

# Support for the Environmental Education Policy: Science 7-12



NEW SOUTH WALES  
DEPARTMENT  
OF EDUCATION  
AND TRAINING



## **ACKNOWLEDGMENTS**

The Department of Education and Training wishes to acknowledge the work of the following in the preparation of this document.

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Public Relations Directorate,  
NSW Department of Education and Training

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ISBN 0 7313 81173  
SCIS1058578



# Introduction

This document complements the *Environmental Education Policy for Schools* and should be read in conjunction with the support document, *Implementing Environmental Education in your school*. It has been specially prepared for secondary teachers who are responsible for implementing syllabuses in the Science key learning area. This document provides ideas and examples of how your faculty can contribute to each of the focus areas.

The policy requires schools to maximise every opportunity to draw on the curriculum in order to develop students' capacity to support an ecologically sustainable world.

Each faculty should:

- identify and address those outcomes in Board of Studies syllabuses K-12 that are specific to environmental education
- integrate the teaching of environmental education topics and issues to support outcomes in other Board of Studies syllabuses
- use the opportunities provided by special events and school community actions to enhance outcomes related to environmental education
- contribute to the development and implementation of the school environmental management plan.

The policy has three focus areas, each of which can be supported by the activities, projects and curriculum programs developed by teachers in all key learning areas in your school. The focus areas are:

- curriculum
- management of resources
- management of school grounds.

## OBJECTIVES OF ENVIRONMENTAL EDUCATION

The objectives of environmental education are summarised below. Wherever possible, you are encouraged to link the appropriate objectives to the achievement of outcomes in the syllabuses you teach.

### Curriculum objectives

Students will develop:

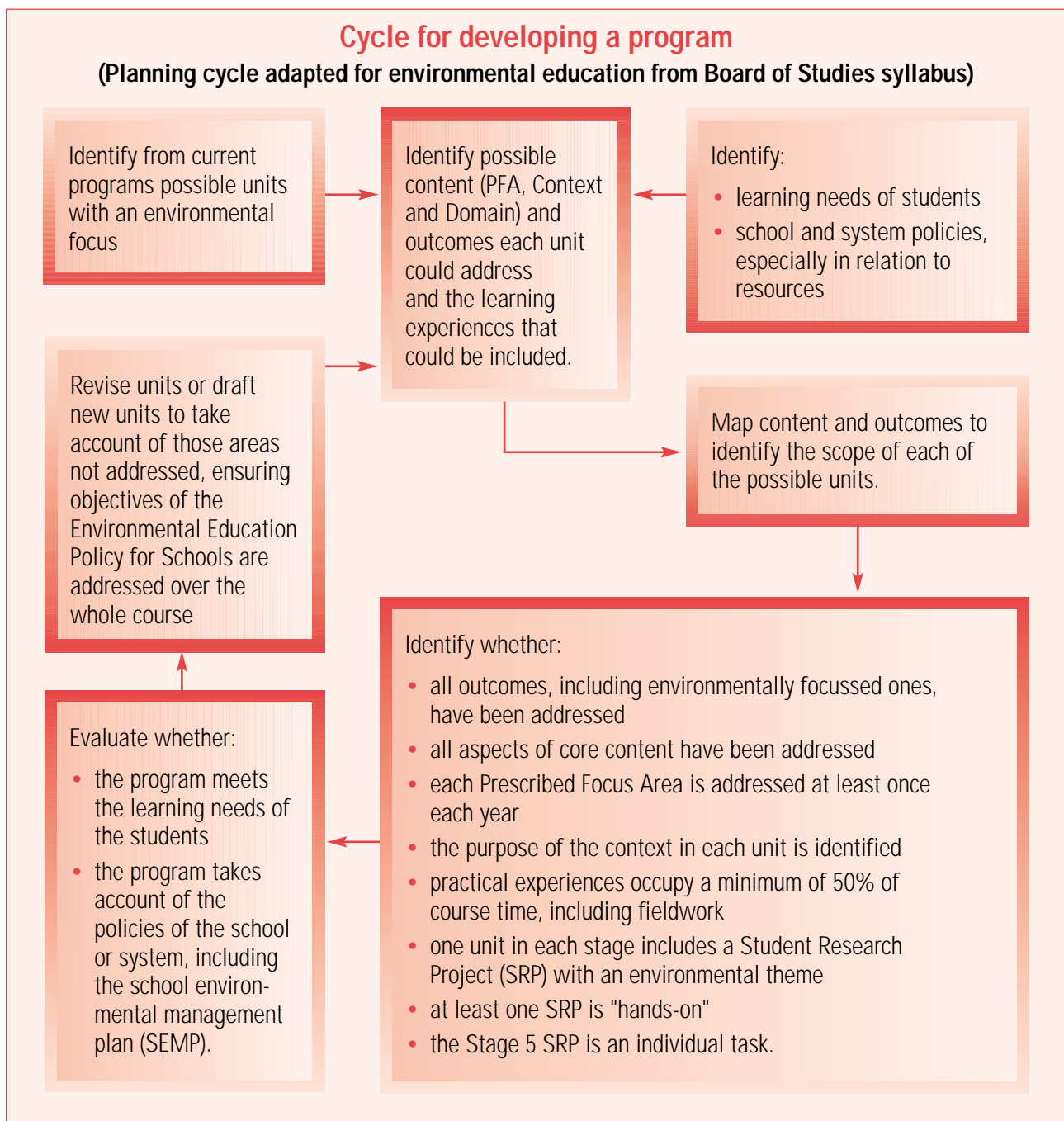
- knowledge and understandings about:
  - ❖ the nature and function of ecosystems and how they are interrelated (K1)
  - ❖ the impact of people on environments (K2)
  - ❖ the role of the community, politics and market forces in environmental decision-making (K3)
  - ❖ the principles of ecologically sustainable development (K4), and
  - ❖ career opportunities associated with the environment (K5)
- skills in:
  - ❖ applying technical skills within an environmental context (S1)
  - ❖ identifying and assessing environmental problems (S2)
  - ❖ communicating environmental problems to others (S3)
  - ❖ resolving environmental problems (S4)
  - ❖ adopting behaviours and practices that protect the environment (S5)
  - ❖ evaluating the success of their actions (S6)
- a respect for all life on Earth (V1)
- an appreciation of their cultural heritage (V2), and
- a commitment to act for the environment by supporting long-term solutions to environmental problems (V3).

