Natural Heritage Trust

Helping Communities Helping Australia

green waste matters!

A Guide On Green And Organic Waste Management For Schools

Leaf litter *is a natural* mulch; mulch *is a layer of leaf litter or other organic material placed or formed over a soil surface;* compost *is the best form of mulch achieved by recycling required amounts of suitable organic materials together under the right conditions and is a waste solution for us to use at school and at home.*

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Foreword (to come)

A message from the Honorable Robert Hill, Minister for the Environment

Acknowledgments

Green Waste Matters!
A green and organic waste management guide for schools

This curriculum guide is designed to introduce young Australians to best practice management of green and organic waste. While not an exhaustive or formal environmental education resource the Guide is intended to raise the awareness of school age children to environmentally sound waste management practices. Information contained in this Guide may be copied or reproduced for study, research, information or education purposes, subject to an inclusion of an acknowledgement of the source.

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Introduction

Green Waste Matters! is an outcome of the National Heritage Trust and the Waste Management Awareness Program. The materials provide information on actions we need to take to manage our green and organic waste in schools. Each section has been developed by teachers and trialed in schools in response to an identified need and learning that is valued *in Australia's National Strategy for Ecologically Sustainable Development.*

Green and organic waste

Green and organic wastes are identified as:

- Garden waste, e.g. grass clippings, leaves, weeds, prunings of trees and shrubs
- Food waste, e.g. vegetables and fruit.

It may also include:

- Some forestry waste, e.g. bark and sawdust
- Paper and cardboard products.

Green and other organic wastes is a large segment of Australia's solid waste stream. Organic waste can be more than 30% of the waste we generate and, according to the available estimates, this equates to a third of a tonne per person per annum.

(Source: *An Information Sheet from the Environment Protection Group on Green and Other Organic Waste,* Environment Australia.

Did you know that the average school could reduce its green and organic waste levels by up to 85% by introducing a simple set of practices and actions?

Everyone has a role to play in recycling green and organic waste!

Ecologically sustainable development (ESD)

Simply stated, ecologically sustainable development is:

Meeting the needs of the present generation without harming the ability of future generations to meet their needs.

From *Rescue mission planet earth – a children's edition of Agenda 21*

ESD is concerned with taking economic, social and environmental factors into account when making decisions, while at the same time thinking broadly about the effect of those decisions.

ESD: One vision for Australian education

What does all this mean for our children and students?

Our young people want Australia to be part of an environmentally responsible, fair and cooperative global community.

For education the challenge is to:

- create learning and teaching environments that reflect ecologically sustainable practices that enable all students to be environmentally active and committed global citizens

- foster new optimism about the future, and teach students so that they have the knowledge, attitudes and understandings, which will allow them to take purposeful action for the benefit of all.

This green and organic waste guide provides an opportunity to address this challenge through:

- a practical school green and organics resource which features strategies which urge all of us in school communities to take positive actions in managing green and organic waste and to ask critical questions of decision makers (Refer to Resources R1-R5)

- meaningful whole school teaching and learning programs for students to sequentially develop knowledge, skills, understandings and attitudes in relation to managing green and organic wastes on school sites (Refer to Units 1-8).

Green Waste Matters! contains an introduction to green and organic waste and information on

- Schools and waste

- Action planning

- Ideas for developing a green and organic waste management policy

- Ways to plan for success

- Resources for the Student Representative Council

- Resources for the School Groundsperson

- Ideas for low waste gardening

and information sheets (Refer to Resources R1-R7).

In the school

The site and situation of each school is unique. Environmental programs are a way to incorporate existing green and organic waste features around the school and the local community into meaningful student learning activities. This provides students with the means to take an active role in environmentally sound practices and see the results in their school and local community. Ideally, school structures and systems should also reflect and model these practices. For example, waste management should reflect principles of sustainable development.

Maximum school and community participation in green and organic waste recycling and waste reduction is vital if Australia is to reach the Australian and New Zealand Environment and Conservation Council (ANZECC) target of a 50% reduction in waste going into landfill disposal by the year 2000.

The majority of school communities are genuinely concerned about the volume of waste currently generated and ending up in landfill or being burnt. Government and its departments at all levels are increasing the opportunities for school communities to make informed decisions about green and organic waste recycling and school community involvement is increasing.

Learning through local issues and priorities

Focusing on local issues and priorities provides learning contexts that are relevant and meaningful for all involved. Green waste management programs also offer opportunities to develop positive attitudes. Lifestyle choices can be clarified, developed and reinforced, not only for students but also for all that make an active commitment to improved green waste management practices.

Community

Environmental education and green waste management is about achieving change through partnerships and projects with other people. Examples of effective partnerships may include school personnel working with:

- parents and friends
- local business and industry groups
- local land managers/landholders
- local Aboriginal groups
- local government
- local environment groups
- Keep Australia Beautiful officers
- Regional Waste Authorities
- Government Agencies
- education officers of Outreach Education Services.

Planning

Commitment and planning ensures both short-term results and long-term effectiveness. A dedicated group of people can achieve many goals. Forums for discussion, communication and decision-making in relation to identified priorities can provide advocacy for green and organic waste management so that it is maintained as a focus for school planning and becomes embedded in the school’s everyday business.

Student Representative Council

Students are an integral part of the planning and learning for green and organic waste management. The Student Representative Council (or School Environment Group) in schools is one way in which students can play an active part in the consultation and decision-making about environmental initiatives. Other student initiated groups, for example, Youth Environment Groups or Student Waste Buster groups can also play a key role. The ideas contained in this resource are based on the assumption that students are able to play a key role. If we use the principles of ESD we can present students with an objective way of assessing decisions about managing green and organic waste and reaching their own conclusions about motives and outcomes.

It is important in all discussions and debates to:

- consider the range of views
- consider the motives of the people representing different views
- use basic principles of ESD to “measure” decisions
- encourage students to make decisions for themselves that fit their values
- prepare students to act responsibly in environmental, political and social ways.

Starting an environmental club

Talk to the students about forming a school environment club. Enlist the support of parents and other staff to help out. Announce the formation of the club to potentially interested students and parents and arrange an information evening. At the first meeting, sign up students and discuss when and where the club will meet. You can brainstorm, as a group, some goals for the club’s first activities. You may also want to elect or decide upon club officers. Alternatively, students can work as a group, sharing decision-making and responsibilities. The most important thing is to have well-developed goals, and keep everyone involved, focussed and having fun.

Whole school approach

A vision of what is possible and meaningful is developed through wide consultation with school and community members. From this information a whole school program can be prepared. This may include setting the school’s green and waste management priorities, establishing a school framework inclusive of all areas of school operations, e.g. maintenance of school grounds, administration, canteen services and the teaching/learning program. An example is given opposite.

Sequentially developed knowledge, skills, understandings and attitudes in relation to green and organic waste management will allow students to retain their interest in the topic throughout the years of schooling.

It is vital that this program is made available for staff and community consultation and comment throughout its development. Ownership of the program is essential to ensure its sustainability. The program needs to include monitoring and evaluation strategies to maintain its relevance and vitality. A dynamic program incorporates new initiatives and priorities during cycles of curriculum review and reform.

School framework

Areas of school operation

	Maintenance of school grounds	**Administration**	**Canteen**	**Teaching/ learning**
Green and organic waste management.	• Identify a composting site • collect and use all green waste in compost system • set up a separate bin system to collect food scraps • establish a school wormery • use compost on school gardens, etc. • reduce waste going to landfill • identify low waste gardening systems	• Commitment from administration to waste management practices in the school • model waste recycling in all areas of the school • commit a budget line and support the program and staff involvement • convey commitment to school and community through school newsletter • separate food waste for own school wormery/compost system • interaction between school, community and support services available in green and organic waste management • seek to improve waste management practices on an on-going basis	Separate food waste from other waste materials for use in own school wormery/compost system; monitor food sales to reduce wastage	• Research for education and awareness • excursions to landfill sites, waste education centres • training and development for all staff • minimisation programs to emphasise to reduce, recycle and reuse

Curriculum Frameworks

The learning as described in the State and Territory curriculum documents supports the whole school program in this guide. These frameworks ensure that the essential knowledge, skills and understandings, attitudes and values are identified and become part of student learning activities.
Green and organic waste management is an implicit part of studies of society and environment, science, health and physical education and technology. The value clusters identified in studies of society and environment, i.e. social justice, democratic processes and ecological sustainability, are key components of any green waste management program. Units of work can also incorporate the other areas of learning. Effective planning includes cross-curricular approaches such as literacy and numeracy and the key competencies. These promote and develop the skills necessary for individuals to critically evaluate conflicting information, decide their position and take action to achieve a sustainable future.

Funding

Green and organic waste management education needs resources and equipment. Some schools fund such programs through curriculum budgets and others as a separate budget line. Many environmental education initiatives, e.g. green waste management financial savings that support further development of other initiatives. Enterprising and innovative activities can also generate funds for other environmental education initiatives (Example included in Unit 6). Many schools achieve this kind of sustainable funding through enterprise and conservation. It is also recommended that schools explore avenues outside the school for further support, e.g. local government, local businesses and industries, and local waste management committees/boards.

Promotion and Publicity

Schools with successful programs in green and organic waste management education promote and publicise the activities of their students in various forums. It is important that partnerships are acknowledged and appreciated in as many ways as possible. The expression ‘think globally, act locally’ has meaning when students and working partners can consider the impact of all the local initiatives in a global perspective.

The scope of this guide

Green Waste Matters! is a strategic program for achieving sustainability of green and organic waste management. It will help school communities deal with waste management on an on-going basis, and aims to reflect the needs, resources and aspirations of a school community in a global context.

The programs within this guide are based upon the creation of appropriate systems to manage for the future. Such management will:

- integrate school planning and policy-making
- focus on long-term outcomes
- involve all sectors of the school community.

The guide also offers a range of ideas and activities in the early childhood, primary and middle schooling years, and enables students to achieve outcomes valued in State and Territory curriculum documents.

The guide models how, through participation, communication and investigation, schools can be pro-active and effective in collecting, separating and managing organic waste material at school.

The **Units of work** indicate the kinds of learning that may be programmed and planned, using green and organic waste as a learning topic in the compulsory years of schooling.

The content of each unit reflects the focus stated on the overview of Units and provides integration into areas of study, suggests a number of approaches to learning that incorporate sequential stages of learning and difficulty, and supports cross-curriculum approaches to Studies of Society and Environment.

The student-centred interactive teaching and learning approaches described in this guide make use of students' own questions and investigations. It embraces the concept that learning is a process of personal discovery and reappraisal of ideas, rather than the absorbtion of a hierachy of taught facts and concepts.

In practical terms, this means that teachers will not be seeking to instill in students a selection of understandings, but rather will be teaching and supporting them to experience green and organic waste management. They will use creative ways of thinking about organic waste management to develop greater understandings of issues and actions about sustainable resource use.

Throughout this guide the emphasis is on providing school personnel with suggestions and possibilities. It makes instruments available to all young people regardless of location, resources or background, to enable them to participate effectively.

The program and what it sets out to do

Green Waste Matters! assists in setting up conditions for students to engage as active environmentally responsible citizens by, for example, working on green waste reduction committees, debating waste issues, making decisions, circulating letters, public speaking, establishing composting, mulching and worm farming programs, and setting up green businesses.

Green Waste Matters! sees the school grounds, our homes and local community areas as the setting for fostering citizen action for a better future, one which incorporates being able to make Australia a more ecologically sustainable nation. The culture of the school sets the scene for the values young people adopt on a host of important life topics and this includes green and organic waste management for environmental and natural resource protection.

Developing a school waste management program

Schools will have different starting points and the following ideas are offered for consideration. School waste management programs draw upon the full range of opportunities and strengths found in any local community. Many of the processes required are not things that are easily packaged. They rely on the understanding and experience of each school in developing environmental programs. The strength of any waste management program relies on leadership, good management and general community acceptance. Consequently, the task for schools for progressing local waste management programs is challenging. It is about balancing strategic views with immediate action. It requires a sense of direction with a pragmatic view of what is needed now. In addition, it depends upon the interrelationships between school and community priorities, economic realities and environmental management. Above all, it is about involvement: school personnel, the local community and, most importantly, the students.

The skills required are not easily taught or learned. Skills like leadership, team building, motivation, networking and strategic planning are essential for developing a sustainable program. This resource material therefore attempts to give a view of the directions needed to develop successful green and organic waste management programs at the school level.

Units - an overview

The following tables give an overview of the units, using sections of the Statements and Profiles for Australian Schools.

Units - an overview

This overview uses sections of the Statements and Profiles for Australian Schools. It is suggested that teachers match outcomes against their State and Territory curriculum documents.

Unit title and suggested year levels	Learning activities	Outcomes
Unit 1 **What is green and organic waste?** **Foundation level and years K-3** **Focus questions** What are green and organic materials? What are some of the green and organic waste materials in our school and local communities? What kind of green and organic wastes in the natural environment could be reused, recycled, mulched or composted? How do green and organic waste materials help the soil? How can we reuse, recycle, mulch and compost green organics? How can we make a difference and help the environment? Investigating green and organic components of the school grounds and gardens.	Examining nature's ability to recycle. Looking at ways green organics can be recycled and/or reused by processes such as mulching or composting. By the end of the unit students: • identify green organic materials as a valued resource • investigate leaf litter and its benefit to the soil • collect and reuse green organic materials • mulch areas of the school • make some compost	**Strands** **Studies of society and environment** Investigation, communication and participation Place and space Natural and social systems **Science** Life and living Natural and processed materials Earth and beyond **Levels** 1 and 2

Unit title and suggested year levels	Learning activities	Outcomes
Unit 2 **Changing habits** **Primary Years 3-6** **Focus questions** What are our ideas and attitudes towards the disposal of green organics? What kind of green organics do we waste or throw away? How do we dispose of food scraps and garden waste? How does the school manage its food scraps and garden waste? How much organic waste is produced at school? What ideas can we develop on alternative methods and attitudes to green and organic waste minimisation, prevention and disposal? What are the advantages of reusing, composting, mulching and vermi-processing organic wastes? What kind of green organics could be either reused or recycled? How do I prepare organics for recycling?	Looking at habitats and behaviours of the past and present. Investigating wasteful and sound waste practices. Investigating green and organic wastes in the school community. Researching staff and students food waste habits. Involving students in a green and organic waste audit. Analysing and presenting of audit findings. Involving students in waste minimisation and reuse actions. Developing a Green and Organic Waste Policy. Using action research at school.	**By the end of this unit students:** • distinguish between wasteful and sound waste practices • practice basic skills auditing the amounts, types and sources of green and organic wastes in the school • take action on green and organic related issues at school • develop action plans for identified sites in the school • Communicate with school leaders about changing habits in the school. **Strands** **Studies of society and environment** Place and Space Investigation, communication and participation **Health and Physical Education** Human relations **Levels** 1, 2 and 3

Unit title and suggested year levels	Learning activities	Outcomes
Unit 3 **Lets Investigate compost** **Primary Years 3-6** **Focus questions** How can we use organic matter and turn it into compost? What lives in compost? How and why does compost make an ideal home to many small creatures? How do we go about making compost? How does compost improve the structure and quality of the soil? How and why is compost important to the planet on which we live? Why and how should people recycle their food and garden waste to make compost?	Investigating recycling resources, compost, compost heaps, uses of compost, how to make compost and caring for compost. Researching the benefits of composting; materials that can/ cannot be composted; methods of composting. Examining what's involved in coordinating a school composting program. Researching to gain a broader understanding of composting and its importance in schools, homes and local communities. Developing a proposal to request a school based composting area and program.	**By the end of this unit students:** • recognise and discuss effects of using composting processes to reuse green and organic waste • initiate and plan a school composting program and area **Strands** **Studies of society and environment** Place and space Resources Natural and social systems Investigation, communication and participation **Science** Life and living **Levels** 2 and 3

Unit title and suggested year levels	Learning activities	Outcomes
Unit 4 Worm away your waste **Middle Schooling Years 6-10** **Focus questions** What are worms? What species of worms are suitable for intensive green and organic waste recycling? What is the relationship in the natural environment between worms and green and organic waste? How can we utilise worms to recycle the green and organic waste produced at school? How does the by-product of worms processing green and organic wastes help the soil? What specific green and organic wastes are suitable for consumption by worms? Investigating the use of worms in green and organic waste management and worm's abilities to recycle waste in schools.	Investigating worm species suitable for green and organic waste management. Planning a worm-based recycling program for both individual classrooms and the school as a whole. Researching the by-products of green and organic waste processing. Investigating the effectiveness of worm castings as a plant growth stimulant. Using a range of tests and findings, recommendations are made regarding the establishment of worm farms as part of the school's waste management program.	**By the end of this unit students:** • understand the role of worms in organic waste management processes • come to informed personal decisions regarding the suitability and effectiveness of worms as recyclers of organic material • explain the effectiveness of related by-products as plant-growth stimulants • present proposals and strategies regarding the school's waste management processes **Strands** **Studies of society and environment** Resources Natural and social systems Investigation, communication and participation **Science** Life and living Working scientifically **Levels** 3-5

Unit title and suggested year levels	Learning activities	Outcomes
Unit 5 **Make a difference - set up a composting program** **Middle Schooling Years 6-10** **Focus questions** Why is it important to minimise and manage our green and organic waste? What areas or sites in our school or local area most need our support and action? What processes make composting and worm farming work? What are people doing about similar problems in other places? What can we do to manage and recycle our green and organic waste and why is it important to do this?	Investigating how the school can reduce its green and organic waste levels by setting up a composting program. Investigating the amount, type and sources of waste in the school. Using action plans and procedures to outline processes and steps to success. Researching financial costs to dispose of waste; who pays for it; types of waste that could be composted; how composting processes work and composting methods available to schools. Presenting information to the school community. Establishing cross-age tutoring projects to establish and maintain school composting program. Investigating similar projects in Australia and other countries of the world.	**By the end of this unit students:** • undertake green waste minimisation activities at the local school level, e.g. audit, action planning, on-site composting solutions **Strands** **Studies of society and environment** Place and space Natural and social systems Investigation, communication and participation **Science** Life and living Working scientifically **Levels** 3-5

Unit title and suggested year levels	Learning activities	Outcomes
Unit 6 **Waste or wealth?** **Middle Schooling Years 6-10** **Focus questions** What products are produced when you recycle green and organic materials? What products could be produced, marketed and sold in a school-based organic recycling venture? Who should be informed? How might decisions be made democratically? What “business structure” suits our purpose? What working groups or committees might our company require? What are the roles and responsibilities of specific committees? e.g. collection, farming committee, packaging, sales, finance and recordings and publicity.	Learning and practising enterprise programs. Investigating how a vermiculture and/ or composting enterprise may effect waste minimisation strategies in schools. Initiating an enterprise to farm worms, market by-products and promote a school-based waste management project.	By the end of this unit students: • develop a greater awareness and appreciation of the opportunities of small business, entrepenuership, and self employment in the green and organic waste management area. **Strands** **Studies of society and environment** Natural and social systems Resources Investigation, communication and participation **Levels** 4-7

Unit title and suggested year levels	Learning activities	Outcomes
Unit 7 **I'd like to do that!** **Middle Schooling Years 6-10** **Focus questions** What has been or could be designed or made to recycle green and organic wastes? Why do we need new ideas, equipment and technologies to recycle green and organic wastes? How can people be involved in designing, making and appraising ideas and practices and their impacts on societies and environment? How can we manage green and organic wastes in sustainable ways?	Investigating technologies currently available to recycle green and organic wastes. Using creativity and innovation students develop new ideas to improve the management of wastes created in the school.	By the end of this unit students: • broaden their appreciation of currently available technologies to manage green and organic waste in Australia and overseas • develop an understanding of innovative, workable, environmentally appropriate and socially acceptable green waste management technologies, creations and actions. **Strands** **Studies of society and environment** Resources Place and space Investigation, communication and participation **Technology** Designing, making and appraising **Levels** 5-7

Unit title and suggested year levels	Learning activities	Outcomes
Unit 8 **Low green waste or no green waste society?** **Middle Schooling Years 7-10** **Focus questions** What might a low green waste - no green waste society look like, feel like, smell like, sound like? Where/when might a no green waste society emerge as a probable future? Which is the more likely, a continuation of the present high levels of waste or a low green waste or no green waste society? What might an alternative future, a sustainable future be like and how might it be achieved? How might I contribute as an active and responsible citizen in the local and global community, on behalf of present and future generations?	Using futures perspectives to explore opportunities for resource recovery from green and organic waste. Researching opportunities for sustainable living, and presenting information through a range of techniques. Using action research in the school community to identify, investigate, evaluate and select actions for green and organic waste management in the school.	**By the end of this unit students:** • develop future-orientated perspectives on the use of green and organic waste management • using action research process devise sustainable options for green and organic waste management **Strands** **Studies of society and environment** Investigation, communication and participation **Levels** 5-8

Contacts

The following organisations may be able to provide resources and information on aspects of waste minimisation and recycling. It is, of necessity, a general list and it is recommended that schools contact the Environment Protection Authority, the Environment department, local government or regional waste board (or equivalent) for suitable contacts in their State or Territory. Schools should also consult their local Yellow Pages for the names of waste recyclers, wormery and compost suppliers.

Environment Protection Authority - general recycling contacts

Friends of the Earth - general recycling; waste minimisation advice

Gould League - schools' resources on waste minimisation and recycling, composting and litter

Keep Australia Beautiful Inc. - litter; waste minimisation, composting; education officers

Industry associations for glass, steel, aluminium, PET, paper, liquidpaperboard, PVC, HDPE and polystyrene manufacturers can supply the names of recyclers of these materials

Recycling companies and regional waste boards - advice on waste minimisation and recycling; tours of waste plants; some have education centres

Local council - some councils have waste education or environment officers

Scouts' and Guides' Associations - in some States these organisations operate recycling enterprises

For publications on waste minimisation and recycling consult the References and Bibliography section of this guide, visit you local library or search the Internet.

Useful references for key contacts*:

Victoria - EcoRecycle Victoria Information Sheets 15 and 16. Available from EcoRecycle Victoria, Level 4, 478 Albert Street, East Melbourne, Victoria 3002 or from their Website www.ecorecycle.vic.gov.au

South Australia - Directions. Waste to Resources Information Directory. Ecorecycle 2000, Local Government Recycling and Waste Management Board Inc., Adelaide. (updated January 1998)

* guides such as these can quickly become out-of-date and users are advised to check current telephone numbers and addresses in the telephone book

Resource Bank

The Resource Bank offers examples of the processes involved in developing strategies for green and organic waste management by schools. They offer suggestions for how your school might go about developing a green and organic waste management policy and action program. Schools should modify them to meet their particular needs.

These resources are referred to in the text as R1 to R9.

Resource R1: Schools and Waste

Schools generate vast amounts of waste. In a study conducted in metropolitan Melbourne in 1996, it was found that on average schools were disposing of 33 tonnes of waste per school per year at an average cost of $1200. It was estimated that the total amount of waste produced by Victorian schools amounted to 78 500 tonnes per year with a disposal cost of $2.85 million (WasteNet conducted by the Gould League of Victoria).

Based on these figures, each student was generating, directly and indirectly, 2.1 kg of waste per week or 84 kg per year.

The study suggested that if all Victorian schools reduced their waste by half, there would be a potential saving of $1.4 million per year in disposal costs and a reduction of 39 000 tonnes of waste going to landfill each year.

Eighty-four percent of schools were recycling one or more materials. Paper was the material most commonly collected for recycling. Composting was being done by 35% of schools and 18% had a wormery. Only three percent of schools had a written waste minimisation policy.

A survey of schools in New South Wales by SCRAP (School Communities Recycling All Paper) found that 50% of school waste was paper and 30% food scraps and green waste. Thus by recycling paper and composting alone, schools have the capacity to reduce their waste by 80%. SCRAP estimated that by recycling just the waste paper the 2200 Government schools could save up to $2.3 million per year.

Why should your school get into green and organic waste recycling?

An effective green and organic waste recycling program can bring a number of advantages to your school and benefit the students, teachers, community and environment. These include:

• opportunities for students to achieve learning outcomes while meeting guidelines in environmental education:

• direct cost savings to the school, e.g. cost savings in purchase of materials, waste disposal, through waste minimisation, recycling and reuse;

• the image of the school is improved by being environmentally responsible and active in environmental management;

• setting an example for the broader community;

• practical and interesting ways to learn about natural resources and their conservation;

• a real contribution to our environment, by conserving resources, reducing environmental degradation and extending the life of landfill sites;

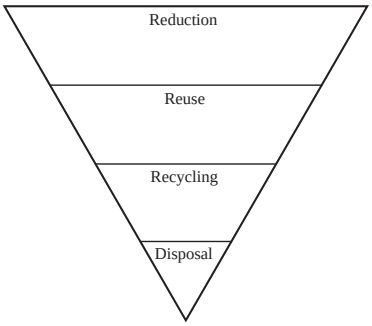
• co-operation and teamwork from all sectors of the school community in working towards a common goal;

• good habits, skills, attitudes and values towards waste as a resource;

• the transfer of these habits, skills, attitudes and values to the home and the broader community.

The Waste Minimisation Hierarchy

To many people, waste minimisation just means recycling. As useful and commendable as recycling may be, it does not tackle the waste problem at source, namely its creation. There are 3Rs in waste minimisation - reduce, reuse and recycle, and as a last resort, dispose of the waste.



Waste Hierarchy

1. Prevention and reduction at source
2. Reuse
3. Recycling
4. Disposal

In assessing any waste issue, the hierarchy should be used - firstly reduce, then reuse, next recycle and finally dispose.

Reduce - simply means to avoid or use less so that you have less waste to deal with later. Reducing is reasonably easy to accommodate with materials like paper and other consumables but is harder with organic material. There are ways however to reduce the amount of food that is wasted in school canteens and the type of gardens planted at your school will dictate to some extent the amount of green waste that is produced.

Reuse - reusing an item means that you do not have to buy a new product , and so you are saving the energy and resources that would be used to make a new product. Reusing also means that the item does not go into the bin and end up in landfill. An example of reusing organic waste would be to use leaves or shredded material as mulch on the school's garden beds, instead of disposing of it or buying in pea straw to use as mulch.

Recycle - recycling means that a waste product is made into either the same product or something different. For example, used aluminium drink cans can be recycled back into either new drink cans or used in making other types of aluminium products. Recycling saves landfill space and also saves resources that were used to make the item in the first place. In some instances, recycling can also save energy and other resources, e.g. water, that are needed in manufacturing processes.

Recycling of green and organic wastes generally involves processes such as mulching, composting and worm farming.

Disposal - generally involves the dumping of wastes in a landfill site or in some countries, incineration. Disposal of green and organic wastes takes up valuable landfill space, leads to the production of methane, one of the greenhouse gases, and is a waste of a valuable resource.

(Adapted from The Waste Wise Way: savings, benefits and school operating practices by Pat Armstrong (EcoRecycle Victoria, 1998)

Resource R2: Developing a Green and Organic Waste Policy

This section will assist your school to develop a green and organic waste policy and to document the changes you will make to the school environment.

A Waste Policy should:

• be concise, no more than two pages in length

• be developed in association with teachers, administrative staff, students and groundsperson(s)

• be given to all staff, groundsperson(s) and Student Representative Council members

• be reviewed at intervals (via feedback and monitoring) and amended as appropriate

• contain details on how the school will reduce or reuse green and organic waste rather than sending it to landfill

• contain details of what materials will be reused and how

• contain details of how the program will be evaluated and monitored

• contain a list of persons responsible for managing the school's green and organic waste program.

Example of a Green and Organic Waste Management Policy

Acacia Range High School Waste Management Policy

The following is a draft Waste Management Policy for a school and could form the basis for a policy for your school. It primarily covers green and organic waste but could readily be amended to cover other types of waste. Schools should modify it to suit their own circumstances.

Acacia Range High School has a commitment to reduce the amount of waste being sent to landfill sites in accord with the national targets.

The school will achieve this by developing and implementing a Green and Organic Waste Management Policy.

We will carryout an audit of the volume of green and organic waste currently being produced by the school and seek advice on the most appropriate ways/methods of recycling this material.

The whole school community will participate in reducing waste to landfill. Responsibility for disseminating information about the program will be the role of the school's Waste Management Strategy Committee which will be made up of staff, student and grounds' staff nominees.

The school will inform the school community of the policy and state who is responsible for its implementation via school newsletters and other written communications.

The school will seek active support for the program from the school community, local government and other local organisations and businesses interested in the area of green and organic waste management and recycling.

The school will develop a monitoring process to evaluate the effectiveness of the waste policy. The policy will be reviewed at intervals (say, every 3 or 6 months) and modified as appropriate in order to achieve its aims.

The school will submit an annual report on the waste recycling program to relevant local, State and Federal government

agencies (e.g. Environment Australia, State Environmental Protection Authority, local council or waste management board) during World Environment Week (June) or Recycling Week (November) each year.

Policy framework

Experience has shown that the best results for the environment occur when the greatest possible number of people have a sense that it is ***their*** policy, that it is designed to improve ***their*** environment, that ***they*** had some say in its development and that it will benefit the world in which ***they*** and ***their*** family live.

The 5 Rs for planning a green and organic waste recycling program

Review - Prepare a status report on existing practices - volume of wastes by type; what is done with them and at what cost? Review the environmental impact of current practices both in the school and in the wider world.

Recruit - Establish a green and organic waste recycling committee to oversee the school's program. Find out who you need to consult to set up a recycling program and make contact with these individuals, companies or groups.

Rethink - Assess the alternatives to current practices. Can the school minimise waste production? Can the waste be effectively recycled and turned into a new resource? Is there the potential to develop a school enterprise here?

Respond - Identify options for changing your waste-producing activities and how your school disposes of waste. Assess the costs and benefits of each option and identify those which will produce maximum reduction in environmental impact in the most cost-effective way. Consider the question, how do we introduce effective incentives to change?

Re-evaluate - Select indicators to monitor change over time. How effective is the program? Do we need to modify aspects of it? Identify emerging issues and seek solutions.

Deal with unresolved issues and initiate further investigations which will lead to positive action.

Consider whether the school should increase its program to include other waste materials.

Implementing a Green and Organic Waste Management Policy

The volume of green waste (viz. lawn and grass cuttings, prunings, leaves, weeds and dead branches, etc) produced by the school per week/month will be estimated and appropriate methods of dealing with it established. Green waste will be collected and composted on-site. Larger material may need to be shredded before being added to compost piles. The product will either be used on school gardens, bagged and sold or used in vermiculture (worm farming).

The main source of organic waste is food waste from school bins (classrooms, staff room, office, lunch shed, school yard) and the canteen. Specific collection bins for food waste will be introduced and the material fed to earthworms in the school's worm farm. Vermicastings and other worm farm products will either be used on the school's gardens or packaged and sold.

Volumes for recycling

Over a period of say four weeks keep records of the quantity of green and organic waste produced at the school. This will give you an estimate of the amount produced per week that will need to be handled by the recycling process. Note: this may vary between seasons (eg leaf fall in autumn) and it may be necessary to keep records weekly for the whole of the first year and to record the type of waste (eg lawn clippings, leaves, prunings, etc).

Record your findings for future reference:

Week/ Date	**Volume of green waste (m^2)** lawn clippings leaves prunings other	**Volume of organic waste (m^2)**
1 - date		
2		
3		
4		
5		
6		
7		
etc.		

Setting goals

After carrying out a waste audit, look at setting some achievable goals that can be worked toward. It may later be shown that these were over ambitious (or even the reverse!) but they will give the school something to aim for and enable it to measure its environmental performance. Best Practice Environmental Management will become an integral part of school activities.

Evaluating and monitoring

Keep records of the amounts of waste collected and processed. This data should be assessed at intervals to determine how effective the program is or if it needs to be modified in some way. Part of the planning process should be to identify how to monitor the program. *Remember, don't collect data for the sake of collecting data. What you collect needs to be useful in measuring the effectiveness of the program.*

Another measure of the success of the program is the savings in dumping costs and the cost of buying mulch, soil and fertilisers to enhance and revitalise school gardens and ovals. There are also environmental savings from the program. The school is contributing to reducing CO_2 emissions to the atmosphere by not burning prunings and other green waste. It is also saving space in landfill by diverting this form of waste for other purposes. The school can put a monetary value on both of these factors.

Determine who will have responsibility for making sure the evaluation is carried out and the results reported.

References

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Resource R3: Action Planning

Waste minimisation issues are everyone's concern, but sometimes as individuals, we feel helpless to change a course of events or actions that seems to bring undesirable consequences for us all.

The basis of all environmental or social action is that individuals, acting alone or in groups can bring about real change.

Successful action needs four things

- involvement
- knowledge
- planning
- determination.

Consider the following prompt statements when planning your school's waste management program.

Involvement

1. Choose a waste recycling topic to investigate.
What aspects of green and organic waste management need researching before we can start the program?

2. What is already known about the issue?
Write down what is already known about the topic you have selected. You may need to talk to others about it or access information from the library or Internet.

3. What needs to be found out?
Are there questions you have not been able to answer (in 2 above)? If so formulate questions that you will need to answer.
How can you find out what you want to know? Information can come from people working in the area, local knowledge, reference materials, media, Internet, CD Roms, videos, posters, magazines, journals and pamphlets.

Knowledge

4. What is the issue about?
Why has disposal of organic waste become a problem? As you investigate this issue, record the various aspects of the topic which are causing concern. Present these in a diagram and as written notes.

5. Who is involved?
Record the names and activities of groups and agencies who are involved in organic waste disposal and recycling. List what each group does and their contact details so that you can refer to these when your school's action plan is being developed.

6. How can we improve the current situation?
What can be done to improve current practices in the school?
What consequences can be predicted if these changes are introduced?
Identify any problems which might arise from introducing new organic waste management practices.
Identify uses for the compost that will be produced as an outcome of the program.

Planning

7. The action plan
Identify what components of waste recycling should form part of the action plan. List them in priority order.
What action can be taken immediately?
What action can be taken by

• individuals?

• groups of students?

• the grounds' person?

• the whole school community?

Do you envisage any conflicts of interest arising? If so, how could they be resolved?
Identify the actions necessary to introduce the organic waste action plan. Use a table to present them.

Action [what?]	**Responsible person(s)** [who?]	**Likely outcome/ benefits** [where and when?]

How can individuals influence decision making? For example, form an environmental group, lobby decision makers in the school and local community, or become a SRC member.

Determination

8. Present the action plan as effectively as possible
Before you present the plan to the school community, it should be as thoroughly researched as is possible. The plan should include supporting materials eg case studies and reports about waste programs that are already in operation, and an outline of the likely short and long term benefits of the program for the school and the wider community.

Resource R4 - Planning for Success

The success of any across school program will depend on the support it receives. If all parts of the school community - students, teachers, administrative staff, groundspersons, canteen staff, cleaners and parents - appreciate why the issue is important and have a role to play in the project, success will be easier to achieve.

Composting is not a common place activity in many Australian schools. Introducing a green and organic waste management scheme to your school may require changes to current attitudes and practices. To achieve this, the support of management - the principal, key teachers, school council - is essential.

Resource for the Student Representative Council/School Environment Group on Green and Organic Waste Management

This section provides some guidelines for how the Student Representative Council (SRC) or School Environment Group (SEG) can get involved in formulating and implementing a green and organic waste policy for your school. The SRC or SEG, in conjunction with the school counsellor and key teachers, may be in a position to take the lead in getting the school to commence a green and organic waste management program or it may choose to work with classes that have taken the initiative and perhaps extend the program to the rest of the school to include garden waste.

This step-by-step guide can be used by any group in the school to help develop your school's strategy.

Step 1 - form a planning group to investigate the why and how your school might initiate a green and organic waste policy. Involve as wide a cross section of the school community as you can - students, teachers, administration and ancillary staff, groundsperson, parents and school council should all be represented. The group should approach the principal regarding the proposal and then write or speak to the various interested parties asking them to nominate a person(s) to be on the planning group.

Convene a meeting to discuss green and organic waste generation in your school. Prepare a brief summary of the discussions and the objectives and action identified by the group.

Step 2 - research current practices and conduct a waste audit to identify the types and quantities of waste generated by the school. Refer to ***Green and Organic Waste Audit*** for details of how to carryout the waste survey. The purpose of the audit is to determine the amount of waste being generated, the type of waste and the sources of wastes. Analyse the results and make recommendations.

Step 3 - write a green and organic waste minimisation and recycling policy for the school. Incorporate this policy in the education policy and the school charter. Refer to ***Schools and Waste*** and ***Developing*** a ***Green and Organic Waste Policy*** for ideas on what to include in a policy statement.

Step 4 - prepare a draft strategy. Include in the strategy

• overview - include a summary of the findings of the audit

• predicted benefits to the school, including cost savings

• predicted benefits to the community and environment

• action lists and a timeline to implement these actions

• set some targets, e.g. to be composting all food scraps within a year; to compost 80% of grass clippings within a year; to set up a worm casting marketing group within 15 months, etc.

• identify occupational, health and safety considerations and procedures to deal with these

• insurance - does the school policy cover the proposed recycling activities?

• identify how best to involve all members of the school community in the waste strategy

• anything else you can think of!

Step 5 - develop an action list. This could take the form of a checklist of what to do and when and who is responsible in implementing the different aspects of the waste strategy. Write separate lists for short and long term goals, and to cover the different areas of the school, e.g. actions to be taken by students, teachers, other staff, groundsperson, etc.

Step 6 - present the draft strategy to staff, students, parents, cafeteria staff and groundsperson(s) in a series of meetings and describe what their roles will be.

Encourage broad-based support. For people to gain a full understanding of the school's waste issues, the "look, feel and smell" approach is far more effective than just talking about the issues. Actually display the amount of waste that the school is throwing away but could be reused, recycled and/or recycled. Consult with your local council or waste business to see how/if they can assist your school's waste strategy.

Step 7 - finalise and promote the strategy. Promote the plan through school newsletters, posters placed around the school explaining why and how the strategy has been developed. Recruit teachers and students to talk to other classes about the strategy.

Step 8 - implement/launch the waste strategy. Launch the strategy on a special day, e.g. World Environment Day or during national recycling or water week, so that the whole school is aware of what is now expected of them and why. You may chose to give the program a name and design a waste management logo for you school.

Step 9 - monitor progress, keep accurate records and modify the strategy (if necessary). Involve students in monitoring the waste strategy. Attention should be given to problems, e.g. contamination of organic waste by non-organic materials.

Conduct a second audit after say, a year and compare the results. You might be able to compare the amount of garbage going to landfill or being composted; amount of money spent on rubbish disposal by the school; income earned by selling compost or castings.

Modify your strategy, if necessary, to deal with any problems.

Step 10 - give feedback, incentives and recognition.

Use charts around the school to show the quantity of organic waste collected each week, and acknowledge the efforts and initiatives of classes.

Report the progress of the waste strategy in the school newsletter and pass your results on to your local council, State or Commonwealth environment departments. Contact a reporter from your local newspaper or submit a story with photographs for publication. Enter the school's waste strategy in environment awards.

(Adapted from Waste Minimisation Actions For Schools by Sarah Burton, Tasmanian Recycling and Litter Awareness Council, Department of Environment and Planning, 1992)

Further reading: Environmental Action - Composting in your Workplace. Compaq, Lane Cove, NSW 1998. Website: www.compaq.com.au/composting (*An excellent guide to workplace green and organic waste management*)

Resource for the school groundsperson on Green and Organic Waste Management.

The school groundsperson/general assistant will play a key role in implementing the school's green and organic waste management program. Their main role may well be in the area of green waste but depending on how the waste strategy is structured, they may also have a key role in the composting of organic/food waste and the operation of the school worm farm.

The groundsperson will have most to do with the day-to-day maintenance of the compost system. This may involve adding additional material to the compost heaps/bins; collecting, emptying and washing the collection bins. Other tasks will include periodic turning of the compost heaps, testing the compost (temperature, moisture, pH), spreading the finished compost and cleaning out the bays/bins ready for the next cycle.

The waste management program may require the purchase/leasing of equipment which will be operated by the groundsperson, e.g. a mulcher for bulkier garden waste, bob-cat to turn the compost.

The processes described in the "Resource for the Student Representative Council on Green and Organic Waste Recycling" and the "Green and Organic Waste Audit" will involve the groundsperson at certain stages, particularly in planning the waste strategy and in carrying out the school's waste audit.

It is important for the groundsperson to have a sound knowledge of organic waste management. Where individuals have not been involved before or feel they need to know more, courses run by Earth Works and R.A.R.E. should be considered. It may also be valuable to send key teachers along to these courses.

What is Earth Works?

Earth Works is a community based education program which uses a train-the-trainer framework to educate and empower members of the community in the knowledge, skills and values of waste reduction, recycling and composting.

The program provides a forum for participants to examine waste reduction methods, to share ideas and come up with practical solutions which will work for them.

A focus is given to the use of composting as a means of reducing green and organic waste. Compostables make up a significant part of domestic and school waste.

The 25 hour course is run over a five-week period and is divided into 5 x 3 hour training sessions and 2 x 5 hour practical field days. The course covers the following topics:

• waste as an issue, including community attitudes
• how waste is currently managed
• practical ways to reduce waste
• composting
• skills to effectively communicate the message of waste reduction to your peers
• field sessions to waste disposal, recycling and composting sites.

Participants who successfully complete the course will receive an Earth Works certificate.

Earth Works is available in NSW, ACT, and SA. To participate in a course, contact your local council, waste board or KESAB to obtain a list of venues and dates. The course co-ordinators will provide further details and costs. The cost of the course will be around $60-70 per participant, includes all materials and course notes.

What is the R.A.R.E. training course?

The Resource and Recovery Education (R.A.R.E.) training course is offered in Queensland and has formal accreditation. The course includes a two-day training session which addresses waste management issues and discussions with members of the waste management industry. Participants are then required to plan, deliver and evaluate a training session, and carryout a field study. Upon successful assessment, participants will receive a nationally recognised qualification, Workplace Training Category I.

For further information contact Queensland Recycling Advisory Council, PO Box 155 Albert Street, Brisbane, Queensland 4002; telephone (07) 32278611

Resource R5: Low Waste Gardening

What are some of the ways in which we can reduce the amount of garden ('green') waste that currently is collected for disposal?

The type of garden you have and how you manage it will determine how much green waste you generate. You can plan to reduce garden waste.

• Examine the environment of your garden. Assess the soil, what is the wind direction, identify sunny and shady areas of the garden, when does the most rain fall, what are the seasonal temperature changes, when do the frosts occur?

• Examine the site features, such as slope, aspect (i.e. what direction does it face), where does the water drain to? Prepare a map of the site.

• What do you want to grow in the garden (e.g. vegetables, flowers, shrubs, trees)? Identify the best location for each and how much time you or your class can devote to looking after the garden.

