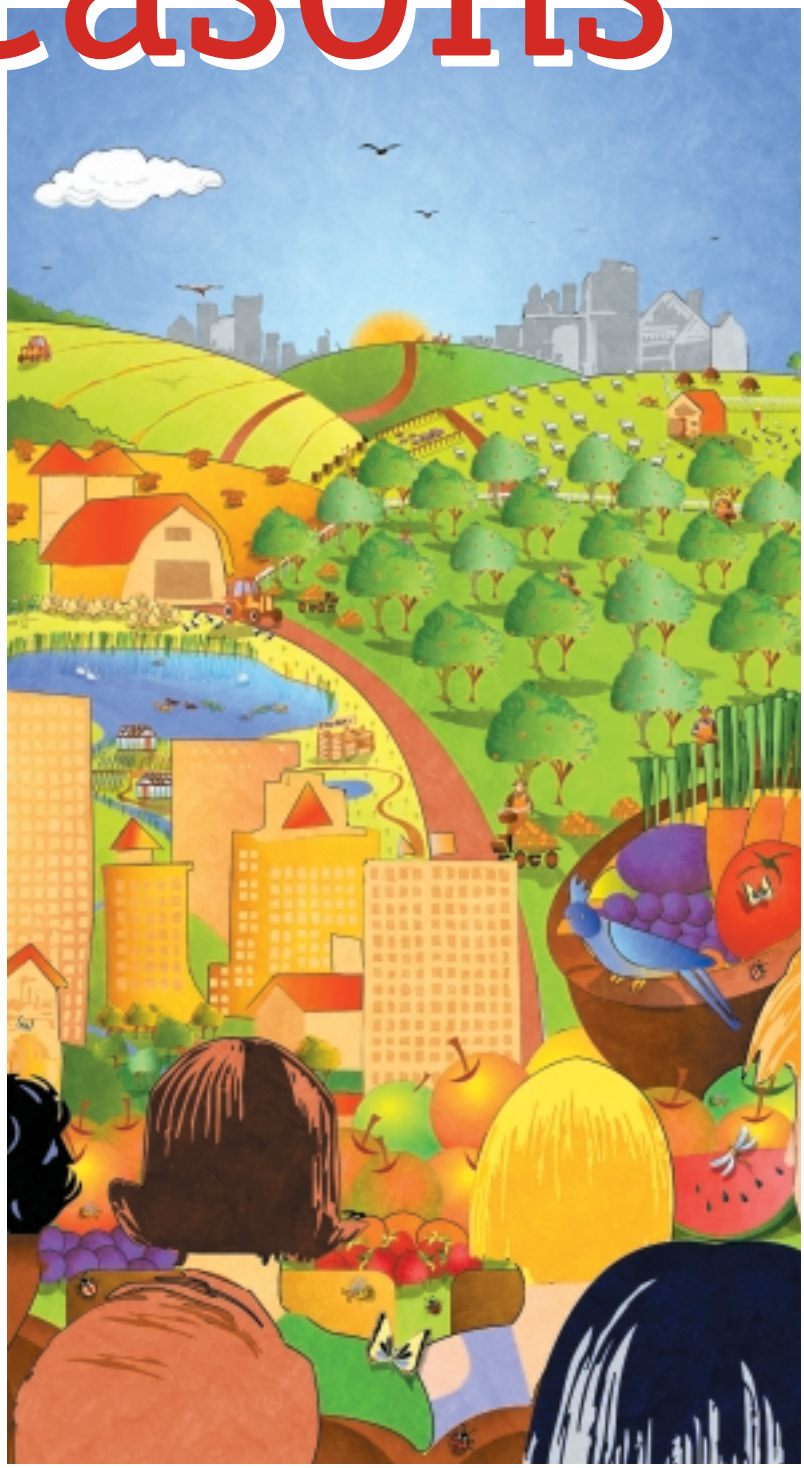
Patterns Through the Seasons

A Year of School Food Garden Activities



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"It is impossible for a child to work [in a] garden without tuning himself to certain universal laws…while he is grubbing in the earth, stirring the soil untiringly so as to let in the moisture and the air, nature's secrets are sinking deep into his heart."

Dora Williams

from Gardens and Their Meaning, 1911

Patterns Through the Seasons

A Year of School Food Garden Activities

KINDERGARTEN TO GRADE 7

written by Sean Welby, BEd

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LifeCycles was established in 1994. Our mission is to cultivate awareness and initiate action around food, health, and urban sustainability. We work proactively to promote and create personal, shared and community gardens, research, and educational activities and youth skills development programs. Through partnerships we strengthen individual, community and global health.

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Evergreen is a national, not-for-profit environmental organization. Our mission is to bring communities and nature together for the benefit of both. We engage people in creating and sustaining healthy, dynamic outdoor spaces – in our schools, our communities and our homes. We believe that local stewardship creates vibrant neighbourhoods, a healthy natural environment and a sustainable society for all.

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Introduction

Patterns Through the Seasons

Why a school food garden?

If you're reading these words, chances are you already have some of your own ideas about what some of the benefits of a school food garden might be. Many generations of educators have recognized the value of maintaining a school garden as a means of connecting the academic curriculum to real-life experiences in the natural world. Almost a century ago, in 1910, a report to an agricultural education conference estimated that there were approximately 80,000 school gardens in existence in the United States alone.[1] Although educational priorities at many schools may have shifted since then, school gardening is now experiencing a significant resurgence around the world.

- In 1990, students at Public School 157 in the Harlem area of New York City worked to transform a "drug-infested, rubble-strewn, city-owned vacant lot" adjacent to their school into a 32,000 square foot garden complete with vegetable and flower beds, a birch and fern 'forest', a performance stage and playground. Since then the Success Garden, as it came to be known, has been expanded to include several additional lots, and the project is being replicated at 6 other sites in Harlem and the South Bronx.[2]
- In Havana, Cuba, a math teacher's interest in gardening led to the creation of a school garden in a nearby vacant lot. Now acting as the school's head gardener, Enrico Diaz helps students to grow 33 varieties of vegetables and medicinal plants that are donated to poor and elderly people in the local community.[3]
- At Lord Roberts Elementary School in Vancouver, British Columbia, a group of neighbours helped initiate a plan to turn the gravel-covered schoolyard into an urban oasis complete with an 18 by 50 foot raised bed garden. The 250 students, mostly apartment-dwellers, learn about science, nutrition and environmental stewardship through activities in the garden.[4]

1 Fang, Wei. *The Case for More High School Gardens.* http://www.cityfarmer.org/highschool77.html

2 Application for Rudy Bruner Award for Urban Excellence. http://ublib.buffalo.edu/libraries/projects/bruner/1995a/success_garden/abstract/

3 Raap, Will. *Cuba's Second Revolution*. Garden Activist Newsletter. http://www.gardeners.com/community/GAfebruary01.asp

4 Whyte, Bruce. "Classes Sprout in Food Garden." from *School Garden Guidelines*. Vancouver: City Farmer, 1988.

- In Berkeley, California, where a recent state-wide initiative sought to create a 'Garden in Every School,' the Edible Schoolyard at Martin Luther King Junior Middle School gives students the opportunity to grow food and eat it too. Students work in the one acre garden to tend vegetable crops, herbs, vines, berries, flowers and fruit trees as well as work in the school kitchen to prepare and serve nutritious meals in what is described as the complete 'Seed to Table' experience.[5]
- In the United Kingdom, a national initiative was launched in 2001 to encourage students to make better use of the "outdoor classroom" amidst concerns that young people there are becoming increasingly distanced from nature. £500,000 has been allocated to 5 flagship projects to help create an integrated approach that ties in with the national curriculum. In 2002 the Growing Schools Garden, incorporating ideas and plants raised by students in 21 schools around the country, earned a silver medal at the prestigious Hampton Court Palace Flower Show.[6]

The purpose of this module is to help teachers make the best possible use of school food gardens, helping to make this important resource into a learning garden for the benefit of students, staff and the school community.

This Module and Growing Schools

Patterns Through the Seasons was developed based on the work of **Growing Schools**, a project initiated by **LifeCycles** in 1997 to help educate students in Victoria about where their food comes from and their role in the food cycle. In the spring and fall of each year, **Growing Schools** staff and volunteers conduct educational gardening workshops at local elementary schools in which students start seedlings, care for the soil in the garden, make compost and plant and harvest vegetables, fruits, herbs and flowers. As part of each workshop, students learn about the principles of organic gardening, the endangerment of native pollinators or the importance of eating food grown close to home. Each of these activities is based on learning outcomes described in the B.C. Ministry of Education curriculum guides, ensuring that by participating in school gardening workshops, students will also be completing required curriculum objectives.

The success of **Growing Schools** has led to the creation of this module, which is designed as a curriculum resource for teachers who want to use a school food garden as an 'outdoor classroom' where students can experience hands-on learning in many areas of the curriculum. Each of the learning activities described in *Patterns Through the Seasons* has been developed and tested by **Growing Schools** or has been adapted with permission from other school gardening curriculum guides that have been used by **Growing Schools**. Using this module, you will be able to conduct learning activities throughout the school year that address all of the major tasks of planting and maintaining a food garden, in addition to meeting many of the learning outcomes described in the B.C. Integrated Resource Packages. Incorporating some of the additional resources

5 The Edible Schoolyard website. http://www.edibleschoolyard.org/homepage.html

6 Growing Schools Garden website. http://www.schoolsgarden.org.uk/

described in Appendix C will allow you to deliver a comprehensive learning program addressing science, social studies, nutrition and many more curricular objectives.

Note: For teachers at schools that have not yet created a food garden, this module does not include instructions for initiating a school garden programme; the activities in *Patterns Through the Seasons* assume that your class already has access to some form of garden. For detailed information about garden design, site considerations, fundraising, setting up a school gardening committee and gaining the support of administrators and maintenance personnel, please contact either Lifecycles or Evergreen for information and support resources.

Organization of Patterns Through the Seasons

Patterns Through the Seasons is designed as a module to complement and extend some of the themes developed in a guide to outdoor learning entitled *Patterns, Plants and Playgrounds*. *Patterns, Plants and Playgrounds* contains activities designed to help students appreciate the patterns that can be observed in the natural world, promoting a deeper understanding of the relationships that exist between humans and the local environment. The skills of observation and attitudes of respect for the natural world that are fostered in *Patterns, Plants and Playgrounds* provide an excellent foundation for students as they branch out into other forms of outdoor learning, including food gardening projects.

Patterns Through the Seasons is organised around the seasonal tasks of gardening. Each garden has its own patterns of growth and activity based on the changing weather of the seasons, changing day lengths and the characteristics of the soil and plants in the garden. Tuning in to these patterns and working with them will make caring for the garden a natural activity rather than a struggle, and will make planning learning activities in the garden much easier. To help you plan learning activities that suit the changes in the garden, each section of this book contains activities suited to a particular season. A checklist of important gardening tasks for each season can be found at the beginning of each section to act as a reminder of what needs to be done in the garden as well as alerting you to possible themes that can be developed with your students. As you become more familiar with the particular needs of your students and the garden, you will discover how best to plan garden activities through the year, even if it means using lessons that are 'out of season.'

Structure of Learning Activities in This Module

The learning activities for each of the seasons are divided into themes suggested by B.C. curriculum learning outcomes. Within each theme, activities are organized in order of increasing complexity. Each activity that is described in detail has the same basic structure:

Title and Grade Level Suitability – Recommended grade levels for each activity are indicated to the right of each activity title. Grade level suitability has been determined based on age suitability and connections to learning outcomes. These are intended as suggestions only. Feel free to adapt activities to suit the needs of your students.

Introduction

Introduction – A brief introduction describes the activity and provides any necessary background information.

Materials – Lists of materials have been simplified as much as possible so that specialized or expensive equipment is rarely required. Most of the outdoor gardening activities can be completed using common garden tools such as shovels, rakes and trowels.

Procedure – Many of the activities begin with discussion questions that will help students to assess what they already know about the topic under consideration, and conclude with additional questions to encourage students to reflect on what they have learned. Questions need not always be discussed as a whole class – vary this component of the activity by asking students to talk about what they think with a partner, give a written response as a journal entry or demonstrate their learning through creating a poster or a presentation. Allowing students to use multiple modes of expression will help extend learning from the garden into other areas of the curriculum and support the variety of learning styles of students in the class.

Extensions – Many activities conclude with a list of suggested extension activities that are intended to allow you and your students to dig deeper into each topic, extending learning as far as possible. Some of these activities will require one or two additional lessons while others can extend into an entire unit of study. Use your judgement to select extension activities that are of greatest interest and value to your students.

Making the Most of Learning Opportunities in the Garden

Learning in the garden is more than planting seeds in the ground and watching them grow; garden learning activities can include a multitude of tasks and topics such as: studying the soil, experimenting with factors that influence plant growth, reading about garden insects and much, much more. While the garden is the best location for conducting many of these learning activities, many can or should be completed indoors, depending on the needs of your students. For both indoor and outdoor activities, the following suggestions will help you and your students make the most of the learning opportunities provided by school garden activities.

- Many school garden programmes have had success with students working in small groups on different tasks. Inviting knowledgeable parents or volunteers from the community to supervise small groups of students, or even using older students as mentors will help make this possible.
- Make expectations about outdoor behaviour clear. Establish guidelines about proper use and care of tools, organization of materials, where to walk in the garden, and what to do if finished early.
- Have students keep a garden journal. This is an important component of learning in the garden that allows students to reflect on their experiences. You may want to give your students specific writing or drawing tasks for their journal, or simply set aside

time for students to write unstructured responses. Journals can also be used as an assessment tool.

- If your group will often be working outdoors in the garden, create a meeting space with places to sit and some shelter from wind and rain to help students stay focussed during whole class discussions.

AN IMPORTANT SAFETY NOTE: It is important that students are able to enjoy eating the food that they grow. Make sure that you and the adults you are working with are clear about the differences between edible and inedible plants, and that this information is made clear to students as well. Students should always wash their hands after working in the garden and before eating.

Meeting Curriculum Goals in the Garden

Many of the prescribed learning outcomes described in the B.C. Ministry of Education Integrated Resource Packages can be met through garden activities. Some of the outcomes, such as the primary science outcomes that address caring for plants, soil formation and decomposition, almost demand that teachers incorporate gardening into their learning programme. While gardening activities can touch upon learning activities throughout most areas of the elementary curriculum, the most direct links between gardening and the provincial learning outcomes occur in the science and social studies curricula.

Science

All of the four strands of the B.C. science curriculum – applications of science, life science, physical science and earth and space science – include topics that relate directly to activities in the garden. Many of these topics are addressed by activities described in this module. Probably the most useful method for teaching science in the garden is to use the garden as an outdoor laboratory for conducting experiments about plant growth, plant characteristics and relationships between plants and soil. This process is described in more detail as part of the spring Experimenting in the Garden theme, and has been developed extensively in schools throughout the United States by LifeLab. LifeLab's garden-based science resources for elementary teachers are highly recommended, and can be found through the contact information listed in Appendix C.

Social Studies

Throughout the elementary years, the social studies curriculum asks that students take action to address a problem or issue of importance to the school, local, national or global community. With the teacher's guidance, students are expected to identify a problem, select strategies to address the problem, then develop and implement a plan of action based on information gathered from a variety of sources by the students. This process can also include making presentations, writing reports, creating information posters and other modes of communicating information. With a garden already in place at the school, students can use activities in the garden to tackle issues that are important to them. The chart below suggests some garden- and food-related issues that fit in

with the social studies curriculum, as well as resources in this module and elsewhere that can be used to help students initiate action to address important issues.

ISSUE	RELATED GARDEN ACTIVITIES	SUGGESTED RESOURCES
FOOD WASTE IN THE SCHOOL	• measuring waste in the school • indoor or outdoor composting	• Winter Theme 1: Conserving Resources Through Composting • composting guides • municipal composting program
LOSS OF SOIL	• studying soil erosion • conducting erosion experiments • mulching • planting cover crops	• Fall Theme 2: Soil Stewardship • Information about soil found on Internet, in books and magazine articles • gardening manuals • seed catalogues
UNHEALTHY DIETS	• growing vegetables • compare nutritional value of fresh and prepared foods • including school-grown vegetables in school food programmes	• Spring Theme 3: Growing a Garden • nutrition guides • activities that address the effects of advertising on consumer choice
LOSS OF WILDLIFE AND AGRICULTURAL LAND IN CITIES	• growing vegetables • increasing green space on the schoolyard	• Winter Theme 3: Planning the Garden • current and historical maps • land use studies • school greening committee
LOSS OF NATIVE POLLINATORS	• plant flowers that attract pollinators • build/purchase and install nest • boxes for native pollinators	• Spring Theme 5: Native Pollinators • bee information found on the Internet and in books • local experts on pollinators
LOSS OF HEIRLOOM VARIETIES	• plant heirloom vegetable varieties in the garden	• Winter Theme 2: Our Vegetable Heritage • grandparents who have experience with gardening • local organic farmers and seed companies
CLIMATE CHANGE	• growing vegetables • eating food grown locally • calculating distances that foods have travelled • calculating carbon dioxide emissions of transportation required to import food	• Fall Theme 4: Apples and the Changing Climate • local orchards • climate change information found on the Internet and in books

Selected BC Curriculum Outcomes Listed by Grade Level

Almost any gardening activity will touch on multiple learning outcomes – this is one of the benefits of learning in the garden. For example, an experiment to determine the effects of soil nutrients on plant growth can help students develop scientific skills associated with soil testing and conducting an experiment, math skills necessary for graphing results, and language arts skills for creating a written report and giving an oral presentation. However, to simplify planning and make incorporating garden activities into the academic curriculum more manageable, only the B.C. elementary level learning outcomes that most closely match the potential for learning in the garden were used as a starting point for selecting appropriate activities. As a result, the outcomes listed below for each grade level are each addressed directly by one or more activities in this curriculum guidebook.

The learning outcomes listed in the following section should be used as a starting point, leaving you the flexibility to adapt activities to meet the specific learning needs of your students and to make your own connections between different areas of learning.