## SCIENCE AND ENVIRONMENTAL EDUCATION

Environmental education can be incorporated into the science curriculum in the following ways:

- through activities that connect students' everyday lives with scientific concepts that relate to environmental issues
- through focus areas of study, addressing content relating to knowledge and skills and reflecting values and attitudes raised in science syllabuses
- through having students participate in maintaining the school environment, in terms of management of resources and management of school grounds.

Head teachers or coordinators could use the following programming and planning cycle to develop programs and activities related to environmental education. This cycle has been adapted from the *Science Stages 4-5 Support Document* (page 88).



The programs or activities chosen should complement the principles of ecologically sustainable development. These can be referred to in the support document, *Implementing the Environmental Education Policy in your School*.

### Which focus areas address the objectives of the environmental education policy for schools?

The five prescribed focus areas in the Science Stages 4-5 syllabus provide opportunities for science teachers to address the objectives of the mandatory Environmental Education Policy in Science:

- history of science
- nature and practice of science
- applications and uses of science
- implications of science for society and the environment
- current issues, research and developments.

Pages 68-70 of the *Science Stages 4-5 Support Document* provide more details on these focus areas, arguing that traditional scientific method does have a particular relevance to environmental education.

## What learning experiences in science are relevant to environmental education?

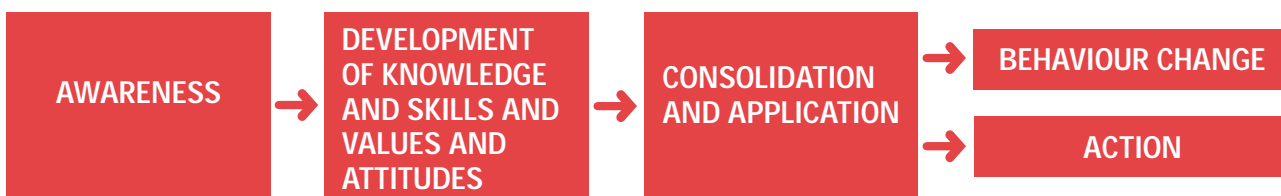
Teachers should develop learning experiences that encourage students to be active in:

- maintaining school and local environments
- collecting data
- researching and maintaining projects
- involving other members of the community in improving and maintaining the school and local environment
- employing strategies in cost-saving in energy and water usage
- creating models for others to see and use
- testing ideas and communicating them to others.

