national tree day

treeday.planetark.org

EARTH ALIVE:

AN ACTION-BASED INVESTIGATION OF LOCAL BIODIVERSITY

FIELDOFMARS
ENVIRONMENTAL EDUCATION CENTRE
EXPERIENCE ENGAGE ENABLE

National Tree Day is organised by Planet Ark in partnership with Toyota Australia

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Earth Alive is a 10 week action-based science unit of work suitable for students in Years 5 & 6 focusing on authentic scientific investigation resulting in local action. The program investigates biodiversity in the school grounds and culminates in a *Schools Tree Day* planting action project.

Acknowledgements

This unit of work is an adaptation of the *Earth Alive* program developed by Field of Mars Environmental Education Centre (**www.fieldofmar-e.schools.nsw.edu.au**) in Sydney, NSW, operated by the NSW Department of Education and Training. The *Earth Alive* program has been successfully taught in several Sydney primary schools over the past ten years and has resulted in extensive improvements to biodiversity in those grounds and increased knowledge and understandings in the students.

The original program was researched and developed by Steven Papp, Field of Mars EEC, 2000 with revisions by Gaye Braiding, Field of Mars EEC, 2006 and 2009. It has been adapted for use nationally to support Planet Ark's *Schools Tree Day* by Gaye Braiding, Field of Mars EEC, March 2010.

Line art by Kerry Cooper. Photographs by Steven Papp and Gaye Braiding.

Special thanks to the Community Biodiversity Network (now non-operational) for allowing the use of the *Earth Alive* title and logo.

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Introduction

What is *Earth Alive*?

Earth Alive is a 10 week science program that aims to develop knowledge, understanding, care and action for local ecosystems and biodiversity. It provides an opportunity for *Schools Tree Day* planting to be integrated into a meaningful teaching and learning sequence.

The purpose of the program is for students to:

- increase their knowledge and understanding of ecosystems and biodiversity
- conduct a scientific investigation into the biodiversity within the school grounds or local area
- plan, undertake and maintain a planting action project to improve local biodiversity.

Who is *Earth Alive* for?

This unit of work has been developed for Year 5 and 6 students Australia-wide.

Where does *Earth Alive* fit into my teaching and learning program?

The *Earth Alive* program can be taught as an independent science unit or in conjunction with environmental units in society and culture.

The unit of work contains ten core sequential learning experiences, each with background information, activities, associated worksheets and Internet resources. Optional additional or alternative activities are also included.

The biodiversity investigation and *Schools Tree Day* planting action project can be an integral part of the school's environmental sustainability planning and management. *Earth Alive* is an ideal unit of work to teach in Term 2, culminating in planting on *Schools Tree Day* at the beginning of Term 3. (*Please note climatic conditions around Australia may dictate a different planting schedule. Simply register your Schools Tree Day planting at **treeday.planetark.org** whenever it occurs.)

What does *Earth Alive* cover?

Bio What?

- What is biodiversity?
- Local biodiversity exploration

Bio Links

- Understanding biodiversity
- Ecosystems, interrelationships, food chains and webs

Bio Threats

- Impacts on biodiversity – local and broader – and their management

Bio Design

- How is biodiversity measured?
- Design a scientific investigation to investigate local biodiversity

Bio Investigator

- Conduct a scientific investigation to investigate school or local biodiversity

Bio Conclusions

- Present investigation findings and conclusions

Bio Action

- Undertake a *Schools Tree Day* planting action project to improve local biodiversity
- Reflect on the investigation and action project processes
- Evaluate knowledge and understandings
- Celebrate success of the action project result

Bio Maintenance and Sustainability

- Develop and implement a plan to maintain the planting project into the future

Why is the *Earth Alive* program important?

Australia is a beautiful country. With its many different environments, and vast array of plants and animals that inhabit them, it has to be one of the most incredible places in the world ….

We live in a truly remarkable biological paradise. However, our paradise is threatened by our appalling record of biodiversity loss due to poor natural resource management practices – mismanagement which also results in extensive biological degradation. This is not a record of which we can be proud.

For future generations, and on behalf of the planet, it is vital that we take more responsibility for caring for our environment, plants and animals.
(David Lindenmayer, 2007, pp. xi-xii.)

Ecosystems which contain the greatest variety of plants and animals are often the most robust, stable and resilient due to the complex interrelationships that occur between living things. However, even the most robust of ecosystems are in danger.

What can be done? This unit of work provides students and teachers with opportunities to get out of the classroom, to explore their local environment, to discover what biodiversity is about and then to do something positive for it.

This requires first investigating what's out there and then determining what actions we can take to help those organisms survive. Regardless of being cute or ugly, pleasant or scary, big or small, all elements of an ecosystem are essential to the maintenance of life.

The *Earth Alive* program stresses the connectedness of all living things and the importance of saving whole ecosystems and all the species they contain. The *Earth Alive* program provides an authentic context in which students and teachers can play an active role in helping to restore the biodiversity in and around their school through planting projects linked with *Schools Tree Day*. It provides an authentic scientific investigation that leads to local social action.

Curriculum Links

Earth Alive supports the content in the Living Things or Life and Living strand and Scientific Investigation processes of state and national Science curricula. It also supports content in the Environment strand of Society and Culture or Geography curricula.

Teacher Preparation

Read through the *Earth Alive* unit of work. The program can be taught as it is or can be modified to suit the needs of your students and school.

Duplicate student worksheets. These work well stapled into a booklet for use during the program.

Gather invertebrate collection equipment (see p.17).

Hold discussions with the Principal/Executive regarding funding availability, potential areas in the grounds that could be planted and the scope of potential planting projects.

If appropriate, invite parent and community involvement.

Suggested Term Timetable

Week	Learning Experiences
1 - 2	**Bio What?** • What do you know about biodiversity? • What is biodiversity? What is an ecosystem? • What is the biodiversity of the school grounds?
3	**Bio Links** • Local small scale ecosystems • Food chains and webs
4 - 5	**Bio Threats** • Impacts on biodiversity • Local biodiversity threats • Managing biodiversity impacts
6	**Bio Design** • How is biodiversity measured? • Design a scientific investigation • Making invertebrate traps
7	**Bio Investigator** • Scientific investigation
8	**Bio Conclusions** • Analysing data and drawing conclusions • Scientific report
9 - 10	**Bio Action Planning** • What can be improved? • Plan a planting project
Schools Tree Day	**Bio Action Doing** • Undertake the Schools Tree Day planting action project • Reflect and evaluate
Ongoing	**Bio Maintenance & Sustainability** • Ongoing action

Learning Experience 1 - Bio What?

Background

What is biodiversity?

What do ponds full of micro-organisms, a forest containing powerful owls, a mangrove area teeming with crabs, the local neighbourhood creek and a flock of galahs screeching overhead have in common? The answer is that they are all facets of Australia's rich biodiversity.

Australia is one of the most biologically diverse countries on the planet. It is home to more than one million species of plants and animals, many of which are found nowhere else in the world. About 85 percent of flowering plants, 84 percent of mammals, more than 45 percent of birds, and 89 percent of inshore, freshwater fish are unique to Australia.
(Department of Environment and Heritage, 2005)

The term biodiversity describes the immense variety of all living things: 'bio' = living; 'diversity' = variety. Biodiversity is the variety of plants, animals and micro-organisms, the genetic information they contain and the ecosystems they form. It is usually considered at three interconnected levels: genetic diversity, species diversity and ecosystem diversity. Biodiversity stresses the connectedness of the living world.

Further information on the definition of biodiversity:

What is Biodiversity (Australian Museum) – **http://australianmuseum.net.au/What-is-biodiversity**

Biodiversity Hotspot (Grow us a Home) – **http://www.growusahome.org.au/biodiversity.php**

Why is Australia's biodiversity special?

Millions of years of isolation from other continents have resulted in the evolution of unique Australian plants and animals. It is estimated that Australia has well over one million different species and because of our isolation a high percentage of these species occur nowhere else.

With habitats ranging from the arid inland to the Great Barrier Reef, from the wet tropical rainforests of the north to the temperate grasslands and tall eucalypt forests of the south, Australia is graced with a rich diversity of ecosystems.

Why is biodiversity important?

Biodiversity is nature's insurance policy. It is about life supporting life. Biodiversity helps to maintain important ecological processes such as oxygen production, pollination, and flood control that, in turn, help support all life on earth.

Biodiversity provides us with clean air and water, soil for crops and forests and to sustain the productivity of terrestrial and aquatic ecosystems. We rely on a vast range of plants and animals, and an equally vast array of micro-organisms, as sources of food, fibre and medicines. For instance:

- Australia has many native fish and crustacean species that are harvested for food.
- A vine from Queensland's rainforests has proved effective in treating leukaemia.
- Bark from a tree in the Kimberleys is a pain killer, more powerful than morphine.

Potential products of the future include sunscreens from corals, light and high tensile fibres from spider silk (eg, bullet proof vests) and instant adhesives from velvet worms or barnacles.

Biodiversity allows for important recreation activities such as bushwalking, fishing, and camping. It also generates significant income for Australia in terms of tourism. The growing ecotourism industry is dependent upon maintaining the natural environment. Biodiversity also provides inspiration and provokes curiosity and imagination, often expressed through art, music and poetry.

All species have the right to exist and no generation has the right to destroy the environment and resources on which future generations depend.

(Source: Recher, 1997, World Wildlife Fund, 1999; Environment Australia, 1998)

What is an ecosystem?