Armed with this sort of information you can begin to plan a garden which is suited to your area. This should go a long way to having a garden that is relatively low maintenance and minimises water use and waste generation.

Plants that are not suited to the area will tend to have a limited life span and will need replacing regularly, thereby creating waste that will need to be disposed of.

Choosing plants

Wherever possible, choose plants that are native to your area or a similar climatic area (be wary of plants that might escape and invade other gardens or the bush).

Plant groundcover shrubs instead of extensive areas of lawn or grass. Lawns demand a lot of water and maintenance and generate great volumes of clippings.

Deciduous plants generate large amounts of fallen leaves in Autumn. These are great for using in a compost heap. Don't let them get washed into watercourses where they can pollute the water.

Use garden waste as mulch

Garden waste can be spread back onto the garden as litter or mulch without being processed. Bulkier material can be shredded before being spread on the garden.

Mulch is best spread in Spring after the soil has started to warm up, or in Autumn to keep the soil warm. Water the soil well before adding mulch. Add mulch up to 100 mm deep; leave a space around the base of trees and shrubs to prevent basal rots.

Add nitrogen - e.g. compost, rotted manure, blood and bone - to avoid temporary nitrogen loss from the soil under rapidly decaying material.

Minimise grass waste

Reduce - by using other types of ground cover. In areas where a hard-wearing lawn is not needed, plant alternatives like Dichondra (Tom Thumb), Lippia or groundcover plants.

Reuse - leave clippings on the lawn after mowing. Only mow when the grass is dry (avoids clumping) so the clippings fall easily between the blades. Don't mow the grass too low.

Recycle - use in compost and mulching.

Adapted from Earth Works: Living with Less Waste - Trainer's Manual, KESAB Inc., South Australia (1998) and Reduce Reuse Recycle Garden & Household Waste, Central Coast Waste Board, New South Wales.

Resource R6: EcoRecycle Victoria Information Sheets

1. Garbage

Introduction

Garbage. It's something we all produce as part of everyday living, but we don't normally think too much about our garbage.

We just put our bins on the nature strip or kerbside every week and the Council arranges for someone to pick up the rubbish and take it away.

However, we all have to start thinking about the waste we throw away; garbage disposal in the 1990s has become a major problem for economic and environmental reasons.

(Refer to Information Sheet 3 - *The 3 R's*)

The history of garbage in Australia

The original inhabitants of Australia, the Aborigines, produced very little rubbish. In coastal regions, archaeologists have found piles of debris at aboriginal campsites, called shell middens. All that is found today in these middens are bones, shells and discarded bone and stone tools, all the organic waste having rotted away naturally.

The early European settlers in Australia also produced little rubbish; things were too hard to get in the first place to be wasted.

Most food scraps were either fed to dogs, pigs and chickens, or used as compost in the gardens.

Until a few generations ago, garbage was not a major problem in Australia, mainly because people didn't produce much garbage and there were plenty of places to dispose of what was produced. In those days, people didn't throw out much garbage for a number of reasons. There was little unnecessary packaging; bottles for milk, beer and soft drink were refilled; food scraps were either fed to the dogs and chickens or composted with garden waste; a lot of rubbish was burnt in backyard incinerators; children's clothes were passed on to younger children; and broken shoes, toys, tools and utensils were repaired rather than thrown away.

Any garbage that could not be reused, refilled, recycled, burnt, given away or fixed was placed out in small metal bins (called dustbins), collected by ‘dustmen’ and taken to Council landfill sites (‘tips’). These ‘tips’ were usually old quarries and, when filled, were often converted into recreational areas.

Garbage today

Since the 1970s garbage has become a problem, mainly because people have been throwing away more and more garbage. This increase has followed a change to our way of living. Supermarkets have largely replaced the small shops and home delivery, especially for food. This has led to an increase in packaging and the use of non-refillable containers. There has also been a greater acceptance of disposable products (e.g. tissues), convenience foods and takeaway food and drinks with disposable packaging. With more efficient manufacturing practices, the cost of household appliances and tools has decreased, so that it is now cheaper to buy a new product than fix a broken one. Fewer people keep chickens, and most pets are fed on packaged pet food rather than family scraps. With concerns over air pollution, many Councils have banned backyard incinerators.

All these changes have lead to large amounts of garbage being thrown away. In metropolitan Melbourne in 1996, the average amount of garbage thrown out by each household was 12.34 kg per week or 642 kg per year. (BIEC, 1996)

To make matters worse, the population of Australia has steadily increased. This means that we now have more people, each one producing more garbage than in the past.

To further add to the problem, some Australian cities today are facing a scarcity of suitable landfill sites. According to the Industry Commission, “Potential landfill sites in close proximity to major urban areas are becoming increasingly scarce and face opposition as disposal facilities by local neighbourhood communities.”

Why don’t we just dig more holes or use old quarries to get rid of our garbage once our present landfill sites are filled? The answer is not that simple. People may object to a new landfill site being established where they live, because of concerns about smell, litter, pollution and reduced value of their homes. This is known as the ‘not in my backyard’ (NIMBY) phenomenon.

In addition, waste management authorities have strict regulations concerning the formation and management of landfill sites to protect public health and the environment around the sites. Therefore, it is often difficult and expensive for Councils to establish new landfill sites. Often the only choice to Councils with no landfill sites is to take the garbage from their city or shire to a landfill site in another area. They may have to build a transfer station and truck the garbage long distances to the new site. This may increase the cost to a city or shire of disposing of their garbage.
In the Melbourne Metropolitan area, for example, the problem is not so much that there is a lack of suitable landfill sites, but more of meeting the cost of providing conveniently located and environmentally responsible landfill facilities.

The Industry Commission reports that high temperature incineration of household garbage is a fairly common practice overseas, but is only used to a limited extent in Australia. This is mainly because the cost of incineration of waste is generally much higher than disposal to landfill and because of community concerns about potential environmental damage.

Garbage in Australia

According to the Commonwealth Environment Protection Agency (1991), Australians generate almost 14 million tonnes of garbage a year. This is about 800 kg per person per year. In 1989, the total cost to collect and dispose of all this garbage was about $500 million or about $28 per person per year.

In most capital cities, only about a third of all the garbage going to landfill is household and other Council garbage. The rest is made up of commercial and industrial waste and building and demolition waste.

Household garbage

The makeup of household garbage for the year 1996 for Victoria is shown in the following list:

Composition by weight of household garbage 1994 (Source: BIEC Vic., 1996)

Category	Percentage
Food waste	39.9%
Green waste	14.4%
Other non-recyclables	25.6%
Paper	11.8%
Glass	3.2%
Steel	2.5%
Liquid paper board (e.g. milk and fruit juice cartons)	0.5%
PET, HDPE, PVC plastic	0.9%
Other plastics	1.0%
Aluminium	0.2%

What is the solution?

The garbage situation is considered to be so serious that several States and the Commonwealth have developed waste minimisation strategies to reduce the amount of garbage going to landfill. In 1992 the Victorian Government set a target of halving the amount of garbage going to landfill by the year 2000. Other States and the Commonwealth have similar targets.

There are encouraging signs that in metropolitan Melbourne garbage production is already decreasing. In a report by the BIEC (1996), it was revealed that household garbage in Victoria has decreased from 12.82 kg per household per week in to 12.34 kg per person per week.

There is still a lot of work to be done by governments, industry and the community if the State and National goals of reducing waste by half by the year 2000 are to realised. Other information sheets in this series will describe some of the strategies of minimising waste that will help achieve these goals.

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EcoRecycle Victoria Information Sheet

3. The 3 R's - Reduce, Reuse, Recycle

On a per person basis, Australia is one of the top producers of garbage in the world. "This has serious economic and environmental consequences which will get progressively worse unless strong action is taken." (Source: RRRC, 1994)

The Commonwealth Government, has a goal to reduce the amount of garbage we throw away by half by the year 2000. We will all need to make changes to the way we deal with waste if this goal is to be reached. With a little more thought, we can all change our habits so that each one of us throws out less garbage. These small, but worthwhile changes may at first seem inconvenient, but soon they will become second nature.

The benefits of minimising waste

Some of the key benefits of minimising waste are:

1.It conserves valuable resources including:
• Minerals - used to make many useful materials (e.g., bauxite is used to make aluminium).
• Energy - used in mining, harvesting, manufacturing and transporting.
• Native forests - used to make some types of paper and other wood products.
• Petroleum - used to make plastics.
• Landfill sites - the life of existing sites is extended.

2.It saves money. Cutting down the amount of waste generated can save money in many different ways:
• If you waste less, you get more out of what you buy and waste disposal costs are reduced.
• Businesses become more efficient.
• Household incomes stretch further.

3.It reduces environmental impact. For example:
• Fewer areas need to be affected by resource extraction (e.g., mining), harvesting or solid waste disposal.
• Less fossil fuel needs to be burnt for energy, thus reducing the release of greenhouse gases and other pollutants.

The 3Rs

The 3Rs are a simple guide to help each of us minimise waste at work, school and home. Combine the 3Rs with composting, and we have a neat package to help us deal with our waste. In minimising waste, remember to first "reduce", then "reuse", and finally "recycle" or "compost" what is left.

Reduce

Reduce simply means to live more carefully so that you have less rubbish to get rid of later on. This could mean:

• Shopping more carefully.
• Making more foods at home instead of buying takeaways or convenience foods.
• Making gifts and cards for family and friends, rather than buying them.
• Growing your own vegetables and flowers.
• Repairing clothes, toys, tools and appliances rather than replacing them with new ones.
• Hiring, sharing and borrowing things rather than buying new ones where possible.

When shopping, try the following ideas to help reduce unwanted garbage -

• Take a bag, basket or box with you when you shop.
• Use a shopping list. Don't buy things on impulse. Buy only what you really need.
• Avoid goods that have excessive packaging.
• Choose products that come in concentrated form (e.g., kitchen detergent) or that have refills (e.g., certain ballpoint pens, some laundry detergents).
• When you buy packaged goods, choose packaging that is either made from recycled materials or that can be refilled, reused or recycled.
• Buy products made from recycled materials (e.g., paper, compost bins, etc.).
• Don't buy too many disposable products such as tissues and nappies.
• Buy products that are durable and will last you a long time.
• Buy products that will not go out of fashion quickly.
• Buy fresh foods where possible and compost the scraps.
• If possible, buy some food from bulk stores or markets. Take your own bags to be refilled.
• Where there is a range of sizes available, choose the largest that you can use thereby avoiding unnecessary packaging.

Reuse
Reusing a waste item means that you don't have to buy a new product for the purpose, and so you are saving the energy and resources that would have been used to make a new product. Reusing also means that the product doesn't go in the bin and end up in landfill.

There are lots of ways that you can reuse things around the home. Here are a few ideas.

• Reuse empty glass jars for jams, and sauces.
• Open envelopes carefully so that they can be reused.
• Use small, empty plastic soft drink bottles as drink bottles for school or outings.
• Buy second-hand books for school and pleasure.
• If you have too much junk around the house, arrange a garage sale and allow others to reuse your 'junk'.
• Save your old margarine and icecream containers and e.g. cartons and donate them to a school or preschool to use.

Recycle
Recycling means that a waste product is returned to a factory where it is remade into either the same product or something different. For example, used aluminium cans can be recycled back into either new drink cans or engine blocks for new vehicles. Recycling saves landfill space and also saves the resources that were used to make the product in the first place. In some cases, recycling can also save energy.

Materials that can be collected from most homes for recycling include:

• Paper and cardboard
• Glass bottles and jars
• Aluminium cans and foil
• PET plastic soft drink bottles and fruit juice bottles (Code 1).

Some Councils also collect other items. Some of these are:

• Plastic milk, cream and juice bottles (Code 2 -HDPE)
• Plastic juice bottles (Code 3 - Vinyl)
• Milk and fruit juice cartons
• Steel cans
• Coloured HDPE
• All types of plastic.

Check with your local Council for details about which materials are collected for recycling in your local area.

You should only place out for kerbside collection those materials that are collected by the recycling contractor for your Council. If the wrong materials are placed out, the recyclables may become contaminated. Contamination can threaten the viability of the kerbside recycling system, by increasing the costs to the collectors, the recyclers and ultimately, the community.

Other items that can be recycled include: plastic supermarket bags (from some supermarkets), laser printer cartridges and ribbons, wine bottle corks, car parts (car bodies, batteries, tyres and motor oil), building materials (timber, concrete, asphalt and bricks) metals (lead, steel, copper and brass) and fire extinguishers (yellow, halon type). For further details about these materials, consult your Council or Waste Recycling Centre.

(Adapted from Waste Matters pages 60-61 and from the RRRC brochure Less Waste Wins -Reduce, Reuse and Recycle, 1994.)

Sources

Armstrong P., and Laffin, J., 1993, Waste Matters, Environmental Education Activities About Waste, Gould League of Victoria Inc.
Beverage Industry Environment Council, 1996, Recycling Audit and Garbage Bin Analysis, June -September.
Recycling and Resource Recovery Council, 1994, Less Waste Wins - How to Reduce, Reuse and Recycle.

EcoRecycle Victoria Information Sheet
11. Composting

What is composting?

Composting is a method of breaking down waste organic materials (kitchen and garden waste) in a large container or heap. The decomposition occurs because of the action of naturally occurring bacteria and fungi. Small invertebrates, such as earthworms and millipedes, help to complete the process.

Composting can convert kitchen and garden waste into dark coloured soil in a matter of a few weeks or months.

Composting has many benefits for the environment:

• it saves valuable landfill space
• compost can be used as fertiliser
• compost improves the condition of soils.

Composting in Australia

About half of the household rubbish in Australia is made up of food and garden waste. Most of this material could be composted in either backyard compost heaps or in large scale composting operations. Australians produce about two million tonnes of food and garden (or green) waste each year. This is about 145 kilograms per person per year.

How composting works

There is nothing mysterious or complicated about composting. Natural composting or decomposition, occurs all the time in the natural world. Organic material, the remains of dead animals and plants, is broken down and consumed by decomposers (mainly bacteria and fungi) and eaten by small invertebrates.

The nutrients, that were once present in these remains, are returned to the soil or water, where they are able to support the growth of new plants. This is natural recycling.

In composting, provided the right conditions are present, the natural process of decay is speeded up. Bacteria and fungi feed and multiply, giving off a great deal of heat. In well managed heaps, this temperature can reach as high as 60 degrees centigrade in the central core.

While the temperature remains high, invertebrates are not present in compost heaps,
but when the temperature drops, invertebrates enter the heap from the surrounding soil and complete the process of decomposition.

In a pile of mature compost, there may be a wide variety of invertebrates present. In fact there is a mini food web in action. Some creatures, such as springtails, millipedes, mites, slugs and earthworms, feed on the partially broken down materials. Other creatures, such as spiders, centipedes and scorpions, prey on the compost feeders.

Choosing a composting system

When choosing a composting system for your school or home, it is important to understand the
types of decomposition that can occur in a compost heap or bin.

Types of decomposition

Anaerobic decomposition occurs without oxygen. This process is quite slow and can give off unpleasant odours and, more importantly, methane, which is an important greenhouse gas.
In **aerobic** decomposition, the breakdown is caused by the action of microorganisms that thrive in oxygen. This process is quite rapid and can cause the heap to become quite hot. Aerobic decomposition does not usually produce unpleasant odours.

Many texts or references on composting refer to aerobic and anaerobic systems. This distinction is misleading, as under certain conditions, so-called “anaerobic systems” (usually closed plastic bins) can operate aerobically and so-called “aerobic systems”, if managed badly, can give off unpleasant odours, indicating that they are operating anaerobically.

Whichever system you finally choose for your school or home, it is important that you operate it aerobically, so that it does not produce methane gas or unpleasant odours. To do this you should:

• add roughly equal amounts of “greens” (kitchen waste and fresh garden waste and “browns” (fallen leaves and shredded paper);
• keep the heap moist, but not too wet;
• place the bin or compost heap on well-drained soil; and
• turn the contents frequently to aerate the organic material (if this is not possible, then insert a piece of plastic agricultural pipe, with slits in the side, into the heap. This will help to bring air into the centre of the heap.) With closed plastic bins, you can drill small holes in the sides to improve aeration. Cover the holes with fly wire to prevent flies and other creatures from entering the bin.
Adding composting worms to compost bins and heaps will also help to aerate the organic material and reduce anaerobic breakdown.

Tumbler type compost systems will, if operated correctly, involve rapid aerobic breakdown and produce compost in a very short period of time.

Compost containers and heaps

There are many types of containers that you can use to compost at school or home. Some of these are:

• Plastic bins with ventilation holes or slits
• Plastic bins without ventilation
• Metal drums with holes punched in the side and with the base removed
• Rotating drum units (tumblers)
• Enclosures for a compost heap made from timber (planks or sleepers), bricks, or chicken wire.

If you prefer, you can make compost in open heaps, but they should be covered with old carpet, a plastic sheet or some hessian to prevent the heap from drying out in hot weather. You can even bury kitchen scraps in holes dug in garden beds.

Precautions

Compost is produced from natural materials and contains a variety of living organisms which, on rare occasions, have been associated with illness and allergies in some humans. For health reasons, it is very important to take the following precautions when handling compost or soil:

• Wash your hands after handling compost or soil materials.
• Wear gloves when handling compost or soil materials.
• Avoid handling compost or soil materials in confined spaces.
• Keep compost moist to prevent fungal spores or bacteria from becoming airborne.
• Avoid direct contact with dry compost; gently wet it to allow for dust-free handling.

For individuals who have either allergies to the fungal spores in compost or have depressed immune systems, it may be necessary to wear a face mask when working with compost. Severely affected individuals may have to avoid contact with compost altogether. Gardeners with respiratory problems should be especially careful when working with compost materials.

Sources

Modified excerpts from *Waste Matters* by P. Armstrong and J. Laffin have been used in preparing this information sheet. Other composting EcoRecycle Victoria Information Sheets. Refer to Information Sheet 12. *Methods of Composting* and Information Sheet 13. *Trouble Shooting with Compost and Mulching*.

Useful References

Armstrong, P. and Laffin, J., 1993, Waste Matters - Environmental Education Activities about Waste, Gould League of Victoria Inc.
Clayton, S., 1993, The Reverse Garbage Garden, Hyland House, South Melbourne.
Cullen, M. and Johnson, L., 1992, Backyard and Balcony Composting, Bookman Press, Melbourne.
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EcoRecycle Victoria Information Sheet

12. Composting Methods

Some methods of composting

1. The layering method (slow and cool)

Add a mixture of materials. Try to add alternate 10 cm layers of vegetable and fruit scraps, grass clippings and leaves and some shredded newspaper. Cover each layer with a thin layer of soil and a handful of fertiliser, such as blood and bone. Keep moist (like a damp sponge) but not too wet. The compost should be ready to use in three to six months. Breakdown will be speeded up if the heap is
turned occasionally.

2. The 'all in together' method (fast and hot)

Store enough kitchen and garden waste to make a heap of about one cubic metre. Add to a bin or a tumbler, or form into a heap with some fertiliser (e.g., cow or sheep). Turn several times a week. This heap will generate a great deal of heat as the rate of breakdown is very high. The compost should be ready in three to six weeks.

3. The compost worm method (moderately fast and cool)

Build the heap slowly as for the layering method, but add some compost worms (special worms that thrive in compost) to the bin. Start with about 2000 worms. Keep the heap well watered, but not too wet. Turning isn't necessary as the worms will turn the heap for you. The completed compost should be ready in about three months.
(Adapted from Earthcycle by Libby Elston)

Worms do not survive in temperatures above 30 degrees Celsius. There is some doubt about whether they are capable of killing weeds and diseases - they might digest some weeds and seeds and ignore others. Worm farmers in the U.S.A. compost first to kill weeds and diseases, and then feed the compost to the worms. More research in this area is needed.

What to add to a compost heap

The following materials can be added to a compost heap or bin:
• Vegetable and fruit scraps
• Fallen leaves
• Tea leaves and tea bags
• Coffee grounds
• Vacuum cleaner dust
• Soft stems
• Dead flowers
• Used vegetable cooking oil
• Egg shells
• Old newspapers
• Lawn clippings
• Sawdust (not from treated timber e.g. treated pine)
• Wood ash

What NOT to add to a compost heap or bin:
• Meat and dairy products
• Diseased plants
• Metals, plastic, glass
• Fat
• Magazines
• Large branches
• Weeds that have seeds, bulbs or underground stems
• Bread or cake (may attract mice)
• Bones
• Animal manures, especially the droppings of cats and dogs.
• Sawdust from treated timber e.g. treated pine.

Precautions

Compost is produced from natural materials and contains a variety of living organisms which, on rare occasions, have been associated with illness and allergies in humans. For health reasons, it is very important to take the following precautions when handling compost or soil:

• Wash your hands after handling compost or soil materials.
• Wear gloves when handling compost or soil materials.
• Avoid handling compost or soil materials in confined spaces.
• Keep compost moist to prevent fungal spores or bacteria in compost from becoming airborne.
• Avoid direct contact with dry compost; gently wet it to allow for dust-free handling.

For individuals who have either allergies to the fungal spores in compost or have depressed immune systems, it may be necessary to wear a face mask when working with compost. Severely affected individuals may have to avoid contact with compost altogether. Gardeners with respiratory problems should be especially careful when working with compost materials.
Note: Please note that there is a lot of variation in printed materials about how to compost. This sheet provides information that is believed to be commonly accepted practice.

Sources

Modified extracts from *Waste Matters* by P. Armstrong and J. Laffin have been used in this factsheet.

Useful References

Other Composting Information Sheets. Refer to Information Sheet 11 *Composting* and Information Sheet 13 *Trouble shooting with compost and mulching*.

Armstrong, P. and Laffin, J., 1993, Waste Matters - Environmental Education Activities about Waste, Gould League of Victoria Inc..
Clayton, S., 1993, The Reverse Garbage Garden, Hyland House, South Melbourne.
Cullen, M. and Johnson, L., 1992, Backyard and Balcony Composting, Bookman Press, Melbourne.
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Federal Publishing Company, Alexandria, NSW.
Gilbert, A., 1992, No Garbage, Thomas C. Lothian Pty Ltd, Melbourne.

13. Troubleshooting with Compost and Mulching

Trouble shooting with compost

PROBLEM	CAUSE(S)	SOLUTION(S)
Compost takes too long to break down.	Too dry.	Add water.
	Not right mix of ‘greens’ and ‘browns’.	Add equal amounts of‘greens’ (e.g. vegetable scraps or fresh lawn clippings) or ‘browns’ (e.g. fallenleaves or straw).
	Not enough air.	• Either turn more frequently or add about 2000 compost worms to the heap. • Punch some holes in the container. • Place a length of slotted agricultural pipe in the heap.
Smelly.	Too wet.	See below.
	Too acidic.	Add some wood ash or dolomite to neutralise the heap.
	Insufficient air.	• Turn more often. • Rebuild with some dry materials.
Flies.	Most of the flies in and around a compost heap are small vinegar flies which are quite harmless.	Cover organic waste with a thin layer of soil, grass or leaves.
	If the flies are house flies or blowflies, then they are being attracted by meat or dairy foods.	Avoid adding meat or dairy products.
Too wet.	Too much water has been added.	Improve the drainage under the heap.
	Organic waste is too moist.	Mix in some dry material such as dry grass clippings or shredded newspaper.
	Inadequate drainage.	Improve the drainage under the heap.
A lot of slaters or ants.	Heap is too dry.	Add water or some moist organic materials.
Rats, mice, dogs or cats are a problem.	Attracted by uncovered food and/or warmth of heap.	• Cover each addition of food with a layer of soil. • Place the bin on a layer of fine wire mesh. • Set traps around the bin.
Spiders under the lid.	Attracted by invertebrates, most likely small flies.	• Have a handle on the top of the lid. • Check for spiders before placing your hand under the lid. • Wear gloves. • Cover each addition of food with a layer of soil.

(Adapted from Earth Works*, 1994)*

Mulching

Organic mulch is simply chopped or shredded plant material that is applied to the surface of gardens or revegetation projects. A thick (15-20 cm) layer of mulch will reduce water loss from the soil while still allowing water to penetrate.

Mulch is used for many reasons, including to:

• suppress weed growth
• provide an alternative to sending green waste to landfill disposal
• reduce water loss from the soil and so reduce the need to watering
• encourage a diversity of fungi and invertebrates and so reduce the need for chemical sprays
• create a natural appearance for gardens
• provide a soft surface for playgrounds and paths
• reduce soil erosion.

There are many organic mulches to choose from. Some of these are:

• pine or eucalypt chips
• straw or hay
• fallen leaves
• sawdust
• chipped tree prunings
• grass clippings
• compost.

Warning

It is important to be aware that weed seeds and plant pathogens (organisms that cause disease in plants) may survive in the production of mulch from green waste, unless the material has been treated at sustained high temperatures. Thus, depending on the product, mulch can spread unwanted weeds and/or diseases if used in either bush restoration projects, on native gardens, or on home or school gardens adjacent to bushland.

It is okay to use fallen leaves, grass clippings or chipped green waste from your own home as mulch on your gardens, but do not include weeds or diseased plants.

If you plan to use mulch made from green waste from other localities on your garden, you should make sure that the mulch has been properly treated to kill weed seeds and pathogens, especially if it is to be used on gardens that are adjacent to native bushland.

Please Note: There is a lot of variation in printed materials about how to compost. This sheet provides information that is believed to be commonly accepted practice.

Useful References

Armstrong, P. and Laffin, J., 1993, Waste Matters - Environmental Education Activities about Waste, Gould League of Victoria Inc.
Clayton, S., 1993, The Reverse Garbage Garden, Hyland House, South Melbourne.
Cullen, M. and Johnson, L., 1992, Backyard and Balcony Composting, Bookman Press, Melbourne.
Cundall, P., 1993, Organic Gardening, Gardening Australia Collector’s series No. 1, Federal Publishing Company, Alexandria, NSW.
Haddon, F., 1993, A Practical Guide to Composting, Simon and Schuster, Sydney.
Roads, M. J., 1989, The Natural Magic of Mulch - Organic Gardening Australian Style, Greenhouse Publication, Elwood, Victoria.

Other Composting Information Sheets - Refer to Information Sheet 11 *Composting* and Information Sheet 12 *Composting Methods*. These sheets include important information on how to start and operate a compost heap or bin and on safety precautions of which you should be aware.

EcoRecycle Victoria Information Sheet
14.Wormeries

Composting garden waste and fruit and vegetable scraps from the kitchen is a great way to reduce the amount of garbage we throw away. This saves valuable landfill space, and compost itself is a great soil conditioner.

Keeping earthworms in containers and feeding them fruit and vegetable scraps, is another cheap, simple way to cut down on garbage disposal. As a bonus, the worms produce a wonderful garden fertiliser - worm castings.

Suitable containers for keeping worms include wooden boxes, stackable worm farms and stackable plastic worm factories. Worms can also be put in standard compost bins or heaps of compost as long as people know how to look after their worms in these situations - adequate instructions should be provided with the worms.

There are many companies that sell worm farms and compost worms. Consult the ‘Yellow Pages’ telephone directory under ‘Worm Farms’.

You can’t use native earthworms in a wormery, as the conditions are too rich for them. Special earthworms, called compost worms, work best, as they thrive in the rich, moist conditions of a wormery. The most common compost worms are Tiger Worms, Red Wrigglers and Indian Blues. (For a supplier of compost worms, check with your local Council or in Yellow Pages telephone directory.)

How to build a simple wormery

Select a container for keeping worms. A polystyrene foam fruit box, with drainage holes, from your local fruit shop is ideal.

Here’s what to do:

1.Wash the box thoroughly, then line it with a few sheets of newspaper.

2.Half fill the box with well rotted compost. This should be quite moist, but not soggy.

3.Add compost worms. It’s best to start with at least 2000 worms. (These worms will breed and multiply to about 8000 worms in 6 months)

4.Cover the box with a layer of hessian, and water to make it moist.

5.Each week, add fruit and vegetable scraps. (Add about 1.5 kg of food in the first week, then as the worms start to multiply, gradually increase the amount to about 7 kg a week at six months.)
6.Add some water every few days or when necessary, to prevent the compost from drying out. You will need to add more water on hot, windy days. It is important to keep the wormery moist, as if it dries out, the worms may die. Ideally, the hessian should feel damp. Don’t forget that there is a lot of water bound up in food scraps. Being too wet is as bad as too dry. The compost should be moist, not soggy.

7.After six months, it will probably be necessary to start another box. Half fill a second fruit box with compost, and carefully transfer the top half of the first box to the second. At this stage, you have a number of choices. These are:
Add fruit and vegetable scraps to the second box only. The material in the bottom of the first box is now almost pure worm castings, with very few worms. It could be used in the garden in the same way as compost or mixed with commercial potting mixes to pot plants.
Place the two boxes side by side on the ground and feed both with food scraps.
Fill the first box with compost, place the second box on top of the first and add food scraps to the top box only. The worms will migrate up through the holes in the base of the second box to feed.

If you have too many worms, you could give some away to friends or another class at your school so that they can start their own wormery.

Worm facts

Earthworms are hermaphrodites, that is, each worm has both male and female sex organs.
All worms can produce young. After mating, a worm will form a capsule (or cocoon) containing eggs. In about 21 days, 2-20 baby worms will hatch from the capsule. In about 2-3 months, the young worms are ready to breed.
Earthworm eggs can survive in very dry conditions for a long time, the baby worms hatching out when the soil becomes wet.
Compost worms breed every 7-10 days and so the population in a wormery will double in 2-3 months.
Compost worms can eat about half their body weight in food in one day.
Earthworms have no eyes, but can sense vibrations, light and temperature through special organs in the skin.
Earthworms can live up to 15 years.
Earthworms breathe through their skin and expel urine through special pores.
There are 350 species of earthworms in Australia. Most compost worms and earthworms found on farms and in gardens are introduced species. Compost worms are rarely found in the bush as the conditions there are not suitable. (Adapted from Christenson & McLachlan, 1994).

About wormeries

The size of worms in a wormery is a good indicator of how well they are being fed. With insufficient food, the worms will be smaller than normal. If a wormery becomes overpopulated, the worms will stop breeding until some worms are removed.

Worms apparently do not breed in organic waste and will move away from the food source to breed. Therefore, it is important to provide a bedding mix that is not as fresh as the main food source. The best material for this is well rotted compost placed over a layer of newspaper and cardboard - a great way to use up compost produced from garden waste.

Worms will eat any type of vegetable and fruit scraps, animal manure, leaves and will even eat damp cardboard.

Some Councils sell wormeries and/or worms to residents or schools in their city or shire, so check with your Council before starting your wormery.

The worms in a small wormery should eat all the fruit and vegetable waste produced by a household of four. Wormeries are ideal for people living in flats or houses with small backyards.

The worms in a single wormery should also eat all the fruit and vegetable scraps of an average size school class. (Plastic worm factories are ideal for a class as they are easily transported to a student or teacher’s home for the holidays.
More permanent wormeries pose a problem during holiday periods, as the worms must be watered every few days and fed once a week).

To collect the worms from an established bin, place the worms and the castings onto a piece of shade cloth held over a tray. The worms will migrate through the shade cloth to the tray below.

Don’t place wormeries with open bases close to trees and shrubs, otherwise the plant roots will invade the bin, seeking out water and nutrients.

Please Note:. there is a lot of variation in printed materials about wormeries. This sheet provides information that is believed to be commonly accepted practice. Thanks to Phil Staggart of Organic Waste Management for his advice in preparing this Information Sheet.

References

Armstrong, P. and Laffin, J., 1993, Waste Matters, Gould League of Victoria Inc.
Colliver, A., 1992, Kids for Landcare WormWatch, Education Department of South Australia.
Christenson, C., and McLachlan, S., 1994, The RELN Worm Factory Education Booklet Primary School, First Edition, RELN Pty Ltd.
CSIRO, 1986, Earthworms for Gardeners and Fishermen, Soils Series 4.
CSIRO,1993, Worms, Worms, Worms, Poster, CSIRO Editorial Services, Melbourne.
Murphy, D., 1993, Earthworms in Australia, Hyland House, Melbourne.

Resource R7: School Based Green and Orgnaic Waste Audit

Aim: To ascertain the types, sources and volumes of green and organic waste produced at your school.

PROCESS

STAGE 1

Research to find out the variety of materials that can be grouped or classified as green and organic waste.

Ascertain what an audit should determine and the purpose for conducting an audit.

STAGE 2

Design a 20 day survey and recording sheet that will ascertain in your school:

- types of green and organic waste produced
- sources of these wastes
- volumes of these wastes

STAGE 3

Collate and publish the results

Note: To successfully complete the Green and Organics Waste Audit there will be a need to set up special recycling bins or areas for
(a) paper and cardboard (b) food waste (c) leaves, lawn clippings and woody material, (d) non-organics such as plastics, glass and metals in the yard and in classrooms.
Separation of organic materials for collection and assessment
is a very important facet of the audit.

STAGE 1

Research and document the variety of materials that fall under the category of green and organic waste.

Hints:

• utilise the resources and references contained in this publication as a starting point and contact organisations or individuals who might be able to aid you gaining an understanding of the variety of materials that fall into the above mentioned categories

• include specific categories, e.g. green waste might need to be listed in a variety of forms as its possible reuse will be dependent on a range of variables. For example the treatment of grass clippings could be different from that of woody material even though they both fall under the green waste category

• you will need to take into account that some forms of green waste are seasonal, e.g. volumes of leaf litter will vary depending on the type of trees, the time of year and the schools location within Australia's variable climatic zones

STAGE 2

Design a survey or collation sheet that will ascertain in your school the:

• types of green and organic waste present

• source of these wastes

• volumes of these wastes

Hints:

• this task would be best run across the whole school community involving all children, staff, grounds people, parents (school canteen)

• before embarking on this task it would be appropriate to approach all the relevant people within the schoool to gain their support for the audit. This might include principals, parent groups, especially the school council, staff, student bodies

• you might like to use or modify the format suggested on the ensuing pages in order to successfully complete stages 1 and 2 of the audit

School Based Green and Organic Waste Audit - a working model

Note: This model is based around a single class in a non-residential school campus being ultimately responsible for the audit but could be easily modified to suit any grouping within a school e.g. SRC, canteen, grounds' staff.

As a class, research to find out what actually makes up green and organic wastes. List these. Next highlight the ones relevant to your school. These items/materials will form the basis of the audit.

For the purpose of this model, the fictitious school has:

• ovals, tennis courts
• flowers, trees and shrubs
• a canteen
• an artroom, a staffroom
• a groundsperson
• a sole principal
• a school council (parents/teaching staff)
• no separate bins for collection of recyclables

For the purpose of this model, the following materials have been identified within the school:

• paper from classroom waste, office waste and canteen
• cardboard from classroom waste
• leaves
• woody material, garden prunings
• grass clippings
• organic lunch scraps, e.g. bread, fruit, vegetables, biscuits
• staffroom waste, e.g. food scraps, tea bags, coffee grounds

Once the green and organic waste types and their sources have been identified individuals are allotted specific waste generation areas and the types of waste produced in each of these areas. Individual students will liaise with adults responsible for these areas.

No. of Students	Individual to liase with	Responsible for
4	Groundsperson	Audit of green waste and school rubbish bins
1	Artroom teacher	Daily collection of waste bins
1/class	Individual classrooms	Informing students & collection of class bins
1	Office staff	Daily collection of bins/waste paper
1	Staffroom Coordinator	Daily collection of bins
1	School Council	Information sharing and funding
1	Principal	Information sharing and funding
1	Staff	Attending staff meetings to inform staff of audit
1	Canteen	Daily collection of waste bins
4-6	Whole School	Audit of already recycled green and organic materials

Informing the School Community

As this is an audit of the school's green and organic waste it will involve members from all sections of the school community. It is important to not only seek permission from the relevant people to conduct the audit but also to have information available to present to all sections of the school in regard to the aims of the audit, what the audit will involve, who will take part and what their individual reponsibilities (if any) will be. Specify what will be done during the audit and how long it will take.

As a class, brainstorm a list of those individuals or groups within the school who will be affected by or responsible for sections of the audit. These could include:

• School Principals who will need to agree to the audit and possibly supply funding or other resources
• Teaching staff who will also need to agree to the audit
• Ancillary staff
• Groundsperson
• Canteen staff
• School council/parent groups could be approached in regard to funding for the exercise
• After school care groups
• Classes
• Staff room monitors
• SRC

As a class, decide which individuals will be responsible for informing each of these groups or individuals and how this will be done. Prepare an information flyer describing how the audit could be used as a starting point for individual discussions, meetings, speaking at school council meetings or communicating to classes.

In order that other members of the school community, particularly other students, feel a sense of ownership in regard to the audit, providing them with information and involving them in the process as much as possible would be extremely beneficial. Below are some suggestions that might aid in achieving this in other classrooms. These principles can be easily adapted for any group or individual.

1. Ensure they are kept well informed about:

• what an audit is
• what is going to be audited
• the reasons for suggesting that there is need for a waste audit
• how the audit will take place
• the level of involvement classes will have and their specific expectations
• how you intend to use the results of the audit.

This can be achieved in a variety of ways, including:

• weekly classroom visits
• newsletters
• updates at the school assembly
• information disseminated via the SRC
• use of notice board - special space for Audit News.

2. Involve students in the classrooms in the audit by:

• suggesting that over the 20 day period that two different students from each class deliver their classroom bins to the assessment area and view the process of calculating volumes each day

• suggesting classes keep a record of their own green and organic waste within their individual classroooms. From these results further valuable information could be gleaned. This could be organised and supervised by the class actually repsonsible for the audit or individual classes

• working with classes to help provide ways and means to minimise the amount of green and organic waste 'thrown away'.

To ensure that the audit doesn't just result in the school having a set of figures in relation to their green and organic waste but provides some positive long term outcomes, involvement by as many classes or individuals as possible can only be beneficial.

Important: Each student involved in the hands-on section of the audit will require:

• parents' permission to take part
• rubber gloves
• access to water, cloths and antiseptic for the cleaning of materials utilised and for washing themselves.

Liaising with Groundsperson

(Note: Groundsperson is used in this guide, although the role is variously called groundsperson, grounds' worker or general assistant in schools.)

Rubbish bins/Classroom bins/Staffroom bins/Office bins/Canteen bins

Note: As mentioned earlier the need for separate bins for various waste types is imperative for a successful audit as separation at the source is far less time consuming and accurate. As rubbish bins are generally emptied at the end of each school day, it makes sense that the audit procedure takes place at that time.
It is also important that when bins are delivered for monitoring that the specific area they have come from is recorded to ascertain exactly which areas within the school are producing what amounts of waste. Devise an identification code to make this as easy as possible, e.g. C = canteen, BO = bin from oval, C13 = classroom 13, etc.

Steps in the Audit Process

1. Arrange a time to meet with groundsperson each day to conduct the audit.

2. In discussion with groundsperson decide on the best way to ascertain volumes or weight of organic material collected each day. This could include:

• using a standard size rubbish bin and calculating its volume to measure daily amounts
• constructing a one cubic metre container as a standard measure
• Note: guessing the volume is the least accurate and is best avoided.

3. As bins are brought from each area (classrooms, yard, office, staffroom, artroom) to the current disposal area, keep wastes from each different area separated. Empty the bins into the standardised measuring bin until full; repeat until all the waste has been dealt with and record number of standardised bins filled. Results for Day 1 might be:

• 2 bins of paper products from yard area
• 3 bins of paper products from office
• 0.5 of a bin of paper products from staffroom
• 0.25 of a bin of paper products from canteen
• 6 bins of paper products from classrooms
• 1 bin of paper products from artroom
• 1 bin of food scraps from yard area
• 0.1 of a bin of food scraps from staffroom
• 1.25 bins of food scraps from classrooms
• 0.2 of a bin of food scraps from canteen

Note: As separation of the different types of waste is imperative it might be an opportune time to audit all forms of solid waste within the school.

4. Record daily details on recording sheet. See example below. Keep daily collection sheets for future reference.

COLLECTION AREA			TYPE OF WASTE	
DAY (1-20)	DATE	COLLECTOR	NO. of BINS	VOLUME (cubic metres)

5. Wash necessary collection bins (particularly those for food waste) and hands thoroughly.

6. Return to classroom and record details on master sheet. See example below.

SCHOOL WASTE AUDIT - MASTER SHEET					
VOLUMES OF WASTE COLLECTED (in cubic metres)					
DAY (1-20)	FOOD SCRAPS	LEAVES/GRASS CLIPPINGS	WOODY MATERIAL	PAPER	Collector's Signature
TOTALS					

TOTAL AMOUNT OF GREEN & ORGANIC MATERIAL PRODUCED FOR DISPOSAL OVER A 20 DAY PERIOD	
TOTAL AMOUNT OF GREEN & ORGANIC MATERIAL RECYCLED OVER A 20 DAY PERIOD	
TOTAL AMOUNT OF GREEN & ORGANIC MATERIAL PRODUCED OVER A 20 DAY PERIOD	

Note: After a 20 school day period (four school weeks) you will have the total volume of organic waste produced in the school for that period and from there you will be able to make the calculations required for planning future waste minimisation strategies.

Green waste from ovals and yard. This could include leaf litter, grass clippings, woody material (prunings).

Note: Time spent/involved in this side of the audit will have to be negotiated with the groundsperson in order that it does not have a negative impact on use of the groundsperson's time. As the collection of green organics might not be part of the groundsperson's daily routine, this section of the audit might be best done on a weekly basis as opposed to daily measuring.

Steps

1. Arrange a time to meet with groundsperson to discuss how best to tackle this section of the audit.

2. In discussions with the groundsperson, decide the best way to ascertain the volumes of green organics collected. This could include:

• construction of a specific sized container to use as a measuring device
• utilising a school/parents trailer/small truck as a standard form of measure
• hiring a known volume waste disposal bin for the duration of the audit
• utilising the groundsperson's existing knowledge and skills to guesstimate the volumes.

3. Suggested method

After having decided on the form of measurement, meet weekly with the groundsperson to view and assess the volume of material collected. If possible, separation of materials into the categories of grass clippings, leaf litter and woody material would be beneficial as the amount of these materials collected will vary depending on the time of year and the climatic conditions that prevail. In discussion with the groundperson you should be able to obtain information like:

• how often pruning takes place
• how often leaf litter needs to be collected
• how often the grass is cut.

These details will be important when trying to calculate annual green waste production.

4. After viewing and assessing the volumes, record collection details on recording sheet.

Note: Care should be taken when handling grass or lawn clippings as they may cause allergy reactions/respiratory problems in some individuals.

5. Wash your hands throughly.

6. Return to classroom. Details for collation of the "School Waste Audit - Master Sheet" can only be filled in on the final day of the audit.

