

The Leaves

The following activities have been developed to support purposeful learning and experiences before, during and after a visit to Pukemokemoke Bush. Although they complement each other, teachers and students can decide which ones to follow depending on the focus of their learning. Each 'leaf' provides opportunities for enquiry, discussion, observation and action. A range of other resources are mentioned throughout this document to support students' understanding of Waikato forest fragments in the context of Pukemokemoke Bush. Of note is the support material produced by the David Johnstone Pukemokemoke Bush Trust which includes a track brochure and recorded stories of the people of Pukemokemoke.



Our Special Place Activities

Learning intentions: Students will explore attitudes and values of different groups, expressing their own values and exploring with empathy the values of others. Students will develop an awareness and understanding of ways that they can be involved in protecting and restoring Pukemokemoke.

Pre Visit

Discuss the concept of a special place. Consider what makes places special and what relationships people have with places they visit. What sort of feelings do you have when you are in a special place. Explore your school grounds and discuss areas that are important to you. Why are they important? How do these areas make you feel? What features do they have? What rules or behaviour or tikanga are appropriate in different place around your school? In different places you visit (library, museum, marae, church, supermarket, park)? Think about why we have rules/ tikanga.

Who looks after Pukemokemoke Reserve? Why might it be special to Ngati Wairere, Ngati Koura and subtribes? Why is it important to the people of David Johnstone Pukemokemoke Bush Trust? Who else might value it? (trampers, ecologists, locals, archaeologists, ???).

Prepare an appropriate mihi for the class to say before entering the reserve. This is a way of honouring the people (the tangata whenua) and place.

Develop a class code of conduct for the trip. Think about what is appropriate for preparing and being in the bush and on an archeological pa site.

Visit

Parking is available at the end of the accessway off Tauhei Road. Before crossing the bridge and entering the bush, gather the students together and say your mihi to the bush. Confirm the code of conduct developed by the class.

Orienteer yourself using your map and landmarks.

After walking along the track into the bush for a while, stop and invite everyone to lie down on the forest floor and look up. Think about the view from this angle. Remain on the ground, stay silent and close your eyes. Focus on the sounds you hear. Then focus on the smells. Repeat this activity at the top of the reserve by the lookout and again in the log hauler site.

Refer to other activity cards to carry out observations and learn about the bush. Remember to have fun.

Post Visit

Reflect on the activity of lying on the forest floor? What did you see? What did you hear. What noises were natural, what were man-made. What smells did you notice? How did you feel when lying quietly on the forest floor?

If you were to describe Pukemokemoke (sight, sounds, smells, feelings) to someone who hadn't visited the bush what would you want to tell them? Record these things under the four headings.

What have you learnt about the value of Pukemokemoke bush? What past actions (and values) have impacted on this bush?

What do we now value and want to protect at Pukemokemoke? Divide your page into 4 sections and record plant, animal, physical and other treasures.

Consider the issues that a forest remnant like Pukemokemoke faces.

What role can children play in helping protect special places like Pukemokemoke?

Background information:

Pukemokemoke is a native forest remnant at Tauhei about 30 km north of Hamilton on Whitiakahu Road. The bush was donated by David Johnstone as a private reserve and is administered by the David Johnstone Pukemokemoke Bush Reserve Trust and managed by a local management committee. The management committee works closely with local iwi who relate strongly to the hill and to the Mangatea Stream along its flank.

Pukemokemoke consists of 40 hectares of original and modified forest cover and has been identified as one of the most species rich forest remnants of the Waikato. It has been designated a Key Ecological Site (KES) by Environment Waikato. The forested hill rises from 20m above sea level at the stream to a lookout at 166m. Here there is a panoramic view of the whole Waikato basin.

The bush contains fine specimens of forest trees including kauri, rimu, totara, kahikatea, matai, tawa, pukatea and some 80 species of native ferns occur there. The forest has been logged in the past, large rimu and kauri in particular having been removed. Many large specimens still remain.

Forest remnants around the Waikato are faced with pressures from surrounding land use and the impact of introduced weeds and animals. In the past, people have used the forest in different ways – for food and shelter, removal of large logs for timber, clearance for farming, as grazing during dry summers. Now Pukemokemoke is managed for its ecological, cultural and educational values.

<http://www.ew.govt.nz/Environmental-information/Land-and-soil/Native-plants-and-animals/Forest-fragments/Life-in-a-forest-fragment/Fragment-vegetation/#Heading5>

Class code of conduct: Things to consider in preparing for the trip and developing a code. Everyone needs to be responsible for their own water, food, clothing and footwear. Discuss what is appropriate for the time of year. Be prepared for wet weather.

Show respect to those who are guiding you (educators, teachers, parent helpers) and listen to and carry out instructions. Ask for help if you need it. In the bush you need to be observant. A lot of learning can take place by just being in the bush and experiencing the sounds, smells, and sights.

Most of the time it is appropriate to stay on the marked tracks. This helps protect the plants and animals that are in the bush. Some activities, however, require students to move off the track to explore leaves, leaf litter, insects etc. It is important that this is done in a way that has minimal impact on the forest ecosystem. It is also important that students stay with their group and do not stray.

What goes into the bush reserve must go out with the individual who brought it in (think about how to ensure food packaging etc is secured in bags after meals). Take only photos leave only footprints is a common mantra. Nothing should be removed from the bush except weeds and animal pests. You are privileged to have access to an archaeological site. It is important that you do not dig anywhere nor damage trench edges. This area has remained like this for a long time. Let it be here for many generations to learn from. Most of all this experience is about fun. Go and enjoy being in the bush.

There are a number of ways that children can use their developing knowledge to act for the environment towards a more sustainable future. Check out information on, <http://www.ew.govt.nz/Projects/Landcare-groups/> Landcare Trust, Enviroschools, or talk to your local council.

Mapping and Perspective activities

Learning intentions: Students will learn about maps and use this knowledge to show position and direction at the Pukemokemoke Reserve.

Pre Visit

Use a map of the school community to introduce map reading skills.