The term ecosystem describes a community of living things in a particular area and their interaction with the non-living things in that area, for instance, soil, rocks, weather and water. Matter constantly cycles and recycles in an ecosystem and energy moves through the cycle.

Plant layers

Plants are the foundation of most ecosystems. In most ecosystems plants can be found in a number of layers. Layers describe groups of plants that usually share similar characteristics. The three most common terms for plant layers are trees, shrubs and ground covers. In areas where certain layers have been removed it is likely the animals that depend on those layers will also be absent. (NSW National Parks and Wildlife Service, 2003)

Trees are usually tall with a single trunk at the base and with the canopy at the top. Native examples include gums, wattles, she oaks and paper barks. Non-native examples include camphor laurels and pine trees.

Shrubs are usually mid-height with several woody stems growing out of the base with foliage growing from the stems. Native examples include bush peas, wattles, grevilleas and banksias.

Ground covers including herbs are usually low height with flexible green stems growing from the base. Examples include native grasses, lilies, mat rush, vines and orchids.

Lessons

1. What do you know about biodiversity?

Get started.

Assess the students' prior knowledge using the *Biodiversity Mindmap (WS1)* or a KWFL chart (what they Know, what they Want to learn, what they have Learnt, How did they learn it). This will provide the students' entry level knowledge. At the end of the program, the sheet can be returned to the students so they can add further information to show their growth in knowledge and understanding.

School provides: *Biodiversity Mindmap (WS1)* or a KWFL chart

2. What is biodiversity? What is an ecosystem?

Tune in. Engage.

Students watch the Wild Classrooms Biodiversity video

http://www.thewildclassroom.com/home/ecogeeksvideos/biodiversity.html

This video defines biodiversity and its three levels: genetic diversity, species diversity and ecosystem diversity.

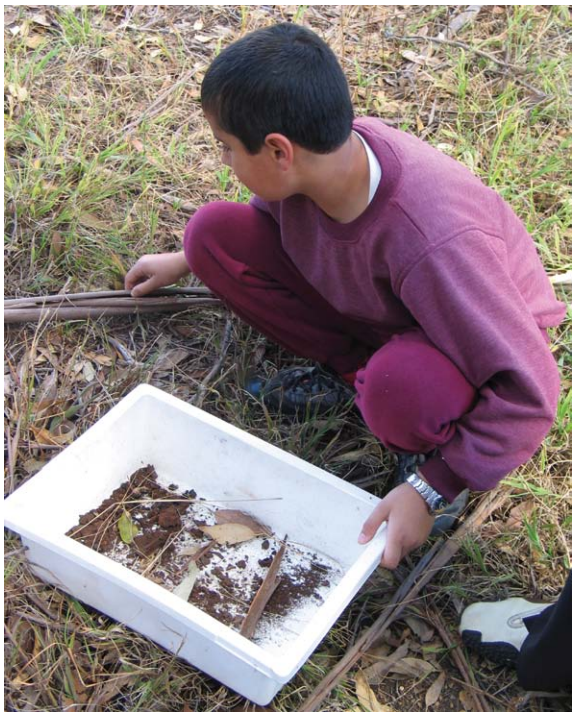
Discuss and define the term 'biodiversity' with the students and identify a variety of ecosystems. A good way to do this is to ask the students where they have been for holidays or where they would like to go.

Watch the Official Video of the International Year of Biodiversity 2010

http://www.youtube.com/watch?v=V1VYmpTikgw.

This video covers the current state of biodiversity, threats to biodiversity, the benefits of biodiversity and solutions and provides a good introduction to the unit of work.

School provides: Computer, screen, projector, speakers



3. What is the biodiversity of the school grounds?

Get outside! Find out. Explore. Observe.

This initial biodiversity survey will focus on plant variety and vegetative layers as plants are the foundation upon which most ecosystems are based. It is designed to get the students to view their playground from a different perspective, with a biodiversity focus, and establish a sense of place.

Walk around the school grounds with the students. Using the *Biodiverse Playground Data Sheet* (WS 2) give the groups a time limit to count as many species as possible belonging to one of the vegetative layers in particular areas. The students justify the number counted by describing or sketching leaf shape, flowers and bark on the data sheet. Students should also take digital photos of each area.

The variety of plant species counted will help the students make inferences about the possible number of animal species at a later date. Also look for evidence of animals in each area, eg, droppings, chewed leaves, scratch marks, webs, etc. Note these on the recording sheet.

Ask the students to compare the areas as you walk around asking questions such as: Do you think this garden area would have greater biodiversity than the bush corner? What invertebrates and other animals would you expect to find in this area? (Invertebrates are a good indicator of biodiversity.)

In the classroom, display a large map or Google Earth satellite image of the school site. Students label the map or satellite image with information from the *Biodiverse Playground Data Sheet* (WS 2) and digital photos. This could be done digitally on an IWB.

School provides: *Biodiverse Playground Data Sheet* (WS 2), digital cameras, large map or Google Earth satellite image of school site

Optional activities

Analysing School Grounds Land Use

(Adapted from Tanner, 2007)

On Google Earth, 'fly in' to your school site and bring the image to screen size. Copy and paste the image onto a blank page. Overlay a grid, this can be a table that is 10 rows by 10 columns, preferably square, or in Notebook, a grid or table and adjust transparency. Alternatively, print the satellite image and overlay a grid printed onto an OHT.

Identify the various land uses and ground cover in the school grounds, eg, mowed turf, asphalt and buildings, trees and shrubs, etc. Create a key using colour for each land use. Fill the grid squares with the appropriate colour over each land use. Count the grid squares for each land use and convert to percentages. What percentage of the school grounds provides wildlife habitat? This activity works well on the IWB.

Wildlife corridors

In Google Earth, zoom out and look for vegetation corridors connecting the school grounds to local corridors. Indicate these on the school map or satellite image. Vegetation corridors connect habitats and are very important for wildlife.

Hidden biodiversity

Biodiversity is all around us but we are often unaware of its existence. Read the picture book *The Hunt* by Narelle Oliver to illustrate that biodiversity is not always obvious. Ask the students to look for the variety of different animals hidden in the pictures as well as other examples of biodiversity. How many animal species are on each page? What other animals do you know of that are camouflaged?

If *The Hunt* is not available, these other Narelle Oliver picture books use a similar technique: *Baby Bilby, Where do You Sleep?; Leaf Tail; Sand Swimmers; Twilight Hunt.*

Students could create an artwork to show (hide) a camouflaged animal, eg, colours, camouflage patterns, etc. A print-making technique similar to *The Hunt* illustrations produces effective results.

Australian habitats

What are the main types of habitats in Australia and the characteristics of each? For example, wet, dry, sandy, muddy, treed, grassland, etc. From the *Wild Kids- Habitats* website, **http://australianmuseum.net.au/Wild-Kids-Habitats**, pick the most relevant habitats to your area, or any you think the students would find interesting. These habitats are all examples of ecosystem diversity.

The habitats shown on the website are: coastal, freshwater, forest, arid, woodland, urban, Antarctic. What habitat types are represented in the school grounds?

Resource: *Wild Kids* - **http://australianmuseum.net.au/Wild-Kids**

Reading about biodiversity

Chapters and extracts from *Biodiversity: Nature's variety, Our heritage, Our future,* available in PDF format, could be used for class reading activities. Available at **http://www.environment.gov.au/biodiversity/publications/natures-variety/pubs/backyard.pdf**.

Learning Experience 2 - Bio Links

Background

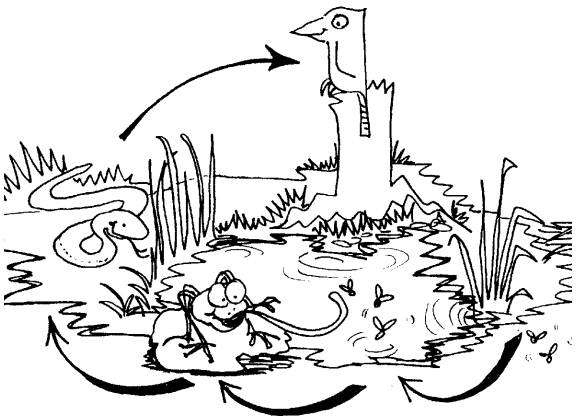
Food chains and food webs

The interrelationships between plants and animals and the non-living elements of an environment form the basis of all ecosystems. Food chains and food webs show the flow of energy through an ecosystem.

A food chain shows feeding relationships at the simplest level. A food chain always begins with a green plant which is a producer. This is eaten by an animal which is a consumer. Consumers that eat plants are herbivores and consumers that eat other consumers are carnivores. Animals that eat some plants and some animals are omnivores. The arrows in a food chain mean 'eaten by' and show the flow of energy.

Example: grass > grasshopper > lizard > kookaburra

Energy flows are not this simple as animals eat a variety of species. The more complex flow of energy among many species are shown as food webs.



Ecosystems

There is an enormous variety of ecosystems in the world providing many different habitats. An ecosystem can be very small or very large. For instance, an entire ecosystem can be underneath a fallen log but that fallen log may belong to a larger dry forest ecosystem. This diagram shows the inter-relationships in an ecosystem - **http://www.environment.sa.gov.au/education/interactive/ecosystems/01_concept.htm**

Lessons

1. Local small scale ecosystems

Get outside! Explore. Observe.

In the school grounds the students look for small-scale ecosystems. Examples include the bark of a tree, under a log, in the mulch or leaf litter, even the accumulated leaves at the entrance to a drain. Using a small stick or similar, the students gently explore the biodiversity within this small ecosystem. They take digital photos or sketch their small-scale ecosystem and list or label the variety of species within it.