KINDERGARTEN AND GRADE 1

British Columbia Ministry of Education Learning Outcomes addressed by Activities in *Patterns Through the Seasons*

It is expected that students will…

SCIENCE

Applications of Science
- safely carry out instructions and procedures involving a small number of steps
- collaborate with others in scientific investigations
- suggest possible interpretations for a set of observations
- suggest questions for investigations
- handle equipment and materials safely

Life Science
- describe the characteristics of a variety of plants
- describe the diversity of plants within the home and school environment
- collaborate with others in the care of a plant or animal
- determine the requirements of healthy plants and healthy animals
- identify the stages in the life cycle of a plant and of a pet or other animal
- demonstrate how plants and other organic material can be recycled back into the environment

Physical Science
- describe how objects can change over time

Earth & Space Science
- describe the characteristics of rocks, soil and water
- classify rocks and soil according to their physical characteristics
- identify the living and non-living materials found in soil
- describe the effects of water and wind on rocks and soil
- describe the effects of weather on living things
- identify characteristics of each season

SOCIAL STUDIES

Applications of Social Studies
- identify and clarify a problem
- draw simple interpretations from personal experiences, oral sources, and visual representations
- present information using oral, visual, or written expression
- identify strategies to address problems

Environment
- practise responsible behaviour in caring for their immediate environment

GRADE 2 AND GRADE 3

British Columbia Ministry of Education Learning Outcomes addressed by Activities in *Patterns Through the Seasons*

It is expected that students will…

SCIENCE

Applications of Science
- conduct simple tests and describe observations
- use simple magnifiers or microscopes to observe things
- suggest possible improvements to investigations
- formulate questions to guide observation and investigations
- communicate scientific observations to peers, teachers and family
- conserve resources in the school

Life Science
- demonstrate a knowledge of how plants take in water, nutrients and light
- compare and contrast different types of plant life cycles
- describe structures that enable different plants to survive in different environments
- suggest reasons for the endangerment or extinction of a plant species
- compare and contrast plant and animal life cycles
- demonstrate a knowledge of what animals need to survive
- suggest reasons for the endangerment or extinction of an animal species

Earth & Space Science
- describe the unique features of the Earth that sustain life
- demonstrate a knowledge of the composition and formation of soil

SOCIAL STUDIES

Applications of Social Studies
- draw simple interpretations from personal experiences, oral sources, and visual and written representations
- identify an issue and provide several reasons to support a position
- identify and implement strategies to address class problems or projects

Society and Culture
- identify changes in the school and community throughout the year
- demonstrate awareness of British Columbia's and Canada's diverse heritage

Environment
- demonstrate understanding of their responsibility to local and global environments

GRADE 4

British Columbia Ministry of Education Learning Outcomes addressed by Activities in *Patterns Through the Seasons*

It is expected that students will…

SCIENCE

Applications of Science
- predict the results of an experiment
- perform an experiment by following a procedure
- construct simple definitions based on their experiment
- demonstrate an ability to recognize a valid interpretation of their results
- present their interpretation of the results from an experiment
- demonstrate responsible action when using the scientific information and skills they have developed

Life Science
- discuss how changes in an organism's habitat can affect the survival of individual organisms and entire species
- relate the growth and survival of organisms to a variety of conditions
- relate the life processes of an organism to its use of nutrients, water and oxygen
- describe the changing requirements of organisms as they grow

Earth & Space Science
- categorize the various uses for water
- outline the importance of water for life

SOCIAL STUDIES

Applications of Social Studies
- identify and clarify a problem, issue, or inquiry
- assess at least two perspectives on a problem or an issue
- design and implement strategies to address school problems or projects

Environment
- analyse how people interact with their environment, in the past and in the present

GRADE 5

British Columbia Ministry of Education Learning Outcomes addressed by Activities in *Patterns Through the Seasons*

It is expected that students will…

SCIENCE

Applications of Science
- design a scientific experiment
- identify relevant variables in an experiment
- identify and test a prediction
- correctly state a hypothesis
- differentiate between relevant and irrelevant information

Life Science
- identify living resources in the local environment
- describe how humans use B.C.'s living resources
- describe the known and potential environmental impacts of using B.C.'s living resources
- devise a strategy for sustaining a living resource

Earth and Space Science
- identify factors responsible for weather systems both locally and globally
- describe the consequences of extreme weather conditions
- describe how non-living resources are used in society
- describe the environmental impacts of using non-living resources

SOCIAL STUDIES

Applications of Social Studies
- identify and clarify a problem, issue, or inquiry
- design and implement strategies to address school problems or projects

Economy and Technology
- analyse the relationship between development of communities and their available natural resources

Environment
- demonstrate understanding of sustainability, stewardship, and renewable versus non-renewable natural resources
- assess effects of lifestyles and industries on local and global environments

GRADE 6

British Columbia Ministry of Education Learning Outcomes addressed by Activities in *Patterns Through the Seasons*

It is expected that students will…

SCIENCE

Applications of Science

- design a scientific test and evaluate its fairness
- draw reasonable conclusions from experiments
- write clear, step-by-step instructions for conducting investigations, operating something, or following procedure
- explain how hypotheses can be valuable, even if they turn out not to be true
- demonstrate an appreciation of the importance of keeping honest and unbiased scientific records

Life Science

- classify plants and animals according to their internal and external features
- analyze the effects of micro-organisms on other organisms
- compare and contrast sexual and asexual reproduction in both plants and animals
- describe the growth and changes in the development of an organism

SOCIAL STUDIES

Applications of Social Studies

- identify and clarify a problem, issue, or inquiry
- assess the relationship between cultures and their environment
- demonstrate appreciation of contributions of a variety of cultures to Canada and the world

Economy and Technology

- assess effects of urbanization and technology on lifestyles and environments

Environment

- compare use of resources and conservation practices in Canada and other countries

GRADE 7

British Columbia Ministry of Education Learning Outcomes addressed by Activities in *Patterns Through the Seasons*

It is expected that students will…

SCIENCE

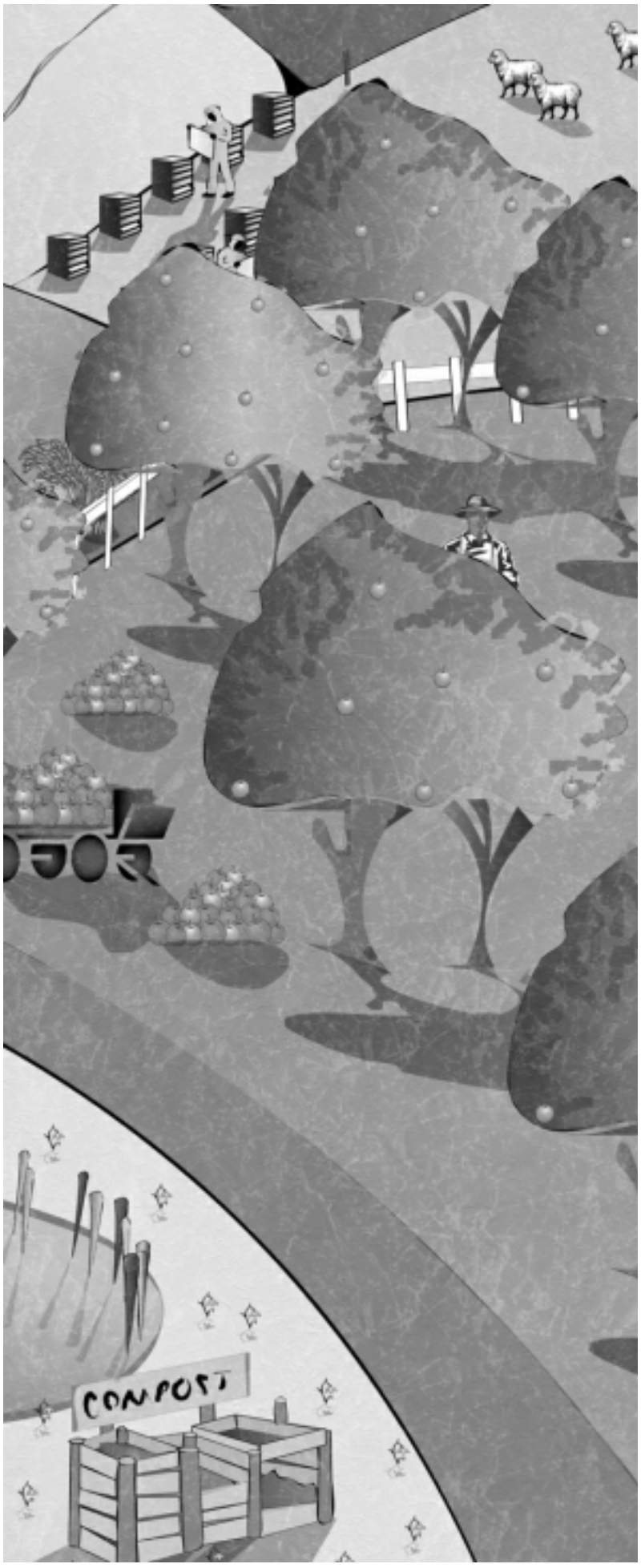
Applications of Science
- elect an appropriate procedure for an investigation
- design an experiment using two or more variables
- use graphs to summarize experimental data
- propose and compare options when making decisions or taking action

Life Science
- describe all organisms in terms of their roles as part of interconnected food webs
- describe ways in which species interact with each other
- compare and contrast sexual and asexual reproduction in both plants and animals
- describe the growth and changes in the development of an organism

Physical Science
- use the pH scale to classify a variety of substances
- identify the chemical reactions that are important in the environment
- assess the impact of chemical pollution on a local environment
- collect, analyse, and interpret data on environmental quality

SOCIAL STUDIES

Applications of Social Studies
- identify and clarify a problem, issue, or inquiry
- design, implement, and assess detailed courses of action to address global problems or issues



UNIT 1

Fall

Unit 1: Fall

Introduction

IN THE SCHOOL GARDEN

- Harvest crops remaining in the garden
- Save any seeds that have been produced
- Plant overwintering crops such as garlic
- Add nutrients to the soil and protect it for the winter using a mulch or cover crop

FALL LEARNING ACTIVITIES

With the garden just passing its peak, fall is the season to introduce or re-familiarise students with their garden and build excitement for learning in the garden throughout the coming school year. The first task is to see just what is in the garden, and to harvest and eat any remaining crops before they succumb to colder weather as part of a celebration of the fall harvest. Subsequent activities in this section use fall gardening tasks as a way for students to learn about stewardship of natural resources and how to care for the environment. By learning how to protect the garden soil from erosion, saving seeds harvested from the garden and discovering the connection between climate change and the distance food travels to reach us, students will be well on the way to appreciating the connection between humans and the natural world that sustains us.

THEME 1: Celebrating the Fall Harvest	Harvesting	K-7
	Four Senses	K-3
	Stone Soup	K-3
THEME 2: Soil Stewardship	If the Earth Was an Apple…	2-5
	Erosion	K-5
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	Mulch	K-7
THEME 3: Seed Saving	Seed Saving	2-7
	Designing Seed Packets	2-7
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	Climate Change and the Food System	4-7
	The Apple a Day Challenge	4-7

Activities

UNIT 1 THEME 1: CELEBRATING THE FALL HARVEST

Harvesting and using vegetables that have been grown in the school garden is a great way to make connections to the garden work that has been done in the spring and to build excitement for the coming year. Even if you have just a small garden, it's still important to celebrate the students' accomplishments and to take time to enjoy the food that students have grown. Remember to check that students are not allergic to any of the produce that is being harvested, and allow the students to eat only the plants that you are absolutely certain are edible.

SUGGESTED ACTIVITIES

1. Harvesting K-7

Bring the students to the garden to observe what makes fall different from all the other seasons in the garden and to harvest any remaining crops.

Materials

- Bags for collecting harvested vegetables
- Sturdy pair of scissors or sharp knife

Procedure

a) What do you notice about the garden? What do you remember about the work that was done in the garden in the spring? How has the garden changed since then?

b) Discuss some of the students' observations. You may want to touch upon ideas such as: different stages of the plant life cycle that can be observed
   - effects of weed competition
   - plants that have gone to seed, seed dispersal mechanisms
   - evidence of insect and animal activity
   - interactions between the weather, soil and plants

c) Demonstrate how to harvest plants gently, without damaging the edible parts (spots on a vegetable that have been bruised or cut will be the first to rot). Harvest any edible plants, looking, touching, smelling and discussing along the way. Put food in a bag for subsequent use. Set aside plants that have gone to seed in a dry, protected area for use in seed saving activities.

d) Wash food that has been harvested and ask students to wash their hands.

e) Share the harvest among the students for taste testing. Sample each item as connoisseurs, discussing flavours or rating tastes. You may want to put some of the harvest aside for use in one of the following activities.

2. Four Senses K-3

For this tasting activity, ask students to close their eyes and tell them that they are going to study food using all their senses except sight. If you are doing this activity with an entire class, select a few students to distribute food samples to their classmates. Without revealing the food's identity, have them feel, smell, listen to and taste some samples from their garden. Let students guess what they are sensing.

3. Stone Soup K-3

For this activity you will need to find a copy of S*tone Soup*, an old folk tale which has been written down and published by many authors. Following the story, students work together to prepare a stone soup of their own using vegetables harvested from the school garden. If you have a very minimal harvest from the school garden, asking students to bring ingredients from home will only make the class' soup more like the soup in the story. Of course if you can't find a copy of *Stone Soup*, it's still a great idea to use the vegetables harvested from the garden to make soup. For this activity to be a success, you'll need the help of some adults or perhaps some reliable older students.

Materials

- Vegetables harvested from the school garden and/or vegetables that students have brought from home
- Crock pot or large pot and stove
- Sharp knives
- Cutting boards
- Spoons
- Bowls or mugs
- Stock and/or bouillon cubes
- Spices
- Water
- Washed stone (could be from the garden)
- A copy of the story *Stone Soup* (many versions of this folk tale are available, including versions by Marcia Brown, Jon J. Muth, Heather Forest and Ann McGovern)

Preparation: If the school garden hasn't produced enough vegetables to make a large pot of soup, ask the students to bring some vegetables from home that could be added to a soup.

Procedure

a) Ask the students to share examples of times when they worked together with other people to do something they couldn't do by themselves.

b) Read the story of *Stone Soup*, a folk tale that tells the story of travellers with nothing to eat who stop for a night at a town. The people in the town have little food themselves and are unwilling to share, until the travellers begin brewing a pot of soup using a magic stone. Soon, the townspeople have all contributed something to the pot and there is enough soup for everyone to share.

c) What did the travellers in the story accomplish that they couldn't have done by themselves? What lesson did the townspeople learn from the travellers?

d) Have some of your students or some older student helpers wash and dice the vegetables to add to the soup, making sure students are supervised while using knives.

e) Have one of the students find a stone, scrub it clean, and add it to the crock pot along with water and/or stock. Bring the liquid to a simmer.

f) Add vegetables to the liquid and simmer for at least 30 minutes. Tender vegetables, such as tomatoes and greens, can be added later. Add some salt to bring the flavour out and add spices as you see fit.

g) Serve the soup and enjoy!

Extensions

- Invite other students or adults that helped with the garden in the spring to share the soup.
- Have students write their version of the stone soup recipe.
- To continue in the spirit of sharing, donate extra harvest from the garden to a local food bank or soup kitchen.

UNIT 1 THEME 2: SOIL STEWARDSHIP

Worldwide, 25 billion tonnes of agricultural topsoil are swept away every year. That's 7% of the globe's good growing land every decade. In these activities students will come to appreciate how little topsoil there is in the world and how it can easily be lost through erosion caused by poor agricultural practices. In the garden, students will discover soil stewardship techniques to build soil health and protect soil from erosion.

SUGGESTED ACTIVITIES

1. If the Earth Was an Apple... 2-5

Use an apple to demonstrate the need for soil stewardship.

Materials

- Apple
- Sharp knife

Procedure

a) Ask the students what they know about soil. What is it? Why do you think plants need it? How does it help humans?

b) Show the students the apple and give the following demonstration:

Let's say this apple is the Earth.

Cut the apple into quarters and set three of the quarters aside.

Three quarters of this apple represent all the oceans on earth. The remaining quarter represents all the land on earth.

Cut the remaining quarter in half and set one piece aside.
One half of the land is unfit for humans; it is either too hot, like a desert, or too cold, like the north and south poles.

Cut the remaining piece into quarters and set three of them aside.
Of the land that humans can live on, only this small piece is land that we can grow food on. The rest is too rocky, or there isn't enough sun for plants to grow.

Peel the remaining piece.
This thin peel represents the thickness of the soil in which we grow our food. It is only about one metre deep. This tiny portion is the only area out of the whole earth where all the right conditions exist to grow food. Enough food has to be produced on this small bit of land to feed all of the people on earth.

c) With so little soil in the world, what should people be doing to take care of it?

2. Erosion K-5

It takes over 500 years to produce just 2.5 cm of soil, and in many parts of the world existing soil is lost as much as 18 times faster than new soil is formed.[7] This activity will demonstrate to students how this important resource can be lost through erosion by rain and wind when the garden is left bare for the winter.

Materials

- Four waterproof trays (could be seeding trays, cookie sheets, old baking pans)
- Sod to fit snugly in one of the trays
- Soil
- Watering can
- Preparation: Dig up a piece of sod to fit snugly into one of the trays, and fill a second tray with soil. Set the two empty trays out on the ground against a wall. Fill the watering can with water.

Procedure

a) In the winter, there is usually plenty of rain and wind. What do you think the rain and wind will do to the soil? When soil or rocks are moved from one place to another by rain or wind, we call this erosion.

b) Ask the students to make predictions about what will happen when the wind blows across the tray filled with sod and the tray filled with soil.

c) One at a time, hold the trays filled with sod and soil over one of the empty trays. Invite a few students to blow across each tray to simulate wind. Notice how much soil collects in the empty tray.

7 Ecology Action. *Worldwide Loss of Soil and a Possible Solution*. http://www.growbiointensive.org/biointensive/soil.html#soil.

d) Lean the two sod- and soil-filled trays on an angle against a wall, with the base of each resting inside one of the empty trays to catch residual water and soil

e) Ask the students to make predictions about what will happen to the soil in each tray when water is poured across the top of them.

f) Pour an equal amount of water across the tops of the two trays and observe the runoff that has collected. Which tray lost the most soil?

g) What happens to soil when the wind blows on it or it gets rained on? What might prevent soil from eroding? What could we do in our garden to prevent erosion?

3. Cover Crops K-7

One of the ways students can protect their garden soil during the winter is to plant a cover crop. Cover crops are usually non-edible crops and often include a mix of different plants with roots that can keep soil from washing away during heavy rains and draw nutrients from deep down in the soil. Planting a cover crop also provides competition for weeds; well-established cover crop will shade out weeds entirely. In the spring, the cover crop is pulled up and added to the compost or cut down, left to dry and dug into the soil. Consult the Appendix A for suggestions about selecting cover crops for school gardens.

Materials

- Cover crop seeds
- Rake or hand-held garden forks
- Watering can

Procedure

a) What happens when you leave an area of the garden bare? Weeds grow. Can you see places in the garden where this is happening? This is nature's way of protecting the soil. This works fairly well, but if you let too many weeds grow they take over the garden and are hard to get rid of. What could we do instead of letting weeds do the work of stopping erosion?

b) Explain how cover crops are like weeds that have been planted on purpose and talk about how cover crops are used in the garden. Show the students the cover crop seeds you have selected.

c) Clear any remaining plants out of the garden.

d) Hand some seeds to each student and have them sprinkle the seeds evenly across the selected section of the garden.

e) Scratch the surface of the soil with a rake or garden forks so the cover crop seeds are turned just below the surface; birds will often eat seeds that are exposed.

f) Gently pat the soil all over to ensure that the seeds are in contact with the soil.

g) Ask the students to make predictions about what the garden will look like in a few months' time.

h) Water the newly seeded area of the garden, and ensure that it is kept moist until the crop is established. After that, leave the cover crop until spring.

4. Overwintering crops K-7

In addition to planting cover crops, a portion of the garden can be set aside for planting overwintering crops. These crops start their growth slowly in the fall and winter and do the rest of their growing when the weather warms up the following year. Probably the simplest overwintering crop to grow is garlic, which is normally planted in October (or later in the warmest parts of the country) and harvested the following summer. A single garlic clove planted in the fall will grow into an entire bulb if allowed to mature, with larger cloves producing the biggest bulbs of garlic. If you don't have enough space to leave the garlic in the ground the following spring or won't be able to harvest and cure it in the summer, pick the plants in early spring and eat the green stems, using them like green onions. Other overwintering crops include: fava beans, purple-sprouting broccoli and some varieties of carrots and greens, although some of these may require additional protection from winter weather in your area.

Materials

- Bulbs of garlic
- Watering can

Procedure

a) During the summer, some of the vegetables we planted earlier in the year helped to prevent erosion. Now that most of those plants are gone what could we do to prevent erosion and still have food to eat early next year?

b) Describe what an overwintering crop is and ask students if they are familiar with any of these vegetables. Explain how garlic is grown.

c) Clear any remaining plants out of the garden.

d) Hand out the bulbs of garlic and have students break them into individual cloves, leaving the skin on.

e) Plant the cloves 15 cm apart (6 inches) with the pointy end up so that the clove is just below the surface. Crows sometimes see the points sticking out of the ground and pull them up for fun.

f) Garlic really appreciates a mulch (see next activity). If you have any mulch available, use some of it to cover the garlic.

g) Water the newly planted area and keep it moist until the winter rains take over. After that, leave the cover crop until spring.

5. Mulch K-7

Another way for students to protect the soil in the garden is to cover it with mulch. Mulch is a layer of organic matter put on the surface of the soil and may include materials such as straw, hay, leaves or compost. A useful analogy is the annual shedding of leaves in the forest, creating a layer of leaf litter on the forest floor. Both fallen leaves and mulches provide a layer of insulation, suppress weeds, decompose to add nutrients and organic matter to the soil and provide a place for helpful insects to hide. Just like the forest floor doesn't turn itself over, there is no need to dig mulch into

the soil. Natural processes help to incorporate the mulch into the soil, and any mulch that hasn't decomposed by the spring can be raked up and added to the compost. For use in a school garden, sources of mulch could include compost from the school compost bin, compost or straw that has been purchased, or the students could even collect leaves from the schoolyard (except for chestnut leaves, which release a chemical that can inhibit the growth of other plants).

Materials

- Mulch material

Procedure

a) In a forest, the trees can create so much shade that things like weeds and the plants we use for cover crops can't grow. What is there in the forest that protects the soil?

b) Explain the similarities between leaf litter in the forest and different kinds of mulches used in the garden. Show the students the mulch material you will be using.

c) Clear any remaining plants out of the garden.

d) Have the students spread the mulch material evenly over the soil, to a depth of 3 cm (1 inch) if you are using compost, 8 to 15 cm (3 to 6 inches) if you are using straw or leaves.

e) Ask the students to make predictions about what will happen to the mulch during the winter.

f) Leave the mulch as it is until spring.

UNIT 1 THEME 3: SEED SAVING

Many gardeners and farmers are rediscovering the importance of saving their own seeds as a way of maintaining favourite flower, fruit, vegetable and herb varieties that are no longer of interest to large seed companies. By learning how to save seeds, students will be using skills that have been practiced by cultures around the world since the beginning of agriculture. Saved seeds can be kept for planting in subsequent years, sold as part of a fundraiser, given as gifts, or passed on to successive classes of students in the same way that seeds have been passed down by generations of farmers.