## What programming guidelines should be followed to facilitate a link between science and environmental education?

Teaching and learning programs must be aimed at an appropriate level to meet the environmental education objectives.

Programs should enable students to progress from a level of awareness, through to a change of behaviour into becoming caring participants who demonstrate a commitment to the sustainable management of the environment.



Choose or write topics, or select activities and research projects, to address the syllabus outcomes.

## What syllabus outcomes and content in the Stages 4-5 Science syllabus relate specifically to environmental education?

Units of work can be written to include the following environmental related activities to supplement existing topics. The links below not only address the outcomes of the Stages 4-5 syllabus, but they may also develop students into caring environmental advocates if used to develop appropriate learning activities.



## Stages 4-5

The following tables suggest some concepts and strategies that exemplify the strong connections that can be made between the Science Stages 4-5 syllabus and the Environmental Education Policy.

Outcomes in prescribed focus areas	Some potential links with environmental education
<p><b>A student:</b></p> <p><b>4.1</b> identifies historical examples of how scientific knowledge has changed people's understanding of the world</p>	<p>The impact of increased greenhouse gas emissions, which is a relatively recent discovery and understanding.</p>
<p><b>5.1</b> explains how social factors influence the development and acceptance of scientific ideas</p>	<p>The creation of government departments, such as the Department of Land and Water Conservation and the Environment Protection Authority, were the result of changing social attitudes to the importance of protection of the environment.</p>
<p><b>5.2</b> describes the processes that are applied to test and validate models, theories and laws</p>	<p>The investigation of phenomena and the devising and testing of hypotheses about the level of biodiversity in a selected area, the causes of global warming and ozone depletion.</p>
<p><b>5.3</b> evaluates the impact of applications of science on society and the environment</p>	<p>The role of scientific knowledge in developing an environmental impact statement. Analysis of industrial pollution to waterways and air.</p>
<p><b>4.3</b> identifies areas of everyday life that have been affected by scientific development</p>	<p>Evaluation of the benefits and environmental disadvantages which cars have brought to everyday life (a case study).</p>
<p><b>4.5</b> describes areas of current scientific research</p>	<p>Possible case studies include salinity, the enhanced greenhouse effect, the thinning ozone layer and investigations of solutions for waste disposal.</p>
<p><b>5.5</b> analyses how current research might affect people's lives</p>	<p>Knowledge about the thinning ozone layer may help to determine the future of food production and influence the choice of recreational activities.</p> <p>Knowledge of the enhanced greenhouse effect may influence our lifestyles and choice of transport.</p>

