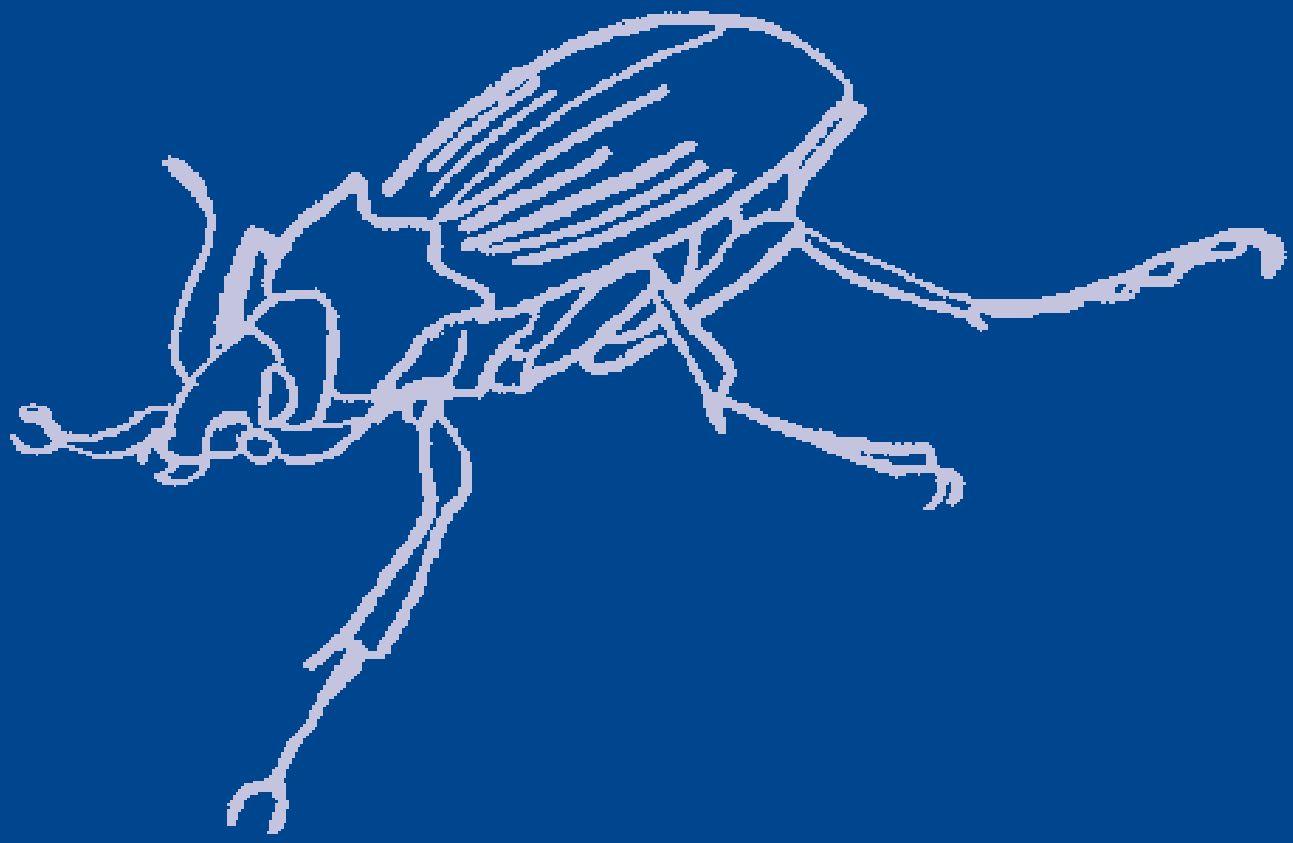
ALBERTA ENVIRONMENT

Waste in the Natural World



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Kananaskis Country

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The publications are produced by environmental education staff in a close working relationship with teachers, community educators, Alberta Environment staff, and program writers. Programs focus on the areas of environmental education, science, social studies, and language arts, and emphasize elements of environmental understanding, lifestyle, and citizenship.

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The Big Picture

Protected areas are legislated lands that have varying degrees of protection, based upon the uniqueness of the area, its diversity, and resources. Field studies in protected areas offer a unique series of opportunities for educational experiences. These areas allow visitors to study and appreciate natural communities and systems, which can be revisited time and time again as the natural processes change over time.

By recognizing the value of the diversity and beauty of these precious lands, visitors can learn stewardship, and an appreciation for their continued existence. The actions and attitudes that apply to learning about protected areas also influence the decisions we make as a society about land use and preserving other lands outside protected areas.

Why Study Waste?

Think about the term *waste*. In the dictionary waste is defined as anything that is regarded, or discarded, as worthless or useless. Is there any by-product in natural communities of living and non-living things that could be considered waste? Do plants and animals produce waste?

In natural communities and processes, nothing is *useless or worthless*. When an antler is shed, when a plant dies, when a bird abandons its nest – all these materials are used again and woven back into the complex tapestry of life. What goes around, comes around. Concepts such as recycling and re-using are not recent phenomena in the natural world; they have been part of planet's natural processes since the beginning of time! Humans are another story. We are the species that invented the concept of waste, and we have not found adequate ways of dealing with the challenges associated with it. Are there lessons that we can learn from the natural environment?

Waste in the Natural World complements the grade four Science Unit, Topic A: *Waste and Our World* from the Alberta Program of Studies, and also connects to other science, social studies, and ecological studies. The essence of this guide is a one-day outdoor field study. Its main focus is on first hand experience – observing, sensing, exploring, and reflecting – connecting students with the life and death cycles of a diversity of life forms and environments. To support this experience, there is background information, classroom activities leading into and out of the field study day, and an appendix of support materials.

Throughout this program, reference is made to natural and human communities. Although the distinction is made to encourage students to compare and contrast the two communities, the reality is quite different. Human communities are very much part of, rather than apart from, the natural processes and functions of biological communities. By looking at natural processes, insights can often be observed on how human communities might better function as a component in the web of life. This field study unit is intended to get students thinking about these kinds of insights and connections to natural communities.

The greatest producers of waste materials in Alberta are: Commercial/ Institutional (40%) Residential (33%) and Construction/Demolition (27%). In the home, 35% of all waste generated in the home is from leftover food and yard waste, while paper makes up 25%.

At A Glance

Topic: Ways in which natural communities deal with waste.

Time Required:

Pre-field study: 4 - 5 hours
Field Study: Full day
(approximately 5 hours, including lunch)
Post Field Study: 3 - 4 hours

Adult Requirements for Field Study:

One teacher, plus one volunteer for each group of five students.

Curriculum Tie-Ins:

Science: Grade Four, Topic A: Waste and Our World
Students will be able to:

- Identify plant and animal wastes, and describe how they are recycled in nature. For example, plant leaves serve as a source of food for soil insects, worms and other creatures. The wastes of these animals may be further broken down by molds, fungi, and bacteria.
- Identify and classify wastes that result from human activity.
- Distinguish between wastes that are readily biodegradable and those that are not.
- Identify alternative materials and processes that may decrease the amount of waste produced; e.g., reducing wastage of food, using both sides of paper.
- Identify ways in which materials can be reused or recycled, including examples of things that the student has done.
- Develop a flow chart for a consumer product that indicates the source materials, final product, its use and method of disposal.
- Identify actions that individuals and groups can take to minimize the production of wastes, to recycle or reuse wastes and to ensure the safe handling and disposal of wastes.
- Develop and implement a plan to reduce waste, and monitor what happens over a period of time.

Recycling one tonne of paper saves seventeen trees!

It takes 60 percent less energy to manufacturer paper from recycled stock than from original materials.

Social Studies:
Topic A:
Alberta: Its Geography and People

- Use and interpret maps of Alberta.
- Analyze how the use of a natural resource can effect the rest of the environment.
- Predict the consequences of misusing natural resources.
- Draw conclusions about the use of renewable and non-renewable resources.

Language Arts:
Exploring:

- Formulating hypothesis
- Posing questions to organize investigations

Constructing:

- Focus their talk or writing on the important ideas related to a topic.

Communicating:

- Provide support for the expression of opinions on topics within their immediate experience.

Math:

- Classify objects according to visible characteristics.
- Use appropriate standard measuring units for length.

Physical Education:

- Experience success and enjoyment through participation in outdoor activities.
- Understand the use of clothing and footwear appropriate to outdoor activities.
- Understand safety principles as they apply to outdoor pursuits.
- Cooperatively work in groups.

Pre-Field Study Activities

What Is Waste?

Objective:

Students appreciate the meaning of the term waste and other related concepts.

Materials:

- Whiteboard and chalk

Time Required:

40 minutes

Background:

In this introductory activity, students identify words related to the following concepts: *waste* (natural versus human-made) *biodegradable* and *non-biodegradable*. They then review the three R's of waste reduction/elimination, and determine if there are examples of reducing, re-using, and recycling in the natural environment.

Instructions:

1. Introduce this unit by writing the word **WASTE** on the board, without any explanation. One by one, ask students to give you one word that they associate with the term waste. (Each word must be different.) Write all these words down.

2. Then ask the class to look at all the new words. Introduce the term *biodegradable* (i.e. something that is able to break down – rot, decay, decompose – through natural processes) and ask students if they know what it means. Can they find an example of a biodegradable item in the list of words? Or a *non-biodegradable* item?