School provides: Digital photos, sketch pads and pencils

2. Food chains and webs

Explain. Elaborate.

The picture book *Leaf Litter: Exploring the Mysteries of the Hidden World* by Rachel Tonkin is a good introduction to this activity as it shows the complexity of small scale ecosystems.

Observing the labeled sketches or digital images of the small scale ecosystems found in the playground, ask the students to make inferences about the links between the plants and animals in that ecosystem, eg, slaters eat the rotting leaves, spiders eat the slaters. Students write or draw these as simple food chains, demonstrating the links between animals and plants.

To deepen understandings about food chains and webs, students could use the Gould League's online food web creator - **http://www.gould.edu.au/foodwebs/kids_web.htm**. Students then create their own food chain or web for a local Australian animal. This could be done as a sketch, a mobile or using mind mapping computer software such as *Inspiration*. Begin with simple food chains, e.g., grass > wallaby > dingo.

Food webs should only be introduced when students have a clear understanding of food chains. Knowledge about what some native species eat is essential for this activity to be effective.

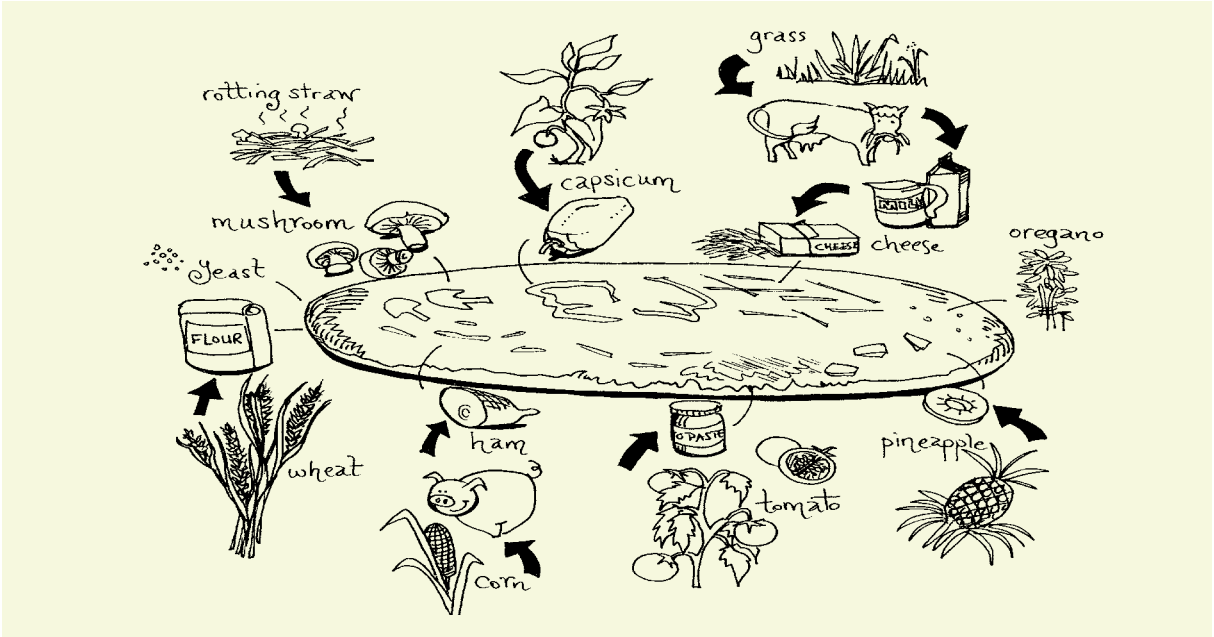
Refer back to the small scale ecosystems explored in the playground. Ask the students to remember what they saw the most of. Discuss what happens when an animal or plant is removed from the food chain. Also discuss the most important elements in the food chain/web. Discuss why it is better for an ecosystem to have lots of different plants and animals.

School provides: *Leaf Litter: Exploring the Mysteries of the Hidden World* by Rachel Tonkin (optional), student computers or IWB

Optional Activities

Food chain pizza (or fried rice or sandwich)

Students are provided with a range of ingredients to create a pizza. Students prepare then cook the pizza. While cooking, students draw a picture of a pizza and trace each of the food items used back to its origin, eg, cheese to milk, to a cow, to grass. Muffins make ideal mini pizza bases. This activity works just as well for fried rice or a sandwich.
(Source Gould League, 1999, p. 25)



Learning Experience 3 - Bio Threats

Background

There are many threats to biodiversity and many of these are a result of activities by humans. Threats include land clearing or habitat destruction, feral animals, weeds, pesticides, pollution, agricultural and farming techniques and climatic changes.

Land clearing has caused more loss of biodiversity than anything else. Land clearing results in:

- loss of habitat and reduced or fragmented ranges of species
- land degradation and salinity, impacting plant growth

Feral animals, eg, foxes, cats, dogs, carp, horses, goats, cane toads, European wasps, honeybees and rabbits, affect our biodiversity because they:

- prey on native animals
- compete for nest sites
- compete for food
- cause soil erosion
- foul waterways.

Weeds:

- compete with native plants for light and growing space
- are unpalatable for many native animals
- smother vegetation and prevent and/or inhibit native plant re-growth.

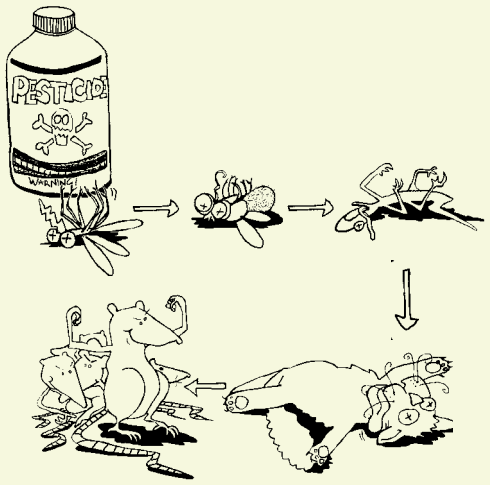
Agriculture and farming techniques, eg, land clearing, the extensive farming of hoofed animals and the use of pesticides, cause problems such as:

- Native vegetation is cleared, destroying animal habitats and causing erosion. With mass tree removal the water table rises and dryland salinity can result.

- Hoofed animals such as cows and sheep compact the soil, can lead to erosion and increase competition for food.
- Mono crops need chemicals such as pesticides, fungicides, fertilizers. These can wash into waterways causing increased nutrients which cause algal blooms. Pesticides can poison many animals, even those not intended.

A pesticide chain reaction

Malaria once infected nine out of ten people on the island of Borneo. In 1955, the World Health Organisation (WHO) began spraying dieldrin (a pesticide similar to DDT) to kill malaria carrying mosquitoes. The program was so successful that the dreaded disease was almost eliminated from the island. But other unexpected things happened. The pesticide killed other insects, including flies and cockroaches inhabiting the houses. The islanders applauded. But then small lizards that also lived in the households died after gorging themselves on dead insects. Then cats began dying after feeding on dead lizards. Without cats, rats flourished and began overrunning the villages. Now people were threatened by sylvatic plague carried by the fleas on the rats. The situation was brought under control when WHO parachuted healthy cats onto parts of the island. On top of everything else, roofs began to fall in. The pesticide had killed wasps that fed on a type of caterpillar that either avoided or was not affected by the insecticide. With most of its predators eliminated, that caterpillar population exploded. The larvae munched their way through one of their favourite foods, the leaves used in thatching roofs. Eventually the situation was brought under control but the story shows the unpredictable results of interfering with an ecosystem. (WWF, 1999, p. 29)



Consumption habits and product choice can affect biodiversity. For instance:

- purchasing rainforest or non-plantation building materials and furniture destroys animal habitats
- buying non-recycled paper destroys habitats
- buying endangered animal products threatens the existence of species
- purchasing from companies that don't have strict environmental guidelines can contribute to environmental destruction and degradation.

Climate change can affect global biodiversity as habitats change faster than species can adapt to them. This can lead to the extinction of species.

The combination of past landscape modifications and future climate change means that many species of animals and plants will find it increasingly tough to find a place to live.
David Lindenmayer, 2007, p. 61.

Other impacts of climate change include:

- Changes in the size and continuity of the area in which native species can survive
- Breeding and migration can become out of synchronisation with food availability, eg, caterpillars hatching before their food source is available. The newly hatched caterpillars die. This will impact on birds which feed on these caterpillars.
- Plant growing seasons may be altered.
- Increased growth and spread of weeds.
- Warmer temperatures will favour some species over others and will affect the balance of nature.

Further information on threats to biodiversity:

What's happening to Australia's biodiversity? (Australian Museum)

http://australianmuseum.net.au/Whats-happening-to-Australias-biodiversity

Impact of global warming on biodiversity (Australian Academy of Science) – **http://www.science.org.au/nova/091/091key.htm**

Lessons

1. Threats to biodiversity

Find out. Explain.

Show images showing threats to biodiversity, read relevant news stories and a variety of picture books dealing with impacts on biodiversity. Relevant picture books include *The Story of Rosy Dock* by Jeannie Baker, *Refugees* by David Miller, *The Tin Forest* by Helen Ward, *The Rabbits* by John Marsden and Shaun Tan, *Belonging* by Jeannie Baker, *The Lorax* by Dr Suess (video - **http://treeday.planetark.org/kids/lorax.cfm**)

The students create Mind Maps or Spider Charts to show a range of threats to Australian biodiversity, for example, feral animals, weeds, pesticides, agricultural techniques, habitat loss, pesticides, pollution, climate change. The students could research the impacts of these on biodiversity. As a class, discuss ways in which these threats could be reduced or eradicated. The students could debate topics relating to biodiversity threats.