Have students draw their own map of the school grounds, creating a legend and using measurements to gain some perspective. Introduce the site Pukemokemoke.

Use a map of the Waikato to locate Pukemokemoke. Locate the position of the school in relation to Pukemokemoke. Find out if any students have visited Pukemokemoke.

Consider the name of the reserve, and using topographical maps and electronic satellite images, discuss why the area would have been given this name.

The Mangatea Stream (meaning clear waters) runs along the base of the hill and bounds the reserve to the South and East. Locate this stream on your map.

Still using your topographical map, locate prominent landmarks around the Waikato (e.g. Pirongia, Kakepuku, Maungatautari, Pukemoremore, Maungakawa, Hakarimata Range, Taupiri.) Where are these mountains and ranges? What is their height above sea level? Use the map scale and grid to determine distances to main features.

Visit

You will need: Topographical map of the reserve with tracks marked on it (see note below). Compass optional.

Using a map students can learn the basic map reading and orientation skills.

Start by orientating the map with the road into the reserve car park, the stream and the hill. Students can be challenged to use their maps to decide which direction (and therefore which tracks) to use in order to reach main points. As they proceed towards these key points they can be encouraged to keep their map true to the terrain. Once the lookout is reached students can use a map of the Waikato to gain a perspective of the Waikato. Use the interpretation panel to help locate landmarks on the map, and then suggest the approximate location of their school. From the lookout students can also discuss the naming of the hill (Pukemokemoke) and the possible significance of it to early Maori. Talk about the current use of the land and how this might have changed over time.

Post Visit

Again reflect on the name of the hill and its position in the Waikato landscape.

When you were on top of the lookout were you able to see other landmarks and identify them?

Return to your large maps of the Waikato and electronic satellite images.

What surprised you about the distances between these landmarks, when seen from the lookout?

What did you learn about using a map? What did you find was a challenge? What would you like to find out more about?

How could using a map help you next time you made a trip?



Mapping and Perspective cont.

Background information:

<http://www.nzorienteering.com/> gives access to the KiwiSport manual for orienteering.

http://www.nzorienteering.com/coaching/kiwisport_manual/Orienteering.pdf

This is an excellent resource to support development of some fundamental skills involved in navigating with a map. Pukemokemoke does not have 'controls' set up. However, there is scope for this if interest is shown in the future. Note: A topographical map for the reserve has currently not been developed by the Trust; however, topographical maps are available from selected map shops and Land Information New Zealand.

<http://www.nztopoonline.linz.govt.nz/nztm-simple/default.aspx>



Forest structure Activity

Learning intentions: Students will learn about the forest structure and how this influences biodiversity.

Pre Visit

In the classroom discuss the layers that make up a forest (see background material). Become familiar with the terms emergent, canopy, sub-canopy, understory, shrub layer, ground cover, epiphytes and lianes.

Find out what plants occupy the different layers in lowland forest of Waikato. You will also need to discuss the main species that you are likely to find in Pukemokemoke Bush (native trees activity) and be equipped with identification guides. Learn how to correctly pronounce the Maori names of these trees.

<http://hedc.otago.ac.nz/whakahuatanga/index.html>

Visit

When you first enter the reserve, look up through the forest and observe the different heights of the plants. See if you can identify the different layers that you have discussed in class.

Walk into the bush along the track for a while. Lie on your back and look up through the canopy. Observe the trees at the very top of your view. Can you see the leaf shapes of these tall trees? Try to follow the tree down so that you can see the trunks of the trees that make up the canopy layer. Use the tree labels or your Plant Guide to identify the canopy trees. Look for fallen leaves.

Look for leaf shape, size, colour, patterns, bark, smell, seeds/ fruit. Choose a leaf from one of the canopy trees and sketch it. Make notes about what you have observed. You might also like to take photographs.

Repeat the observations and recordings for the sub-canopy. Are there epiphytes on the trees?

Observe the different types of plants that make up the ground cover.

When you reach the lookout point, check to see if you can spot any emergent trees. Check again when you reach the log hauler site.

Post Visit

Reflect on what you saw during your Pukemokemoke experience. Close your eyes and try to imagine what the Pukemokemoke bush structure was like. What different layers were evident?

Using a circle divided into 4, record: Pukemokemoke Bush looks like, smells like, sounds like, feels like.

What surprised you about the forest at Pukemokemoke? What would you like to know more about?

Consider how the different layers of a forest contribute to increased biodiversity. Compare the healthy forest with the privet patch (see privet weed activity). What do you think is the difference and how could this affect the health of our forests?

Why is it important to think about different layers of a forest when restoring it? What might this mean when choosing plants?

Background information:

Emergent trees reach out through the main canopy. These emergent trees, such as rewarewa, can be seen towering above the other trees at irregular intervals.

The canopy is the dense ceiling of closely spaced trees and their branches, made up from the large-growing dominant trees (rimu, kauri, tawa, pukatea) whose top branches and leaves are up in the sunlight.

Sub-canopy is the term for more widely spaced, smaller tree species and juvenile individuals (future canopy trees) that form a broken layer below the canopy.

The shrub layer is made up of more shade-tolerant species and characterised by shrubby plant species and juvenile trees of a low stature.

Ground cover plants grow on the forest floor and may include sedges, grasses, ferns, mosses and fungi.

Epiphytes and **lianes** are found perched in trees, climbing up or twining around them. These might include, species of rata, kiekie, astelia, perching lilies, orchids and ferns.

These layers are not always distinct and can vary from forest to forest, but serve as a good model of the vegetative and mechanical structures of the forest.

Biodiversity is short for biological diversity. It is the number and types of organisms in an ecosystem, region or environment. Biodiversity is increased when a range of habitats is available. Conversely it is decreased when the ecosystem is degraded (e.g. through logging or animal or plant pests).

Forest structure and health can be affected by events such as logging, pest browsing and weeds as well as natural events such as wind throw and floods.

Native Trees Activities

Learning intentions: Students will become familiar with main tree species of Pukemokemoke and create an identification card using this knowledge.