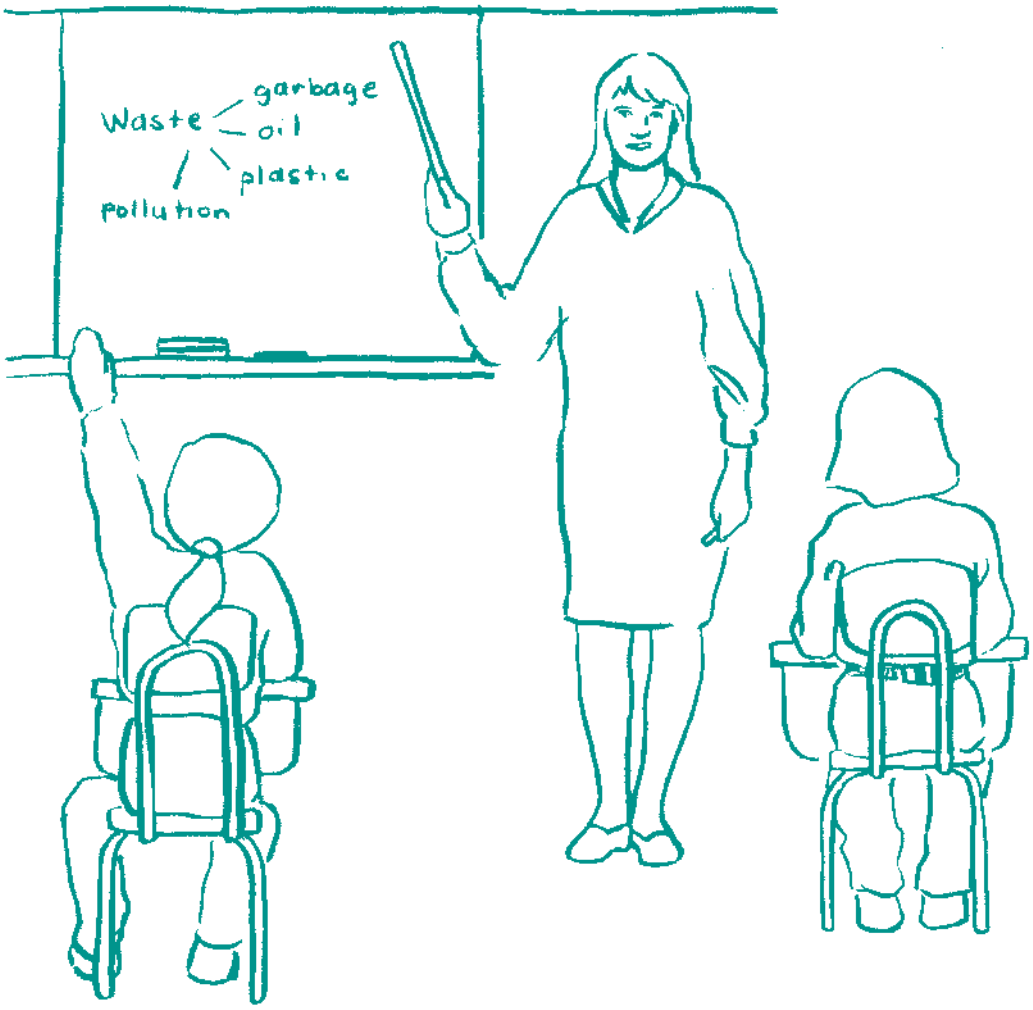
3. Ask students to tell you what the three R's represent (i.e., reduce, re-use, recycle)

4. Divide the class into six groups. Assign each group a category from the following list. Ask students to place any words from the list on the board that fit within their category. Each group records their words on a separate sheet of paper.
   The categories are:
   - Biodegradable
   - Non-biodegradable
   - Recyclable
   - Re-usable
   - Reducible
   - Non-recyclable, non-re-usable, non-reducible

5. Ask each group to read out the words they placed in their category. Which categories had the least number of words in it, The most? What does this tell us about the waste we produce? What does this tell us about how much waste could be managed through recycling, reducing, or re-using?

6. To conclude the activity, ask the class to examine the words on the board again, and this time to find a word(s) which describes waste produced by organisms in the natural environment. Which category would the word fit in? Can they think of any other examples of natural waste? From their review, is there anything in the natural world that can be placed in the categories: non biodegradable, non-recyclable, non-reusable, or non-reducible? What does this tell us about the presence and value of waste in a natural community? A human community?

Paper makes up 32% of Alberta's solid waste.



Falling to Pieces

Objective:

Students conduct an experiment to explore the concept of decomposition.

Materials:

Bag of potting soil
Ten containers (e.g. tin cans – a good re-using exercise!)
Masking tape and markers (for labelling)
Large sheet of newsprint
Following ten items:

- Green leaf (from a house plant is fine)
- Wooden match
- Slice of apple
- Slice of banana
- Small piece of paper
- Piece of polystyrene cup
- Plastic straw wrapper from a drinking box
- Potato chip bag
- Plastic drink top
- Metal bottle cap

Time Required:

One hour (plus on-going weekly monitoring for six weeks)

Background:

Students set up an experiment to be monitored over the course of the unit. Ten containers are filled with soil and a variety of different items, both biodegradable and non-biodegradable. Students are asked to predict which ones will decompose and the order in which the items will *disappear*. The containers are checked once a week for the six-week duration of the unit, to monitor the ongoing process of decomposition.

Instructions:

1. Review with students the meaning of the term *biodegradable*. Tell students that they will be conducting an experiment to test the biodegradability of a number of different objects.

2. To set up the experiment, divide the class into 10 groups. Instruct each group to fill a container with garden soil and bury one of the ten items from the list of materials. Label the container according to what is inside.

3. Review the items in each container with the class. Ask them to predict which ones will decay, or decompose, and the order in which the decomposition will occur. Inform the students that they will be checking the containers once a week for the next six weeks.

4. Write the class prediction for the *order of decomposition* on a large sheet of newsprint and post it on a wall in the classroom. Beside the list of items, at the top of the page, write **Week 1** through **Week 6.**

5. Once a week, assign a different group of students to check the containers and record, on the newsprint under the appropriate week, the status of each item. Remarks could compare the current item to its original form, what might be growing on it or eating it, if colour or odour has changed, etc.

Remember to collect your beverage containers for recycling. Ninety-five percent of the energy required to make aluminum is saved in the recycling process.

Every tonne of recycled paper saves 4200 Kilowatts of energy, enough to meet the energy needs of at least 4000 people, or power the average home for 6 months! Every tonne of paper not landfilled saves 3 cubic meters of landfill space!

ITEM	WEEK 1 WEEK 2	WEEK 3 WEEK 4	WEEK 5 WEEK 6
Green leaf			
Wooden match			
Slice of apple			
Slice of banana			
Small piece of paper			
Piece of polystyrene cup			
Plastic straw wrapper			
Potato chip bag			
Plastic drink top			
Metal bottle cap			

A Rotten Time

Objective:

Students develop an awareness of factors affecting the rate of decomposition of organic material.

Materials:

Soil
- 4 plastic containers
- 4 slices of apple
- 4 spoons
- Resealable plastic bag
- Water
- Earthworms
  Contact a local fishing shop for information about where to obtain live earthworms.
- Masking tape and marker
- Seeds (e.g. *Brasica rapa)*
  Oilseed Rape (a mustard) or alfalfa seed. Seeds are available from any home and garden centres.

Time Required:

One hour (plus on-going daily monitoring for four weeks)

Background:

Soil forms when *organic material* decays, breaks down and mixes with inorganic materials such as clay, sand or silt. The breakdown of organic material happens naturally with the help of decomposers such as soil organisms, which in turn require oxygen and water to survive and carry out their roles in the decomposition process.

A plastic bag prevents oxygen, water, and decomposers from getting at the organic material preventing decomposition from happening. (This is analogous to the plastic bags full of garbage that we send to the landfill every week.)

Recycling one tonne of paper (about a stack of bond paper 20 meters high) saves 31500 litres of water, enough to supply the daily water needs of almost 30 households.

In this activity, students set up an experiment to determine what factors affect the rate of decomposition and decay in organic materials, and what soil components assist in the growth of plants. Four containers are filled with soil. The same amount and type of organic material (slice of apple) is added to each container, with varying treatments. Students then predict the rate of organic decay in each of the containers.

Students also plant a seed (e.g. *Brasica rapa*) in each of the containers, and predict which soil treatment will provide the best medium for growth. Containers are checked **daily** for seedling development and after **two and four weeks** for decay of organic material.

Instructions:

1. Divide students into four groups. Each group is given a container, some soil, and a slice of apple.

2. Assign a different treatment of each container to each of the four groups as follows:
- bury the apple slice in the soil
- seal the apple slice in a resealable plastic bag and bury it in the soil
- bury the apple slice in the soil, with the addition of water, as needed, to maintain a moist soil
- bury the apple slice in the soil, with the addition of earthworms, and with the addition of water, as needed, to maintain a moist soil.

3. Have each group make a label for their container, based on what its contents are.

4. In each container, have students plant 3 or 4 seeds just below the surface of the soil.

5. Place all four containers in the sunlight, by a window in your classroom. For containers three and four, make sure water is added whenever necessary.

6. Have each group make notes every day about what they see happening in the development of the seedlings and any other changes to the contents of the containers.

7. After two to four weeks, have students remove or replant the seedlings and gently scoop out what is left of the apple slice from the soil. Have them record their observations of the changes they see.

8. As a follow-up class discussion, raise the following questions:
- What were the differences in the amount of decay of the apple slices in the 4 containers?
- Which decayed the fastest? Which decayed the slowest?
- What does this tell you about the components that are required for decomposition?
- Which container(s) had the best seedling growth?
- What does this tell you about the relationship between decomposition, soil, and plant growth?

The bicycle is the most efficient form of transportation known. It uses five times less energy than walking. You get the same amount of exercise on a bicycle– it's just that you travel five times as far.

Meeting Some Decomposers

Objective:

Students observe the relationship between soil animals and soil decomposition.

Materials:

One of each of the following items per group of five students:

- Labelled diagram and instructions for making a Berlese funnel (see p.12)
- Resealable plastic bags
- Tin can, open at both ends (e.g., soup can)
- Funnel (or students can make a funnel out of cardboard and masking tape)
- 13 mm hardware cloth (15 cm. square)
- Clear plastic container (i.e., 2L soft drink bottle cut in half)
- Paper towel
- Water
- Dark construction paper
- Masking tape and marker
- Soil insects identification sheet
- Other identification references

Time Required:

Approximately one and a half hours

Background:

Students work in small groups to construct Berlese funnels (a simple instrument for filtering out soil dwelling animals). Each group collects topsoil or leaf litter from different locations near the school to place in the funnel. Afterwards, students record and compare their findings.

Instructions:

1. Divide the class into groups of five students each. Explain that they are going to meet some of the animals that live in the soil. One of the pieces of equipment that they will use is called a Berlese funnel.

2. Give each group one of each of the items from the list of materials above. Ask them to follow the enclosed instructions for making the Berlese funnel.

3. Have each group collect a resealable plastic bag full of soil from different parts of the schoolyard. As an extension, you could have the class compare lawn soil with woodlot soil or schoolyard soil with natural meadow soil. Try to ensure that there are different kinds of soil collected (for example, some with leaf litter, some with sandier content, or some dark soil).

4. When the groups have completed their funnels and filled the cans with soil, have students place them in full sunlight or under an electric light. The idea behind the funnel is that the soil insects will tunnel deeper into the soil to avoid the light and heat; they will eventually fall through the funnel into the moist dark environment inside the jar.