School provides: Picture books (optional): *The Story of Rosy Dock* by Jeannie Baker, *Refugees* by David Miller, *The Tin Forest* by Helen Ward, *The Rabbits* by John Marsden and Shaun Tan, *Belonging* by Jeannie Baker, *The Lorax* by Dr Suess; newspaper articles

2. Local biodiversity threats

Get outside! Explore. Explain.

Discuss the threats relating to biodiversity in the school or local area. Walk around the school or local area and identify threats and their impact on biodiversity. Also look for management strategies, for example, pollution traps on drains, fox-baiting programs, “Dumping Prohibited” signs. Students complete the *Biodiversity Threats* worksheet (WS 3). Students then create a Consequence Chart or Cause and Effect Wheel to show the immediate consequence and flow-on effects of the local biodiversity threats.

Local council environment officers or Landcare members could be invited to talk to the class about issues affecting local biodiversity and their solutions to these issues.

Students could design and display posters outlining actions people can take to solve or reduce an environmental problem in their school.

Students could use the *My Environment* online tool to generate a report on the biodiversity of their local area - (Australian Government Department of the Environment, Water, Heritage and the Arts) **http://www.environment.gov.au/erin/myenvironment/about/index.html**

School provides: *Biodiversity Threats* worksheet (WS 3); digital cameras

3. Managing biodiversity threats

Go further. Elaborate.

Show excerpts of the video on Biodiversity and Climate Change (International Convention on Biological Diversity, 2007) - **http://vimeo.com/7965089**.

Hold class discussions about the challenge for current and future generations to manage biodiversity in a way that ensures economic viability, that is, to manage production in a way that is ecologically sustainable.

To apply their understandings, the students use the *EcoFarm* and *EcoForest* interactives on the *On Borrowed Time* website (CSIRO) **http://www.publish.csiro.au/onborrowedtime/sections/index.html**. Students make choices that endeavour to promote or maintain biodiversity whilst ensuring economic profitability and maintenance of jobs. The interactives display the consequences of decisions made over time.

School provides: student computers, screen, projector, speakers, computer

Optional Activities

Remnants game

This game provides students with an insight into how the fragmentation of bush can affect biodiversity. Students will experience habitat loss, overpopulation and breeding problems.

In an open space spread large sheets of newspaper on the ground to represent trees. Each square can only support four animals if it is intact. When the music plays the students move like animals around the newspaper. Liken this to night-time with nocturnal animals. When the music stops (sunrise) students need to find a newspaper to stand on.

Start to remove newspaper sheets while providing a scenario such as, "We need to put a road through here, a housing development, a new shopping centre, a school, etc." As the newspapers are removed the students who are not standing on a paper are also removed from the game. They represent animals which died because they were not located in a safe place in the bush during the day.

As the game continues the sheets of newspaper become tatty and torn. These represent over populated areas, that is, too many animals in one small part of the bush. Remove some animals from these sheets as they can now only support two animals. How long does it take for the animals to die off without sufficient bush? What happens when the bush is cut up into small bits?

Add another element to the game. As the number of students decreases introduce the problem of breeding. If a paper does not have both male and female animals on them when the music stops then the species won't be able to breed and they will die.

At the end of the game discuss the importance of the size of the areas of bushland, linking remnant bushland together to create bush corridors, and our behaviour in the bush that is left.

Ecological Footprint

Discuss ways in which everyday living impacts on the planet and explain the concept of "ecological footprint". Students then calculate their ecological footprint using the web-based *Bigfoot* calculator available at (Powerhouse Museum) **http://www.powerhousemuseum.com/education/ecologic/bigfoot/mid/**. There is also a school ecological footprint calculator at (EPA, Victoria) - **http://www.epa.vic.gov.au/ecologicalfootprint/calculators/school/schoolDetails.asp**

Biodiversity debates

This is a good assessment strategy.

This activity helps students develop deeper thinking about an issue relating to biodiversity and gets students to analyse some of the associated feelings and values towards the issue. Groups of students select a biodiversity issue (or select from the list below) and then they decide which pair argue for the affirmative or the negative. Debates are presented to the class.

Possible topics:

- Native gardens are better than non-native gardens
- Cats should be kept inside
- All pesticides should be banned
- All non-native animals should be culled
- Aboriginal fire-stick farming was good for the bush
- Vegetation corridors waste good farmland
- Bush regeneration is a waste of time and effort.

Learning Experience 4 - Bio Design

Background

How is biodiversity measured?

Biodiversity is usually measured by assessing the variety of species in a particular area. This can be done by counting the variety of plant species, checking for the presence of and combination of plants belonging to different layers, or counting the abundance and variety of animal species. The types of animals present will be influenced by vegetation in the area.

Invertebrate organisms, such as ants, termites and beetles, play a key role in ecosystem health because of their dominant contribution to biodiversity, and their influence on important ecological processes. If an ecosystem's invertebrate populations are in good shape, then this indicates that the ecosystem in general is also in good shape. (CSIRO, 2005)

As invertebrates are a good indicator of the health of an ecosystem, collection and recording of invertebrates in an area provides a good measure of the biodiversity of the area.

Conducting scientific investigations

A scientific investigation involves students using the processes of observing, questioning, planning, predicting, testing, collecting, recording and analysing data to draw conclusions in order to develop a better understanding of the world around them, relying heavily on first hand information.

The process is further explained in *Investigating Scientifically: Support for Stage 3 Teachers* (NSW Department of Education and Training, Curriculum K-12 Directorate, 2005) - **http://www.curriculumsupport.education.nsw.gov.au/primary/scitech/investigate/docs/invest_st3.pdf**

Invertebrate trapping, collecting and observing

Refer to the *Trapping Invertebrates* worksheet (WS 5) for traps the students can make and set for trapping invertebrates.

Other simple collecting equipment includes:

- small plastic containers with lids or specimen containers or bug jars
- magnifiers, eg, hand lenses or magnifying glasses
- trowels
- old sheets
- butterfly nets or sweep nets
- invertebrate identification charts.

For safety reasons, it is important that students do not touch invertebrates with their hands.

Arboreal invertebrates - A tree shake is used to collect and observe invertebrates that live in trees and shrubs. This involves placing a large sheet under the branch of a tree or shrub while another student gently shakes or beats the branch over the sheet. Any insects on the branch should fall onto the sheet for collection or observation.

Leaf litter invertebrates - To collect and observe leaf litter invertebrates, use a trowel to scoop up some leaf litter and spread it out onto an old sheet or into a tray. Use a stick to sift through the leaf litter looking for invertebrates. Gently tap them into collection containers for further observation.

Ground cover layer invertebrates - Depending on the school grounds, sweep nets can be used to capture invertebrates that live in or near the ground layer of plants. Nets are swept side to side through low soft foliage plants and grass. Captured animals are transferred from the net into a collection jar.

Videos showing invertebrate collecting methods:

Minibeast mission leaf shake (Macquarie ICT) - **http://www.youtube.com/watch?v=u315VvOEm5U&NR=1**

Minibeast mission leaf litter (Macquarie ICT) - **http://www.youtube.com/watch?v=x6wrtvNJou0**

Collecting bugs, SCOPE video (CSIRO) - **http://www.csiro.au/scope/clips/e02c02.htm**

Invertebrate identification charts and guides

Bugwise Quick Invertebrate Guide (Australian Museum) - **http://www.bugwise.net.au/files/resources/pdf/quick_invert_guide.pdf**

Bugwise Invertebrate Identification Guide (Australian Museum) - **http://www.bugwise.net.au/files/resources/pdf/invertebrate_guide.pdf**

Spider Identification Chart (Queensland Museum) - **http://www.qm.qld.gov.au/features/spiders/spidersnest.asp**

Spider Gallery (Museum Victoria) - **http://museumvictoria.com.au/spiders/gallery.aspx**

Backyard Bugs Guide (CSIRO) - **http://www.csiro.au/files/files/p8m0.pdf**

Lessons

1. How is biodiversity measured?

Engage. Tune in.

Ask the students: If you were a scientist, how would you find out about the biodiversity in your school?

Watch these video clips showing scientists at work measuring biodiversity. Savannah Walkabout, Meet the Researchers (EnviroNorth) - **http://www.environorth.org.au/teach/walkabout/living_savannas.html**

Measuring Biodiversity (*Wildlife Friendly and Productive Farms*, CSIRO) - **http://www.publish.csiro.au/onborrowedtime/sections/farm_sci_exp.html#measuring**

School provides: student computers or screen, projector, speakers, computer

2. Design a scientific investigation

Get outside! Question. Plan. Predict. Test.

Re-visit the areas of the school playground explored in Learning Experience 1 and refer to the class satellite image/map created after that first playground biodiversity exploration. Ask the students about differences they noticed among the areas they recorded. Question them about the differences.

Explain that the students are going to investigate this biodiversity further in a scientific investigation.

Show the students examples of invertebrate traps (from the *Trapping Invertebrates* worksheet - WS 5) and show them other collecting equipment that they will use. This may need to be brought in by the students. Whilst outside, demonstrate how to use the equipment.