SUGGESTED ACTIVITIES

1. Seed Saving 2-7

The first step in studying seeds is to collect some from the garden. Among the easiest seeds to collect and save are pea, bean, radish, broccoli, calendula and sunflower. Seeds from fleshy fruits such as tomato, cucumber and squash need to be dried on paper towels, or better still, left to ferment. Consult a seed saving guide such as *Seed to Seed* by Suzanne Ashworth for detailed seed saving information.

Materials

- Seeds collected from the garden
- Paper bags or envelopes

Procedure

a) As part of the fall harvest look through the plants in the garden and ask students which of the vegetables they would like to plant in the garden in the spring. What can we do to make sure that we can plant these same vegetables in the garden next year? Long before there were seed companies and garden stores, people had to save their own seeds to make sure that they could grow the foods they liked year after year. By saving seeds, we know that next year we will be able to enjoy the foods we grew this year.

b) Try to identify any seeds that have been produced.

c) Place seeds that are already dry in paper bags or envelopes labeled with the vegetable variety and date of harvest. Plants that have not fully dried before the weather begins to cool should be pulled out of the ground and stored upside down in a covered, ventilated area out of the sun until the seeds have cured completely. A few seed saving tips to keep in mind:
   - Avoid saving seeds from plants that are obviously diseased or malformed, as the seeds may carry the disease or be less vigorous.
   - Do not store seeds in plastic bags as moisture will be trapped in the bag, causing the seeds to rot.
   - Don't try to save seeds that are beginning to mould; the mould will spread to other seeds.

d) Once seeds have dried completely, they should be stored in airtight containers in a cool spot until planting time.

Extensions

Many seeds are harvested while still in pods. Before putting these seeds into storage, they are usually threshed and winnowed. Threshing is the process of breaking the seed away from its covering; separating the seeds and the leftover debris (chaff) is called winnowing. Many gardeners thresh their seeds by putting the pods in a pillowcase, then jogging on the pillowcase. Winnowing is usually achieved using some kind of blower. Have students experiment in groups to design a process to thresh and winnow their seeds without damaging or losing seeds.

In traditional farming societies seeds had to be protected from animals and the elements through the winter until planting season. Many cultures have developed special decorated vessels, often made of clay or woven baskets, in which to store their seeds. Find pictures of such storage vessels and have students create their own to store their seeds until the spring. Possible materials could include jars, or seeds placed in Zip Lock bags tucked into a decorated box.

In addition to saving vegetable seeds, herbs can be harvested and dried to give as gifts or sold as part of a fundraising activity.

2. Designing Seed Packets 2-7

In this activity students create criteria for an appealing seed packet and design their own seed packets for seeds collected from the garden. These decorated seed packets can be sold as part of a garden fundraiser, used as gifts or saved for planting in the spring.

Materials

- Seeds collected and dried from the garden
- Copies of the seed packet template for each student *(see Appendix B, page 83)*
- A variety of seed packets leftover from the spring
- Scissors
- Glue
- Pencil crayons

Procedure

a) There are many farmers and seed companies that earn their living by selling seeds. Imagine that you own one of these small seed companies and you want to sell some of your seeds. When you go to the garden stores you see that there are many other companies trying to sell their seeds as well, so you want to design a seed package that will stand out from all the others and convince people to buy your seeds.

b) Show the students the seed packages and have them point out some of the features that stand out on each package, such as colour pictures, detailed planting information, the name and address of the seed company, etc. Ask students to rate the seed packets from most appealing to least appealing.

c) Create a list of criteria for an appealing seed packet on the board.

d) Have students design seed packets for the seeds the class has saved, based on the list of criteria.

e) Cut and fold the seed packets, then fill them with seeds. Make sure that the packages are cut and sealed carefully so that seeds won't fall out.

f) Have students look at each others' seed packets. Did we meet the criteria we established? What other techniques do you think seed companies might use to sell their seeds? Are the seeds in the nicest packets always the best seeds?

Extensions

Student-designed seed packets serve as an excellent symbol of the work and learning that takes places in a school garden. Use the seed packets to help raise awareness about the benefit of a school gardening programme by selling them at a fundraiser or giving them as gifts to administrators who have supported the school garden.

UNIT 1 THEME 4: APPLES AND THE CHANGING CLIMATE

Our food travels great distances to reach our plates. In Canada, on average, each meal ingredient travels close to 2000km to reach us.[8] Transporting food such long distances requires burning large amounts of fossil fuel, resulting in increased emissions of CO^2 and other greenhouse gases. As a consequence of this globalized food system, the eating habits of a typical family of four can result in nearly the same volume of greenhouse gas emissions as heating a home and using a car combined.[9]

On grocery shelves in British Columbia, we often find apples that are grown locally or elsewhere in the province, in Washington State, or grown in New Zealand. An apple grown in New Zealand travels approximately 12,000 more kilometres to reach us than an apple grown locally, resulting in more than 50 times the amount of CO^2 emissions through transport alone.[10] In this series of activities, students will examine how growing their own food and eating food grown closer to home can help slow climate change.

SUGGESTED ACTIVITIES

1. Greenhouse in a Jar 2-7

Through a simple experiment, students will discover how the greenhouse effect causes climate change. This activity can be completed in small groups or as a whole class experiment.

Materials

- Two thermometers
- Glass jar
- Clock or watch
- Sun lamp or access to sunny area
- Greenhouse in a Jar worksheet *(see Appendix B, page 84)*

Procedure

a) Describe how living on earth is a bit like living inside a jar; carbon dioxide (CO^2) and other greenhouse gases create a layer of insulation that helps to keep the atmosphere warm enough to allow life on earth. Ask student to make predictions about what the temperature inside the jar will be like compared to the temperature outside the jar.

b) Place the two thermometers close to each other in direct sunlight or under the sun lamp.

c) Wait about three minutes so that the thermometers are both giving the same reading. On the first row of the worksheet, record the time and the temperature readings on both thermometers.

8 Ten Days for Global Justice. *What's All the Hot Air About?* http://www.web.net/~tendays/hotair.

9 Jones, Andy. Summary of *Eating Oil: Food Supply in a Changing Climate.* http://www.sustainweb.org/pdf/eatoil_sumary.PDF

10 Calculations of the author, based on CO2 emission statistics cited in Kaymar Enshayan et al. *Food, Fuel and Freeways.* http://www.leopold.iastate.edu/pubinfo/papersspeeches/ppp/foodmiles.html

d) Place a jar over one of the thermometers, taking care that the jar does not cast a shadow over the other thermometer. If the thermometer is too large to remain horizontal inside the jar, stand it against the inside of the jar.

e) Every minute, for ten minutes, record the readings of both thermometers.

f) Ask the students to explain why the temperature inside the jar is hotter than the temperature outside of the . If the jar is a model of Earth's atmosphere, what will happen on Earth if we add too many greenhouse gases to the atmosphere?

Extension

- Graph the results of the Greenhouse in a Jar experiment.

(see Appendix B, page 84)

GREENHOUSE IN A JAR

MEASUREMENT	TIME (MINUTES)	THERMOMETER 1 Temp (°C)	THERMOMETER 2 Temp (°C)
1			
2			
3			
4			

2. Climate Change and the Food System 4-7

Once students have an understanding of what climate change is, they can begin to consider how they might take action to minimize their own contributions to climate change. In this activity students discover the intimate connection between climate change and the transportation of food around the world. As it turns out, choosing to buy food grown locally can reduce production of greenhouse gases, helping to reduce the effects of climate change.

Materials

- Copy of sample graphs, either on overhead transparency or on paper for each student *(see*

SCIENTISTS AT NATURAL RESOURCES CANADA PREDICT THAT SOME OF THE EFFECTS OF CLIMATE CHANGE IN B.C. MAY INCLUDE: [11]

- a rise in sea levels by up to 30 cm on the northern coast of the province
- increased flood dangers in some areas of the coast and in the interior

  drought in some areas
- fishes that prefer cold water may mover farther north, while warmer water fish such as tuna and mackerel may move into the area off our coast
- some tree species will extend their ranges northward and to higher elevations
- grasslands may replace some Douglas fir forests in places where there is less rain
- changes in tree growth, fire frequency, and insect infestation that may cause difficulties for forest companies

Appendix B, page 85)

Procedure

a) Ask students what they think some of the effects of climate change might be in British Columbia and how we might be able to reduce the effects of climate change. Discuss some of the predictions made by scientists.

b) Look at the sample graphs using an overhead projector, or distribute copies to the students. Explain that these graphs are clues about how students can help slow climate change. Each graph shows the number of apples eaten on the same day by two different classes located in Victoria. The four locations on the graph are the most common places where the apples we find in stores are grown.

c) Ask some questions about the graphs to check for understanding: Which class ate more apples from BC? Which class ate more apples from New Zealand?

d) Ask students to guess how many kilometres an apple would have to travel from each of these growing regions to reach Victoria (you may want to modify these distances if you live somewhere else). Write the actual distances on the graphs for reference:

   - Apple grown locally (in Victoria): 0-50 km
   - Apple grown in Okanagan Valley, BC: 450 km
   - Apple grown in Washington State, USA: 500 km
   - Apple grown in New Zealand: 12,000 km

e) Apples and other foods are brought to us using big trucks, ships, trains and airplanes. All of these vehicles use fuel and emit greenhouse gases like carbon dioxide. The further the food has to travel, the more fuel is needed and the more greenhouse gases are released. Which kind of apple would take the most amount of fuel to bring to us? Which kind of apple would take the least amount of fuel? What kind of apples could you choose to help slow climate change? Write

11 Natural Resources Canada website. http://adaptation.nrcan.gc.ca/posters/teachers/bc_e.asp

the actual amounts of carbon dioxide emitted for each apple on the graph:

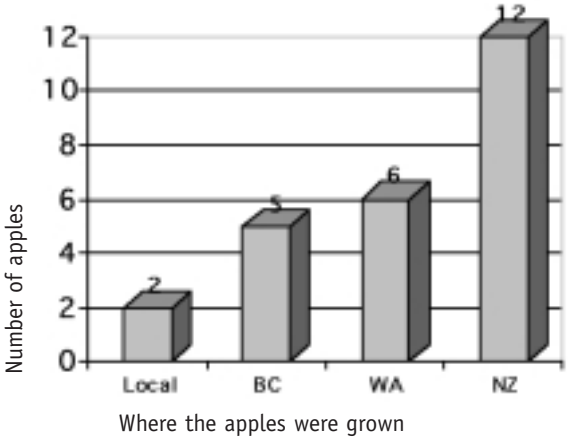
- Apple grown in Victoria: 0-2 g
- Apple grown in BC: 14 g
- Apple grown in Washington State, USA: 16 g
- Apple grown in New Zealand: 110 g[12]

f) Looking at the graphs again, ask the students to determine which class helped to slow climate change the most by eating more apples that were grown closer to home. (Ms. Gala's class) How could we choose foods that make the smallest contribution to climate change?

(see Appendix B, page 85)

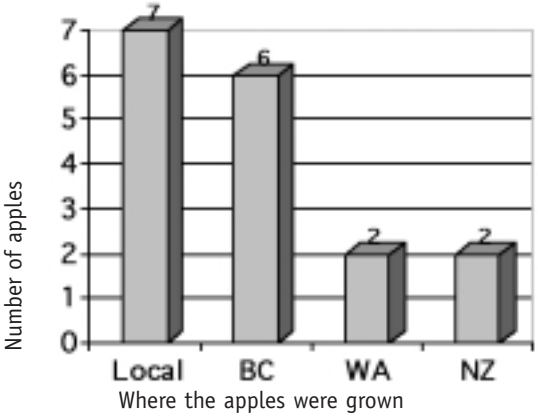
GRAPH 1

APPLES EATEN BY MR. SPARTAN'S CLASS



GRAPH 2

APPLES EATEN BY MRS. GALA'S CLASS



Extensions

- Use a map to determine the distance an apple grown in various regions travels to reach you in your town. Most apples that are bought in British Columbia are grown in either New Zealand, Washington state or in the Okanagan region of BC.
- Look at labels on food packages to determine where other foods are grown. How far did they travel to reach the students?
- If you know the distance travelled by an item of food, determine the amount of CO2 emitted to bring it to your town. The numbers can be a bit messy, but the math is straightforward:

CO2 EMITTED (G) = EMISSION VARIABLE X MASS OF FOOD (G) X DISTANCE (KM)

12 Calculations are based on CO2 emission statistics cited in Kaymar Enshayan et al. *Food, Fuel and Freeways*. http://www.leopold.iastate.edu/pubinfo/papersspeeches/ppp/foodmiles.html. Transport from New Zealand is by freighter to Los Angeles then to Victoria by semi-trailer truck. All other emission statistics assume transport by semi-trailer truck.

MODE OF TRANSPORTATION	RAIL	WATER	ROAD	AIR
EMISSION VARIABLE (g CO2/g-km)	.000041	.000030	.000207	.001260

3. The Apple a Day Challenge 4-7

Once your students are familiar with the idea of climate change and eating food grown closer to home, try the Apple a Day Challenge. Create a tally on the blackboard or on a large piece of paper with four categories: Victoria (or your own town), British Columbia, Washington, New Zealand. Each time a student brings an apple to school, have them make a tally mark next to the region in which the apple was grown. At the end of the week, have the students create graphs to display the results of the tally, incorporating the specific graphing skills appropriate to the grade level of your students.

Give students the responsibility for keeping the tally up to date by making a tally mark just before recess or lunch if they have brought an apple with them. Encourage students and their parents to leave the stickers on their apples to make it easier to identify where each apple was grown.

You may want to repeat this exercise each week for a period of up to one month. Compare the graphs produced during subsequent weeks and ask the students to interpret the results: which week did we eat the most apples grown closest to home? Which week did we make the biggest contribution to climate change?

Extensions

- Determine how many grams or kilograms of CO2 were saved by eating more apples grown closer to home.
- Create posters to raise awareness about the environmental benefits of eating food grown closer to home.

Unit 2: Winter

UNIT 2

Winter

Introduction

IN THE SCHOOL GARDEN

- Make plans for outdoor or indoor composting, or continue your existing composting program
- Order seeds and other supplies
- Plan the garden for the coming spring

WINTER LEARNING ACTIVITIES

For most gardeners, the reduced sunlight and cold weather of winter slows work in the garden to a halt. This period of respite leaves time to reflect on accomplishments and shortcomings of the previous year and to make plans for the coming year of gardening. For most school gardeners, winter is the time to leave the outdoor garden alone and focus instead on garden-related activities that are best done indoors.

The winter activities described in this section focus on making preparations for spring. Setting up a composting program is a key element in building a healthy soil for the school garden, allowing students to practice stewardship of resources found in the school and in the school yard which would otherwise be sent to the landfill. Another important resource is the diversity of fruits and vegetables that have been passed down for many generations, known as heirloom varieties. In late winter, well before the spring gardening season begins, start making plans for the garden.

Activities

UNIT 2 THEME 1: COMPOSTING, DECOMPOSITION AND RESOURCE CONSERVATION

Ask any experienced organic gardener, and they'll tell you that compost is the best thing going. Compost is an ideal soil amendment that provides essential plant nutrients safely while improving the soil's ability to hold water. Better still, it can be made from materials that are readily available and can be obtained for free.

Compost is the end result of the natural process of decomposition. Any plant materials, if left long enough, will decompose into compost with the help of worms, fungi, bacteria and other soil microorganisms. In the schoolyard, the challenge is to select an appropriate composting system that suits the needs and constraints of the participating classes and that makes the best use of available compostable materials. At most schools, a significant portion of the leftover food thrown into the garbage has the potential to be turned into compost. Other possible materials available to schools include fallen leaves, grass clippings and plants and weeds pulled from the school garden. As part of these composting activities, students will gain valuable insights into conserving natural resources, decomposition and soil stewardship.

Note: Some activities in this section were adapted with permission from T*he Growing Classroom* by Life Lab science program.

SUGGESTED ACTIVITIES

1. Compost in a Bag — K-3

Use this demonstration to introduce students to the natural process of decomposition. Begin this activity about one month before beginning composting in the garden or in the classroom.

Materials

- Large clear plastic bag and twist tie
- Compostable food scraps: pieces of fruit, bread, grass clippings, paper
- Non-compostable items: plastic, scraps of metal (make sure these are blunt so they won't puncture the plastic bag)
- Moist soil from the garden

Procedure

a) Tell the students that you know the ingredients for a secret recipe. Have them guess what the results of the recipe might be as you put the ingredients together.

b) Put a generous helping of moist soil into the bag.

c) Add the rest of the ingredients (using lots of compostable items, but fewer non-compostable items). Mix everything well with the soil.

d) Breath air into the bag until it is full, then seal the bag with the twist tie.

e) Tape a sign on the bag listing the ingredients and the date, and a question: "What's going on in here?"

f) Put the bag somewhere in the classroom where it won't be disturbed.

After one month, open the bag outside and look through the contents. Some of the items will have decomposed into compost, while others will have remained unchanged. Fungi and bacteria from the soil will have decomposed the organic material in the bag in the same way that leaves decompose in the forest, or as compost is made in the garden.

Extension

Have students make predictions about what other kinds of materials will decompose. Which materials will decompose more quickly or slowly? Once the weather has warmed up, dig holes of the same depth in the ground and put a different item in each one. Fill in the holes and mark each spot. Dig the items up weekly to see how well each material decomposes.

2. Worms 101 K-3

What has five hearts, a gizzard, no eyes, arms, legs or teeth and can make a special kind of compost in the corner of the classroom? A worm! In this activity students are introduced to the fascinating world of worms, and examine their important role in the decomposition of organic matter.

Materials (for groups or whole class)

- 2 clear containers (mason jars, bottom of a pop bottle, etc.)
- Worms (Red Wigglers – gathered from garden or purchased)
- Soil
- Green plant material (fresh weeds, leafy greens, etc.)
- Black paper or cloth

Procedure

a) Whenever you dig in healthy soil, you're likely to find some worms. What do you think earthworms do in the soil? How might they help the soil? Record predictions.

b) For each group, or as a whole class experiment, layer materials in the two containers as follows, starting from the bottom: Soil, plant material, soil, plant material. The layers of plant material shouldn't be more than a couple of centimetres deep. Cover with leaves or more soil so that the top layer of plant material isn't exposed to the air.

c) Add worms to just one of the two containers. Keep the material in this container slightly moist for the duration of the experiment.

d) Cover the container with worms in it using black paper or cloth in such a way that air can still get in.

e) Lift the cover off daily for a few weeks to observe what the worms are doing. Make notes or drawings to record the worms' progress as compared to the container without worms.

f) Compare the materials in the two containers. What effect did the worms have in the soil? How did the worms help to recycle the plant material that was added to the soil? How do you think what the worms are doing in the soil might help plants to grow?

g) Ensure that students return the worms to the garden.

Extensions

Use this activity as an introduction to a study of worms, including observations of their anatomy and behaviour, research, and simple experiments to determine their responses to such stimuli as water, vibrations and light.

Conduct further experiments to determine the food preferences of worms. Introduce different materials to small containers filled with soil and a few worms to figure out which materials worms will and will not consume. One simple design for small worm composters that is perfect for such experiments can be found in *The Wonderful World of Wigglers* (*see resource list in Appendix C*).

3. Setting up a Compost System K-7

Once students have been introduced to decomposition and the role of Red Wiggler worms in recycling plant matter, it's time to set up a compost system. Composting can happen indoors or outdoors, on a small or large scale, using a wide variety of techniques and materials. The major decision for a school garden programme is the choice between worm composting, known as vermicomposting, which is often done indoors and the more traditional form of outdoor garden composting in a heap. There are many excellent resources on both forms of composting which can provide detailed information for making composting work in the school environment. The following brief overview of these two methods may help start your thinking:

VERMICOMPOSTING IN A WORM BIN	**COMPOSTING IN AN OUTDOOR BIN**
Vermicomposting happens in a worm bin, a sturdy box filled with bedding material and worms. Scraps of fruits and vegetables are added regularly and eaten by the worms, resulting in nutrient-rich material called castings. Castings are an excellent soil amendment for the garden.	Food scraps and garden materials are made into a heap or added to an outdoor bin and left to decompose naturally over a period of a few months, resulting in dark, nutrient-rich compost that can be added to the garden to help condition the soil and provide nutrients.
Can be set up indoors or outdoors.	Suitable for outdoor use only.
Bin can be constructed using recycled, inexpensive and easy to find materials.	Bin can be constructed using recycled, inexpensive and easy to find materials.
Can be done on a small (inside a milk carton) to large scale.	Minimum size of one cubic metre.
Requires regular attention.	Can be left for many months.
A well managed worm bin can produce worm castings in 2-3 months.	A well managed compost bin produces compost in 3-12 months.