Pre Visit

Pukemokemoke supports mixed lowland forest. There are over 300 plant species that live here in this small forest fragment! Together they create a diverse and rich ecosystem, along with native birds such as tui, kereru, piwakawaka, and riroriro (grey warbler) and a large variety of invertebrates. There may also be reptiles (skinks and lizards) and bats. All these elements of a forest are interconnected and work together to create a complex, diverse community of living things.

Familiarise yourself with the Pukemokemoke Loop Track brochure in your Education Pack.

Choose a featured tree species from this brochure to further investigate using a range of media. Create an identification card for your chosen species noting: habitat that the plant prefers (where it likes to live), leaf size, shape and colour, bark characteristics, tree size, other distinguishing features. Present this on an A4 poster.

Visit

Testing your "Identification Card":

Take your "Identification Card" with you to Pukemokemoke. Using the Loop track brochure or help from educators, find an example of your chosen tree. Look for the leaves and bark. Was your card useful? Does your card give the right information? Does it require more information or adjustment? Were you able to find good examples of the leaves? Bark? Fruit? Other?

Swap cards with a classmate. Use their card to identify a tree. Give feedback to each other about the information on the card. Discuss possible improvements. Take photographs of the trees to add to your cards. Create a bark rubbing of your tree species. Sketch parts of the tree.

Note the habitat that your plants are growing in. This is one of the factors that helps us with identification (e.g. some plants prefer dry ridges, others prefer damp gullies, others are perched in trees).

Post Visit

Reflect on your ability to identify key native tree species on your trip to Pukemokemoke. What helped you? What did you find difficult? How many tree species did you identify?

Make adjustments to your cards based on your trip experience. Where possible use photos taken on the trip or bark rubbings and sketches.

Consider your observations of leaves and how the different shapes and sizes of them and the position on the branches all contribute to identification.

In a group, or as a class, create a simple classification chart of common native trees you found based on leaf shape (rounded, elongated), where the leaves are positioned on the branch (opposite or alternate) and length (< 50 mm, 50 - 100 mm, > 100 mm).

Are they hardwood or softwood? What is a gymnosperm? angiosperm?

Display your identification cards together or create a book that includes all the cards.

Native Trees cont.

Background information

Use the Pukemokemoke brochure and www.forestflora.co.nz to help familiarise yourself with the forest trees you might find at Pukemokemoke.

<http://www.ew.govt.nz/environmental-information/Land-and-soil/Native-plants-and-animals/Forest-fragments/> is a good source of information about forest fragments in the Waikato and their values and issues surrounding their conservation.

The indigenous vegetation of Hamilton Ecological District is described by Clarkson et al.

http://cber.bio.waikato.ac.nz/PDFs/CBER_58_Hamiltonbasincomposition2007.pdf

Pukemokemoke was known as one of a few remaining sites of the kauri-hard beech forest within the Hamilton Ecological District. Unfortunately the hard beech has disappeared, however kauri trees are a feature of this bush along with stands of tanekaha. Vegetation types found within the reserve include mixed conifer-broadleaved forest (with canopy species of totara, Halls totara, matai, miro, rimu, kauri, tanekaha, kohekohe, tawa), kanuka scrubland on the ridges, small patches of kahikatea-pukatea forest in the gullies and small patches of semi-swamp forest on the flats.

<http://www.doc.govt.nz/conservation/native-plants/manuka-kahikatoa-and-kanuka/>

<http://www.doc.govt.nz/conservation/native-plants/kauri/>

<http://www.doc.govt.nz/conservation/native-plants/podocarp-hardwood-forests/>

The terms hardwood and softwood refer to the botanical origins of woods and not to their density or physical hardness. Softwoods are conebearing trees, often with evergreen needle-like leaves, belonging to the botanical group gymnosperm – (plants with naked seeds – generally produced on cone-like structures). Hardwoods are broad-leaved trees, either evergreen or deciduous, belonging to the angiosperm group of flowering plants producing flowers and seeds that are enclosed within some sort of fruiting structure.

There still some old mature trees remaining in this bush (left behind when the rest were logged in the 1940s). These trees are significant because of their seed production, their provision of diverse habitat amongst their roots, leaves, branches and bark for other native plants as well as animals.

Native Birds and the Impact of Predators' Activities

Learning Intentions:

Students will learn how to recognise common native bird calls, investigate the issue of animal pests in our native forests and observe signs of these during a trip.

Pre Visit

Use the websites in the background information or North Island New Zealand bird identification books to learn more about the birds that inhabit lowland forest fragments. Develop your skills in recognition of bird call by using the Department of Conservation site (and the Environment Waikato halo site for tui song <http://www.ew.govt.nz/PageFiles/233/38Tui-smaller.mp3>)

<http://www.ew.govt.nz/Projects/Hamilton-Halo/Pest-control/>

Use the Environment Waikato website to become familiar with the issue of pests in our native forests, how to recognise if they are present and what is happening to control them. Create a poster to record this information and help inform others of this issue. What do they look like? What do they eat? Where do they live? What impact do they have on our native birds? What impact do they have on our native plants?

Find out what a tracking tunnel is and how they can be used to indicate pest presence and abundance.

What is the Halo Project?

Visit

After walking about 10 minutes into the bush, stop and sit quietly listening for bird sound. See if you can remain silent for 5 minutes. How many birds did you hear calling? How many different species do you think you heard? What might they have been? Repeat the silent bird count when in a different area of bush, and again on the Mangatea track at the log hauler site.

On your visit to Pukemokemoke Bush, see if you can find any signs of pest presence (using the suggestions on the Halo site – droppings, scratch marks, bites, run tracks etc). Look for fallen leaves, flowers, fruit or seeds. Is there any damage on these? This could possibly be caused by pests.

During your walk you will notice that occasionally you will come across mounded plastic containers against the trees or on posts. These are for the possum poison (bait stations) so should not be touched. Think about the size of Pukemokemoke and what it might mean in terms of workload to maintain possums bait stations. Why is this worth it?