Back in the classroom, assist the students to formulate a **hypothesis** for investigation. For example:

There is a greater diversity of animals in the native garden than the non-native garden. OR

There is a greater diversity of animals in the area with shrubs and trees than the area with just trees.

The students should record the hypothesis on the *Conducting an Investigation* worksheet (WS 4).

Ask the students to **predict** what they think they will find and why.

As a class with teacher guidance, or in pairs or small groups, students describe a **procedure** for their investigation and the equipment they will need to use. Discuss with the students how they should make their investigation fair and reliable. For instance, two or more pairs of students collect data from the same area, on the same day, at a similar time of day from areas of similar sizes. The procedure should be written on the *Conducting an Investigation* worksheet (WS 4). Students should identify the specific areas of the school they are going to study.

In the investigation, the students will measure the number and variety of invertebrates at each study site. The invertebrates are the dependent variable. The independent variable is what the investigator changes or controls. Selecting two or more areas with differing characteristics provides the independent variable and therefore comparisons can be made.

School provides: *Conducting an Investigation* worksheet (WS 4), student computers or screen, projector, speakers, computer, examples of invertebrate traps, invertebrate collecting equipment and ID charts (see p. 17)

3. Making invertebrate traps

Make. Create. Elaborate.

Some simple invertebrate traps are provided on the *Trapping Invertebrates* worksheet (WS 5). Watch the video How to build a pitfall trap (CSIRO) - **http://www.csiro.au/scope/activities/e02c02activity.htm**.

Students make one of the traps on the *Trapping* sheet or they can try to design their own. This is a good homework task.

These traps can be used in conjunction with the other simple collecting equipment and should be put into the study area overnight. Students should consider what they are trying to trap and issues related to trap safety for the animals and themselves.

School provides: *Trapping Invertebrates* worksheet (WS 5), student computers or screen, projector, speakers, computer, materials to make invertebrate traps

Learning Experience 5 - Bio Investigator

Background

Invertebrates are animals without a backbone and include animals such as insects, spiders, ticks, slaters, snails, slugs and worms. 99% of all animal species are invertebrates.

In natural systems invertebrates are very important animals. For instance, invertebrates help to recycle dead plant and animal matter, help to pollinate flowers and distribute seeds, and help aerate and turn the soil. Some eat other invertebrates which balances population numbers. Invertebrates are also an important food source for vertebrates higher in the food chain. Loss of habitat and inappropriate use of pesticides have an impact on invertebrate populations.

Scientists use invertebrates as a bio-indicator, that is, an indicator of the biodiversity of an area. This is because invertebrates are easy to sample, have great variety and abundance, play an important role in ecosystems and are sensitive to environmental changes. When assessing the biodiversity of an area, scientists make comparisons in invertebrate samples collected from various sites at the same time and also within the same area taken at different times.

Lessons

1. Scientific Investigation

Get outside! Collect. Record.

Students undertake their scientific investigation. (Student-made traps should have been put into the study areas the night before.) The students, working in pairs or small groups, select the equipment they need to conduct their investigation, following the procedure they described on their *Conducting an Investigation* worksheet (WS 4).

Students collect invertebrates in their study areas and record what they collect on the *Bio Survey Data Sheets* (WS 6 & 7). Students will need a separate data sheet for each area they investigate. Digital photos of the animals could also be taken. If available, students should also use magnifying devices to examine their animals more closely.

On completion of the *Bio Survey Data Sheet* (WS 5) it is important to return the animals to their habitat.

School Provides: *Bio Survey Data Sheets* (WS 6), pencils, clipboards, student-made traps set the day before, invertebrate collecting equipment and ID charts (see p. 17)

Learning Experience 6 - Bio Conclusions

Background

Students analyse their data so that they can draw conclusions in order to develop a better understanding of the world around them.

Lessons

1. Analysing data and drawing conclusions

Elaborate.

As a class, or in groups, collate the data for each study area. Students construct graphs to show the diversity and number of invertebrates found in each area. This could be done using the chart function in a spreadsheet application such as *Microsoft Excel*.

Review all the information gathered so far on the biodiversity of the school grounds. Discuss the results and ask the students questions such as: What is the total number of animals found in each area? Which species were the most common? Which areas had the greatest number of invertebrates?

Discuss whether or not the data collected supports the students' hypotheses. Assist the students to write a conclusion to their scientific investigation. Students complete the *Conducting an Investigation* worksheet (WS 4).

School provides: Completed *Conducting an Investigation* worksheets (WS 4), student computers or IWB

2. Scientific report

Publish. Present.

Students publish their investigation as a scientific report, a scientific poster, or as an electronic presentation. Analysis of student reports, posters or presentations can be used as an assessment strategy. They may wish to use this Scientific Report Template (EnviroNorth) -

http://www.environorth.org.au/learn/savanna_walkabout/images/MyScientificReport.pdf

School provides: Completed *Conducting an Investigation* worksheet (WS 4), Scientific Report Template (optional), student computers or exercise books, digital photos

Optional Extras

Information report

This activity could be conducted as a research task in the library or for homework. Students create an information report about one of the animals that was collected. Include details such as:

- What does it eat? (Food)
- Where does it live? (Habitat)
- What does it look like? (Appearance)
- What are its predators?
- What characteristics does it have which may help it's survival? (Adaptations, e.g., flat body, hard shell)

Bug box

Design and create a habitat for an invertebrate found in the school grounds. Completed habitats can be used to house invertebrates in the classroom. Students need to consider elements like size, access, food, water, temperature and cleaning for their chosen invertebrate.

Alternatively, create a diorama that shows an invertebrate in its habitat.

Resource: *Keeping Live Invertebrates Fact Sheet* (Royal Alberta Museum) -

http://www.royalalbertamuseum.ca/natural/insects/projects/insects.htm

Learning Experience 7 - Bio Action - Planning

Background

Animal habitats

By creating the right conditions for one group of animals, you also make a home for other wildlife. For example, a ground cover of native grasses and herbs planted as a seed supply for finches, is also home to lizards, small mammals and butterfly larvae. Trees and shrubs are often planted to attract birds seeking nectar or pollen, but they are equally attractive to leaf eaters like possums, and a host of wonderful insects. Try to recreate natural conditions by including all plant layers and habitat components in your *Schools Tree Day* action project.

Habitat components

Layers of trees, shrubs and groundcovers - allow animals to move from one plant layer to another layer safely and provide different kinds of food all year round such as flowers, seeds, fruit and leaves. Some animals only like to live in one plant layer whilst other animals might live in one plant layer but feed in another. Each plant layer helps to keep the other plant layers healthy.

Trees - provide nest sites for mammals, birds, reptiles and frogs and homes for invertebrates. Trees grow flowers containing nectar and produce seeds and fruit which is used as food for birds, invertebrates and mammals. Trees also provide safe places to hide from predators and provide birds with a perch to check the ground for food. Trees provide hollows, which are used by many animals for homes.

Shrubs - grow flowers containing nectar used by nectar feeders. They also produce seeds and fruit which are food for many animals. Shrubs provide

nest sites for small mammals, birds, reptiles, frogs and invertebrates and safe places to hide from predators. They protect the roots of trees.

Ground covers - provide homes and nest sites for invertebrates, small mammals, ground feeding birds, reptiles and frogs. They also produce seeds that provide food for many small birds and safe places for them to hide from predators. Ground covers help keep the ground moist.

Flowering plants - provide nectar and pollen for invertebrates, small mammals and birds. Flowers develop into seeds and fruit that are food for many invertebrates, mammals and birds.

Leaf litter or mulch - stops soil from drying out. It prevents soil from washing away or being blown away in storms. It provides homes for invertebrates, reptiles and frogs and food for decomposers such as slaters and springtails. As leaf litter rots, it forms soil and creates nutrients for plants.

Rocks - are used by small mammals, reptiles and frogs for homes, nest sites and for protection from predators and the weather. Reptiles also use the surface of rocks to warm their bodies. Rocks help to hold the soil together and reduce moisture loss. They also create moist places for young plants to grow.

Fallen logs - provide small mammals, ground feeding birds, reptiles frogs and invertebrates with homes, nest sites and protection. They provide a perch from which birds and reptiles can hunt and food for decomposers such as millipedes and bush cockroaches.

Tree hollows or nest boxes - provide nest sites for different animals at different times of the year and provide homes for invertebrates. About 17% of birds, 28% of reptiles and 42% of our native mammals need tree hollows to nest in. Hollows also provide safe places to hide from predators and protect animals from bad weather.

Ponds, creeks and water - provide water for animals to drink, moisture to keep plants alive, and provide moist places for young plants to grow. Ponds also provide habitats for invertebrates, frogs and fish.

Lessons

1. What can be improved?

Get outside! Elaborate.

As a class, review the information gathered from the scientific investigation. This provides a 'biodiversity snapshot' of the school. Identify areas of low or lower biodiversity.