## Knowledge and understanding outcomes

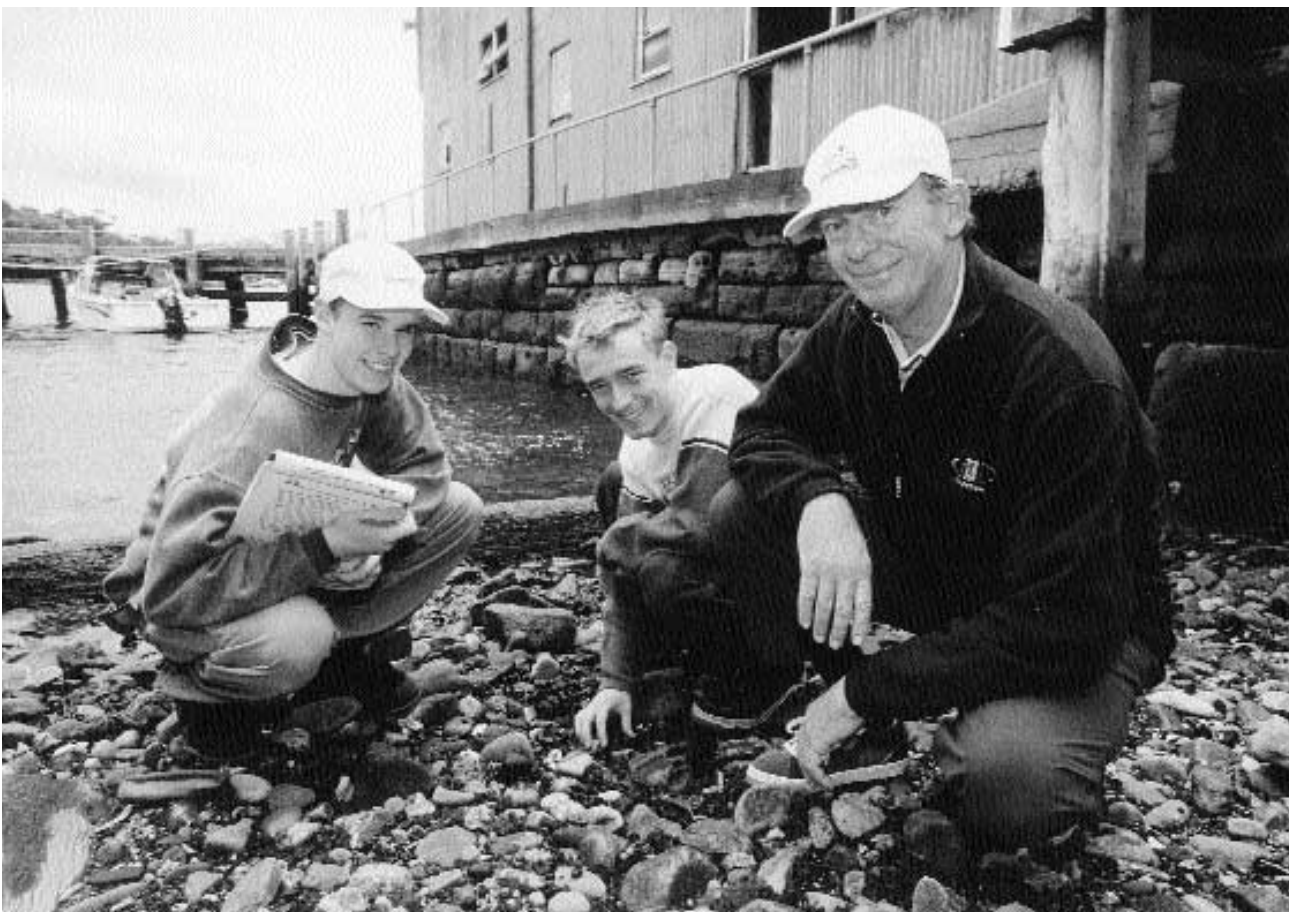
Some potential links with environmental education	
<p><b>A student:</b></p> <p><b>4.8</b> describes features of living things.</p>	<p>A study of the role of micro-organisms on living things and the environment can lead to a greater understanding and appreciation of the environment.</p>
<p><b>4.9</b> describes the dynamic structure of Earth and its relationship to other parts of our solar system and universe.</p>	<p>Development of greater understanding of the nature of the processes that have formed the Earth and the ways those processes can impact on living things (over time and catastrophically through volcanoes and earthquakes).</p>
<p><b>4.10</b> identifies the factors affecting the survival of organisms in an ecosystem.</p>	<p>The development of better understanding of the nature and function of ecosystems and how they are interrelated.</p>
<p><b>5.10</b> assesses human impacts on the interaction of biotic and abiotic features of the environment.</p>	<p>The development of better awareness of the impact of human activities on ecosystems and an understanding of the principles of ecologically sustainable development.</p>
<p><b>5.11</b> analyses the impact of humans' use of resources on the biosphere to evaluate methods of conserving, protecting and maintaining the Earth's resources.</p>	<p>A better understanding of the role of the community, politics and market forces in environmental decision-making associated with resource use.</p>

## Skills outcomes

Some potential links with environmental education	
<p><b>A student:</b></p> <p><b>5.13</b> identifies a problem and independently produces an appropriate investigation plan.</p>	<p>Analysing water quality in the local area. Testing it as a Streamwatch activity, recording the data and reporting on it. Using a systematic approach to analyse change in species of vegetation over time.</p>
<p><b>5.17</b> explains trends, patterns and relationships in data and information from a variety of sources.</p>	<p>Using data from the GLOBE project to compare local observations with data from other sources.</p>
<p><b>5.20</b> selects and uses appropriate strategies to solve problems.</p>	<p>Using a typical environmental problem, such as stormwater pollution in a beach suburb, and offering different strategies to solve it.</p>