Post Visit

How easy was it to listen to and record bird song at Pukemokemoke? What other sounds did you hear? What birds did you actually see? What do you think they were feeding on?

Reflect on what indications you saw of pests while visiting Pukemokemoke.

A range of control methods are used to reduce rats, mice, possums, and stoats in our natural fragments. Often a combination of methods provides a more effective eradication. (Use the Environment Waikato site to find out more about rat and possum control techniques.)

Debate, using the help of a PMI tool or similar, the control of possums in our Waikato Reserves.

Consider community projects such as planting trees to encourage birds back to our forests and towns. How can you be involved?

<http://www.forestflora.co.nz/birds.html>



Native Birds and the Impact of Predators cont.

Background information:

<http://www.teara.govt.nz/en/native-birds-batsongoing>

<http://www.doc.govt.nz/upload/training-courses/biodiv/bird-id/birds.html>

Forest birdlife in the Waikato has been significantly affected by predators such as rats, stoats and possums. With predator control programmes such as Hamilton Halo it is hoped that native bird numbers will increase. <http://www.ew.govt.nz/Projects/Hamilton-Halo/> It is estimated that, at present, only 27% of tui chicks survive long enough to leave the nest.

The Halo project researchers are already seeing a difference in bird numbers in Pukemokemoke Reserve and an increase in fruit and flowers suggests a reduction in possums, rats and mice. This is confirmed by tracking tunnels set up in Pukemokemoke after the Halo poisoning programme began in winter/spring 2009. The results showed no sign of rats or stoats. Possum numbers were also reduced to zero.

For further educational resources on pest control visit:

<http://www.tekauri.org.nz/education.html>

You could also use the interactive games and information on Tui Time to increase your knowledge of this bird.

<http://www.tuitime.org.nz/> <http://www.doc.govt.nz/conservation/native-animals/>

Kawakawa Activities

Learning intentions: Students will learn about the delicate web of life in a forest through investigating the kawakawa plant.

Pre Visit

What do students already know about the kawakawa plant? Is there any growing near you? In the school gardens, at home?

Using the background information and resources, familiarise yourself with this shrub. Go on a walk around the school grounds to see if there is a kawakawa plant.

Web of life: – consider what a food web is. Create a simple food chain for a forest (e.g. sun - tawa berry – kereru). Think about what happens when the kereru poos or dies and how this might benefit the tawa tree. Build up your food web to add more information. How else might the web be affected?

From the website <http://sciencealivediary.blogspot.com/> and see what Poppy has been up to, researching the kawakawa plant and looper caterpillar. She is investigating how wildlife responds to environmental pressures such as climate change and habitat loss. Her work helps us understand the impact that cutting down trees has on animals (habitat loss) and how climate change changes the conditions of where plants and animals live (think about the web of life).

Kawakawa has been used in the past as a medicine. Learn about traditional Maori uses of kawakawa using websites.

Visit

At the kawakawa grove you will need to stop and observe the main species here. Sketch the leaves of the kawakawa. Can you see any sign of the caterpillars that have made the holes? How many holes are there in each leaf? Which leaves have no holes? Why might this be? What other plants are there growing in this area?

Who uses the tree for shelter and/or food? How does the tree benefit from these animals (seed dispersal, composting)?

What other insects are making our forest a home? After placing a sheet of paper beneath a kawakawa, shake the plant. What has dropped out? Can you identify any bugs?

Now find a patch on the forest floor about the size of a dinner plate. Gently remove layers of humus, observing the change in the leaf litter. What bugs can you see? What might they be doing?

Post Visit

Reflect on what you saw at the kawakawa grove. What did you observe about the kawakawa leaves? Colour, shape, other features, grazing damage.

Web of life: What were the insects you observed in and around the kawakawa grove. What role did they play in the web of life? Consider the inter-relationships within a forest ecosystem and how the loss of one species may have an effect on others. Why might studies like Poppy's be important?

Check out the Landcare Research website to see if you can identify any of the bugs, and see what the kawakawa looper moth looks like (did you see one on your trip?).

http://www.landcareresearch.co.nz/research/biosystematics/invertebrates/invertid/order_page.asp?Or_ID=13

Consider the use of kawakawa as a traditional medicine. Think about its availability and how this compares with modern medicines.

Kawakawa cont.

Background information:

Kawakawa *Macropiper excelsum* is a shrub growing up to 5 metres. This plant grows best in damp (but not water logged), shady and well drained forest, sheltered from frost and strong winds. It is often found in the forest shrub layer.

There are separate male and female plants. The flowers are produced in winter, are pollinated by wind and the soft orange fruit ripens in summer.

Kawakawa is a member of the pepper family and is related to the plant used in the Pacific to make kava, (see the name similarities). The fruit and leaves are highly aromatic.

The fruit, bark and leaves of the kawakawa were recognised by Maori to have medicinal properties. Leaves are made into a tea by being steeped in hot water and also used as poultices to treat bruises. Decoctions of the leaves and fruit were used for treating toothache, boils and stomach ailments. The shiny side of leaves was put on cuts and grazes, while the dull side was used for stings and bites.

Leaves were placed on a fire to create an insect repellent and branches and leaves were burnt around kumara gardens to kill off pest insects.

<http://maoriplantuse.landcareresearch.co.nz/WebForms/default.aspx>.

Kawakawa's characteristic heart-shaped leaves are always full of holes. Sometimes 30% or more of the leaf surface is eaten away by a native looper caterpillar *Cleora scriptaria* which feed nocturnally on leaves of both kawakawa and other native shrubs including ake-ake . "Kawakawa is also known as pepper tree because of the aromatic and spicy chemicals contained in the leaves, no doubt a defence mechanism against browsing pests. The looper caterpillar is really the only invertebrate that can hack the heat and recent studies indicate that the caterpillar's chewing activities result in increased levels of these defence chemicals, so that the plant may look a bit tattered, but has a much better chance of warding off other foliage feeding critters." Ruud Kleinpaste

<http://www.gw.govt.nz/assets/Get-Involved/TAFW-Exploredaysection.PDF> There is an interesting activity and chart in this website that could be used anywhere that kawakawa grows.