SCHOOL WASTE AUDIT - GREEN WASTE COLLECTION (Volume in cubic metres)				
	Leaf litter	Grass clippings	Woody material	Collector
Collection 1				
Collection 2				
Collection 3				
Collection 4				
Total				
Average collection volume (Total / 4)				
Number of times this material is collected annually				
Annual total Average collection X by number of times collected annually				

As part of the audit, it is very important that the students also ascertain the volumes of materials currently being recycled, as it will hopefully make up some percentage of the green and organic material. Also as part of the follow up action from the audit, some of the existing recycling processes could be extended or built upon and new waste minimisation strategies introduced.

The table below is provided as a guide to record this information for further discussion and action. It is recommended that this or some other form be completed daily in a similar manner to the disposal collation sheets, that a master sheet for recycled materials be produced and then at the end of the 20 day period both the collected waste details and the recyled waste details can be combined to ascertain the total amount of green and organic waste produced.

SCHOOL WASTE AUDIT - RECYCLED GREEN AND ORGANIC WASTE			
TYPE OF WASTE			FORM OF RECYCLING
DAY (1-20)	WHERE WASTE IS RECYLED	ASSESSOR/S	ESTIMATED/CALCULATED VOLUME (cubic metres)
TOTAL AMOUNT OF MATERIAL RECYLED OVER 20 DAY PERIOD			

Resource R8: Unravelling the Web

The World Wide Web (or www) is a complex global network of information or ‘texts’ which can be an effective tool for students and teachers to access information.

Many users browse or ‘surf’ the Web to locate information. This is a hit-and-miss way to locate information and can be costly! Some useful strategies to refine a search for subject-related teaching and learning resources are covered below.

These notes were developed by Environment Australia and their website is used as an example to illustrate examples and procedures.

Locating websites by address

A website address - a Uniform Resource Locator (URL) - is much like your street postal address and includes all the information to reach the correct destination. No two websites have the same address.

Environment Australia’s website address is http://www.environment.gov.au/index.html

Some explanations would probably be useful at this stage.

http://- this stands for Hyper Text Transfer Protocol. It specifies how hypertext (the text of the website pages) should be found and is the standard protocol for web-source material.

www.environment.gov.au - this is the name of the domain (or computer) which stores the home page hypertext. Reading right to left, the domain is Australia (au), belongs to a government organisation (gov), namely its environment department (environment), and the domain is part of the World Wide Web (www).

Index.html - this is the file being sought. The name index is commonly that of the website’s homepage. The extension html identifies the type of file - Hypertext Markup Language, the code used to create hypertext for the website's words, images and dynamics.

To locate Environment Australia’s homepage:

type the URL in the ‘Netsite:’ or ‘Address:’ field. Be careful to type the ULR exactly as it is given, that is, http://www.environment.gov.au/index.html

hit the Enter key. Your browser will then contact directly to site location and ‘download’ the hypertext. You can now ‘Navigate’ around the site and select the information areas you wish to look at.

If your entry returns a ‘File Not Found’ message, it could be that the site has been modified. Try pruning the URL, for example, try http://www.environment.gov.au

If this does not work, follow the procedures for a subject search.

Search by subject or name

If you don't know the URL you can locate information by using a ‘search engine’. Internet search engines are like indexes to the hypertext library of the World Wide Web.

Enter the name of an organisation or the topic you wish to search for into the search field. Often it helps to enter the name or subject topic within inverted commas, e.g. “Environment Australia”, “organic waste recycling”. This search request instructs the search engine to locate all Internet resources bearing the word and will often provide a number of alternatives and related websites.

A search for resources on ‘organic waste recycling’ may turn up a great variety of resources of varying usefulness. To refine your search you can include operators like ‘AND’, ‘NOT’ or ‘OR’ in the search query.

AND will refine the search for hypertext to need both terms present: organic waste AND recycling. NOT can be used to exclude resources not required: organic waste AND recycling NOT United States of America - will exclude resources from the USA.

Bookmarking Websites

Browsers help your PC store information about a previously visited website. This enables you to revisit these sites without the need for the browser to download all of the code necessary to build the pages. This process is called reloading and it is simply a matter to file useful websites as Bookmarks or Favourites.

Reference: based on Accessing Resources pp.17-21 (Environment Australia, 1998) - devised by Matt Simon, Open Access.

Pledger, P. and Pledger, P. (1998). WebLinks for Society and Environment. Pledger Consulting, PO Box 173, Kangarilla, SA 5157
(Useful resource on using Websites and gives SOSE links and lesson activities to develop research skills.)

Resource R9: Song Lyrics

Hey Gran

Hey ey ey ey grandma there's something here you should see
Wo oh a giant worm and all its mates
Slip sliding round grandpa's favourite tree

"A giant what?" Gran rushes out
to save her little boy
But when she sees what's going on
She smiles and jumps for joy

'Cos granny knew that any worm
is good to have around
'Cos a worm just does what a worm just does
Yep-Fixes up the ground

Chorus

Slip sliding around, up and down
Terri the worm and the team
They're good ol' chaps
They eat up our scraps
Help to make our whole world clean

Robert Colliver

My Backyard

Ooo what a day come outside
Let me show you round my backyard,
I'm glad that you came 'cos I've been waiting...
Hey where are you going?... oh all right, you can have a go on the swing

This is where the veggies grow, have a cherry tomato
Want to see worms? Well I'll show ya
Here's a blue... pleased to know ya
Here's a tiger he won't eat ya
G'day worm... pleased to know ya
I want to show you one more thing...
Hey where are you going?... oh all right, you can have a go on the swing

Here's a nest the wagtails made
There's the eggs the wagtail laid
Want to see bugs? Well I'll show ya
Here's a slater... pleased to know ya
Here's a spider he won't eat ya
G'day spider... pleased to meet ya

Want to show you one more thing...
Hey where are you going?... Oh all right let's have a go on the swing...

The wind in my face... Oooo what a place... my... back... yard

Nick Vall

Chew and Roll

Terri and the troopers
Slip and roll and chew
Eating eating night and day
How good is what they do?

What they make's amazing
And helps to save the land (it's poo)
Anything that wants to grow
Just loves the Terri Band

Chorus

They roll and chew and chew some more
Then pass the good staff out
They do the Terri chew and roll
That's what it's all about oo oo
That's what it's all about

Worms can eat the rotting leaves
They love organic waste
Anything that was alive
Is to the troopers' taste

Terri's in the worm zone
Using Nature's way
To get the garden growing
That's what the troopers say

Robert Colliver

Feed the Soil

Green leaves, brown leaves,
Any leaves at all.
Orange leaves, red leaves,
You can use them all.

Chorus

Put them in a compost heap
For all the little bugs.
They will turn them into food,
The soil will give you hugs.
For compost is the soil's food
For soil it is yummy
Compost helps our plants to grow
And fills the soil's tummy.

Green grass, brown grass,
Any grass at all.
Thin grass, fat grass,
You can use it all.

Chorus

Put them in a compost heap
For all the little bugs.
They will turn them into food,
The soil will give you hugs.
For compost is the soil's food
For soil it is yummy
Compost helps our plants to grow
And fills the soil's tummy.

Soft twigs, hard twigs,
Any twigs at all.
Short twigs, long twigs,
You can use it all.

Chorus

Put them in a compost heap
For all the little bugs.
They will turn them into food,
The soil will give you hugs.
For compost is the soil's food
For soil it is yummy
Compost helps our plants to grow
And fills the soil's tummy.
Lunch scraps, dinner scraps,
Any scraps at all.
Supper scraps, snack scraps,
You can use them all.

Chorus

Put them in a compost heap
For all the little bugs.
They will turn them into food,
The soil will give you hugs.
For compost is the soil's food
For soil it is yummy
Compost helps our plants to grow
And fills the soil's tummy.

Newspaper, torn paper,
Any paper at all.
Blank paper, used paper,
You can use it all.

Chorus

Put them in a compost heap
For all the little bugs.
They will turn them into food,
The soil will give you hugs.
For compost is the soil's food
For soil it is yummy
Compost helps our plants to grow
And fills the soil's tummy.

Robert Colliver

Help the Earth

Chorus

If you want to help the earth,
Then help the earth, please help the earth.
If you want to help the earth
Then do your bit today.

Don’t mix up all your rubbish
In one big yucky pile
Use the pieces that you can
The earth will surely smile.

Chorus

If you want to help the earth,
Then help the earth, please help the earth.
If you want to help the earth
Then do your bit today.

Don’t throw away important things
Like glass and wood and tins,
Use them as containers
Keep in different bins.

Chorus

If you want to help the earth,
Then help the earth, please help the earth.
If you want to help the earth
Then do your bit today.

Don’t burn leaves and grasses
The smoke will choke the air,
Think how you can use them
Show how much you care.

Chorus

If you want to help the earth,
Then help the earth, please help the earth.
If you want to help the earth
Then do your bit today.

Don’t throw away your papers
Use them front and back
They’re even great to give your worms
For a little snack.

Chorus

If you want to help the earth,
Then help the earth, please help the earth.
If you want to help the earth
Then do your bit today.

Robert Colliver

The Compost Critters Band

Chorus

They are the soil's cheersquad
The Compost Critters band
Singing out for all your waste
To compost for the land.

ALL SING OUT LOUD

Give me a C for compost critters
An O for organic waste
Give me an M for micro-organisms
A P for a productive place
Then give me another O,
For oh what a great idea!
Give me an S, to set up the heap
And a T when the compost's there

Compost critters love it dark
Moist and fairly warm
The critters eat organic waste
And help the soil to form

Feed them grass
Feed them twigs
Feed them kitchen waste
Feed them any leaves at all
They might like peanut paste

As long as once it was once alive
The critters they don't care
As long as waste is plentiful
And they can get their share

They'll munch, they'll crunch
And they'll bite and chew
With every little munch and crunch
They'll change that waste to new

Your job is to keep them moist
And turn the compost heap
The Critters are your soil friends
Friends you want to keep.

Chorus

Repeat last verse of chorus

Robert Colliver

Unit 1

green waste matters!

What is green and organic waste? Let's investigate

WHAT IS GREEN AND ORGANIC WASTE?

- Let's investigate Nature's examples.

Synopsis

This unit is designed to provide students in the early and middle primary years with a greater understanding of the value of green and organic waste materials in the environment, and the ways people can assist Nature in recycling and replenishing the soil. Students investigate the green and organic components of the school grounds and other gardens.
In examining green organics and Nature's ability to recycle them students are also given a preliminary introduction to the way green organics can be recycled and/ or reused by processes such as mulching or composting.

Learning Objectives

To enable young students to investigate and broaden their understanding about green and organic matter available in the natural environment and the shared needs of living things.

Resources

See 'References and Bibliography' for an annotated list of resources.

Learning Activities

Whether living in the heart of the city or on an isolated farm or station property, the outdoor areas can be explored, so that students develop an understanding of green and organic waste materials, the shared needs of living things and items we throw away. The local area, school grounds or garden are an ideal setting. It can also be the student's own garden, the gardens of friends or relatives, the gardens of the elderly and of people too busy to look after their own, council areas, or green areas owned by the government.

Introductory activities to assist the teacher to find out what students already know about green and organic waste materials.

• Ask students about the types of wastes they produce at home, and introduce green and organic waste.

• Ask students to draw what they think green and organic waste materials look like. Assist by talking about green and organic materials and reading stories about these materials in gardens.

• Read fiction or non-fiction books which feature information or drawings of green and organic materials. Students ask questions regarding green and organic waste materials in a class discussion.

What are green and organic materials?

• Find a story about a garden to explore the range of green and organic waste materials which exist in gardens and the relationship between plants, soil, water, animals and the sun.

The following stories are suitable:

Jack and the Beanstalk
Great Garden Adventure
by T. Furchgott
Nowhere to play
by A. Kurusa and C. Black
Kimi and the watermelon
by M. Smith
The Giant's Garden
by F. Weedn and L. Gilbert
Kate and the professor
by R. Colliver
The Giving Tree
by S. Silverstein
The Garden
by D. Sheldon and G. Blythe
Millicent by J. Baker
(See references for other suggested titles)

• Read and discuss stories drawing students attention to the variety of features, uses and settings of gardens. Focus on green and organic waste materials found in these settings.

• Ask students what they know about the term green and organic waste materials.
Encourage them to draw, write or tell their ideas about what green and organic waste materials are.

• Go on a walk/ramble around the school gardens or a local garden or park and investigate the availability and location of green and organic waste materials. Touch, feel and smell specimens, noticing colours and textures.

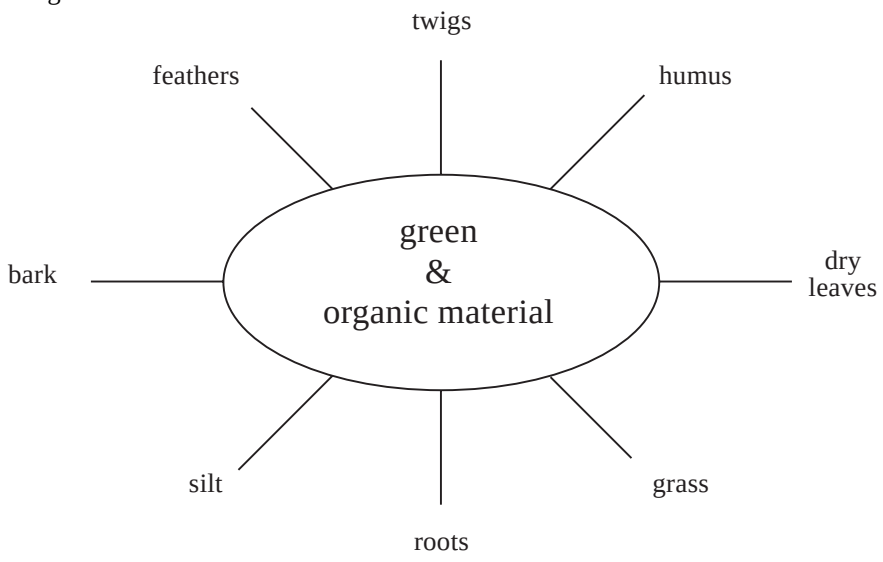
• Encourage students to look at leaf litter and topsoil and notice the colour and texture of the leaf litter and topsoil. Collect some samples and crumble through a sieve on to white paper.

• Record on paper all the things that were found. Relate the plants growing at each site to the leaf litter and topsoil found there.

• Create a concept map showing what green and organic waste materials lying on topsoil within the school grounds looks like.

• Discuss how these green and organic waste components got there and what their benefits to the topsoil are.

• Design a poster to promote the importance of leaf litter. Send it home in the school newsletter.



concept map

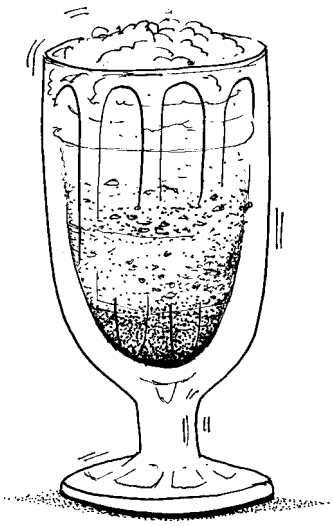
Build on understandings with a story.

Great Garden Adventure

Outdoors or sitting in the adventure playground tell the story then...

Explore and observe the differences between an empty block and a garden. Talk about the green and organic waste material available in either locations. Discuss its potential worth in the garden and on an empty block.
Respond personally through the creation of friezes, charts, drawings or models high-lighting appearances and differences of each location.

Collect green and organic waste materials and present ideas in books, collages, illustrations, or charts to show the relationships between the different items.



topsoil shake

Go outdoors, visit a home garden or park and play 'Nature Detective' while observing and brainstorming what green and organic waste materials can be seen.

Collect some of Nature's fallen objects, examine them and discuss where they come from, why they've fallen, what use they are, e.g. as leaf litter for the topsoil and as part of the ecosystem.

• If unable to visit a garden, listen to, read and sing 'My Backyard' and 'Hey Gran' (Resource R9). Focus on the lyrics for information and ideas about organic materials in backyard gardens. Also read Nature's Silent Work (Resource 1.1)

• Play the game 'Animal, Vegetable, Mineral' after repeated singing. Use the song lyrics to check students' understandings about what organic materials are OR make a set of cards and play 'Spot the green and organic materials'. (Resource 1.2). Using a number of cards with green and organic waste materials on them ask students to say which are green and organic waste materials and why.

• View the illustrations in a range of the picture books mentioned or ask students to bring photographs taken in their garden to share.

In groups talk about:

• types of plants grown and what waste material they drop
• ground coverings created by waste material like leaf litter
• areas of the garden which use waste materials, e.g. vegetable patch, flower beds, compost heap, worm farm
• what plants depend on e.g. soil, sunlight, water
• plants and creatures which depend on leaf litter, e.g. mosses, insects, birds, worms, mites.

Life in the leaf litter

When leaves fall, they become part of the leaf litter - the top layer of ground that is made up of whole leaves and leaf fragments. As it becomes buried by other leaves, soil creatures, bacteria and fungi feed on it, causing it to decay. Finally, all that remains of the leaf is a crumbly substance called humus. This provides nutrients for growing plants, and so the substances in falling leaves are continuously recycled.

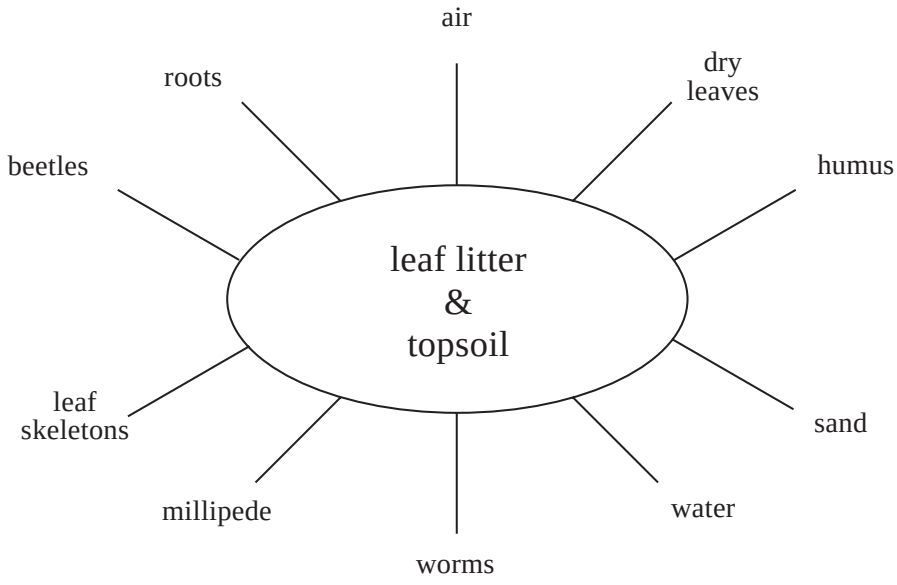
• Collect some leaf litter and topsoil and use a magnifying glass to observe creatures and particles within it. Talk about whether the topsoil is organic. Imagine being a soil scientist looking at a soil sample and suddenly an amazing finding is made. Draw the organism you have discovered and give it a name.

• Make a "leaf litter and topsoil thick-shake". Shake a small quantity of topsoil in about twice as much warm water until it is completely mixed. As it settles discover the different materials in the leaf litter and topsoil as they separate into different layers.

• Create a concept map showing of what the leaf litter and topsoil consist (see next page).

• Classify what is found in leaf litter and topsoil samples into animals, plants and other things.

Discuss how these leaf litter and topsoil components got there and what their benefits are, e.g. fallen leaves of trees, shrubs and grasses improve soil quality by adding rich humus as they decompose.



concept map

Devise a survey called “What’s in the topsoil?” Ask students to records what’s in their topsoil at home and return the survey to school. As a class, draw a picture graph and tabulate the results.

Classify these findings into green and organic or non-organic materials.

• Share the resource titled, “Nature’s silent work” (Resource 1.1). Talk about how leaf litter enriches the soil.

• Write word banks or labels to describe what’s in topsoil. Share, telling what is known about topsoil and what makes topsoil important, for plants.

• Use the illustration in Resource 1.1 for students to find information about organic waste materials and how they improve the soil. Encourage students to add captions to the illustration to high-light areas where green and organic waste materials make a difference, e.g. using mulch as a compost.

• As a class visit the school garden or a child’s home garden. Discuss the original and planted vegetation, how plants are cared for, what they need when they’re tended to, the role of leaf litter, where their leaf litter is kept and what’s in it.

• Imagine what gardens and parks would be like without soil, water, leaf litter, soil animals, plants and sunshine.

• Develop a futures wheel. Model a futures wheel with students based on a familiar topic first; demonstrating the ways in which each consequence leads to another. (This strategy from Hicks (1994), is similar to the effects wheel strategy of Hamston and Murdoch (1996)).

• Pretend that we live in a world where there isn’t any topsoil, leaf litter or soil animals.
Discuss the sort of things we could or could not do. Explore the benefits of having leaf litter. Devise a play about this.

• Ask students to make their own futures wheels considering what parks and gardens would be like without leaf litter and rich topsoil. Encourage students to draw conclusions based on their futures wheel. Discuss these as a class.

• Write creative stories depicting yourself as leaf litter helping the topsoil. After sharing individual stories, question students about what they know about leaf litter or topsoil and what they’d like to find out.

• List ways green and organic materials in leaf litter care for and improve our topsoils. Design posters or signs to promote leaf litter being left to do its natural job, feeding and protecting the soil.

• Produce a calendar with 12 reasons to look after and use green and organic waste materials in gardens.

Bring some magic to the school garden

Many people think of leaf litter as a nuisance, but it has so many uses. It also has some amazing qualities. Leaf litter can be rough, smooth, delicate, tough, light or heavy. Leaf litter can be colourful, interesting and mostly free. It also conserves water and helps grow bigger and healthier plants.

• Using gloves, a broom or rake collect leaf litter to use as mulch in school garden areas. If there aren’t many organic materials around collect them from home and school and store them in hessian bags or wool bales. Mix the materials together. Talk with the students about the need to cut/shred larger materials into smaller pieces, as this helps them decompose more readily. Encourage students to spread the mixed mulch on soil up to 10 cms thick.

• Revisit the benefits of mulching with the students. Ask questions like: What do you think some of the benefits of mulching might be?

• Ask students to consider what might be needed when the mulch begins to decompose, e.g. add some more, and why?

• Introduce the word compost and talk with the students about compost being a good type of mulch.

• Talk about compost as something soil needs. Make predictions about where it comes from.

• Listen to “Feed the soil”. Focus on the lyrics for information and ideas.

• Ask students to share what they know about compost. Record. Encourage students to tell, write or draw their ideas about compost, what it is, where it comes from, how humans can make compost, what it does for the soil.

• Create a four part display using butcher’s paper, a whiteboard, or blackboard for students to share ideas, information and artefacts. Title the four parts ‘What we know about compost’, ‘What we want to find out about compost’, ‘What the class now knows about compost’, and ‘What other things we would like to find out’.

• Use ‘What we know about compost’ as a source for class, group or individual sharing. Provoke thinking about compost by sharing the following resources for young children.

Songs:

“Feeding the compost bin”, from *Garbage, Gums and Greenhouse, an environmental song tape.*

“Compost Makes Work Song”, in *Soils Ain’t Dirt, The Landcare songbook for kids.*

Stories:

Compost. Growing gardens from garbage by L. Glaser

The POP-sters by Robert Colliver, provided in this resource.

• Read the lyrics of the songs and discuss what compost is and what it needs to be healthy; e.g. compost is an organic fertiliser, to be healthy compost needs water.

• Collect compost samples and use magnifying glasses to examine them. Record information about its colour, plant remnants within it, animals seen within it, texture and moisture level.

• Go on a compost hunt in the school grounds or local area. Make a record of the area and the number of composting areas you find.

• Make observations and write about features of places where the compost and composting areas are located. Identify whether it is there naturally or whether it has been gathered there or directed there by people.

• Ask students to draw maps, paint pictures, create concept maps about where compost and composting areas were found and what it consists of. Display in an interest centre under the title of ‘Where composts and composting areas are found in our school grounds’.

Back in the classroom, recall the compost hunt:

• Talk about and describe the compost and areas where it was found.

• Make a chart recording these ideas.

• Use recycled art and craft materials to make something chosen by the students to show the properties of compost and areas where composting areas can be located, for display with appropriate labels.

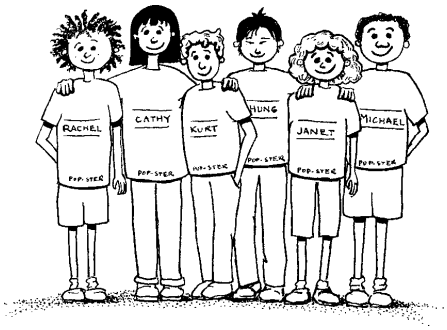
• Make a big book recalling the outdoor activity and write/scribe sentences for each illustration.

• Elaborate on how composting is an ideal waste solution and talk with students about composting being a natural process in which organic materials are recycled and decomposed.

• Encourage students to pose simple questions about the composting process e.g. how does ..., what if ..., when does ...?

• Explore students prior knowledge of the composting process.

• Share *Compost! Growing gardens from your garbage*, by L. Glaser (early years) or resource entitled Composting (for primary years), (Resource 3.1) encouraging students to listen to others explanations of composting and its process as a waste solution, and have an opportunity to revise their own ideas and opinions.



The Pop-sters

• Gain information through direct observation of compost heaps, an excursion to a home garden composting area or surveying parents about how they compost. See Resources 1.3 and 1.4.

• Build on students understandings with some simple experiments (See Resources 1.5, 1.6 and 1.7) entitled:

"Make a compost castle" (early years)
"Composting in a carton" (primary years)
"Bottled compost" (primary years).

Ask students to share and discuss the results of these simple investigations during class sharing circles, show and tell or oral presentations.

• Visit the school, a home garden or local compost heap and link the results of previous investigations to these situations. Whilst visiting these locations investigate the knowledge and composting processes used by local people, e.g. groundsperson, facility manager, home gardener.

• Reconsider the composting process, review ideas based on results obtained and record. Record compost findings. Use Resource 1.8.

• Invite parents and peers to a special assembly. Present students' work and present oral, sung or dramatic pieces to highlight aspects of the unit.

• Write letters to parents and family members about the value of mulching and composting in the garden as a way of managing green and organic wastes.

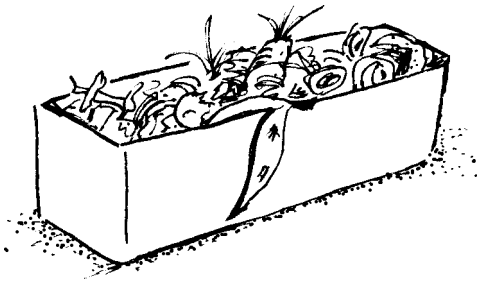
• Ask students to complete a self-assessment and reflection activity using the following questions:

~ What is the most important thing I have learned about green and organic waste materials?

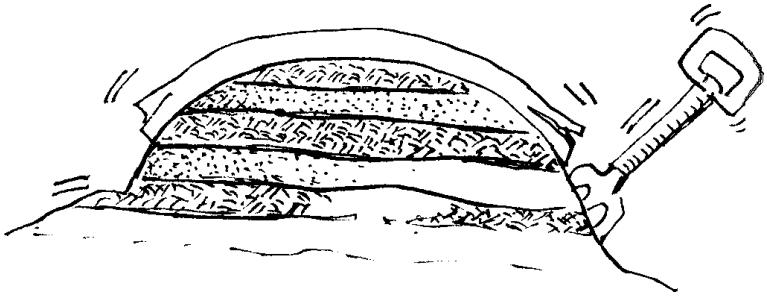
~ What is the one thing I have learned about myself and how I treat the environment?

~ What would I still like to find out about how green and organic waste material can be used to help the environment?

~ What piece of work am I most satisfied with? Why?



kitchen compost (in used icecream container) ....don't forget the lid!



Resource 1.1

Nature's silent work

Have you ever noticed how gardeners collect up dead leaves, stalks and dried plants?

Dead, dried plants might look useless, but stored inside them are all the tools that plants need to grow. Releasing of foods - called nutrients - and reusing them is the job of tiny creatures that live in the soil.

Nothing is ever wasted by Nature. Nature's compost heaps are all around us.

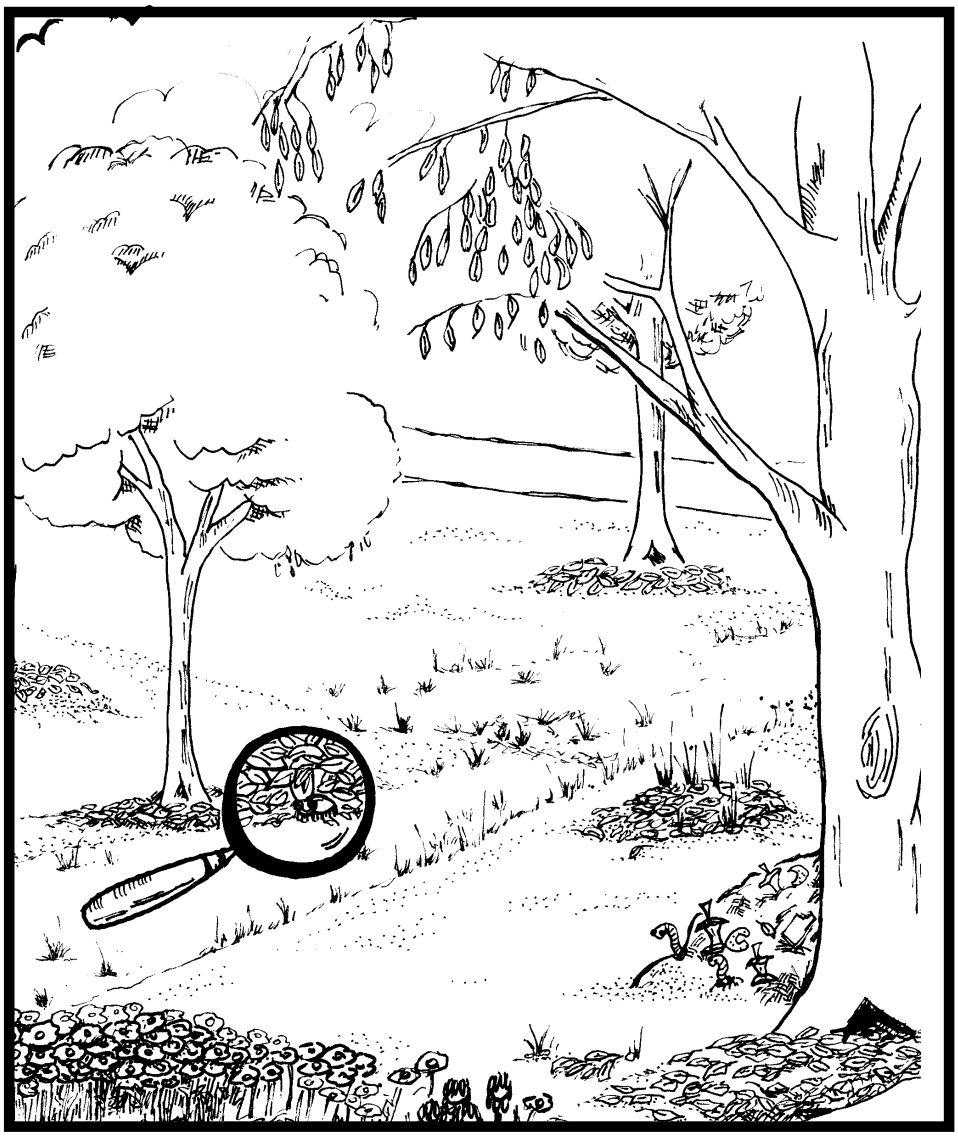
Walk beneath a tree and see the layers of fallen leaves on the ground. Very carefully pick the surface leaves away and you will see partly rotted leaves.

Further down the leaves are even more rotted.

How do you think these rotting leaves or mulch help the soil in the garden?

Well, it keeps soil moist, saves water and adds plant food or nutrients to the soil.

Find some magic mulch in this drawing which is working away silently.



Resource: 1.2

A Card game - Spot the green and organic materials

eggshells

foodscraps

glass & plastic

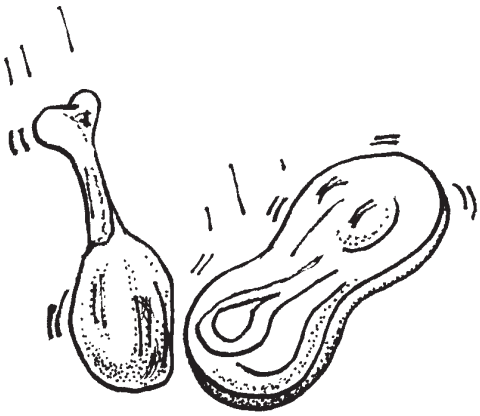
grass clippings

Resource: 1.2

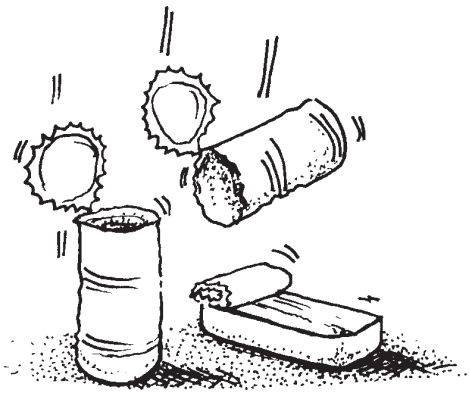
A Card game - Spot the green and organic materials

dry fallen leaves

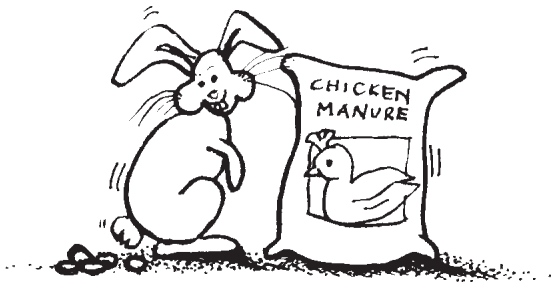
meat



metals



rabbit droppings/ chicken manure

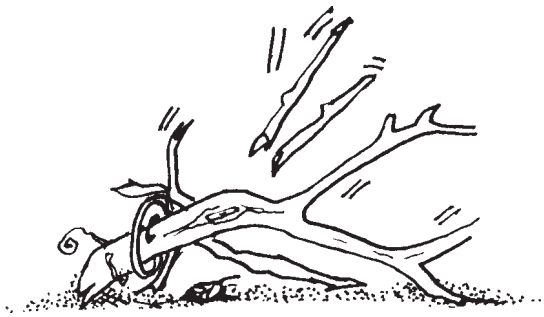


Resource: 1.2

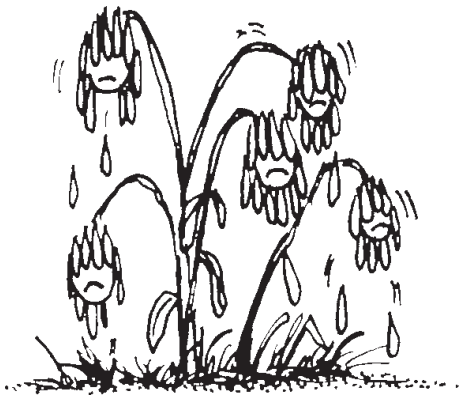
A Card game - Spot the green and organic materials

soil

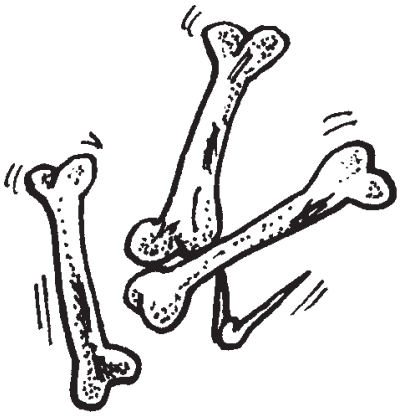
twigs & branches



wilted flowers



bones



Resource 1.3

Finding out about home composting.

Dear Parent/Caregiver

Would you please take a few moments to assist your child to complete this survey on home composting methods?

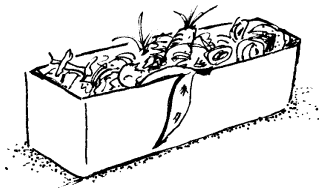
Composting is a great waste solution. It can convert kitchen and garden waste into a dark coloured soil conditioner in a matter of a few weeks or months.
Composting not only saves valuable landfill space, but the material produced can be used in gardens as a soil improver or mulch. This is being discussed in class and we are trying to find out how families compost via this survey.

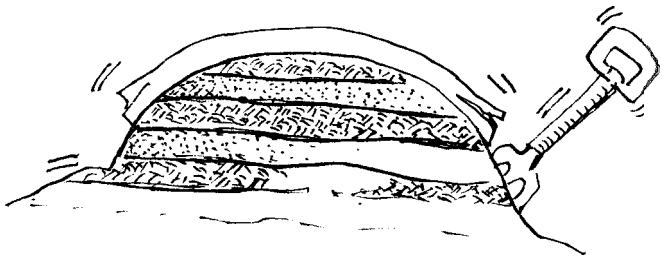
Please identify the materials you compost and how you do so in your own home and garden on the enclosed survey form.

All information provided is only to be used for class investigation.

Thank you for your assistance,

Yours sincerely,





Resource: 1.4

Green and Organic Waste Survey

1. What kinds of kitchen/garden waste do you put in your compost heap?

- ☐ tea bags
- ☐ tea leaves
- ☐ fruit peelings
- ☐ vegetable waste
- ☐ egg shells
- ☐ dead flowers
- ☐ leaves
- ☐ grass clippings
- ☐ paper products
- ☐ vacuum cleaner residue
- ☐ grass cuttings
- ☐ anything else (please list)

2. Do you have a special compost container in/near the kitchen?

Yes ☐ No ☐

If yes:
What kind of container is it? _____
Where do you empty this container?_____
What made you choose this type of composting system? eg. affordable, easy to remove compost, compost container made from recycled materials._____

3. What kinds of kitchen/garden wastes do you not put in your compost heap?

- ☐ meat and dairy products
- ☐ bones
- ☐ large fruit stones
- ☐ animal manure°
- ☐ metals, plastic, glass
- ☐ anything else? (please describe)

4. What kinds of unwanted materials "sneak" into your compost heap? _____
_____

- ☐ small pieces of plastic
- ☐ small pieces of aluminum foil
- ☐ anything else? (please list)

5. How do you manage your compost heap?

Do you add soil to the kitchen and garden material?

Yes ☐ No ☐

Do you add anything else ?

Yes ☐ No ☐

If yes, please describe. _____
_____

6. How do you know when your compost is ready to be used? _____
_____
_____

7. Does your compost heap create any problems?

(i) Does it attract any pests?

Yes ☐ No ☐

If yes, please explain. _____
_____

(ii) Does it have any unpleasant odours?

Yes ☐ No ☐

8. If your compost heap does create problems, how do you handle them?

pests _____

smells _____

any other problems _____

9. How do you use your compost?

☐ add to garden beds, pots, lawn
☐ add to water and use to water plants

What effect has it had on your garden?

☐ improved the soil
☐ healthier plants
☐ water garden/lawn less
☐ buy less fertilisers
☐ less garden pests
☐ other....

Thank you for your assistance in completing this survey.

Adapted from: Gould League, At Home With Compost record sheet, in "Waste Matters, Environmental Education Activities About Waste", Gould League of Victoria Inc. 1993

Resource: 1.5

Make a compost castle

Along with paper and food scraps, garden waste make up a large part of our classroom and household rubbish.

Experiment and use your food scraps and garden waste to make compost.

Compost helps recycle waste and improve the soil.

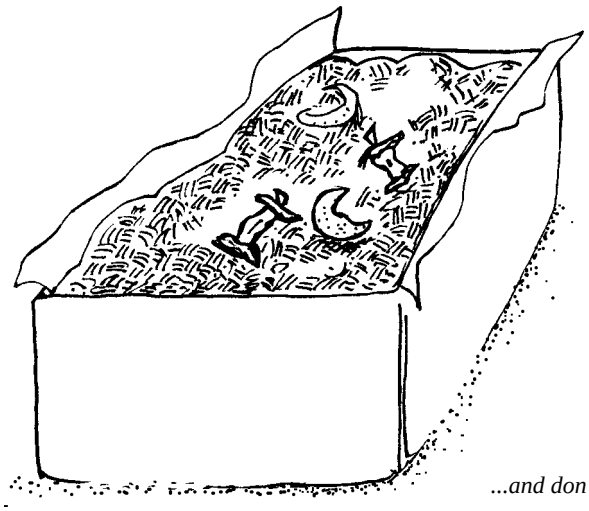
To make a compost castle you will need:

- a polystyrene box
- newspaper
- organic matter such as food scraps, leaves, manure and paper
- soil

• Place newspaper in the base of the polystyrene box.

• Add layers of different types of organic matter such as food scraps, leaves, manure and paper, with layers of soil.

• Record the changes in the compost each week (see Resources 1.9 and 1.10).



...and don't forget to cover it!

Resource 1.6

Composting in a Carton

Your challenge is to make a rich, damp, crumbly material suitable for recycling into the garden both as a soil improver and a valuable source of plant nutrients.

To compost in a carton you will need:

1 milk carton (thoroughly rinsed)
1 sheet clear, rigid plastic (5 cms x 16 cms)
1 clothes peg
adhesive tape

To make the compost:

Leaves, lawn/grass clippings, kitchen waste (lettuce leaves, fruit peelings, egg shells), soil, garden lime and blood and bone.