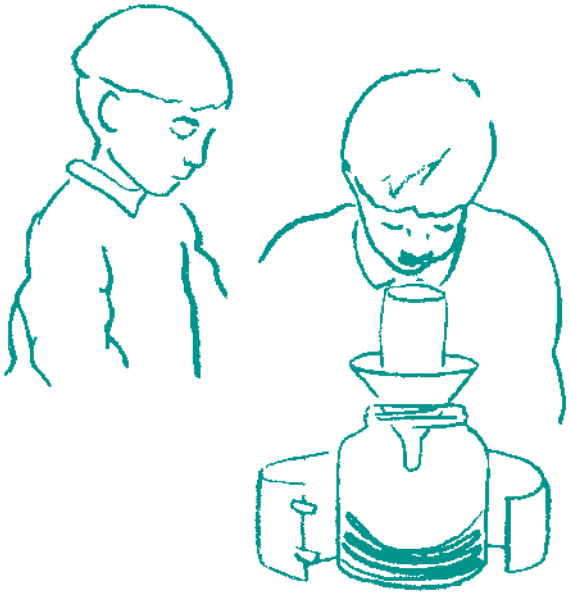
5. Allow about 24 hours before checking the clear bottom container, by pulling back the dark paper to look inside.

6. Have students examine the contents of the container and identify the soil insects by referring to the identification sheet (p.39) and other references (p.43).

7. In a class discussion, raise the following questions:
- Were you surprised at how many animals were in the soil?
- Were there differences in the numbers and kinds of animals in the different soils?
- What are these animals eating?
- How do you think they help create soil?

8. Each group can conduct further research on one of their animals and its role as a decomposer. This information could then be shared with the rest of the class.

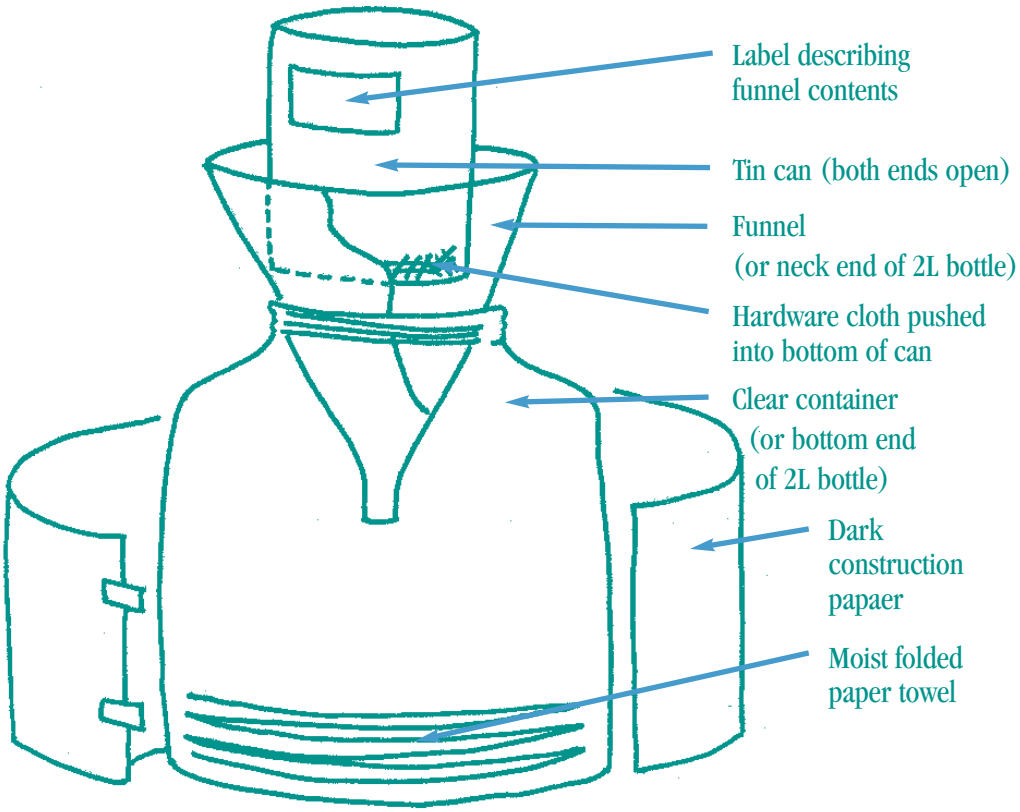
Fluorescent lighting is four times as efficient as incandescent lighting. A 13-watt compact flourescent bulb can be used in place of a standard 60-watt incandescent bulb and lasts 10 times longer.



Instructions for Making a Berlese Funnel

Instructions:

1. Push the hardware cloth through the tin can to the bottom.
2. Fold the paper towel and place it in the bottom of the clear container. Add a bit of water so that the paper towel is moist.
3 Fit the funnel in the container opening. Then place the empty can on top of the funnel.
4. Tape dark construction paper around the outside of the container.
5. Fill the can with leaf litter and soil. Use the masking tape and marker to make a label describing where the sample came from and what it looks like. Put the label on the can.
6. Place your Berlese funnel under an electric light.



Canada is the **second** greatest producer of waste in the world. The United States is first with some interesting statistics.

Every two weeks, enough glass bottles and jars are thrown away to fill the 400 meter high twin towers of New York's World Trade Center!

American consumers and industry throw away enough aluminum to rebuild their entire commercial airfleet every three months!

Two and a half million plastic bottles are produced every hour, and only a small percentage are now recycled.

Every week more than 500,000 trees are used to produce two-thirds of the newspapers in the United States that are never recycled.

There is enough office and writing paper thrown away annually to build a wall 4 meters high stretching from Los Angeles to New York City.

Twenty-four million tonnes of leaves and grass clippings are disposed of every year, which could be composted to conserve landfill space.

There is enough iron and steel thrown away to continuously supply all of the nation's automakers.

A Bad Kind of Litter – Human Litter

Objective:

Students examine the materials (garbage or solid waste) of which human communities dispose. Investigate the amount, composition, and the time it takes to break these materials down through natural decomposition processes.

Materials:

- Gloves (one pair per student in group)
- Garbage bags (heavy duty)
- Old tarp or large garbage bag cut open
- Rope or string (approximately four metres)

Time Required:

Class period

Background:

Students search for and collect garbage from different locations. Have them sort through and categorize the different kinds of garbage and create a garbage time-line, predicting the order in which each type of waste would decay.

Instructions:

1. The day before you plan to do this activity, ask students to pick ten items from home that they know will end up in the garbage bag and be thrown out. Caution students to avoid items that have sharp or broken edges.

   Optional: Students can also do a quick pickup in the schoolyard during the beginning of the class period. This can be added to the material brought from home.

2. Have students dump their items onto the tarp. Using the rope or string, measure out a distance of about four metres. Inform the students that the rope represents a decomposition time-line. Pick a leaf off the floor and place it at one end of the rope, indicating that the leaf represents items that will decay the fastest. The other end is for materials that decay the slowest.

3. Have one student after another pick an item out of the garbage and place it somewhere on the time line. Ask them to try to form different categories of garbage (e.g. hard plastic, plastic wrapper, glass, foil, paper, and wood). Initially students will make the decision on their own about where the pieces of garbage should go along the timeline.

White walls and ceilings reflect 80% of the light that strikes them, while black ones reflect only 10%. It takes less energy to brighten a room that is lighter in colour.

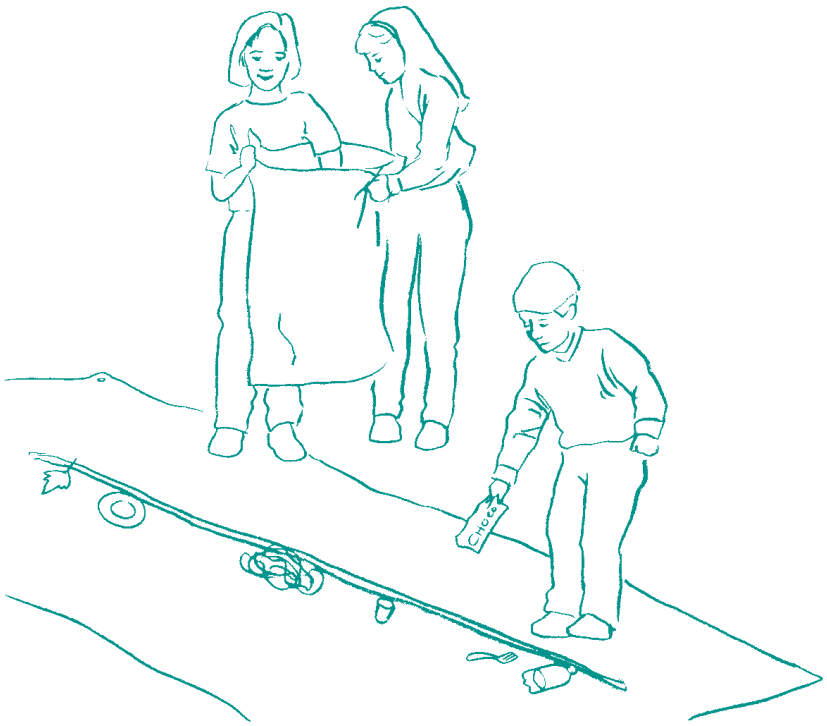
4. Once there are about 7 to 10 categories of garbage on the time line, ask the group to have another look at the order, and together decide if they are satisfied with where everything is placed. Once they have made a group decision, review the timeline with them.

Here are some estimates of the rate of decomposition for different kinds of garbage:

• paper/paper plate	2 - 5 months
• cotton rag	6 months - 1 year
• rope	1 - 2 years
• orange peels	6 months - 2 years
• wool sock	1 - 2 years
• milk carton	5 years
• plastic bag	5 years
• cigarette butt with filter-tip	10 - 12 years
• wooden popsicle stick	10 - 12 years
• leather shoe	25 - 40 years
• nylon cloth	30 - 40 years
• plastic containers	50 - 80 years
• tin can	100 years
• aluminum can	200 - 500 years
• glass bottle	1000's of years to indefinite

5. Put all the items back into a garbage bag. Follow-up discussion could focus on the following questions:

- Approximately how many years will it be before all of this garbage decomposes?
- What changes could be made with these and other products to make them more *compost- friendly* and reduce the amount of waste in landfills? Why don't we do it?
- Are any plants or animals going to decompose these materials?
- How does all this waste make you feel?
- What happens to all the waste we currently produce?
- What can we do to cut down on the amount of garbage we produce?
- What can students do personally to make a difference?

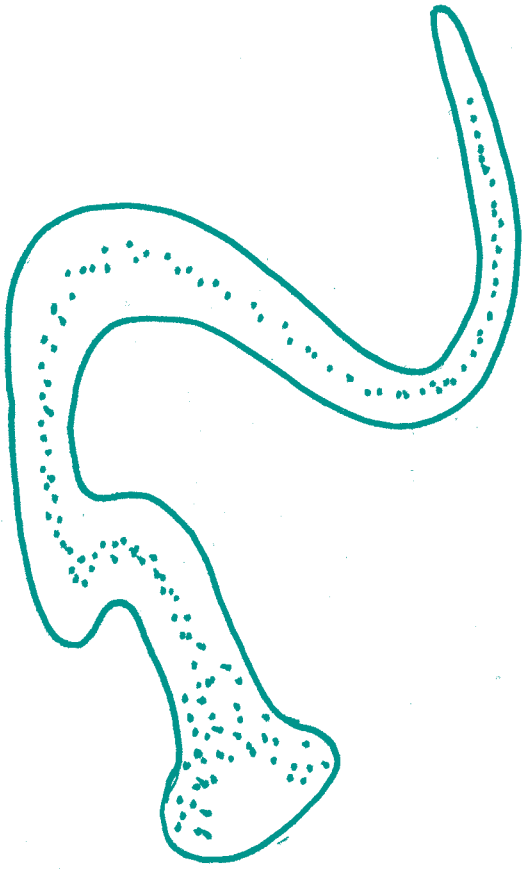


Field Study Activities

A fixture with 25-watt light bulbs gives half the light of one 100-watt bulb.

The following field study activities are grouped into two categories:

1. Introductory activities, including two short and active activities designed to get students moving after their bus ride and to highlight some of the key concepts for the day.
2. Field stations that include six distinct field activities. Each activity requires approximately the same amount of time to complete.



There are several options for conducting these activities with your class:

- Rotating field stations; two sets of three activities each. Class is divided into three groups of approximately 8 to 10 students each. Each group begins at one of the first three activities. At a set time, groups rotate to the next station. First set of three activities are done before lunch, second set of three after lunch. One parent volunteer stationed at each activity.

- Rotating field stations; one set of six activities. Class is divided into six groups of approximately 4 to 5 students each. Each group begins at a different station, and rotates to another after a set time. Groups complete three activities before lunch, three after lunch. One parent volunteer stationed at each activity.

It is suggested that teachers appoint a parent volunteer to teach a particular station. This would require a short workshop for the volunteers after school to demonstrate how each activity is conducted. This preparation will ensure a smooth running of the day's events. This format also frees up the teacher to circulate amongst the different stations and monitor the students' progress throughout the day.

Introductory Activities

What's the Answer?

Objective:

Students appreciate that the environment is always in a state of dynamic change.

Materials:

Index cards and pencils (one per group)

Time Required:

Twenty minutes

Instructions:

1. Divide the class into groups of three students each. Give each group one index card and a pencil. Tell students that their task is to search the field study area for any examples of things that **do not change**. (They can write down the names of any items they find on the index card.)

2. After ten minutes, call students back to the circle. Ask them to share their discoveries. What did they find?

3. Follow-up discussion serves as an introduction to the day – the environment is **always** changing, cycling and recycling. Even rocks, which appear solid and unchanging, erode over time. However, did any students find evidence of human-made waste materials? Garbage produced by humans may eventually break down, but some materials such as glass and plastics, take a very long time, even longer than some rocks.

Garbage: Could we bury it?
Burying garbage can contaminate groundwater. The water that flows beneath these deep holes is often our drinking water. Landfills are carefully sealed; however, there is always the chance that they could leak. Once groundwater is contaminated, it is extremely expensive and difficult, sometimes impossible, to clean up.

Could we burn it?
Yes and no. Incineration does generate energy, but at a cost. It may release toxins into the air and create ash that requires disposal in hazardous-waste landfills. And that takes us back to the starting point: cities are running out of places to put their trash.

Producers, Consumers and Decomposers

Objective:

Students appreciate the interrelationships and interconnectedness of life, through an active game of tag.

Materials:

Four sets of coloured arm bands (e.g. ten red, ten brown, ten green and two yellow bands.)

Time Required:

20 minutes

Background:

This activity is a game of tag, beginning with a short review of producers, consumers, and decomposers:

- **Producers:**
  Green plants that are able to make their own food using energy from the sun.
- **Consumers:**
  Any living organism that cannot make its own food and must eat plants and animals to get the energy it needs for survival; consumers can be **herbivores** (plant eaters), **carnivores** (animal eaters), or **omnivores** (plant and animal eaters).
- **Decomposers:**
  Living organisms, including bacteria, fungi and insects, that break down the remains and waste products of plants and animals.

Instructions:

1. Begin with a quick review of producers, consumers, and decomposers. Using these three categories and the sun, review some of their interrelationships.
   For example:
   What do decomposers eat? (*Dead producers and consumers*)
   What do consumers eat? (*Other consumers, producers, and decomposers*)
   Where do producers get their energy? (*The sun*)

2. Divide students into three groups of about ten students each, plus two students in a separate group. Tell everyone that they are going to represent the three living components of an ecosystem – producers, consumers, and decomposers; and two students will represent the sun. Distribute the armbands in the following way;
   - Green - Producers
   - Red - Consumers
   - Brown - Decomposers
   - Yellow - Sun

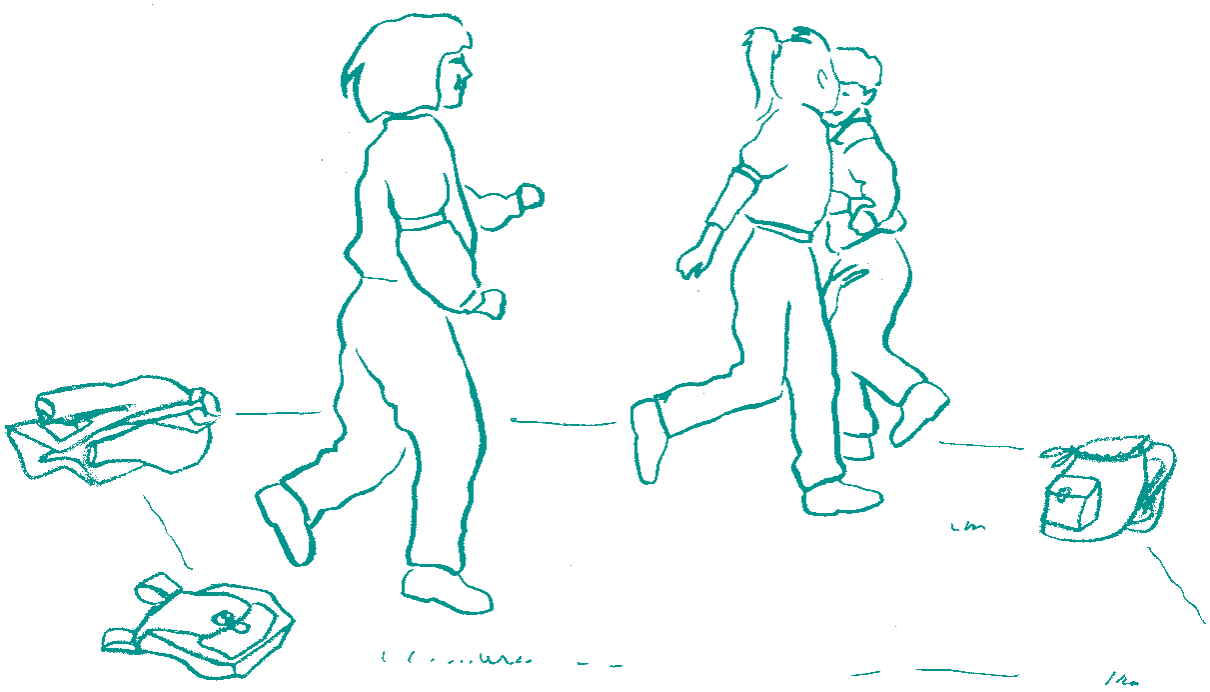
One tonne of recycled tin cans saves 560 litres of oil in manufacturing and 1.5 tonnes of iron ore, both non-renewable resources.

Every tree absorbs an average of 4 kilograms of carbon dioxide from the air every year.

3. Outline the play area boundaries, using jackets or backpacks as the four corners. Have students spread out. Every couple of minutes, call out a different relationship which requires one group to chase after and tag another to demonstrate the connections. For example:

- "Decomposers break down consumers and producers!" - All the brown arm-banded students chase after the green and red arm-banded students.
- "Consumers eat producers!" - Red chase green.
- "Consumers eat consumers" - Red chase red.
- "Consumers eat decomposers!" - Red chase brown.
- "Producers get energy from the sun!" - Green chases yellow.

4. Let the game continue until all the relationships have been explored. Then call students back to the circle. The follow-up discussion can review how the game showed the interconnectedness of all life - and death - in an ecosystem. As the game demonstrated, all the components of the ecosystem were active; no one was left standing around wasting their time! Every part of the ecosystem played an important part and nothing was **wasted.**



Field Stations

Buying in bulk saves up to 30% of packaging over buying in small quantities.

Life On A Rotting Stump

Objective:

Students discover that, even though something may appear dead and decaying, it is being recycled into a life-giving source for other plants and animals.

Materials:

- Rotting stump or log
- 2 hand lenses or magnifying glasses per group
- 2 small penlights per group
- Data sheets (see enclosed), clipboard, and pencils; enough for one per group
- Field guides (e.g. non-flowering plants, insects)

Time Required:

Class period

Background:

A rotting stump or log offers one of the best locations for exploring the rich variety of life found on the woodland floor. Many of the life forms found there, such as mosses and lichens, are slowly breaking down the log into organic material. The stump also provides a home for small mammals, insects, worms and spiders. Students look for signs of activity and interactions between the rotting stump or log and plants and animals. The student's findings are recorded on a data sheet.

Instructions:

1. Scout the field study area ahead of time to locate either a large fallen tree that is decaying, or a rotting stump. Try to find several logs or stumps to look at throughout the day, rather than using just one for all the groups. Review the activity and the site with one parent volunteer who will stay at the stump or log to facilitate each of the groups coming through.

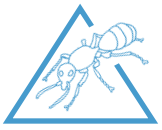
Note: As many students may be looking at the same feature on the stump or log, ask students to carefully explore its features and, if they move or lift a part, to put it back gently in its place.

2. After a group arrives at the station, begin by having them look closely at the stump or log without the aid of magnifying lens or light. What do they see? Is the stump or log moist or dry? What kinds of plants live there? What is the condition of the stump? Are there signs of insect holes or animal dens?

3. Assign roles to different group members (these should be changed several times during the activity):
- **Botanist**(s): Look for plant life
- **Zoologist**(s): Look for animal life
- **Recorder**: Record findings on data sheet

4. Distribute one magnifying lens, penlight, and identification sheet to each of the groups of botanists and zoologists. Ask them to find and identify at least seven different plants and animals. *Zoologists* can also note evidence of animals, if they cannot observe the animal itself. For example, they should look for fungi, lichens, mosses, seedlings, borings, tunnels, sawdust, seed cases, nut shells, exoskeletons, webs, holes, pupa cases, larvae, insects, etc. The recorder notes each group's observations in the appropriate place on the data sheet.

5. It is important to stress that this is a home for living organisms. Any explorations should be done very gently, and everything should be left as it was found.



Driving a four-cylinder rather than a six-cylinder car will save approximately $500 a year in gasoline, oil and maintenance costs.

6. Before the group moves on to the next station, discuss the following questions:
- What is happening to the stump or log?
- How has it changed since the tree fell down?
- What will eventually happen to the log or stump?

Life On A Rotting Stump Or Log: Data Sheet

Observations–Botanist	Description	Location
Green Plants 1		
2		
3		
4		
5		
6		
7		
Non-Green Plants 1		
2		
3		
4		
5		
6		
7		

Life On A Rotting Stump Or Log: Data Sheet

Observations–Zoologist	Description	Location
Animals Sighted 1		
2		
3		
4		
5		
6		
7		
Evidence of Animals 1		
2		
3		
4		
5		
6		
7		

Mushrooms and Other Fun Guys

Objective:

Students learn to differentiate between fungi and lichens, and will observe the role that fungi and lichens play as natural recycling agents.

Materials:

- Diagram of a mushroom (enclosed)
- 2 or 3 hand mirrors
- 2 or 3 magnifying lenses
- Clipboards, coloured pencils, and data sheet (see enclosed)
- Optional: field guide to non-flowering plants

Time Required:

Class period

Background:

All plants grow, reproduce, and use energy. Green plants make their own food using the energy of the sun and the process of *photosynthesis*. Fungi cannot convert energy from the sun because they do not have the necessary ingredient of *chlorophyll*, so they obtain their energy from dead plant or animal material.

Fungi send out threadlike strands called *mycelia* from which they draw their nourishment. A *mushroom* is the reproductive body of a fungus and grows from the mycelium. Mushrooms are filled with millions of *spores*, which are dispersed by the wind to produce new plants. Feeding by fungi plays a key role in the natural recycling of materials. They contribute to the decaying process by eventually returning materials to the soil.

Lichens are different from fungi; they are formed from the combination of certain fungi and algae. (Here's a saying to help students remember the difference: "A fungus met an alga and they took a *lichen* to each other.") Lichens grow on trees, the ground, or on rocks. The fungus provides a body structure to hold the plant and protect the alga; the alga contains chlorophyll, thus making food for the lichen. The lichen very slowly secretes an acid, which eventually corrodes and erodes the material on which it lives, recycling it back into the soil.

In this activity, students search for different kinds of fungi and lichens. They investigate the kind of environment in which fungi and lichens thrive, what makes them different from green plants, and how they survive in soil filled with dead and decaying matter. Students also examine what effect fungi and lichens have over time on decaying matter, rocks or trees; and how they contribute to recycling in natural communities. Students record their observations on a data sheet.

Instructions:

1. Explain to the students that they will be looking for some of the environment's best recyclers – fungi and lichen. Begin with a brief review of the differences between the two (see background information); show the diagram of the mushroom and review the labelled parts.

2. Have students separate into smaller groups of 2 or 3 students each. Give each group a clipboard with one set of coloured pencils, a magnifying lens, and a small mirror. Ask them to look for one example of a mushroom and one example of a lichen. Using the coloured pencils, ask students to make a coloured drawing of their sample, reflecting actual colours in their artwork.

3. After they have spent approximately 10 minutes at one location exploring one item, groups can move and search for a second item. When they have found an example of each, regroup students at the main field station site for a quick discussion of their work.

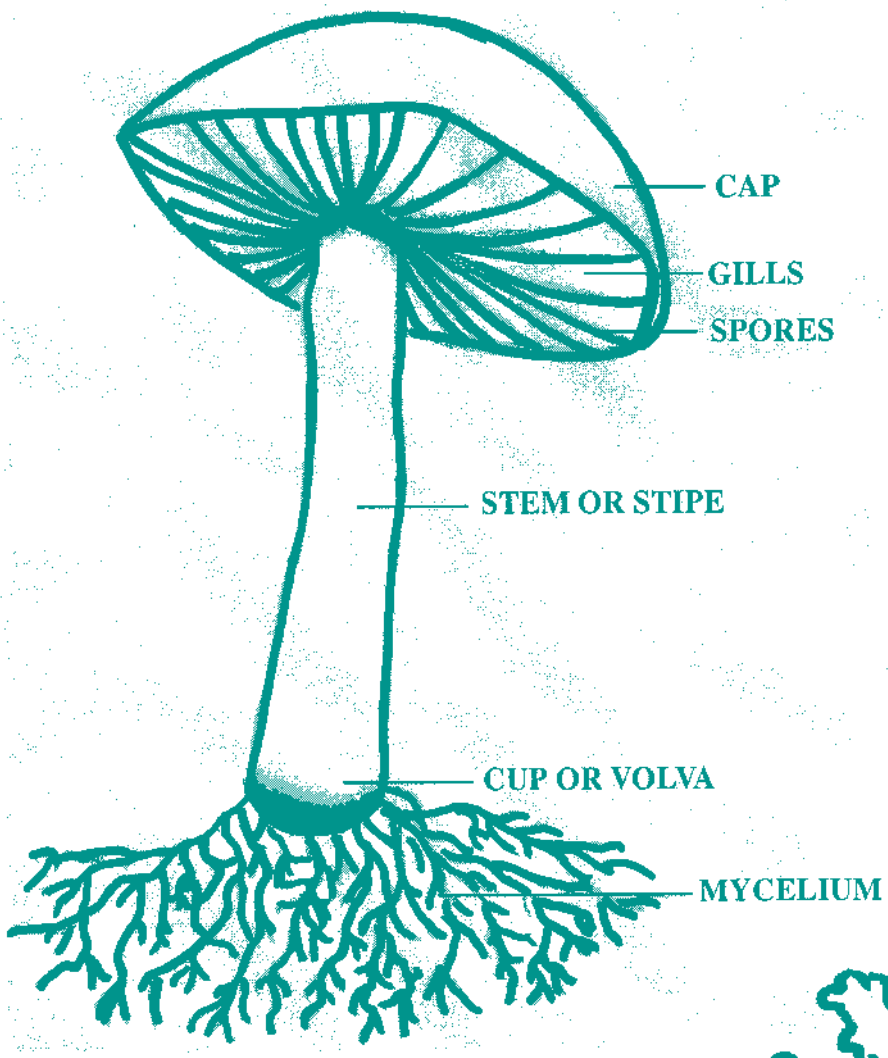
In the winter, for each degree you set your thermostat above 20 Celsius degrees over a 24-hour period, your fuel consumption will increase by 5%.

4. Follow-up discussion could include the following questions:

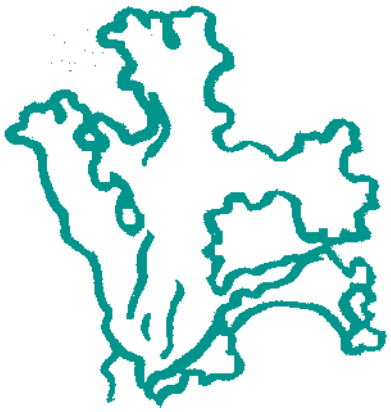
- What makes fungi and lichens different from green plants? What colours did they use in their drawings?
- Where do fungi and lichens grow?
- What effect do they appear to have where they grow?
- How do fungi and lichen contribute to recycling in the natural environment?

If there is time, students can try to identify their mushrooms and lichens using the field guides.

A Mushroom and A Lichen



A Mushroom



A Lichen

Some lichens, such as *Rizocarpon geographium,* can take long periods of time to grow; 0.42 mm a year for the first 100 years! They also live for very long periods of time – up to 9600 years in the Arctic!

Lichens are found throughout the world in a diversity of *clean* environments. Their high sensitivity to air pollutants is such that scientists study the diversity and number of lichens in a region to help determine air quality. Geologists establish the history of glacial advances and retreats over the last few hundred years by measuring the diamenter of lichens on the boulders of glacial moraines.

Mushroom and Lichen Data Sheet

Mushroom

Draw a coloured picture of your mushroom here, including the environment in which it is growing. Label the different parts of the mushroom.	Gently place the mirror, side up, just below the cap of the mushroom. Draw what you see. Very gently tap the top of the mushroom. Is there anything on the mirror? If so, what do you think it is? Draw and label what you see.
Describe the textures of the different parts of the mushroom.	Describe the place where you found the mushroom.
• Use the magnifying lens to examine the material on which the mushroom is growing. Do you see any white threads? Do you see any small white pea-shaped forms attached to the strings near the mushroom? If so, add these to your diagram and label them.	

Mushroom and Lichen Data Sheet

Lichen

Draw a coloured picture of the lichen here, including the surrounding environment in which it is growing.	Use the magnifying lens to examine the lichen closely. What do you see?
Describe the texture of the lichen.	Describe the place where you found the lichen.
Other notes:	

Shelters and Nests

Objective:

Students appreciate ways in which animals re-use materials found in their environment.

Materials:

Binoculars

Time Required:

Class period

Background:

Animals re-use and recycle materials they find in the natural environment to make nests and shelters. Many species of birds use dead twigs, grasses, and other materials to make their nests. Some species of tree squirrels make nests out of leaves; and red squirrels create **middens** out of chewed-up cones. Species of woodpeckers, as well as many small mammals, make nests in dead or dying trees; beavers use twigs, branches, and mud to make their lodges.

In this activity, students search for examples of animals re-using materials from the environment to make nests or shelters. The activity continues with students attempting to build their own bird's nest, using dead plant materials from the forest floor and surrounding area.

Instructions:

1. Begin with a brief discussion of ways in which animals might re-use materials from their natural environment. (For example, to make nests or shelters). What kinds of animals do this?

2. Lead students on a short hike in which they look for signs of nests or animal shelters. If time permits, scout the area beforehand and find a couple of examples.

3. If a nest is found, ask students to look at it carefully, using the binoculars if it is high in a tree. What materials are used? How do you think it was made? What will happen to it over time, after the animals have left?

4. Return to the field station area. Inform students that it is now their turn to try to build a nest. Tell them that they can use any dead plant materials they find on the forest floor or surrounding area, and they can build their nest anywhere they want. The idea is to build something that will hold a few small rocks (to represent eggs); and that will not fall apart.

5. Allow 5 to 10 minutes for the nest building. Then, one by one, have students explain what they did. What materials did they use? Why did they choose their particular location? What difficulties did they have? What did they use to hold it all together? Does the nest hold a few "eggs"? (You could mention an example of the robin using mud to bind together dead leaves and twigs to form its nest.)

Making paper from recycled paper stock uses 15% less water than making paper *from scratch.*

A Real Scavenger Search

Objective:

Students develop an awareness of the role of scavengers in the recycling of dead matter in the environment.

Materials:

- Clipboard
- Blank paper
- Pencils

Time Required:

40 minutes

Background:

Scavengers are animals that feed on dead plant or animal matter. These include not only many insects and worms, but also many birds and some mammals. Many of the hawks are scavengers, as are eagles and turkey vultures. Other scavengers include ravens, crows, herring gulls, gray jays, foxes and coyotes, to name a few. Scavengers not only clean up the carcasses of animals that have already been partially eaten by other animals, but they also feed on road kills, or animals that have died of starvation or old age.

In this activity, students search for examples and signs of environmental scavengers. Since it is unlikely that they will see the larger scavengers, they will search under stones and logs. They also will search for signs of animal remains (e.g. antlers, bones, eggshells, and feathers).

Instructions:

Reducing speed from 95 kph to 80 kph saves 10% in fuel.

1. Inform the students that they are about to embark on a search for scavengers. This activity has students play the role of wildlife detectives searching for evidence of animals that feed on dead matter. Begin by asking students if they can think of any examples of scavengers. Then ask them to consider their role as detectives – where would they look? What would scavengers be feeding on?

2. Divide students into groups of two or three each. Distribute a clipboard with a blank piece of paper and a pencil to each group. Ask them to search for scavengers or evidence of scavenging activity. Ask students to record their findings by either naming the scavenger or drawing diagrams and describing what evidence they found and where.

3. After about 15 minutes of searching, bring the groups back together again to share what they have found.

A Good Kind of Litter– Leaf Litter

Objective:

Students discover the variety and amount of life in a dead and decaying layer of leaf litter.

Materials:

- Trowel
- Tray (s)
- 2 or 3 pairs of small work gloves (e.g. cloth gardening gloves)
- Basic identification sheet to insects
- Clipboard, pencils, and data sheet (see attached)

Time Required:

Class period

Background:

Students sift through different samples of leaf litter. For each sample, they record their findings. With the help of a basic identification sheet, students identify the numbers and types of organisms living there.

Instructions:

1. Gather students around a section of forest floor where there is a good accumulation of dead leaves – called *leaf litter*. Ask them if they can see any sign of life on top of the leaves. What do they think lies underneath? Ask students how many different animals they think might be found by sifting through several samples of leaf litter. Which animal do they think will be the most abundant; the least?

2. Ask one student to use the trowel to remove the layer of litter and place it onto the tray. Have two other students put on gloves and gently sift through the leaves to see if they can find any insects or other animal life. The other student(s) in the group can try to identify whatever they find by referring to the identification sheet and other references. They then record the species and the number in the appropriate place on the data sheet.

3. The same steps can be done until three or four samples of litter have been sifted through. Each sample can be chosen from a different area; under a coniferous tree, under a deciduous tree, or in an open field. In examining the litter, students should notice that the samples get progressively darker in colour and moister in texture as they go down into the litter, until the last component or layer is hard to distinguish from the soil. Have students change their roles each time a new sample is examined.

4. After the data has been filled out for all four samples, total the number of different animals found and the number of each species. Write the number in the bottom right corner of the sheet. Were any students close to the number of different species in their original estimate? Did the number surprise them?

5. A final discussion could focus on the following questions:
- How did the number and variety of animal species change in the different locations?
- How did the litter itself change, the deeper the layer?
- What were the animals eating?
- What was the litter turning into on the bottom layer?
- What does this tell you about what will happen to the litter over time?

A proper engine tune-up can save $100 a year in fuel costs. An overly-rich fuel mixture caused by a sticking choke can increase fuel consumption by 30%.

Litter Data Sheet

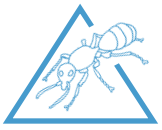
Sample Number _____

Location _____

Description and Diagram of Organisms

Organism 1 Name Food Number Diagram Description	**Organism 3** Name Food Number Diagram Description	**Organism 5** Name Food Number Diagram Description
Organism 2 Name Food Number Diagram Description	**Organism 4** Name Food Number Diagram Description	**Other Organisms** Name Food Number Diagram Description
Description of Litter (Colour, texture, location , change with depth)		
Total Species Number –		

Concluding Activity



Under-inflated tires rob your fuel efficiency and your wallet. For every 14 kPa below the recommended pressure, efficiency is cut by 1%.

What is Waste?

Objective:

Students review the activities of the field day, and compare and contrast the cycle of materials in natural and human communities.

Materials:

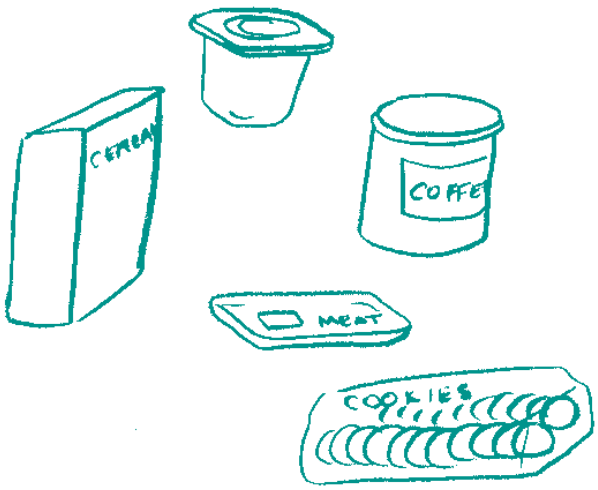
None

Time Required:

Approximately 40 minutes

Background:

Students discuss the work they did at the field stations. What did they learn? Was anything **wasted** in the natural environment? What happened to dead, decaying, and other non-living components? Students look at the human waste materials they examined during their study. What are the differences between human waste products and natural world products?



Instructions:

1. When students have completed each of the field station activities, have them gather for a sharing circle. This is the final discussion for the day, a time to collectively review what was learned.

2. The following questions may help to guide the discussion:

- What do you think the word *waste* means (is it a concept that has any meaning in natural cycles, or is it just a concept that relates to us)?
- What are some examples from today's activities of ways that plants help as natural recyclers (think of the rotting stump, mushrooms and lichen, animal nests)?
- What are some examples from today's activities of ways that animals help as natural recyclers (think of the rotting stump, animal nests, scavengers, leaf litter animals)?
- Did you see anything in the natural environment that would not be used, or recycled, back into something which could be used again?
- How does this compare with recycling of materials in human communities?
- Are there any lessons to be learned from natural communities, that could be applied in human communities to reduce waste production?

Post Field Study Activities

The Cycle of Waste

Objective:

Students compare waste *reduction/recycling/elimination* strategies in the natural world with strategies in human communities.

Materials:

- Pencils and paper

Time Required:

40 minutes

Background:

As students have discovered through both the pre-field and field study activities, the natural world does not produce non-reusable materials (*waste*). In this activity students compare the changes that occur to something that lives and dies in the natural environment with something human-made and synthetically produced.

Using the Energuide label in selecting a new appliance can result in lifetime energy savings of $808 for a refrigerator, $554 for a freezer, $721 on a clothes washer, and $3546 on a clothes dryer.

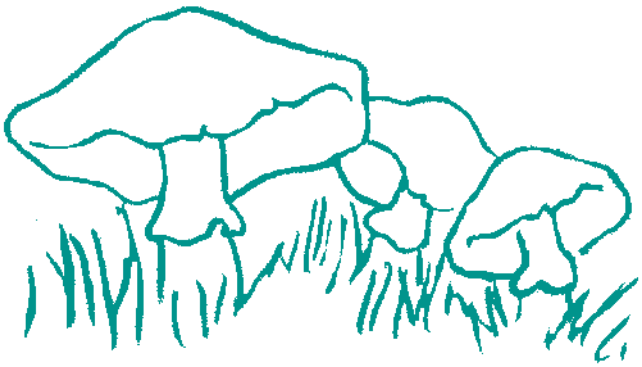
Instructions:

1. Ask students to think about and write down the names of two items:
   - something that we produce and use
   - something produced in the natural environment.

2. Using one page for each item, have students create the following outline: in the top half of the page, draw a *life* chart showing the changes that happen to each item after it is:
   - thrown out
   - dead

   On the bottom half of each page, write a creative story about these changes over time. What happens to the item? What else does it relate to? How does it change? What, if anything, does it become? What will it look like in one year? In a hundred years?

3. The follow-up class discussion could focus on the similarities and differences between the two different items. Does our human waste cycle back into the environment? How can we better emulate the recycling systems of the natural world? Why can we not cycle our materials more effectively when the rest of the planet has been doing it for such a long time?



What Did We Learn

Objective:

Students draw conclusions based on the results of their post-field study experiments.

Materials:

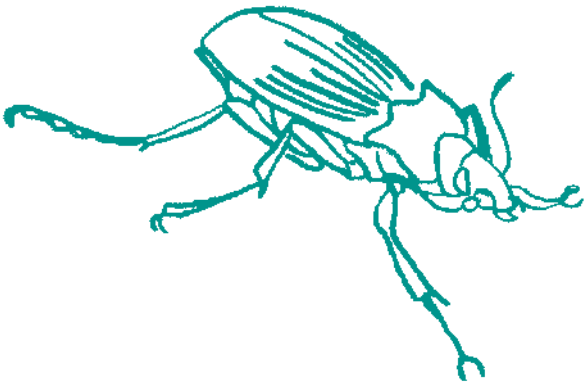
See Activities *Falling to Pieces* (p. 6) and *A Rotten Time* (p. 8)

Time Required:

40 minutes

Background:

After returning from the field, students revisit the observations they made during the field study. They write down their observations and conclusions; and then compare their results with those of the other groups through a class discussion.



With water, a drop a second from a leaky faucet can fill 16 bathtubs in a month.

Instructions:

1. Follow-up for the *Falling to Pieces* activity:
   At the end of six weeks of observation, review students' predictions for which items would decompose more rapidly. Compare the actual results with the predictions. Follow-up discussion could include the following questions:
   - Which items decomposed rapidly?
   - Which items decomposed slowly?
   - Which items showed no signs of decomposing over the six weeks?
   - Which items were made from natural materials, and which were synthetic (not made from natural components)?
   - What conclusions can students make about the biodegradability of the different materials?
   - What do these results tell us about how the natural environment is able to deal with its materials?
   - What do these results tell us about the challenges humans have with waste reduction/ recycling/elimination?

2. Follow-up for *A Rotten Time* activity:
   At the end of two to four weeks of observation, review the results compiled by each group. Have students draw conclusions about the experiment, by answering the following questions:
   - What were the differences in the amount of decay of the apple slices in the 4 containers?
   - Which decayed the fastest? Which decayed the slowest?
   - What factors affected the rate of decay?
   - Which container(s) had the best seedling growth? What affected the rate of growth?
   - What does this tell you about the relationship between decomposition, soil, and plant growth?
   - How do these findings compare with the discoveries made during the field study?

What Can We Do?

Objective:

Students determine ways in which they can effect positive individual and group change in terms of reducing/recycling/eliminating waste produced in human communities.

Materials:

- Blackboard and chalk

Time Required:

One hour (followed by ongoing project work)

Background:

As a class, students discuss ways in which they can effect positive change in reducing, re-using, and recycling waste generated by their class and their school. Students decide upon, and carry out, a waste reduction/recycling/elimination/ action for their class or school.

Instructions:

1. Begin with a discussion of what each of us as individuals can do to reduce, recycle or eliminate waste in our communities. How can we change some of our lifestyle patterns related to activities such as eating, shopping, travelling, and other aspects of day to day living so that we reduce, recycle, or eliminate our waste materials? What are some guiding principles for waste reduction/ recycling/elimination? What could be the goal of our actions?

A microwave oven uses less than half the energy used by a standard stove.

2. Have the students discuss ways in which their mini-community (their class) could make a difference in some area of waste reduction/recycling/elimination. What could they do together to reduce, re-use, or recycle waste produced by their class or their school? Some possible examples could include:
   - A school or class waste recycling program.
   - A composting program or, specifically, a worm composting (vermicomposing) program.
   - A public awareness campaign for the school.
   - A schoolyard clean up and litter reduction/elimination program.
   - A paper-saving, re-using and recycling program

3. The next step is to **just do it!** Have the students collectively decide on one idea that will become their class project. Students are responsible for researching the problem, determining the solution, and carrying it out. They may need to assign roles and responsibilities for getting the job done. It is important that the project is manageable and that it has a high probability of success. Starting small and building upon success is vital, as is ongoing class discussion and evaluation of the project.

4. To conclude the project, have students write a class report. They can work on the report together, including photos or illustrations in their report. Ask students to consider ways in which they could share what they have done with others in the school and community.

Extension Activities

- Challenge students to have a waste-free lunch hour. The goal is to bring only materials that can be re-used or recycled... or eaten!

- Have your students make a presentation about consumer packaging. They bring one packaged item to school and suggest ways they would change the design so that the amount of packaging was reduced.

- Conduct a survey of the amount of waste produced during school lunch hours. Weigh it every day. Develop a school awareness campaign to reduce that amount.

- Take a field study to a recycling depot, a landfill site, or other community waste handling facility.

- Invite a guest speaker from a local business, e.g. hotel or restaurant, to talk to the class about ways in which they are reducing their waste output, and some of the other waste reduction/recycling/ elimination/ issues they face day to day.

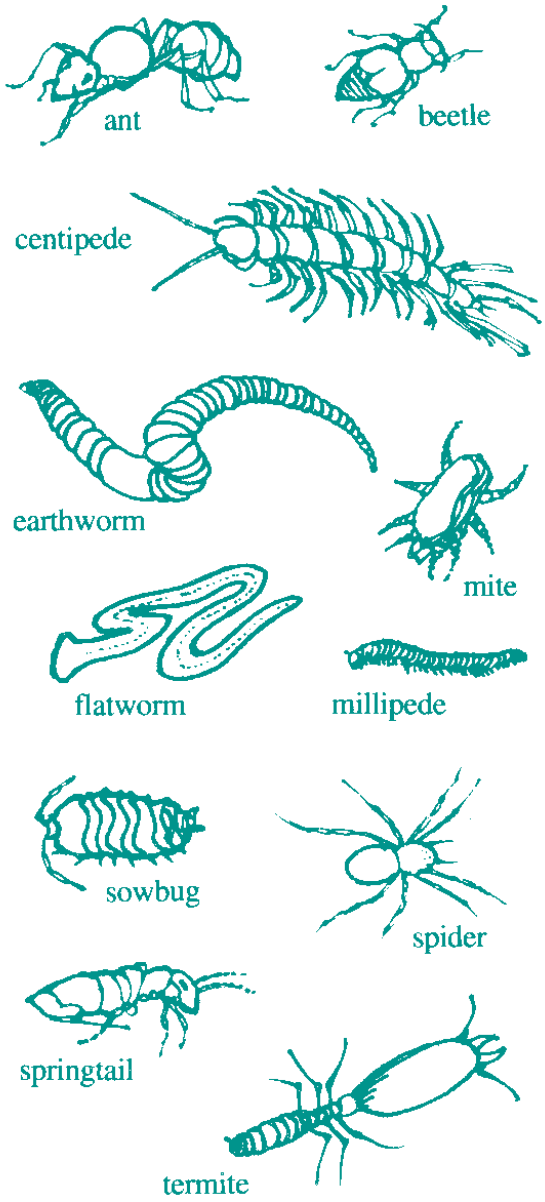
- Invite a community gardener to visit your class to discuss methods of composting.

- Write a class play on an issue surrounding waste, and perform it for the rest of the school.

- Choose a product and develop a detailed product *life cycle*, from the ingredients that are used to make the product, its primary use, and what happens to it after it has served its primary role. If the product usually ends up as waste in a landfill site, describe how it might be reused, recycled or reduced instead of deposited as waste.

Appendix

Identification Sheet of Alberta's Common Soil Animals



Ants:

- Have a bend in their antennae and a slender waist.
- Build their nests underground or in dead trees.
- Are primarily scavengers, eating decaying material.
- Keep their environment clean.

Beetles:

- Appear wingless, but actually have two sets. The outer pair forms a protective shell over the wings underneath, which do all the flying.
- Are scavengers, eating decaying plant and animal material. Are also carnivores, preying on other insects with their strong jaws.

Millipedes:

- Have less than 1000 legs, usually 200 - 300 legs.
- Are not insects.
- Are predominantly herbivores, feeding on plants in the litter/topsoil region.

Spiders:

- Have eight legs, so they are not insects.
- Are predominantly carnivores, feeding on insects caught in a variety of habitats.

Termites:

- Are equipped with powerful chewing jaws and a special chemical in the stomach to break down wood.
- Are scavengers, feeding on dead or rotting logs.
- Live in nests below, on, or above ground.

Springtails:

- Any tiny, wingless insects.
- Live in soil, leaf litter, under bark and in rotting wood.
- Are capable of springing great distances using their tail as a launching mechanism.

Centipedes:

- Have numerous pairs of legs and a pair of long antennae. They are not insects.
- Are carnivores, feeding on a wide variety of insects.
- Inhabit surface areas, sometimes burrowing in the topsoil.

Mites:

- Are closely related to the spiders, but are much smaller in size.
- Are primarily parasitic, feeding on plants and/or animals.

Sowbugs:

- Have numerous pairs of leg-like structures and are flat in appearance.
- Inhabit areas under rocks and bark.
- Are scavengers, feeding on dead and dying materials.

Earthworms:

- Are multi-segmented, round organisms of variable length and color.
- Live in soil at various depths feeding on dead and dying material.

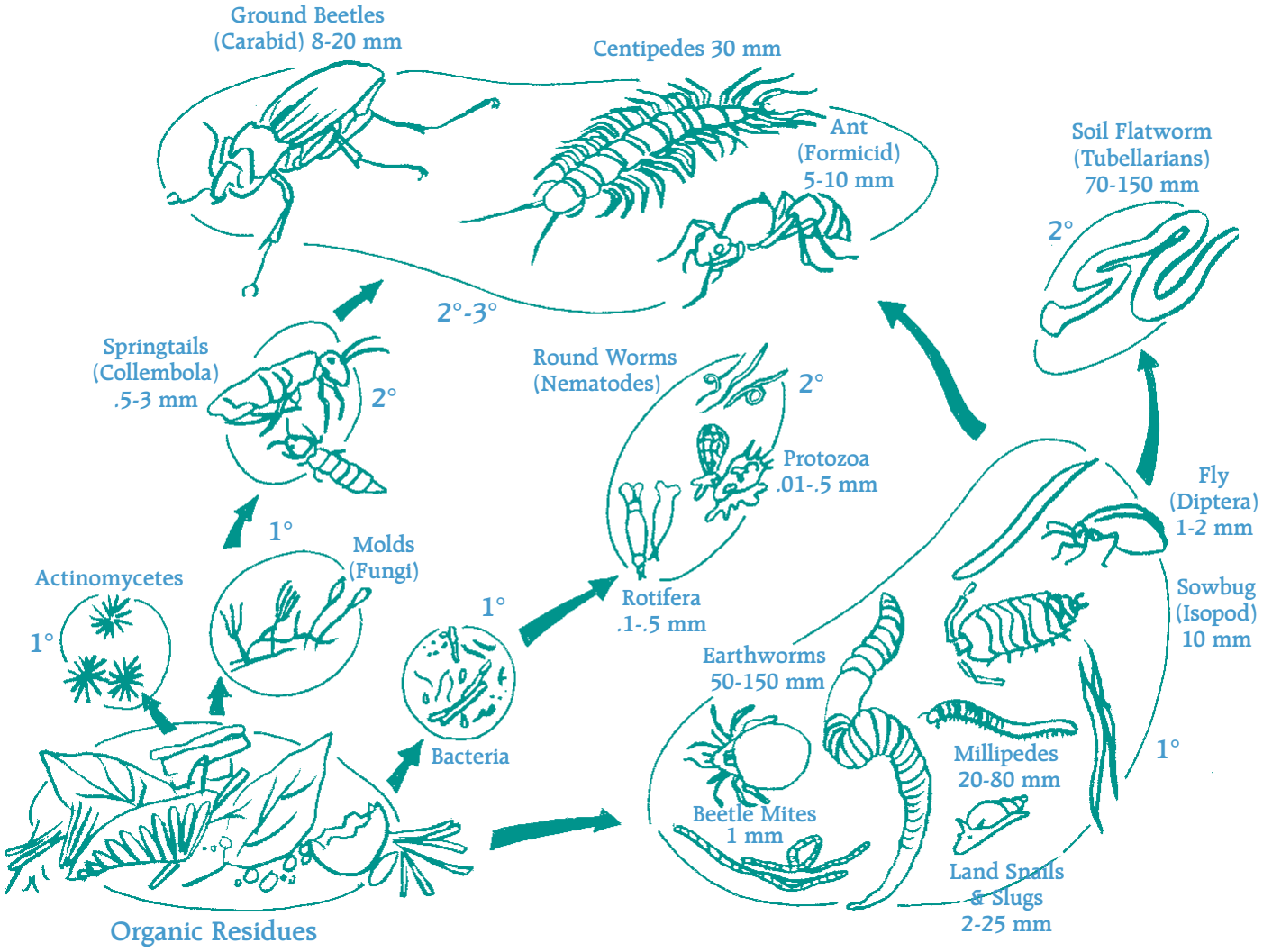
Flatworms:

- Are non-segmented, flat and smooth-skinned.
- Live in water.
- Feed in dead and decaying animal matter

Food Web of The Compost Pile

Energy flows in the direction of the arrows.