Food Gathering Activities

Learning intentions:

Students will investigate old food gathering and preparation techniques and compare these with their own.

Pre Visit

Check current knowledge of traditional Maori food gathering. Record.

Use local museums and online information to find out what early Maori ate, how they gathered or produced this and what preparation was required.

Consider the seasonal aspects of gathering food. Berries/fruit were only available at certain times of the year (especially later summer and autumn). Some birds were only able to be caught when in season and there were rules about harvesting during breeding season. Some food was prepared over open fires or hangi and there were different methods of preserving.

Learn to identify food sources: karamu, kiekie, tawa, aruhe (bracken), makomako (wineberry), raupo, kereru, tui, tuna, huhu, kiore, koura.

Investigate one particular food source and create an information brochure for this. Include what it looks like, where it is found, what season it is available in and how it is prepared.

You might also want to consider the rules today about hunting/harvesting these foods.

Visit

During your trip you will need to be observant and come prepared with identification field guides for the food plants and animals you have studied. These may not be in standard 'field guide' booklets. Use the Pukemokemoke brochure and the plant signs to help you locate key plant species.

As you walk up the tracks stop occasionally. Instruct everyone to stay silent for 5 minutes. Try to identify different bird calls and sightings. Record the number of birds you heard and the different species.

Try this again in a different area (e.g compare the forest edge by the stream with the middle of the bush, halfway up to the lookout).

Look for signs of plants flowering and fruiting. The abundance will depend on when you are visiting.

Carefully dig away the surface of a rotten log. Can you see anything tasty? Are there signs of grubs, such as the huhu?

Post Visit

Reflect on the food plants and animals that you managed to see on your trip. Were they common? If you were hungry in the bush would it be easy to find some food?

Compare this with the availability of food to you now. What food is in your lunch today? Where did it come from? Who prepared it/made each part of it? How was it packaged? And the taste.

Think about traditional food gathering and preparation and use a double bubble tool or similar to compare this with food gathering today.

How has reduction of natural areas affected the availability and the rules of gathering traditional food?

A video clip of local kaumatua talking about some of the history of the bush and its people is available on request. Contact the David Johnstone Pukemokemoke Bush Trust.

Background information

Under natural conditions Waikato forest foods available were roots, pith, shoots, and leaves of selected trees. Fruit and berries were also eaten in season. Most important of the root foods were the rhizomes of the bracken fern. Bundles of rhizomes were collected and thoroughly pounded with a wooden pounder (patu aruhe) on a stone base. The starchy material thus separated was made into cakes which were cooked in hot ashes. Fern rhizome was also cleaned and chewed raw by commoners and slaves. <http://www.teara.govt.nz/en/1966/maori-material-culture/5>.

Ti kouka or cabbage tree (*Cordyline australis*) was eaten as a vegetable. The heart of the tree was removed and the tough leaves were stripped away leaving a firm white core. This was then boiled.

Kiekie (*Freycinetia banksii*) fruit (tawhara) was gathered as a delicacy from the climbing plant in summer.

Pikopiko or hen and chicken fern (*Asplenium bulbiferum*) (<http://www.teara.govt.nz/en/ferns-and-lycophytes/2/3>) is a fern found in the bush. Maori gather the young fronds before they open, and cook them.

Eels (tuna) were caught in the streams and wetlands and were either cooked and eaten fresh or prepared by drying so that they would last longer (remember no fridges or freezers). Koura (fresh-water crayfish) were also gathered from the streams.

Birds such as kereru and tui were snared and cooked before eating, or preserved in their own fat and placed in gourds for later. Then they were strung on flax, harakeke (*Phormium tenax*) to dry quickly in the wind.

Raupo bread was made when the yellow pollen was shaken from the large brown flower heads of raupo (*Typha orientalis*), then mixed with water to create a paste. The Maoris used to wrap raupo leaves round the mixture and steam in the hangi creating a bread. (adapted from <http://www.kawhia.maori.nz/kai-recipes.html>)

Karamu (*Coprosma robusta*) berries were eaten mostly by the children. The seed gave a sweet taste at first to a slightly bitter after taste (Crowe, 2004). It is also popular with fruit eating birds and is one of the plants used to re-establish native vegetation along the Mangatea stream edge. Karaka (*Corynocarpus laevigatus*) produces a bright orange berry. The pulp of the fruit is edible, although bitter, but the fresh kernels contain the lethal poison karakin. Early Maori use these as a food source but if the processing was not done with the greatest care, poisoning would result with symptoms including violent convulsions and severe muscle spasms which could leave the limbs permanently fixed in contorted positions. Death resulted in a few cases. The kohekohe tree was known as an antidote. Patients were buried as soon as possible, in an upright position to restrict movement of the limbs and therefore damage from convulsing while someone was sent to find some kohekohe and a concoction prepared.

<http://tpo.tepapa.govt.nz/ViewTopicExhibitDetail.asp?ExhibitID=0x000a6dc5&ExhibitionID=0x000a5174&Language=English&dumbyparam=search>

<http://www.tepapa.govt.nz/Education/OnlineResources/Matariki/Pages/Overview.aspx> <http://www.nzetc.org/tm/scholarly/tei-BesMaor-c6-8.html>

http://www.historic.org.nz/Publications/~/media/Corporate/Files/Brochures/Archaeology_midden.ashx <http://www.teara.govt.nz/en/te-mahi-kai-food-production-economics>

http://www.aucklandmuseum.com/site_resources/library/Education/Teachers_Guide/Teacher_Resources_Library/Maori_Education_Kits/Maori_08MaoriFoodGathering_1_.pdf

A Field Guide to the Native Edible Plants of New Zealand by Andrew Crowe, 2004 Penguin Books, NZ

New Zealand Medicinal Plants by S.G. Brooker, R.C. Cambie, R.C. Cooper 1987 Heinemann Publishers, NZ

Stopover Pa

Learning intentions:

Students will develop a knowledge and understanding of early Maori pa construction. Students will experience an archaeological site. Students will construct a model of a pa or shelter.