Some steps for you to follow as you **plan** your task are to:

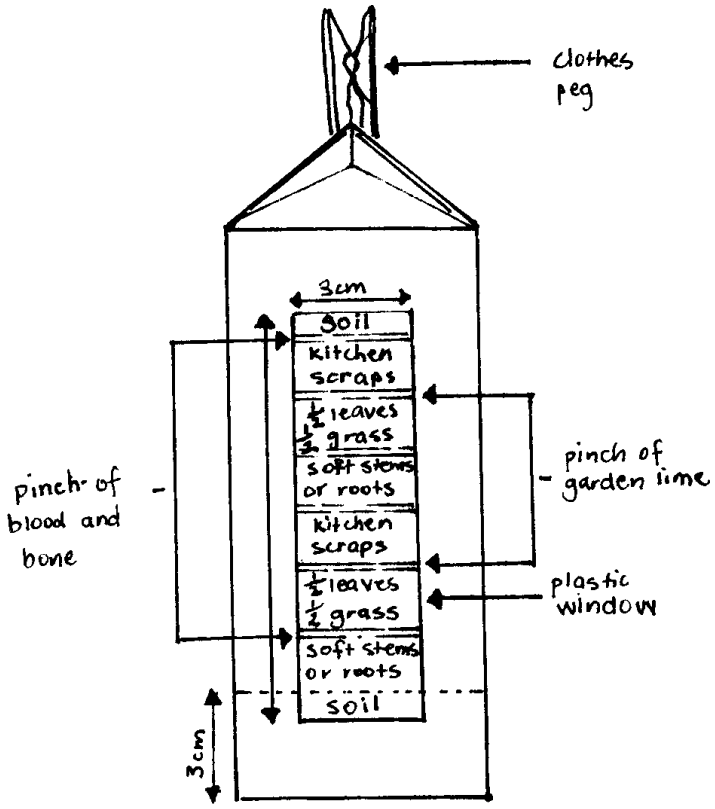
- cut a window into one side of the milk carton
- poke three pencil sized holes in three sides of the milk carton which do not have a window cut into it
- cover the cut out window with a clear plastic shape on the inside of the milk carton
- gather materials needed to make compost
- place 3 cm of soil in the bottom of the carton
- add layers of materials as shown in the diagram
- use a clothes peg to secure the top of the carton.

Every week test to see if it is moist and add a spray of water, if necessary.

Try aerating the compost too. Think about how you might use a skewer or knitting needle and the holes in the recycled carton to do this.

Observe your compost and record your observations each week. You may be able to give your parents some advice about recycling food and garden waste and making compost for the garden at home.

Source: Adapted from "Composting in a Carton" in Arbor Week Activities, Book 2, Victorian Schools' Nursery, Ministry of Education and Training, 1991.



Resource 1.7

Make some bottled compost

Your challenge is to make compost in a clear plastic bottle and observe the process of composting.

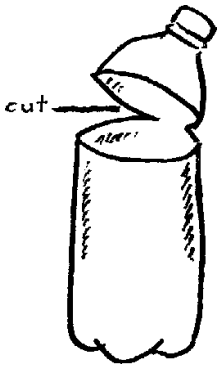
You teacher will provide a used 2 litre plastic soft drink bottle. Cut around the top, leaving 20 mm uncut. This uncut section will act as a hinge between the top and the bottom sections of the bottle.
Your teacher will also supply a spoon, masking tape, fruit and vegetable scraps, grass clippings, leaves, soft stems and some shredded newspaper.
Along with this you and a partner will need one cup of garden soil, 1 dessert spoon of organic fertiliser (preferably blood and bone), some water in an spray bottle and a felt tipped marking pen.

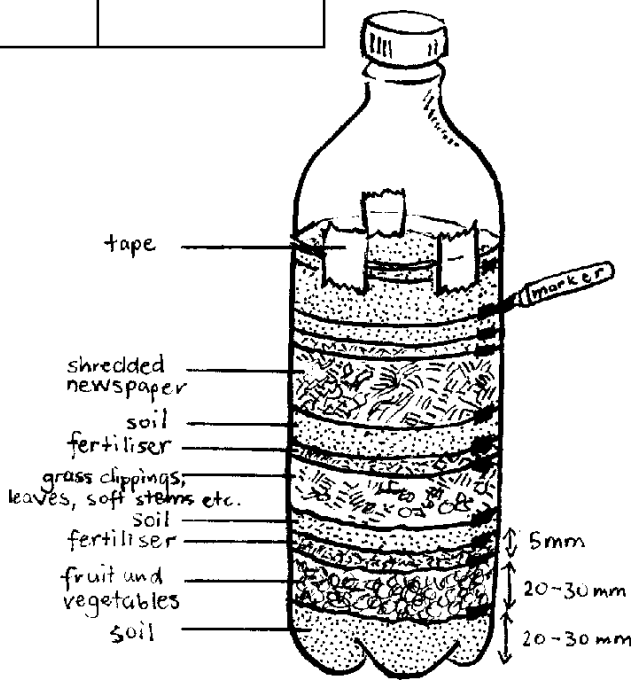
You and a partner should make up some compost by adding 20-30 mm of soil in the base of the bottle, then 20-30 mm of fruit and vegetables.
Sprinkle over this a teaspoon of fertiliser and then cover with a 5 mm layer of soil.
Repeat this recipe until the bottle is full (see illustration). Spray the top surface with water.
Pull the top over the base and secure it with masking tape.
Draw lines on the bottle to show the levels of the organic material and soil.
Make up a key to show the composition of the compost system you have produced.
Once you have made your bottled compost you should write the date on the bottle and then carefully observe and record any changes in colour, size and shape of the organic material. Watch also for fungi or small creatures that may be feeding on the plant material.
You could draw up a table like the one below to record your observations.

Date	Changes in colour	Size & shape of layers	Other observations

You may also like to draw some graphs making sure to use a key for the different recordings. At the end of your experiment you should be able to reach a conclusion about the process of composting and which ingredients are needed and decompose the best?

Source: Adapted from "Bottled Compost" in Waste Matters, Environmental Education Activities About Waste, Gould League of Victoria Inc., 1993





Resource 1.8

Compost Report

Date:

Stage 1-:

Stage 2-:

Unit 2

green waste matters!

CHANGING HABITS

Synopsis

In this unit students discuss and decide what can be done in their lives and at school to manage green and organic waste. It addresses habits and gives students an opportunity to consciously change or develop positive non–wasteful habits. It highlights the idea that many of us are wasteful without even realizing it. Students in the primary years investigate consumer habits - how they waste resources, compared with their grandparents. They identify ways in which these problems can be addressed and practical actions which are accessible to the students are investigated.

Learning Objectives

To enable students to recognise and act upon the growing issue of green waste in our schools and global community and recognise their role and that of society in this issue. Students will develop an understanding that everything the individual does affects the environment either positively or negatively.

Resources

See ‘References and Bibliography’ for an annotated list of resources.

Learning Activities

While Nature is very good at reuse and recycling, humans can be very efficient at wasting materials.
Many of us are wasteful without even realising it.
We have become wasteful by habit.

Introductory activities to focus on the students thinking

Communities all over the world throw items away each day of the year and this includes green and organic waste.
We need to consider what would happen if what we throw away wasn't collected. Within a short time, huge piles of rubbish would build up on streets, in schools and in gardens. People's health would be at risk and there would be unhappy communities everywhere. Waste disposal methods can have a serious impact on both human communities and our environment.

• Encourage students to think about what they can do to solve local/ global environmental problems.

Firstly, get informed-find out the facts, ask questions and take nothing for granted.
Secondly, get involved in small-scale changes which you can make in your life and persuade others to make in theirs.

(See Resource 2.1 Waste - a world apart, and Going Green at Home and School by John Howson)

• Discuss why the volume and type of waste generated varies from country to country.

• View the image of "Wecare School", which was called "Wewaste School" before steps were taken to overcome their waste problem (See Resource 2.2), and ask students to identify ways people are depicted being wasteful or showing sound waste practices. As a class identify preferred habits and behaviours and the reasons for them. Group class preferences and reasons for choices. Discuss these. Consider how these preferences might affect the value we place on recovering resources from a range of materials and places.

• Ask students to look at what they throw-away each day. Discuss whether this is all rubbish or valuable resources.

• Play Green Waste Matter Bingo. Use Resource 2.3 and find people in the class who can answer questions on the bingo sheet. Ask one question per person. Fill in the answers as you go. Share findings as a class.

• Present the following scenarios:

"You see your school becoming more and more littered by paper, weeds, garden and food waste, cans and bottles". Brainstorm student ideas. Discuss options and how useful they might be.

• Read the story "The POP-sters, Protectors of Our Planet" included in this resource kit and identify why students at the school need to change their habits. Locate information about what they need to do; what they did; what habits they changed; and the problem and solution in the story. Complete the story frame on Resource 2.4 to summarise the story.

• Ask the students to imagine attending "Wecare School". Draw pictures of the sights and smells at the "Wewaste School"/ "Wecare School" and make charts or mobiles. Label these with pleasant or unpleasant sights and sounds.

• Explore the messages in the story about recycling, reusing and composting. Experiment creatively using the same messages in poems and advertising.

• Write slogans, prepare banners, make posters, signs and badges conveying messages to a wider audience about these waste issues and what can be done in our everyday lives to reduce waste.

• Recall and share the problems and difficulties the school faces in the story. Discuss whether your school's issues are similar or different from that of the students at "Wecare School". Consider the following questions:

~ Do you know what you would do in their position?
~ What action would you take to manage the school's waste?

• Brainstorm ways we could all change our habits and manage waste in schools, and create a display.

• Working in small groups, conduct a structured brainstorm and help students discuss the following questions. Get them to ask "If so, why?" after each question.

~ Do we waste our natural resources without even thinking about it?
~ Do we throw our leftover food into the classroom bin?
~ Do we compost our class food scraps?
~ Do we have a worm farm in our school to recycle food scraps?
~ What materials could be reused, recycled or composted at school?
~ What are the benefits of mulching, composting or farming worms?
~ Have we set up a separate bin system to better dispose of waste in the classroom?
~ Do we sort our classroom rubbish?

Encourage students to suggest further questions and options.

Decide which options are realistic and unrealistic. Ask students to explain their choices and decide which options can be acted upon within the school.

Green and organics - using a past perspective

• Talk with students about the past and how it was barely a few generations ago that our schools and society generated so little waste that its impact was not seen as any great threat. Discuss how times, people and the environment have changed.
Make predictions about the future. Talk about changes that we have made and changes which could occur to ways we manage waste, and in particular green waste in natural and built environments.

• Research these changes. Talk to grandparents, parents and community residents. Ask them about what they recycled, reused and made themselves. Ask specific questions about how they reused food scraps and garden waste.

• Record information from investigations in forms of the students' choice. Present class findings to others via displays, school newsletters or an assembly presentation.

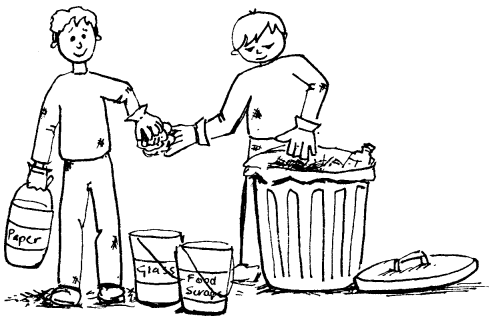
• Ask students to identify other ways of exploring the management of green waste in natural and built environments. Negotiate activities with students so that a range of ideas are covered.

Caring about green and organic wastes

In school settings, students can participate in routines and projects not only by exploring their environment but also by taking action for the environment and seeking solutions to its problems. It is crucial that teachers provide a long period of uninterrupted time for students to become familiar with green and organic wastes and ways to reuse and recycle them in the environment, school ground, classrooms, canteen and office area, and with the messages people are putting forward with reference to managing green and organic waste in sustainable ways.

• Go out and investigate green and organic wastes in the:
- classroom bins
- canteen bins
- yard bins
- office bins
- staffroom bins.

• In pairs, wearing gloves and using tongs rummage through the rubbish and learn more about who generates what sort of rubbish. See R7 "School Based Green and Organic Waste Audit" for explicit steps of what to do. Discover just how much "rubbish" is in fact re-usable, recyclable, compostable, or just plain avoidable in the first place.



• Look for solid evidence of what can be composted when undertaking the waste audit. Physically go through the rubbish, sorting out waste that could be composted and recycled, or avoided in the first place. Consider whether the amount of compostable material represents a justification for the introduction of:

~ a 3 bin system to dispose of rubbish in the classroom (food scraps for compost, paper and cans for recycling)
~ a 3 bin system in the school grounds, canteen and staffroom
~ an on–site composting system
~ worm farms in classrooms or a school worm farm

•Graph the findings of the waste audit and gain awareness of:
~ the amount of waste
~ the type of waste
~ the sources from which the waste orginates, e.g. classrooms, staffroom, canteen, school grounds.

Note : Younger students can collect 10 pieces of rubbish in the school grounds, sort into groups, draw a simple graph to show what was found.
Then analyze the class rubbish bin contents and present results on a picture graph.

• Present findings and results of the initial waste audit, accompanied by the graphic representation and stacks of real waste to the Principal, School Council and school staff. Ask the Principal, School Council and school staff for their support in dealing with issues such as waste reduction, team forming, communication, composting and developing a school green waste program into standard school practices.

• Show people within the school just how much of the material they are throwing away can be reused, recycled and/or composted. Use a “look, feel and smell” approach. Consider SRC meetings, school assemblies and class meetings as vehicles for enabling the school community to gain a full understanding of avoidable, recyclable and compostable material.

• Discuss working for change by means of letters, meetings, petitions, posters and pamphlets. Examine the saying “The pen is mightier than the sword” and how this applies to exercising power in a democratic society.

• Enlist other staff and student support for implementing a new bin system, composting site and waste management policy. Write letters to the editor of the school newsletter, bring ideas and concerns to others attention in class meetings, SRC meetings and school assemblies.

• Practice the skills of persuasive writing. In groups identify the green waste management issue requiring action and work out to which school staff member or committee they could address a petition. Choose from the following list or identify an issue, formulate the request and identify to whom it should be addressed.

~ Currently Australians generate 14 million tonnes of waste each year. Of this 20% is green and organic waste, with 53% of household waste consisting of organic, compostable material. This is a challenge to change our behaviour. (data from National Recycling Audit 1997)
~ Walking around the school grounds we have located lots of green and organic waste. Students want better management of this resource.
~ There are many ways of handling and managing green waste at school. To be fair, all students want to try a new bin system, establish Green Waste Teams and develop a school waste policy.

~ Every year Australian schools generate thousands of tonnes of school generated waste. Much of this waste consists of garden and food waste. Most of this material can be composted. Students want to compost, reduce the amount of rubbish our school throws away, decrease the need for landfill sites and provide a chemical-free fertiliser for the school grounds.

• Follow up by writing to the student representative body or youth environment council. Letters may be formulated and written, or posters and leaflets may be created to emphasise that change is needed and what can be done about it.

• Draw up an agenda for a meeting about green and organic waste management at the school. Circulate it before the meeting so that participants can be prepared and add any other business.

• Students may call special meetings or go through class meetings or SRC meetings to raise the issues about how much green and organic waste is generated and by whom in the school. During these meetings the issues of taking action can be explored.

For example:
~ Discuss how much green and organic waste is generated in each class and in the canteen, staffroom, yard area, office, etc and what can be done with it, e.g. compost, mulch, worm farm.

~ Discuss how easy/difficult green organic waste minimization suggestions / activities are, and identify the steps needed to

implement them as regular practice in daily school life, e.g. set up a 3 bin system in the yards and classrooms; allocate an area for a compost site.

~ Discuss with students what they could exchange with others during class meetings. Ideas may include:

• ideas for action
• information about some local school's composting, mulching and worm farming program (See Case Studies in Units 5 and 6)
• information needed for a school's green waste policy (See R2)
• ways to recover products from green organics, e.g. compost, mulch, worm farms.

• Create displays for others to learn from. Discuss with others what information could be developed for display purposes, e.g. how we recycle food waste in our classroom.

• In SRC or class meetings put forward ideas and suggestions, vote and make decisions regarding actions you could take, e.g. start a compost heap, mulch the garden areas, set up separate bins in the yard and classrooms to sort waste, develop a policy.

More food for thought and action

• Identify areas in the school which generate food and garden wastes. Discuss the environmental issues, ways to solve the problems and ways to use these wastes.

• Set up teams of Green Waste Busters to collect, sort and compost green waste.

• Organise rosters for Green Waste Busters.

• Set up a food scrap bin in every classroom. Use some plastic ice-cream containers and encourage everyone to place their food scraps in the bins.

• Create a large poster that shows the amount of food waste generated in one day by the class and the corresponding suggestions for waste minimisation.

• Undertake waste minimisation suggestions and rank the success of such activities.

• Help students prioritise the actions. Discuss and vote to decide which actions to take on.

• Develop a "Green and Organic Waste Policy" (see R2). Develop it in association with teachers, office and grounds' staff. Review it at intervals and ensure it contains detail on how the school will reduce or reuse green and organic waste rather than sending it to landfill. Consider the following:

~ what materials will be reused and how?
~ how the program will be evaluated and monitored?
~ what persons will be responsible for managing the green and organic waste program?

For more information see "Developing a Green and Organic Waste Policy" (R2)

• Develop action plans for identified sites in the school, e.g. canteen, classroom, office, yard, as well as the needs of the whole school. See R3"Action Planning". Set in motion a green and organic waste program to care for your school.

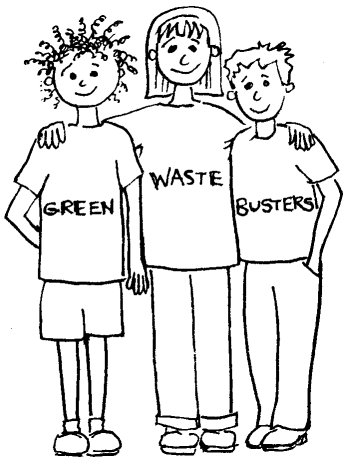
• Invite the school's groundsperson to visit the class and talk about beginning a compost heap, or how to contribute to an existing one.

• Develop community links in the area of composting. Negotiate with your local Council.

• Listen to, read the lyrics and learn "Feed the Soil", "Help The Earth" and "Compost Critters Band", included in this resource kit. See R9 for song lyrics (Early Years).

• Contact a local waste educator or Keep Australia Beautiful Inc. contact in your state to be put in touch with other schools interested in exchanging information about their composting or worm farming programs (Primary and Middle Schooling).

• Visit your nearest landfill site, an industry, home garden or business involved in composting, vermiculture or resource recovery of green organics to learn new ways of minimizing green and organic waste.



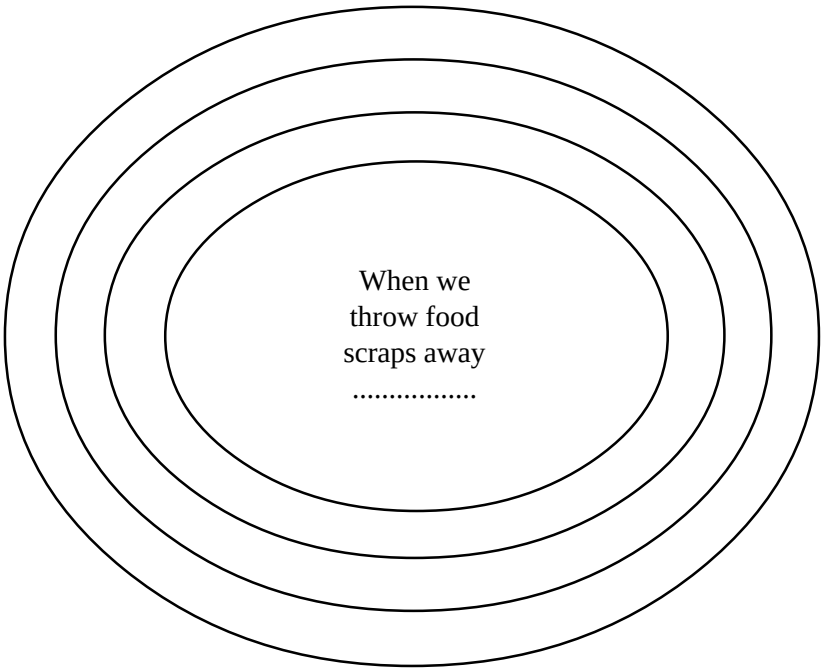
• As computer technology continues to develop, opportunities for green waste education via the Internet continue to evolve. Use the search engines linked to your web browser to collect information on the following topics:

• organic learning
• resource recovery
• organic waste management
• vermiculture
• organic waste treatment
• organic waste recycling
• composting

www.csiro.au/enquiries/earthworm.htm
www.gould.edu.au/wastewise/index.html
www.compaq.com.au/composting
www.iisd.ca/business/
www.vermico.com/index.html
www.hs.freeport.k12.me.us
www.globalpresence.com.au/exchange/about.htm
www.ac-grenoble.fr/yre/feee.htm
www.act.gov.au/nowaste
www.epa.nsw.gov.au
www.cfe.cornell.edu/wmi/
www.edf.org/heap/a_compost/index.html
www.education.uts.edu.au/projects/
(Also see References and Bibliography for other sites)

• Help students to draw up a cause and effect wheel to investigate the consequences of reusing, recycling, and composting green and organic waste.

• Develop a journal that will contain responses to reflective activities from the unit.
Consider the saying, “Green waste matters!”. Use the journal to record what students think the phrase means.
Consider situations where the phrase has been spoken or heard.



A ‘Cause and effects wheel’ is used to explore the consequences that can follow from a particular trend, decision or event. Your challenge is to explore the issue, “What are the consequences?” When these have been established, place them in the ring around the main idea. Consider whether your thoughts are first order, second order or third order consequences of the idea.

• Develop a questionnaire that includes questions about how staff and students disposed of their food waste before and after learning alternative attitudes and methods towards green waste minimisation and prevention.

• Interview staff and students about their food waste habits and determine whether they have changed. Think about why some habits are easy to change and why some are difficult. Determine whether the same things are easy or difficult for everyone when they try to mange their food wastes better.

• In light of this unit, ask students to review some of the responses they made to the questions provided earlier in the unit. Are they now able to understand more clearly the influences on their choices? Would they have changed any of their habits, attitudes and behaviours? How and why?

• Gather the class together and discuss the unit that has been undertaken. Ask students to recall activities covered. Ask students to draw the journey of their learning as a story map about managing food and green waste materials in the school. The journey should be sequential.

• Ask students to write a brief account of the various activities they were involved in. Finally ask students to annotate their map with some reflective comments about how they felt about the activities and which activities they liked the most and least, and why.

Resource 2.1

Waste - a world apart

Next time you go to the shop to buy something, try asking yourself, ‘Do I really need this?’ Having many possessions - clothes, tools, furniture, cars, bicycles, toys, videos - is a luxury only common to the richer nations of the world. In poor countries, people have to use their possessions much more carefully, and repair them when they get old rather than replace them.

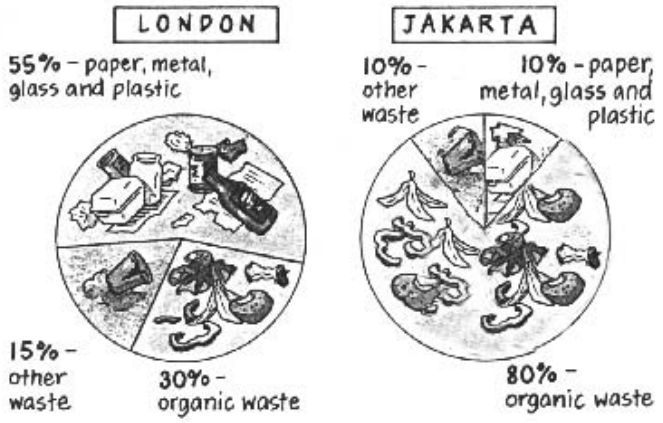
In the past, most towns had workshops where you could take things to be mended. Many department stores used to have repair sections too. Today it is difficult to get things repaired when they wear out. Shops want you to buy new things rather than repair the old.

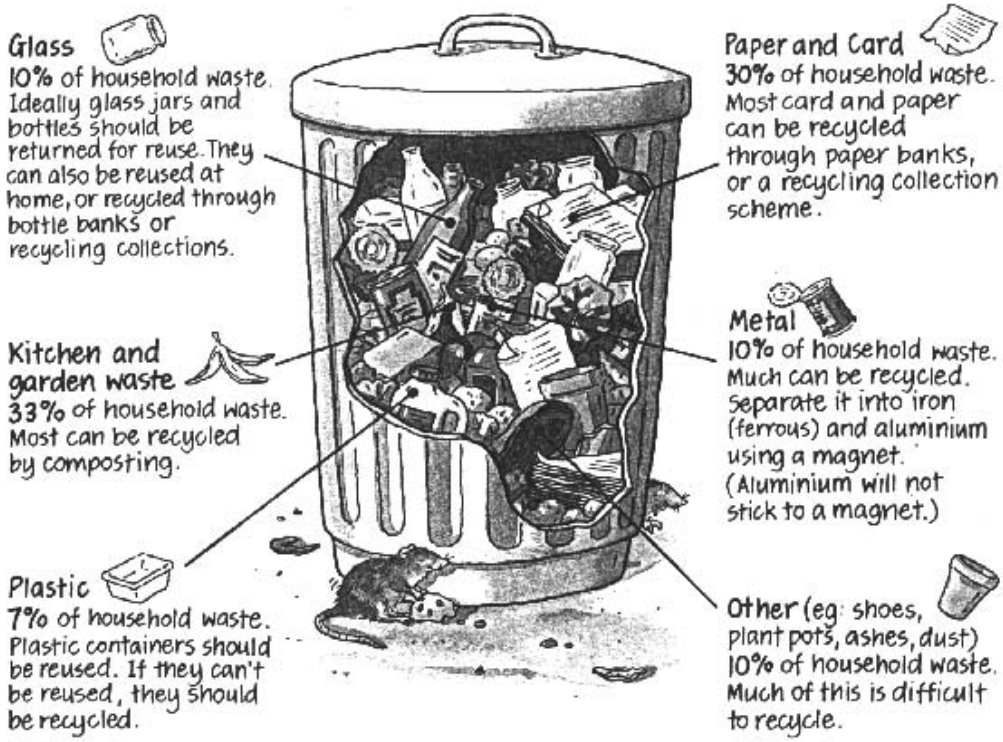
Poorer countries produce less waste per person than the richer countries.

As well as some countries throwing away more than others, the kind of things they throw away differs too. The pie charts below show the difference between what people throw away in Jakarta and in London. Why do you think there is such a difference? (Also see Resource 7.1 - Using a global perspective).

Below is a picture of what is in an ordinary family’s dustbin in Britain, showing how much of it can be recycled or reused.

Adapted from - Going Green at Home and School by John Howsen (1993), courtesy of Wayland (Publishers) Ltd, East Sussex, UK





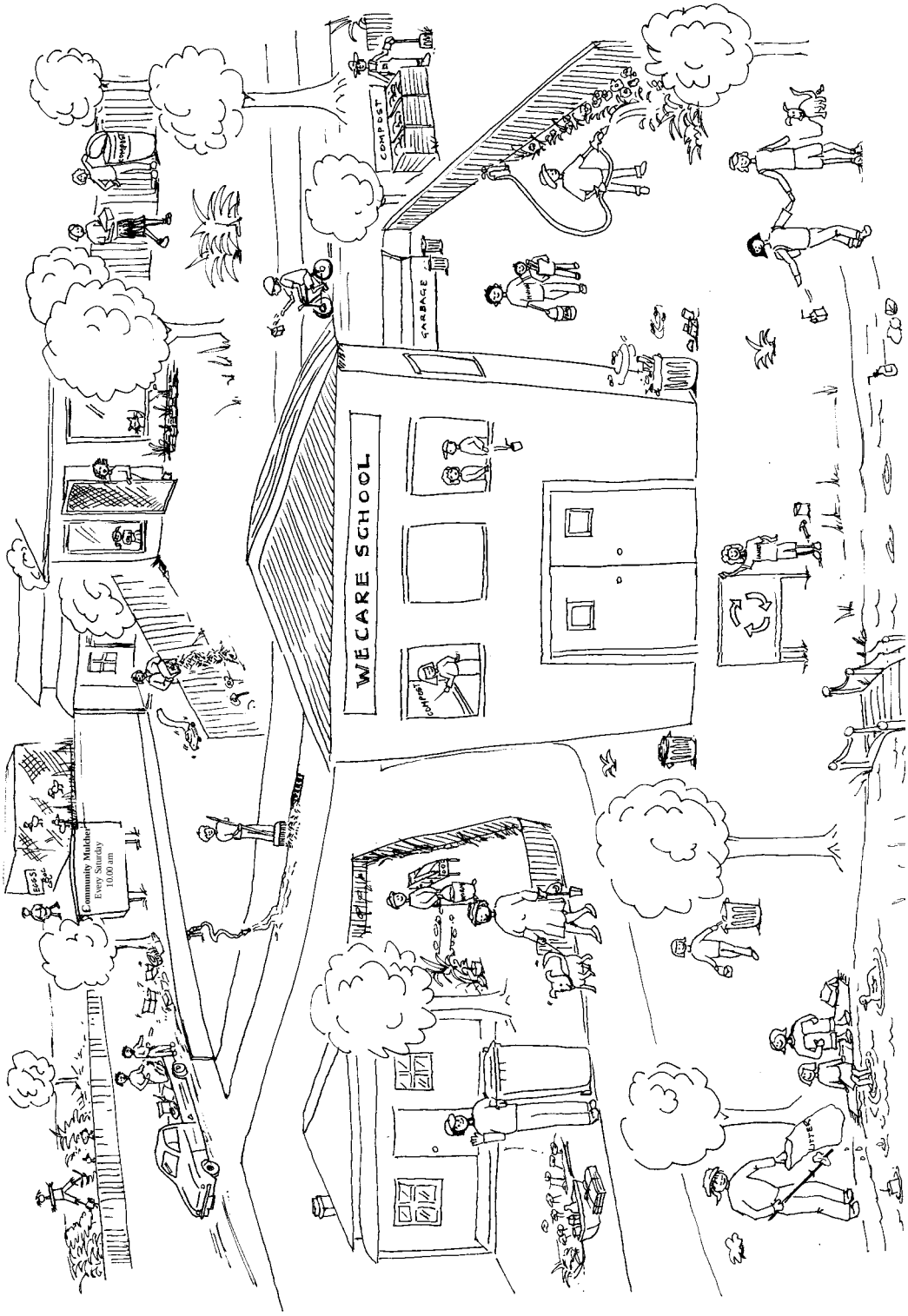
Resource 2.2

Have a peek at the Wecare School and its community.

Name and identify ways people are:

• Being wasteful
• Showing sound waste practices.

Circle people being wasteful in red and those showing sound waste practices in green



Resource 2.3

Green Waste Matters Bingo

Find people in the class who can answer questions on the Bingo sheet.
Ask one question per person.
Fill in the answers as you go.
The aim is to correctly complete a horizontal or vertical line.

Has a special compost container in / near the kitchen. *What sort of container is it?* _____	*Has a worm farm at home.* *What is fed to the worms?* _____	*Knows what 3R's stands for and can spell each word.* *How are they spelt?* _____ _____ _____
Recycles green waste at home. *Which materials?* _____	*Can name a consequence of not managing green waste.* *What consequence?* _____	*Knows the name of a way to recycle green organics.* *Which way?* _____
Can name one way of recycling green waste without harming the environment. *Which way?* _____	*Is a member of an environmental group.* *Which group?* _____	*Has changed their lifestyle because of environmental issues.* *How?* _____
Practices composting at home? *How?* _____	*Sweeps up leaf litter instead of hosing it into street gutters.* *Recycles the leaf litter.* *How?* _____	*Considers food scraps as a resource.* *For what?* _____
Knows what worm castings are. *What are they?* _____	*Makes their own compost or mulch instead of buying it.* *Which product?* _____	*Knows how worms help reduce green waste going to landfill.* *How much?* _____

Resource 2.4

Summarising "The POP-sters. Protectors of Our Planet".

Title of the story :

In this story, the problem starts when

After that,

Next,

Then,

The problem is finally settled when

The story ended when

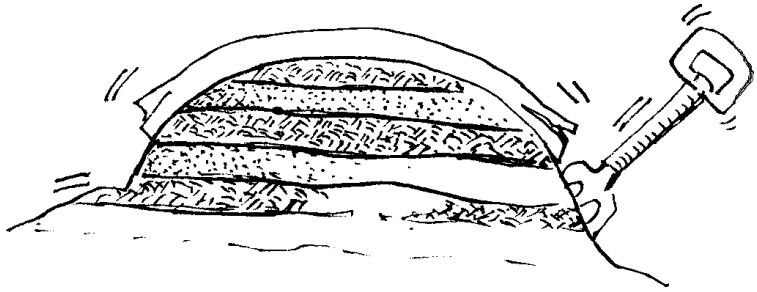
I predict that

Unit 3

green waste matters!

Let's investigate compost

LET’S INVESTIGATE COMPOST



Synopsis

In this unit students investigate the compost heap as well as its importance in natural and built environments. Students discover the many animals which make their homes in compost and how, while it is forming, it provides food for them. They explore the general benefits and uses for compost and also recognise that compost has specific uses and values. Issues related to waste management and ecological sustainability are introduced and researched. Students become involved in composting projects.

Learning Objectives

To enable students to develop an understanding of compost, compost heaps, uses of compost, how to make and care for compost. Students also use supporting evidence to argue for a school based composting program.

Resources

See ‘References and Bibliography’ for an annotated list of resources.

Introductory Activities

What is compost?

• Ask students to consider the questions “What is compost?” Have a sample for students to examine. Brainstorm ideas.

• From the answers that students present in their responses, groups collate the themes they believe are most apparent in the recordings, using key words and phrases.

• Set up an area of the classroom for students to develop collections of artefacts and/or pictures. These might include:

~ samples of organic matter
~ examples of brochures or pamphlets on compost
~ pictures of compost heaps
~ a plastic compost bin

Make labels or captions about the items displayed.

• Read books or pamphlets, or sing songs as a basis for discussing issues, such as recycling resources, uses of compost, how to make ompost, or caring for compost. Note valuable information on waste management and recycling practices can be obtained from Local Councils or Regional Waste Management Boards (particularly with regard to what is or is not collected in your area).

Suitable resources are:

Mr. Mick by S. Augarde
Compost. Growing gardens from your garbage by L. Glaser
Compost heap by H. Rockwell
The POP-sters – Protectors of Our Planet by Robert Colliver (contained within this resource)
Compost Critters by B. Lavies
Animal Homes by B. Taylor
Resource 3.1 “Composting”
(see ‘References and Bibliography’ for summary of content of these resources)

Suitable songs are:

Feeding the compost bin, from Garbage, Gums and Greenhouse. An Environmental Song Tape
Compost Makes Work Song, in Soils Ain’t Dirt, The Landcare songbook for kids
Feed the Soil - provided in this resource
Compost Critters Band - provided in this resource

• Working in small groups, help students discuss the following questions:
~ How could we as a class and school reuse our green and organic waste and stop sending it to landfill?
~ How can we use our food scraps, the food scraps thrown away in other classes, the canteen and staffroom in addition to the school garden waste to make compost?
~ What would we have to do to make this possible?
~ Who might we need to negotiate this with?
~ How might we need to support other classes so that they could participate successfully?
~ What might we need to buy or have donated to start a composting program?
~ How could we do this?

Encourage students to develop additional questions.

• Using the issues generated from the previous activities, students are given **research contracts** about composting. Students write a list of questions the group wishes to explore. For example:

~ What are the benefits of composting?
~ What materials can/cannot be composted?
~ What are the different methods of composting?
~ What is the best type of composting bin, container or structure for the school’s needs?
~ How do we determine how much of the school’s waste is of a type that could be composted?
~ What do we need if we want to compost? How much will it cost?
~ How will the school coordinate a composting program?
~ How will food wastes be collected?
~ Who will look after and maintain the compost heap? i.e. add waste materials, water it, collect the compost?

In their group they brainstorm ways that the information can be gathered; allocate different tasks to group members; consider how information will be recorded and then presented to others; develop a time-line predicting when each stage of the project might be completed and by whom; establish a schedule of meetings with the group and with the teacher. All parties help develop and then sign The Compost Contract.

Finding out about compost, the compost heap and the composting process

• Students visit compost heaps located in home gardens or the local area. During visits students find out about the compost heap or bin, how it is made and the composting process, i.e. the right conditions and techniques. Whilst visiting students undertake activities to collect information to help them better understand:

• methods of composting and worm farming
• the composting and worm farming process
• the life in compost, e.g. bacteria, fungi, millipedes, slugs and earthworms
• how the natural system functions best in a compost heap or worm farm with identification of problems and possible causes (For information see Resources 3.2, 3.3 and R6)

• Develop community links with a grandparent, elderly person, neighbour, or a parent and negotiate to use their garden area for composting if locations are unavailable at the school. Other ideas include developing links with an agricultural high school or the local council.

• Discuss observations about the nature of a composting area and the compost heap itself. Identify problems which the school might have in developing a compost site:

~ finding a suitable site
~ inadequate water collection receptacles
~ distance to water source
~ lack of in-house knowledge
~ lack of trees
~ lack of tools
~ vermin

In small groups, prepare notes that:

~ describe each problem
~ define the extent of the problem
~ suggest key strategies
~ identify questions to ask the Principal at a later time

Students decide which of these could be answered by meeting with the Principal, groundsperson, or SRC representatives, or by library research, use of the Internet or by developing proposals for the school's consideration.

• Students prepare questions and interview the Principal, staff members, family and extended family members to determine how people use organic material and turn it into compost; the composting process; the life in a compost heap; how often the material in a compost heap should be turned for the fastest compost production.

• Using pamphlets, brochures, and resource sheets contained within this resource and located from other sources explain the composting process, why it is important and how to go about it. Students contribute ideas for a class effects wheel, exploring the ramifications of "more people composting and the school actually composting". This can be added to during the unit and the ideas suggested can be followed up.

• Students sort out and make sense of the information they have collected from site visits, composting activities, guest speakers, surveys, pamphlets and resources. Groups decide on the best way to represent the information to the rest of the class and the school.

• In small groups students select a sub-topic within the unit topic to research in order to gain broader understanding of composting and its importance in schools, homes and local communities, and how it not only saves valuable landfill space but can be used in gardens as a fertiliser or mulch to improve the condition of the soil. The topics may be developed from questions or issues raised earlier in the unit. Ideas for investigation might include:

• Find out what proportion of household and total waste generated in Australia is green and organic waste. How does this compare with other countries?

• What are or could be the long-term environmental impacts of disposing of green and organic waste to landfill sites?

• What health and safety precautions should be taken when composting? Discuss why. (Refer to R6 EcoRecycle Victoria Information Sheet 11. Composting)

• Your school has decided to compost food scraps. Find out what type of compost bin it should use and how to maintain that system.

• Research a list of what materials can/cannot be added to a compost bin or heap and why?

Students investigate and then share their learning with the rest of the class.
• Hold a debate. Suggestions include:
~ We as a community should be building more landfill sites to take our waste.
~ Green and organic waste is a valuable resource.
~ It is more important to recycle cans and glass than green and organic waste.
~ Individual action to compost green and organic waste at home is just as important as large commercial composting operations.

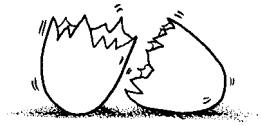
• Individuals and then small groups devise statements of generalisations about compost, composting, waste management and green waste issues. These statements are then tested, ordered or challenged. students revisit earlier ideas and work and see how their ideas about composting have changed and why.

• Students develop a proposal to request their involvement in developing a school based composting area so as to be able to manage school and green and organic waste in sustainable ways.

• Students create an awareness campaign about compost, composting and green waste management. Ideas for inclusion include:

~ Making their own video or computer presentation
~ Presenting findings at an assembly
~ Writing an article for the school newspaper
~ Creating a public display and a leaflet about composting and green waste management and display it at the local library, council chamber or shopping centre.

Can these be added to compost?



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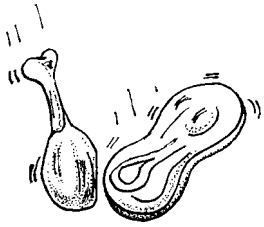

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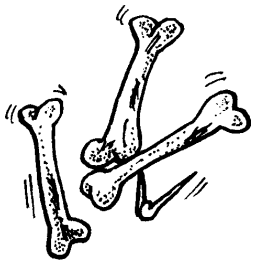

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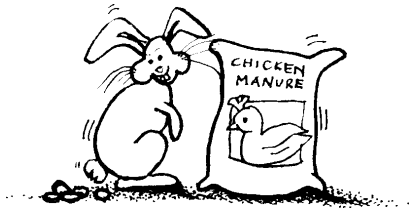


...or these?

Resource 3.1

Read the information below to assist you in being able to discuss issues related to green and organic waste management.

Composting

In our everyday lives we all produce rubbish. But, is it rubbish? It is probably better called waste and most waste materials can be reused, recycled or composted.

What kinds of things make up your household or school waste? Make a list of the things you throw away at home or at school.

Rubbish disposal

In most areas of Australia, waste is collected from your front gate and is taken away in a big truck to a landfill site where it is covered with soil.

In other parts of the world waste is burned in a large incinerator.

Reduce, recycle, reuse

Much of our waste can be reused or recycled. It is also important that we reduce the amount of waste we generate in the first place. Recycling is important but it is expensive and uses up resources.

Kerbside recycling is now a part of waste collection in many Australian cities and towns. Materials such as glass, metals, paper and cardboard, milk and juice containers and some types of plastic are separated from the waste stream for recycling.

Recycling used materials to make new goods means that we reuse valuable resources and we don't have to use new materials. For example, we can make paper from used milk cartons, and cardboard from used writing paper.

Organic Wastes

Nature creates waste such as dead leaves, dead branches, dead insects and animals - this type of waste is called *organic waste*. It is rapidly broken down by insects, small animals, bacteria and fungi and goes back into the soil.

Over 53% of household waste in Australia is green and organic waste. *Green waste* is waste from our gardens - leaves, prunings, lawn cuttings, dead branches. Organic wastes are mainly food scraps from our kitchens. All this material can be reused or recycled by composting.

Composting is the process of breaking down green and organic wastes to make a rich soil-like fertiliser which can be used on our gardens as a soil conditioner and fertiliser. Organic material is broken down by the action of bacteria, fungi, worms and insects that live in compost heaps.

Compost should be spread over the garden. It recycles nutrients, improves soil condition and can also conserve water in the soil.

Compost can be made in a heap on the ground or in specially constructed compost bins or bays.

Making your own compost

1. Select a suitable site in your garden or the school yard. The site should not get too hot, so find a spot that gets some shade.

2. Set up the compost bins or build a series of compost bays of timber, bricks or sheets of iron (2 x 2 metres with side walls 1.3 metres high is a common size).

3. Start the compost heap by layering materials, e.g. small prunings on the bottom followed by layers of lawn clippings and weeds, food scraps, clippings, prunings, food scraps, and so on until the bin or bay is full. Cover the compost with straw or old carpet underlay to keep it moist.

Let this pile go through its composting process; don't add to it but rather start a new compost pile.

4. Check the compost regularly. Keep it moist (not wet) and turn it once every 1-2 weeks. Turning is made easier if you have two bins or bays that you can use. Simply fork the pile from one area to the other. The pile will get quite hot during the composting process, reaching 50-60 degrees Celsius. You can keep track of the temperature changes using a thermometer.

Worms will help the composting process but will only be present once the temperatures drop below 30 degrees Celsius.