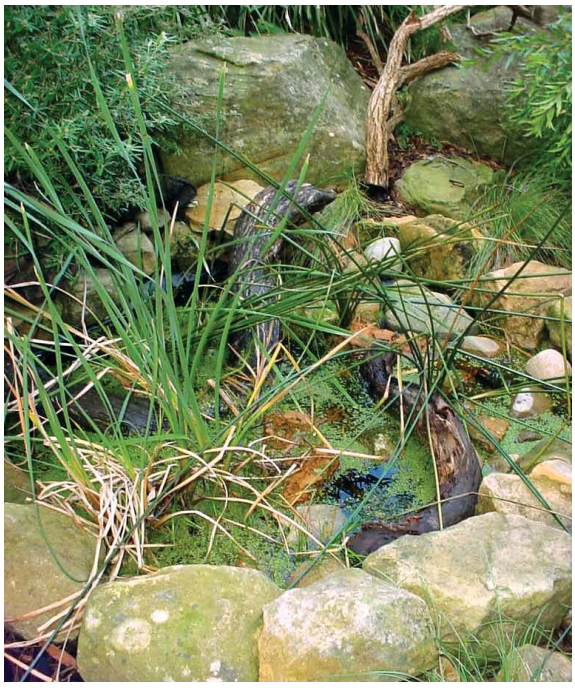
As a class, revisit the areas of low biodiversity. Students use the *Habitat Scorecard* (WS 7) to rate the habitat value and determine what is missing from the areas. The scorecard helps students make informed decisions about what is needed in the school to support biodiversity and can be used as the basis of their action plan.

Ask questions such as:

- What are the features of the site that are good for biodiversity?
- In what ways could habitat and biodiversity values be improved, eg, adding some nest boxes for different species, removing weeds?

(Adapted from *Victoria's Biodiversity: Education Resource Book 1*, 1999, p56-57)

School provides: Information gathered through the term, *Habitat Scorecard* (WS 7), digital cameras



2. Plan a Schools Tree Day planting action project

Take action. Plan. Prepare.

As a class, or in groups, students use their knowledge and understandings to suggest ways in which an ecosystem within the school or local area could be improved or created through a planting project. (Analysis of student suggestions can be used as an assessment strategy.)

With teacher guidance, the students devise an action plan for the *Schools Tree Day* planting project to improve the biodiversity in the school. The *Action Plan* (WS 8) sheet can be used as a planning guide. The students should also create a timeline or flow diagram for the project leading towards planting on *Schools Tree Day*. Identify responsibilities and funds needed.

Projects might include:

- Plant shrubs and ground covers to an area with mainly trees
- Plant a layer missing from an area and add habitat features, such as rocks
- Plant local native (endemic) plants, trees, shrubs and grasses
- Plant a bush food garden

It is also important for the students to create a map (drawn plan) of the area to be planted and find out the most suitable plants for the area. These should be listed with approximate quantities required. The Create a Garden (Flora for Schools) is a very useful planning tool - **http://www.floraforfauna.com.au/planner/**.

Register at Planet Ark's *Schools Tree Day* – **http://treeday.planetark.org/**

School Provides: Completed *Habitat Scorecard* (WS 7), *Action Plan* worksheet (WS 8), student computers or IWB, paper, pencils

Project Planning Resources

The following Internet sites and organisations can be of assistance with the preparation of an action plan.

Planting for Biodiversity (Planet Ark) – **http://treeday.planetark.org/about/biodiversity.cfm**

Planet Ark *National Tree Day* – tips on planting -**http://treeday.planetark.org/**

Wild Backyards (Queensland Museum) – videos on 3 Queensland wild backyards in which biodiversity was imporved: rainforest, arid and bush - **http://www.qm.qld.gov.au/education/resources/wild/index.html**

NSW Wildlife Atlas (NSW National Parks and Wildlife Service) – search for lists of native plants and animals in your area - **http://wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas/watlas.jsp**

School biodiversity projects in Victoria –

http://sustainability.ceres.org.au/schoolProjects.php?action=category&categoryId=4

Sustainable Schools Showcase in Tasmania - **http://www.education.tas.gov.au/curriculum/resources/AuSSI-Tas-Booklet.pdf**

Build a garden (SA Department for Environment and Heritage) - **http://www.backyards4wildlife.com.au/index.php?page=interactive-kids-game**

Urban Habitats Guidelines for the ACT (Life in the Suburbs) - **http://www.lifeinthesuburbs.net.au/res/File/51515%20ANU%20Life%20in%20Suburbs%20Book%20with%20live%20links.pdf**

Landscapes Alive, Plant Selector – (Sustainable Landscapes Project, SA) - **http://webservices.lga.sa.gov.au/login.php**

Flora for Fauna - schools – **http://www.floraforfauna.com.au/schools/**

Society for Growing Australian Plants – provides detailed information on growing native plants - **http://asgap.org.au/sgap1a.html**

Your local council - can usually provide plant lists for the area and possibly some native plants.

Learning Experience 8 – Bio Action - Doing

Background

Action is one of the most important components of this program. The *Schools Tree Day* planting project, once completed and with ongoing maintenance, will leave a lasting legacy to the school of the senior primary students.

Prior to the planting project, the area will probably need to be prepared, for example, weeds removed, soil dampened, mulch laid, habitat features added.

National Tree Day and *Schools Tree Day*

National Tree Day, proudly sponsored by Toyota, is Australia's biggest community tree-planting event and a day for all Australians to help out by planting native trees and shrubs at a *Tree Day* site in their local area. In 2009, over 312 000 people, including 229 000 school children dug deep to improve their natural surroundings. *Schools Tree Day* shows children how easy and fun it is to help our environment.

Lessons

1. Undertake a Schools Tree Day planting action project

Get outside! Plant. Protect. Inform. Celebrate.

This is the day of actually doing what was planned – planting trees, shrubs or grasses on *Schools Tree Day* to improve biodiversity in your school. Members of the school community and local council may be able to provide assistance and help make your *Schools Tree Day* planting project a community event. All the resources, equipment, plants and people should be assembled and ready. You may wish to invite local media to photograph your students in action.

Ensure that the students plant according to their map (plan) of the area. Also ensure that the students plant from centre to edges or from back border to front so that newly planted plants aren't damaged by feet. Protect the plants from other students in the playground and animals that may eat them by installing plastic plant protectors around each plant and fencing off the area so it has a chance to get established.

Document what was planted for future reference, eg, make a scrapbook of plant tags and photographs. Also record the progress of the planting action project with photos or video. Display the progress on a news board, the school's website or in an album in the foyer or library.

Keep the school community informed of your actions through the school newsletter, web pages and school presentations. Write and let local politicians, newspapers, local environment groups and the local council know about your *Schools Tree Day* planting project and how you are improving biodiversity in your school.

School provides: Completed map (plan) of area to be planted, plants, planting equipment, plant protectors, signage/temporary fencing, digital cameras, scrap book, sticky tape

2. Reflect and evaluate

Review. Reflect.

Review the scientific investigation and action project process. What worked well? What could be improved? What changes to the process would you recommend?

Reflect on the learning. Return the *Biodiversity Mindmap* (WS 1) or KWFL chart the students completed before the start of the program. Ask the students to add further information about what they know now about biodiversity.

School provides: Partially completed *Biodiversity Mindmap* (WS 1) or KWFL chart

Bio Maintenance & Sustainability

Background

Encourage students to see their efforts as an ongoing process where their initial findings and work in the area can be built on by students in the following years. Data collection will take on a new significance and value as changes in trends may take some time to occur.
Christine Worrall, 2007

Ongoing action

Maintain. Sustain. Commit.

What steps are you and your class going to take to ensure the long-term benefits of your *Schools Tree Day* planting project? For instance, consider maintenance, future funding and additional actions. Perhaps an environment group could be instigated to maintain the area, or a grade given responsibility for it.

Ongoing maintenance is essential to ensure the project has long-term biodiversity benefits. Consider watering, weeding, ongoing protection and future use of the area.

Monitor the growth of the plants. Taking photos once a term is a good way to do this. Record what survived and didn't survive in a scrapbook so that you can use this knowledge for future planting projects.

Bio Teaching Options

Additional activities for teaching about ecosystems and biodiversity

Bio news

Students collect or make notes on a range of articles from newspapers, magazines, Internet, radio and TV which relate to biodiversity or any environmental issue. (The Planet Ark website provides daily Reuters World Environment News. Available at **http://planetark.org/enviro-news/**)

Students form 'news groups' to share the main points of an article with a group of students. Articles could be sorted into international, national and local issues and displayed.

Bio glossary

Students create or look up definitions for the following words and terms. As the students encounter other new 'bio' words they add them to the glossary. Display the glossary.

Word bank

adaptation	interrelationship
animals	mammals
diversity	parasite
ecocommunities	recycle
ecology	reduce
endemic	reuse
extinct	sustainable
fauna	symbiosis
feral	threatened species
flora	tree hollows
habitat	web of life
indigenous	wetlands
interdependence	woodland

(Adapted from *Clockwork*, 1997, p. 15, **http://home.vicnet.net.au/~clokwork/pdf/BigHand.pdf**)

Bio collage

Make a biodiversity collage showing the importance and value of biodiversity. (This is a suitable assessment strategy.)

Examples of the value of biodiversity include:

- We eat it and drink it
- All food originates in wild plants and animals
- Native birds, bats and insects pollinate plants, gardens and crops
- Invertebrates fertilise and protect the soil
- Crops are protected from pests by foraging birds and insects
- We rely on biodiversity for the origin of many medicines, eg, aspirin from willows, antibiotics from mould, cancer treatments from plants
- Recreation and tourism depend on healthy ecosystems
- Timber is used for building, shelter and fuel
- Oxygen comes from trees (all plants)
- Trees remove carbon dioxide from the air
- Trees protect the soil
- Marine organisms clean sewage from the sea
- Wetlands, mangroves and estuaries help clean water
- Plants help remove salt from the soil.

Classifying biodiversity

Discuss why we need to classify. Classification involves grouping organisms according to the characteristics that they have in common. Organisms that have been classified are easier to find, easier to talk about, and easier to study. The items in a supermarket are classified into groups. Why? Imagine walking into a supermarket that didn't group or classify its products. What would it be like? How would you find the products you need?