Pre Visit

Find out from students through whole class discussion, or small group “bus stops” what they already know about early Maori pa. Ask questions such as what was their purpose? Where were they built? How were the sites chosen and why? What did they look like? What building materials were used?

Discuss with the students what further information they would like and pose questions that might help them research. Decide how as a group you will locate, process and analyse information to answer these questions.

What is an archaeological site? What are some significant archaeological sites in Waikato?

Investigate Maori pa design.

http://www.historic.org.nz/en/ProtectingOurHeritage/~/_media/Corporate/Files/Brochures/Archaeology_pa.ashx

<http://www.nzetc.org/tm/scholarly/tei-Cow02NewZ-b3.html>

<http://www.nzetc.org/tm/scholarly/tei-BesMaor-c6-7.html>

http://www.maori.info/maori_society.htm

Visit

Half way up the track from the bridge over the Mangatea to the summit you will come across signs that lead you to the remnants of the old stop over pa. Remember that you are entering a significant site both architecturally and spiritually. Recap the code of conduct that you developed before the visit.

Because over time nature has taken over the site, you will need to look carefully and use your imagination in some aspects of what the camp may have looked like 200 years ago. Use the sketch map of the site to help you imagine what it was once like. You will see a deep trench dug to the North western end of the site. Why was this constructed? Observe the top of the site and imagine small shelters built upon it. Look out through the trees to the East and discuss the view and what advantages this might have created. Consider the importance of the sun and the view.

Sketch aspects of interest or the whole site.

See location of pa site on back page..

Post Visit

Reflect on your observations on the stop-over pa site.

What did you see that suggested it was once a camp site?

What wasn't evident about past use?

What hindered your ability to imagine it as a camp-site that it was 200 years ago.

What has changed over time?

Using knowledge gained from research, discussions and your Pukemokemoke experience, design and create using natural and/ or man-made materials a model of a stop-over pa or a hut/ shelter (tīhokahoka) that would keep you warm and dry overnight.

Prior to starting your design process discuss the criteria that the model or shelter should meet. Consider aspects such as strength, durability, weather proof, impact on the environment, readily (locally) available materials, natural, sustainable. Create a grid with these criteria to help peer assessment of the final structures.

Stopover Pa cont.

Background information:

On a ridge of Pukemokemoke there are the remains of a stopover pa. Pa sites were built as a stopover on the north-south and east-west routes through the Waikato, with the tracks often passing from high point to high point. Members of various tribes are thought to have travelled extensively through Whitikahu, Tauhei, Hoe-O-Tainui, Mangateparu and into the Hauraki Plains across to Thames.

Elevation: The site provides a clear view of the land below. This would be valuable in terms of security, ensuring that any other people approaching could be seen well before they reached the pa. The site has an uninterrupted vista towards the rising sun, considered spiritually important. The hill was possibly also an observation point from which early Maori watched for the appearance of certain stars and constellations indicating times of the year and giving navigational guidance. For extended study on the likes of Matariki use Te Ara resources <http://www.teara.govt.nz/en/matariki-maori-new-year/1/1> and <http://www.nzhistory.net.nz/classroom/matariki-maori-newyear>

<http://www.korero.maori.nz/news/matariki/background.html>

Swamp lands below: The extensive swamplands below the pa would have created a natural barrier to the South as well as being a source of food such as tuna (eel), koura (freshwater crayfish), ferns, reeds and water fowl. Prior to draining for farmland these lands would have supported mixed vegetation communities of sedges, reeds, ferns, and shrubs, as well as patches of lowland kahikatea swamp forest.

Steep banks/escarpment: These would have helped with security, reducing the speed with which an unfriendly group could raid the site.

Water: The Mangatea stream and tributaries are not far from the site. Water had many significant roles in Maori life and wellbeing, including for drinking, washing, food harvesting.

Food: Both cultivated (potatoes, kumara, karaka) and wild (keikei fruit [tawhara], tawa berries, pikopiko [young fern fronds], ti kouka [cabbage tree], harore [fungus], kereru) were likely to have been available to the travellers. Food gathering would have included catching birds and fish (kokopu, tuna, koura). Earthworks on the site suggest that food was grown and stored here to feed those passing through.

Shelter: Although the site may have been exposed to the prevailing winds, there was ample material available from the forest (tanekaha and kauri saplings, bracken, ponga, ti kouka) and low-lying swamps (raupo, harakeke) to construct tihokahoka (bivouac) or whare (house) to keep the worst of the weather off tired travellers.

Medicine: Native forest plants such as kawakawa, koromiko, kohekohe, harakeke, kowhai and manuka could have been used. <http://www.teara.govt.nz/en/rongoamedicinal-use-of-plants/3>

View from the Top Activities

Learning intentions:

Students will learn about the different land uses that have influenced Pukemokemoke Bush.

Pre Visit

Develop an understanding of needs v wants and that people make decisions based on their needs and wants. (See Branch section of resource.)

Land uses (including quarrying, forestry and farming) have influenced the current extent and health of the native forests and wetlands of the Waikato. Imagine what the land below was like 200 years ago. Consider why they were cleared of natural vegetation and what the pluses and minuses of this development were. Think about why the natural vegetation cover was removed from the surrounding land. What were the advantages? What were some disadvantages? Who made the decision to do this? What might have been their needs? What might they have wanted?

What social and political events may have influenced them?

Visit

If you have been lucky enough to visit the Reserve on a fine clear day you may be able to see the mountains and ranges around the Waikato and even as far as Taranaki on a really good day.

Using your map of the Waikato locate key sites such as Taupiri, Hakarimata, Pirongia, Kakepuku, Maungatautari, Pureora, Pukemoremore, Maungakawa, Te Aroha.

Try to locate approximately where your school is.

Observe and discuss the different land uses that are visible from the lookout.

Imagine what the view would be like if it was still all forest and wetland. What other patches of native vegetation can you see from here? What percentage of the total land cover do you think this might be? How could this influence the value of remnants such as Pukemokemoke Bush?