## Values and attitudes outcomes

Some potential links with environmental education	
<p><b>A student:</b></p> <p><b>4/5.23</b> demonstrates confidence and a willingness to make decisions and to take responsible actions.</p>	<p>Many issues relating to sustainable living could come under this domain, e.g.</p> <ul style="list-style-type: none"> <li>• walk rather than drive over relatively short distances</li> <li>• recycle garden waste, plastics and glass</li> <li>• conserve energy in the home and at school.</li> </ul>
<p><b>4/5.25</b> recognises the relevance and importance of lifelong learning.</p>	<p>Students acknowledge the continued impact of science on understanding environmental issues and realise that the knowledge base about the environment grows continually.</p>
<p><b>4/5.27</b> acknowledges his or her responsibility to conserve, protect and maintain the environment for future generations.</p>	<p>Select an area of degraded bushland and restore it.</p>



## Stage 6

All Stage 6 science courses will expose students to environmental issues. Through the introduction of appropriate activities relative to the local environment, students will be exposed to real-life science and issues, thus consolidating their understanding of sustainable management of the environment.

The following table describes the components of the science courses most relevant to the Environmental Education Policy (EEP).

Course	Preliminary		HSC	
	Outcomes closely related to the EEP	Modules closely related to the EEP	Outcomes closely related to the EEP	Modules closely related to the EEP
<b>Biology</b>	P4, P7, P8, P11-P15, P16	8.2 <i>Local Ecosystem</i> 8.3 <i>Patterns in Nature</i> 8.4 <i>Life on Earth</i>	H4, H7, H8, H11-H15, H16	9.2 <i>Maintaining the Balance</i> 9.9 <i>Option: Biochemistry</i>
	<p>Biology modules often focus on investigation and research skills, which are particularly relevant to solving environmental problems. The concept of the ecosystem, which is basic to the understanding of environmental education, is well treated in the course (Modules 8.2 and 8.3). Studies of the evidence that present-day organisms have evolved from different organisms in the distant past (Module 8.4) enable students to see how the present environment has evolved to its present state and emphasise its fragility. Modules in the HSC course provide detailed studies that would be particularly relevant to aspects of environmental science.</p>			
<b>Chemistry</b>	P4, P16	8.3 <i>Metals</i> 8.4 <i>Water</i>	H4, H16	9.3 <i>The Acidic Environment</i> 9.4 <i>Chemical monitoring and management</i> 9.5 <i>Option: Industrial Chemistry</i>
	<p>A number of the modules relate to objectives in the <i>Environmental Education Policy for Schools</i>. Some modules investigate the environmental impact of the extraction process and ecological sustainability, the impact of people on environments and resolving environmental problems. The relationship between pollution and contamination by substances is investigated.</p> <p>The HSC course refers to concerns about the increased release and impact of acidic and basic substances on the environment. Students study industrial processes and changes in the composition and structure of the atmosphere and hydrosphere and thus the impacts of people on environments.</p>			

Course	Preliminary		HSC	
	Outcomes closely related to the EEP	Modules closely related to the EEP	Outcomes closely related to the EEP	Modules closely related to the EEP
<b>Earth and Environmental Science</b>	Every outcome of this course has the potential to strongly support the <i>Environmental Education Policy for Schools</i>	8.2 <i>Planet Earth and Its Environment: A five thousand million year journey</i> 8.3 <i>The local environment</i> 8.4 <i>Water issues</i> 8.5 <i>Dynamic Earth.</i>	Every outcome of this course has the potential to strongly support the Environmental Education Policy	9.2 <i>Tectonic impacts</i> 9.3 <i>Environments through time</i> 9.4 <i>Caring for Country</i> 9.5, <i>Option: Introduced Species and the Australian Environment</i> 9.6 <i>Option: Organic Geology – a non-renewable resource</i> 9.7 <i>Option: Mining and the Australian environment</i> 9.8 <i>Option: Oceanography</i>
	Earth and Environmental Science modules refer to the impact of increased resource use on environmental change and inferences made about changing environmental conditions. The importance of biodiversity through the study of past environments is addressed. All modules relate to caring for the environment and examine major environmental issues.			
<b>Physics</b>	P4, P6, P7, P16	8.3 <i>Electrical energy in the home.</i>	H4, H6, H16	9.3 <i>Motors and generators</i> 9.5, <i>Option: Geophysics.</i>