5. After 2-6 months (time will depend on size of heap, materials being composted and seasonal conditions) your compost will be ready to use. Finished compost is dark in colour, friable and sweetly smelling. Dig it into new garden beds or spread it on top of existing beds. Watch your plants grow!!

Further reading

Bailey, Donna 1991. What we can do about - Recycling Rubbish. Franklin Watts, London.

Hare, Tony 1992. Domestic Waste. Franklin Watts Ltd, London.

Howson, John 1993. Going Green at Home and School. Wayland (Publishers) Ltd, East Sussex, England.

Llewellyn, Claire 1991. Rubbish. Simon & Schuster, Great Britain.

Walker, Colin 1992. The Great Rubbish Mountain. Lands End Publishing, Wellington, New Zealand.

Resource 3.2

Compost Heaps

Compost heaps are a useful way of turning food and garden waste into compost, soil fertiliser or conditioner.

A compost heap is much more than just a pile of green and organic waste. It is like a fertilizer factory working around the clock to make food for gardens.

A compost heap begins life as a pile of food and garden waste. The layering of the green waste materials with some soil, water and frequent turning enables a warm moist environment to develop in the compost heap which makes it an ideal home for many creatures. Bacteria start to break down the plant foods and the heap begins to heat up. Fungi then start to grow, feeding on the tougher, woody materials and thousands of tiny creatures arrive in the heap. While the compost is slowly forming, the rotting plants provide food for many small creatures, such as slaters worms, millipedes, slugs and earwigs.

As the fungi, bacteria and small animals feed on the heap, they make the organic material rot away. In the middle of the heap, eggs and young are kept warm and are hidden from predators. A heap starts to heat up about a day after being made and within weeks may even be steaming.

Animals in the heap need air and water to survive so a heap will not rot down if it gets too dry, too waterlogged or does not have enough air circulating through it. The heap can be readily aerated by turning the waste using a garden fork. A well-aerated, moist heap will rot much more quickly than one that is not managed properly.

Mature compost is dark in colour and crumbly and takes from 2 - 6 months to form, depending on the size of the heap.

The completed compost can now be used on the garden. Dig compost into new garden beds prior to planting or spread on the surface in existing gardens. Keep the compost away from the trunks of trees and shrubs to prevent rotting.

Resource 3.3

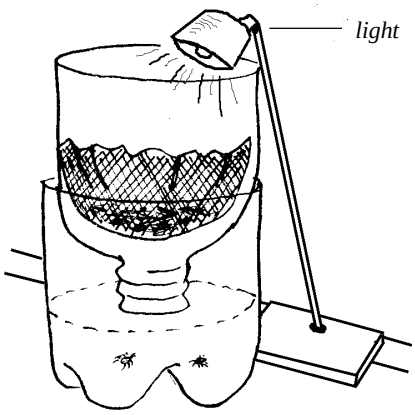
“I’d like to make that!”

Develop ideas and design an imaginative device for separating some small compost creatures from compost for observation.

Make a prototype of the design, test it, modify the design then produce a “Compost Critter Viewer”.

Remember that these creatures normally live in the dark, are often sensitive to light, and enjoy a warm moist environment. Also, all compost creatures must be returned to the compost heap after observation to prevent them them drying out.

Task: Design a Compost Critter Viewer



Materials:

- 1 X 1.25 litre PET plastic bottle
- some plastic insect screen
- some compost
- desk lamp
- scissors
- magnifying glass or stereo-microscope

Look at the example of a compost creature viewer, and draw your sketch plan in the box below.

In a small group come up with:

• the best way of cutting the plastic bottle and the insect screen

• ways of constructing the “Compost Creature Viewer”.

Select the chosen plan and make a prototype. Draw to scale the selected plan from a range of views and show measurements.

Make a prototype.Test it. Observe the compost creatures you find. Study them with the aid of a magnifying glass.

Compare the animals observed with those in the drawings below.

Record the number of different Compost Creatures observed and found in your sample.

Source: Adapted from “Compost – its alive” in Waste Matters, Environmental education activities about waste, Gould League of Victoria Inc., p 55.

Unit 4

green waste matters!

WORM AWAY YOUR WASTE

Synopsis

This unit is designed to provide students with an understanding of the important role of earthworms in organic waste management and sustainability. As nature's recyclers, certain species of worms can be used to process large amounts of organic waste. Students will investigate the specific species of worms required, the best environment for them to work in, the value of the by-products produced, and the options of utilising worms in their school's recycling program.

Learning Objectives

To enable students to develop an understanding of the important role of worms in waste management. Students develop an understanding of:

• the characteristics of soil processing worms and compost worms
• the interdependence of worms within the ecosystem
• the importance of worms in waste management.

Resources

See 'References and Bibliography' for an annotated list of resources.

Learning Activities

Regardless of location students can investigate and gain an understanding of the use of worms in green and organic waste management and also utilise the worms' abilities to recycle waste in their school. Schools provide an ideal location for worm processing of waste, particularly considering the variety of green and organic waste available and its suitability as a food source for worms. Students will, as part of this unit, plan a worm-based recycling program for both individual classrooms and the school as a whole. This will not only involve the processing of waste but the utilisation of the by-products produced.

Introductory activities to assist the teacher to find out what students know about worms.

• Brainstorm information students have about worms. If they have a sound knowledge base extend the activity to include what role worms play in the environment.

• Organise a guest speaker on worms to provide students with basic details about them. This can be done by contacting CSIRO, Department of Primary Industries, worm farmers, worm retail outlets or organic gardeners.

• Students listen to the songs "Hey Gran" and "Chew and Roll" and also read the lyrics, both provided in R9 of this resource.
~ Discuss the songs and the information they provide in regard to worms and their roles, drawing attention to their recycling potential. Record under the heading "Worm Food" green and organic waste materials mentioned in the songs that worms consume. Retain these lists to add to them as students progress through the unit.

Read the earthworm factsheet for more information (See Resource 4.1).

A worm might be a worm but their roles differ

Worms fall into two main categories based on their roles in the environment. Soil processing worms or the common earthworm and organic waste processing worms, also known as manure or composting worms. (For the sake of this resource organic processing worms will be referred to as composting worms).

Composting worms can not survive in harsh field conditions, and are usually found on the soil surface under moist leaves or mulch. They consume vast amounts of green and organic materials.

Soil processing worms live in the soil and can be sustained with less food. They have a very positive impact on soil structure through their burrowing and are much less active than composting worms.

Of the two types of worms, the composting worms work very effectively under 'farming conditions' while it is very difficult to use composting worms in farming. Most soil processing worms are native earthworms whereas the composting worms have been introduced to Australia from other parts of the world.

Students should also be aware that worm farming is different from composting. The use of worms is a cold material breakdown method wheras composting generates considerable heat. Worms will not live in an active compost heap but will enter it once it has cooled down.

• Students conduct a worm search. To collect composting worms is simply a matter of locating them at work in 'their natural' environment. Composting worms can be found in compost heaps, under existing mulch and in manure piles. Soil dwelling worms are located in the soil.

Note: it is important that when students are rummaging through mulch, compost heaps etc that they wear rubber gloves. Secondly, any worms found must be returned to the same spot at the conclusion of the students' observation to ensure the population is not too disrupted. Thirdly, most varieties of worms are extremely light sensitive.

Collecting compost worms

• Students explore the dark moist recesses of compost heaps, manure piles or under mulch at school, the home garden or a garden of a friend or relative. Students collect approximately a bucketful of the organic material housing the worms. Organic material is then piled onto a piece of plastic either in the direct sunlight or under the light of a desk lamp. Every few minutes scrape some of the organic material off the surface of the pile until any worms become visible. Having been stimulated by the light the worms will move away from it, down through the pile.

Continue this process until all the worms are separate from the organic material that housed them. To keep the worms comfortable until students have been able to observe them, place a small amount of the organic material in a used ice cream container, add the worms and place the lid on the container (ensure the lid has ample air holes). Store container in a dark, cool place.

(If composting worms can't be found easily then they can be purchased for a very reasonable cost, approximately $2.50 per 100 worms. Students can access sources through advertisements in newspapers, Yellow Pages under worm retailers, bait shops, worm farmers).

Collecting soil processing worms

This is more laborious and will require a garden fork and access to a garden.

• Students dig up 30 cm square patches of garden area to a depth of 30 cms. Selecting the correct area is important and students should access areas that have been mulched or fertilized with organic material. Once worms have been located and dug up students separate them from the soil by hand. Record how many different varieties are found. To store, place a small amount of the soil in a recycled ice cream container, place the worms inside, place the lid (with air holes) on and keep in a cool dark location.

• Students, in small groups, observe the two types of worms, recording differences and similarities. Consider colour, size and levels of activity (to ascertain this, students expose worms to bright light for a short period of time and note the reactions). Students also compare differences and similarities between the environments the worms were found in. Groups report back to whole class, discussing their findings. Students collate results and record details on Resource 4.2.

Working worms

• To compare the differences in how soil processing and composting worms work students can set up two simple experiments that will highlight the differences.

Materials:
2 clear plastic 2-litre bottles *
stanley knife or sharp cutting instrument
2 pieces of clear plastic approximately 20 cms square
2 rubber bands
2 pieces of cloth to cover each of the bottles
spray bottle for water
soil
organic compost
* alternative containers include glass jars or an aquarium

Procedure:

• Students and/or teacher removes the top of the bottles
• Students and/or teachers place six drainage holes in the bottom of each bottle
A school compass can be used but extreme care must be taken
• Each bottle is filled with alternate 5 cm layers of soil and sand
• Soil in bottles is moistened using a spray bottle
• A 5 cm layer of composted organic material is placed on top of the soil
• Using the spray bottle moisten the organic material
• Worms are introduced by placing them on top of the composted organic material (use 20 worms per bottle)
• Clear plastic sheet is placed on top of the open bottle, stretched tight and held down by a rubber band
• At least 20 small holes must be punched into the clear plastic sheet to allow air flow
• Bottles are covered and placed in a cool, dark location
• Students illustrate each of the bottles in order to visually be able to represent the changes that will take place.

• Students view bottles once a week for a four week period, recording any changes they notice. Students make simple anecdotal writings or illustrations highlighting the visual changes noticed. At the end of the four week period students illustrate the bottles as they appear and where the worms were found. (See Resource 4.3)
Note: With 20 worms per treatment, the compost should last them for the whole experiment without the need to add food or water.

• In groups, students compare results of the changes they recorded.

• As a class, discuss the changes evident and how they relate to the different types of worms working naturally within the environment using the following questions:

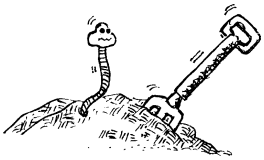
~ Have the contents of the bottles changed? If so, how?

~ How could we best represent the changes?

~ What differences can be noticed between the two experiments?

~ How do the results of the experiments relate to what takes place naturally within the environment?

~ From the investigations, what type of worms would be most suitable for recycling of organic waste within the school?



• Ask students to choose one of the two types of worms, e.g. soil processing or compost worms, and write a short autobiography entitled "A day in the life of a worm", based on their knowledge and the results of the experiments highlighting:

~ living conditions
~ movement within the environment
~ organic materials consumed
~ how they change the environment they live in.

• Students use the results and knowledge they have obtained to inform other students within the school of the workings of the two types of worms and their important roles in the school and at home. This could be done via an information flyer, library display, oral presentations to classes, class visits to view investigations and materials produced or assembly presentation. This knowledge will provide other students in the school with some background knowledge and an introduction to worms and their possible role in the school's waste management program.

Worm food – What are their favourites?

For the remainder of the unit students will be dealing almost solely with composting worms and their role in the school's green and organic waste recycling program.

Composting worms consume virtually "anything that was once alive". However there are certain organic materials that composting worms initially avoid and either require some form of pre-processing or are best not fed to them. In order that students can assess exactly what part of the school's green and organic waste the worms will consume a simple investigation can provide the answers.

• Students build six simple worm farms as a means of seeing what types of green and organic waste the worms will consume.

Aim: The aim of this investigation is to determine what types of green and organic waste worms consume.

Materials:
• 6 polystyrene boxes (obtain from grocers, supermarkets, fruit stores)
• soil
• composted organic materials
• 1.5 kilograms of composting worms (cost approximately $15 - $25)
• enough newspaper, old hessian backed carpet or hessian bags to cover the surface of the 6 polystyrene boxes
• spray bottle
• 6 recycled ice cream containers
• blocks of wood or house bricks
• samples of green and organic waste (green waste 50% composted and 50% fresh)
• piece of shadecloth
• roll of packaging or masking tape

For details and diagrammatic representation see R6. Divide the class into 6 groups. Each group sets up a worm farm.

Procedure

• With a screwdriver, pen or pencil students punch at least four holes in the bottom of each box (these holes are for drainage and are best placed when the end side meets the bottom of the box. The liquid collected is a quality organic fertilizer and will be relevant to activities later in this unit of work). On the inside of the box place a piece of shadecloth over the holes and fasten in place using tape.

• Half fill each box with garden soil.

• Spread 2 cms of the composted organic material evenly over the surface of the soil.

• Moisten contents of the box using spray bottle.

• Cover surface of the box with hessian, hessian backed carpet or wet newspaper.

• Moisten covering using spray bottle.

• Lift covering and place approximately 250 grams of composting worms in each box.

• Replace covering.

• Place boxes on a slight slope using blocks or house bricks and place ice cream containers underneath to collect liquid run off.

• Label the 6 boxes:

Green waste (fresh and composted)
Food 1
Food 2
Food 3
Food 4
Food 5

Box 1 – Green waste (fresh and composted)

Students place a variety of the school's green waste across the surface of the box to a depth of 5 cms. By dividing the surface into 6 sections students will be able to ascertain which types of the green waste the worms consume most readily. Students should feed the worms as they use up the green waste and record the amount of material that is added throughout the experiment. Weighing the material is suggested. The Diagram below offers a suggested set up for this box.

Fresh grass clippings	*Fresh leaves*	*Fresh twigs*
Composted grass clippings	*Composted leaves*	*Composted twigs*

This set up will allow students to compare the worms ability to recycle a variety of composted and non-composted green waste.

Students keep records of worms' waste consumption over the four week period. A suggested record sheet is contained in Resource 4.4 "Green waste and worms".

Boxes 2 – 6 - Food scraps

As seen above each box (worm farm) relates to a specific type of food waste. As a class brainstorm and record a list of the types of food waste the class usually has each day. After assessing the most common food waste produced by the class, students assign the different types of food waste to each box, e.g.:

• Box 2 – bread/paper (wrappings)
• Box 3 – vegetables
• Box 4 – fruit
• Box 5 – cakes, biscuits, pastries
• Box 6 – meat (including pies)

Other suggestions include bulky vs shredded vegetables/leaves/paper.

Label boxes to avoid confusion and for record keeping. Each day of the week students place their lunch scraps in the appropriate box. These experiments also run for a four week period. Experiments should give students an idea of the food scraps worms consume more readily.

Some food waste might require pre-composting. This will become obvious to students as they follow through with their observations of the investigation as some forms of organic food waste will not be consumed as quickly as others and some might not be consumed at all, requiring pre-composting prior to feeding to the worms.

• Students record observations weekly of worm activity within the boxes. A suggested recording sheet is contained in Resource 4.5 "Food scraps worms love". Assessing weekly the consumption of food waste is as simple as observing each

box at the end of the week and recording your observations.

• Students can also weigh food scraps prior to feeding in order to ascertain how much food the 250 grams of worms consume over the four week period. This will aid planning for a larger scale worm farming venture.

It is advisable for students to keep the six worm farms fed (preferably with foods identified as quickly consumed by the worms) after the four week investigation period for the following reasons:

~ the liquid collected and the castings produced by the worms will be used later in this unit to investigate their value to the soil and plant life.
~ by continuing to feed the worms their numbers will increase supplying breeding stock for a larger scale worm farm if worm farming is to become part of the school's green and organic waste management program.

• Students present their results to the class. To evaluate the results obtained, students should consider the following questions:

• What type of **green waste** was consumed most quickly?

• What type of green waste was not consumed by the worms?

• Was there any difference between the consumption of green waste that was composted and not composted? If so, students state the differences.

• Students hypothesise as to reasons for any non-consumption and what could be done to aid this in the future? This could relate to:

~ size of particles
~ excess heat caused by decomposition process (evidenced during observation of consumption by a simple 'feel test'. Worms do not like extreme heat, over 30 degrees C)
~ food not conducive to worms due to acidity, toxicity
~ lack of moisture
~ hardness of the waste

A 'feel test' is a simple way of ascertaining heat during decomposition. Simply lift up a section of the non-consumed food and using the palm of a students' hand hold it over the area approximately 2 cms above the food. Any excess heat will be obvious. This investigation could be taken further by the use of thermometers to keep records of the heat produced by each of the six types of green waste. Simply insert the bulb of a thermometer into the compost and after a minute then record the temperature. Do this at regular intervals (e.g. daily, twice a week).

• Are there any things students believe they could have done to improve the efficiency of their worm farm?

• Students view remaining unconsumed green waste and compare it to the material (commonly called castings, worm castings or vermicastings) produced by the worms, recording the similarities and differences.

• Students make a list of the:

~ green waste the investigation showed worms consume readily
~ green waste the investigation showed needs time to decompose (through some form of composting) prior to being fed to worms.
~ green waste that the investigation showed worms were not interested in at all.

A suggested range of areas to comment on in regard to **food waste** consumption could be:

• What type of food waste was consumed quickly by the worms?

• What type of food waste was not touched at all by the worms?

• What type of food waste was consumed after it had some time to decompose?

• Students hypothesise reasons for any non consumption and what could be done to aid this in the future? This could relate to:

~ acidity levels in food (worms do not like foods that are too acidic, e.g. some citrus fruits, onions, garlic). Students could test the acid level of materials using litmus paper or universal indicators.
~ hardness of the food
~ excess heat caused by decomposition

• Are there any things students believe they could have done to improve the efficiency of their worm farm?

• Students make a list of the:

~ food waste the investigation showed worms consume readily
~ food waste the investigation showed needs time to decompose prior to feeding to worms
~ food waste that the investigation showed worms were not interested in at all.

• To update the results of both the green waste and the food scraps investigation students read books/ brochures in libraries, contact the CSIRO, Department of Primary Industries, worm retailers or worm farmers, or search the Internet to validate results with past research

done by these researchers or organisations.

• Students, taking into account their investigation and information gathered from ‘experts’, finalise lists of the type of green and organic waste that can be consumed by worms, the type of green and organic wastes that need pre-composting and any waste shown not to be suitable at all.

The results of both investigations should show that some green and organic waste needs time to partially breakdown. Generally the most effective way to do this is by composting the waste prior to feeding it to the worms. This fits in very well with in a whole school composting and worm farming program.

Worm by-products of green and organic waste processing

When worms consume green and organic wastes the by-products produced, the liquid run off or liquid castings and the solid castings have shown to have many benefits for the soil and plant life. These benefits include:

• 100% organic (chemical free)
• pH neutral – can also be used to assist to balance soil pH
• odourless and odour inhibiting
• reduces need for chemical fertilisers – improves Nitrogen and Phosphorous uptake by increasing soil biological activity
• improves starch and protein synthesis
• increases root development
• reduces the demand for water, keeping water at the root zone
• increases soil microbial activity
• increases pest and disease resistance of plants (via promoting healthy growth)
• acts as plant growth stimulants and soil conditioners.

• Students research the use of worm processed by-products (liquid castings or vermicastings, castings or worm castings or vermicastings) as a fertiliser/soil conditioner. Students visit libraries to source information or write letters seeking information and brochures from CSIRO, worm breeders, and worm retailers, or search via the Internet. Students collate the information and produce some form of informative writing/presentation for other students within the school to highlight the benefits of these products. This could include:

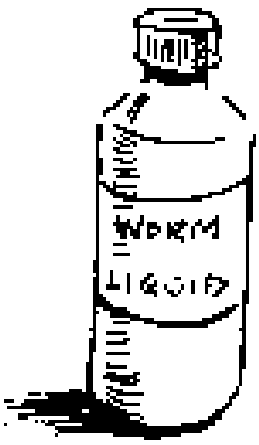
~ an information flyer to be sent to each class
~ a poster
~ an oral presentation for a school assembly
~ a newspaper report entitled “Nature’s way to feed the soil”
~ a flow chart highlighting both the production of worm castings and also the benefits for display in library, science room.

• Students contact and invite a worm farmer, waste educator, a worm retail outlet representative, an organic gardener or researcher to talk to their class about their knowledge in regard to the use of worm castings in the garden and other growing areas. Students design a series of questions to supply to the speaker prior to the visit. These might include:

~ What value do worm castings have as a fertiliser/soil conditioner?
~ Are worm castings good for the environment? If so, why?
~ How long can worm castings be kept before using?
~ How is it best to store worm castings?
~ How much do castings cost?
~ What areas of our school gardens and grassed areas can we use worm castings on?
~ What types of farming can the use of worm castings be beneficial for?
~ Are there any plants that do not like worm castings?
~ How do worm castings compare with chemical fertilisers?
~ Does the quality of worm castings vary? If so, what causes the variation?
~ What types of green and organic waste do we need to feed to worms to make good quality worm castings?

• Students prepare a class letter and send a questions, including an explanation about their investigations and the reasons for requiring the information, to worm farmers, waste educators, worm retailers, CSIRO information officer, or Internet sites. Students collate information from this and other sources and present to other members of the school as:

~ an informative flyer to be sent to each class
~ a poster
~ an oral presentation for a school assembly
~ a newspaper report entitled “Nature’s way to feed the soil”
~ a flow chart highlighting both the production of worm castings and also the benefits for display in library, science room.



• Students hypothesise how the use of worm castings for a range of farming activities can be environmentally beneficial.

• Students write letters to the editors of local newspapers highlighting their findings. They suggest where in the commercial and horticultural farming community worm castings could be utilised.

Worm castings – the big test

Investigate the effectiveness of worm castings in regard to plant growth when compared with a variety of fertilisers. The investigation will run for a four week period.

Materials required per student:
• 3 small to medium sized pots (10-15 cm) or 3 used 2 litre icecream containers
• potting mix
• worm castings
• any suitable chemical fertiliser
• seeds or seedlings for any plant life
• measuring container for water.

• Students produce an information flyer, see Resource 4.6 "Parent help required" to be sent to parents highlighting their investigations, the reasons for doing so and their aims. In the same flyer students request donations of the materials listed above.

• Students send out a similar flyer to all students in the school.

• Students write an article for the school newsletter explaining what they are doing and asking for donations.

• Students write to or contact in person the local nursery or garden centre seeking donations.

Procedure

Each student will be responsible for 3 pots. Each pot will use the same type of seeds or seedlings. Suggested seeds - broad beans, pumpkin, sweet or field pea, cereal (wheat or barley), sunflowers. Use 3 or 4 seeds per pot.

Pot 1 (control – potting mix only)

1. 3/4 fill the pot with potting mix
2. Plant seeds or seedling
3. Using a measuring container, water an amount, agreed to by the class
4. Label the pot, "Pot 1 – Control – potting mix only"
5. Measure height and width of seedlings and also cuttings, the number of leaves visible
6. Record results on "Plant growth record sheet" (Resource 4.9); if possible take photographs or illustrate changes
7. Place pot in a light airy location either in classroom or in a slightly shaded area outdoors.

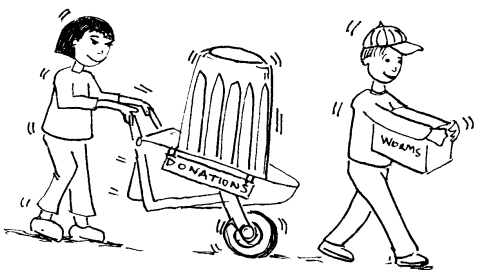
Pot 2 (worm castings added)

1. 3/4 fill the pot with potting mix
2. Place 2 cms of worm castings over the surface of the potting mix
3. Plant seeds or seedling
4. Using measuring container, water (same amount to that used in Pot 1)
5. Label the pot, "Pot 2 – worm castings added"
6. Measure height and width of seedlings and also cuttings, the number of leaves visible
7. Record results on "Plant growth record sheet"; if possible take photographs or illustrate changes
8. Place pot next to Pot 1.

Pot 3 (fertilised with a manufactured chemical fertiliser)

1. 3/4 fill the pot with potting mixture the recommended amount of chemical fertiliser
2. Plant seeds or seedling
3. Using measuring container and agreed amount of water, water the plant
4. Label the pot, "Pot 3 – fertilised with chemical"
5. Measure height and width of seedlings and also cuttings, the number of leaves visible
6. Record results on "Plant growth record sheet"
7. Illustrate changes by photographs or scaled drawings
8. Place pot with others.

Plants are to be watered every second day, depending on their location, ensuring that the agreed amount is used. If due to extreme heat or dry conditions the plants require extra water, it is important to ensure that all plants are watered the same amount at the same time and that amount is recorded. See Resource 4.9 "Plant growth record sheet".



Monitoring plant growth

Students observe three growth trials, in order to collect data that will allow them to make conclusions in regard to the effectiveness of worms castings as compared with a chemical fertiliser.

It is important for the validity of the results that each of the three pots has planted seeds or seedling of the same variety and size. It is also important that, although there might be a variety of potting mixes available, each student uses exactly the same blend for their three pots. Pot 1, the control experiment, will show the growth of plants with no nutrients added other than what exist in the potting mix. Students record any changes every two days when watering takes place. (Pots planted with seeds will take longer to show signs of change - seeds will take a week or so to germinate).

• Students design a record sheet to record the growth rate in the three trial pots. See Resource 4.7 “Plant growth record sheet”.

• At the end of the second week, students provide the class with a brief oral report on the progress of their trial pots. This activity can be done at the end of each week of the four week investigation period.
• At the end of the four week period students collate their results. Individual students prepare a written report, including specific data as support, on the results of their trials and conclusions they may draw. Suggested questions could be:

~ Which of the three trial pots showed the best growth results? What evidence highlights this?

~ Which of the three trial pots showed the poorest growth results? What evidence highlights this?

~ From the results you achieved, which material do you believe is best to use for the type of plants you grew? Why?

~ If the trial results are inconclusive what would students recommend is required to ascertain some form of meaningful result?

~ From your results is it possible to successfully utilise worm castings in your school as a substitute for existing fertilisers? If yes, what recommendation would you make in regard to setting up worm farms as part of the school’s green and organic waste management program? Why?

As a class, collate all results of individual trials and record on a master collation sheet. See Resource 4.8 “Investigation Collation Sheet”. Students could also present results as a graph, bar diagram or on a computer spread sheet.

From the collated results discuss the following questions:

• Which of the plant growing mediums (potting mix, worm castings added or fertilised with chemical fertiliser) showed the best growth results? What evidence highlights this?

• Which of the three showed the poorest growth results? What evidence highlights this?

• Compare the class results with student’s individual results. How do they compare? Which is more reliable and why?

• From the results you achieved which material do you believe is best to use on the type of plants grown at your school? Why?

• If the trial results are inconclusive what would students recommend is required to ascertain some form of result?

• From the results is it possible to successfully utilise worm castings in the school as a substitute for existing fertilisers? If yes, what recommendation would you make in regard to setting up worm farms as part of the school’s green and organic waste management program? Why?

• How can students or the school use the worms left at the end of the experiment? (For example, start a school or home wormery).

• Students present overall results, conclusions drawn and recommendations from the investigation in the form of:

Posters to be displayed in an appropriate location within the school (library, resource centre, science room, school notices board, school office foyer) and individual classrooms.
~ An information flyer for both other students and parents
~ A school newsletter article
~ An oral assembly presentation
~ An oral presentation to the SRC
~ An article for a local newspaper
~ A page for the school’s home page on the Internet.
(These presentations could be used for assessment to show students’ understandings or the conclusions).

Resource 4.1

Earthworms Factsheet

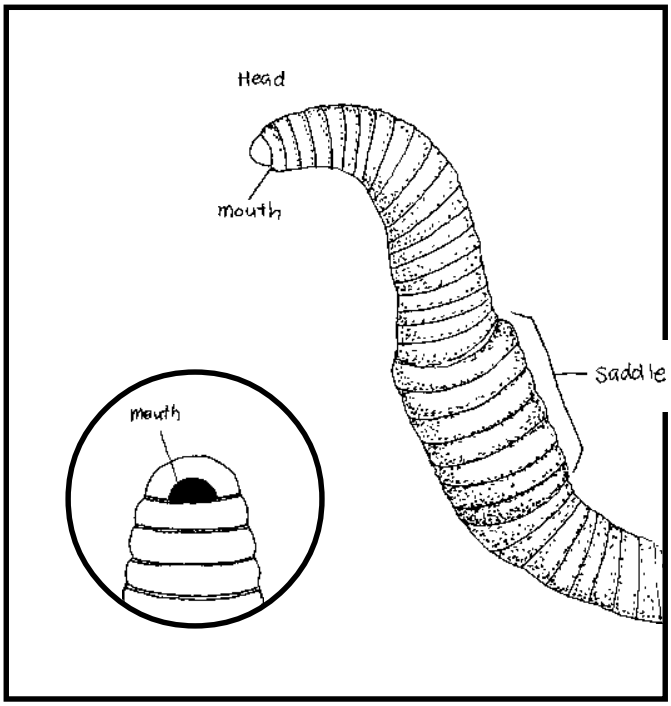
Earthworms are soft, long, cylindrical soil dwelling invertebrates divided into rings or segments. Earthworms are important soil animals because they help to keep our soils healthy.

How earthworms help the soil

• They improve the structure and fertility of the soil
• They help provide food for important micro-organisms
• They help break down plant matter to return nutrients to the soil
• They make holes which help root growth and allow air, water and fertilisers to enter the soil
• They increase plant growth.

Earthworms in your soil

• Native and introduced worm species live in our soils
• Most of the earthworms found in cultivated soil on farms and in gardens are from Europe, introduced with potted plants in the early days of Australian white settlement
• Native worms are mostly only found in natural bushland
• Native worms have a saddle (or clitellum) very close to the head.



Gemascolex lateralis is a species of worm which is native to Australia.

Introduced worms vary in appearance

Eisenia fetida are commonly called tiger worms and can he found in compost heaps.
Aporrectodea trapezoides have a brown-blue body and a creamy underside.
Aporrectodea rosea have front segments which are pink and the remainder appears mostly yellow.
Octolasion cyaneum are blue-grey in colour, soft bodied with a yellow tail.
Aporrectodea longa have dark and glossy front ends.

Australia's longest earthworm

The Victorian Gippsland Giant is about 100 cm in length. It is the largest earthworm in Australia. When relaxed, it stretches to about 2 metres. The average garden worm is about 10 cm long.

What do earthworms eat?

Earthworms will eat things like rotting leaves, stems and roots of plants and soil particles which contain nutrients.

How do earthworms move?

Earthworms do not have legs. They have bristles or setae around their bodies. By bunching up like a spring and using the bristles at the back as an anchor they can push themselves forward through the soil.

Are you aware of these facts?

Earthworms are sensitive to light and strong smells.
Earthworms tie themselves in knots in summer to conserve moisture.
Some earthworms spend their whole life feeding underground.
Others feed on the soil surface.
Earthworms cannot survive without air.
After rain or when the ground becomes waterlogged, they head for the surface.
Earthworms are both male and female (hermaphrodites).

The life cycle of an earthworm

Some species can produce fertilised eggs without mating but other species still need to mate to fertilise their eggs.

The eggs are contained in cocoons and young worms hatch from the cocoons within a few weeks. It can take months or even years for a worm to mature. A worm is an adult when the swelling around the body, called the clitellum, is visible. The clitellum produces the cocoons in which the eggs hatch and young worms develop.

Adapted from CSIRO Worms, Worms, Worms poster

Source: Education Department of South Australia. 1992. Kids for Landcare: Wormwatch. Adelaide: Education Department of South Australia.

Resource 4.2

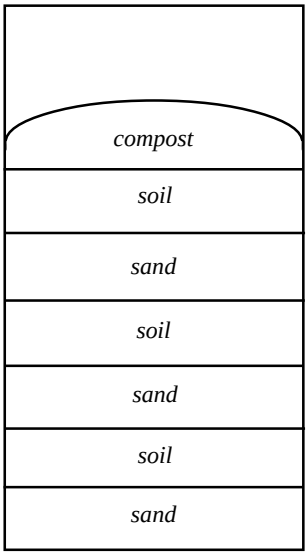
Worms, Worms, Worms!

SOIL PROCESSING WORMS	**COMPOSTING WORMS**
Illustration of worms	**Illustration of worms**
Illustration of worm's environment	**Illustration of worm's environment**
Observations	**Observations**
Size (in cms): Colour: Level of activity: Describe environment worms were found in:	Size (in cms): Colour: Level of activity: Describe environment worms were found in:
Similarities	
Differences	

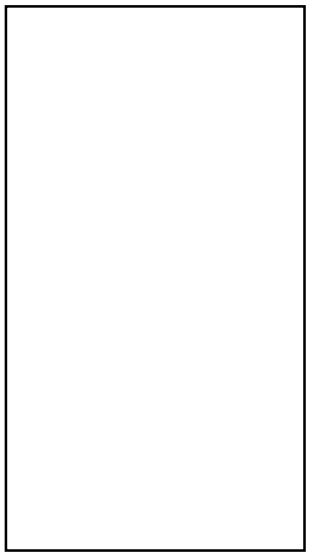
Resource 4.3

Worms Working Differently

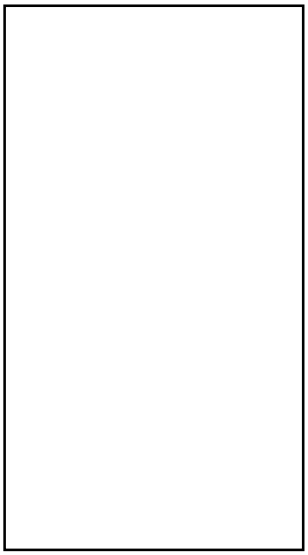
Initial Set Up



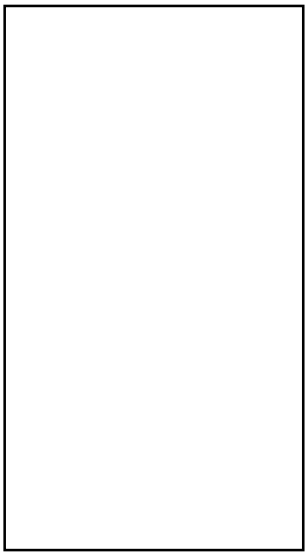
☐ **Soil Processing Worms**
☐ **Composting Worms**



Week 2



Week 3



Week 4

☐ **Soil Processing Worms**
☐ **Composting Worms**

Illustrate the appearance of the complete bottles at the end of each week of the investigation. After all illustrations have been done, you will be able to notice the changes in the ‘environment’ brought about by the worms and draw conclusions about their impact if this was to occur in the natural environment.

Resource 4.4

Green Waste and Worms

GREEN WASTE AND WORMS *Record from observation the amount of green waste consumed by worms (none, small, medium or large amount)*	
COMPOSTED GREEN WASTE	**FRESH GREEN WASTE**
Grass clippings	**Grass clippings**
Leaves	**Leaves**
Twigs	**Twigs**
CONCLUSIONS DRAWN FROM OBSERVATIONS ABOVE	

Resource 4.5

Food Scraps Worms Love

FOOD SCRAPS WORMS LOVE				
FOOD TYPE	**OBSERVATIONS**			
	WEEK 1	**WEEK 2**	**WEEK 3**	**WEEK 4**
Box 1 **Green Waste**				
Box 2 **Bread**				
Box 3 **Vegetables**				
Box 4 **Fruit**				
Box 5 **Cakes**				
Box 6 **Meat**				

CONCLUSIONS:

Resource 4.6

Parent Help Required

Year 6/7
Room 12

Dear Parents

Over the last few weeks, our class has been investigating the recycling of the school's green and organic waste. We have completed our preliminary research and have moved into the phase of conducting certain experiments to determine the best direction to proceed. We believe that when we finally complete all of our investigations, we will be able to come up with a strategy for the school that will not only save the school money, but treat our green and organic waste in an environmentally friendly manner.

However, to achieve our aims, we are seeking your support. As part of our investigations we have determined that worm farming might play a role in any future strategy the school puts in place. It is one aspect of that we need assistance in investigating. We have found that the by-product of worms processing green and organic waste is a product called worm castings. Much of the literature highlights its value as a soil conditioner/ fertiliser, but before we commit our plan to utilising worm processing and its by-products, we want to be able to compare worm castings to chemical fertilisers.

To do this we have designed an experiment to compare the two types of soil additive. Unfortunately we do not have access to some of the materials required and so we would like to ask for any support you can provide, both to our class and in the future the school, by please donating any of the following materials:

- *Small to medium sized plastic pots (10-15 cm)*
- *Potting mix*
- *Any suitable chemical fertilisers*
- *Seeds or seedlings*
- *Worm castings*
- *Financial donation to purchase materials.*

If you are able to help us out, please return the following slip to our classroom. Thankyou for your assistance.

Our plant growth project

Name:

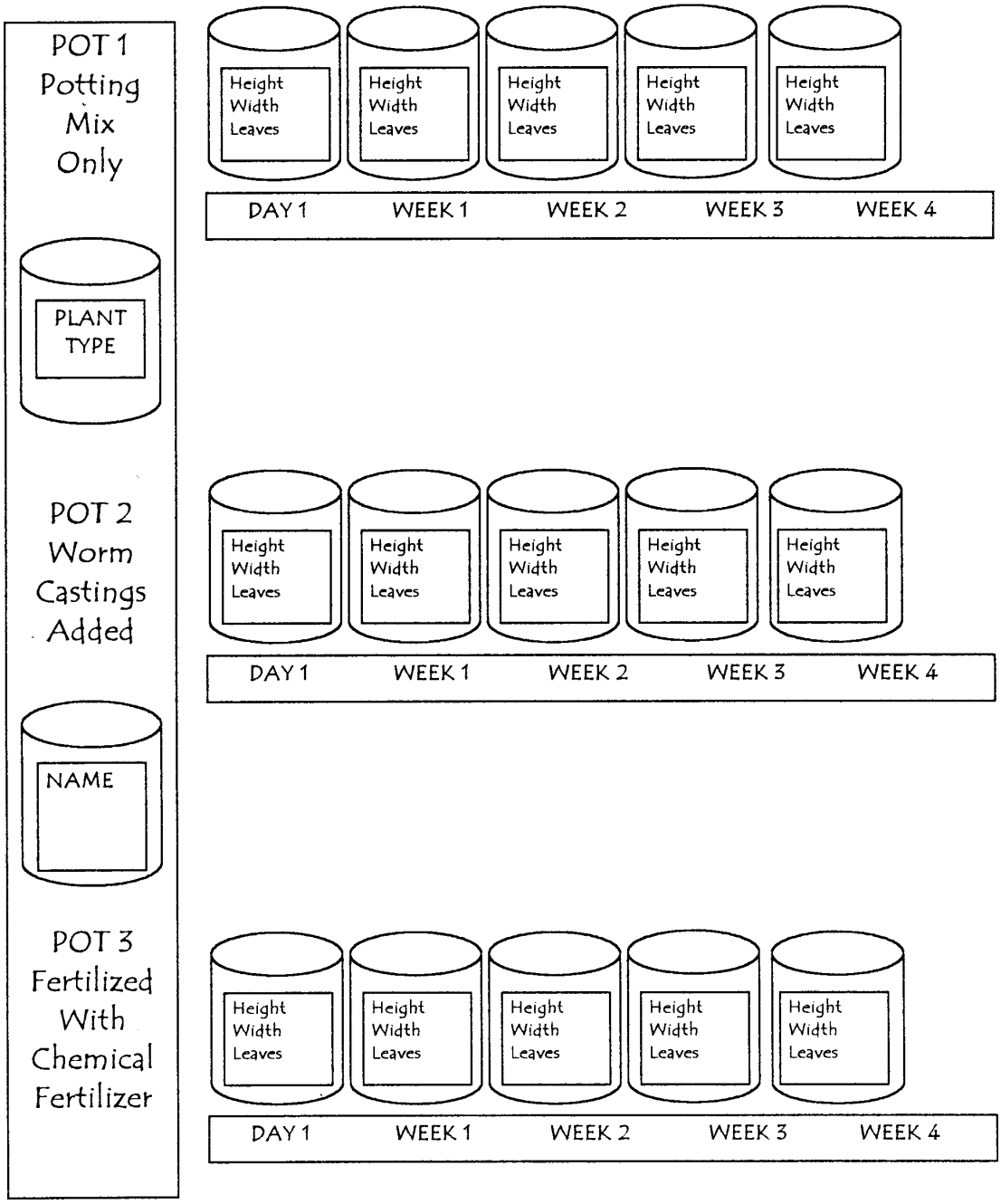
I can donate the following:

Resource 4.7

Plant Growth Record Sheet

Record plant growth each week.

- measure height
- measure width
- count the number of leaves
- illustrate the plant



Resource 4.8

Investigation Collation Sheet

Investigation Collation Sheet					
Students Name	**Plant type**	**Pot 1** Potting Mix Only	**Pot 2** Worms Castings added	**Pot 3** Chemical Fertiliser added	**Sign**
Total Points					

From individual “Plant Growth Record Sheets” fill in the above, including:

• Your name
• The type of seeds or seedlings used in the investiagtion
• A 1, 2, 3 point rating – this rating represents a point scheme where 3 points represents the pot that showed the best plant growth at the end of the four week period, and 1 point represents the least amount of growth
• Your initials (Sign)

When the sheet has been completed by all students then total points can be tallied.
The pot displaying the highest number of points will represent the most effective growing medium.

Unit 5

green waste matters!

MAKE A DIFFERENCE

- Set up a composting program

Synopsis

In this unit students and school personnel are encouraged to rethink their attitudes and behaviours in order to reduce, reuse and recycle green and organic materials previously considered rubbish. Models are provided for undertaking green waste minimisation actions at the local school level.

Students investigate what green waste is produced in the school, how it is produced and where it goes. After identifying suitable sites for environmental action, students find out about composting and worm farming processes and the management issues associated with them.

Students undertake a range of activities to manage their green waste, promote new values and facilitate behavioural changes to decrease the amount of green and organic waste going to landfill.

Learning Objectives

To enable students to develop an understanding of how to undertake an audit, action planning process and on-site composting program.

Resources

See ‘References and Bibliography’ for an annotated list of resources.

Introduction

Everyone has a role to play in recycling green and organic waste. Green and other organic wastes are identified as:

• all food waste
• garden waste, e.g. grass clippings, leaves, weeds, prunings and bushes
• some forestry waste e.g. bark and sawdust
• paper and cardboard products.