4. The Worm Squirm K-3

There are many materials that can be successfully made into compost in either a worm bin or outdoor compost bin, but some materials should not be added to the compost either because they won't decompose or because they pose a health hazard to students. This quick game will help young students remember what to put into the compost and give them a preview of what their composting efforts will produce.

Materials

- Examples of compostable and non-compostable materials, or the names of these items written on cards
- Small container of compost or worm castings

Procedure

a) Review materials that should and should not go into the worm bin or compost.

b) Ask the class to hold hands to form a giant worm.

c) Hold up items that can and can't go into the compost. Ask the 'worm' whether it would like the item.

d) If the answer is yes, everyone says "WORM SQUIRM!" and the worm wiggles by sending a wave down the line. If the answer is no, ask where the item should go (e.g. in the garbage, in the recycling box, etc.).

e) After a few rounds, ask the class to sit down. Look through the items or cards that were used and ask why they were or were not used for the compost.

f) Bring out a small container of compost and show the 'worm' what it has just made. Pass it around for the children to see, touch and smell.

DO ADD TO THE COMPOST	DON'T ADD TO THE COMPOST
fruit and vegetable scraps	metal, plastic, glass
eggshells	stones
grass clippings	meat, fish or poultry
leaves	large sticks
seaweed	cooked foods
shredded newspaper or cardboard	dairy products
weeds that haven't gone to seed	diseased plants
manure from farm animals	perennial and invasive weeds (morning glory, ivy, buttercup, blackberry)

UNIT 2 THEME 2: OUR VEGETABLE HERITAGE

An heirloom vegetable is a non-hybrid vegetable variety that has been passed down from generation to generation, usually considered a long-time family favourite.[13] Most of the heirloom plant varieties grown in Canada were either cultivated by First Nations peoples or brought by immigrants. Before the advent of advanced cultivating techniques and genetic engineering, heirloom varieties were grown in home gardens across the country and were readily available through catalogues and seed companies. Different regions each had their own preferred heirloom varieties that adapted over time to suit the climates where they were grown.

As gardeners and farmers have become increasingly reliant on the hybrid seed varieties produced by large companies, many heirloom varieties are no longer planted. After being in storage for a number of years, the remaining seeds lose their viability – many heirloom varieties become extinct this way every year. The disappearance of heirloom varieties is problematic not only because of the loss of interesting vegetables to grow and eat, but also because of the loss of varieties which are adapted to specific climates. Some heirloom varieties even possess genetic traits that give them resistance to certain pests and plant diseases. As heirloom varieties become extinct, these special characteristics are lost forever.

By growing heirloom fruits, vegetables and flowers, students will be acknowledging the contributions of many cultures to Canadian gardening and food production. These activities will introduce students to the rich variety of our vegetable heritage, as well as providing opportunities for students to plant and save heirloom seeds for future generations of gardeners.

SUGGESTED ACTIVITIES

1. What is an Heirloom? 5-7

This activity introduces students to heirloom seed varieties, and can act as a lead up to the J.J. Seed Role Play described in the next activity.

Materials

- None

Procedure

a) Ask the students to think of as many varieties as possible for each of these vegetables: tomato, lettuce, bean. List responses on the board.

13 Ashworth, Suzanne. *Seed to Seed*. Decorah: Seed Saver Publications, 1991. p. 13.

b) Compare the number of varieties listed by the students to the number of varieties known to grow in North America:
   - Tomato – 5,500 varieties
   - Lettuce – 1,000 varieties
   - Bean – 5,200 varieties

   (These are conservative estimates, based on the varieties known to the Seed Saver's Exchange as of 2003.)

c) Where could all these different varieties have come from? Explain to the students that most of these varieties are known as 'heirloom vegetables.' An 'heirloom' is something that has been kept in a family for many generations, maybe a special piece of furniture, a special doll or piece of art. When people immigrated to Canada from other parts of the world, many of them brought their heirlooms with them, including heirloom seeds to grow their family's favourite plants. Some interesting examples of heirloom vegetables include:

   Tennis Ball Lettuce – the colour and shape of the leaves resemble tennis balls. Tennis ball lettuces used to be pickled in salt brine during the 17th and 18th centuries.

   Moon and Stars Watermelon – the green skin of these watermelons are covered with small bright yellow "stars" and usually one large yellow "moon," so that the pattern on the skin looks like a starry sky at night.

   Queen Anne's Pocket Melon – the fruits of this plant are usually only 5cm in diameter and aren't particularly tasty. However, these melons smell so good that women used to carry them in their pockets as a perfume.

   Aunt Ruby's German Green Tomato – the fruits of this variety of tomato never turn red, but are green when they are ripe and taste better than many red tomato varieties.

d) Discuss why people would want to save their heirloom vegetable varieties. What might it be like if we didn't have these heirloom varieties any more?

Extensions

Have students interview their parents or grandparents to find out what kinds of vegetables they ate as children. Are all of these foods still eaten today?

Have students create their own heirloom-like seed varieties. Look at examples of seed varieties in *catalogues* or on seed packets, then create a seed packet for an original seed variety *(see seed packet template in Appendix B, page 83)*. Students could also make seed packets based on information gathered from an interview with an older family member or from a presentation made by a guest speaker to the class.

2. J.J. Seed Role Play 5-7

By taking on a particular role, students can have the opportunity to see an issue from a perspective other than their own and can experiment with making important decisions. In role as J.J. Seed Company executives, students work together to decide which vegetables will be included in the

coming year's seed catalogue. Through the role play, students will discover how heirloom varieties are becoming extinct. The Variety Cards used in the role play will also introduce students to the incredible diversity of vegetables grown in North America.

Note: The images and variety descriptions used in the Heirloom Variety Cards are all from the 2000 Seed Saver's Exchange catalogue. Text and images used with permission. For more information, please visit www.seedsavers.org.

Materials

- Set of Heirloom Variety Cards per group *(see Appendix B)*
- One copy of J.J. Seed Letter per group *(see Appendix B, page 86)*

Procedure

Preparation: Before the lesson, copy and cut out the Heirloom Variety cards and make copies of the J.J. Seed Letter for each group.

a) Divide students into small groups.

b) Explain that students are to become members of J.J. Seed, a large seed company that has just bought up some smaller seed companies. Each group of students will take on the role of experts on a particular kind of vegetable.

c) Give each group a copy of the J.J. Seed letter to read through and check with the students to ensure that they understand their task.

d) Distribute Variety Cards so that each group has all the Variety Cards for one type of vegetable (e.g. all the tomatoes to one group, all the cucumbers to another group). Multiple groups can have Variety Cards for the same kind of vegetable, as long as each group has a complete set of all the varieties of one vegetable (i.e. copies of all the tomato cards, or all the pepper cards).

e) Give the groups time to choose 2 varieties from among the Variety Cards that J.J. Seed would want to put in their catalogue.

f) Have each group present the two varieties they have selected to the rest of the class.

g) Congratulate the students for helping J.J. Seed to raise its profits. But, because the varieties that were discarded will not be sold and planted, many of them could become extinct. Consider what might happen in each of these scenarios:

   winter comes early – only crops that ripen early or are frost tolerant do well

   a rainy summer – any crops that prefer dry conditions give poor yields

   disease outbreak – varieties that aren't resistant to diseases do poorly

   Did the 2 varieties that were chosen produce well? What varieties that were discarded could have been helpful?

h) What could a company like J.J. Seed do to make sure that they can still make money without letting heirloom varieties become extinct? Discuss who should be responsible for making sure that heirloom vegetable varieties do not become extinct. Seed companies? Home gardeners? Governments?

Extensions

- Grow heirloom varieties in the school garden. Refer to Appendix C for a list of companies that sell heirloom seeds. Local organic farmers and gardeners often save heirloom seeds and may be willing to sell or donate them to a school programme.
- Grow heirlooms that can be passed on to next year's class of student gardeners as a symbol of passing on the responsibility of caring for the garden. Heirloom sunflowers and beans are easy to find, grow and save for seed.
- Participate in the preservation of heirloom varieties by growing heirloom vegetables and saving the seeds. Dry beans work particularly well for this activity – order beans with unusual patterns such as Yin-Yang, Hidatsa Shield, or Red Cranberry, grow the plants out, save the seeds and redistribute them locally or through a seed exchange such as Seeds of Diversity. Dan Jason of Salt Spring Seeds has developed a program called Beankeepers that helps children to become stewards of heirloom bean varieties. Find more information at www.saltspringseeds.com

UNIT 2 THEME 3: PLANNING THE GARDEN

Late winter, well before the growing season has begun, is the time to make plans for the garden. Based on curriculum requirements and students' interests, define the objectives for the gardening season. Will your class focus on growing lots of vegetables? Will the class need space to conduct their own student-initiated growing experiments? Will the class be selecting plants to attract beneficial insects and pollinators to the garden? Do you plan on being able to save seeds the following fall? There are so many possibilities in the garden; decide on your priorities and help students to make plans for the garden accordingly.

These activities will help students to determine the purpose of the garden in the schoolyard and to make plans for the coming growing season.

Note: Some activities in this section were adapted with permission from The *Growing Classroom* by Life Lab science program.

SUGGESTED ACTIVITIES

1. An Ideal Schoolyard 4-7

In this activity students are encouraged to take a closer look at the features found in their schoolyard to compare the environmental benefits of pavement, playground, grass, trees and gardens and envision how they might improve the schoolyard.

Materials

- Copy of the Schoolyard Environment Quiz for individuals or small groups *(see Appendix B, page 95)*
- Pencils

Procedure

a) Ask the students what kinds of things can be found in their schoolyard (e.g. grass, playground, trees, etc.). What takes up the largest area of the schoolyard? What takes up the smallest area?

b) Distribute copies of the Schoolyard Environment Quiz sheet to individuals or small groups of students to fill out.

c) Put a check mark in the appropriate box for each 'yes' answer.

d) Ask students to total up the score (number of check marks) for each area of the schoolyard to determine which area rated the best overall.

e) Based on the results of the quiz, discuss how the students would change the schoolyard to provide maximum benefits for people, animals and the environment. Would they want to have more pavement? Bigger gardens? More grass? More trees? What might happen if schoolyards had only pavement or only grass? What would it be like if schools had fruit trees and bigger gardens?

f) Have students create a plan of their schoolyard showing the changes they would like to see in it.

Extensions

- Based on the students' ideas, create a class plan of action to make changes to the schoolyard such as planting trees or expanding the garden.

2. Ordering Seeds 4-7

The most interesting seed varieties are available through seed catalogues and from local farmers and gardeners. To ensure that the garden gets an early enough start to produce a harvest before the end of school, plan ahead and order seeds early. Students can be involved in selecting seeds and filling out order forms if you send away for a variety of seed catalogues; once you are on the mailing lists for these companies, you will receive a catalogue every year. Decide on seed selection criteria as a class. In small groups, have students look through catalogues and select the most interesting seeds. These group lists can be narrowed down into a single class order list.

For more information on types of vegetables to select, see *Appendix A*.

3. Planning the Garden 4-7

Starting with a list of plants to be planted in the garden, students work in small groups to design a plan for the garden that will take into consideration the different needs that each plant has.

Materials

- Graph paper
- Copy of the list of plants to be grown in the garden for each group
- Map of the garden from the previous year, if available
- Gardening books
- Pencils
- Rulers

Procedure

a) Do all plants grow to be the same size and shape? What are some of the differences? What are some of the needs of these different plants that we should keep in mind as we plan our garden? (tomatoes grow tall, pumpkins need lots of space)

b) Divide the class into five groups.

c) To get a sense of the spacing needs of plants, have the group members huddle close together, curled up into balls as if they were seeds. Have them stand up to their full height and stretch their arms out. Does everyone have the space they need? Ask the groups to turn toward the sun. Is each person in the group getting the same amount of sunlight shining on them? Ask them to try to arrange themselves so that they have the space they need and so the sun is shining on every person in the group. How could we use what we've just discovered to help us plan our garden?

d) Ask the students to take out a pencil and a ruler. Distribute graph paper to each group with a list of the plants that will be grown. As a class, decide on a scale that everyone will use for graphing tasks (e.g. 1cm=10cm). Explain that each group will work on a different part of the planning. Once all the groups have completed their tasks, representatives from each group will meet to make a map for the garden.

   Group 1 will draw a map of the garden to scale on graph paper, showing the compass directions and location of nearby trees and other structures.

   Group 2 will refer to seed packets or a seed catalogue to make a bar graph with the names of the plants along the x-axis and the height of each plant on the y-axis. Based on the graph, the students will then make a list of all the plants to be grown according to height.

   Group 3 will refer to seed packets, seed catalogues or a gardening manual to determine the space requirements of each type of plant on the class' list. They will then show the space needs of each plant on graph paper, shading in the area needed by mature plants.

   Group 4 will look at the previous year's garden plan and refer to a gardening manual to ensure that plants are not put in the same place where they were planted last year and that they are planted so that they can take advantage of some of the benefits of crop rotation (see below). Using this information, Group 4 should make a simplified plan showing where different plants should be grown this year.

   Group 5 can create a list of plants that grow well together and plants that should be grown far apart by referring to a list of companion plants found in a gardening manual (see below).

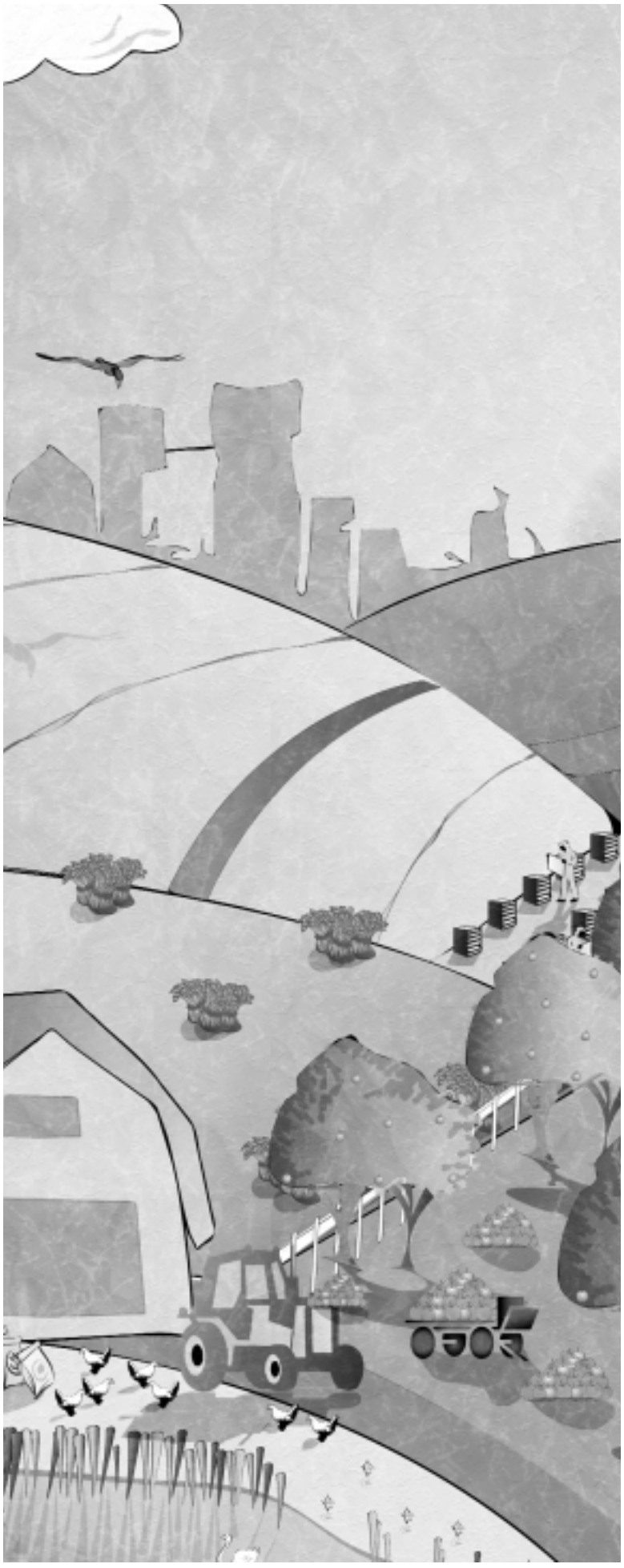
e) Once all five groups have completed their tasks, have one representative from each group meet to prepare the final garden design for presentation to the class. Does the plan consider the different needs of each kind of plant? What compromises had to be made?

CROP ROTATION

Rotating crops is the practice of not growing the same plant in the same place year after year. Each kind of plant requires certain kinds of nutrients; these nutrients will be used up before they can be replenished if the plant is grown in same part of the garden every year. By changing the type of plant that is grown in a particular spot in the garden, the soil will have time to replenish the nutrients needed by each kind of plant before they are planted again. Changing crops that are grown in the garden can also confuse pests and prevent diseases from building up in the soil. The simplest rule of thumb is to wait three to seven years between growing crops of the same family in the same bed. A more complex crop rotation pattern is leaf to root to flower to fruit; the part of the plant you harvest will fit into one of these categories. For example, start with spring lettuce, follow with winter beets, then the following spring plant flowers to attract beneficial insects, followed by a fruit crop such as tomato. Other crop rotation methods can be found in organic gardening manuals.

COMPANION PLANTING

Some plants grow well together, while others do not. One of the best known examples of companion plants is the Three Sisters: corn, squash and beans. The Iroquois and other First Nations developed methods of planting these three vegetables together such that the corn provided something for the beans to climb up, the large leaves of squash or pumpkin plants shaded out weeds, while the beans added nitrogen to the soil. Simpler examples include planting lettuce in the shade of larger plants and using flowers to attract beneficial insects to the garden. For more information on companion planting, consult one of the many books on this topic.



UNIT 3

Spring

Unit 3 Spring

Unit 3: Spring

Introduction

IN THE SCHOOL GARDEN

- Start tender, long season plants (tomatoes, peppers, squash, etc.) indoors as seedlings
- Determine the health and quality of the garden soil, improve as necessary by adding amendments such as compost
- Transplant seedlings into the garden
- Plant seeds directly into the garden
- Plant flowers and improve the habitat around the garden to attract pollinators and other beneficial insects
- Care for the garden, keeping it watered and weeded
- Make plans for summer care of the garden
- Harvest spring crops before the end of the school year

SPRING LEARNING ACTIVITIES

Spring is the main event of the gardening year, and is the season that provides the most opportunities for learning in the school garden. For a successful harvest before the end of the school year, students will need to start seedlings early inside a greenhouse or cold frames, or you can purchase transplants for planting outdoors once the weather warms up. Once the weather has warmed sufficiently to begin outdoor activities, students can begin exploring the soil and performing tests to indicate soil composition and nutrient levels, helping to improve the health of the soil. Other activities in this section will help students to discover the diversity of plants and learn about plant growth and anatomy as well as the relationship between plants and pollinators. Many of the spring gardening activities can be completed within the framework of science experiments; this method is described in more detail in Theme 4: Experimenting in the Garden. By the end of the school year the garden is in full swing; this is the time to celebrate the students' achievements in the garden by tasting vegetables they have grown and sharing the harvest with others.

THEME 1: The Soul of Soil	Soil Hunt	K-3
	Clay, Silt, Sand	4-7
	Soil Nutrients	4-7
THEME 2: The Not So Secret	What is a Plant?	K-3
Life of Plants	Mysteries of Life	K-3
Patterns Through the Seasons	Sandra and the Sunflower	K-3

	Comparing Plant Life Cycles	2-4
	Sexual and Asexual Reproduction	2-7
THEME 3: Growing a Garden	Starting Transplants Indoors	K-7
	Transplanting	K-7
	Outdoor Seeding	K-7
THEME 4: Experimenting in the Garden	Indoor Experiments	K-4
	Plant Growth in Different Soil Types	K-4
	Seed Planting Depth	K-4
	Water Uptake	K-4
	Effect of Gravity on Root Growth (Geotropism)	2-4
	Effect of Light on Plant Growth (Phototropism)	2-4
	Outdoor Experiments	K-7
	Compost and Plant Growth	2-7
	Soil Compaction	2-7
	Weed Competition	2-7
	Effects of Increased Light	2-7
	Comparing Vegetable Varieties	2-7
THEME 5: Native Pollinators	The Mason Bee Buzz	2-5
	Home for the Winter	2-5
THEME 6: Celebrating the Spring Harvest	Spring Harvest	K-7
	Garden Burritos	K-7
	Tussie Mussies	2-5
	Spring Salad	K-7
	Harvest Market	4-7

Activities

SO WHAT *IS* SOIL MADE OF?

