.



Pukeko Photo: R Morris

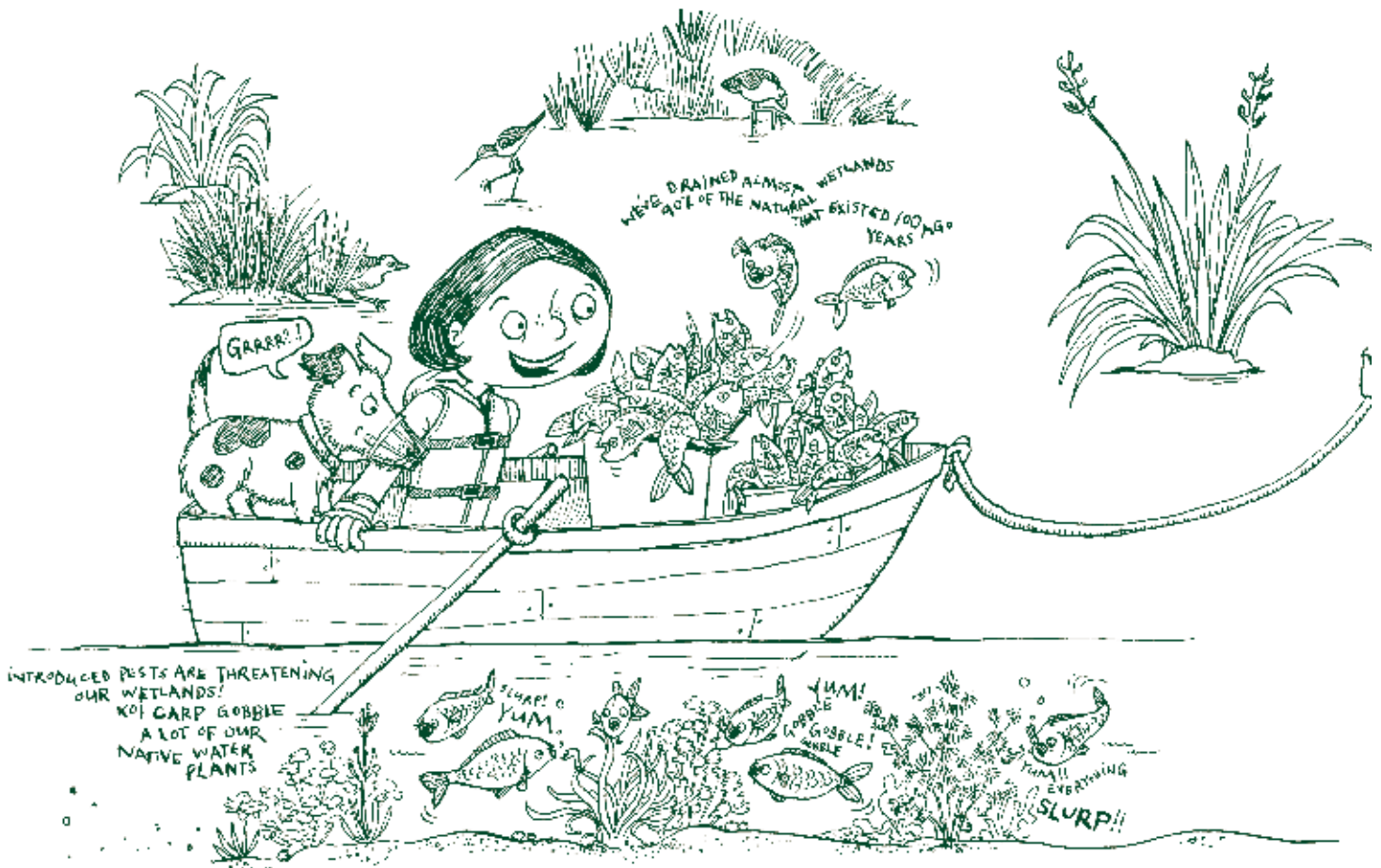


Illustration: Ali Teo

## Ngā Tipu Whakaoranga o Tutekawa—ethno-botanical garden



Piupiu (above)  
and paraerae/sandals (below)  
from Canterbury Museum collection

From the time Māori first arrived in New Zealand/Aotearoa from Polynesia, they depended on native plants for the necessities of life—food, firewood, shelter, clothing, and medicine. They adapted their traditional knowledge of tropical wild plants to related or similar-looking plants growing here. The cultural garden has been named *Ngā Tipu Whakaoranga o Tutekawa*, which means 'the plants that sustain us', with a dedication to chief Tutekawa who lived at Te Waihora/ Lake Ellesmere.