Green and other wastes are a large segment of the Australian solid waste stream. Organic waste can be over 30% of the waste we generate in Australia which, according to the estimates available, equates to a third of a tonne per person per annum.

Adapted from: An Information Sheet from the Environment Protection Group on Green and Other Organic Waste, Environment Australia.

Each of us is responsible for the generation of food waste; we are also responsible in part for the production of other wastes that are created by the process of providing us with the environs, goods and services we use in our schools, homes, shops and offices.

This unit is based on the premise that an average school could reduce its green and organic waste levels by up to 85% by introducing a simple set of practices and actions.

Set the students the challenge of seeing how little waste they can generate.

• Present students with statements and quotes that express people's deep connection with the environment, cited in Resource 5.1. Visit http://www.nidlink.com/~bobhard/seattle.html and discuss why the environment was important to Chief Seattle [Seeathl] (1786-1866), a chief of the Suquamish and Duwamish Indians.

~ Use these resources and their sentiments as a springboard for developing a graffiti wall which students annotate with statements, poems and symbols to describe the importance of taking action in and for environments.

• Ask questions about why it is important to minimise and manage the amount of green and organic waste we produce. Record ideas.

• Discuss what areas or sites within the school and local community most need onsite management. Record these.

Think before you throw these in the rubbish bin!

• Bring in a bag of clean mixed rubbish. Empty the bag's contents onto a sheet of plastic and invite students to make observations about the pile. Using tongs, gloves and five signs reading "Recycle, Reduce, Reuse, Compost, Landfill/ Disposal" placed around the edge of the rubbish plastic. Students select an item and place it against one of the signs, explaining why.

~ Prompt discussion and explanation of issues and attitudes, in particular about the choices we as individuals and groups make about waste.

• Support students' explanations into whether:

~ the rubbish pile is typical of that which is generated at their school
~ the school currently recycles efficiently
~ the school might need to promote the notion of reducing waste
~ the school and environment might benefit from sorting their waste and recycling, reusing and composting whatever they can.

Adapted from: Earthworks: Living with Less Waste – Trainers' Manual, page 40

• Focus specifically on the green and organic waste in the pile. Talk with students about:

~ green and organic waste being a large segment of the Australian solid waste stream.
~ green and organic waste comprising over 30% of the waste we generate in Australia which, according to estimates available, equates to 0.3 tonne per person per annum.

Source: An Information Sheet from the Environment Protection Group on Green and other Organic Waste, Environment Australia, 1998

• Ask students how green and organic waste might be recycled.

• Introduce students to the many ways in which they can live with less waste by reducing, reusing and recycling. Invite a Waste Educator from your local EPA or Council/ government body to visit and share information.

• Read Resource R6 and 5.2 entitled The Waste Hierarchy: The Three R's Reduce, Reuse, Recycle and Compost for information.

• Students research the various ways they can live with less waste by reducing, reusing and recycling. Encourage use of a range of Internet sites. For example:

http://www.globalpresence.com.au/exchange/about.htm
http://www.gould.edu.au/wastewise/index.html
http://www.ecorecycle.vic.gov.au
http://www.ac-grenoble.fr/yre/feee.htm
http://www.iisd.ca/
(also see References and Bibliography for other useful sites)

Record and display the information.

• Visit a local landfill, recycling or resource recovery site and ask about the many ways our personal efforts can reduce waste. Preplan questions. Share reports with Student Representative Councillors, the school environment group, school council members and the school community.

• Working in small groups, create a short role play to show how personal efforts can reduce waste at school. Share at a school assembly.

• Write news reports about the effects of not reducing, reusing, recycling and composting. Publish in school newsletters.

Focussing the inquiry

• Present the following scenario:

You have been asked to learn more about who generates what sort of rubbish in the school. This is your opportunity to discover just how much rubbish is in fact re-usable, recyclable, compostable or just plain avoidable in the first place. How will you do this? What areas of the school will you investigate and why? How might you gain an understanding of the amount of waste, the type of waste, and the sources from which it all originates in the school?

In groups, students identify what they might do, places to investigate and share ideas.

Students prepare a case why something should be done to discover just how much waste is generated, is re-usable, recyclable and compostable. Students:

~ identify the waste problem(s) associated with the school, e.g. grounds, canteen, classrooms, staffroom and office areas and suggest possible causes

~ indicate why they believe it is important to do something about waste generation and management at the school

~ rate the practicality of students undertaking action at the school.

Getting ready

• Talk with students in the class about the need to find out and learn more about who generates what sort of waste at the school, how it is disposed of and whether it is re-usable, recyclable or compostable. Explain that they need to develop a plan to guide their investigations and any actions arising from the investigations. Ask students to respond to the following questions:

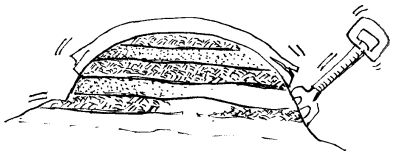
~ What questions do we need to ask to help us understand the waste problems of our school?
~ What do we need to do to undertake this project?

Record students' suggestions such as:

• find out if we need to obtain permission to go through the school's rubbish and sort it
• photograph student behaviours
• identify major and minor problem areas
• find out the amount of waste plastic, cans, paper, food scraps and glass being put into bins
• find out where it comes from
• find out if all classes have the same problems
• find out what students in other schools have done about similar issues
• decide what needs to be done and whose responsibility this is.

• As a class develop understandings and a focus for the investigation, e.g. green and organic waste management focus. Share R7 'School Based Green and Organic Waste Audit' and find out how an Australian school and computer company were challenged to change their ways. Share Resource 5.3 entitled "The Composting Classroom!" and "Being Green Pays Off". View the company's Internet site. See: *http://www.compaq.com.au/composting*

• Decide on an action plan. Use this for determining possible sources of information and to decide who is responsible for undertaking the various tasks. Use the prompt statements on Resource R3 "Action Planning" as a planning tool. Review the action plan, resources and contacts. Share it with the Principal, Student Representative Council, groundsperson and School Council, requesting feedback and suggestions for improvement.



Finding Out

• Arrange for students to undertake a school based green and organic waste audit. See Resource R7 and gain an awareness of:

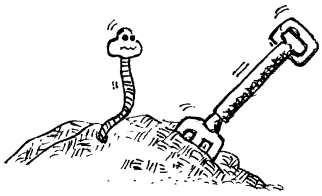
~ the amount of green and organic waste
~ the types of green and organic waste
~ the sources from which the green and organic wastes originate.

• Undertake activities to collect information to understand some of the on-site solutions available to schools. Begin with composting and/or worm farming.

• Place a selection of compost bins, worm farms or photos of different types of compost ingredients, some finished compost, worms or worm castings on display to generate interest in the class. Share some fascinating facts about compost, or worms and worm farming or ask a few interesting "Did you know?" type questions. See Resource R6 for more information.

Adapted from: Earth Works: Living with Less Waste – Trainers' Manual, page 48

• Give a compost or worm farming demonstration. See Resources 5.4 and 5.8 for details.



• Visit a home garden, local composting facility and report back on how to recycle green and organic waste and make compost or worm castings.

• Invite the groundsperson, a Waste Educator, Keep Australia Beautiful education officer or local council environment officer to visit the school and demonstrate how to build aerobic compost heaps or worm farms using school green and organic materials.

• Investigate the potential for establishing a compost or worm based recycling system at school. In groups, prepare proposals that students and staff and parents will accept. Find out:

~ How much it costs at present to dispose of the school's rubbish? Who pays for it?

~ How much of the school's rubbish is of a type that could be composted or processed by worms? (Check with Green Waste Audit results).

~ What are the benefits of composting and worm farming?

~ How the composting and worm farming processes work?

~ What materials can be composted or fed to worms?

~ What are the different methods of composting and worm farming?

~ What the best type of composting container or worm farm for the school's needs might be? How much they cost, how many are needed and where they should be placed?

~ What other items – shovels, forks, buckets, fertiliser, lime – might be needed and how much they will cost?

~ Who might coordinate the composting or worm farming project?

~ How might food wastes be collected and taken to the compost or worm farm area?

~ Who might maintain the compost heap or worm farm? That is covering with soil, adding fertiliser (blood and bone), turning the heap, manage and re-use the compost; or feed, water and manage the worms.

~ How much money might the school save if it composts or farm worms?

~ How might the students inform the rest of the school, Principal, staff, parents, local community and Education Department about the composting or worm farming system?

Adapted from: Composting heaps at school in Waste Matters, Environmental Education articles about waste, Gould League of Victoria Inc., 1993

• Present proposals during class meetings. Decide on a course of action and share this at the next SRC meeting and with the school Principal. Negotiate to have the proposal accepted and work out ways classes can help set up and maintain the composting or worm farming system.

• Develop a cross age tutoring project involving younger and older classes in the establishment and maintenance of a school compost or worm farming system. The older students manage the program, train and guide the younger students, collect the green and organic waste from classrooms each day, manage the compost heap and plan the spreading and sale of the compost and worm castings. See Resource 5.5 for planning details.

Adapted from: Cross-age tutoring, in Waste Matters, Environmental Education Activities About Waste, Gould League of Victoria Inc., 1993

• Older students may also assist younger students gain a range of understandings about composting or worm farming in cross age tutoring opportunities, for example:

~ investigations in the compost heap as the warm, moist environment makes it an ideal site for many animal homes, e.g. fungi, bacteria, millipedes, slugs, springtails and worms. (see Unit 3 resources for additional ideas and information about this)

~ rates of decomposition using common plant materials available locally with and without soil present (see Resource 5.6 "Wasting Away")

~ the temperature changes in compost which occur during decomposition

~ how often the material on a compost heap should be turned for the fastest compost production (see Resource 5.7 "When to turn so it will churn")

~ how to build a simple wormery in the classroom where worms can be kept safe and observations made weekly (see Resource 5.8 "Building a worm farm – its fun and easy!")

~ investigating whether and how earthworms can eat and recycle all foods that can be placed in the compost bin

~ investigating what composting worms need

~ investigating how a school can put compost, mulch and worms to work to reduce, reuse, and recycle its green and organic waste.

Each group prepares material about their investigations or tasks undertaken in composting or worm farming. As a class, make decisions about a common format if desired using programs such as *Powerpoint, Hyperstudio or Microworlds*, a video-taped presentation or a written report.

Where to now?

Green and organic waste management in schools and communities is a national and global issue. Encourage further exploration of what is being undertaken and achieved by investigating related projects in Australia and countries of the world.

• Talk with students about the value of making connections and sharing ideas with others who are managing their green and organic waste effectively in schools and local communities. Explain to students that having investigated the nature of the green and organic waste situation and managing at the school and identifying needs and issues related to this, they could find out what people in Australia and other countries have done to solve similar situations. Brainstorm ways to achieve this. For example:

~ Communicating with best-practice schools identified below
~ Establishing a discussion site on the school's homepage, seeking responses to student-generated questions
~ Writing to government officers associated with composting or vermiculture
~ Inviting officers associated with recycling organic matter to talk to students about successful projects both nationally and internationally
~ Using the Internet to research similar projects.

Suggested websites:
www.globalpresence.com.au/exchange/about.htm
www.hs.freeport.k12.me.us
www.vermico.com/index.html
www.ac-grenoble.fr/yre/feee.htm
www.edf.org/heap/a_compost
www.epa.gov/teachers
www.epa.gov/students/waste&.htm
www.dpa.act.gov.au/nowaste
www.gould.edu.au/wastewise/index.html
www.civeng.unsw.ed.au/water/awdb/awdb2.htm
www.vicnet.au/~when/

Allocate investigation tasks to small groups. Each group might:

• Define and record their task
• Identify and describe their findings
• Indicate how findings could assist the school in achieving its objectives in managing green and organic waste sustainably.

Reflecting on the learning

• Develop a green and organic waste management school policy in collaboration with the Principal, groundsperson and SRC. See Resource 2.8 "Developing a Green and Organic Waste Policy" for ideas and information.

• Discuss what and who benefits from the actions being undertaken and what can be continually improved upon to ensure long-term outcomes. Record and share with SRC, the Principal and with others at school assemblies.

• Prepare an environmental newsheet highlighting what has been achieved, how, and why. Publish and distribute to the school community.

• Undertake another Green Waste Audit and compare findings with the initial school audit. Report on the achievements being made and worked towards. Communicate the percentages of green and organic waste which currently make up the total waste disposed by the school. Share the positive effects this is having on the environment and how actions are significantly reducing the amount of rubbish going to landfill.

• Continually raise the school and its community's awareness of green organic waste issues and act as a vehicle for school and community participation in taking positive action in green and organic waste minimisation and management, e.g. prepare posters, E-mail announcements and achievements, develop slogans, badges and stickers, create a mural … all conveying messages to wider audiences about these issues.

• Develop a guide to ensure proper facilitation, management and care of the school composting or worm farming program for people implementing and using it. Present the guide to others through the school newsletter, special days or school homepage.

• Invite local waste educators, Keep Australia Beautiful officers and Council environment officers to visit and become familiar with the school's program.

• Undertake a public awareness campaign about the school's program through articles, advertisements or letters to the editor in the local media, and/or displays that highlight the need for community support and action.

Resource 5.1

Statements and Reflections

The quotations which follow are from *"A Dictionary of Environmental Quotations and Environmental Issues for the 1990's."* Students should focus on the sentiments being shared by each author.

"Use it up, wear it out, make it do, or do without."
New England Proverb

"Waste is not just stuff you throw away, of course, it's the stuff you use to excess."
Joy Williams, Esquire, 1989

"Waste isn't waste until its wasted."
Dan Knapp, Sierra Club Sourcebook, 1990

"High quality water is more than the dream of conservationists, more than a political slogan; high quality water, in the right quantity at the right place at the right time, is essential to health, recreation, and economic growth."
Edmund S. Muskie, U.S. Senator, speech, 1 March 1966

"Children of a culture born in a water-rich environment, we have never really learned how important water is to us. We understand it, but we do not respect it."
William Ashworth, Nor Any Drop To Drink, 1982

" … we have been educated to use; we shall now have to be re-educated to reuse, restore, renew and conserve."
Sam Levinson, New York Sunday News, 28 November 1971

"Recycling is a good thing to do. It makes people feel good to do it. The thing I want to emphasize is the vast difference recycling for the purpose of feeling good and recycling for the purpose of solving the trash problem."
Barry Commoner, Orion Nature Quarterly, Winter 1990

"If you are not recycling, you're throwing it all away."
Environmental Defense Fund, advertisement, Environment, 1990

"If we stop and put our house in order, we can have a pretty decent lifestyle for 5 billion people. If we stop 20 years down the line, I don't think we've got a hope in hell's chance."
Dr David Bellamy (U.K.)

"You can't ordinarily tell when you exterminate a single species what it will mean in the long run, any more than a pilot can tell you what will happen if you lose a rivet from the wing of an aeroplane. But any pilot can tell what will happen if you lose enough rivets, and any ecologist can tell you what will happen to our civilisation if we wipe out enough populations. The answer is the same – utter disaster."
Professor Paul Ehrlich (U.S.A.)

"There is alight at the end of the tunnel, and the particular light I see is the tremendous growth of grass roots movements throughout the world which are concerned about an ecologically sustainable future."
Professor Charles Birch (Australia)

"For the future, despite the depletion and abuse of natural resources, we must find hope in the wisdom of the past. The past as it is preserved by the present-such as the work of the weaver of fibres, the woman who cultivates, gathers, recycles …… The woman who knows and loves Papatuanuku and celebrates the bounty of the earth. This knowledge, if emulated and perpetuated, will serve as our strength and foundation for the times that lie ahead."
Ngahuia Te Awekotuku (New Zealand)
From Caldecott, L. and Leland, S. (Eds). (1983). Reclaim the Earth. Women speak out for life on Earth.
The Women's Press Ltd, London. p. 140

Resource 5.2

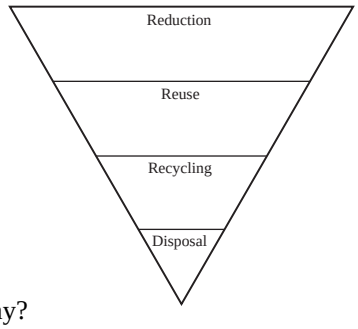
The Waste Hierarchy: The Three R's - Reduce, Reuse, Recycle and Compost.

It's all too easy to become overwhelmed by the problems; we need to focus on solutions.

The amount of green and other organic waste we create must be reduced. We all create it, and we all have a part to play in reducing it. We can all learn and help to educate each other in the many practical ways in which we can make less green and organic waste.

'Reduce' simply means not creating green and other organic waste in the first place or creating as little as possible.

Your challenge is to consider how this might be possible. State your ideas.



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Here are some 'reduce' questions you can ask yourself:

- Do I really want to peel this apple?
- Is there a simpler, less wasteful alternative to throwing these foods scraps away?
- How can I maintain, repair or restore the school garden with these grass clippings?
- What are the environmental impacts of my actions?

Re-use

The best type of reuse is to use an item again for the same, or a similar, purpose. You can reuse green and organic items as mulch or as food for the compost bin or worm farm.

Some 're-use' questions you can ask yourself are;

- Just because I no longer need it, does it have to become waste?
- Can it be used elsewhere?
- Is there a re-usable alternative to throwing this away?

Recycle

Recycling involves breaking down the materials of a used product and using those materials to make something new. The most common things that can be recycled from a school or household's green and organic waste are:

- All food waste
- Grass clippings
- Leaves
- Prunings from trees and shrubs
- Weeds

Some recycling questions to ask yourself are:

- Is it made from materials that can be recycled, and is there a local collection for them?
- Can the item easily be recycled, or are the materials mixed in such a way that they are difficult to separate?

Adapted from: Earthworks South Australia, Participant's Notes. KESAB, Adelaide, 1998

Resource 5.3

The Composting Classroom

Being Green Pays Off

The media - print and electronic - have a lot to say about cooperative actions being undertaken to improve the quality of the environment. Read the following newspaper article from The Australian.

Publication: The Australian June 3, 1997 page 9
Byline: PHILLIPPA YELLAND
Headline: BEING GREEN PAYS OFF FOR DIGITAL

DIGITAL Australia has won a $20,000 grant for its composting program from the NSW Environment Protection Authority.

It will use the grant to create a Web site and a brochure, which explains how other companies can create a similar composting system.
The award recognises Digital as being one of the first companies in Australia to use a close-looped composting operation to reduce the amount of green waste it produces.
Green waste includes garden clipping, food scraps and wool waste.
Digital produces more than one tonne of finished compost a month at its Rhodes based Australian headquarters alone.
Close-loop composting takes organic material (in this case, food and garden waste), and transforms it into compost, at the same place where the material is generated.
To complete the loop, the compost is then used on the site it originated.
The close-loop system eliminates the need for sophisticated collection.
The compost waste comes from several areas at Digital.
These include: 1 Cafeteria - Digital has about 700 employees at its Rhodes head office who use the on-site cafeteria at least once a day.
The waste left at the cafeteria is sorted into compostable and noncompostable waste.
Tearooms - Digital's tearooms now all have organic collection points for food waste to be composed.
Garden clippings - clippings from Digital gardens and grounds are used for composting.
"Combining the cafeteria, tea room and garden waste, we divert about 500 litres of organic material a day from the kitchens and grounds to the composter bins." Digital's environmental manager Eedra Zey says.
"This adds up to about one tone of finished compost every month, which is reused on the company grounds and offered to employees to purchase for home used.
"Before we implemented composting as part of a comprehensive waste-minimisation program, we were having around 20 rubbish skips removed each week. Now, we're lucky to fill eight bins a week."
The Digital composting initiative is part of a larger waste minimisation system, which applies to all Digital sites.
This includes the Australian headquarters of Digital's PC business unit in Lane Cove, Sydney, and it's manufacturing plant.

For more information also see http://www.compaq.com.au/composting

Answer the following questions.
1. What is the issue featured in this article?
2. Where does it occur?
3. How is it caused?
4. What are the solutions?
5. Why is this issue of concern to society?
6. What aspects of our society have an impact on this issue?
7. What are some of the points of view that relate to this issue?
8. How has this issue developed over time?
9. What is understood about this issue?

The Composting Classroom

Background

Staff and students at Dimboola-Pimpinio Primary School (a rural school located in north western Victoria, about mid-way between Melbourne and Adelaide) have incorporated into the curriculum, the trialling of a new method of composting food scraps. The Japanese developed method is called ‘EM Bokashi.’

This is a Japanese term meaning ‘fermented organic matter.’ Unlike the outdoor compost bin that most of the world is familiar with, EM Bokashi food waste can be efficiently composted into nutrient rich garden soil without the unpleasant smell associated with the decay of current aerobic composting methods. This means that food waste compost bucket can remain in the classroom until it is ready to be dug into the soil-thus making it accessible for adding scraps daily.

This is the first time children in Australia have used this method to compost food scraps. EM Bokashi is used in many schools around the world including Japan and the students are enjoying sharing and comparing with other international Bokashi via the Internet.

EM Bokashi compost starter

EM Bokashi compost starter is a unique product used to recycle kitchen waste into an organic soil conditioner. It consists of rice pollard (or wheat bran) that is inoculated with EM (Effective Micro-organisms) that helps balance the microbial ecology of the soil and supply nutrients to your garden.

What is EM?

EM is the abbreviation of Effective Micro-organisms, originated by Dr Teruo Higa. It is a mixed microbial culture of selected species of lactic acid bacteria, yeasts, photosynthetic bacteria and actinomycetes, a group of fungi. All of these are mutually compatible with one another and co-exist in liquid culture. When applied to the soil as an inoculant, these micro-organisms function co-operatively to exert beneficial effects on soil quality. Some of the micro-organisms in EM are known to produce bio-active substances such as vitamins, hormones, enzymes and antibiotics that can directly, or indirectly, enhance plant growth and protection. It also has many uses for environmental applications.

How to recycle food waste with EM Bokashi compost starter

Materials needed

• A 20 litre bucket with an air-tight lid that will provide an hermetically sealed environment (anaerobic condition).
• EM Bokashi compost starter
• Food wastes of all kinds. The amount of organic waste will vary from day to day depending on students eating habits. Use only organic material, exclude paper, plastics, aluminium cans, tea bags etc.

Method and application

• Place an initial layer of EM Bokashi at the bottom of the plastic bucket before any food scraps are added.
• Put a layer of food scraps in the bucket and coat it with a layer of EM Bokashi. For less than an 8 centimetre layer of food scraps, sprinkle 2 handfuls of EM Bokashi to cover the entire surface.
• Press down firmly on the scraps and seal the bucket with the lid.
• Keep repeating the process as needed.
• Periodically, drain the liquid that has collected in the bottom of the bucket. The liquid is alive with Effective Micro-organisms and is a terrific fertilizer. You can apply this liquid to your plants at a dilution rate of 1:1000, or p[our it down drains to stop odours and scum build up. This liquid cannot be stored so please use it that day.
• Once the bucket is full, drain any remaining liquid from the bottom and leave the food scraps to ferment for 7-10 days at room temperature. The appearance of Ray Fungi (a white mould) on the surface of the food scraps indicate that fermentation is in progress.

• After fermentation, the food scraps will have a sweet/sour smell like pickles. The food scraps will also retain most of their shape and colour as they have fermented and not decomposed. The scraps will break down when dug into the ground.

You now have two options for transferring the compost

Option 1
Dig a trench 45 centimetres deep and bury the compost in the ground. Cover the trench with soil and wait two weeks before planting.

Option 2
Fill a planter pot with one third soil, then add kitchen scraps and top the pot up with soil. Leave for two weeks, then either add to the garden or use in pots.

Helpful Hints

• You can never add too much EM Bokashi to the food scraps. Better too much than too little.
• Only add *fresh* food scraps to your bucket. Never add rotten food.
• Remove air from the food scraps for better fermentation by firmly pressing down the scraps.
• Always close the lid and drain the liquid that accumulates at the bottom.
• Wash the bucket after use.

How to make EM Bokashi

Materials needed

10 kgs rice pollard
20 mls molasses
20mls EM
2 litres of water
large lidded container lined with newspaper

Method

Spread rice pollard onto waterproof sheet.
Mix together molasses and EM, add to water, mix well. Apply to rice pollard using a fine spray applicator. Rub liquid into pollard, taking care to break down any clumps that may develop. When all liquid has been distributed through pollard, mixture can be transferred to lined bucket. It is important to pack mixture in well, *pushing* out air with each 10 cm layer.
Cover with more newspaper and seal. Leave for 10-14 days in a warm spot. Bokashi is ready according to its smell-a sweet/sour fermented smell.
Shelf life approximately one month (if dried it will last for 12 months).

Contact

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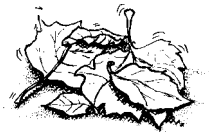
Resource 5.4

How to give a composting demonstration

The Composting Demonstration

Giving compost demonstrations is a lot of fun and a great way to enthuse and encourage others to ‘have a go’ at home composting. Here is a general guide to conducting a public compost demonstration, but please remember that there is no one right way to do this. Get the basic content from here, and then use your own great ideas and creativity and do your demonstrations the way that works best for you.



Materials You Will Need

Use see-through, wide mouthed sample jars, containing the following:

- Garden prunings cut into small lengths (10-15 cm)
- Leaves
- Grass clippings
- Kitchen scraps (Good ones to use for demonstrations are cabbage, grated carrots, bread, apple slices and tea bags. Don’t use anything that will begin to smell by the end of the day)
- Vacuum cleaner contents
- Hair from the hairdressers - great slow-release nitrogen material
- Pelletised chicken or cow manure
- Soil
- Lime, dolomite or wood ash
- Brown paper bags
- Two or three newspapers
- Finished compost
- 1000-2000 compost worms.

If your containers are a 2 litre size or bigger you should be able to fit enough materials in them for five or six demonstrations. Top the containers up before the next day’s demonstrations.

Other Equipment You Will Need

- A home compost bin of the type that local councils sells
- Clear laminated signs for each ingredient on the table
- A small watering can to add moisture
- A clear circular container with a hollow top and bottom, in which to do the demonstration - a used and worn-out 20 L plastic filtered water container, cut off top and bottom, is ideal
- A shallow tray to fit under the demonstration container to catch the water.

Setting Up the Demonstration

- Have your table set up with your sample ingredients in jars with their lids off, along the front of the table (containers with large opening make things a lot easier)
- Have your kitchen scraps in a 5-8 L container with a neat but easy to remove lid
- Have your clear demonstration container on the drip tray in the centre of the table, with half the ingredient containers on one side and half on the other
- Have your filled watering can handy
- Have ready an empty 20L bucket that you can tip the ingredients into after your demonstration. Then take it home and add it to the compost heap - don’t put it into the bin!

Running the Demonstration

Begin a couple of minutes before your scheduled time by chatting about the huge amount of waste we all generate. Almost a tonne per person per year in Australia. Almost half of the 'waste is compostable materials…and so forth.

'In one teaspoon of rich compost there can be up to 3-4 billion living organisms. It is this abundance of life that is the key to healthy soils and plants. Compost is about creating and breeding amazing life.'

(Hold up a handful of compost and tell the audience that there are probably more living microscopic organisms in your hand than there are human beings on the entire planet, there are 5-6 billion humans).

Explain that it is the living things in compost that turn 'this (hold up scraps)…into this' (hold up finished compost). Emphasise the importance and value of all living things (including 'creepy crawlies' in the compost). Highlight the fact that chlorine products and synthetic pesticides kill off these living organisms. Point out that compost is a wonderfully alive system and needs to be managed properly.

Diversity

'Diversity is the heart and strength of all living systems. For compost to work quickly, and to finish up with a well-balanced end product, it is important to add as many different things to the heap as possible. Diversity is the key.'

(State some of the possible ingredients. Put a layer of coarse materials in the very bottom of the demonstration container and say that these are for aeration - you will explain this in a minute).

'But how do we know what we know what we can and cannot add? Well, there is a simple question that people can ask themselves; was it once part of a plant or animal? If the answer is yes, then it is probably OK to go into the compost - but cat and dog faeces and meat can be a problem in compost. Why?

Add a couple more ingredients (for example, grass clippings or kitchen scraps) in thin layers - stress the thin layers.

Aeration and Moisture

'Air (oxygen) is critical to composting because it helps to speed up the process and prevent bad smells.'

Explain this: hold up scraps and some finished compost and state that these are two types of organisms that decompose 'this (the scraps)…into this' (the finished compost): 'aerobic - these organisms need oxygen and cause quick, hot decomposition, with no offensive odours; and anaerobic - these organisms live and work where there is no oxygen and are responsible for all the bad smells. Compost heaps need to be built in a way that ensures that air (oxygen) can get in and encourage the sweet smelling aerobic microbes. How you do this is by adding layers of "coarse" materials (such as leaves, sticks and twigs) regularly in the building of the heap. Turning the heap regularly (every two weeks) also helps aerate it and mix up the materials (and dissuades rodents from nesting there).'

Ask the group the question: "What happens if we don't drink?" (Answer: " We die.") "Well, so does your compost heap if it isn't kept nice and moist. Compost heaps need to have a moisture content of 50-60% for microbes to work quickly and efficiently."

(Add some water from the watering can to the demonstration container. Mention that all the wastewater from cooking, old coffee and tea and soft drinks can be collected in a container and added to the compost heap).

'You should be able to squeeze a drop or two of moisture out of a handful of compost from your heap. The secret of good composting is to find the delicate balance between adequate moisture and plenty of air.'

Summarise the demonstration: it is important to provide an opportunity for the class to ask questions.

Source: adapted from Earth Works South Australia, Participants Notes pp 73-76.

Resource 5.5

Cross-age Composting

Cross-age tutoring projects, problem solving and cooperative learning opportunities are feasible, exciting and important elements of any school learning program.

These strategies:

Challenge all students in non-threatening ways
Actively involve students in interesting experiences
Allow for risk-taking and learning from mistakes
Evoke a variety of responses
Assist student's confidence
Give student's responsibility for their own learning
Develop a range of skills
Allow for self and peer assessment.

Establishing and maintaining a school compost system as a cross-age tutoring project requires appropriate planning in the areas of:

Getting started
Finding suitable activities
Assessment
Management

The suggestions, which follow, offer a range of suggestions for each of these areas. Teachers should select activities that suit their students' needs. We hope you find the ideas stimulating and a good starting point.

Getting Started

1. Involve all staff in the consideration of a 'cross-age composting' program.

2. Ensure all students understand composting and its benefits.

3. Set aside an appropriate area in the school grounds for the siting of the compost bin(s) or heap. This area requires some sunlight and should be easily accessible. Allow for expansion as more classes or families generate, collect and compost their waste.

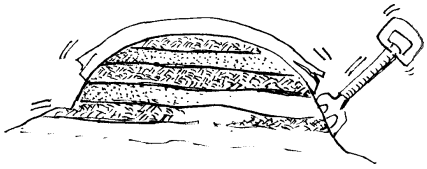
4. Decide upon the design of the compost bin or heap. Obtain information on various designs. Consider - is the bin or heap to be purchased or designed and constructed by students or parents and friends' working bees?
If constructed, what funds are available and who might assist?

5. Ensure that appropriate food waste container (with lids) are obtained and made available to all classrooms, the canteen and staffroom, ie a 2 or 5 litre icecream bucket.

6. Ensure food scrap bins are positioned strategically around the school grounds.

7. "Pair" the senior and junior students.

8. Organise a daily food waste collection roster.



9. Appoint senior students as managers of the compost heap. Encourage them to work cooperatively with the school groundsperson in the maintenance of the heap.

Senior students will need to know and understand:

The many things that can be added to the compost bin or heap, i.e. things that were once part of a plant or animal.

The things that can't be added to the heap, e.g. meat, bones, dog and cat faeces.

How to layer the heap or bin ie a layer of coarse material at the very bottom and covering each layer with a thin layer of soil.

Need to aerate the heap by adding layers of "coarse bulky" materials (such as leaves, twigs and sticks) regularly in the building of the heap and turning the heap regularly (every two weeks) to help aerate it and mix up the materials.

The need to evenly moisten the compost heap with water from a watering can.

The value of adding composting worms to the compost heap.

The abundance of life that is the key to a healthy compost, healthy plants and soils.

The secret of good composting is finding the delicate balance between plenty of moisture and plenty of air.

Resource 5.6

Wasting Away

Composting is simply a method of decomposing kitchen and garden waste in a large container or heap.

Your challenge is to design and conduct an experiment to compare the decomposition of some common plant materials over a two week period; to observe and record the rate of decomposition of these materials both with and without soil.

In addition record your work including information about planning and conducting your investigation and then processing data and evaluating your findings.

You will need:
10 glass jars with lids
5 different materials that could be placed in compost bin
Some rich garden soil
A spoon
A spray bottle of water
A record sheet.

Find out:

Which materials changed the most over the two weeks with and without the addition of soil?
Where the moulds and bacteria originated from in the experiments with and without the addition of soil.
Whether dry or moist conditions affect the rate of decomposition both with and without the addition of soil.
Which materials decomposed the fasted with and without the soil?
What are the ideal conditions for composting?

Adapted from: Moulide Oldies, in Waste Matters - Environmental education activities about waste, Gould League of Victoria Inc, 1993.

Resource 5.7

“When To Turn” so it will churn

Many schools and households compost food and garden waste in large plastic compost bins with close-fitting lids. The bins are completely sealed, although they are open at the base and therefore should sit in the soil to allow liquids to seep away. In these bins, bacteria that thrive in the absence of oxygen are responsible for the breakdown of the organic material. This process is called *anaerobic decomposition.* In this type of bin the compost is not turned.

Most other structures used for composting are more open in construction. This allows for the entry of air into the decomposing material. Such structures include enclosures made from wooden boards, bricks, chicken wire and plastic. In these containers and in open heaps, bacteria and fungi, which thrive with abundant oxygen, are responsible for the decomposition. This process is called *aerobic decomposition.* With open heaps an open-construction structures, it is usually recommended that the heaps of organic material are *turned regularly* to allow more oxygen to enter the heap and so speed up the rate of decomposition.

Your challenge is to investigate how often the material in a compost heap should be turned for the fastest compost production.

Therefore you will need:

5 identical containers with lids, e.g. recycled buckets - bases removed
sharp knife
mixed kitchen scraps (no meat or dairy products)
shredded paper
grass clippings and leaves
garden soil
fork
felt pen
small garden shovel
a record sheet.

Write a record of your work including information about planning and conducting your investigation and then processing and evaluating your findings.

Record details about how you:

turned the compost
when you turned the compost
observed changes in the colour, texture, smell and breakdown of the organic materials during the decomposition process.

Your technique will require you to make compost in a number of identical, medium sized structures or containers. Try to use recycled materials here.

Read up on how to compost successfully as this will be useful.

Resource 5.8

Building a Worm Farm. It's fun and easy.

An earthworm farm can be made from any large container. For example, a styrofoam box makes an ideal home for earthworms.

Your *challenge* is to *build a worm farm*, which has s*mall holes* in the bottom of the box so that there are no problems with drainage and so that the worms will not drown.

You will need to

Half fill the box with *bedding material* for the worms - this may be garden soil which can be mixed with organic matter such as decomposed compost, cow manure, sheep manure or horse manure.
Moisten the bedding with a *fine spray of water*, as worms need moisture to survive.
Add small pieces of *food scraps* in *heaps* on areas of the bedding surface.
Add a layer of *composting earthworms* on top. The worms will congregate in the scraps or tunnel beneath the surface.

To *maintain* your worm farm, you will need to

Ensure that citrus peel, onions, garlic and artichokes are not given to the worms.
Ensure that the bedding remains a neutral environment, around *pH 7*.
Sprinkle the surface with *lime or dolomite* every 2 or 3 weeks, as this keeps the mixture sweet and palatable for the worms.
Keep the worm farm in a *cool* well-protected shady place, which can be either inside or outside the classroom.
Cover the worm farm, keeping it dark and well protected. Weed matting, hessian or old, clean carpet is useful as they help the farm to retain moisture and does not seal the surface, but allows water to pass into the soil. It also allows oxygen to get into the soil for the worms to breathe.
Add more *food scraps* when the worms have partially eaten the available scraps.
Observe how over time the scraps and bedding will be converted into rich organic substance called *vermi-compost*.
Harvest the vermi-compost after approximately three months. Separate the worms from the vermi-compost and use it on the school garden. Worms are *light sensitive*, therefore use a desk lamp to help in the separating process. Consider how you might do this?

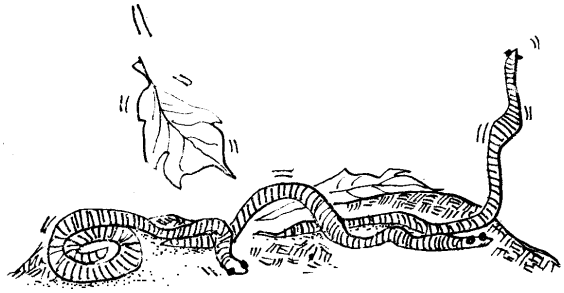
For example:

Hypothesis - earthworms are sensitive to different forms of light.

Revise your experiment to see whether this is accurate by:

STEP 1 Researching and investigating the claim, recording sources of information.

STEP 2 Stating the conclusions you have drawn from your research and investigation.



STEP 3 Taking into account this code of ethics

Only use the minimum number of composting earthworms needed.
Ensuring that capturing, transporting or using the composting earthworms does not harm or kill them.
Not damaging the environment whilst collecting composting earthworms
Feeding composting earthworms over weekends and holidays
Never exceeding the range of conditions that the composting earthworms would experience in their natural environment.

STEP 4 Recording results from observations.

STEP 5 Drawing conclusions from your observations.

STEP 6 Comparing your findings with those from research and investigation.

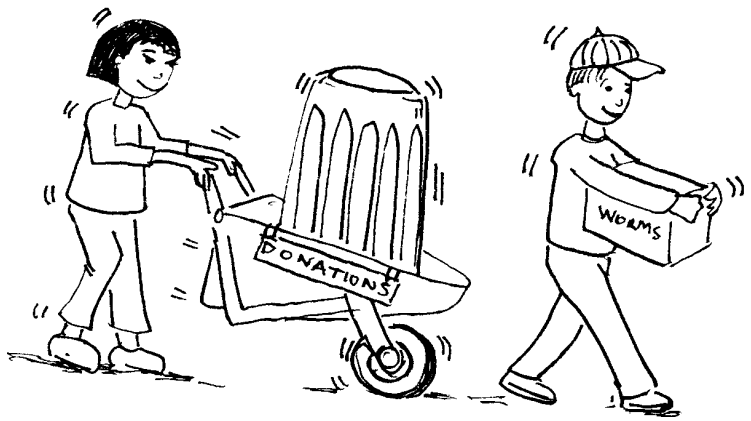
STEP 7 Devising a way to present/share your results.

Adapted from: Kids for Landcare: Wormwatch, *Education Department of South Australia, 1992, pp.16, 75 & 83.*

Unit 6

green waste matters!

WASTE OR WEALTH?



Synopsis

This unit introduces students to understandings about enterprise and innovation.

Students investigate how a vermiculture and/or composting enterprise may effect waste minimisation and management strategies in their school.

Students see that by identifying a new need, a new enterprise can be established.

Students use understandings and skills gained to farm worms, market their by-products, promote a school-based waste management project and run a business.

Learning Objectives

To enable students to develop a greater awareness and appreciation of the opportunities of small business, entrepeneurship, and self-employment in the green and organic waste management area.

Resources

See ‘References and Bibliography’ for an annotated list of resources.

Learning Activities

This program has been adapted from a proven system that was put in place in a South Australian Primary School (See Resource 6.1 “Mitcham Case Study”).

What to recycle and what to sell

Utilising the knowledge gained from previous work on recycling green and organic materials, students list all the by-products they are aware of in relation to green and organic waste recycling.

As a class work through the list, discussing each product and its potential for sale.

When a list of all possible saleable products is exhausted, students then discuss which products they would like to produce and market. This will also determine the types of recycling activities that will make up the program.

For the purpose of this example compost, paper waste and worm castings will be produced for marketing.

Informing the School

As any planned Green and Organic Recycling Enterprise Program will involve and impact on sections of the whole school, it is important that students keep the Principal, staff, other classes, groundsperson, canteen staff and parents aware of the proposed activities. Students will also need to inform them of any possible involvement they may have.

Initially it will be important to seek permission from certain members of the groups mentioned above, e.g. the Principal and other staff members, before actually proceeding with the program. Refer to Resources R2 “Developing a Green and Organic Waste Policy”, R3 “Action Planning” and R4 “Resource for SRC.”

• As a class, students brainstorm a range of procedures they might adopt in order to seek the permission they require and to inform the necessary individuals of their proposed plans.

Seeking permission

• Students arrange a time to visit the Principal to seek permission to go ahead with their Green and Organic Recycling Enterprise (also referred to in this unit as the Enterprise). Prior to the meeting students, as a class, plan their verbal presentation. Information that they may wish to present to the Principal could include:

• The aim of the Enterprise

• A brief description of what will actually take place.

• The possible need for funding

• How the Green and Organic Recycling Enterprise will impact on: the staff, other students, the parents, the groundsperson, the office and canteen staff and the local community

• The benefits for the school and the wider community of recycling the green and organic waste.

• Students elect representatives to meet with the Principal, to attend a staff meeting and present ideas to the staff.

How best to inform the school

• Once permission has been granted to involve the school in their Green and Organic Recycling Enterprise Program, students, as a class, decide

on the most appropriate means to inform the school of their plans.

This initial contact is seen as a way of students letting others within the school know of their plans. Further, more specific details will need to be provided as students work through the project planning as it will be very important to keep everyone informed and up to date, particularly those who will be required to be involved in a more 'hands on' manner.

Business Structure

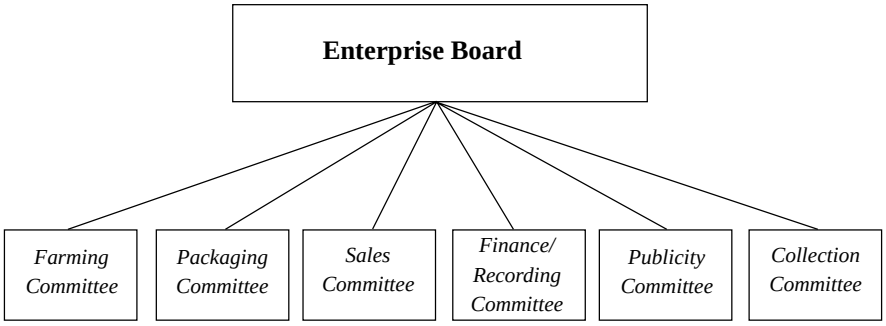
There are a range of ways to organise a Green and Organic Recycling Enterprise Program within the class. The example highlighted in this unit uses a 'company type' of structure, but as 'ownership' of the program will be important in its on-going success, it is vital that the structure utilised to manage the Enterprise is one chosen by the students themselves.