Soil is made up of four main ingredients:

Minerals these are basically ground up rock. The biggest particles are called SAND, medium particles are SILT, and the smallest particles are CLAY

Humus decaying organic matter made of decomposing plants and animals

Water and *Air* these make up the spaces in the soil, allowing room for for roots to grow and for soil creatures to move around

The *Feel Test* is a simple test for figuring out the texture of your soil:

Put a small sample of soil, about the size of a sugar cube, in the palm of your hand. Add a few drops of water and rub the soil with the thumb of your other hand. If the soil feels:

Sticky it is a clay soil
Gritty it is a sand soil
Smooth and *not sticky* it is a loam, the best kind of soil for most plants.

A sandy soil will warm up earlier in the spring, is easy to dig, but will dry out quickly when watered. A soil that contains mostly clay can hold water for long periods of time, but takes longer to warm up and can be difficult to dig. A loam is a balanced mix of sand, silt and clay and shares the best qualities of a sandy and clay soils. Soil texture can be changed by adding sand or organic matter.

UNIT 3 THEME 1: THE SOUL OF SOIL

It has been said that poor gardeners grow good weeds, good gardeners grow good vegetables, and excellent gardeners grow good soil. To 'grow' healthy soil in a school food garden, students will need to determine the existing quality of the soil, then make improvements based on recommendations provided in a gardening manual. Activities in this section introduce students to the composition and characteristics of soil, providing a variety of simple tests students can use to determine the health of their garden soil. More advanced activities at the end of this section introduce intermediate students to pH and nutrient tests that can provide even more detailed soil information.

Note: For more soil activities, please refer to Unit 4 of *Patterns, Plants and Playgrounds*.

Activities in this section were adapted with permission from *The Growing Classroom* by Life Lab science program.

SUGGESTED ACTIVITIES

1. Soil Hunt K-3

Students work in groups to collect soil samples from the schoolyard and analyse the samples to identify living and non-living materials in soil, then try to make their own soil.

Materials

- One container per group
- One hand lens per group (optional)

Procedure

a) Ask the students to make predictions about what they think soil might be made of.

b) Divide the students into groups of three.

c) Send each group to a different area of the schoolyard to look closely at the soil in that area and try to figure out what the soil is made of. Each group should examine the soil in only one spot.

d) Gather the class together and ask them to list what they saw in the soil. Were our predictions correct? How were the soils in different parts of the schoolyard the same or different?

e) Challenge the students to make soil. Begin by sending each group to collect one ingredient (twigs, small rocks, sand, leaves, etc.).

f) When all the ingredients have been gathered together, ask students to work in their groups to use some of each of the ingredients to make soil by hand. This may involve such tasks as breaking leaves up and trying to crush rocks.

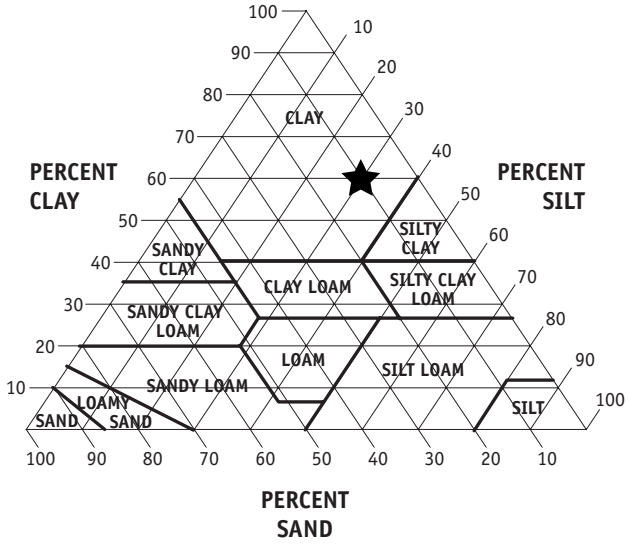
g) Compare the 'soil' the students have made with some real soil. Is really possible to make soil with your hands? Why not? In nature, it takes over 100 years to make just three centimetres of soil. There are many tiny creatures in soil, including bacteria and fungi that are constantly working to decompose nutrients to make soil. In one handful of soil, there are more tiny creatures than there are people in the entire world. Our hands could never do as much work as they do.

2. Clay, Silt, Sand 4-7

Knowing the texture of your soil will help in planning which crops will grow best as well as indicating how the soil of the garden needs to be improved. In this activity, students analyse the characteristics of soils collected from home or from the school grounds using a 'shake test.'

Materials

- Glass jars with lids
- Masking tape
- Permanent marker
- Soil samples
- Water



Example: A soil that is 60% clay, 10% silt and 30% sand would be a clay soil, according to the soil texture grid at left. *(see Appendix B, page 96)*

- Trowels for collecting soil (optional)

Procedure

a) Have students make predictions about what soils are made of. Do you think all soils are the same? How might they be different from each other?

b) Divide the class into groups

c) Have each group collect a soil sample from a different area of the schoolyard, including the garden. Alternatively, students could bring soil samples from home.

d) Put each soil sample into a different glass jar so that each jar is filled halfway with soil.

e) Label each jar using masking tape, indicating the students in the group and where the sample was collected.

f) Add water to the jars until they are full.

g) Screw the lids tightly onto the jars and shake vigorously for up to one minute.

h) Allow the jars to sit undisturbed for as long as possible. It can take up to 24 hours for the soil layers to settle completely, even longer for heavy clay soils. Students can make an initial observation after a few minutes, then confirm their observation the following day.

i) Ask students to draw and describe what they see. The minerals in the soil will be layered with the heaviest particles at the bottom of the jar. In order from bottom to top, the mineral layers will be sand, silt then clay. Decomposed humus will sit in a thin, dark layer on top of the clay (only after the soil has settled completely) and humus that has not yet decomposed will float to the surface of the water. Air in the soil may be visible as bubbles when water is first added to the soil.

j) Ask the students to determine which layer is the thickest. This will determine what kind of soil you have.

k) Ask students to predict what might be the best kind of soil for the garden. What kind of soil would be easiest to dig? What kind of soil would hold water the best? (The ideal soil texture is

called a 'loam' and has a balance of different grades of minerals: 40% sand, 40% silt, 20% clay.)

Extensions

- Have students refer to a soil texture grid, such as the one below *(see Appendix B, page 96)*, to determine the name for the soil texture of each sample. Perform a shake test and measure the height of sand, silt and clay layers in the sample, then convert these measurements to percentages. Using the soil texture grid *(see Appendix B, page 96)*, find the point where the lines indicating the percent of each soil component meet, being careful to follow the direction of the lines leading off from the numbers around the edge of the grid.
- Challenge students to create an ideal soil. Starting with different types of soil gathered from the schoolyard, try adding sand, topsoil and/or compost to make the soil more like a loam. Use the feel test, described above, to determine if the soil is becoming more like a loam.
- If the soil is very sandy or contains mostly clay, look in a gardening book to determine how to add sand or organic matter to the garden to improve the soil.

(see Appendix B, page 96)

3. Soil Nutrients 4-7

In this activity, students test the garden soil for levels of nitrogen, phosphorous and potassium to determine the health of the soil, discovering the relationship between soil nutrients and plant health. As an extension activity, students can also be introduced to soil acidity and perform a pH test on the garden soil.

Materials

- Soil test kit (available at garden stores)
- Soil sample from garden

Procedure

a) Plants, like people, need vitamins, minerals and other nutrients to live. People get the nutrients we need from the food we eat. If we're not getting enough of a certain vitamin or mineral, we get sick and have to change our diets. Where do plants get the nutrients they need to live? There are many nutrients that plants need, but the most important ones are:

Nitrogen (N) – responsible for growth and healthy green leaves

Phosphorous (P) – helps plants to develop strong roots

Potassium (K) – important for producing flowers and fruits, and helps protect the plant from diseases

Why might it help to know how much of each of these nutrients is in our garden soil?

b) Divide students into three groups and have each group test the soil for one or more nutrients. Assign specific tasks to each member of the group so that everyone can be involved. You may

want to have groups complete this activity one at a time under direct supervision.

c) Use the colour chart provided with the test kit to determine results of the test.

d) Discuss how a plant might do if it was to be planted in the soil as it is now, and what needs to be added to improve the soil.

Extensions

- Based on the results of the soil test, add soil amendments to the garden prior to planting. Garden fertilizers commonly available in garden centres, unless they are certified organic, are often made with petroleum products and can be damaging to the soil in the long term and are wasteful of natural resources, as well as being a health hazard to students. Certified organic alternatives may be available, but an even better option is to use compost. Compost can provide most of the nutrients any soil requires if made correctly. Consult an organic gardening manual for further information.
- Test the garden soil for acidity. Many soil test kits include materials for determining pH, which is a significant indicator of soil health. When the soil becomes highly acidic (has a low pH), soil organisms and worms suffer and may die out, reducing levels of soil nutrients accessible to plants. Teach students to use litmus paper to test a variety of liquids including vinegar, water, dish soap and fruit juice to introduce the concept of acidity, then measure the pH of the soil in the school garden. Based on the results, add lime or another soil amendment as recommended by a gardening manual to raise the pH of the soil as needed.

UNIT 3 THEME 2: THE NOT SO SECRET LIFE OF PLANTS

I can't conceive the nucleus of all
Begins inside a tiny seed
And what we think as insignificant
Provides the purest air we breathe

But who am I to doubt or question the inevitable being
For these are but a few discoveries
We find inside the Secret Life of Plants

– Stevie Wonder, The Secret Life of Plants, 1979

Without plants, humans simply wouldn't exist. This section begins with lessons designed to introduce young students to the diversity of plants and our dependence on plants, then moves ahead to looking at what plants need to grow and explorations of some of the differences between plant species in the garden.

SUGGESTED ACTIVITIES

Unit 3 Spring

1. What is a Plant? K-3

According to the Concise Oxford Dictionary, a plant is "any living organism of the kingdom Plantae, usually containing chlorophyll enabling it to live wholly on inorganic substances and lacking specialized sense organs and the power of voluntary movement." In this introduction to the diversity of plants, students come up with their own definition of what a plant is.

Materials

- Paper
- Pencils
- Clipboards or something hard to write on

Procedure

a) Ask students to suggest some of the different kinds of plants they know of. What kinds of plants are there in the garden and the rest of the schoolyard?

b) Head outside and ask students to spread out and draw a few different plants with as much detail as possible.

c) Back inside the classroom, discuss what the students observed.

d) Imagine that you met someone who had never seen a plant before. How would you explain to them what a plant is? As a class, create a list of attributes that describe what a plant is.

e) Test the students' definition, helping them to make it as specific as possible. Plants are green things? Does that mean a frog is a plant?

Extension

- Show students an example of a labelled scientific diagram in an encyclopedia or illustrated science book. Have students draw a scientific diagram of a particular plant from the garden, with labels showing the features that were included in the students' definition.

2. Mysteries of Life K-3

An introduction to the things plants need to survive and our reliance on plants for food and clothing.

Note: This activity is adapted with permission from a lesson developed by the Banana Slug String Band, a musical environmental education group.

Materials

- Three opaque containers with lids (yoghurt containers, film canisters, etc.)
- Soil
- Water

Procedure

a) Before the lesson, put a small amount of water in one container, soil in the second, and leave

the third container empty.

b) Tell the students that you are holding four mysteries that make life possible. Without these four mysteries there wouldn't be any food, I wouldn't have this shirt, there wouldn't be anything alive and we wouldn't even be here. If students notice that you have only three containers, tell them that is part of the mystery.

3 Pass the containers around, one by one; have them shake each one and guess what might be inside it without saying their guesses out loud.

d) After all three containers have gone around the class, ask a child to guess what is in the first container. Throw the water high up in the air to give a few students a bit of a sprinkling. With the next container have someone else guess its contents, then pour the soil into his or her hand and show everyone. For the third container, tell the class it contains two mysteries. Have them say their guesses. Have a child open the container. There is nothing in it? Everyone take a deep

Sandra and the Sunflower

Sandra decided to plant a garden. She wanted to grow all the things that had the same first letter as her name, but the only plant she knew that started with an S was sunflowers, so that was what she planted. Sandra got a sunflower seed from the garden shed and threw it on a rock. A crow flew down from the sky and ate up the seed. The End.

Hmmm. Something doesn't seem quite right about this story. What did Sandra do wrong? Oh... she should have put the seed in the soil. Let's try the story again.

Sandra decided to plant a garden. She wanted to grow all the things that had the same first letter as her name, but the only plant she knew that started with an S was sunflowers, so that was what she planted. Sandra got a sunflower seed from the garden shed and planted it carefully in the soil. After a few days, a sprout came up. Sandra put a box over the sprout to protect it from the sun. The sprout turned yellow and died. The End.

Ask for suggestions again, until the students say the sunflower needs light.

Sandra decided to plant a garden...

(see Appendix B, page 97)

breath and breathe out. Guess again. Oh, there is air. Well, cover it up, so the fourth one won't get in. Take the lid off and in rushes the fourth, close the lid and it can't get in. What is it? Sun or light.

e) Teach everyone the following call and response chant and repeat it a few times. Say one line at a time and have the students repeat it.

Sun, soil, water and air,
Sun, soil, water and air,

Everything we eat
And everything we wear
Everything comes from
Everything comes from

PARTS OF A SEED

Seeds are protected by a **seed coat**. Inside, the **embryo** is the beginning of a new plant, complete with a tiny root, leaves, stem and special leaves called **cotyledons**. A **monocot**, such as corn and grasses, has only one cotyledon. **Dicots**, such as beans and most other vegetables, have two cotyledons that provide energy for the plant until it is big enough to produce its own food.

Sun, soil, water and air
Sun, soil, water and air
– (©Banana Slug String Band, 1990. Used with permission.)

f) Discuss a few examples of food and clothing to demonstrate that 'everything we eat and everything we wear' really does come from 'sun, soil, water and air.' For example, the cotton used to make many clothes grows in the soil and needs sun, water and air to live.

Extensions

- To extend this activity for older students, create a flow chart tracing the origins of the ingredients of a commonly eaten food item all the way back to sun, soil, water and air. For example, in a ham sandwich, the bread comes from wheat which needs sun, soil, water and air to grow, the ham comes from a pig which eats grains, which need sun, soil, water and air to grow, etc. The flow chart could be extended even further to include the truck that delivers the meat that is powered by fuel, made from oil, made of fossilized plants, that needed sun, soil, water and air to grow, and so on. After creating one flow chart as a class, students can create their own flow charts using their favourite foods.

3. Sandra and the Sunflower K-3

Sandra and the Sunflower tells the story of a girl trying to grow a garden and the things she learns about caring for plants. This quick activity will reinforce what students know about the things that plants need to survive.

Materials

- Copy of *Sandra and the Sunflower* Story *(see Appendix B, page 97)*

Procedure

Read *Sandra and the Sunflower* to your class. You could invite a student to act out the part of the sunflower to add to the humour. After each section of the story, ask the students what Sandra should do differently. The story then repeats itself from the beginning; speed through the repeated sections as if in fast forward mode to keep the story moving along quickly.

4. Comparing Plant Life Cycles 2-4

Each type of plant in the garden is unique, but the differences in early plant growth are most apparent when comparing the growth of a monocot and a dicot. In this activity students study the seeds of both types of plant and compare the early growth of corn, a monocot, with a bean, a dicot.

Materials

- Bean seeds (lima, pinto, etc.)
- Corn seeds (sweet corn, popcorn or other, NOT microwaveable popcorn)
- Small Zip Lock bag for each pair of students
- Paper towels
- Magnifying loops (optional)

Procedure

Preparation: Soak all seeds in water overnight prior to this activity.

a) Ask students to make predictions about might be inside seeds that makes it possible for them to grow into full size plants.

b) Divide the students into pairs. Distribute one pre-soaked bean seed to each student.

c) Have pairs of students help each other to carefully remove the seed coat of the bean and carefully split the seed in half lengthwise.

d) Help students identify the seed parts inside the bean.

e) Have students make labelled scientific diagrams of the interior of their bean seeds. (You may choose to dissect a corn seed for comparison, but corn seeds won't split open easily.)

f) Distribute a few corn and bean seeds, a Zip Lock bag, and a paper towel to each student pair.

g) Have students follow these steps to set up a seed observation bag:
   - fold the paper towel so it fits inside the bag
   - moisten the paper towel
   - put the paper towel inside the bag so that it is lying flat
   - put the seeds inside the bag, on top of the paper towel

h) Keep the bags in a warm location and observe the seeds daily. In particular, notice how the corn and bean seeds sprout differently. Record and discuss observations.

Extensions

- Plant bean and corn seeds directly into the garden and compare how these two plants grow differently. In addition to differences in early growth habits, another difference between monocots and dicots can be observed in the way veins are arranged in the leaves.
- Collect and compare more types of seeds. Sort them according to different classifications, including: size, texture, colouring, etc.
- Have groups of students "adopt" a plant in the garden, observing the growth of their chosen plant in the garden starting from the day the seeds were planted. Compare the growth habits of each type of plant. Which kind of plant germinated the fastest? Which plant grew fastest? Tallest? Bushiest? What are some of the different features of each kind of plant?

5. Sexual and Asexual Reproduction 2-7

Plants, unlike humans, have the ability to produce an entire new plant from just a piece of the original one. This type of reproduction is called vegetative or asexual reproduction, as opposed to sexual reproduction that takes place when plants are grown from seeds. Many food crops, including potatoes, garlic and strawberries are almost never planted in the garden as seeds, but are encouraged to reproduce vegetatively. Try some of the following activities to introduce students to the similarities and differences between sexual and asexual reproduction:

- Plant garlic cloves or onion sets in the garden. How are cloves and onion sets different from seeds?
- Challenge students to determine the smallest piece of potato that can start a new potato plant (the piece must have an immature sprout, known as an 'eye', in order to reproduce).
- Try to start plants from vegetable scraps such as carrot or beet tops
- Learn how to make cuttings to start plants such as perennial herbs
- Cut runners from strawberry plants to grow new plants

For more complete lessons on this topic, consult *GrowLab: Activities for Growing Minds (see Appendix C).*

UNIT 3 THEME 3: GROWING A GARDEN

This section describes specific activities that will allow students to plant a school food garden. Through the work of starting and caring for seedlings, planting seeds and transplanting seedlings out in the garden, students will be collaborating in the care of plants and learning how to care for their immediate environment. Growing and maintaining a school garden provides opportunities to observe, experiment and make discoveries about plants and their environment that go far beyond the potential of any classroom activities, while meeting learning outcomes prescribed in many areas of the elementary curriculum.

SUGGESTED ACTIVITIES

1. Starting Transplants Indoors K-7

Many of the vegetables grown in the garden need to be started before the weather outside has warmed up sufficiently for tender plants to survive. In cooler climates, starting seedlings early enough so that students can harvest produce before the end of the school year requires careful planning based on planting dates for your region. You will need to consult with an experienced gardener or check a gardening manual to determine the best time to start seedlings for June harvesting. Planting seedlings indoors will allow students to closely observe plants as they grow, providing opportunities to work together, to discover the characteristics of different species of plants, and to learn how plants grow.

How you choose to do this activity with your students will depend on their ages and abilities and on how much mess and noise you are comfortable with. Please consult the list of variations following the activity outline for ideas that will help you to adapt this activity to your classroom situation. As with any complex activity involving the whole class, inviting volunteers to help out will help this activity flow smoothly.

Materials (for each group)

- 4L bucket
- Empty 2L pop bottle
- Trowel
- Sprinkler top to screw onto pop bottle (available at garden stores)
- 3 small pots per child OR 1 seeding flat per group
- Seeds *(see Appendix A for seed selection information)*
- Large plastic sheet (can also use a garbage bag cut open)
- Masking tape
- Permanent marker
- Potting soil

Procedure

a) Look at the different types of seeds and talk with the students about which kinds of vegetables they would like to grow. How can we divide up the seeds we want to plant so that we end up with enough healthy seedlings to plant in the garden?

c) Divide the class into groups of 5.

b) Send each group to a separate spot in the room at a table, on the floor, or with desks pushed together.

e) Ask students to number themselves from one to five, so that there is one student with each number in every group.

f) Assign the following duties according to the students' numbers, writing the tasks on the board for reference. Each person will collect and put away the materials they are responsible for and make sure that they are used properly:

- Labels
- Pots
- Soil
- Water
- Seeds

g) Assign tasks as follows:
   - collect masking tape and permanent marker to label pots/flats

SEEDLINGS VS. DIRECT SEEDING

The advantage of planting seedlings into the garden, rather than sowing seeds outdoors, is that plants can begin their growth long before it is warm outside, as well as the further advantage of being able to select the healthiest seedlings to fill the garden. In most parts of Canada, in order to produce a sizeable harvest before the end of the school year, many crops will need to be grown using seedlings.