Post Visit

Locate on your map Valentine Road, then follow the confiscation line south east to Pukemoremore.

Aukati line: What was the Aukati line? What events led to its creation? Why was it significant? What is confiscation? Using a map follow the Aukati line from Orakei stream to Pukemokemoke hill. Who were significant people in the decision making of the time? What were the different attitudes, values and perspectives that might have contributed to these decisions?

How has this influenced land uses of today?

Discuss values and attitudes to land today.

View from the Top cont.

Background information:

<http://www.doc.govt.nz/conservation/land-and-freshwater/wetlands/wetlands-by-region/waikato/>

<http://www.ew.govt.nz/environmental-information/Rivers-lakes-and-wetlands/Freshwater-wetlands/>

The indigenous vegetation of Hamilton Ecological District is described by Clarkson et al.

http://cber.bio.waikato.ac.nz/PDFs/CBER_58_Hamiltonbasincomposition2007.pdf

Early European ownership followed the colonial government imposition of the aukati, or confiscation line, on Waikato lands after the land wars of the 1860s. The confiscation line is still visible from the northern end of Valentine Road looking south to Pukemoremore. The Government offered large areas of confiscated land for sale.

“European missionaries arrived in the 1830s to establish the first missions. Traders then arrived in growing numbers during the 1850s, and the first permanent Pākehā settlements were established from 1865 following the land wars and subsequent land confiscations, which resulted in large tracts of swamp being cleared by Pākehā for agricultural farming. The original boundary line that separates the Waikato and Matamata/Piako Districts was first drawn in 1864 following the land wars, and was later used to determine the then new council boundaries in 1876 when the District Councils were first established. The boundary includes one particularly long perfectly straight line at about 10 degrees counter-clockwise from true north on the compass. This boundary line stretches for over 43kms from the Orakei Stream in the north to Pukemoremore Hill just south of the Waitakaruru Arboretum. The boundary line encompasses mainly farmland plus 3 roads along its path: Manuel Road, Valentine Road and Pukemoremore Road. Although not easily visible from the ground, the scale of this 43km long perfectly straight divide can be clearly seen from the air. The absolute divide reflects the artificial border or aukati that separates the Waikato and Matamata-Piako districts.” <http://researcharchive.wintec.ac.nz/252/>

“The great calamity that befell the Waikato people in the 19th century was the confiscation of millions of acres of tribal territory after the Waikato war of the 1860s. The government wanted to obtain the fertile Waikato lands for Pākehā settlement, but the King movement, which was centred in Waikato, resisted the loss of land and control.

“British and colonial forces crossed the Mangatāwhiri Stream on 12 July 1863. The stream, just north of Meremere, was established by King Tāwhiao as a boundary line (aukati) between land to the south controlled by the king, and land to north under government control. Tāwhiao had warned that should the British forces cross that boundary, war would ensue.

“Troops pushed south into the Waikato region, engaging King movement forces in a series of battles at Koheroa, Rangiriri, Rangiaowhia and finally at Ōrākau, a pā just outside Kihikihi. Following that battle, the Waikato people were forced into exile in what became known as the King Country, and the Waikato lands were confiscated by the government.” <http://www.teara.govt.nz/en/waikato/6>

Log Hauler Site Activities

Learning intentions:

Students will learn about the history of logging in the Waikato through Pukemokemoke Bush.

Pre Visit

Explore logging history in New Zealand. What were the native trees that were most valuable? How big were some of the trees extracted from our native bush? What was the timber used for? What equipment was used?

<http://www.teara.govt.nz/en/bush-trans-and-other-log-transport>

What changes did the development of steel cable allow?

Create a timeline of logging technological changes based on what you have learnt from the Te Ara website.

What impact did logging have on the forest? What might happen if you take out the large seed bearing canopy trees from a forest?

What if you remove the whole forest? What impact would this have on biodiversity? Water quality?

What tree species are now grown commercially to meet timber demands?

Using the map provided or an online satellite image, locate the log hauler clearing in the reserve.

Imagine living as a tree feller in the 1930s and 40s. What skills would you need? How might your day be spent?

Visit

Treasure hunt: Find 5 native trees that are labelled along the boundary of the site. Record both the Latin name and the common name and the shape of the leaves.

Find a piece of steel wire rope that was left from hauling the logs from the bush.

Find a plant that you think does not belong in the bush. Describe what it looks like. What made you think that it didn't belong?

What birds are using this space? Native? Introduced?

How many tracks branch off this site?

When was the gazebo built? What is its purpose?

The largest tree thought to come out of the Pukemokemoke bush was a totara log that was similar in circumference to the gazebo.

Pace out the diameter (distance across the centre) of the gazebo. Repeat this measurement out on the grass and have 2 students stand at either end. Create the log circumference by the remaining students forming a circle from the 2 points. Have everyone raise their hands up and imagine reaching up into a tall tree. How many epiphytes, birds, bugs, bats and geckos might the tree have supported?

Post Visit

Reflect on what you learnt at the log hauler site. How much evidence was there of the past logging operations?

Where do our timber supplies for housing, furniture and things like barbecue tables come from now? Compare locally produced sustainably grown timber such as pine, eucalyptus and macrocarpa with timber such as kwila imported from tropical forests around the world. Create a double bubble venn diagram to look at similarities and differences. Use a PMI to consider the effect of the 2 on the environment. Investigate what timbers are used in your school classroom construction.

Use the websites below to explore past logging practices and the effect logging has and is having on our environment.

<http://www.maf.govt.nz/forestry/illegal-logging/nz-policy-on-illegal-logging/page-07.htm>

<http://www.waitakere.govt.nz/AbtCit/ec/bldsus/pdf/materials/timber.pdf>

Log Hauler Site cont.

Background Information:

The log hauler site is a clearing in the bush created from logging operations in the 1940s. Pukemokemoke Bush Trust volunteers have erected a gazebo in this area to provide a sheltered resting place. Water is collected from the roof and held in a small tank.



The gazebo is a great gathering point for class trips and the open area surrounding it gives lots of space for students to play games (there are a lot of experiential games such as Rob the nest, Web of life, 5 minute bird counts, Meet a tree, Non-nature trail, available on line – see below for suggested sites).

Large rimu, kauri and totara logs were removed from the bush by Caesar Roose Company and transported to timber mills in Mercer. The timber could have been used in both NZ and Australia (as Roose was known as a timber exporter). Roose also supplied kahikatea to a butter box factory in Tauranga. Roose was also a flax miller –there were previously mills along the Mangatea stream.

http://www.dnzb.govt.nz/dnzb/default.asp?Find_Quick.asp?PersonEssay=4R27

Apart from the clearings left there is little else remaining on site that gives any insight into the logging or flax milling history. (You may be able to find the wire rope still.) Use the New Zealand Encyclopaedia website to learn more about life in the bush in early New Zealand. <http://www.teara.govt.nz/en/the-bush>

Experiential Nature activities and games sites (this is just a start):

<http://www.doc.govt.nz/getting-involved/for-teachers/outdoor-and-classroom-activities/>

<http://www.outdoor-nature-child.com/nature-activities.html>

<http://www.ultimatecampresource.com/site/camp-activities/nature-games.page-1.html>

<http://wilderdom.com/games/EnvironmentalActivities.html>

<http://www.thebiggreenidea.org/images/biggreenidea/files/info-sheets/NatureGamesAndActivities.pdf>

<http://www.kudu.net/OUTDOOR/winter/activities/games/nature.htm>

Privet/Weed Activity

Learning intentions:

Students will learn what a weed is and how to identify a major weed species of Pukemokemoke. Students will learn about weed management options and consider how, as individuals or as a group, they can make a difference.

Pre Visit

What is a weed? What features make a plant a weed?

As a class develop a definition for a weed.

If you were a weed, what features would you want to be successful? What impact does a weed have on our forests?

Privet is one of the most problematic weeds in Pukemokemoke. How does privet get into our forest fragments? Was it always thought to be a weed? How did it get into New Zealand? What country did it come from? Was it a problem in that country?

Create a privet identification card of your own. Note the colour, shape and size of the leaves, the shape and size of the tree and any other features that will help identify this plant in the field.

Before you go on your trip you might like to contact Pukemokemoke Trust to discuss ways that you could help.

Visit

Walk along the road to the north-east of the log hauler site a short distance. Note the large clumps of privet trees. Can you see any other plants growing up through them? Do you think these are native? Crawl under a clump of privet. What is it like beneath? How much light is getting to the ground? What undergrowth is there? Compare this with the main bush areas and in particular the kawakawa grove.

From the log hauler site walk towards the stream and view the different areas where privet has been removed and the area which has been replanted with natives. What do you notice? Is there any sign of the privet regrowing?

Why do you think the Pukemokemoke Trust people want to remove the privet?

Consider the option of leaving the weeds. Could the natives eventually take over? What might happen?

Post Visit

Reflect on what you observed about privet plants in Pukemokemoke. How big is the problem? Why? Create a double bubble comparing the privet infested area with that of the kawakawa grove.

Did you see any evidence of ecological restoration work? What were some of the methods used?

If you were able to participate in ecological restoration when on your Pukemokemoke trip, reflect on what actions you took. Why were you doing this? How do you know if you were successful?

What can you do to help in the future? Pukemokemoke Trust has a long term management plan for looking after this forest. Discuss as a class the sort of things that you could be involved in and contact the Trust to offer help.

<http://www.doc.govt.nz/getting-involved/volunteer-join-or-start-a-project/join-a-group/waikato/pukemokemoke-bush-reserve>

Weeds cont.

Background information:

Plants brought into New Zealand because of their horticultural values (e.g. as garden plants, pasture, fruit), have in some instances become weeds. In their native country they would have had natural competitors and enemies that might graze on or parasitise them. The climate may also have contained their growth. When these plants are brought into New Zealand with our different range of plants, bugs, birds and soils and climate they sometimes behave differently. Some of these introduced plants have proliferated to the detriment of biodiversity and commercial values.

A weed might have any number of the following characteristics or more: smothers/shades out other plants, reproduces prolifically, spread easily by having tasty fruit, or sticky seeds, readily spreads by vegetative growth and/or seed/fruit, produces large quantities of seeds, upsets the community dynamics by outcompeting certain species, prevents regeneration of native species by restricting their growth and reproduction, unpalatable to stock, poisonous.

Weeds such as privet can have an effect on biodiversity and health of a forest fragment (*environmental*), aspects such as time and money to remove/manage, reduced value (*economic*), as well as impacting on people who visit (*health*).

A number of weeds are found in Pukemokemoke. Gorse and pampas, previously at problem levels have now been almost eliminated (through chopping, and spraying). Privet http://weedbusters.co.nz/weed_info/detail.asp?WeedID=86 and honeysuckle are still major problems especially along the river margin and on the lower flats to the north-east of the log-hauler site. A massive effort during 2005-2006 saw all the privet and honeysuckle removed from a large area along the Mangatea Stream either side of the bridge. This was subsequently planted in 2000 native trees and shrubs. The majority of these plants have grown well and are now creating a canopy of healthy vegetation along this portion of the stream bank.

There are approximately 3.5 hectares of solid privet and associated honeysuckle that have taken over the very fertile river flat to the south-east of the log hauler site. Many hours are spent each year by volunteers removing adult plants, poisoning them and weeding out young re-growth. Because privet is a prolific fruiter and berries are readily spread by birds, the problem is huge, and needs constant work to maintain cleared areas as well as on-going removal of the adult (seed-source) trees. Unfortunately this cannot be achieved quickly. The Trust has developed a plan of attack in manageable stages (a long term management plan). After clearing the privet by cutting and poisoning, replanting with eco-sourced native species is carried out to help restore the vegetation to what it once was. The sooner a forest canopy is established, the sooner the river flats will become attractive to native birds such as kereru, bellbird and tui.

<http://weedbusters.co.nz/index.asp>

<http://www.landcareresearch.co.nz/education/weeds/>