Course	Preliminary		HSC	
	Outcomes closely related to the EEP	Modules closely related to the EEP	Outcomes closely related to the EEP	Modules closely related to the EEP
	<p>The increasing dependence on electricity over the last 200 years has led to the increased use of fossil fuels, thus enhancing greenhouse gas emissions. In this course, students investigate ways in which electricity consumption could be reduced and study how alternative forms of electricity generation in remote areas could lead to more sustainable living practices. Students learn to analyse the effects of the development of AC and DC generators on society and the environment and to assess evidence about the physiological effects on humans living near high voltage power lines.</p> <p>Some topics relate to health and the environment, reinforcing the notion that humans are part of the environment and not a separate controller of major environmental interactions.</p> <p>Students learn about the benefits of geophysical methods in mineral exploration and environmental monitoring. Since geophysics is partly concerned with problems associated with the exploration of the Earth's crust for minerals and engineering purposes, it is clearly appropriate that the impact on the environment is a major consideration for mineral exploration companies.</p>			
<b>Senior Science</b>	P3, P4, P7, P16	8.2 <i>Water for living</i> 8.3 <i>Plants</i> 8.4 <i>Humans at work</i> 8.5 <i>Local environment.</i>	H4, H6, H16	9.5 <i>Polymers</i> 9.8 <i>Option: Disasters.</i>
	<p>The Senior Science course has a strong emphasis on environmental education through numerous investigations of the interactions within biological and physical systems and between organisms and their environments.</p> <p>Students are encouraged to develop deeper understanding of science concepts and their applications and to develop investigation and thinking skills through careful, systematic study.</p>			

## Integrating the science curriculum into the school environmental management plan

Science teachers can take a leading part in developing school activities to support the school environmental management plan through the science curriculum. This section offers some ideas.

Addressing more than one environmental education focus area will increase the value of the activity for students and for the school plan.

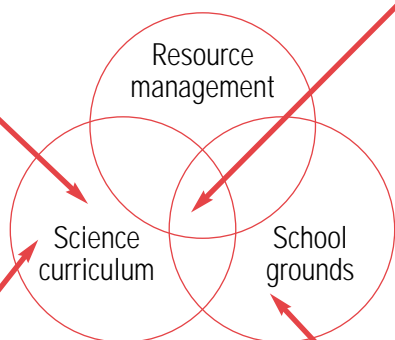


### **Activities with a science curriculum focus only**

- Survey animals in a local ecosystem and observe how numbers change over time
- Design an experiment to monitor the response of plants to changes in temperature
- Investigate the distribution of lichen in relation to pollution levels
- Research projects that investigate the historical use and management of land by Aboriginal communities and early European settlers

### **Activities with a science curriculum focus and a focus on the management of resources**

- Participate in a greenhouse gas reduction program: collect and record energy usage by the school. Suggest how to reduce consumption.
- Investigate the effectiveness of recycling programs
- Investigate the efficiency of generating electricity from renewable and non-renewable resources
- Investigate the relationship between packaging and rates of decomposition
- Investigate the effectiveness of energy-efficient products
- Research and design an energy-efficient house
- Research recycling systems initiated by outside companies. Introduce a recycling scheme into the school



### **Activities with a science curriculum focus and a focus on the management of school grounds**

Students can participate in activities that demonstrate sustainable management of school grounds, e.g.:

- Stencil storm water drains in conjunction with local councils
- Participate in Streamwatch in conjunction with the local Catchment Management Trust; monitor water quality of the local creek
- Research and understand the meaning of a catchment and its management; implement a management plan for the school and local area
- Test water quality in a local creek. Suggest reasons for current quality and strategies to improve quality
- Investigate how abiotic features of an environment can vary over an area (e.g. a steep slope)
- Design a database where litter levels of the school grounds or the local area or the local creek are collected and recorded on a regular basis

### **Activities focusing on science, curriculum, management of resources and management of school grounds**

- Design and implement an environmental management plan for the school, outlining its goals, objectives, time frames, responsibilities, obstacles to their achievement and suggestions on how to overcome them
- Participate in the Duke of Edinburgh Award Scheme. Students develop leadership and an awareness of the environment through this scheme. They are encouraged to partake in environmental programs as part of the community service requirement of the scheme.
- Mount displays of students' environmental projects at local shows, fairs, P&C meetings and festivals
- Participate in excursions. These can be organised in conjunction with local councils, businesses, local interest groups and mining companies in the context of how they are contributing to a sustainable environment. Career opportunities can also be addressed.

## How science contributes to the school environmental management plan