Classify the animals recorded on the *Bio Survey* worksheets (WS 5) into broad groups, eg, birds, reptiles, mammals, amphibians, fish, invertebrates. The invertebrate group may need to be further subdivided, eg, insects, spiders, praying mantids, grasshoppers, moths and butterflies.

Graph results. Which group is the largest and smallest? What is the total number of animals found? Which species were the most common? Why?

Bio comparison

This activity provides students with an opportunity to compare their original survey results with those from another site. Visit a 'natural' site in the local area and conduct a biodiversity survey using the same methods as used previously.

Compare the plants and animals found in the natural area to those found at school. Are they the same or different? Did the students find the same number of animals in both sites? Which site had the greatest amount of biodiversity? What would help explain the differences? Remind the students that the greater the variety of plants, the greater the variety of animals.

Our place in the past

Read the students the story *My Place* by Nadia Wheatley which shows changes in an area then discuss how the students' local area has changed. What was the local area like in the past? Schools often have aerial photos of the local area. Grandparents may also have photos or be a good source of information. Perhaps the local bush was larger, or the coast was not covered with houses or the native grasslands were thick. Or, perhaps the local area is in better shape now than it was 50 years ago.

The class could make two maps or pictures of a section of the local area. One map or collage represents today, the other represents the past. Ask the students: What is different about the two maps or pictures? How do these differences impact on local biodiversity?

(Adapted from *Clockwork*, 1997, p. 26, **http://home.vicnet.net.au/~clokwork/pdf/BigHand.pdf**)

Additional Resources

Spider Charts, Consequence Charts, KWFL Charts, etc

Teaching Templates on the Global Education Website – **http://www.globaleducation.edna.edu.au/globaled/go/cache/offonce/pid/1431;jsessionid=C5522ECA5702E7D0C25B2940E188EBBB**

Biodiversity Teaching and Learning

Backyard Biodiversity – Savannahs, NT – **http://www.environorth.org.au/teach/teach_primary_backyardbiodiversity.html**

Backyard Explorer, Qld – **http://www.qm.qld.gov.au/education/resources/wild/QM_backyard_explorer.pdf**

Biodiversity for a Sustainable Future – Unit of work, ACT – **http://www.sustainableschools.act.gov.au/__data/assets/pdf_file/0006/17295/Biodiversity_curriculum_program.pdf**

Biodiversity Unit case study from Anakie Primary School, Victoria – **http://sustainability.ceres.org.au/uf/63/File/Anakie_biodiversity.pdf**

BioWhat? Biodiversity unit, SA – **http://www.backyards4wildlife.com.au/uploads/BioWhat.pdf**

Grow us a Home – WA – **http://www.growusahome.org.au/**

On Borrowed Time (CSIRO) – **http://www.publish.csiro.au/onborrowedtime/sections/index.html**

Primary Connections – Schoolyard Safari – (Academy of Science) – **http://www.science.org.au/primaryconnections/schoolyardsafari.htm**

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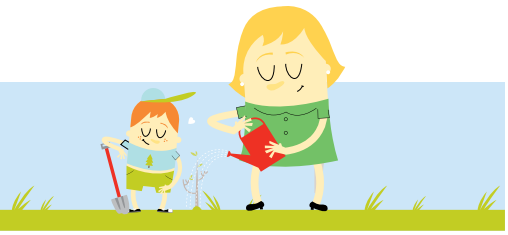


Worksheets

WS1 – Biodiversity Mindmap

WS2 – Biodiverse Playground Data Sheet

WS3 – Biodiversity Threats

WS4 – Conducting an Investigation

WS5 – Trapping Invertebrates

WS6 – Bio Survey Data sheet

WS7 – Habitat Scorecard

WS8 – Action Plan

national tree day

EARTH ALIVE:
STUDENT WORKBOOK

FIELDOFMARS
ENVIRONMENTAL EDUCATION CENTRE
EXPERIENCE ENGAGE ENABLE

National Tree Day is organised by Planet Ark in partnership with Toyota Australia

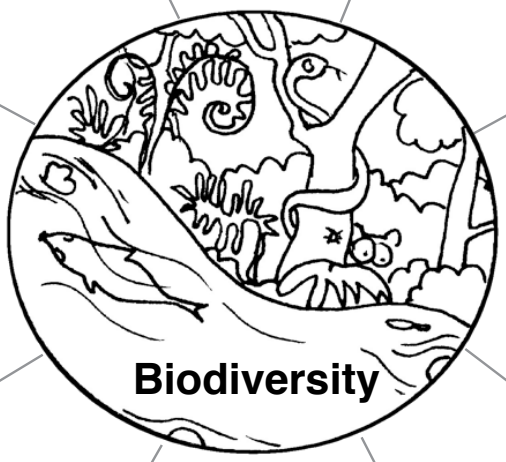
PLANET ARK

TOYOTA HYBRID SYNERGY DRIVE
toyotahybrid.com.au

Biodiversity Mindmap

WS1

What do you know about biodiversity?



Biodiverse Playground Data Sheet

WS2

What is the biodiversity of the school grounds?
How many different species of plants can you find in each layer? Do not include turfed areas, eg. ovals. Sketch leaf shape, flowers, seeds or bark for each species to show the differences.

	AREA:		**AREA:**	
No. of species of **TREES** 	Tally No.	Sketches	Tally No.	Sketches
No. of species of **SHRUBS** 	Tally No.	Sketches	Tally No.	Sketches
No. of species of **GROUND COVERS** 	Tally No.	Sketches	Tally No.	Sketches
ANIMAL EVIDENCE eg, droppings, chewed leaves, scratch marks, webs, footprints, trails 	List		List	

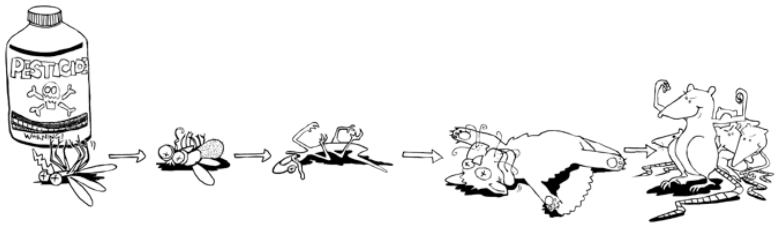
Biodiversity Threats

WS3

What threats to biodiversity can you see in the area you are studying?

- Write each **threat** you see.
- Work out the **problems** the threat creates for local biodiversity.
- Suggest some **solutions** that could reduce or manage each threat.

THREAT	PROBLEMS	SOLUTIONS

THREATS	CONSEQUENCES
Threats to local biodiversity can include cats, feral animals, weeds, vandalism, pesticides, littering and pollution, and clearing of bushland areas.	

Conducting an Investigation

WS4

Group members _____

Introduction - I am going to investigate _____

Prediction - What do I think will happen? _____

_____

Why I think it will happen _____

Hypothesis _____

_____

What am I going to do? _____

_____

_____

_____

_____

How will I make it a fair test?

Change _____

Keep the same _____

Measure _____

What equipment will I need?

_____

_____

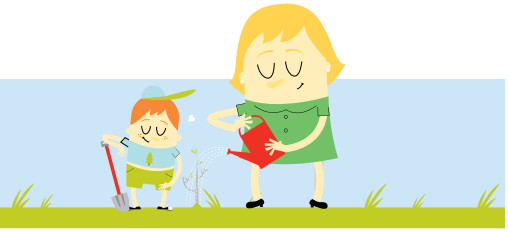
_____

_____

_____

_____

_____



Data Recording - use the Bio Survey Data Sheet (WS5)

WS4 continued

Results - What happened? What did I learn from this investigation?

Discussion

Was this what was expected? If not, why not? How can these results be used to improve or change?

Scientific investigation method from: K-6 SciTech, Curriculum K-12 Directorate, NSW Department of Education and Training, November 2004

Trapping Invertebrates

WS5

Here are some ideas for trapping invertebrates at home and at school.

Pit-fall Traps

A pit-fall trap is used to trap small animals living in leaf litter.

Materials needed

Soft drink bottle, plastic bag, scissors or craft knife

Method

- Cut around the top of the bottle just below where it starts to narrow. This should provide both a capture container and a funnel. Place the plastic bag in the capture container ensuring the top of the bag sticks out. Place the funnel, pointed end down, into the bag and container.
- Dig a hole in the soil and place the pit-fall trap into the hole. Replace the soil around the bottle. The top of the trap should be level with the ground. After 24 hours remove the funnel and extract the plastic bag. The animals in the bag should be moved into a more secure container for closer examination.
- Return animals to the capture area after examination.

Pooters

These devices allow students to 'suck' insects into a collection container.

Materials needed

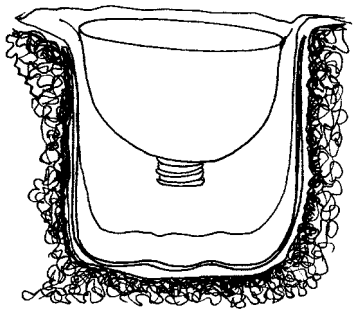
A clear plastic jar with a screw top lid, 'blue tac', fine netting. tape, pieces of hose

Method

- Make two holes in the lid large enough to fit the hose. Place the lengths of hose into each hole. Place mosquito netting around the end of one hose inside the lid. Seal any gaps around the hose with 'blue tac'.
- To use the pooter, place one end of the hose above a small insect. Students suck on the hose with the fine netting on the inside end. The insect will be sucked into the jar. The fine netting stops the insect from being sucked into the student's mouth.
- Return animals to the capture area after examination.