• Students research the various structures utilised by businesses. Information can be gathered from a variety of sources.

• Having accessed a variety of information about different types of business structures, as a class, students discuss the various types and decide on which structure suits their needs the best.

The Company Model

A suggested structure for the Green and Organic Recycling Enterprise could be:



Committees / Working Groups?

• Having decided on a form of business structure students will then need to decide the specifics of the structure. Using the research and information collected during their investigations students, as a class, brainstorm the type of tasks that need to be undertaken as part of the program. These can form the basis of the committees/working groups assigned to work on the particular tasks identified.

• Once the makeup of the committees/working groups has been finalised students need to decide on the particular roles of the committee/working groups within the program, ensuring all necessary tasks are catered for. The size of the committees will vary depending on the tasks they are responsible for.

Note: students might benefit from changing committees at the end of each term in order to experience a broader range of roles and responsibilities. This could be determined by the board or controlling body.

Committee Elections

Companies, committees/groups are known to perform at a more efficient level if the individuals involved are working in an area of their choice. However, when filling any such positions there is also a need for individuals with an understanding of the role they are to play and have some expertise in that area.

Provide students with a model of how State and Federal government members are elected.

• Students discuss the above statement and related questions highlighted below in small groups with the aim of working out a means to best fill the committee positions available. Record the suggestions on a large sheet of butcher's paper. Display all the sheets around the classroom for students to read.

• On what basis are people elected to parliament?

• How do voters choose the candidate they prefer?

• What information is provided by candidates to help them decide on who to vote for?

• Does voting for a friend mean you get the best person for the job? Why or why not?

• Should a secret ballot be used? Why?

• How could this type of electoral system be modified by students to fill the committee positions?

• As a class, students, having read all the group's suggestions, discuss the pros and cons of the various ideas before a vote is held to ascertain the most popular means to fill committee positions.

A suggested committee voting paper is given below. It can be modified for use in electricity members for the Board and various subcommittees.

VOTING PAPER

Five candidates are to be elected. Voters should place an X in the box next to the names of their preferred candidates. You can vote for say five or less candidates. Candidates receiving the most votes will be elected to the committee.

Candidate 1

Candidate 2

Candidate 3

Candidate 4

Candidate 5

Candidate 6

(insert name of candidate, ie Jones, Jennifer)

Authorised by teacher, XY school

Committees and their roles

The particular tasks and roles within the committees or groups are decided by the individual members of each committee/group.

Collection

The Collection Committee is responsible for designing a collection system for the school's green and organic materials. Students will have to consider a range of variables when planning, including:

• Whether waste is separated at the source into the various types or mixed together? If all waste is collected and placed in a single container students will need to put in place a system that encourages everyone in the school to separate the green and organic waste from other types.

• Students investigate how the current waste disposal system functions.

• Committee members then discuss how the current system can be adapted to fit in with the Green and Organic Recycling Enterprise.

• Students plan their strategy to collect the green and organic waste.

• Students then prepare an oral and visual display to present to the Board for ratification.

• Once any required changes to the plan have been made committee members then present the final draft to the Principal and/or staff for approval. The final draft will need to consider the following points:

• The various areas of the school where waste is produced or stockpiled, e.g. classrooms, canteen, staffroom, office area and grounds.

• Students arrange an appointment with the groundsperson to discuss current location of green and organic waste stockpiles.

• The type of containers and equipment required to ensure that there is no risk to health and odour is kept to an absolute minimum, particularly in classrooms where food scraps might be stored until collection time.

• Students investigate to find out what is available within the school, if it is suitable, and if not what they are required to access from the broader community.

• Students design flyers, newsletter articles, posters, class or assembly presentations seeking donations of the required materials.

• The collection routine is as quick and non-invasive as possible, causing the least amount of disruption to the various members of the school population.

~ Students will be required to investigate and gain an understanding of the school timetable and the existing waste collection routines.

• A collection time during the day that has the least impact on those involved, i.e. classes, students managing the program, staff, canteen and office personnel and groundsperson.

• The area required for storage and treatment of the collected materials. This will need to be:

~ Of a reasonable size as it must cater for storage, treatment, future package and storage of the by-products.
~ Secure to avoid damage from vandals.
~ Located in a region away from areas of human usage, mainly because of possible odour and noise associated with students maintaining any composting or worm farming systems.

~ If possible, protected from extreme heat and rain but still in an area of good airflow. This is more a requirement of the worm farm than the compost area which can be set up undercover if necessary (as long as airflow is of a reasonable level).
~ Close to a water supply.
~Sited to minimise the time required to move to and from the area.
~Sited near some form of storage shed for equipment utilised in maintaining the systems.
~ Easily accessible for the groundsperson.

• Students investigate suitable areas in association with the groundsperson, ensuring that an appointment is made at a time that causes the least interruption to their work.

Farming Committee

The Farming Committee is responsible for the management and treatment of the green and organic waste collected. Students will have to consider a range of variables when planning, including:

As this particular committee will be responsible for the production of the products the company is to market they will need to decide the type of composting system they will require, what type of worm farm and what type of equipment will be required to maintain the systems. When investigating it would be valuable for students to inquire about the merits of the following:

Composting systems

• Plastic bins with ventilation holes or slits
• Plastic bins without ventilation
• Metal drums with holes punched in the sides and with the base removed
• Rotating drum units (tumblers)
• Enclosures made from timber (planks or sleepers), bricks, or chicken wire
• Windrows

Composting methods

• The layering method (slow and cool)
• The “all in together” method (fast and hot)

Source: EcoRecycle Victoria Information Sheets 11 (Composting) and 12 (Composting Methods) (provided in Resource Bank)

Worm systems

• Containers, e.g. foam boxes, wooden crates, metal drums cut in half, plastic drums, commercially manufactured worm farms

• Pits or beds, or windrows

• Students investigate the various composting and worm farming systems available. Students can utilise a range of support people.

Students organise visits to a commercial worm farm or composting operation. By contacting the AWGA, the Australian Worm Growers Association in their state, they will be able to access a list of commercial worm farmers and the names of large scale composting operations could be accessed through the EPA.

Having accessed a variety of information from different sources students will need to consider a range of variables before deciding on the most appropriate systems for their school. These include:

• Quantity of waste to be processed. Students can assess this via the results of the school’s green and organic waste audit (See “Green and Organic Waste Audit”).

• Area required and available for the treatment site.

~ Students will need to collaborate with Collection Committee to ensure that the area chosen meets the needs of both groups.

• Whether the particular system requires locating in a shaded or open area.

• The type of pre-processing treatment required before green and organic material is fed to worms.

~ Students can assess these requirements from investigations conducted in a previous unit.
See also Resources 4.3 and R6.

• The types of equipment required for each of the different systems. These could include:

~ pH tester kit to measure pH of bedding material
~ Material to use as starter bedding for the worms, e.g. worm castings, thoroughly leached horse manure, or peat moss compost, or coconut fibre .
~ Forks for turning the bedding material
~ Old hessian-backed carpet, underfelt, hessian or hessian bags, weed mating, plastic (for shaded areas only)
~ Spray nozzle for hose or watering cans for consistency when watering
~ Rubber gloves.

• Students will then need to assess what is required, what they can access from the school or what they will be required to borrow, have donated or purchase.

• Whether students intend to collect liquid run off from the wormery bedding. It is also a marketable commodity as a liquid fertiliser.

• From their research, students will also need to plan the maintenance routine of the chosen system including:

~ Pre-processing of raw green and organic waste materials (if necessary).
~ Feeding routine, when and how?
~ Watering routine, when and how?
~ Turning of the bedding on a regular basis; how often?
~ Regularity of pH testing, what it means and how students can take steps to control any irregularities?
~ Harvesting of worm castings. How often? How it is done? What is required to harvest the worm castings? Students will need to liase with the whole company as harvesting is best done just prior to the selling of the products. If this is not possible, students will need to decide on the form and storage location of the harvested products while awaiting packaging and sale of the products.

The majority of the information required can be found in a range of sources, e.g. worm farmers, books, the Internet.

Packaging

The Packaging Committee is responsible for designing appropriate packaging for the products produced. In regard to the sale of the paper products collected as part of the program, the Packaging Committee is responsible for the storage and packaging for delivery or collection of this material.

To determine the type of packing required for the compost, the worm castings and the liquid (if collected) students will need to consider:

• Whether they can reuse recycled containers, e.g. ice cream containers, buckets with lids.
• Will the consumer be able to reuse the container?
• Are air holes required?
• Do containers need to be waterproof?
• Do the containers need to be durable?
• Are the chosen containers available in various sizes?
• Can labels be easily fixed to the containers?
• What types of containers can be borrowed, donated, are available at the school or require purchasing?

Students on the committee can:

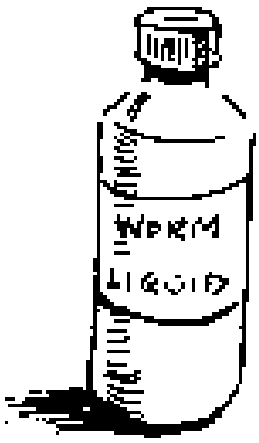
• Arrange a visit to a hardware store/garden centre to view the variety of packaging used. Students illustrate or photograph packaging that appears suitable/unsuitable.

• Ask other students in the class to bring examples of the required type of packaging from home to assess its usefulness for the task.

• Decide on the type of packaging they will use for their products.

• Design labels for the products. Again, using the samples, illustrations, photographs and information they have accessed students discuss what they believe the labels should attempt to do. This could include:

• Highlight a product or brand name that is catchy and has not been used by other products
• A design to attract attention
• Inform the consumer of the contents
• Describe what the product is
• Describe how the product was produced
• Describe on what and how the product is best used
• Indicate the volume or weight of product (as there will be a varying water content in both worm castings and compost material they



will have to be packaged by volume as opposed to weight)
• Indicate the company name and details
• Indicate the address of the company for further purchases or enquiries
• Promote the positive aspects of the product

Students view information gathered and focus on the following questions:

• What appeals to you about the packaging? Why?
• If it was your product what would you change about it? Why?
• Does the name of the product indicate what the product is?
• Would the colours used be effective in making the product stand out amongst competitors products?
• Is the product clearly explained?
• Are the instructions of what the product does clear and informative?
• Would you purchase the product to use on your garden? Why or why not?

Using all the information gathered students then design labels for the various products.

Sales Committee

The Sales Committee is responsible for the selling of the products.

• Students brainstorm all the types of selling mechanisms they know of.

• Once students have a comprehensive list of the various means of selling products, through discussion and consensus they eliminate those models not applicable to their enterprise. The remaining model's names are each placed on a separate sheet of paper, which has been divided into two columns. Students write down the positives and negatives of each models. Students then use that as the basis to decide the type of selling model they will use.

• Students, when choosing a model, should focus on the following questions:
Will the model have the mechanism to:

• know how much stock to have available?
• know how much stock is ordered?
• know how much stock has been purchased?
• know how much stock is to be and has been delivered?
• know that orders have been filled?
• check irregularities and queries from consumers?
• deliver goods to outside clients or take phone orders and arrange delivery?

Students, having discussed those questions, and depending on the outcome, might need to plan:

• order forms
• how to issue receipts
• a means of providing change if selling from a shop or stall
• to be able to accept cheques
• to work with the Finance Committee to ensure they are clear on their roles and where there might need to be some cross-over in tasks.

Paper and Cardboard

• Students investigate potential purchasers of paper and cardboard products. Prior to contact, focus their discussion on the following questions:

• What type of paper and cardboard products does the purchaser buy?
• How are they to be packaged?
• Are they to be delivered or require collection?
• What is the price paid for the product?

• Students get quotes from three different purchasers. Compare them, discussing the positives and negatives of each. Students then select their favoured purchaser(s).

Finance and Recordings Committee

The Finance and Recordings Committee is responsible for all financial matters, book keeping, and the coordination of meetings.

Financial Matters includes:

• handling cash
• issuing receipts
• organising change
• banking and operating a bank account
• grant applications
• fundraising ideas.

• Students investigate what sources of finance are available for their type of project, who they approach in this regard and how any available finance is accessed.

• Students prepare what is required to access funds.

• Students decide on a range of funding raising ideas and plan the details.

• Students arrange a meeting with the Principal and School Secretary/ Bursar to discuss how they will bank the money they have to deposit and how they will organise cash for change, using the school's financial system.

Book Keeping includes:

• Working with the Sales Committee to check that the books balance after all sales.

• Keep records of all financial transactions.

Students investigate to decide what type of accounting system they are going to use to keep the company books.

• Contact the School Secretary/ Bursar
• Use the Internet to access any free downloadable accounting programs
• Seek advice from parents working in the finance industry
• Organise to meet with the school's Bank Manager
• Inquire to find out if the school has any appropriate software programs or purchase an accounting program.

Coordination of Meetings includes:

• Organising and maintaining all company meeting records, correspondence, press articles, etc.
• Ensuring all students are aware of Board meeting times.
• Announce apologies at Board meetings.

• Students design a filing system to store meeting minutes, copies of all correspondence, promotional material, grant applications and financial books.

Students consider:

• The use of computers for record keeping.
• If not using the computer, then students consider the amount of space required to store books etc., the space available and the security of the space.
• Materials required to use or store, e.g. receipt books, record keeping books, folders, pens, etc.
• The cost of materials
• How they will access the money to purchase their needs?
• Students decide on the method they will use to inform other company members of Board meetings and how they will receive apologies.

Publicity Committee

The Publicity Committee is responsible for the design and production of all publicity and advertising material, and the arrangement of displays for special occasions and locations promoting the company and what they are attempting to achieve.

Publicity and Advertising includes:

Presenting to the Board for ratification the committee's designs for:

• Company name
• Company logo
• Company catch phrase or slogan

Students brainstorm company images they see portrayed in the media. View examples focussing on the following questions:

• What is the value of having a company logo?
• What makes a logo recognisable and appealing?
• Is the use of colour important?
• How important is the name of a company?
• What message should the name of a company portray?
• What makes people remember a company name?
• Do people remember company catch phrases?
• What are they designed to do?

• Students use the information and the assessments they have made to design their company's name, logo and catch phrase.

• Students investigate if there are any penalties for using another company's name, logo or catch phrase and how and where they can check to ensure the designs they intend to use is original?

• Once the company image has been agreed to students work closely with other committees in order to produce the promotional materials they require, e.g.:

• Collection Committee – Flyers to parents, school community local businesses requesting donations of materials.
• Farming Committee – Signage for the treatment area.
• Packaging Committee – Producing packaging labels for the products.
• Sales Committee – Producing all advertising and sales publicity, and signage for 'Sale Days'.

• Students brainstorm the equipment they will need access to and proceed about the task of procuring permission from the appropriate people. Depending on what material other committees require students might have to seek the use of equipment and assistance from outside of the school community.

• Students design, coordinate and set up both permanent and temporary displays for the school resource centre, school foyer, local shopping centre, local library. When they plan these displays they will need to work closely with other committees and emphasise the following:

• Why the company was set up.
• What the company does.
• What the company produces.
• What are the benefits to the environment, the school, and the school grounds.

MITCHAM PRIMARY SCHOOL

HOOKED ON CASTINGS

Students at Mitcham Primary School have been successfully farming wriggly, Eisenia foetida worms since 1992. Inspired by a year 7 classroom teacher, Robert Colliver, they have set up their own business called the Mitcham Worm and Construction Company. The purpose behind this venture was to raise funds for a pergola extension to their classroom.

Mitcham Primary School is the oldest continuing state school in South Australia. The school includes an annexe of Regency Park Special School with about 16 students who participate in regular classroom programs with full-time teaching support. The schoolÕs environmental education program is classroom-teacher based.

THE INITIAL IDEA

In 1992, Robert was involved as a contributor to the Wormwatch school resource package and the motivation for establishing a Mitcham worm business arose when a year 6 student expressed her boredom at learning about the environment for six years, but never actually doing anything constructive. Robert felt that a worm farm business, largely driven by the students, would provide them with ÔhandsonÕ activities, develop important skills, enhance their decision making skills, give them a sense of responsibility to others and themselves and improve their communication skills. The project offered ample scope to develop many essential learning skills across the curriculum. Two year 6 classes adopted the environmental project.

THE PLAN

The plan was to breed composting worms (chosen because of their huge appetites), feed them on school food scraps, collect their castings and sell them to the school community for garden fertiliser. Initially, the liquid castings were also bottled and sold.

Once the children decided to set up their worm business they began researching worms as recyclers, and company structures and enterprises. They made contact with local worm farmers and selected Eisenia andrei, Eisenia foetida and Perionyx evacatus worms.

The children applied to the school for funds and they were given an initial loan of $300. Robert also applied for a Special Projects Grant. The children held a class competition to design a company logo.

Robert says that he guided them into something that would work. ÔNaturally mistakes occur, but thatÕs all part of the learning processÕ. The children brainstormed ideas and these helped the project to evolve.

Decision making was a major skill being developed at this initial stage. Many other skills were identified as learning outcomes for this project, including identifying needs, describing processes, explaining the worm business operation verbally and incorporating different writing genres, predicting consequences and analysing their business practices and procedures.

IMPLEMENTING THE PLAN

The students elected five committees, each with a specific job description. These are: farming, packaging, sales, finance and publicity. There are two secretaries. The children vie for their preferred position based on the skills they believe they possess. Written job applications or presentation of their skills verbally, is voted on by the class. This facilitates teaching meeting procedures to the students and gives them an opportunity to describe how individuals identify the work done by themselves and others, thereby supporting the development of the resources strand in the studies of society and environment.

Farming committee

The farming committee organises the food supply by utilising food scraps from the school canteen, students and staff. The children organise materials for the construction of the breeding pit and procure other materials such as rubber gloves, buckets, spray bottles, bins and garden forks. Canvassing of local garden centres and hardware stores provides the students with donations.

Robert believes that students have improved their skills by writing letters to promote their projects, and gain support from local businesses. The ongoing tasks of this committee include: watering, feeding, turning the pit, pH testing, collecting the liquid run-off and harvesting the castings!

Packaging committee
The packaging committee organises suitable containers for packaging the castings. The students chose ice-cream containers as they are durable, waterproof and easy to obtain from the school community. Recycled plastic bags are used to carry larger orders. Labels for the casting containers are designed, defining the product, explaining its values and how to best use it! Ongoing tasks for this group include: preparation of containers prior to the harvesting date, reminding the school community of the need for more containers, weighing castings and bottling liquid castings.

Sales committee
The sales committee designs order forms, circulates them to every family in the school, fills out the orders and double checks them prior to the delivery. Students are engaged in writing for a purpose in many of these activities. Group management and co-operation skills are also evident.

Finance committee
The finance committee designs share certificates and applies for loans or funds, keeps receipts, and records and arranges the banking with the school secretary. All the financial arrangements are contractual and are drawn up by this committee in consultation with other parties, including the school secretary. Ongoing tasks include recording expenses, sales, auditing and closing down the company at the conclusion of each school year. The students and their teachers each bought $2.50 share certificates in the business. ÔEverything had to be done on a shoe-string budgetÕ, says Robert.

Publicity committee
The students are computer literate and the production of high quality promotional material is now part of their computer studies curriculum at Mitcham Primary School. Posters are displayed and flyers are designed and delivered to each family associated with Mitcham Primary School.

General organisation
Every Friday afternoon has become Ôworm business timeÕ for these active students. The committees use this time to write, research, design materials, make contacts and promote their work. To avoid Ôover the phoneÕ ordering, the committee sent out order forms and the students have negotiated with parents to assist them with delivering their products.

In mathematics the students estimated, then calculated, the cost and profit margins of their sales. They charge $2 for a bottle of the liquid fertiliser or 1 kg of castings.

Research and preparation for sale days, harvesting, delivery of goods, and the construction of the pits was carried out well before the worms arrived at Mitcham Primary School.

The worm farm was built outside their classroom and they secured a piece of land nearby for a compost pit. Manure was donated by parents and the school educated about recycling their food scraps. In media studies the students produced a short video and a recorded telephone jingle which can be heard if you ring the school and are put Ôon holdÕ.

News of their wriggling success has spread across the State. Numerous requests to share their knowledge and experience led to a small group of students publishing a step-by-step guide on how to set up a worm farm and business at home or school. This book was launched at the school and the

proceeds raised from its sale are distributed to a charity elected by the students. This is just another way the students develop key competencies by working with others in groups and developing communication skills.

Students are also constantly planning and organising activities. From a handful of worms ÔbumpingtogetherÕ, the students have developed and maintained an active, but quiet business, well hidden under hessian!

However, the students are anything but quiet when it comes to talking about their achievements. They have promoted the business through the local press and newspapers and some articles have appeared in *Contagious* (a national childrenÕs magazine), *Landcare news*, *School post* and even the *Stock journal*.

ÔIn addition to the initiative and enterprise shown by the students I was also greatly impressed by the articulate and mature way in which they explained their activitiesÕ, said the Chief Executive, Education, after watching a TV interview with some of the students.

Robert says, ÔThe kids feel as if theyÕre working for themselves and that the work theyÕre doing is also of benefit to othersÕ.

The students wind up the business each year and the new class is given the opportunity to set up the company in their own manner with a new logo and name. This wind-up occurs in the school activity room, with outstanding loans paid, shareholdersÕ dividends calculated and any remaining castings and worms sold. This is the highlight for Robert each year as he says the satisfaction of the students is enormous and the room is like a stock exchange, with everyone getting what they want in the end.

This practice was adopted as many children were inspired by worm farming and have bought worms to set up their own farms at home, or in conjunction with friends and other family members. Many mathematical processes are involved in the final wind-up. The students learn from the previous classes and build on these experiences.

The ownership factor is extremely important and the business is largely student driven, with the two teachers being equal shareholders. In 1992 the children earned $60.00 each for their $2.50 shares.

The students are now diversifying the project, by using some of the funds to construct a pergola enclosing a pond outside their classroom. They have established a plant propagation area and a small garden plot. The operation is now on a much larger scale, involving two classes in a unit with a second teacher, Amanda Spiers.

Keen not to spend too much money, they have shown resourcefulness in obtaining materials. The *Mitcham Worm and Construction Company* is developing personal and group management skills in this valuable enterprise. These skills are desired learning outcomes in the studies of society and environment in the statements and profiles for Australian schools.

PROBLEMS AND PITFALLS

The worm farming enterprise can be seen as a disempowering experience for teachers, as this project is student driven rather than teacher directed, with everyone working as an equal team member.

At times students have not been able to meet the demand for their orders and castings were purchased from another school company. This led to a rather enterprising student preparing a proposal to Ôbuy outÕ the other school company. This was not carried out but shows the way in which the

business is developing innovative thinking skills in the students.

The *Mitcham Worm and Construction Company* was a finalist in the 1994 Young Achievers Award. The students appreciated this recognition of their efforts.

Other schools have been inspired to set up their own worm farms as a result of the efforts and promotion by the children. ÔItÕs no good hiding your achievements under a bushelÑor in this case hessian! The students are keen to leave something lasting in the school rather than graffitti,Õ says Robert. ÔThey are establishing a flora and fauna area within the pergola extension. They are learning skills of working with people, being resourceful in managing a business, developing a personal and group identity and caring for their school and the wider community.Õ It has impacted on so many areas of the curriculum, from mathematics with calculating costs, profits etc, to the arts, in designing posters and producing videos. There are strong links with the resources, investigation, communication and participation strands in the studies of society and environment.

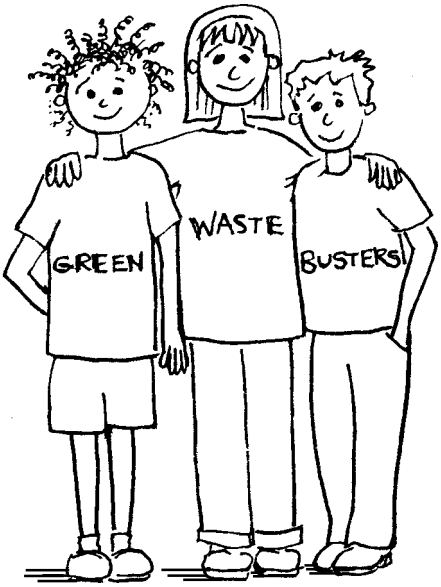
Recycling the schoolÕs food scraps has become a cost-efficient exercise and provides them with a useful product as well as, most importantly, teaching the students lifelong skills, values and attitudes.

Unit 7

green waste matters!

I'd like to do that!

I'D LIKE TO DO THAT!



Synopsis

In this unit students are involved in the application of knowledge, experience and resources to create products and processes which recycle green and organic wastes.

Students examine a range of technologies which are employed to manage green and organic wastes.

They are provided with learning experiences in which developed and applied technologies are investigated.

Students then engage in processes of investigation design, making and appraising of a technology of their choice.

Learning Objectives

To enable students in the secondary years to broaden their appreciation of currently available technologies to manage green and organic waste in Australia and overseas.

To enable them to develop an understanding of: innovative, workable , environmentally appropriate and socially acceptable green waste management technologies, creations and actions.

Resources

See 'References and Bibliography' for an annotated list of resources.

Introductory Activity

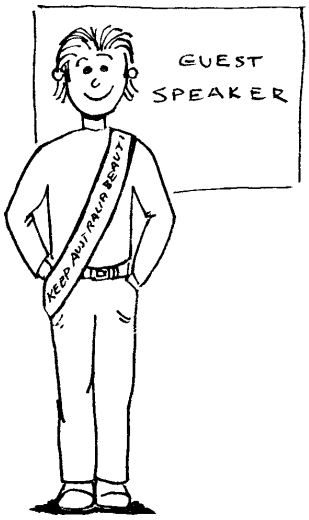
In this unit students initiate investigations into technologies that are available for recycling green and organic wastes. They pursue investigations to manage waste that is created in their school and they design, make and appraise new technologies.

• Groups of students determine their own area of inquiry based on issues, interests and technologies which have emerged from earlier activities.

Exploring the issues

Support students to identify issues by undertaking one or more of the following activities.
For example:

• Develop a futures wheel and/or concept map to unearth a range of topics related to green and organic waste management in schools.
• Brainstorm issues related to the management of green and organic waste.
• Determine sources of information students have access to and are realistically likely to need, e.g. volumes of waste produced, current methods of reuse or disposal, alternatives available.



• Express ideas with the local waste educator/school groundsperson/ teacher in a role as the "Devils' advocate" and take different poles on issues to expose a range of views and possible starting points.
• Encourage students to explore the issues of managing green and organic wastes in the school through class discussion, class and SRC meetings, guest speakers, viewing excerpts from videos, searching the local papers and media for ideas and sketching proposals and notions.
• Ask students to complete a questionnaire to document their attitudes to the issue at this stage.

Framing questions and actions

• Encourage students to clarify the questions they are intending to investigate by, for example:

• Individual or group formulation of possible inquiries or designs, tested against the reaction of other class members.
• Listing and categorising all types of information related to their design and the green waste issue under headings - green waste; organic waste; actions we can take; probable and possible futures' technologies available today; possible innovations/inventions.
• Developing a table to outline the information that needs to be gathered, who is responsible, and where they will seek information, how it will be gathered.
• Devising sub-questions which could be addressed and determine whether they are best addressed by the school's administration, staff, student body or community members.
• Thinking about how they will know when they have found and determined possible solutions, strategies or technologies to the green and organic waste issues.

Collecting information

Valuable information can be collected via a multiplicity of means, and students could be encouraged to:

• conduct a green waste audit
• conduct interviews
• identify people who are known to be informed in green and organic waste management techniques, processes and technologies
• access and create databases
• document known information
• design technologies
• conduct trials and experiments
• take notes from published information. (See Resource 7.1 for information which uses a global perspective and
Resource 7.2 for a national perspective)
• make comparisons between local, national and global contexts
• engage in learning opportunities conducted by the groundsperson, parents or guest speakers
• summarise information presented on relevant television/video programs
• map the information
• join in actions on the ground
• contact mentors by the Internet; consider the following addresses:

www.vermico.com/index.html
www.hs.freeport.k12.me.us
www.globalpresence.com.au/exchange/about.htm
www.ac-grenoble.fr/yre/feee.htm
www.gould.edu.au/wastewise/index.html

• library research
• develop contacts within the school or broader community for relevant information
• write or fax letters

• use the phone book or directory within this resource to contact relevant organisations
• see Resource 7.3 for newspaper articles which cite innovative and environmentally appropriate green waste management technologies, creations and actions. (Students should read the articles critically, not accepting the claims made on face-value).

Interpreting the information

Encourage students to:

• graph or tabulate findings from their investigations
• consider the motives of author(s) of information
• apply De Bono's six-hat thinking to determine the orientation of statements found
• check one person's interpretation against anothers
• search for inconsistencies
• check information which presents contrasting opinions or views to that found
• make judgements about how to deal with conflicting information
• rearrange the information to detect new patterns
• determine the features needed in a green waste management technology
• examine the appropriateness of processes used in available green waste technologies
• identify the key functional, aesthetic and environmental features of technological ideas and practices
• investigate how green waste technologies are used and explain their impact at a local and global level.

Making conclusions from the information

Once investigations have been completed, and additional information has been weighed up, students could be supported to:

• write a series of generalisations based upon the information that has been analysed
• discuss conclusions with other classes and be questioned about them
• investigate the economic, environmental and social costs and benefits of the various solutions
• defend their conclusions by reference to the information they have analysed
• consider the consequences of acting in different ways on the same conclusions, and / or
• present the worst and best case scenarios in a persuasive genre.

Acting on the information

• The form of actions should be related to the information which has been discovered in the course of the students' investigations. Some appropriate forms of action might include the following:

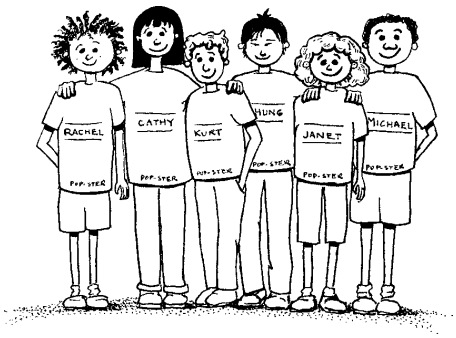
• develop an action plan using flowcharts, consequence charts and draft design sketches
• generate detailed plans and solutions after exploring a range of alternative design and production ideas
• articulate reasons for using some ideas and rejecting others
• identify what is needed to make a prototype green waste technology
• invite comments and constructive feedback from others
• construct a model
• develop an information brochure
• mount a display in a prominent setting inviting others viewpoints and ideas
• seek a donation from a range of local suppliers to construct a prototype.

Reflection on outcomes

• Encourage students to:

• assess the effectiveness of their designs, production processes and products
• match outcomes with original intentions and needs
• review plans, techniques and resources
• examine the benefits and costs in functional, social and environmental terms
• make modifications to incorporate new ideas and overcome deficiencies
• discuss what were the main opportunities and obstacles to obtaining information
• write an account of the project or recapitulate through the development of a flowchart identifying various strengths and weaknesses, opportunities and threats of the green waste management technology
• reflect on how the project has changed students' individual attitudes to innovation in the green waste management area.

Following a period of reflection, students could engage in group discussions about how to deal with unresolved questions and initiate further investigations.



Resource 7.1

Using a global perspective

Every year the world produces more waste than the year before. This is partly because the world's population continues to increase, but it is also because the wealthier nations continue to generate more waste per head of population. The United States of America, for example, produces over 19% of the world's waste.

People in the wealthier nations have more money so they purchase more and have more waste to get rid of. Many modern products are made for cheapness or convenience and have to be regularly replaced. Many modern electrical appliances are cheaper to replace than have repaired. The worst excesses of our throwaway society are goods that are made to be disposed of after one use, for example disposable cameras and razors, plastic plates and cutlery. Such items are a waste of natural resources and also generate a lot of waste.

The following table compares the amount of domestic waste generated in tonnes per day by some of the world's largest cities in 1991.

City/Country	Waste generated per day (tonnes)
New York, USA	15,557
Los Angeles, USA	10,770
Medellin, Colombia	986
London, UK	6707
Lisbon, Portugal	850
Rome, Italy	2354
Alexandria, Egypt	1759
Amman, Jordan	414
Ibadan, Nigeria	589
Karachi, Pakistan	3088
Calcutta, India	5646
Hong Kong	5586
Tokyo, Japan	9189
Singapore	2105

Source: Hare, T. 1992. Domestic Waste. Franklin Watts Ltd, London.

An even more revealing figure would be the amount of waste generated per person per day. The following list covers some of the same cities and gives urban or municipal waste in kilograms per person per day (1992 figures):

Kano, Nigeria 0.46
Medellin, Columbia 0.54
Jakarta, Indonesia 0.60
Rome, Italy 0.69
London, UK 0.77
Hong Kong 0.85
Hamburg, Germany 0.85
New York, USA 1.80

The quantity of urban or municipal waste generated in various European nations and the United States of America is given in the following table.

World municipal waste generation, 1980-1992 (kg/person/year)

Country	1980	1985	1990	1992
United States of America	600	620	710	730
Japan	380	340	410	410
Canada	510	-	670	660
Norway	420	460	470	517
France	-	-	460	470
West Germany	350	320	340	-
Russian Federation	137	-	159	-
Portugal 200	230	300	330	
The Netherlands	500	440	500	500
OECD countries	330	340	390	400
Europe (average)				
New South Wales	-	412	459	470

- = not available

Source: New South Wales State of the Environment 1997

Case Study - Norway

The amount of waste delivered for deposition in Norway continues to increase. Norwegians have become better at separating waste materials for recycling, but there has been an increase in all types of waste. However, the number of landfill sites are being reduced and controls over waste delivery is improving.

The total amount of waste generated per person has increased by 47 kg in the period 1992-1995, from 242 kg in 1992 to 289 kg in 1995. If this trend continues, every Norwegian will soon be generating 1 kg of household waste per day.

“The goal is that the waste problem shall be solved in a way that environment and human health is not jeopardised. The treatment of waste shall demand as little as possible from the resources of the society. The main strategy is to prevent generation of waste, to reduce the number of hazardous products in the waste, encourage reuse, recycling and secure a proper treatment of the remaining waste.”

Waste from households is a small proportion of total waste generated. The main waste generators are offices, industry, trade and other sources. Municipal waste, encompassing all waste delivered at municipal waste management systems, increased by more than 100 kg per person between1992 and 1995, that is, from 517 kg in 1992 to 623 kg in 1995. Of this total, 68% was deposited in landfills, 18% was incinerated, 13% was recycled and 1% was composted.

In spite of efforts to recirculate paper, glass and other types of reusable waste, the total amount of waste is increasing. Improved economic conditions have resulted in more waste being generated.

Source: State of the Environment Norway 1997; http://www.grida.no/soeno97/waste/wapress.htm

Case Study - Switzerland

The volume of mixed municipal waste has risen steadily since the first waste statistics were compiled in 1970, peaking at 2.98 million tonnes in 1989. Since then, there has been a substantial drop to around 2.6 million tonnes (1996). This corresponds to an annual volume of about 370 per capita (person). Although the economic recession has played a role in the decline, the decisive factor was the sharp rise in separately collected waste material from households and small industry, which in 1996 amounted to 1.72 million tonnes or 240 kg per capita. Close to 40% of municipal waste, including separately collected material, is recovered.

Besides better public information and the expanded collection infrastructure, the success of recovery is also due to the introduction of bin-liner (refuse-bag) charges that relate better to volume.

Used paper, compostable waste and glass containers make up the bulk of the 240 kg of used materials collected separately per capita and per annum.

The 400,000 tonnes of **compostable waste** delivered to central green waste disposal plants in 1995 constitute the second largest separately collected type of waste after paper. An equal volume of kitchen and compostable waste is generated and is composted in district facilities. Sixty-three of the 200 central composting facilities have a capacity in excess of 1000 tonnes. In 1996, six facilities which ferment compostable waste under anaerobic conditions offered an additional 45,000 tonnes of annual capacity, creating in addition to compost the methane-containing 'bio-gas' which is used to generate electricity and heat. The relatively expensive fermentation facilities are an alternative to composting plants in urban areas.

The Swiss Government has four strategies of waste management:

1. prevention of waste at source
2. reduction of pollutants in production and goods
3. reduction of wastes by improving recovery
4. environmentally compatible treatment of the remaining wastes within the country.

Waste prevention

Waste can be prevented at source by adopting low waste production techniques. Products with a long service life or which are easy to repair also reduce the quantity of waste, as do reusable containers and optimising packaging.

Passing on the costs of waste disposal to those who generate the waste in the first place is a strong incentive to prevent the production of waste in the industrial and commercial sectors. Producers have a dual financial interest in developing and applying low-waste techniques. However, there are no such clear financial incentives to develop long-life or low-waste products. With low raw material and energy costs, together with high wage costs, the tendency is to replace old plant rather than carry out repairs.

Greater waste awareness has been communicated to consumers in recent years, i.e. they are more aware of the relationship between consumption and waste volumes. Higher taxation on energy and raw materials would have a far stronger impact in reducing waste than the costs of environmentally compatible waste treatment.

Multiple-use containers are often an excellent means of avoiding packaging waste. This applies to transportation packaging and reusable containers. Life cycle assessments are effective aids to optimising of packaging according to ecological criteria. For example, a polythene bag weighing no more than seven grams has become established as an optimized form of packaging for pasteurised milk. In life cycle assessment terms, it compares well with the reusable bottle. Other examples of lightweight, low material packaging are refill bags for cleaning agents, detergents and foods.

Source: The Environment in Switzerland (Swiss Federal Statistics Office, 1997)

Resource 7.2

Waste Generation in Australia

Key findings of the 1997 National Recycling audit and garbage bin analysis conducted by the Beverage Industry Environment Council.

A national audit was conducted over seven weeks in August and October 1997 in all states and territories. A total of 84.4 tonnes of waste, comprising 63.8 tonnes of garbage, 2.7 tonnes of green waste and 17.9 tonnes of recyclabes, was collected from 5369 households in 98 local government areas.

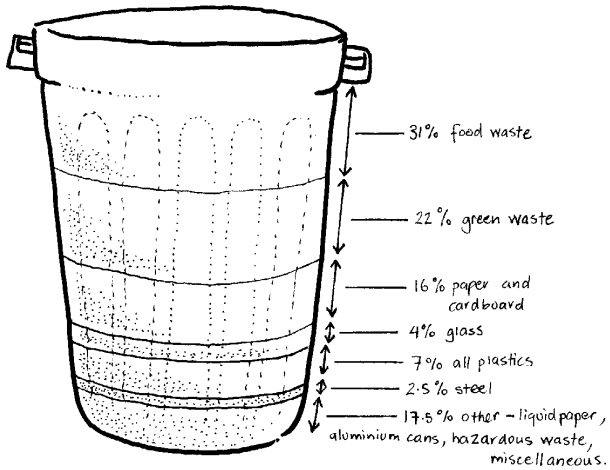
Waste generation

The average Australian household generates 15.7 kg of waste for collection per week. This comprises 11.9 kg of garbage, 3.1 kg of recyclables, 0.2 kg of contamination and 0.5 kg of green and organic waste.

Composition of the garbage stream

The main components of the garbage stream were:

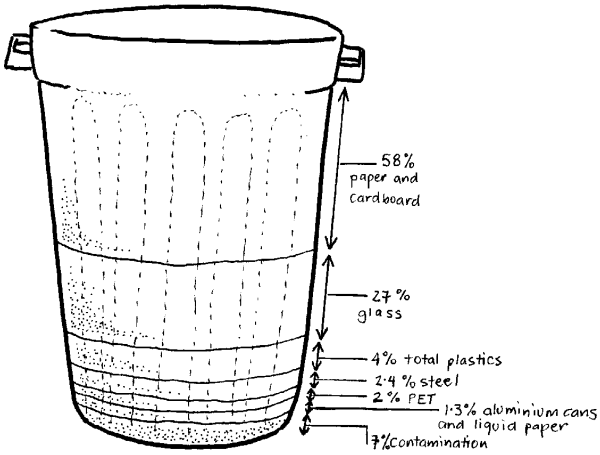
food waste 31.0%
green waste 22.4%
paper and cardboard 16.0%
liquidpaper 0.5%
PET 0.4%
HDPE and PVC 0.7%
other plastic 6.0%
glass containers 3.9%
aluminium cans 0.2%
steel 2.5%
hazardous 0.2%
other materials 16.2%



Composition of the recycling stream

The main components of the recycling stream were:

paper and cardboard 58.3%
glass containers 27.4%
steel 2.4%
aluminium cans 0.6%
PET 2.0%
HDPE 1.7%
PVC 0.1%
liquidpaper 0.7%
contamination 6.8%



Diversion rate

The national diversion rate of domestic waste from landfill is 19.8%. If all potentially recyclable materials were recovered from the waste stream, the highest possible diversion rate achievable would be 43.1%. If green and organic waste, which accounts for 20.1% of the total waste stream, is included in collection systems the potential diversion increases to 63.3%.

Waste composition

The single largest component of the waste stream is organic material (green and food wastes). It totals 43.5% - 23.4% food and 20.1% green waste.

Recycling

Paper (58.3%) and glass (27.4%) together account for over 85% of the recycling stream.

Some 58.5% of households placing material in the domestic waste stream at the time of kerbside collection also placed material in the recycling stream. Of the households that recycled, 14.4% recycled 80% or more of the potentially recyclable material. Only 5% of households recycled all available recyclable material.

Green waste collection

Waste collection systems that regularly collect green waste achieve diversion rates of 43.9%, compared with 19.8% of those that do not. Only 12 out of the 98 local governments included in the audit had regular green waste collection services.

Recovery rates of green waste (for the areas surveyed) were NSW 29%, SA 17%, Victoria 15% and WA 7.5%. None of the local government areas surveyed in Tasmania, NT or ACT were collecting green waste.

Reference: *1997 National Recycling audit and garbage bin analysis.* Beverage Industry Environment Council. Leichhardt, New South Wales.

Solid waste generation and disposal

The following data was collected by the CRC for Waste Management and Pollution Control. This and other information can be accessed on their Web site, http://www.civeng.unsw.edu.au/Water/awdb/repintro.htm

Municipal and total waste (kg/person/day)

State/Territory	Year	Municipal waste (kg/person/day)	Total waste (kg/person/day)
New South Wales	1995-96	1.09	2.36
Victoria	1995-96	1.0	2.7
Queensland	1994-95	n.a.	2.21
South Australia	1996-97	n.a.	2.39
Western Australia	1996-97	1.52	3.09
A.C.T.	1996-97	0.09	2.08

Total waste = municipal + commercial and industrial + building and demolition
No data given for Tasmania and Northern Territory

Composition of waste streams, Adelaide, South Australia, 1996

Material	Garbage stream (%)	Recycling stream (%)	Total waste stream (%)
garden	25.7	1.5	24.0
food	23.6	1.0	23.5
other	16.1	0.3	11.1
paper/cardboard	12.2	12.3	10.8
newsprint	5.7	30.9	9.2
other plastic	5.1	0.6	3.3
glass	4.2	20.7	5.6
steel cans	2.6	3.5	2.0
HDPE	1.3	1.9	1.1
liquid paperboard	1.1	2.5	1.1
polypropylene	0.8	2.0	0.6
other steel	0.8	0.1	0.5
PET	0.5	0.8	0.4
PVC	0.2	0.2	0.3
aluminium cans	0.1	0.1	0.1

Other - includes nappies, bricks, ash, sand and other materials which cannot be allocated to other categories

Source: Recycle 2000

Resource 7.3

Newspaper Articles

Read the following articles from The Weekend Australian, The Messenger andFar Eastern Economic Review on Green Waste and Organic Waste Disposal Technologies.

Date.....: September 28, 1996
Publication.: THE WEEKEND AUSTRALIAN **Page.....:** 51
Byline.....: DIANA THORP
Headline....: Bugs may turn garbage into profits

A LARGE tin shed filled with bacteria, maggots, insects, beetles, little mites, 500 tonnes of household garbage - and air filters - this week became the latest weapon in the crusade against Australia's growing solid waste problem.

Scientists with the Co-operative Research Centre for Waste Management and Pollution Control's newest facility hope the experiment assessing the power of the bugs could result in a process to convert about 45 per cent of ordinary household garbage into organic fertilizer worth up to $150 a tonne.

The executive director of the centre, Dr David Garman, said that if the process is successful, the resulting organic fertilizer could replace some of the millions of dollars spent on importing chemical fertilisers each year.

"This is an Australian invention," he said. "If successful, we would like to see landfill sites using this process . . . Hopefully, the organic fertilizer could be used for home use and agriculture and could be used as a fertilizer available to farmers."

The shed, in bush in **Sydney's south west**, is carefully instrumented to monitor moisture, temperature and the level of bug activity.

Manager of the centre's solid waste program, Dr Ron Wainberg, said the facility was one of only a handful in the country and would be used for experiments on how to make better use of household garbage.

Dr Wainberg said the difference between the fertilizer produced under this method and normal compost was the nutrients in the waste.

While compost sells for $20 to $30 a tonne, the organic fertilizer could sell for $120 to $150 a tonne.

The experiment is based on a method developed by Christian Fayd' Herbe in Western Australia more than 20 years ago to turn waste into valuable fertilizer.

"Christian Fayd' Herbe converted waste into fertilizer but he didn't understand the pure science of what was happening," Dr Wainberg said.

"He fell on hard times and only produced 10,000 tonnes of fertilizer.

"We are trying to understand what is going on and create a better process. We sorted the waste which we got from a local landfill site and took out the big bits like mattresses, car parts and bottles, and the rest was shredded and taken into the shed.

"It is mixed with other **organic waste** and left to sit for eight to 10 weeks and we will keep taking samples and try to understand what is going on."

After a couple of months, the nutrient rich compost will be sorted, pelleted and evaluated. The CRC aims to perfect the process and licence the design to other producers.

Date.....: Wed 25-Feb-1998
Publication.: MESSENGER **Page.....:** 11
Byline.....: THEA WILLIAMS
Headline....: Wheelie bins or user-pays?
Libhead.....: Refuse disposal - **South Australia**
WHEELIE bins are not the open-and-shut solution to green recyling, a Flinders University biotechnologist says.

Dr Nick McClure has conducted research for Marion Council looking at ways to adapt “wheelie bins” for recycling **green waste** to overcome odour problems.

Wheelie bins, which don’t allow for air circulation and create odour problems with garden materials breaking down, had been successfully adapted in Europe to overcome the problem, Dr McClure said, although they were more expensive.

“The question mark is: Is it worth going to an improved MGB (mobile garbage bin) for **green waste** or is a user-pays system the way to go?” Dr McClure said there would always be problems with wheelie bins “because not everybody will do the right thing”, adding that contamination was a problem as well as odour.

There needed to be improved education programs, even in council areas such as Marion where recycling is trumpeted as a great success.

Engine blocks to tennis nets have been found among the autumn leaves in wheelie bins.

People also often neatly tied up their **green waste** in a plastic bag before putting it in the bin. Plastic bags were the most common problem and unsightly in the end product mulch intended for people’s gardens and along roadsides.

The smell of **green waste** wheelie bins could be reduced if people mixed the **green waste** with bulky recyclable paper or cardboard so not all the grass clippings were weighted, hot and moist, in the bottom.

Green Machine: Japanese companies set their sights on trash
By Eriko Amaha in Tokyo
08/06/1998
Far Eastern Economic Review Page 63

The word “hi-tech” usually evokes thoughts of the Internet or the latest home-entertainment gadgetry. But Japan’s leading electronics manufacturers, which already make plenty of money in those fields, are smelling cash in trash–hi-tech waste processors to be precise. For many Japanese consumers, their newest Panasonic or Hitachi isn’t a stereo system but a device that turns banana peels, fish innards and coffee grinds into fertiliser.

Garbage processors that recycle organic household waste are hot. Sales have been lifted by growing environmental awareness and increasing concerns over the harmful effects of dioxin, a by-product created when plastic is incinerated. (The machines, ironically, can’t deal with plastic waste just yet.) One of the scores of processors now on the market, Sanyo Electric’s Gomi Nice (“gomi” means garbage in Japanese), churns organic waste at high temperatures inside a television-sized processor that contains wood chips treated with microbes to promote decomposition. After a few days, the trash is transformed into a fine, soil-like substance that can be used as fertiliser.

The Kitchen Waste Processor from Matsushita Electric Industrial uses hot air to dry and shrink organic waste. In two-and-a-half hours, the processor compresses the waste to one-seventh of its original size.

In densely populated Japan, dealing with ever-expanding amounts of trash has been a problem for years. As current landfill areas reach capacity, local governments across the nation are finding it difficult to secure new sites. Increasing awareness and the growing urgency of the problem have helped waste processors find their way into homes.

More than 100 Japanese companies have entered the trash game and have devices on the market, says Matsushita spokesman Akira Kadota. Industry officials estimate about 100,000 processors were sold in Japan in 1997, and they say the figure is likely to double this year.

Hideki Atarashi, head of domestic sales at Sanyo Electric, expects demand to blossom in the coming years. “The price will come down further and I think by the year 2000, about 1 million waste processors will be sold annually,” Atarashi says. In fact, it was lower prices that sparked the current surge in demand. Sanyo Electric marketed its first trash transformer in 1994, but sales didn’t take off until last year, when the company slashed the price to 60,000 yen ($430) from 180,000.

Sales are also getting a boost from local governments. More than 500 municipalities now offer subsidies for electric waste processors.

Toshihiro Yamaga, who works for Sanyo but not in the waste-processor division, had to pay the full price for his trash transformer, but he’s not complaining. An amateur angler, Yamaga bought his processor in June to quickly dispose of the smelly innards of fish he caught and cooked. “My wife begged me to stop fishing because of the smell. I bought this when our neighbours started complaining, too,” he says. Now, instead of producing a stench, Yamaga’s hobby provides some tasty meals and fertiliser for his wife’s balcony garden.

But waste processors aren’t limited to the home. Industrial-sized models are becoming popular at schools and restaurants interested in improving their image and promoting efforts to protect the environment. In December 1996, the city of Yokohama spent 6.33 million yen to build a facility to recycle food waste at a private condominium. The city funded the project and pays the facility’s bills in hopes of encouraging other buildings to follow suit. Tokyo’s international airport in Narita plans to start recycling organic waste later this year.

Governments are eager to do whatever they can to reduce trash. In 1997, the Tokyo metropolitan government spent 308.8 billion yen on garbage collection and disposal – nearly 5% of its total budget. It cost the national government 2.16 trillion yen to collect and dump 50.54 million tonnes of garbage in fiscal 1994, the most recent year for which statistics were available.

Kenya Tanaka, a spokesman for the Tokyo government, says waste generated in the metropolitan area has declined somewhat due to the sluggish economy. But recycling remains essential. “The planned lot for waste dumping along Tokyo Bay will be filled in the next 30 years,” Tanaka says. “And we haven’t decided anything about the next dumping place.” The government has proposed a number of landfill sites but all have been staunchly opposed by nearby residents.

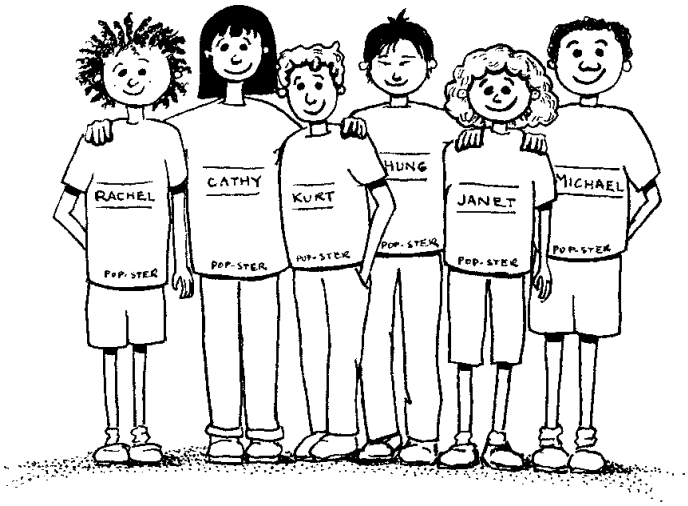
So far Japanese companies are only selling their waste processors on the domestic market. But that’s likely to change. Sanyo Electric says it has received inquiries from companies in North America, Europe and Asia. The company is also working on a product that would tackle the bigger problem of plastic waste without producing dioxin. Trash is universal –and it may not be long before trash processors are, too.

Unit 8

green waste matters!

Low green waste or no green waste society

LOW GREEN WASTE OR NO GREEN WASTE SOCIETY



Synopsis

In this unit students explore future scenarios which project into the near future and describe particular green waste issues.

Students develop a more future-orientated perspective on their own lives and green waste management in the wider world, identify and envision alternative futures which are more sustainable and participate in a range of decision-making activities.

Learning Objectives

To enable students to develop a more future-orientated perspective on the issue of green and organic waste management.

Resources

See ‘References and Bibliography’ for an annotated list of resources.

Learning Activities

The following activities use futures perspectives to explore the topic of green waste management. The objective is to support students to become aware of and concerned about the amount of green and organic waste in our world community, and to accept that most of this can be utilised in forms of "resource recovery".

• Ask students to imagine they are a child born today and in 20 years time when they have grown to adulthood the built environments of the world would have become almost unlivable due to inappropriate waste management.

Support students to reflect on how our understanding of the use of the earth's resources differ from that of our parents' and grandparents' generation. Also, consider what factors have contributed to our changing understanding of *the environment.*

• Read the poem "The Seventh Generation" and reflect on this writers perspective on the importance of ecological sustainability.

The Seventh Generation

"Will it benefit the seventh generation?"
Was the question that the Hopi dwelt upon.
"Will it help the future people who will walk on this earth
Long after you and I are dead and gone?"
And if the Hopi saw that the answer was "no"
They would drop that new idea.
They thought not only of themselves
But future generations as well.
I speak now for that seventh generation,
For the seventh generation from now on.
I speak for the people who will walk upon this Earth
Long after you and I are dead and gone.
Will they reap a bitter harvest from the things that we have done?
Will they thank us for the healing that in our time has begun?
Will there even still be people seven generations on?
For I fear for the seventh generation.

By Sue Doessel

Source: The Gap Issue 5 1994 p. 7
Global Education Centre, Australia

• Brainstorm the many factors that may have caused the situation described or that may result from it. Ask students to rank the 10 factors that they consider are the most important.

• Develop a future's wheel to explore the consequences of decisions and choices in groups, encourage students to decide what issue they wish to explore. The issue is written in the centre of a sheet of paper and a series of concentric circles are then drawn lightly around it. The first question asked is "What are the immediate consequences?"
Ask groups to discuss what these might be and briefly write them around the first circle. Ask groups to link each statement to the central point by a single line.
Next students discuss what consequences may follow-on from the first ones.
These "second order" consequences can be linked by double lines to those from which they flow.
Following on, third and fourth order

consequences can be explored and marked in a similar way.

• Share future wheels and explore the difference between intended and unintended consequences.

Adapted from: Educating For The Future - a practical classroom guide by D. Hicks (WWF, 1994)

• Ask questions about green waste management issues.

• *What is the issue*?
~ What do we think, feel, hope and fear in relation to this particular issue?
~ What do others who are involved think, feel and say?

• *How has it come about?*
~ Why do we and others think, feel and act the way we do? What and who have influenced us and others involved? What is the history of this situation?

• *Who gains, who loses?*
~ Who has the power in this situation and how do they use it? Is it used to the advantage of some and the disadvantage of others? If so, in what way?

• *What is our vision?*
~ What would things look like in a more sustainable future, for ourselves and for others? What values will we use to guide our choices?

• *What can be done?*
~ What are the possible courses of action open to us?
~ What are others already doing?
~ Which course of action is the most likely to achieve our vision of a preferred future?

• *How will we do it?*
~ How shall we implement our plan of action in school, at home, or in the community?
~ How shall we work together? Whose help might we need? How do we measure our success?

Source - Adapted from Educating For The Future - a practical classroom guide by D. Hicks (*WWF, 1994 p. 10*)

• Discuss the following quote and the implications it alludes to.

"As the nineties begin, the world is on the edge of a new age…. We are now in one of those rare points of history - a time of great change, a time when change is as unpredictable as it is inevitable. No one can say with certainty what the New World will look like. But if we are to fashion a promising future for the next generation, then the enormous effect required to reverse the environmental degradation of the planet will dominate world affairs for decades to come."

Source: State of the World by L. Brown (Earthscan Publications, London, 1991)

• Encourage students to sketch their impressions of what "the world on the edge of a new age" might look like. Ask students to include images that relate to green and organic waste issues.

• Ask students to record changes, which they feel, are most important.

• Introduce the terms "probable" and "preferred" futures, i.e. what we expect the future to be and what we hope the future to be. Encourage discussion, which explores how students expect green waste might be managed and how they hope green waste will be managed in future years.

Using a timeline marked off in 10-year intervals for a hundred years ahead, have students record what the realities and/or milestones in green waste management are likely to be.

Repeat the timeline activity this time focussing on preferred green management options and trends that students hope will come about.

• In groups reflect on how the preferable timelines compare with the previously drawn probable ones. Talk about how they are different and what would need to happen for the probable timeline to be more like the preferable one.

• Ask students to consider what the future would look like if their hopes for the planet were realised.
• Encourage discussion about where green waste management fits into the overall picture of resource reuse and recycling.

Finding out

• Students select an area related to innovative solutions for green waste management and sustainable living that they are concerned about or interested in to conduct interviews and surveys on.

• Students undertake or research contracts. Small group brainstorm ways to find and gather information, consider how information will be recorded and presented. Groups develop a timeline, outlining stages of their work; or

• Students, through action research discover and explore possibilities for a low waste - no waste school community.

Students:
• Identify the issue
~ generate a list of issues
~ report back to class
~ select key issues that are possible to investigate and change.

• Investigate the issue
• form groups around particular issues and complete a KWL chart.

• Evaluate data
~ use surveys, interviews and data gathering methods
~ consolidate and organise data.

• List possible actions
~ brainstorm alternative solutions.

• Predict outcomes
~ describe possible consequences of various solutions, investigate costs and benefits of various solutions.
~ consult with interested individuals and groups who would be affected by particular choices of actions.

• Select best action
~ decide on possible courses of actions and rank these.

• Implement action
~ develop an action plan
~ exhibit the plan and invite comments from the school/ community
~ allocate roles and responsibilities.

• Evaluate action
~ consult action plan and journal to compare and contrast plans with completed actions, and review reflective comments
~ invite relevant key stakeholders and dignitaries to celebrate completion of the project.

Sorting Out

• Students sort information gathered and record their "futures" issue from the perspective of the past, the present and the future, discussing how green waste management has changed or is likely to change.

• Students explore issues raised using De Bono's "Six Thinking Hat Technique" or '"PMI" technique of identifying Plus, Minus and Interesting aspects of statements developed from the research findings.

• Students consider the rights of future generations and discuss what is happening at present that might mean the next generation inherits less sustainable waste management approaches and strategies than those of today. Students also explore what people are doing to make sure the next generation does inherit a sustainable environment and society.

• Students draw up their own "Charter for Future Generations" or "Goals for a Better World".

• In groups, students consider how these goals might be perceived differently depending on gender, race, age or class.
~ For example, do cultural groups interpret green and organic waste management differently?
~ Do males and females view the importance of green and organic waste management differently and, if so, how?

Taking Action

• Students explore the notion of a low green waste - or no green waste future in relation to the school and local area. Create a display/report based on information compiled.

• Encourage students to start acting for the future now by doing things to manage green and organic waste in sustainable ways.

Write actions they can do/ undertake.

Discuss strategies to make the school and local area more environmentally sustainable.

• Ask students to reflect on the topic and all they have learned and consider the questions:
• What has this to do with me?
• Where do I fit into the picture?

Ask students to draw connections between themselves and the topic and write letters from the present to their grandchildren in the future about how they contribute as active and responsible citizens by managing green waste appropriately. The letters could discuss the ways society is trying to make lives better by the changes being made to lifestyles.

Glossary

Aerobic composting	the biochemical decomposition of organic material into carbon dioxide and water by micro-organisms in the presence of air (oxygen)
Anaerobic composting	decomposition which occurs in the absence of air (oxygen).
ANZECC	Australian and New Zealand Environment and Conservation Council
Aqueous waste	liquid waste which is predominantly water and generally contains material the floats, settles out or is suspended.
Backyard composting	the composting of domestic organic and garden wastes in home-made or commercially available compost units
Biodegradable	term to describe organic materials that can be broken down by naturally occurring bacteria and other micro-organisms, usually in the presence of moisture and oxygen, into simple, stable compounds such as carbon dioxide and water. Materials include paper, food scraps, leather, natural cloth fibres, garden waste and wood.
Biosolids	primarily organic solid products produced by municipal sewage treatment plants.
Commercial waste	waste material generated by commercial premises, eg, offices, stores, markets, hotels, warehouses.
Conservation	planned management of a natural resource to prevent exploitation, destruction or neglect.
Compost	a stable material, high in organic matter content, that is the product of an aerobic composting process. Compost can be used as a soil conditioner and can improve soil structure, water retention, aeration, erosion control and other soil properties.
Composting	method of converting food scraps and garden waste into a clean-smelling material which can be used as a soil conditioner and fertiliser.
Contaminants	foreign material such as heavy metals, plastics and other non-organic waste materials, that make it more difficult to recycle green wastes, or reduce the usefulness of the final compost.
Decomposer	any small animal, insect or micro-organism that causes organic material to undergo chemical breakdown.
Decomposition	the act or process of breakdown of organic materials by micro-organisms or other decomposers.
Digestion	the process by which organic or volatile matter is gasified, liquefied, mineralised or converted into more stable organic matter through the actions of living organisms.
Disposal	last waste management option, used after all other environmentally acceptable avenues have been exhausted; includes methods such as landfill operations and incineration.
Ecology	the scientific study of the relations of living organisms to one another and their environment. From Greek *oikos* meaning house or home.
Ecosystem	an ecological community of organisms and their surroundings.
Energy recovery	the generation of energy using some materials that are currently sent to landfill disposal, as fuel
Emissions, gaseous	waste gases released into the atmosphere as the product of combustion or decomposition processes.
Environment	the sum of all conditions, factors or influences surrounding and affecting the life and development of organisms.
EPA	Environment Protection Authority
Garbage	see waste
Greenhouse gases	atmospheric gases which enhance the natural greenhouse effect including carbon dioxide, methane, chlorofluorocarbons, ozone and water vapour.
Green waste	any material that comprises vegetation, viz. grass, leaves, mulch, plants, branches, twigs, tree trunks and stumps, from domestic or other sources.
Groundwater	water that occurs in a saturated subsurface geological formation of rock or soil (termed an aquifer).

Hazardous waste	any waste containing significant quantities of a substance which is toxic, poisonous, infectious, flammable, corrosive or highly reactive.
Incineration	disposal of waste which involves the burning of waste without energy recovery to either reduce the volume of waste and/or destroy its infectious properties.
Industrial waste	any waste material generated by industrial or manufacturing processes.
Integrated waste management	the complementary use of a variety of waste management practices to handle municipal solid waste safely and effectively. Techniques might include source reduction, re-use, recycling and disposal.
Landfill	an engineered ground facility for the burial or disposal of solid, non-hazardous wastes under controlled disposal conditions which eliminate releases to the atmosphere, groundwater or neighbouring land.
Leachate	liquids released by or water that has percolated through organic or other wastes and that contains dissolved or suspended liquids, solids or gases.
Life cycle analysis	the analysis of the potential environmental impacts resulting from the input and output flows of a product system throughout its life cycle, ie from cradle to grave.
Methane	a non-toxic, highly flammable gas which is formed during anaerobic decomposition. Methane is a significant greenhouse gas.
Micro-organisms	bacteria, fungi, unicellular plants and other small organisms not visible to the naked eye.
Mixed waste collection and processing	a system involving minimal or no separation of green waste from contaminants. The waste is composted and contaminants are screened out at the end of the composting process.
Mulch	a mixture of organic material, such as shredded or chipped wood waste, straw, peat moss and leaves, that is spread over the soil to reduce evaporation, maintain an even soil temperature, prevent soil erosion, control weeds and enrich the soil.
Organic waste	term generally refers to biodegradable, compostable wastes of plant or animal origin, such as food scraps, grass clippings, garden wastes but excludes other organic wastes such as plastics, timber, rubber and oils.
Packaging	materials used to preserve, protect, store or transport a product.
Pathogen	a living organism that can be harmful to humans, animals, plants and other living organisms.
Pollution	pollution occurs when the waste loads on water, air or the land overwhelms the natural process of assimilation of such waste materials.
Putrescible waste	waste liable to decay and decomposition e.g. household garbage
Recovery rate	the percentage of a resource that is recycled.
Reduce	a generic term incorporating the concepts of avoidance, reuse and recycling.
Renewable resource	a resource derived from a cyclic source, eg, the sun, wind, water, or living organisms. With careful management, the consumption of these resources can approximately equal the replacement by natural or human-assisted systems.
Reprocess	the converting of waste into a different but similar product, eg the production of cardboard from waste paper.
Resource recovery	to direct products and materials from the waste stream for re-use, recycling, energy generation or composting.
Post-collection separation	collection of mixed waste and removal of contaminants from green waste at a central facility (materials recovery facility). The green waste is then separately processed.
Recycling	a resource recovery method involving the collection and processing of waste for use as a raw material in the manufacture of the same or similar non-waste product.
Reduction	activities that decrease or eliminate the production of wastes. Industrial production changes (eg, cleaner production) or modified consumer practices can decrease consumption of materials or the quantity of waste produced.
Reprocessing	the processing of waste into a different non-waste product.
Resource recovery	the extraction of economically useable materials or energy from wastes. This may involve recycling or the conversion onto another often unrelated use.

Re-use	to use a product or packaging again, for either the same or a different purpose. It entails less intensive processing than recycling.
Soil conditioner	any material added to the soil in order to enhance its physical or chemical properties or biological activity.
Source separation	the separation of used materials from the waste stream into specific categories at the point of generation in order to facilitate re-use, recycling or reprocessing. It results in lower amounts of contamination, and consequently better products and fewer residual wastes.
Sustainable development	development that meets the needs of the present generation without compromising the needs of future generations.
Vermiculture	the processing of compost in the digestive tracts of composting earthworms. The resulting product is worm castings which are stable and typically contain higher amounts of plant nutrients than aerobic compost.
Waste	any discarded, unwanted material deposited into the environment. It has the capacity to result in environmental degradation.
Waste audit	analysis of total waste produced by an activity or process to determine the quantity and composition of that waste.
Waste avoidance	not creating waste in the first place or elimination of waste at the source of generation.
Waste facility/depot	any premises used for the storage, treatment, reprocessing, sorting or disposal of waste.
Waste management hierarchy	a system for prioritising ecologically sustainable waste solutions, based on the maximum conservation of resources. It stresses avoidance and reprocessing, with waste disposal as the least favoured option.
Waste minimisation	any technique, process or activity which avoids, eliminates or reduces a waste at source, or allows for the re-use or recycling of wastes.
Waste stream	a general term used to describe the total waste material generated by an area, location or facility.
Wood waste	untreated timber material destined for disposal, including sawdust, bark, offcuts and wooden packaging.

Sources: Green Waste Action Plan. (1997) Environment Protection Authority, New South Wales
Integrated Waste Strategy for Metropolitan Adelaide 1996-2015. (1996). Environment Protection Authority, South Australia
The R.A.R.E. Resource Manual 1998

Glossary No 2

bacteria	tiny living organisms that eat up dead animals and plants
biodegradable	able to degrade (decay or rot) naturally through the action of living organisms such as bacteria and fungi.
compost	a mixture of dead leaves, grass and other organic materials, partially decomposed, used as fertiliser or potting mix.
conservation	planned management of a resource, plant or animal to prevent its overuse or loss
conserve	to keep natural resources safe from waste, loss or damage.
consume	to use up resources.
deciduous	trees or shrubs that lose their leaves in winter
decompose	to rot or decay; to break down into smaller and smaller bits
ecosystem	community of different species interacting with one another and with their environment.
effluent	waste water and other substances from a waste pipe from houses, business or factory
emissions	waste gases and solids discharged into the air from chimneys or from vehicle exhausts.
environment	the conditions that affect how people and nature live.
global warming	the gradual warming of the surface of the Earth as a result of a change in the composition of atmospheric gases, in particular an increase in levels of carbon dioxide and methane in the atmosphere.
greenhouse effect	see global warming
green waste	waste made up of leaves, grass clippings, prunings and other garden materials
groundwater	water that is found beneath the surface of the earth
hazardous waste	waste that contains chemicals or other compounds that may be harmful to humans or other organisms in the environment.
landfill	a site usually in the ground where solid waste is dumped and buried
leachate	liquids formed during the decomposition of wastes in landfill
methane	a gas that is formed by the decomposition of green waste
natural resources	term used to describe resources such as air, water and soil.
non-renewable resource	something that cannot be replaced, e.g. coal or oil resources
pollution	the potentially harmful contamination of air, water, soil or food. This may affect the health of humans and other organisms.
recycle	to reprocess materials such as paper, glass and metals, to produce new products
renewable resource	something that can be replaced or regrown, e.g. trees, wind or solar energy
re-use	using the same item over and over again.
seedling	young plant grown from a seed
solid waste	waste from households and businesses mostly made up of paper, food scraps, containers and garden (green) waste
sustainable	a way of using our natural resources that does not threaten their long-term survival or the survival of plants and animals (including humans) that depend upon them.
toxic	poisonous to living organisms
transfer station	a place where garbage trucks deliver waste to be sorted for re-use or recycling or to be transferred to a landfill site.
waste	left over or unwanted materials to be disposed of.
waste water	water after it has been used by people or industry, and which must be treated (made cleaner) before it is allowed back into rivers or the sea.
worm farm	place where earthworms are used to eat organic waste

References and Bibliography

Part 1: Green and organic wastes - mainly teacher resources

Appelhof, M., Fenton, M.F. and Harris, B.L. (1993). Classroom activities for a better environment. Flower Press, Michigan, USA.
Activities centred around a classroom worm farm.

Armstrong, Patricia (1998). The Waste Wise Way: savings, benefits and school operating practices. EcoRecycle Victoria.
A guide to becoming a Waste Wise school, including ways to minimise waste generation, recycling and composting.

Armstrong, Patricia and Laffin, John (1993). Waste Matters. Environmental education activities about waste. Gould League of Victoria Inc., Parhran, Victoria.
Resources covering waste issues, waste solutions, including composting.

Beverage Industry Environment Council (1998). 1997 National Recycling audit and garbage bin analysis. Beverage Industry Environment Council, Leichhardt, New South Wales
National, state and territory data on waste generation and recycling, based on a survey conducted in 1997. Good up-to-date source of data.

Commission for the Future (1989). Personal Action Guide for the Earth. Commission for the Future, Carlton South, Victoria.
A guide to personal action at home, in the garden, when shopping, on transport, at work and in the community.

DECS SA (1995). Educating about, in and for the environment. Department for Education and Children's Services, South Australia.
Case studies of effective environmental education for early childhood to year 10.

Ecologically Sustainable Development. Department of the Environment, Sport and Territories, ACT.
Leaflet, A4 format published in 1995 - useful definitions and background information.

EcoRecycle Victoria (c.1998). EcoRecycle Fact Sheets. EcoRecycle Victoria, East Melbourne, Victoria.
Series of 18 fact sheets on various waste topics including composting and wormeries.

Environmental Audits. An Environmental Education Resource for Students and Teachers Years 5-8. (1996). Gould League of New South Wales Inc. (The Gould Leaguer Volume 5 No 4).
A ready to use resource for conducting an environmental audit.

EPA NSW (1992). Home composting. Recycling Household Organic Waste. Environment Protection Authority New South Wales.
Booklet on how and what to compost.

EPA NSW (1993). Turn talk into action. Start an enviro youth forum. Environment Protection Authority New South Wales.
How to establish an enviro youth forum to debate environmental issues and plan actions to combat them.

EPA NSW (1997). Don't rubbish green waste. Environment Protection Authority New South Wales.
Topics covered in this booklet include mulching, composting and worm farms.

Gell, Rob and Beedy, Rosslyn (1989). It's easy being green. McCulloch Publishing, Victoria.
Guide to everyday environmental practices for Australian homes and workplaces. Covers a wide range of environmental issues including green waste.

Gough, Noel (1992). Blueprints for Greening Schools. Gould League of Victoria Inc.
A guide to developing an environmental education policy and practices for schools; includes examples.

Keep Australia Beautiful Council (1998). Environmental Education Resource Kit. Keep Australia Beautiful Council, NSW.
Teaching modules focus on ESD, biodiversity, heritage, pollution and waste.

Keep Australia Beautiful Council (1998). School Environmental Audit. A guide to best practice environmental management. Keep Australia Beautiful Council, NSW.
Well-designed guide to conducting a school environmental audit in water and energy use and waste generation.

Kefous, Keryn (1995). Working Worms - a half day field trip to the ACT Government Worm Farm. Department of Urban Services, ACT.
Activities for students visiting a worm farm or for general school use.

Murphy, David (1993). Earthworms in Australia. Hyland House Publishing, Melbourne.
Useful reference on earthworms - physiology, farming and use of worm castings to improve soil fertility. Informative and practical.

Nunes, Kelli (1998). A Directory of Compost Bins and Wormeries. Ecorecycle Victoria and the Gould League of Victoria Inc.
Why compost? Discusses types of compost bins and systems and lists suppliers in Victoria.

Our Land. LandCare Activities for Upper Primary. (1989). Department of Conservation, Forests and Lands, Victoria.
Student resource covering catchment and soil management, alien plants and animals and includes a section on earthworms.

Taylor, David and Yvonne (1998). The Compost Book. Reed/New Holland Publishing Pty Ltd, Sydney.
An approachable, alphabetical listing of topics relating to composting. Great drawings by Helen McCosker.

Thomas, Ray, Rea, Jeannie, Preuss, Peter and Malcolm, Steve (1995). We can do that! Education and action for our environment. The Victorian Environmental Education Council and Gould League of Victoria Inc.
Case studies of schools involved in communal composting, cooperative recycling, running an environmental camp and conference, and a host of other environmental projects. Great resource.

Windust, Allan (1994). Worms Downunder Downunder. Allscape, Victoria.
Useful text on worm biology and worm farming, including a section on worm systems for schools.

Other resources

Gould League of Victoria Inc. Education Programs - include Composting and Wormeries Programs, and The 3Rs Programs. For details contact Gould League of Victoria Inc., PO Box 1117, Moorabbin, Victoria 3189 or telephone (03) 9532 0909.

Compost and Minibeast Teachers Kit. Teacher's kit comprising Compost Creatures poster, bug catcher, and activities resources. Gould League of Victoria Inc.

Compost Creatures. Poster produced by Gould League of Victoria Inc.

Worms, Worms, Worms. Poster produced by CSIRO/Gould League of Victoria Inc.

Do Something! Planet Ark Environmental Foundation, Surry Hills, NSW.
Environmental education in action for primary schools. Kit comprises 15 units and a colour A1 size wall poster.

The Waste Wise Schools Kit. No Time to Waste video; The Waste Wise Way; Learning to be Waste Wise: A Curriculum Resource; Waste Information Sheets; The Footprints Project; Ollie Recycles CD-ROM. Gould League of Victoria Inc.

Part 2: Environmental and Waste Management Websites

Alternative Technology Association
ATA is a non-profit community group that aims to use and promote environmentally friendly technology.
http://www.ata.org.au

American Bio Tech
Commercial producers of composting machinery.
http://www.abt-compost.com

Biocycle Journal
Journal for researchers and operators in the composting and organic waste industry.
http://gm.com/news/home/biocycle/index.html

CRC for Waste Management and Pollution Control
see The Australian Waste Database

CSIRO
General information, research and publications on earthworms.
http://www.csiro.au/enquiries/earthworm.htm

Earthlink
A community organisation dedicated to environmental issues
hhtp://www.green-pages.com.au

EcoRecycle Victoria
Government agency with aim of minimising waste creation and promoting the sustainable use of resources and managing waste disposal. Useful education resources.
http://www.ecorecycle.vic.gov.au/sites.htm

Environmental Organisation Web Directory
Possibly the largest environmental organisation directory on the Web, includes sites from over 100 countries.
http://www.webdirectory.com

Environmental Sites on the Internet
A library of other environmental sites on the Internet designed by the Royal Institute of Technology, Stockholm, Sweden.
http://www.lib.kth.se/~lg/envsite.htm

Gould League of Victoria
Source of educational resources.
http://www.gould.edu.au/wastewise/index.html

Illawarra Waste Management
Worm farming information and links to other Australian and overseas sites.
http://www.globalpresence.com.au/excahnge/about.htm

International Institute for Sustainable Development, Winnipeg, Canada
Programs on sustainable development for business
http:/iisd.ca/

Keep Australia Beautiful
KAB runs antilitter campaigns and provides educational programs on environmental issues including waste minimisation, recycling, energy and water conservation.
http://www.kabnational.org.au

National Geographic Magazine
Extensive Web site with wide range of environmental articles and resources.
http://www.nationalgeographic.com/index.html

New Zealand Institute for Crop and Food Research Ltd
Useful material on earthworms and their role in agriculture.
http://161.65.2.12/curresea/soil/wormman.htm
http://161.65.2.12/curresea/soil/wormtype.htm

Norway, State of the Environment
Waste production in Norway from the State of the Environment Report 1998.
http://www.grida.no/soeno97/waste.htm

Planet ARK
An independent environmental organisation that aims for change by working with business and educating the community.
http://www.planetark.org/news/

PRISM
An information service of the World Resource Foundation, dedicated to providing information on sustainable waste management.
http://www.wrfound.org.uk/index.html

Singapore, Ministry of the Environment
Waste management and data from Singapore's Department of the Environment.
http://www.gov.sg/env/function/solid.htm

The Australian Waste Database
AWD provides an overview of waste management in Australia. Data is available on a State/Territory basis.
http://www.civeng.unsw.edu.au/water/awdb/awdb2.htm
Also provides access to waste data from other countries.
http://www.water.civeng.unsw.edu.au/water/awdb/otherwd.htm

United Kingdom, Environment Agency
Waste management program in the United Kingdom.
http://www.environment-agency.gov.uk/envinfo/understand.htm

WHEN (World Home Environment Network)
WHEN is a non-profit group whose aim is to educate the community in order to effect positive environmental management.
http://www.vicnet.au/~when/

Worm Woman
The Worm Woman, Mary Appelhof's web site. Information about earthworms and composting, resources and more!
http://www.wormwoman.com/frameindex.html

This list is in part based on EcoRecycle Victroia's Education fact sheet Other Web Sites (1998)

Part 3: Wastes including green and organic - books for students

Asimov, Isaac (1992). Why does litter cause problems? Gareth Stevens Publishing, Milwaukee, Wisconsin, USA
Litter in our environment and how you can help reduce it by a well-known scientist.

Augarde, Steve (1980). Mr. Mick. Andre Deutsch, London.
Story about a man who finds treasures on the local rubbish tip and learns how they got there.

Bailey, Donna (1991). What we can do about Recycling Rubbish. Franklin Watts Australia, Lane Cove, New South Wales.
What rubbish do we create and how can it be recycled.

Bellamy, David (1991). How Green are You? Frances Lincoln, London.
Environmental activities for younger students by a famous scientist and botanist.

Bonar, Veronica (1992). Metal Rubbish! Heinemann, Oxford, UK
Bonar, Veronica (1992). Paper Rubbish! Heinemann, Oxford, UK
Bonar, Veronica (1992). Plastic Rubbish! Heinemann, Oxford, UK
Bonar, Veronica (1992). Wood Rubbish! Heinemann, Oxford, UK
Series of books on metals, paper and wood waste - what is it, what it is used for and how we can recycle or reuse this type of waste.

Brown, Paul (1998). Energy and Resources. Living for the future. Franklin Watts, London, UK
Well-illustrated text on our natural resources (energy, water, air, forests, wildlife) and their management.

Condon, Judith (1990). Waste Control - Just Rubbish. Franklin Watts Inc., New York, USA
What is paper? How can we recycle paper waste and how you can help.

Dehr, Roma and Ronald Bazar (1989). Good planets are hard to find! Namchi United Enterprises, Canada.
An environmental information guide, dictionary and action book for students. Contains a lot of useful information.

Gamlin, L. (1990). Let's Explore the Plant World. William Collins & Sons, London.
Well-illustrated book about plants, seeds, growing plants and conservation issues.

Glaser, L. (1996). Compost. Growing gardens from your garbage. The Millbrook Press, Connecticut.
Composting and recycling green waste; beautifully illustrated.

Hare, Tony (1991). Recycling. Franklin Watts Ltd, London.
Good text on waste, recycling methods, energy from waste and how to get involved.

Hare, Tony (1992). Domestic Waste. Franklin Watts Ltd, London.
Good text on waste generation, disposal methods and taking personal action; well-illustrated.

Harris, Colin (1992). Protecting the Planet. Wayland (Publishers) Ltd, Hove, East Sussex, UK
Protecting our environment and wildlife; types of pollution (water, air) and resource conservation; recycling

Hawkes, N. (1988). Toxic Waste and Recycling. Franklin Watts, London.
Includes section on living on a landfill site.

Houghton, Graham (1990). Bioenergy. Alternative Energy Series. Wayland (Publishers) Ltd, Hove, East Sussex, UK
Why alternative energy? What is bioenergy and how is it produced?

Howes, J. (19940. Solving Our Rubbish Problems. Macmillan Education Australia, South Melbourne.
Contains information on world waste generation.

Howson, John (1993). Going Green at Home and School. Wayland (Publishing) Ltd, East Sussex
Global environmental issues including information on waste generation around the world and recycling; written in association with Friends of the Earth.

Ingpen, R. and Dunkle, M. (1987). Conservation. Hill of Content, Melbourne.
Explaining conservation to young children.

James, B. (1989). Waste and Recycling. Wayland (Publishers) Ltd, Hove, East Sussex, UK
Types of waste generated by humans, pollution and how to protect the environment.

Lavies, B. (1993). Compost Critters. Dutton Children's Books, New York.
Great colour photographs of the creatures that live in a compost pile or bin.

Llewellyn, Claire (1991). Rubbish. Simon & Schuster, Hertfordshire, UK
Suitable for early childhood; what is rubbish and how can we recycle it?

McHarry, Jan (1995). The Great Recycling Adventure. A lift-a-flap look at old things made new. Hodder Headline Australia Pty Ltd, Sydney.
An innovative approach to discussing recycling using detailed pictures with flaps to lift and pictures that move. Good fun and very informative.

Moon, Pat (1991). Earth Lines. Poems for the green age. Greenwillow Books, New York.
A collection of poems that celebrate our planet Earth and our concern for its healthy survival.

Morrissey, D. (1993). Recycling Wastes. Changing Our World. Macmillan, Melbourne.
Good summary of recycling all types of wastes.

Parker, Steve (1997). Waste, recycling and re-use. Wayland (Publishers) Ltd, Suffolk, England.
Well-illustrated book on waste issues, disposal and recycling.

Pearce, F. (1991). Ian and Fred's Big Green Book. Kingfisher Books, London.
Major environmental issues discussed; well-illustrated.

Peckham, Alexander (1990). Resources Control. Franklin Watts Ltd/Gloucester Press, London, UK
Resources and their use; lifestyle and resource use; recycling and conservation.

Rosser, J.K. (1991). Teenage Mutant Ninja Turtles ABC's for a Better Planet. Random House, New York, USA
Illustrated A to Z of environmental issues and what you can do to solve environmental problems.

Royston, Angela (1998). Recycling. Environment Starts Here! Series. Wayland Publishers Ltd, London.
Waste generation and disposal; recycling, reuse and creating less waste. Well-illustrated and easy to read.

Skidmore, S. (1990). What a load of rubbish! Collins Dove, Melbourne.
Rescuing and using your household waste.

Spence, M. (1992). Toxic Waste. Franklin Watts Ltd/Gloucester Press, London, UK
What is toxic waste? Discusses air pollution, domestic waste, sewage, nuclear waste, and taking action.

Taylor, B. (1996). Animal Homes. Harper Collins Publishers, Sydney.
Animals that live in a compost heap; well-illustrated with colour photographs.

Walker, Colin (1992). The Great Rubbish Mountain. Lands End Publishing, Wellington, New Zealand.
How can we re-use or recycle paper, plastic, metal, glass, organic and other wastes?

Walker, Kath (1981). Father Sky and Mother Earth. Jacaranda Press, Brisbane.
Aboriginal perspective on plants and animals on earth.

Wilcox, Charlotte (1988). Trash. Carolhoda Books Inc., Minneapolis, USA
Well-illustrated book on the story of garbage including pick-up, landfills and recycling.

Wilkes, Angela (1991). My First Green Book. Hodder & Stoughton, Sydney.
Well-illustrated activity book on environmental issues for young students.

Videos

My First Green Video (1992). Dorling Kindersley Ltd
Includes segments on Your Rubbish and Soil Testing

Worm Bin Creatures Alive Through a Microscope. 31 minutes. Flowerfield Enterprises, Michigan, USA.

Wormania! (26 minutes and teaching guide) Flowerfield Enterprises, Michigan, USA.