   - gather 3 pots for each person in the group or 1 seeding flat
   - fill a small bucket with potting soil and get a trowel for the group
   - fill up pop bottle with water, put on sprinkler top
   - collect seeds for the group

h) If your class is using individual pots, they should all be labelled with the students' name and the plant variety before the seeds are planted, otherwise some students will forget what seeds they chose. Ask the number 1s to distribute pieces of masking tape while students take turns labelling their pots or the group's seeding flat.

i) Demonstrate how to fill a pot or seeding flat full with potting soil. If students are using pots, they should plant no more than 3 seeds in each pot. Demonstrate how to plant a few seeds in a pot or how to scatter the seeds across a flat, then cover the seeds with soil and water until the soil is moist but not soaking wet.

i) Have students complete their assigned tasks and plant their seeds.

j) Bring pots or flats over to the chosen location, preferably in a south-facing window or better yet on a heated table placed under a full spectrum light.

k) Have students return their materials, clean up their workspace, and wash their hands.

Variations

- *Groups* – Instead of having the whole class complete the activity all at once, set up a station where a few students at a time can prepare their seedlings while the rest of the class is occupied with another activity.
- Y*ounger Students* – For young students in particular, simplify this activity as much as possible by preparing labels ahead of time, setting up a station for each group, and laying out materials so that they are easily accessible. Try to find a few adult volunteers to help out.
- *Pots vs. Flats* – Using plastic seeding flats, which are readily available at most garden stores, will greatly simplify seeding. Each group can prepare a seeding flat and distribute one variety of

seed across the surface of the flat. If you have access to a large supply of small plastic pots, students can prepare a few pots each and plant different seeds in each pot. Pots are a better option if you want students to be able to take any extra seedlings home.

- *Seed Choices* – For younger students in particular, this activity is simpler if students have only a few options of seeds they can plant, or else each group could plant just one seed variety. Older students may prefer having a wider variety of seeds to choose from and will be better able to keep track of what they are growing.

2. Transplanting K-7

Seedlings that have been started indoors during the colder winter of early spring will need to be transplanted into the garden once the weather warms up sufficiently for the seedlings to survive. In this activity, students will learn how to transplant seedlings into the garden, using seedlings that have been started in the classroom or purchased.

Materials

- Seedlings grown by the students or purchased
- Plan for the garden (see Winter activities)
- Watering cans
- Trowels (optional)
- Labels
- Waterproof pens

Procedure

Preparation: Ensure that the garden has been cleared of weeds and winter cover crops, any necessary soil amendments or compost have been added and the soil has been loosened up for planting.

a) Look at the seedlings that the students planted in the classroom, or the seedlings that have been purchased, and notice how the seedlings are much smaller than full-grown plants. What special treatment might these smaller plants need? (more frequent watering, to be handled gently…)

b) If the students will be transplanting seedlings they have grown themselves, talk about which of the transplants might do well outside and which ones might have a hard time in the garden (root systems are stronger, leaves and stem are healthier). Select the healthiest seedlings to be transplanted into the garden.

c) Water the seedlings well before transplanting them.

d) Referring to the plan for the garden developed by the students, mark the spaces in the garden where the seedlings will be planted.

e) Dig a hole for each seedling that is twice as big as the root clump.

f) Demonstrate how to transplant seedlings into the garden. Begin by carefully separating the seedlings in the flats or pots by hand or using a trowel, keeping as much soil around the roots as possible. Without squeezing the stem or damaging any leaves, place the seedling in the hole and

cover with enough soil so that the plant is buried up to the bottom of the first true leaves. (The lowest pair of leaves, called cotyledons or seed leaves, are not true leaves and can be buried). Pat the soil gently down around the seedling and water well.

g) Transplant each of the seedlings into the garden according to the bed plan and ensure that the seedlings are labelled.

h) Water the soil around the seedlings well.

i) What steps did we take to ensure that the seedlings got a good start in the garden? What could we have done to give the seedlings an even better start?

c) Outdoor Seeding K-7

Sowing seeds directly into the garden, called direct seeding, can be accomplished using a similar procedure to the transplanting activity described above. Crops that are best to sow directly into the garden include fast-growing crops like radishes, root crops such as carrots, and beets, peas and beans, and crops like potatoes, garlic and onions that are not usually grown from seeds. The critical factors for good seed germination are moisture and warmth. By planting seeds to the correct depth and keeping the seed bed moist until the plants are germinated, students will help their seeds off to a good start.

Materials

- Seeds
- Trowel, shovel or board for making furrows
- String tied to stakes to mark straight lines (optional)
- Watering cans
- Labels
- Waterproof pens

Procedure

Preparation: Ensure that the garden has been cleared of weeds and winter cover crops, any necessary soil amendments or compost have been added and the soil has been loosened up for planting.

a) Have a look through the seeds to be sown into the garden. The weather is warm enough for us to plant seeds outside now, but we still need to make sure that the seeds are planted so that they don't get too cold or too warm, and we'll need to keep them moist. What are some things we could do to make sure that the seeds stay warm and moist?

b) Mark the areas to be planted according to the garden plan developed by the students. If necessary, straight lines can be marked using a string tied between two stakes pushed into the soil. Refer to seed packets for the spacing between rows.

c) Demonstrate how to plant the seeds. The general guideline is that seeds should be planted 3 times as deep as the width of the seed. For smaller seeds, this can be accomplished by making a shallow trench, known as a furrow, by pressing the edge of a board into the soil or dragging the point of a tool in a straight line along the soil. For larger seeds, students can poke a hole for the seed into the soil with their fingers. Cover the seeds by gently pushing soil over the furrows or

holes, and pat the soil gently.

d) Have students plant their seeds by sprinkling them evenly along the furrow or putting them one by one into holes.

e) Label the areas that have been planted.

f) Water the planted area and ensure that it stays moist until the seeds have germinated.

g) What did we do when we were planting to make sure that the seeds will stay moist and warm?

UNIT 3 THEME 4: EXPERIMENTING IN THE GARDEN

"Doing" science, as opposed to simply reading about it, is perhaps the best way for students to learn concepts described in the science curriculum, and the garden is the perfect laboratory for "doing" science. Beginning in the primary grades, students can be introduced to a wide variety of scientific concepts through simple, whole-class experiments that demonstrate some of the fundamental principles of plant growth, decomposition, and the relationships between plants, soil and the environment. As students gain experience and understanding of scientific methods, they can design their own experiments and follow them through to completion.

The framework for "doing" science is the scientific method. The components of the scientific method are:

- *Question* – questions for investigations can be drawn from curriculum learning objectives or may be suggested by students.
- *Making predictions/hypotheses* – students predict what the results of the experiment might be.
- *Experiment* – the experiment may be a procedure that is selected from a book or other resource or designed by the students to test their predictions.
- *Results* – students make observations before, during and after the experiment to determine the results of their experiment, compare these results to their predictions, and draw conclusions about the experiment.
- *Communicating results to others* – students interpret their results and present their findings to others through a report, display or presentation.

A simplified version of the scientific method for young students used in LifeLab programs is Guess-Test-Tell, in which students guess the answer to a question, test their guesses through an experiment, then tell what they discovered in writing or as part of a presentation.

Each of the experiments described below have been selected to illustrate learning objectives described in the elementary science curriculum. Some experiments can be performed indoors using small potted plants, while others require space in an outdoor garden. For each experiment, apply the scientific method to design a complete learning experience for students. Possible variations include: using an experiment as a whole class, small group or individual activity or having

different groups complete different experiments. As students become familiar with the scientific method, challenge them to design their own experiments to address questions that they have about plants and the garden.

Note: Many of the experiments described in this section have been adapted with permission from *The Growing Classroom* by Life Lab Science Program, a comprehensive resource for teaching science through garden-based experiments.

SUGGESTED ACTIVITIES

1. Indoor Experiments K-4

The following experiments demonstrate some of the fundamental principles of germination and plant growth and can all be conducted indoors using simple materials.

A. Plant Growth in Different Soil Types K-4

Compare the growth of plants sown in different types of soil.

Materials

- A variety of growing media (potting soil, topsoil, compost, clay, sand, etc.)
- Pots
- Bean or pea seeds
- Labels or masking tape
- Waterproof pens

Procedure

Label and fill pots with different growing media such as: potting soil, topsoil, compost, clay and sand. Plant an equal number of seeds in each pot and water each pot equally for the duration of the experiment. Observe plant germination and measure growth every few days for three weeks or more.

B. Seed Planting Depth K-4

Plant seeds at different depths to determine the optimal planting depth.

Materials

- Clear plastic container
- Bean or pea seeds
- Potting soil
- Labels or masking tape
- Waterproof pens

Poke holes in the bottom of a clear plastic container. Fill with 3cm of soil and then lay a few bean or pea seeds on top of the soil, against the sides of the container. Pack another 3cm of soil into the container and lay some more seeds against the sides. Add another 3 cm of soil and another layer of seeds. Place the container in a warm place and keep it moist, but not too wet. Once most of the seeds have germinated, determine which layer of seeds grew best.

C. Water Uptake **K-4**

Determine how plants take in water.

Materials

- Glass or clear plastic cup
- Red food colouring
- Celery stalks
- Water
- Sharp knife

Procedure

Fill a glass or clear plastic cup halfway with water. Add a few drops of red food colouring. Cut the bottom off a celery stalk, leaving the leaves attached. Place the bottom end of the celery stalk into the coloured water. Every few hours for a couple of days observe the celery stalk and record the height of the coloured water in the stalk. When the food colouring has reached the leaves, cut the stem and observe.

D. Effect of Gravity on Root Growth (Geotropism) **2-4**

Observe how roots bend to grow downwards.

Materials

- 2 Glass jars
- Paper towels
- Radish seeds

Procedure

Soak some radish seeds overnight. Line two glass jars with moist paper towels and place an equal number of seeds in each jar, between the paper towel and the inside of the jar. Grow the seeds in the dark until the stems are about 3cm long, then pour off the excess water from the jars. Turn one jar on its side and keep both jars in the dark for 24 hours. Observe the growth of stems and roots. Continue changing the direction of the first jar every 24 hours, keeping the second jar upright. Keep both jars in the dark except when making observations. Draw the growth of the seeds in both jars over a period of a few days.

E. Effect of Light on Plant Growth (Phototropism) **2-4**

Observe how plants grow toward light.

Materials

- 2 Small pots
- Potting soil
- Bean seeds
- Shoebox

Procedure

Partially fill two small pots with potting soil. Plant a few bean seeds in each pot and moisten the soil with water. Cut a hole 3cm in diameter at one end of a shoebox. Place one of the pots inside the shoebox, as far away from the hole as possible. Leave the second pot of seeds outside of the shoebox. Keep the soil in both pots moist, but remove the shoebox cover only when watering. One week after the beans have sprouted, observe the direction that the plants have grown.

2. Outdoor Experiments K-7

Outdoor experiments require a portion of the garden to be set aside for growing test plots of plants to be raised under experimental conditions. Using as large an area for the test plots as possible will help to ensure that the experiment will produce reliable results. These experiments will help students to discover how soil quality, weed competition, varying light conditions and other variables affect plant growth.

A. Compost and Plant Growth 2-7

Determine the effects of adding compost to the soil on plant growth and health.

Materials

- 2 test areas in the garden
- Garden forks or shovels
- Seeds or seedlings
- Signs to indicate test areas

Prepare two test areas of the garden for planting, without adding any soil amendments. Turn an ample amount of compost into the surface of one test area, and leave the second test area alone. Plant seeds or seedlings of the same variety in both test areas and label the two test areas with signs. Measure plant height and assess plant health and appearance weekly for one month or more.

B. Soil Compaction 2-7

Determine the effects of compacted soil on plant growth and health

Materials

- 2 test areas in the garden
- Garden forks or shovels
- Seeds or seedlings
- Signs to indicate test areas

Procedure

Divide a section of the garden into two test areas. In the first test area, loosen the soil using garden forks or shovels. Leave the second area as it is. Plant seeds or seedlings of the same variety in both test areas. Measure plant height and assess plant health and appearance weekly for one month or more.

C. Weed Competition 2-7

Determine the effects of weed growth on vegetables growing in the same part of the garden.

Materials

- 2 test areas in the garden.
- Bean or radish seeds
- Signs to indicate test areas

Procedure

Prepare a section of the garden and plant it with beans or radishes seeded in straight, well-spaced rows. Divide this section into two test areas. Allow weeds to grow in one area, and keep the second area free of weeds. Compare the growth of the weeds with the growth of the crop plants in the first area, and compare the growth of the crop plants in both test areas until the crops are ready for harvest.

D. Effects of Increased Light **2-7**

Determine the effects of increased light on plant growth by planting light-reflecting aluminum foil around the bases of plants.

Materials

- 2 test areas in the garden
- Aluminum foil
- Seedlings
- Rocks or other weights
- Signs to indicate test areas

Procedure

Prepare two test areas of the garden for planting. Plant seedlings of the same variety in both test areas. In one test area, place large sheets of aluminum foil around the base of each seedling, leaving enough space to add water to the soil. Try to cover as much of the bed as possible with foil. Place rocks or other weights on top of the aluminum foil to keep it from blowing away. Leave the soil of the second test area uncovered. Mark the two test areas with signs. Record the heights of the plants in both areas weekly for one month or more.

E. Comparing Vegetable Varieties **2-7**

Compare the growth and characteristics of different vegetable varieties.

Materials

- Seeds of different varieties of one vegetable
- Separate test area for each vegetable variety
- Signs to indicate test areas

Procedure

Purchase several different varieties of one particular vegetable. Prepare a section of the garden for planting and divide it into several equal test areas and mark each area with signs. Plant a different variety into each section. Be sure to treat the different varieties exactly the same. Make weekly

observations comparing height, germination rates and appearance for each variety. When the plants are mature, harvest and compare the taste of the different varieties.

UNIT 3 THEME 5: NATIVE POLLINATORS

Over three quarters of the plants that feed us rely on pollination by animals and insects to produce food. Bees are responsible for pollinating more flowers than any other creature on earth, including such food crops as apples, almonds, cherries, tomatoes, blueberries, melons and squash. Although bees help to produce over one third of the food crops we eat, these helpful insects are seeing a population decline due to urban development and a widespread use of pesticides. Without pollination, plants lose their ability to reproduce and flower blossoms wither away without producing fruit. Eventually, all flowering plants and the creatures they support would disappear.

While most people are familiar with honey bees, this is just one species of the more than 20,000 bee species worldwide. One of these other species, the blue orchard mason bee, is gaining increasing attention as being both a more efficient pollinator and more resistant to bee pests and diseases than honey bees. Blue orchard mason bees are slightly smaller than honey bees and are a shiny blue-black colour, often mistaken for flies due to their similar size and appearance. Blue orchard mason bees are more appropriate for study in schools because they are less aggressive than honey bees, having no hive to protect, and have much less venomous stings. The following activities explore the relationship between blue orchard mason bees and plants while addressing factors that could lead to endangerment of pollinators.

SUGGESTED ACTIVITIES

1. The Mason Bee Buzz 2-5

This variation on musical chairs introduces students to the blue orchard mason bee and addresses the threats to the habitat of these and other bees.

Materials

- 6 copies of each Mason Bee Habitat Cards. Individual cards (water, mud, flower, nesting) are created by cutting up the blackline master *(see Appendix B, page 99)*
- Masking tape
- Recorded music such as *Flight of the Bumblebee* (optional)

Procedure

a) Ask the students what they know about how bees help us to make food. If students don't have a clear idea of what pollination is, explain it to them. What would happen if there were no bees to pollinate plants?

b) Read the following story to the students, acting it out or otherwise bringing it to life if possible. Ask the students to listen to hear what the bees in the story need to survive.

You've all heard about the bees that make honey, but I'm going to tell you about another kind of bee, called the blue orchard mason bee. They don't live in hives like a honey bee, they live in holes in old dead trees, in hollow stems of plants or tucked in the sides of buildings. They don't have queens or live in large groups – the mason bee lives by itself, and early in the spring the mason bees come out of their holes.

Once the mason bees come out in the spring, the females find other holes nearby to build new nests. They collect mud to build with, and visit many flowers to collect pollen and nectar to put in their nests. Then the females lay an egg next to the pollen, fill the nest in with more mud, and go out to collect more pollen to put next to another egg. When they get thirsty, the bees find water to drink.

At the end of the summer, the female dies. Soon, the eggs that the female laid hatch in the nest, and the young larvae eat their pollen balls, then make cocoons and become adult bees. The mason bees wait in their nests all winter long until its warm enough for them to come out in the spring.

c) Ask the students if they remember the four things mentioned in the story that blue orchard mason bees need to survive: water, mud, flower and a nesting hole.

d) Tape up the mason bee habitat cards throughout the area where the game is to be played.

e) Explain that each of the habitat cards represents one of the things that mason bees need to survive, and that the students are the blue orchard mason bees. When the music starts (or on a signal given by the teacher) they are to buzz around the playing area. When the music stops (or on a second signal given by the teacher) all the bees need to be touching one of the pieces of paper. Only one bee can be touching each of the habitat cards. Bees who can't find a card to touch return to their seats for the rest of the game.

f) Begin the game, and as the students are buzzing around, remove a few of the habitat cards. When the music stops, the bees that aren't touching a habitat card die and should sit somewhere out of the way.

g) When everyone is sitting, discuss these questions: What happened when the food and shelter for the bees started to disappear? What kinds of things might be dangerous to blue orchard mason bees? What could we do to help bees? A few suggestions:

- put up nesting boxes around the garden for bees to live in
- provide access to fresh water
- provide mud by leaving some areas unplanted
- grow flowers that bees like
- don't use pesticides (even small amounts of pesticide residues on flowers can be harmful to bees)

Extensions

- Visit the garden and look for flowers that might be attractive to pollinators; look for different kinds of bees collecting nectar and pollen from the flowers.
- Learn to identify mason bees and other bee species such as the leafcutter bee, bumble bee, berry

bee and carpenter bee.

- Plant flower varieties in the garden that blue orchard mason bees and other pollinators are attracted to.
- Buy or build nesting boxes for blue orchard mason bees to install near the garden.
- Based on the information presented in this activity and information gathered from other sources, create a diagram showing the life cycle of the blue orchard mason bee.

2. Home for the Winter 2-5

A more complex activity that reinforces the connection between the blue orchard mason bee and the dangers of habitat loss and pesticide use. This game is organized into three increasingly difficult rounds of play.

Materials

- Red, blue and brown construction paper cut into 1" or larger squares with enough squares so that every student can have one of each colour
- Containers to put coloured squares in
- Pinny or other easily distinguishable piece of clothing

Procedure

Round 1

a) Look around the garden and surrounding area to find things that blue orchard mason bees need to survive: flowers, mud, water and nesting holes. Place one or more containers full of red squares near flowers, place containers with brown squares near mud or soil, place containers with blue squares near a source of water. Choose an area to be the nesting holes, or 'home'. Decide on the boundaries of the playing area.

Students, playing as mason bees, assemble at 'home.' On a signal from the teacher, they run to collect pollen, water and mud – one square of each colour of paper – and return to their nesting hole as quickly as possible. When they arrive back at 'home' they can yell "home for the winter!" Once the bees have made it home, return the coloured squares to where they were found and prepare for the next round.

Round 2

b) What is a pesticide? Explain how pesticides are usually designed to kill pests, but they sometimes also kill beneficial insects like mason bees. For this round, choose one student to be the Pesticide. The Pesticide starts the game some distance from 'home,' then runs to tag the bees as they collect their squares of paper. If a bee is tagged, s/he becomes a Toxic Spot and must stand in one place, trying to tag other bees that run by. Bees that are tagged by Toxic Spots also become Toxic Spots. When all the bees have either made it home for the winter or have been turned into Toxic Spots, round two is over. How did the Pesticide make the game harder for the bees? Return the squares of paper to their containers and prepare for the final round.

Round 3

c) What are some of the things that might cause there to be less pollen, mud or water for bees?

Possibilities might include replacing a garden with lawn, not planting flowers in the garden or cutting down an apple tree. To simulate the loss of habitat, remove some of the coloured squares, so that there are not enough for every student to get one of each. Choose a new Pesticide and play the game again. What happened to the bees that couldn't find enough pollen, mud or water?

d) Ask the students what they discovered about bees through playing Home for the Winter. What could be done to help mason bees?

UNIT 3 THEME 6: CELEBRATING THE SPRING HARVEST

After all the working and learning that students have done in the garden over the year, it's important for students to celebrate their achievements and to make the connection between the work that has been done in the garden and the food that has been produced as a result. The best way to make this link is for students to eat the food that they helped to grow. The activities in this section provide some suggestions for making the most of the spring harvest, no matter how big or small it may be.