1°: First Level Consumers
2°: Second Level Consumers
3°: Third Level Consumers



These organisms are commonly found in compost. Energy flows from organism to organism, as one is eaten by the other in a natural recycling system.

Glossary of Terms

Algae
Simple plants that lack true stems, roots, and leaves, but contain chlorophyll.

Biodegradable
Something that is able to break down – rot, decay, decompose – through natural processes.

Botanist
A scientist who studies plants.

Button
The head of a small mushroom.

Carnivore
An animal-eating or predatory consumer.

Chlorophyll
The green pigment in plants which allows photosynthesis to take place.

Consumer
Any living organism that cannot make its own food, and must eat plants and animals to get the energy it needs for survival.

Decompose
To break down into simpler elements.

Decomposer
Living organisms such as bacteria, insects, molds, or fungi that break down the remains and waste products of plants and animals.

Fungus (Fungi)
A plant which does not contain chlorophyll; a decomposer which draws nourishment from dead and decaying matter.

Garbage
Anything that is no longer considered of use or value (i.e., food wastes, trash).

Herbivore
A plant-eating consumer.

Hyphae
Thread-like strands which form the mycelium on a fungus and from which the plant draws its nourishment.

Leaf litter
Dead and dying leaves.

Lichen
A crustlike, scaly, or branching growth on rocks or tree trunks formed from the symbiotic association (a relationship where both organisms benefit from each other) of a fungus and alga growing together.

Litter
Two meanings: In natural communities, the uppermost layer of soil, consisting of mostly decaying organic matter. In human communities, an accumulation of objects, especially carelessly discarded waste materials or scraps.

Midden
A refuse heap (e.g. a squirrel midden is a pile of discarded pinecones).

Mushroom
The umbrella-shaped cap born on a stalk; the reproductive body of a fungus which grows from the mycelium.

Mycelia (Mycelium)
The vegetative part of a fungus, consisting of a mass of threadlike filaments called hyphae.

Non-biodegradable
Not capable of being decomposed by living matter, especially by bacteria, soil insects and non flowering plants such as fungi and moulds.

Omnivore
A plant-eating and animal-eating consumer.

Organic material
Material containing carbon, as a result of once being alive.

Photosynthesis
The process by which chlorophyll-containing plants convert light energy into chemical energy and synthesize organic compounds.

Producer
A green plant that is able to make its own food using energy from the sun.

Scavenger
An animal that feeds on dead organic matter.

Soil
The top layer of the Earth's surface, suitable for the growth of plant life.

Spores
A reproductive structure of plants such as fungi, mosses, or ferns.

Stipe
The stemlike support of the cap of a mushroom.

Waste
Regarded or discarded as worthless or useless.

Zoologist
A scientist who studies animals.

Supplementary Resources

Alberta Education Authorized Teaching Resources / Activity Guides

A Matter of Waste: A Waste Education Program for Grade 4 to 6

Copyright Year: 1994
Publisher/Distributor: Alberta Environment
Resource Description: "The Minimizers" + Teacher's Guide (39 pages, softcover) + Poster Panels + Activity Masters + Posters +Panel Activities, all in a folder.
Available from Alberta Environment (Free of Charge)

Annotation:
A teacher's guide, colour posters, blackline masters, reproducible student booklet and information sheets are included in this resource on waste. Activities proceed from developing awareness of the different forms and amounts of waste generated, to learning about the effects of waste and means of its disposal. The student booklet relates the story of Michael and Meaghan, two young students who are researching the topic of waste.

Grow-Lab: Activities for Growing Minds: Teacher's Guide

ISBN: 091587332X
Copyright Year: 1990
Publisher/Distributor: National Gardening Association / National Gardening Association
Resource Description: 307 pages, softcover
Available From: LRDC
Order No.: 306565 Est. Price.: $35.75

Annotation:
This resource book provides teachers with background information and plant study activities that are coded for the grade ranges K–2, 3–5 and 6–8. All activities are clearly outlined and illustrated. A set of reproduction masters and an annotated list of additional resources are included.

Waste and Recycling

Series: Conserving Our World
Author: James, B.
ISBN: 0750202742
Copyright Year: 1989
Publisher/Distributor: Wayland Publishers Ltd. / ITP Nelson
inquire@nelson.com / inquire@nelson.com
Resource Description: 48 pages, softcover
Available From: LRDC
Order No.: 293077 Est. Price.: $10.60

Annotation:
This resource examines the various forms of waste that result from consumer lifestyles and current technologies, and the impact of those wastes on environments, animals, and people. Colour pictures, diagrams, and charts expand points made in the text.

From Seed to Plant: Teacher's Guide

Series: Delta Science Modules
ISBN: 0875047114
Copyright Year: 1988
Publisher/Distributor: Delta Education / Delta Education
Resource Description: 20 pages, softcover
Available From: LRDC
Order No.: 299934 Est. Price.: $18.80

Annotation:
Nine activities for the study of seeds and growing plants are outlined in this teacher's guide. Activities include: observing and classifying seeds, planting seeds, and observing and measuring plant growth and plant parts. Each activity includes a statement of objectives, materials list, background information, teaching suggestions and ideas for extending concepts. Blackline masters, a glossary and suggestions for evaluation are also included.

Bottle Biology: An Idea Book for Exploring the World through Plastic Bottles and Other Recyclable Materials

Author: Ingram, M.
ISBN: 080438601X
Copyright Year: 1993
Publisher/Distributor: Kendall/Hunt Publishing / Prentice Hall Ginn Publishing Co.
cdn order@prenhall.com / cdn order@prenhall.com
Resource Description: 127 pages, coilbound

Plant Growth and Development: Teacher's Guide

Series: Science and Technology for Children
ISBN: 0892786337
Copyright Year: 1991
Publisher/Distributor: National Science Resources Center / Carolina Biological Supply Co.
Resource Description: 142 pages, softcover
Available From: LRDC
Order No.: 293176 Est. Price.: $44.65

Annotation:
Students observe the growth and development of a mustard seed plant from a seed until it produces seeds of its own, 41 days later. Working in groups, students germinate the seeds, thin and transplant seedlings, pollinate flowers, and harvest mature seeds. During the process, they observe, measure, record, draw, graph, and construct models. This teacher's guide may be used in conjunction with the accompanying student activity book but provides sufficient information to be used on its own.

The Growing Classroom: Garden-Based Science

Author(s): Jaffe, R.; Appel, G.
ISBN: 020121539X
Copyright Year: 1990
Publisher/Distributor: Addison-Wesley Publishers / Addison-Wesley Longman Ltd.
Resource Description: 480 pages, coilbound
Available From: LRDC
Order No.: 292334 Est. Price.: $47.95

Annotation:
This teacher resource book outlines over 100 activities on topics directly and indirectly related to growing plants. The resource is organized in four sections. The first section provides a general introduction to the methods and materials of plant studies; the second section outlines 14 science units; the third section outlines three nutrition units; and the final section includes blackline masters, materials lists and an English/Spanish vocabulary list. Each activity in the science and nutrition units consists of an overview description, objectives, teacher background, materials preparations, and specific steps in developing the activity. Some black and white photographs and simple line drawings are included.

Innovations in Science: Level 4: Teacher Resource Package (Alberta Edition)

Series: Innovations in Science
Author(s): Peturson, R; McAllister, N.
ISBN: 0774701765
Copyright Year: 1996
Publisher/Distributor: Holt, Rinehart & Winston / Harcourt Brace & Co.
Resource Description: Seven softcover booklets: Includes: Waste Not, Want Not: Teaching Notes (45p).
Available From: LRDC
Order No.: 292748 Est. Price.: $199.50

Annotation:
This series supports student-centred, activity-based science. It is organized around themes and topics that provide science–technology–society links and can be readily integrated into other curriculum areas. Students develop concepts, skills, and attitudes through theme cards, student books and activity centres. Comprehensive teaching strategies, assessment ideas, centre activities, literature links, and blackline masters are included for each theme.

Let's Recycle

Publisher/Distributor: Alberta Environment
Resource Description: Teacher's Guide (24 pages, softcover) +Reproduction Masters + Colour Posters, all in a folder.
Available from Alberta Environment (Free of Charge)

Annotation:
A teacher's guide, colourful posters, and activity masters cover the four R's: reduce, re-use, recycle and recover.

Selected References

Science Is...
Bosak, Susan. Youth Science Foundation and Scholastic Canada, Richmond Hill, Ontario, 1991. ISBN 0-590-74070-9

The Canadian Junior Green Guide.
Degler, Teri, and Pollution Probe. McClelland and Stewart Inc, Toronto, Ontario, 1990. ISBN 0-7710-7157-4

The Nature Specialist: A Complete Guide to Programs and Activities.
Hendler Miller, Lenore. American Camping Association, Martinsville, Indiana, 1986. ISBN 0-87603-087-5

Nature With Children of All Ages.
Sisson, Edith. Prentice-Hall Inc., Englewood Cliffs, New Jersey, 1982. ISBN 0-13-610444-4

The Curious Naturalist.
Mitchell, John, and the Massachusetts Audubon Society. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1980. ISBN 0-13-195412-1

Focus on Forests: A Resource Manual for Intermediate and Senior Teachers on Forests and Forest Management.
Ministry of Natural Resources, Queen's Printer for Ontario, 1989.

Project Learning Tree: Supplementary Activity Guide for Grades K through 6.
American Forest Institute, Inc., Washington, D.C.,1977.

Project WILD: Elementary Activity Guide.
Canadian version by the Canadian Wildlife Federation, Ottawa, Ontario, 1985.

Related Web Sites

Alberta Environment
http://www.gov.ab.ca/env/waste/aow/index

City of Calgary Solid Waste Services
http://www.gov.calgary.ab.ca/eesd

City of Edmonton Waste Management Services
http://www.gov.edmonton.ab.ca/pw/wst/home.htm

Garbage: How Can My Community Reduce Waste?
The Annenberg/CPB Projects Exihibits Collection (United States)
http://www.learner.org/exihibits/garbage/intro.html

The Composting Council of Canada
http://www.compost.org

The Amazing Environmental Organization Web Directory
http://www.webdirectory.com/

Other Information

Alberta Environment
Toll- Free Recycle Information Line: 1-800-463-6326