Traps

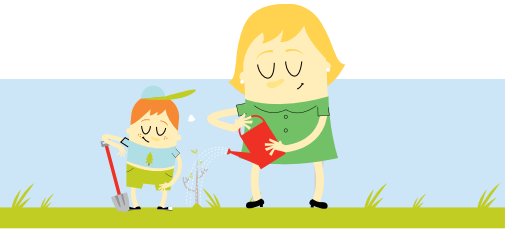
PIT-FALL TRAP



POOTER

Trapping safety

Don't touch invertebrates with your hands. You might hurt them, or they might hurt you!



Traps

WS5 continued

Sweep Netting

Collect flying invertebrates and those found in ground cover plants.

Materials needed

Dowel, netting, needle and thread or craft glue, coat hanger, tape

Method

- Pull the coat hanger into a round shape. Sew or glue the netting onto the hanger. Tape the coat hanger and the net to the dowel.
- Sweep the nets through a section of ground cover plants as you walk or try to catch flying invertebrates. Transfer animals to collection jars.
- Return animals to the capture area after examination.

SWEEP NET

Water Traps

These traps help catch flying invertebrates.

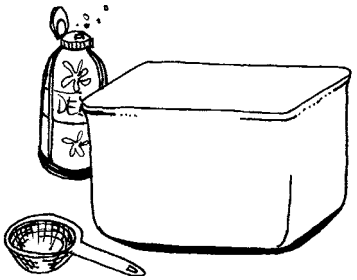
Materials needed

Ice cream container, water, detergent

Method

- Fill container half way with water, place a few drops of detergent in the water. This disrupts the surface tension so insects can't escape.
- Place the container outdoors. Check each 24 hours and collect any invertebrates that have been trapped in the water.

WATER TRAP



Berlese Funnel

A Berlese funnel works by slowly drying out a soil sample with a light which forces any resident animals into the container below.

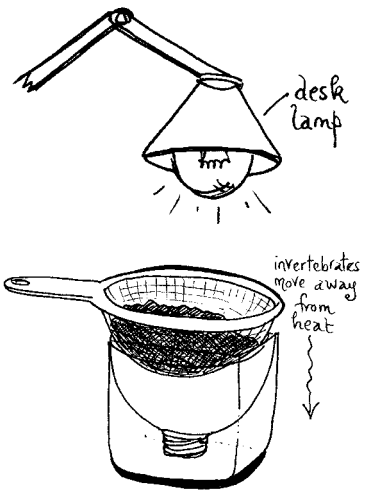
Materials needed

2 litre soft drink bottle, 2 litre plastic milk bottle, a small sieve (the bigger the holes or slits, the better) or shade cloth or fly screen, desk light, black paint or dark cardboard or fabric.

Method

- Make a broad funnel from the soft drink bottle.
- Cut the milk bottle and use the base as a stand for the funnel and to collect the animals. Paint the base black or cover with dark cardboard or fabric to encourages animals to move into the base.
- Gently scatter 10 cm of soil and leaf litter in the sieve.
- Place a desk lamp with a 40 watt globe over the soil sample. The light will dry out the sample in 2-3 days resulting in most animals moving into the base. Collect the animals from the milk bottle base.

BERLESE FUNNEL



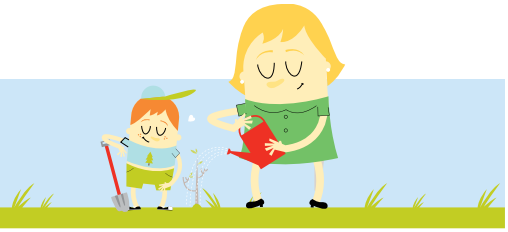
Bio Survey Data Sheet

WS6

Date: _____ **Time:** _____ **Weather:** _____

Type of invertebrate	**AREA 1** No. of different species	**AREA 2** No. of different species	Type of invertebrate	**AREA 1** No. of different species	**AREA 2** No. of different species
 Alderflies & dobsonflies			 Earthworms		
 Ants			 Earwigs		
 Bees			 Fleas		
 Beetles incl. weevils			 Flies incl. mosquitoes		
 Caddisflies			 Grasshoppers, locusts, crickets, katydids		
 Centipedes			 Lacewings		
 Cicadas & hoppers			 Lice		
 Cockroaches			 Mayflies		
 Dragonflies & damselflies			 Millipedes		
SUBTOTAL:			**SUBTOTAL:**		

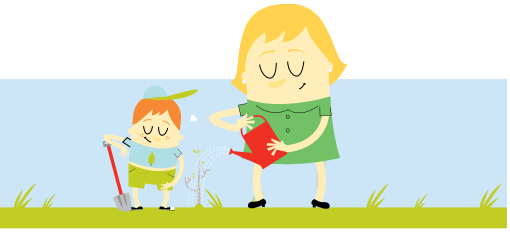
Illustrations by A Howells,©Australian Museum. Sourced from www.bugwise.net.au.



Bio Survey Data Sheet

WS6 continued

Type of invertebrate	**AREA 1** No. of different species	**AREA 2** No. of different species	Type of invertebrate	**AREA 1** No. of different species	**AREA 2** No. of different species
 Mites & ticks			 Spiders		
 Moths & butterflies			 Springtails		
 Praying mantids			 Stick insects		
 Pseudoscorpions or 'false scorpions'			 Stoneflies		
 Psyllids, aphids, scale insects, white flies			 Stylops		
 Sawflies			 Termites		
 Scorpion-flies & hanging-flies			 Thrips		
 Scorpions			 True bugs		
 Silverfish			 Wasps		
 Slaters			 Web spinners		
 Slugs & snails			**SUBTOTAL:**		
SUBTOTAL:			**TOTAL NO. OF DIFFERENT SPECIES:** (add all columns)	**AREA 1**	**AREA 2**

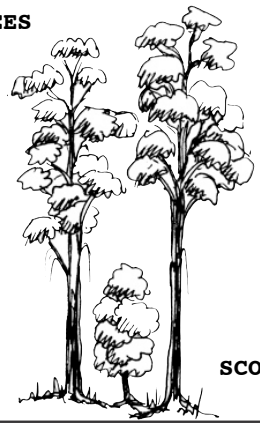
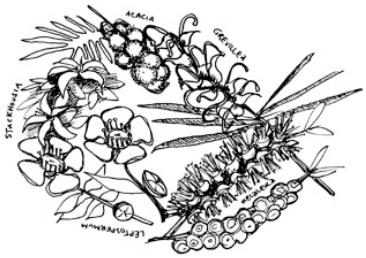
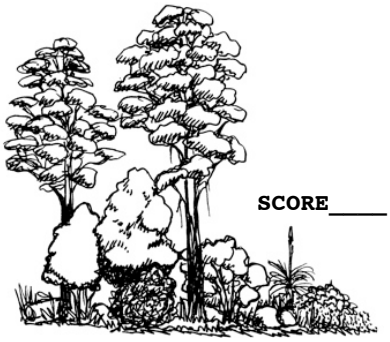
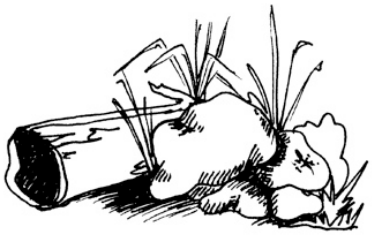
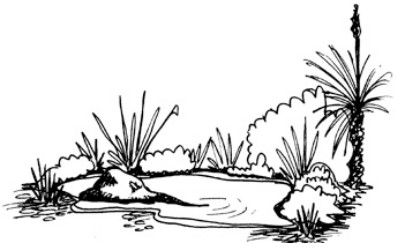
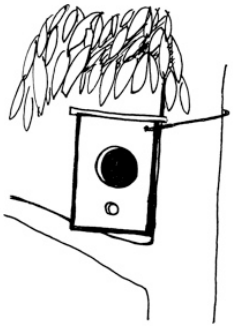


Habitat Scorecard

WS7

Rate the health of your school grounds. My group's area: _____

SCORING: None = 0, One or two = 1, A few = 2, Quite a few = 3, Lots = 4

TREES  **SCORE**____	**SHRUBS**  **SCORE**____	**GROUND COVERS** (not lawn)  **SCORE**____
FLOWERING PLANTS  **SCORE**____	**LEAF LITTER OR MULCH**  **SCORE**____	**PLANT LAYERS**  **SCORE**____
ROCKS OR FALLEN LOGS  **SCORE**____	**PONDS OR WATER**  **SCORE**____	**HOLLOWS OR NEST BOXES**  **SCORE**____

TOTAL SCORE _____

Action Plan

WS8

What?
What are you going to do?

Where?
Area in school

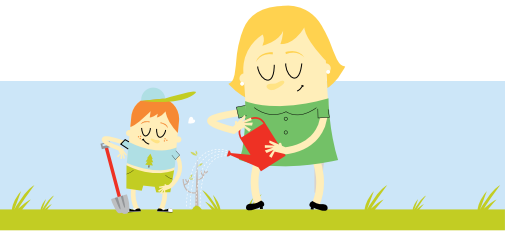
When?
Time frame

How?
Steps involved

Who?
Class, parent helpers, council...

Why?
What is the purpose?

Evaluation
How did it go? What can be improved?



Notes