SUGGESTED ACTIVITIES

1. Spring Harvest K-7

Celebrate a year of learning in the garden by making the most of the spring harvest. Refer to the procedure described in the Fall Harvest activity for planning the spring harvest. Many crops that are ready earlier on in the spring, including lettuces and edible flowers, are best eaten as soon as they are picked, so plan on harvesting just before any of the spring celebration activities.

2. Garden Burritos K-7

If there is lettuce available in the garden, show the students how to make garden burritos as they visit the garden at the end of the school year. Lead a short tour of the garden and point out the crops that are ready to be harvested. Have each student pick a lettuce leaf then choose other vegetables, herbs and edible flowers that they would like to try. Show the students how to place their small harvest onto the lettuce leaf, roll it up like a burrito and eat it.

3. Tussie Mussies 2-5

Throughout the world, different flowers have been used to communicate special meanings. Most people are familiar with the rose as a symbol of love, but during the Victorian period 'floriography,' the study of the language of flowers, reached its peak. Bouquets of flowers and herbs were used to communicate complex messages between lovers, while flowers in paintings and poetry symbolized particular meanings for the viewer to decode. This tradition borrowed from many previous cultures and earlier times, including the Elizabethan tradition of tussie mussies – small bouquets of flowers and herbs.

Vegetables and Fruits

- Radish
- Lettuce
- Young chard, spinach and beet leaves
- Green onion
- Garlic stems (strong flavour)
- Young kale and arugula leaves
- Strawberry

Flowers

- Calendula
- Nasturtium
- Violas
- Borage

Herbs

- Rosemary
- Thyme
- Sage
- Chives
- Mint
- Parsley
- Dill
- Fennel

Weeds

- Chickweed
- Miner's Lettuce
- Sorrel

By creating a tussie mussie, students will become aware of some of the meanings associated with flowers, and use the language of flowers to convey a message. If there are not enough flowers and herbs in the school garden for this activity, ask students to collect flowers from their home gardens or have students work in small groups to make a tussie mussie to send a group message to another teacher or staff member. This activity can also be used during the summer or fall, depending on the availability of flowers in the school garden.

Materials

- Tussie Mussie Lore sheet for each student or small group *(see Appendix B, page 100)*
- Flowers and herbs from the garden
- Elastic bands or pipe cleaners
- Scissors
- Paper doilies (optional)
- Floral tape (optional)
- Materials for making cards

Procedure

a) Who has ever given or received a bouquet of flowers? For what kinds of special occasions do we send flowers? (weddings, new babies, funerals, etc.) Many people believe that different flowers mean different things. What might a rose mean, for example? Discuss the history of sending messages with flowers and explain what a tussie mussie is.

b) Pass out the Tussie Mussie Lore sheet to individuals or small groups. Ask students to identify plants on the list that are growing in the school garden.

c) Ask students to choose someone that they would like to send a special message to using flowers. They should be thinking of this person as they collect their flowers and herbs.

d) Demonstrate how to cut flowers and herbs carefully using scissors, then arrange the flowers and wrap an elastic or pipe cleaner around the stems. If available, wrap floral tape around the stems.

Cut a small 'x' in the middle of a paper doily to slip the stems of the bouquet through. Give students a maximum number of flowers that they can use to make their tussie mussies.

e) Send students to collect their flowers and herbs. If space in the garden is limited, send a few students at a time, while others work on cards.

f) Student can make cards to go along with the tussie mussies to explain the meaning of the flowers they have selected.

g) Once the students are finished, ask some of them to explain the meaning of their tussie mussie if they wish.

4. Spring Salad K-7

Even if the school garden was planted so late that it is just getting going by the end of the school year, there should be enough produce to harvest to make the beginnings of a salad. Often there's more to be eaten in the garden than first meets the eye. If you're confident that you can help students to accurately identify these plants, try adding some of them to your salad:

Have students bring additional produce from home or buy some from a local farmer or grocery store to round out the salad. Divide the class into groups to wash and prepare the lettuce and other vegetables, to make a dressing, and to prepare a serving and eating area for the feast.

Extensions

Finish the school gardening year with a bang by extending this activity into a larger harvest celebration. Use the celebration as an opportunity to recognize the hard work of the students and the contributions of parents, administrators, other staff members and members of the community by inviting them to participate in the festivities. Invite members of the media to help publicize the event. Hosting a harvest celebration can help to ensure continued support for the school garden, encourage others to lend their support and help to build awareness about the value of gardening with students.

5. Harvest Market 4-7

If there is more produce available in the garden than can be consumed by the students, consider selling some of the produce or flowers as a fundraising activity. To prepare their produce for market, students will need to consider all the details of advertising, setting prices, timing the harvest, storing produce and displaying the produce for sale. Just as farmers do, students will need to figure out how to make the most of what their gardens have to offer. Some ideas for items to sell:

fresh produce

salad mix

fresh/dried herbs

seeds harvested from the garden

cut flowers

bouquets/tussie mussies

Extensions

UNIT 4

Summer

- Extend the idea of a harvest garden into a year-round activity, running the school food garden as a market garden. In the process, students can be given opportunities to learn some of the skills needed to run a business; making a business plan, developing marketing strategies, and running a profitable vegetable garden are just a few related activities that can be extended into other areas of the curriculum.
- Instead of selling produce from the garden, donate it to a local food bank or soup kitchen.

Unit 4: Summer

Conclusion

IN THE SCHOOL GARDEN

- Follow through with summer garden care plan organized during the spring
- Plant summer crops for fall and winter harvesting if desired

SUMMER GARDEN CARE

One of the biggest challenges of many school garden programmes is ensuring that the garden is cared for during the summer. With the increased daylight hours and reduced rainfall of summer, plants in the garden are particularly dependent on people as they put on tremendous growth. The most important summer task is to keep the garden watered regularly. Other tasks include weeding, pruning crops such as tomatoes that tend to sprawl all over the garden, and harvesting crops as they mature to keep fruits from attracting pests to the garden as they rot on the surface of the soil. By selecting crops that mature before the end of the school or else mature when the students return in September, summer work in the garden can be kept to a minimum.

Well before the end of the school year, make plans for summer garden care so that the work doesn't all fall on the shoulders of one dedicated individual (usually the teacher!). Find someone to take on the task of making up a list of volunteers so that responsibility for summer care of the garden can be shared among many people. Let volunteers know in advance what they should be doing in the garden by giving them written instructions with a reminder of the days or weeks that they are responsible for the garden.

One important strategy that many schools have used to extend the usefulness of the garden outside of the school year is to find ways to make the school garden available for the use and enjoyment of others during the summer. Making plans for other to be in and around the garden during the school vacation will help to ensure that the garden is cared for and that it is less of a target for vandalism.

- Invite a nearby daycare centre or summer recreation programme to use a part of the garden or to help maintain it in exchange for produce.
- Encourage students who live near the school who have shown an interest in the garden to continue to care for it during the summer.
- Invite a group of parents or community members to organize a work bee or special event in the garden, such as making signs or installing benches.

To really make the best use of the garden all year round, organize a group of students and par-

Appendices

Appendix A

ents to plant crops in the garden during the summer. In the warmest parts of Canada, there are many crops that can be planted in mid-summer that will mature in late fall and be available for harvest through the winter with minimal protection. In colder regions, plants that begin their growth in the summer can be protected using a cold frame or grown in the shelter of a greenhouse. Although these techniques will certainly require extra time and energy, such efforts will pay off in fresh vegetables available to students during the winter months. Consult *Appendix A: Selecting Crops for a School Garden* for additional information on this topic or find a copy of Eliot Coleman's *Four-Season Harvest*, an inspiring book that describes in detail how to select crops and protect the garden to allow for harvest throughout cold winters.

By putting a summer maintenance plan in place, inviting neighbours and nearby community organizations to get involved in the garden or by getting a group together to plant a crop of winter vegetables, your efforts will go a long way towards ensuring that the school garden is in great shape when students return in the fall for another year of school gardening.

APPENDIX A: SELECTING CROPS FOR A SCHOOL GARDEN

When selecting crops to grow in a school food garden, the first consideration is of course what plants and varieties will grow best in your area. Detailed planting information is beyond the scope of this module and can instead be found in gardening books or learned from farmers and gardeners in your area or from the experts at a local garden center. Local seed companies can often provide very specific information on the particulars of growing vegetables in the climate of your region, and can usually provide seeds for locally-adapted varieties that are well suited to your area.

Once you have determined the best vegetables to grow in your area, you will need to select plant varieties that are suited to a school food garden and to the requirements of your educational programme. You will want the school's garden to:

- fit with the school calendar, minimizing work and harvesting during the summer months
- maximize the amount and variety of crops which children can harvest at various times in the school year
- provide a wide range of learning opportunities
- demonstrate the wide diversity of food crops and the many interesting vegetable varieties, including heirloom varieties, that can be grown and eaten
- take advantage of growing techniques which suit the local climate
- increase opportunities for children to participate in seed saving

SALAD IN SPRING, SOUP AND SEEDS IN SEPTEMBER

For most of southern Canada, there are three main opportunities for growing food crops during the school year:

a) Plant fast-growing crops such as lettuces and radishes in spring to provide a harvest of salad ingredients before the end of the school year in late June.

b) Longer season crops can be started indoors or purchased in spring, transplanted into the garden and harvested in the early fall when students return to school. Some of the commonly grown longer season crops include tomatoes, pumpkins and other squash, sunflowers, corn, carrots and broccoli. Fall season activities in this module discuss how to use these crops to make a soup or for other harvest activities, including seed saving.

c) Once fall crops have been harvested and there is additional space available in the garden, students can plant hardy overwintering crops that will survive in your region. One common overwintering crop discussed in the fall activities section of this module is garlic.

With some attention to planning, students would be able to harvest salad ingredients in late

spring, harvest soup ingredients and save seeds in the fall, and harvest overwintered crops the following year.

To make even better use of the garden, set aside a section of the garden for enthusiastic students and parents to plant in mid-summer. Crops such as carrots, turnips, brussels sprouts, cabbage, and some varieties of vegetables usually grown in the spring can be planted in the summer to provide a harvest in early winter, even lasting through to the following spring in the mildest Canadian climates. Please refer to the summer activities section of the module for more ideas about summer planting.

SUGGESTED CROPS

The following suggested lists provide a starting point for selecting crops for a school garden, and include many vegetables that are preferred by children. The crops that have been listed here are 'best bets' as they are the simplest to grow and are most likely to provide satisfactory results in a school garden. Specific varieties have not been recommended, as these will vary depending on the climate where your school is located.

Best Bets for Crops to Start Indoors or Purchase for Transplanting into the Garden

Spring Harvest

- Lettuce (grow lots of lettuce so that students can have a salad in June, choose unique heirloom varieties)
- Edible flowers (calendula, nasturtium, violas, pansies, borage)
- Annual herbs (parsley, dill, fennel, cilantro)
- Flowers to attract beneficial insects (monarda, phacelia, yarrow, allysum, marigolds)

Fall Harvest

These crops require a lot of nutrients and attention during the summer if they are to be harvested successfully.

- Tomatoes (choose hardy determinate varieties from local growers)
- Sunflowers (these can also be seeded directly, great for saving lots of seeds)
- Squash and pumpkin (these take up lots of space and require a rich soil)
- Corn (needs to be grown in large blocks for successful pollination)

Best Bets for Crops to Seed Directly into the Garden in Spring

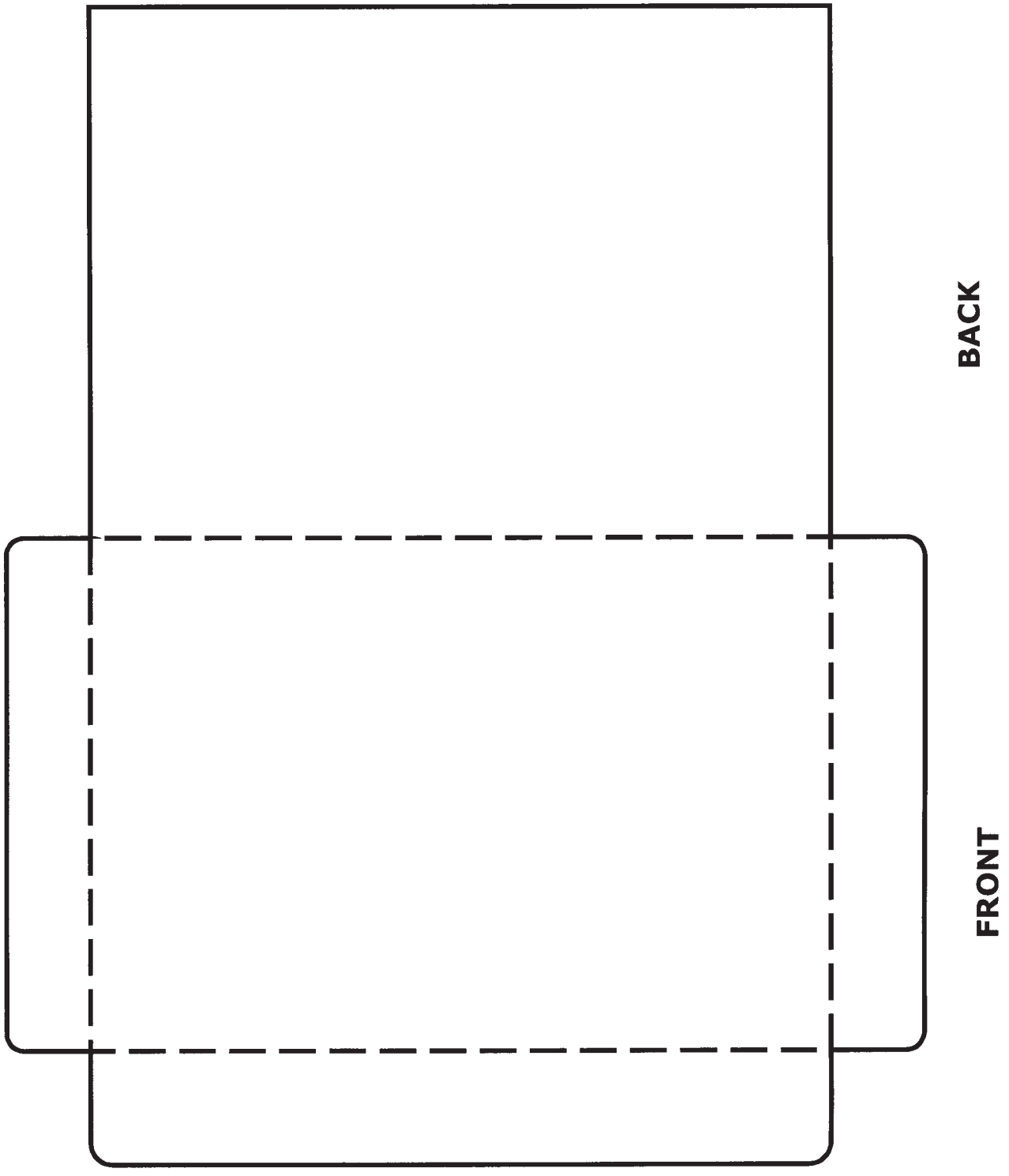
Spring Harvest

- Radishes (plant lots of these to eat in June; get colourful varieties like Easter Egg)
- Salad greens (try a mix of mustard greens which can be added to a salad when small)

SEED PACK TEMPLATE

CUT on solid lines

FOLD on dotted line



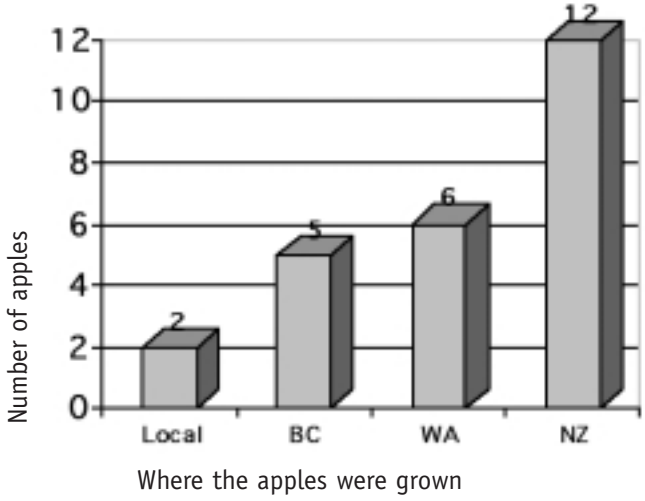
GREENHOUSE IN A JAR

Measurement	Time (Minutes)	Thermometer 1 Temperature (°C)	Thermometer 2 Temperature (°C)
0			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

- Green onions (plant onion 'sets,' not seeds, into the garden for an earlier harvest)

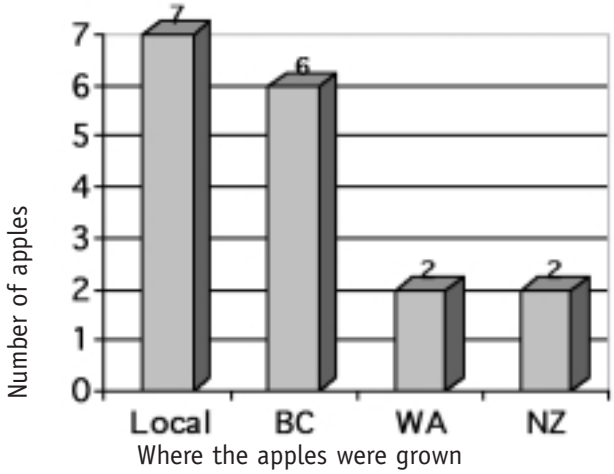
GRAPH 1

APPLES EATEN BY MR. SPARTAN'S CLASS



GRAPH 2

APPLES EATEN BY MRS. GALA'S CLASS



Fall Harvest

- Flower mix to attract bees (make sure they're not poisonous to children)
- Bush beans (particularly heirloom bush dry beans with interesting colours, these are easy to save for seed, note: pole beans require something to climb up)
- Potatoes (look for coloured heirloom varieties)
- Carrots (tough to grow in school gardens, but these are the crop de choix for kids)
- Sunflowers (require little water and are great for seed saving)

Edible Perennials to Grow in a School Garden

- Strawberries
- Culinary herbs (sage, rosemary, chives, oregano)
- Herbs for making herbal teas (chamomile, mint, lavender)

4. Selecting Cover Crops for Fall Planting

Many growers use fall rye because it grows well in cold weather, but in areas with milder winters these strong plants tend to overwhelm small raised beds and are very difficult to remove in the spring. Consult a book such as *The New Organic Grower*, or a local seed catalogue for information on selecting less vigorous cover crops such as barley, buckwheat, cowpeas, vetches, or mustards.

FINDING SOURCES FOR SEEDS AND TRANSPLANTS

Ideally, plant seeds that you or the students you're working with have saved the previous year. The next best option would be to get seeds from local organic farmers, many of whom are willing to donate excess seeds to school garden programmes. Obtaining seeds from local farmers is an excellent way to get unique varieties that are more likely to thrive in your climate. Other options are to buy from nearby seed companies or from regional or national seed saving organizations like Seeds of Diversity (Canada) and Seed Saver's Exchange (USA) – most seed companies and organizations can be easily found on the Internet. Remember that if you intend to save seeds for planting another year, select non-hybrid varieties to be sure that you end up growing the same variety you started with. Also, **never use treated seeds**, as these are coated with chemicals that can be harmful if ingested.

If starting transplants indoors is not an option for your class, transplants can often be ordered directly from local farmers. Buying locally is a great way to support local farmers, and allows more control over selecting crop varieties and maturity of transplants. Be sure to make arrangements well in advance so that the plants will be mature enough to fend for themselves when they are transplanted into the school gardens. As a last resort, if you need to pick up a few transplants at the last minute, garden stores and nurseries usually have vegetable starts available.

SAMPLE APPLE A DAY CHALLENGE GRAPHS

J.J. Seed

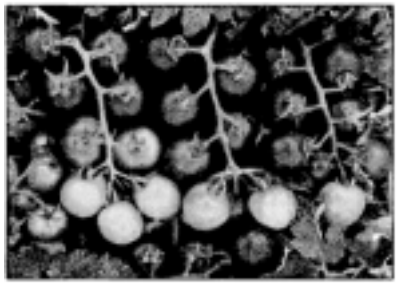
Company

SUPPLYING THE SEEDS THAT LARGE FARMS NEED

Memo to: All Vegetable Expert Committees

As many of you know, J.J. Seed has bought out a number of small seed companies in the past year. Many of these companies sold most of their seeds to small farms and

home gardeners. Now we need to decide which of these heirloom seed varieties we might be able to sell to the large farms that buy their seeds from us.



Each of the Vegetable Expert Committees must select the TWO varieties that our customers will be most interested in.