The garden features several native plants used by Canterbury Māori. The garden forms a koru, reflecting the continuity of life. The raised border on the garden resembles the protective ramparts of a Māori pā. The help, knowledge and aroha of the people of Te Hapū o Ngāti Wheke (Rapaki) and Sue Scheele from Landcare Research were instrumental in the garden's creation.

Several varieties of flax/harakeke feature in the garden. Flax was worked in different ways; split green leaves were plaited for ropes and fishing nets, sandals, disposable kete/bags and platters for serving food. Dressed fibre (whītau) of varying quality was woven into clothing, floor mats and kete. This fibre was also used as bindings for wounds and splints, and—when lined with soft moss—for baby nappies and sanitary napkins. The traditional skills and customs associated with tending flax and preparing its fibres are still practised by skilled Māori women weavers today.

Cabbage trees/ ti kōuka were highly valued as a source of food, fibre, and medicine, as well as featuring in creation stories and ancestral legends. Throughout Canterbury, cabbage trees were regularly harvested for food. The strong strappy leaves yielded a tough, enduring fibre used for anchor ropes and cooking mats, bird snares, and waterproof rain capes and cloaks.

Plants were used by early Māori in many ways. Scented grasses, berries and gums were used for perfumes. Canterbury Māori travelled long distances into the mountains to obtain one of their favourite scents—gum from the Spaniard plant/taramea. Dyes were also extracted from plants to colour/dye fibres; grasses like pīngao produced bright yellow; reds and blacks were extracted from tree barks like tānekaha and hīnau.



Traditional meal—waitau (porridge) made from cabbage tree stems, pikopiko (fern tips) and baked aruhe (fern root).

Bowl from Canterbury Museum collection



Rain cape (right)  
and kete (left)

from Canterbury Museum collection



## Ngā Tipu Whakaoranga o Tutekawa—ethno-botanical garden

### At the gardens activity

#### Plants for life

1. Ask students to imagine they are marooned on a small island. What sort of uses would they want to put plants to? Get them to find some examples of some of these uses amongst New Zealand native plants (e.g. flax fibre to make a fishing line.)
2. Think of all the different traditional uses for plants. Use the interpretation panels in the gardens to check your answers. What are some of the ways that people use plants today (e.g. cotton)?



Rope from Canterbury Museum collection

### In the classroom activities

#### Tea for two

Arrange with the nursery manager to pick some kawakawa leaves (left) from the garden to take back to school. Boil some water and make a brew from the leaves as a tea to drink. Discuss taste, colour and medicinal uses.

#### Paint the whole world with a rainbow

Experiment with creating your own dyes from plant materials. Have you tried boiling a white egg with onion skins?

#### Weave-wonder

Before your visit—arrange for a traditional weaver to come and talk to your class. Write your own karakia (prayer) to sing before harvesting. Talk to the nursery manager to arrange a demonstration of how to harvest flax from the garden. Source some flax locally for your own weaving project. Check out the book *Fun with flax* by Mick Pendergrast for weaving ideas.

#### Top ten ways we use plants today

1. Break students into pairs or small groups. Ask students to write down the names of as many plants as they can that they have used in the past week. Share the results as a class. As you compile the answers on a board, break them into different categories, such as food, medicine, clothing, cosmetics, recreation etc.

2. Work with the students to compile and agree on a 'top ten' list of beneficial plants.

Some questions you might want to ask are:

What seem to be the most important benefits we derive from plants?

Do you think that most people know what their clothes are made from or what is in the foods they eat? Why might that be important?

What, in your opinion, are the most important reasons to save plants from extinction? Why are plants so important for the planet's health?

3. As a follow-up to this activity, the students can choose one plant from their list and find out more about it. For example, they can trace the origins of their favourite foods or report on a plant's history, uses, distribution, risk status (of becoming endangered), and whether it is native or introduced.





## Threatened plants

One out of ten New Zealand plants is under threat of extinction in the wild. As habitats have changed or disappeared, populations of some plants have dwindled to just a few individuals. Sadly, Canterbury has over 80 plants which are threatened with extinction. Some plants have never been widespread and have site-specific habitat requirements, such as limestone areas or volcanic outcrops. Others are found in habitats which were once widespread but have been modified and lost, such as wetlands.

### What are the common threats?



Goats

**Fire**—half the population of the pygmy button daisy was lost when a fire raged through Medbury Reserve in the Hurunui district.

**Browsing animals**—browsing by introduced animals has caused the decline of many species and remains a major threat. *Pittosporum patulum* is found only in the eastern South Island, and possums love it! They target adult plants causing severe canopy defoliation (loss of leaves) and death.

**Weed competition**—special plants, such as the cushion forming ‘forget-me-not’ and the rare, tiny woodrush, grow exclusively on high-country shingle riverbeds. Weeds like Russell lupins invade riverbeds, forming dense stands and eventually shade out and displace these special plants and communities.

**Habitat loss**—salt marshes and wetlands have been drained and converted to pasture throughout New Zealand with less than 10% of wetlands remaining today. In the Canterbury region it is estimated that only 2% of the original wetland areas still exist.



Lupins smothering river bed

### What’s being done?

- animal pest and weed control
- habitat restoration
- plant translocation and restoration planting
- survey and monitoring
- public advocacy



Possum Photo: R Morris

### What threatened plants can you see in this garden? Where in the wild are they?



*Hebe cupressoides*

*Australopyrum calcis* subsp. *optatum*

*Carmichaelia juncea*

*Carmichaelia kirkii*

*Carex inopinata*

*Gentianella calcis* subsp. *taiko*

*Gentianella calcis* subsp. *calcis*

*Helichrysum dimorphum*

*Hebe armstrongii*

*Hebe cupressoides*

*Heliohebe raoulii* var. *maccaskillii*

*Ichnocarpus novae-zelandiae*

*Poa spania*

*Ranunculus* aff. *stylosus*

*Senecio dunedinensis*

Mt Cass/Castle Hill

Lake Lyndon

Poulter River

Kura Tāwhiti/Castle Hill

South Canterbury

Awahokomo Waitaki Valley

Poulter River

Waimakariri basin

Cave Stream

Mt Brown/North Canterbury

Mt Somers

Awahokomo Waitaki Valley

Waihao, South Canterbury

Medbury, North Canterbury



## Resources

### Habitat restoration

*Protecting and restoring our Natural Heritage – a practical guide*, Mark Davis and Colin Meurk, Department of Conservation, Christchurch, 2001. Available from the nursery, Christchurch DOC visitor centre or on-line at [www.doc.govt.nz/conservationnursery](http://www.doc.govt.nz/conservationnursery)

*The propagation of New Zealand native plants*, Laurie Metcalf. 1995, Godwit, Auckland.

*Native forest restoration. A practical guide for landowners*, Tim Porteous, Queen Elizabeth II National Trust, Wellington, 1993.

*The Bush – Classifying Forest Plants*, Ministry of Education Building Science Concepts Series 7, 2001.

*Canterbury native plants by area*, Department of Conservation, Christchurch. Fact sheets covering the different kinds of native plants found in different Canterbury environments. Available at the nursery or [www.doc.govt.nz/conservationnursery](http://www.doc.govt.nz/conservationnursery)

*The Green Toolbox*, Landcare Research – Manaaki Whenua. Includes an on-line plant selector guide, [www.landcareresearch.co.nz](http://www.landcareresearch.co.nz)

New Zealand Ecological Restoration Network also offers an on-line planting guide based on soil type, [www.bush.org.nz/planterguide/](http://www.bush.org.nz/planterguide/)

### Banks Peninsula

Banks Peninsula Conservation Trust – [www.bpct.org.nz](http://www.bpct.org.nz)

*Te Ngahere* – newsletter produced by the Motukarara Conservation Nursery

### Canterbury Plains

Canterbury Plains—Green pathway project. Te Ara Kākāriki Greenway Canterbury  
<http://www.lincoln.ac.nz/story10345.html>

*Native plant communities of the Canterbury Plains*, compiler Katie Williams, Department of Conservation, Christchurch, 2005. [www.doc.govt.nz/conservationnursery](http://www.doc.govt.nz/conservationnursery)

*Te Ngahere* Spring 05 issue; feature article by Nick Head, Spring 02 issue

*Talbot Forest plant list*, based on G Kelly's report, Department of Conservation, 2005.

### Coastal areas

*Te Ngahere* Autumn 03 issue

Coast Care [www.ccc.govt.nz/Parks/NaturalAreas/coastcare.asp](http://www.ccc.govt.nz/Parks/NaturalAreas/coastcare.asp)

### Foothills forests

*Ferns in Peel Forest – A field guide*, Brian Molloy, Department of Conservation 1983.

*Native plant communities of the Canterbury Plains*, Compiler Katie Williams. Department of Conservation, 2005.

### Subalpine

*Protecting the High Country*, Forest & Bird magazine article, August 2002.  
[www.forestandbird.org.nz](http://www.forestandbird.org.nz)

*Dobson Nature Walk – the natural history of an alpine park*, Original text Colin Burrows, Helen Young, Andy Dennis and Lands and Survey staff. Revised 2006.

*A Field guide to the Alpine Plants of New Zealand*, John T. Salmon.

*Te Ngahere* Autumn 06 issue, Spring 03 issue

### Wetland and stream margins

*Ecosystem Maps of Christchurch*, published by Christchurch Otautahi Agenda 21 Committee – lists of native plants natural to different areas of Christchurch

*Streamside Planting Guide*, published by the Water Services Unit of the Christchurch City Council.  
[www.ccc.govt.nz](http://www.ccc.govt.nz)

*A guide to Managing Waterways on Canterbury's Farms*, ECAN [www.ecan.govt.nz](http://www.ecan.govt.nz)

For more information on aquatic plants, check out NIWA's species guide at:  
[www.niwa.cri.nz/rc/prog/aquaticplants/species/submerged](http://www.niwa.cri.nz/rc/prog/aquaticplants/species/submerged)

*Braided River Field Guide*, Compilers Barry Hibbert and Kerry Brown. 2001, Department of Conservation, Christchurch.

*Te Ngahere* Autumn 06, Spring 06 and Spring 02 issues.

### **Birds, insects and invertebrates**

*Attracting native bush birds back to Christchurch*, Christchurch City Council, Christchurch. (Brochure)

*Kā Kai ā te kererū* – a guide to food plants for kereru. [www.kaupapakereru.co.nz](http://www.kaupapakereru.co.nz)

*Tūi tucker – attracting tūi to your garden*, Banks Peninsula Tui Restoration

*Life on a braided river*, Department of Conservation, 2007. (Brochure)

*Attracting lizards to your garden – Options for Canterbury*, Department of Conservation, Christchurch, 2005. (Brochure)

*Take a closer look – Exploring our Biodiversity*, Conservation Week resource.

### **Weeds**

*Garden escapes – Garden plants invading Canterbury*, Department of Conservation, Christchurch, 2005. (Brochure)

*Plant me instead! Canterbury and Otago*, Weedbusters, 2007. (Booklet)

### **Ethno-botanical**

Information on the cultural uses of New Zealand native plants can be found at Ngā Tipu Whakaoranga – <http://www.lawsite.co.nz/landcare/>.

*Pīngao on coastal sand dunes – Guidelines for seed collection, propagation and establishment*, D O Bergin and J W Herbert. CDVN Technical Bulletin no. 1, New Zealand Forest Institute Ltd, 1998.

*Pīngao: The Golden Sand Sedge*, A Herbert and J Oliphant. Nga Puna Waihangā, New Zealand, 1991.

*Flax/harakeke*, Christchurch City Council, Christchurch. (Brochure)

*Fun with Flax – 50 projects for beginners*, Mike Pendergrast, Reed, 1987.

*Te Ngahere* August 04 issue – feature article 'A place for pīngao'.

### **Threatened plants**

*Threatened plants of Canterbury – A field guide*, Compilers Nicholas Head and Ian Bunk. Department of Conservation, Christchurch, 2005.

*Threatened plants of Canterbury*, article by Nicholas Head, DOC botanist, Canterbury Botanical Society journal 35, 2001.

*Te Ngahere* Autumn 02 issue.