Things to keep in mind:

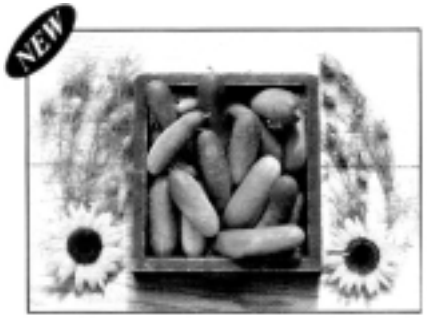
- Farmers have a hard time selling vegetables that look unusual at grocery stores. Choose varieties that will look familiar to customers.
- Most farms we sell to are in the middle

of the country where the climate is warm. Choose vegetable varieties that do well in hot, dry weather

- Most farmers use large machines to the entire crop all at once. They don't like varieties that ripen over a long period of time.

- Many farmers want to be able to sell their vegetables to be made into things like sauces, salsa and pickles or else they want vegetables that can stay fresh during the long trip to the grocery store.

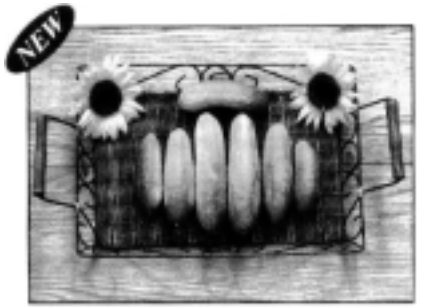
Remember, we are only able to include 2 of



the 6 varieties of each vegetable in our next catalogue.

Thank you for your expert advice in these matters.

President, J.J. Seed Co.



BLACK PLUM TOMATO

Originally from Russia. Oval-shaped fruits ripen from a deep brown colour to black.

FEATURES: Unusual colour,prefers hot sunny weather, good for making into spaghetti sauce.

EUROFRESH TOMATO

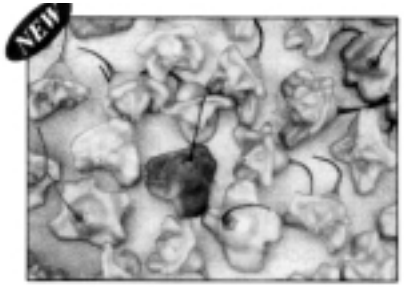
Very round and juicy red tomato with great flavour. Meaty fruits that are ideal for canning.

FEATURES: Good for canning, fruits will crack in wet or cold conditions.

MEXICO MIDGET TOMATO

Produces lots of round, dark-red cherry tomatoes that are great for salads.

FEATURES: Produces tomatoes throughout



the entire season.

RED CUP TOMATO

Unique variety that is ideal for stuffing. Wavy shaped fruits have dry flesh and only a few seeds.

FEATURES: Unusual shape.

STUPICE TOMATO

Loaded with nice round, red tomatoes, very juicy fruits have great flavour. Very early to ripen.

FEATURES: Grows well in cold conditions.

TOMMY TOE TOMATO

Plants yield hundreds of apricot-sized fruits, produces over the whole season. Outstanding superb flavour.

FEATURES: Provides tomatoes through the whole season, resistant to blight disease.

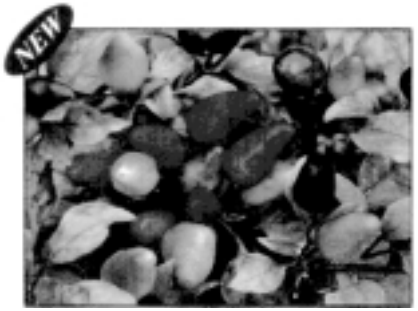
TRUE LEMON CUCUMBER

Similar in appearance and size to a lemon. Good for making pickles and slicing into salads.

FEATURES: Unusual shape, drought resistant, resistant to rust disease.

PARADE CUCUMBER

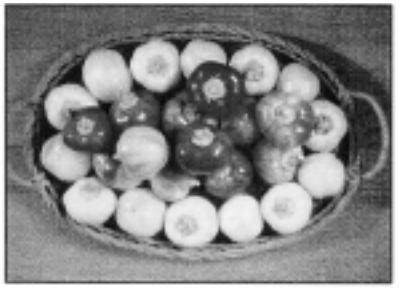
Originally from Russia, these cucumbers are



a nice shape and size.

FEATURES: Cucumbers ripen at the same time, resistant to wet and cold conditions.

DOUBLE YIELD CUCUMBER



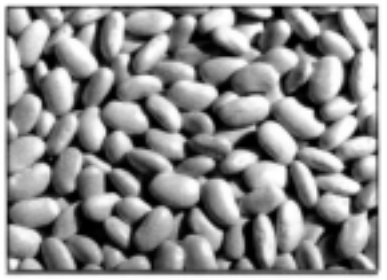
Developed by a home gardener in New York who had been perfecting this variety for many years. Great for pickling.

FEATURES: Good for making pickles.

SNOW'S FANCY PICKLING CUCUMBER

First collected by J.C. Snow of the famous Snow Pickle Farm in Illinois, U.S.A. Good for making small specialty pickles.

FEATURES: These cucumbers are too short for making dill pickles.



WHITE WONDER PICKLE

First introduces in 1873 by W. Atlee Burpee of Philadelphia. Cucumbers are ivory white in colour.

FEATURES: Grows well in hot dry weather.

EARLY FORTUNE CUCUMBER

First introduced to North America in 1906. A great cucumber for eating fresh.

FEATURES: Ready to harvest very early in the season.

MONASTYRSKI CUCUMBER

Nice juicy cucumber variety from Poland. Has very short vines, so it doesn't take up much space.

FEATURES: Cucumbers stay fresh for a long time after picking, cucumbers ripen very early.

BALLOON PEPPER

Unique bell-shaped fruits with square-tipped wings. The wings are sweet but the rest of the pepper is extremely hot.

FEATURES: Unusual shape, peppers ripen late.

BULGARIAN CARROT PEPPER

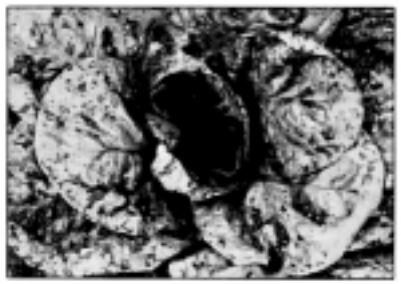
The shape and colour of these peppers are just like carrots. Peppers grow protected from the sun by leaves.

FEATURES: Good for making salsa and chutney, grows well in hot weather.

SANTA FE GRANDE PEPPER

Hot, cone-shaped blunt peppers introduced in 1965 by Peto Seeds.

FEATURES: Peppers ripen throughout the whole season.



AURORA PEPPER

Small plants with purple leaves, peppers change colour from lavender to purple to orange and finally to red as they ripen.

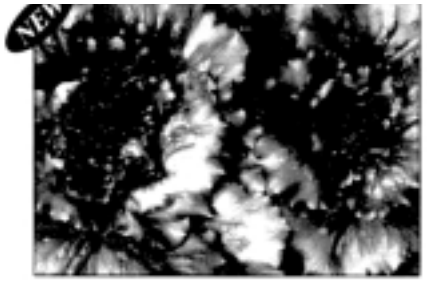
FEATURES: Unusual colours, extremely spicy.

KLARI BABY CHEESE PEPPER

Heirloom pepper variety from Hungary. Usually pickled whole after ripening from white to yellow to red.

FEATURES: Peppers don't keep for very long, peppers ripen very early.

VARINGATA PEPPER



Beautiful ornamental plant with green, white and purple leaves, and small green and purple fruits that ripen to red.

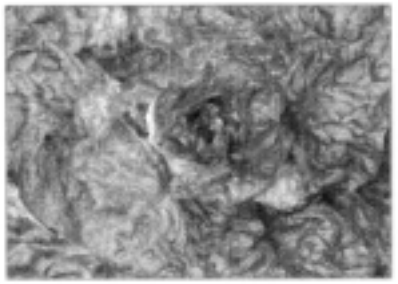
FEATURES: Best used for decoration rather than eating.

GREAT NORTHERN BEAN

Originally grown by the Mandan tribe. Found in burial mounds known to be many centuries old.

FEATURES: Evenly shaped beans, excellent for baking and canning.

KENTUCKY WONDER BUSH BEAN

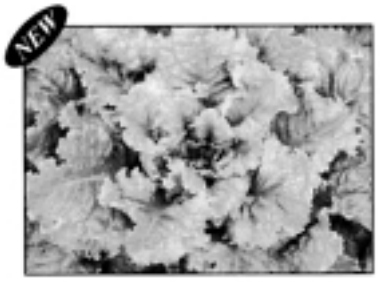


A bush variety developed from the popular Kentucky Wonder Pole bean. Seeds are a very bright red colour.

FEATURES: Unusual colour, beans ripen over a long period of time, beans ripen early in the season.

BLACK VALENTINE BEAN

Introduced in 1897 in New York. Pods are green

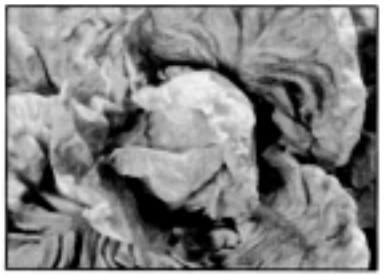


with black seeds.

FEATURES: Good for eating fresh or for making into soups, beans are produced above the leaves and are easy for machines to pick.

HENDERSON LIMA BEAN

Discovered in Virginia, U.S.A. This bean is green



when fresh and dries to creamy white, known for its good flavour.

FEATURES: Beans ripen over a long period of time, grows well in wet and cold conditions, good disease resistance.

RATTLESNAKE SNAP BEAN

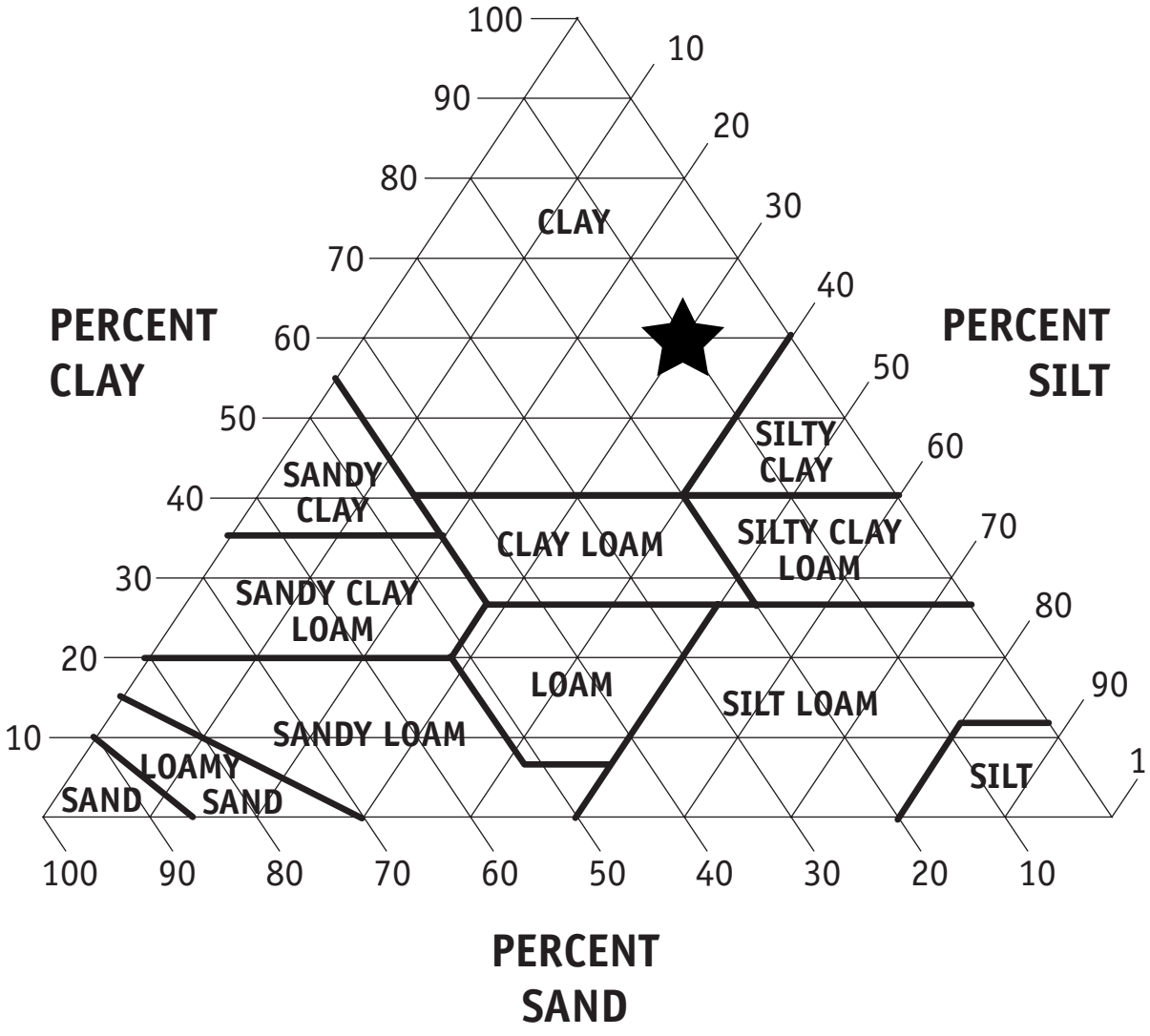
Tasty beans that are coloured green with purple stripes. Good resistance to drought.

FEATURES: Unusual colour, grows well in hot dry conditions.

	PAVEMENT	PLAYGROUND	GRASS	GARDEN	TREE
Can you play on/in it?	❑	❑	❑	❑	❑
Can you play sports on it?	❑	❑	❑	❑	❑
Is it a nice place to hang out?	❑	❑	❑	❑	❑
Is it cheap to make/grow?	❑	❑	❑	❑	❑
Is it easy to care for?	❑	❑	❑	❑	❑
Will it do well without being watered?	❑	❑	❑	❑	❑
Can it provide food or shelter for birds?	❑	❑	❑	❑	❑
Can it provide food or shelter for insects?	❑	❑	❑	❑	❑
Can it provide food for people?	❑	❑	❑	❑	❑
Can it provide shade?	❑	❑	❑	❑	❑
Does it help clean the air?	❑	❑	❑	❑	❑
Is it beautiful?	❑	❑	❑	❑	❑
TOTAL SCORE					

ROYALTY PURPLE POD BEAN

Bred by the legendary plant breeder Elwin Meader.



Pods are purple, turning green when cooked.

FEATURES: Good for canning and freezing, grows well in cold, wet conditions.

FORELLENSCHLUSS LETTUCE

Austrian heirloom variety that translates as "speckled like a trout." Medium green in colour with splotches of maroon.

FEATURES: Grows well in hot, dry conditions.

GREEN OAKLEAF LETTUCE

This variety has been popular since the 1880s, still in high demand at specialty restaurants. Beautiful green colour.

FEATURES: Grows well in hot, dry conditions, doesn't stay fresh for very long.

PABLO LETTUCE

Heads of lettuce that look almost like flowers. Large wavy-edged flat leaves. Good texture, excellent mild flavour.

FEATURES: Unusual colour.

MERVEILLE DE QUATRE SAISONS LETTUCE

French for "Marvel of Four Seasons," this is a pretty red variety of lettuce with excellent flavour.

FEATURES: Grows best in cold conditions.

GRANDPA ADMIRE'S LETTUCE

Named for George Admire, a veteran of the American Civil War. Green leaves with bronze tinges. Good flavour.

FEATURES: Grows well in hot, dry conditions.

TENNIS BALL LETTUCE

Sold by 116 seed companies in 1904. Tennis Ball Lettuce was used in the past to be pickled for winter use.

FEATURES: Good for pickling, unusually small shape.

Appendix B

SLOBOLT LETTUCE

Developed in 1946, this variety of lettuce grows large heads with thick clusters of light green frilled leaves.

FEATURES: Ripens over a long period of time, grows well in hot, dry conditions.

Appendix B

THE SCHOOLYARD ENVIRONMENT QUIZ

Complete this quick quiz to help you think about what sorts of things you might want to see more of in your schoolyard. For each 'yes' answer, put a tick in the box, and add up all the ticks in each category to find the total score.

SOIL TEXTURE GRID

SANDRA AND THE SUNFLOWER

Read this story out loud to your class. You could invite a student to act out the part of the sunflower to add to the humour. After each section of the story, ask the students what Sandra should do differently. The story then repeats itself from the beginning; speed through the repeated sections as if in fast forward mode to keep the story moving along quickly.

Sandra decided to plant a garden. She wanted to grow all the things that had the same first letter as her name, but the only plant she knew that started with an S was sunflowers, so that was what she planted. Sandra got a sunflower seed from the garden shed and threw it on a rock. A crow flew down from the sky and ate up the seed. The End.

Hmmm. Something doesn't seem quite right about this story. What did Sandra do wrong? Oh… she should have put the seed in the soil. Let's try the story again.

Sandra decided to plant a garden. She wanted to grow all the things that had the same first letter as her name, but the only plant she knew that started with an S was sunflowers, so that was what she planted. Sandra got a sunflower seed from the garden shed and planted it carefully in the soil. After a few days, a sprout came up. Sandra put a box over the sprout to protect it from the sun. The sprout turned yellow and died. The End.

Ask for suggestions again, until the students say the sunflower needs light.

Sandra decided to plant a garden. She wanted to grow all the things that had the same first letter as her name, but the only plant she knew that started with an S was sunflowers, so that was what she planted. Sandra got a sunflower seed from the garden shed and planted it carefully in the soil. After a few days, a sprout came up. Sandra watched it grow straight up toward the sun. By the time the sunflower was as tall as Sandra, the soil was quite dry. The sunflower turned yellow, then brown, and one day it was so dry the stem broke in half. The End.

Ask for suggestions. The sunflower needs water.

Sandra decided to plant a garden. She wanted to grow all the things that had the same first letter as her name, but the only plant she knew that started with an S was sunflowers, so that was what she planted. Sandra got a sunflower seed from the garden shed and planted it carefully in the soil. After a few days, a sprout came up. Sandra watched it grow straight up toward the sun. By the time the sunflower was as tall as Sandra, the soil was quite dry. Sandra filled a watering can, and poured the water out all around the sunflower. The sunflower continued to grow, and after a few more weeks, a beautiful yellow flower opened up. Sandra liked the yellow colour so much that she painted the stem and the leaves to match. Of course the sunflower couldn't breath through its leaves anymore, so it died. The End.

The sunflower needs air. Read from the beginning, then:

Sandra decided to plant a garden. She wanted to grow all the things that had the same first letter as her name, but the only plant she knew that started with an S was sunflowers, so that was what she planted. Sandra got a sunflower seed from the garden shed and planted it carefully in the soil. After a few days, a sprout came up. Sandra watched it grow straight up toward the sun. By the time the sunflower was as tall as Sandra, the soil was quite dry. Sandra filled a watering can, and poured the water out all around the sunflower. The sunflower continued to grow, and after a few more weeks, a beautiful yellow flower opened up. Sandra loved all the different colours on the sunflower – the green leaves and stem, and the bright yellow petals around the flower. The bees loved the yellow on the flower too, and spread pollen all around the sunflower. As summer ended, the flower began to dry out. Sandra ate most of the sunflower seeds and saved a few to put in the garden shed to plant next year. The End!

MASON BEE HABITAT CARDS

Make 6 copies of this page and cut so that the four items are on separate pieces of paper.

water

mud

flower

nesting hole

TUSSIE MUSSIE LORE

Many people believe that each plant has a special meaning. Many years ago bouquets of flowers and herbs called 'tussie mussies' were used to send messages between people. Here are some of the meanings of common flowers and herbs. If you want to know the meaning of a plant that is not on this list, try looking in a book or on the Internet, or make up your own meaning!

Borage:	courage, bluntness
Calendula:	health, joy
Chives:	usefulness
Clover:	think of me
Dill:	good spirits
Fennel:	strength
Lavender:	luck, success
Mint:	virtue, wisdom
Nasturtium:	patriotism
Parsley:	festivity
Peppermint:	warmth of feeling
Rose:	love
Rosemary:	remembrance, wisdom
Sage:	virtue
Sweet Pea:	meet me, departure
Thyme:	activity
Violet:	faithfulness, happiness

APPENDIX C: RECOMMENDED RESOURCES

RECOMMENDED SCHOOL GARDENING CURRICULUM GUIDES

Appelhof, Mary. ***Worms Eat Our Garbage: Classroom Activities for a Better Environment.*** Kalamazoo, Michigan: Flower Press, 1993.

Cohen, Joy and Eve Pranis. ***GrowLab: Activities for Growing Minds.*** Burlington, Vermont: