



Breaking Ground – Biodiversity in the Schoolyard

A Resource Manual for Newfoundland and Labrador Educators

March 2011



Breaking Ground Teacher's Workshop, October, 2010

Larry Williams, Carl White and Roy Stares showed teachers how to build a butterfly shelter in an area newly opened up by hurricane Igor. The shelter was based upon the research of Bernard S. Jackson, the Garden's first curator, who erected many of these shelters as part of the Garden's habitat management and enhancement program.

This project was undertaken thanks to the financial support of the Government of Canada, provided through the Environment Canada (EcoAction Community Funding Program).



Acknowledgements

Memorial University of Newfoundland Botanical Garden Inc., as part of the university's inclusive community, is a not-for-profit corporation that creates and inspires understanding, appreciation and conservation of plants in gardens and natural areas to further Memorial's mission of research, education and outreach. The Botanical Garden, created in 1971, is a resource centre for basic and applied botanical research and education with a particular interest in the flora of Newfoundland and Labrador. It seeks to foster an appreciation of natural history in the development and future of the university and the province. Curriculum-linked education programs have been developed and offered by the Garden since its inception.

Breaking Ground – Biodiversity in the Schoolyard; A Resource Manual for Newfoundland and Labrador Educators project would not be possible without the financial support of the Government of Canada, provided through the Environment Canada (EcoAction Community Funding Program).

Many members of MUN Botanical Garden staff were involved in this project, including the teacher workshop and the research and development of this manual. We would like to acknowledge the contributions of:

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 Todd Boland, Research Horticulturist
 Christine Byers, Public Outreach Assistant
 Jane Cooper, Giftshop Manager
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 Jaimie Farrell, Public Outreach Assistant
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 Roy Stares, Assistant Gardener
 Tim Walsh, Nursery Manager
 Carl White, Head Gardener
 Larry Williams, Grounds Maintenance



**Breaking Ground:
Biodiversity in the School Yard**

Teacher Workshop Itinerary

October 6-7, 2010, 9 a.m. – 4 p.m.,

MUN Botanical Garden, 306 Mount Scio Road, St. John's

This workshop is offered in conjunction with the From Garden to Classroom Outreach Program, which is supported by the Natural Sciences and Engineering Research Council (NSERC) PromoScience funding program and with the financial support of the Government of Canada provided through the Department of the Environment (EcoAction Community Funding Program).

Refreshment Breaks: 10:15 a.m. and 2:15 p.m. – provided by the Botanical Garden

Lunch Breaks: noon – 1 p.m. - lunch is not provided; coffee and tea and kitchen facilities are available. Brown bag or purchase from Garden Café or nearby food outlets

Day 1: Wednesday, October 6, 2010

- *Welcome and Overview of Workshop* – Anne Madden, Education Coordinator
- *Vermicomposting & Composting* - Anne Madden, Education Coordinator
- *Bats, Butterflies, Birds and Bees: Tips on providing wildlife habitats in your garden* – Anne Madden, Education Coordinator
- *Nature Hikes and Nature Trails* – Christine Byers, Public Outreach Assistant
- *Grocery Store Botany* – Hannah Dickson and Heather Reid, YMCA Eco-Interns
- *Get Growing in the Greenhouse; plant propagation (seeds, cuttings and divisions)* – Tim Walsh, Nursery Manager
- *The Dirt on Soils; a practical guide to working with soils* - Carl White, Head Gardener
- *Building a Butterfly Shelter* – Larry Williams, Grounds Maintenance, Carl White, Head Gardener, Roy Stares, Assistant Gardener

Day 2: Thursday, October 7, 2010

- *Gardening in Newfoundland*: Site selection, preparation, design, plant selections, vegetable plots, etc. – Todd Boland, Research Horticulturist and Tim Walsh, Nursery Manager
- *Planting a Tree 101* – Carl White, Head Gardener and Roy Stares, Assistant Gardener
- *Gardening Q&A* – Todd Boland, Research Horticulturist and Tim Walsh, Nursery Manager
- *Landscape Newfoundland and Labrador* – Dave Kiel, President, LNL
- *School Yard Funding Opportunities* – Madonna Bishop, Research Liaison



Teachers pick up some tips in the classroom at MUN Botanical Garden

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Background and Introduction

In recent times there has been an increased interest in trying to educate students about our natural world. With modern urbanization, exposing youth to nature has become increasingly more difficult and challenging. *'Breaking Ground – Biodiversity in the Schoolyard'* has been provided by the staff of the Memorial University of Newfoundland Botanical Garden as a way to help teachers and educators 'enhance' their school property to allow wildlife to move back into the area, making it possible to move the classroom to the 'outside' environment; in essence, bringing wildlife to the students. This resource guide will provide a variety of techniques and projects that may be employed to help enhance the school ground for wildlife.

In October 2010, twenty teachers from local St. John's schools gathered at MUN Botanical Garden to participate in a unique program: *'Breaking Ground – Biodiversity in the Schoolyard'*. During this two-day workshop, the Garden's staff shared their expertise with local educators. The topic was one very dear to MUN Botanical Garden; how to enhance our local biodiversity, hence improve our environment for local wildlife and, more importantly, how to engage our youth in the process.

The workshop activities included everything from plant propagation, composting and soils, Newfoundland gardening basics, butterfly gardening, grocery store botany, habitat enhancement for birds, bats and other wildlife, plus information on funding opportunities for school yard projects.

Thanks to the teachers' enthusiasm, energy and constructive feedback, this first draft of our *'Breaking Ground – Biodiversity in the Schoolyard'* Teacher Resource Manual is now available province-wide, in print and on our website. The information provided is based on the expertise, research, experiments and development carried out at MUN Botanical Garden by its staff and volunteers during the past 40 years. It is our hope that the information enclosed will not only provide useful information for local educators, but will encourage educators, administrators, parents and volunteers to create this special type of outdoor classroom for all students.

This project would not have been possible without the financial support of the Government of Canada, provided through the Environment Canada (EcoAction Community Funding Program). Suitable activities for K-12 students have also been included in this manual. These resources were developed through the *From Garden to Classroom* Outreach Program, which is supported by the natural Sciences and Engineering Research Council (NSERC) PromoScience funding program.

MUN Botanical Garden will continue to offer training workshops for educators. We will also continue to modify and expand this resource. Your feedback for this project is essential. Please feel free to submit your feedback, questions and stories. We look forward to hearing from you.

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Chapter 1



Red Admiral butterfly on lance-leaved goldenrod

Creating Habitat for Wildlife

Chapter 1 – Creating Habitat for Wildlife

The most reliable ‘nature’ to bring to the school yard are butterflies, birds, bees and bats. One of the easiest projects to help achieve this is the construction of a wildlife friendly garden. For all intents, this will involve culturing plants attractive to bees, butterflies and birds. However, for this to be possible, you have to install a proper growing area.

Schools in more rural areas may already have the advantage of naturally occurring forests, meadows, streams, etc. If so, take advantage of these features – you are already ahead of the game! However, you may still wish to further enhance the schoolyard and the following information will still be very useful.

Site Location

There are several aspects of a school yard which must be taken into account before you decide to install a wildlife friendly garden: how much light is available, is the site exposed to wind, what are the existing soil conditions, what types of plants are you attempting to grow (i.e. vegetables, trees and shrubs, perennials, annuals).

First step, select your site. Bees and butterflies are not strong fliers, so a garden designed for these insects should be reasonably sheltered from strong winds. This will also reduce the amount of staking required for certain perennials. Insects, being cold-blooded, need a warm site to be active, so the wildlife garden should be located in a reasonably sunny site. Watering may be required for new plantings and possibly during dry spells, so the garden should be located where there is reasonable access to water. The site should be located where general student activity (lunch, recess) will not result in hundreds of students trampling the area. An important consideration in Newfoundland, is to avoid sites where snow is piled in the winter.



You should avoid positioning flower beds where snow is piled in winter

Soil Preparation

Soil will make or break your success in creating a wildlife friendly garden. Chances are, the soil in the site you select will be composed of compacted gray gravel...not at all suitable for growing anything other than dandelions! The successful cultivation of any plant comes down to proper soil preparation.

What is soil? Soil is the natural medium for the growth of plants and furnishes the plant with an anchor for its roots as well as nutrients including water, and oxygen for growth and reproduction.

Soil consists of five components:

1. mineral material
2. organic matter
3. water
4. air
5. micro and macro organisms : (micro-bacteria, fungi, algae), (macro-earthworms, beetles, nematodes)

In the Botanical Garden soil mixes, all these components are present in different percentages depending on its intended use. We have separate 'formula' for rock garden plants, peat garden plants and general perennial/annual/shrub beds. For the purpose of constructing a wildlife friendly garden you are best to use a mix which consists of 5 parts screened topsoil, 2 parts leaf mold and 1 part grit.

Soil texture is one way to describe a soil. It is sometimes called the "feel" of the soil and gives a measure of the proportions and abundance of different sizes of mineral and rock particles (sand, silt, and clay). This controls the physical behavior of the soil such as drainage, moisture content, plant nutrient supply and workability. The texture classes run from heavy clay to sandy loam and combinations of each.

Soil structure is a measure of how well the soil particles are aggregated into crumbs with pore networks of different sizes connecting them and thus refers to the physical arrangement of the mineral and organic particles in the soil. The soil structure affects the movement of air and water through the soil and influences the supply of water, air and nutrients to the plant roots.

Soil reaction refers to the pH of the soil. It is a measure of the degree of acidity or alkalinity. It is measured on a scale of 0 to 14, with less than 7 being acid, 7 neutral and greater than 7 alkaline. A simple pH test can be done with litmus paper where the degree and quickness of the colour change can give a good rough idea of your soil's pH.

Soil reaction is important to a plant nutrition because (1) It has an effect on solubility and availability of soil minerals. (2) It affects the soil micro-organisms and therefore the breakdown of organic matter and nutrient availability. (3) At extremes of high and low pH a plant's roots can become stunted which in turn affects nutrient uptake. Newfoundland's soil is fairly acidic (low pH) and this is why we add lime to many of our gardens to raise the pH to neutral or slightly alkaline. Most garden plants (excluding members of the Ericaceae family such as rhododendrons and heathers) prefer a soil pH of 6.5-7.5. Ericaceous plants prefer acidic soil with a pH 5.0-6.5.

Our soil in eastern Newfoundland is naturally acidic so it might be advised to liberally dust the planting bed with lime, thoroughly mixing it into the soil. The existing 'soil' in the planting area will probably require complete replacement with the above recommended mix. The planting area should be dug to a

depth of at least 25 cm (10 in.) if you are growing perennials, annuals or vegetables. This should be increased to over 30 cm (12in.) if incorporating trees and shrubs.

The dimensions of the bed are ultimately left up to you, but consider future maintenance. You want to avoid too much trampling on the soil, which will lead to compaction. A bed that can easily be accessed from both sides is preferable to one which is so wide that you need to step among the plants to water, weed, cultivate, etc.

Installation of the new bed should ideally take place when the soil is not too wet. April and early May may be too wet to properly prepare the soil. June to September is probably the optimum time when soil conditions are ideal for mixing and cultivating.

Plant Material

Not all plants are created equal when it comes to attracting bees, butterflies and birds. However, those that are, may include annuals, perennials, shrubs and trees. Among the trees and shrubs, you can select among deciduous, broad-leaved evergreens or conifers.

- Annuals are plants that germinate, grow, flower and set seed in one season. These plants die come winter.
- Perennials live for many years, dying to the ground in winter, re-sprouting come spring.
- Shrubs are woody plants with several relatively thin stems. They may reach to 5 m.
- Trees are generally taller woody plants with one or only a few relatively thick stems.
 - Deciduous plants are those that lose their leaves in winter.
 - Broad-leaved evergreens have leaves similar to deciduous plants but retain their leaves all year long such as rhododendrons and holly.
 - Conifers are plants that produce cones. Most have evergreen, needle-like foliage but an exception is larch; its needles turn yellow and drop in the fall.

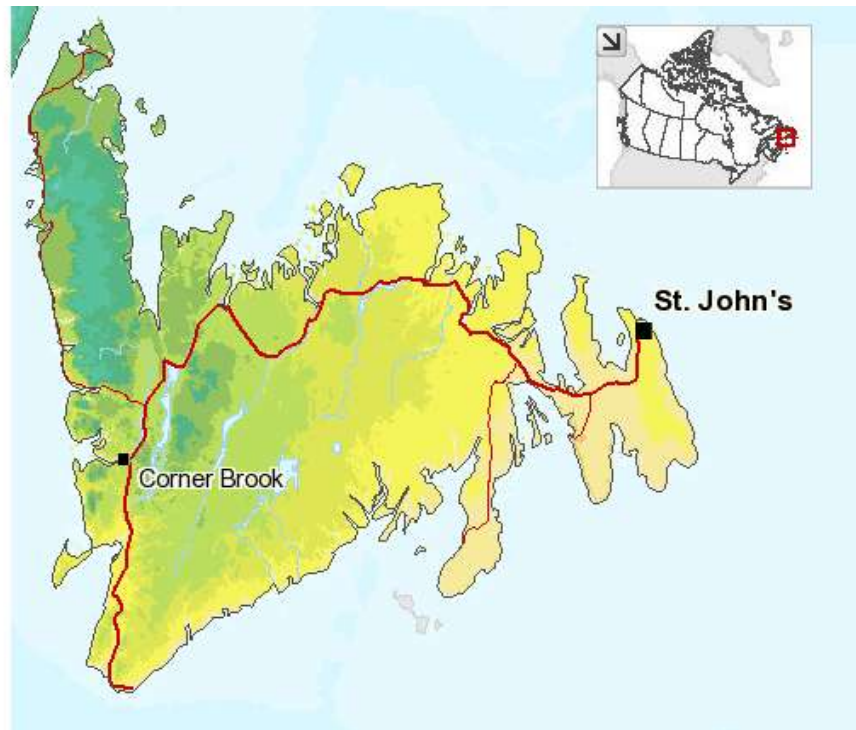
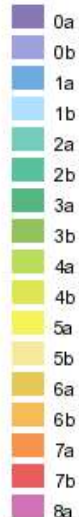


Larch is an example of a deciduous conifer

Plant Hardiness Zones

So which plants should you use? First of all, you need to determine what hardiness zone you are located within; in the greater St. John's area we are zone 5b. Below is a hardiness zone map for Newfoundland. It has been taken from the Plant Hardiness Zones map of Canada, 2000, which can be accessed at <http://sis.agr.gc.ca/cansis/nsdb/climate/hardiness/intro.html>

Plant Hardiness Zones 2000



Depending on what area your school is in your hardiness zone may be different. The map above will provide you with the hardiness zone rating for your area. When you select plants, make sure their hardiness rating is the same as or lower than the zone rating for your area.

If the site is windier than you would like, you should stick to lower-growing plants or trees/shrubs that are known to be particularly wind hardy. Conifers are particularly effective at creating wind protection for subsequent plantings. One thing to keep in mind is when the garden will be used. For schools, the attraction of bees and butterflies will primarily be May-June or September-October so plants selected for the garden must bloom that time of year. However, to keep bees and butterflies around all season, you will need to use at least a few summer-blooming plants.

From late fall through winter, birds will be the main wildlife you want to attract. Berry producing trees and shrubs will be attractive to the over-wintering fruit-eating birds such as waxwings and robins. Conifers, especially spruce, fir and larch, will attract a variety of seed-eating birds such as chickadees, finches and juncos. Evergreens also provide protection for over-wintering birds via wind shelter and cover from predators. For seed-eating birds, bird feeders will be the main method of attraction. For more information on attracting birds, please refer to **Chapter 3**.

Many teachers may be tempted to grow annuals from seed. It can make a great classroom project to start the seeds then transplant them outside. However, this is not the easiest project. Seeds need

bright light yet cool temperatures to keep them compact, otherwise if too little light and too warm, they will become lanky and not transplant very well. If grown inside, most of our annuals are not suitable to plant outdoors until after mid-June; a little late as a school activity. Some annuals may be directly sown outdoors in late May, but ongoing care will require thinning the plants and weeding them regularly throughout the summer months. For more information on growing annuals, refer to **Appendix 1 and 2** at the end of this chapter.

In regards to perennial flowers and shrubs, you may either purchase them at local nurseries or propagate them yourself from plants in your own garden or a friend's garden. MUN Botanical Garden does have lance-leaved goldenrod and pearly-everlasting, both known native butterfly flowers, available for schools, while supplies last. **Appendix 3** at the end of this chapter describes various ways to propagate plants.

Bees and butterflies need flowers as a nectar source while birds harvest the fruit or seeds. However, in the case of butterflies, you could also incorporate host plants for their larvae. If the caterpillars are feeding in the garden, then it increases the chances that the flying adults will also stick around. Chapter 2 will provide more details about butterflies and how to attract them.

The colour and shape of flowers are very important to whether you will attract bees or butterflies. Bees prefer flowers that are pink, purple or blue, especially those with tubular flowers. Butterflies, on the other hand, prefer flat flowers like daisies, which are yellow, orange and red. Hummingbirds, while rare in Newfoundland, do breed in small numbers in the Codroy Valley. Red, tubular flowers, like beebalm (*Monarda* spp.), are among their favourite nectaring plants. Seed-eating birds, like finches and chickadees, prefer the seeds from various types of daisies. Fruit-eating birds like robins and waxwings, are most attracted to red-coloured fruit.



Bees prefer blue, purple and pink flowers while butterflies prefer yellow, orange and red

The list of plants provided in **Appendix 4** provides native/naturalized and ornamental perennials, shrubs and trees known to be particularly attractive to butterflies, birds or bees. The table also provides the time of year of maximum attraction and the group of wildlife most likely to avail of the plant.

Although not previously noted, it goes without saying that you must avoid the use of pesticides. Pesticides will kill any bees and butterflies and will most likely deter birds as well. The choices of plants given in **Appendix 4** are not particularly prone to insect problems.

Planting Trees

The first step in tree planting is appropriate tree selection. Make sure that the tree species you are considering can flourish in your local climate and soil conditions (i.e. is suitable to our hardiness zone which is 5b in the greater St. John's area). There are several other factors to keep in mind:

Matching tree to site is a key part of the tree selection process. A common problem for home owners is selecting a tree that eventually outgrows the area delineated for it. On a school yard, this is generally not a problem. However, it is still advised to make sure the tree is not too close to the school, sidewalks, parking lots or situated where snow clearing will have a negative impact. And of course, always look up to see if there are any wires that may be affected once the tree reaches its mature height.

Trees purchased from wholesale and retail nurseries and garden supply stores generally come in one of three forms:

1. Balled and Burlapped (B&B)

The roots of the tree and the ball of soil containing the roots are bound in burlap.

2. Container-Grown

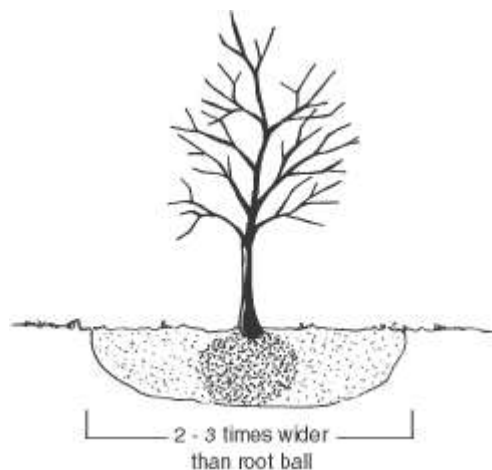
The plant is sold in the container in which it was grown.

3. Bare-Root

The plant is sold with the roots exposed; this is rare at nurseries but can occur if you are given a 'free' tree.

The ideal time of year to plant trees is immediately before they leaf in spring. If bareroot, this is the **ONLY** time you can successfully move them. Container-grown and B&B can be moved any time during the growing season if care is taken, but spring or fall are the best times.

The most common mistake when planting a tree is digging a hole, which is both too shallow and too narrow. If too shallow, the tree risks blowing over during wind storms. Too narrow and the root structure can't expand sufficiently to nourish and properly anchor the tree. As a rule, trees should be planted at the same depth as they grew in the nursery field (this is marked by a change in the colour of the bark at the soil/surface interface). The width of the hole should ideally be 2-3 times the diameter of the root ball or container or the spread of the roots in the case of bare root trees. This will provide the tree with enough worked earth for its root structure to establish itself.

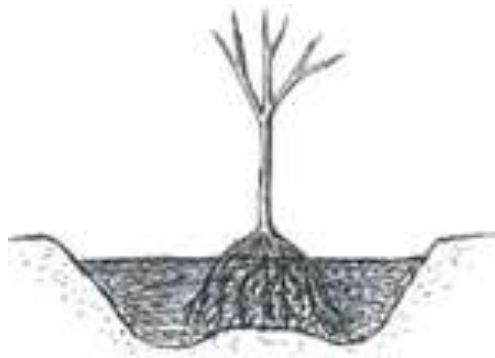


B & B trees should always be lifted by the ball, never by the trunk. The burlap surrounding the ball of earth and roots should either be cut away completely (mandatory, in the case of synthetic or plastic burlap) or at least pulled back from the top third of the ball (in the case of natural burlap). Any string or twine should also be removed. Backfill soil (combinations of peat moss, composted manure, topsoil, etc.) is then placed in the hole surrounding the tree just to the height of the ball.

The procedure for planting container trees is similar to that for B & B trees. In the case of metal or plastic containers, remove the container completely. In the case of fiber containers, tear the sides away. Once carefully removed from the container, check the roots. If they are 'rootbound', use your fingers or a blunt instrument (to minimize root tearing) to carefully tease the fine roots away from the tight mass and then spread the roots prior to planting. In the case of extremely woody compacted roots, it may be necessary to use a spade to open up the bottom half of the root system. Loosening the root structure in this way is extremely important in the case of container plants. Failure to do so may result in the roots 'girdling' and killing the tree or at the very least, the roots will have difficulty expanding beyond the dimensions of the original container.

Once the tree is seated in the hole, the original soil is then back-filled into the hole to the soil level of the container. Compress the soil using your hands, to remove any air pockets.

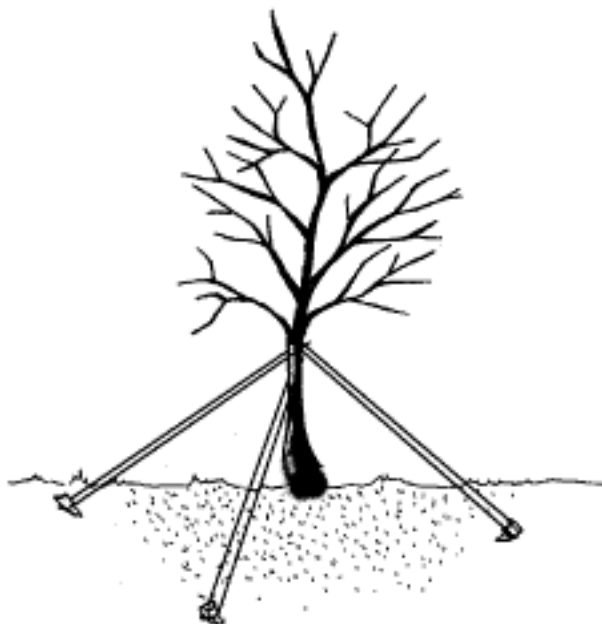
Planting bare-rooted trees is a little different as there is no soil surrounding the roots. Remember that bareroot trees can only be successfully planted prior to their leafing. Do not allow the roots to dry at any point during the transplanting process. Prune broken or damaged roots but save as much of the root structure as you can.



To plant, first build a cone of earth in the centre of the hole around which to splay the roots. Make sure that when properly seated on this cone the tree is planted so that the tree is growing at the same level as it was when in the nursery field. Bone meal or a transplanter fertilizer (follow the manufacturer's directions) is also recommended. This can be mixed into the backfill soil when planting.

Once a tree is planted, it must be watered. Provide a good initial soaking then give a thorough watering once a week for the first month or so and perhaps weekly if the weather should become dry during the first growing season. Do not just give the tree a sprinkling of water. A 5-8 cm (2-3") mulch of compost, wood chips, etc, can help maintain evenly moist soil. Finally, the tree will require staking or guying. A

coniferous evergreen should be guyed on 3 sides on a 45° angle. Deciduous tree should be staked on 3 sides with horizontal wires positioned about 1.2 m (4 feet) off the ground. Staking and guying should only be needed for the first year. Make sure the wires attached to the tree do not cut into the bark; running the wire through a short length of rubber hosing will do the trick. When staking and guying, remember to position the stakes in the undisturbed soil, outside the planting hole. The soil here will be firmer than that located within the planting hole.



Maintenance

Newly planted beds will require regular watering until the plants become established. The rule is one inch of water, once a week, rather than daily sprinklings. Generally, once established, perennials, trees and shrubs will probably not require additional watering but if annuals are incorporated, they may well need a little more aftercare as they are more shallow-rooted and more prone to droughty soil.

Weeding will be the main activity that will require continued vigilance. Once beds are well established and well planted, the 'ornamentals' can often outcompete the weeds, but new beds with thin plantings will be a shangra-la for weeds. Weeding will need to be done all season, even during the summer months, so volunteer gardeners will be required. These summer volunteers may also be needed for watering purposes.

There are a number of chores which need attending to in the autumn, to prepare the garden for spring. Refer to **Appendix 5** for these suggested chores.

The culture of rhododendrons have special requirements. Please refer to **Appendix 6** at the end of this section for details on how to grow this group of broad-leaved evergreens. They are especially attractive to bumblebees.

Vegetable Gardens

The above information regarding site and soil preparation equally applies if you wish to install a vegetable garden on the school property. You still need to prepare the planting area with the proper soil and the site should be relatively sheltered and sunny. Watering and weeding will require more work as vegetables have more water needs and often seem to encourage even more weed activity. Insects will be more of a problem than for ornamental plantings, yet, ideally you want to avoid the use of pesticides. As with wildlife friendly gardens, you have to keep in mind the time of year that the vegetables will be used. For example, beans, peas, leaf lettuce and radishes will be ready for harvesting in mid-summer, not ideal for school-grown vegetables. Root-crops are perhaps better choices as they will be ready for harvest in Sept-Oct. Bottom line, you will definitely need volunteer gardeners over the summer months if you wish to install a vegetable garden on your school grounds.



All of the vegetables at MUN Botanical Garden are grown in raised beds

Many gardeners prefer to use raised beds for growing their vegetables. See **Appendix 7** for an article on the use of raised beds.

The following local publications are excellent references for Newfoundland and Labrador gardening information:

- Scott, Peter J. *Atlantic Gardening*. Portugal Cove-St. Philip's, NL: Boulder Publications, 2010.
- Senciall, Ian R. *The Avalon Gardener – A Newfoundland Horticultural Society Guide to the Ornamental Garden*. St. John's: Newfoundland Horticultural Society, 2002.
- Senciall, Ian R. *The Avalon Vegetable Garden*. St. John's: Newfoundland Horticultural Society, 2005.
- Traverse, Ross. *Ask Ross Traverse About Gardening*. Traverse Gardens Consulting Ltd. Newfoundland, Canada, 2006

Appendix 1

Tips on Gardening with Annuals in Newfoundland

Todd Boland, Research Horticulturist

What is an Annual?

An annual is a plant which completes its life cycle in one season (that is, it germinates, grows, flowers and sets seeds all in one growing season). Once exposed to killing fall frosts, the plant will die. Tender perennials such as snapdragons, China pinks, fuchsia, geraniums and gazanias are often grown as annuals in northern climates.

Annuals are perhaps the most popular plants used by the home gardener. They are versatile, they can be used in almost any garden and they are available in a wide range of sizes, forms and colors.

Annuals vs. Perennials

While perennials often take several years to settle down and bloom, annuals are ideal in a new garden. Planting annuals with perennials will provide much-needed color while the perennials are becoming established.

While perennials are a poor choice for planters such as large tubs, pots or window boxes, annuals are ideal for these situations. Since they are available in such a wide range, you can mix and match every year so that a planter never looks the same twice.

Annuals are usually cheaper than perennials and most bloom all season.



Fuchsia and geraniums are tender perennials commonly grown as annuals in our region

Growing Requirements

All annuals do not grow under the same light conditions. While most annuals prefer full sun, some grow better in light shade. Very few will grow in dense shade. Therefore, when choosing your annuals you must keep your growing area in mind.

Generally, most annuals will prefer a moist, well-drained soil. Garden loam can be amended with peat, old compost, leaf mold or old manure. Certain annuals will actually grow better in poor, dry soils. Nasturtiums and portulaca fall into this category.



Nasturtium (left) and portulaca (right) are annuals that prefer poorer soils

Tips for Purchasing Annuals

Ensure plants are stocky, compact and a healthy green colour. Spindly, yellowish growth is a sign of stress. Do not buy such plants as they are often permanently set-back. Height is not an indication of a better plant.

Ask if the plants have been hardened off. All plants need to be hardened off before planting outside (for more info on hardening-off refer to the 'Transplanting' section on the next page).

Resist the temptation to buy annuals already in flower even though this gives an "instant garden" effect. Flowering plants do not transplant as well as those just coming into bud.

Examine plants to ensure they are free of pests and diseases. Often, crowding plants in their flats/cell-packs will cause poor air-circulation which results in the lower leaves being mouldy or rotten. Avoid buying such infected plants. Also check for infestations of aphids since many annuals are prone to these tiny green insects.

Transplanting

The vast majority of annuals will not tolerate spring frost, so you need to wait until all risk of frost is past before you decide to plant them outdoors. At MUN Botanical Garden we set mid-June as our 'safe to plant out' date.

Before transplanting, you need to harden-off your plants if the nursery has not already done so. This process will gradually acclimatize your plants to the rigours of outdoor life.

Initially, expose your plants to a couple of hours of outdoor conditions. Avoid exposing them to full sun for the first couple of days. As the week progresses, gradually increase their exposure to outside light conditions, including more direct sun (remember to expose them slowly to full sun or their leaves will scorch).

When your plants are outside they will dry out very quickly, so be sure to check the moisture levels regularly. If the weather is dry, they may require daily watering.

When you are ready to transplant, make sure the plants are well watered. If your plants are growing together in a flat, the best way to separate them is to use a sharp knife and cut between each plant as you would a cake, so that each plant has its own block of soil. This method will cut many roots, but new roots will quickly grow and help establish the new transplants. Plants in cell-packs need only be punched out of the cells.

Never transplant on a hot sunny day! Remember to properly space the plants to ensure they spread to their full potential. Water well. A transplant fertilizer may be beneficial at this stage.



Calendula (left) and sweet alyssum (right) are suitable for direct planting outdoors in Newfoundland

Care and Maintenance

Do not overwater! Only during very dry periods do most annuals require extra watering. Too often, home gardeners water frequently but lightly. Such watering does little for the plants and actually encourages fungal diseases and slug activity and encourages shallow root systems on the plants. More frequent watering is required for the new transplants to become established.

To help maintain soil moisture, plants can be mulched with 2-5 cm of leaf mold or old compost. These mulching materials release nutrients for the plants as they decompose and they keep weeds down or make them easier to pull.

In contrast, annuals grown in containers may require daily watering. These plants are growing in a limited volume of soil and cannot draw upon moisture reserves in the ground. This is especially true if they are located in an exposed, windy location. The regular addition of water-soluble fertilizers will help keep container-grown annuals in good flowering condition.

For garden-grown plants, mix old compost/old manure or leaf mold into the ground and add bonemeal to the planting hole. Using organic sources of nutrients will prevent any over-fertilization or fertilizer burn, which sometimes occurs when chemical fertilizers are employed.

Deadheading, the process of removing old faded flowers, should be attended to regularly. This not only results in a tidier display of plants but also encourages greater flower production. If old flowers are not removed, the plant will direct its energy into seed production rather than flower production, hence the end of your floral display! With annuals, once they set seed, they die, so dead-heading will help curb premature death.



Marigolds (left) and cosmos (right) will bloom all season and into fall if deadheaded regularly

Pests & Diseases

Slugs and snails are our most common pests here in Newfoundland and both can cause serious damage to annuals. Our prevalent damp weather is very conducive to slug activity. Slug bait is available from garden centres but ensure you are following the application rates and procedures as recommended on the label. A shallow pan of stale beer placed around your plants will also work effectively (slugs are attracted to the beer and drown). If all else fails, you can physically remove them.

Aphids are another common pest of annuals. They suck the sap from plants causing their leaves to become yellowed, curled and stunted. A high population of ladybugs or lacewings, the natural predator of aphids, may keep their numbers in check.

Cutworm infestation, most common with young vegetable plants can be controlled by placing a collar of cardboard around the base of the plant.

Mildew is a common disease often brought on after too much rain and/or poor air-circulation. Keeping plants well spaced will help reduce this disease.

Final Note

The wise selection of proper annuals suitable for your particular growing conditions will make the difference between a good display of flowers and a poor one. Tall annuals are not the best choice for growing in open, exposed sites, nor are they good for containers. Only a select few annuals will grow in shade and none will thrive in dense shade. Even with regular dead-heading, some annuals have a short blooming period.

With the proper choice of annuals, you can be rewarded with constant flowers for at least the months of July through September. The choice of hardy annuals can extend this blooming period into October, at which time, you can replace the annuals with fall bulbs.

Appendix 2

Tips on Growing Annuals from Seed

Todd Boland, Research Horticulturist

Growing annuals has always been a popular form of gardening in Newfoundland. Many people limit their use of annuals to nursery-raised plants. While growing annuals from seed certainly does require more work, it does have its advantages. Not only is it more economical to grow plants from seed but there is usually a wider selection of seeds to choose from. Sometimes the variety of plants offered by local nurseries is somewhat limited. In addition, there is a wonderful sense of satisfaction as you tend your seedlings through our long, cold spring and finally enjoy their wonderful blooms throughout the summer.

Because all annuals do not grow at the same rate, you should always check the seed package or catalogue for information on when to sow seeds. Keep in mind that generally in Newfoundland annuals should not be planted outside until mid to late June. As a note, some large fleshy seeds are treated with fungicides (this usually dyes them pink). Exercise caution when handling such seeds.

Sowing Seeds

Most growing media consists of perlite, vermiculite, peat, sand or any combination of these. Any media will work as long as it is sterilized.

Garden soil is not a good choice for sowing seeds indoors as it contains many fungal spores. While these fungi will not normally harm a mature plant, they can cause the dreaded seedling disease, damping-off. This fungal disease attacks the seedlings at the ground surface, causing them to collapse and die.

Unfortunately, even sterilized soil is not immune to this disease. Overwatering, overcrowding, poor light and poor air circulation can all lead to an outbreak of damping-off.

Individual pots, jiffy-pellets, flats or cell-packs may be used as containers when sowing seeds. With cell-packs, plants undergo the least root-shock when transplanted to the outside.

Prior to sowing, ensure that the growing media is thoroughly moistened. A heavy watering after sowing will dislodge most seeds, resulting in irregular germination. Very fine seeds need only be pressed into the surface. Larger seeds may be covered with soil to approximately three times the seed's width. Mist the surface of the seeds and/or soil layer over the seeds.

Care and Maintenance

One of the biggest problems with growing seed indoors is maintaining moisture. It is imperative that the seeds not dry out while they are germinating. To help guard against this, you can place a pane of glass over the pots or place the pots in sealed plastic bags. Either method will slow evaporation and keep the soil moist. Remember to remove the glass or plastic as soon as the seeds sprout.

Temperature is another important factor to keep in mind. Most seeds will germinate readily under normal household conditions, but some require very warm (25°C) temperature, while others germinate better under cooler (15°C) temperature. Other seeds may require pre-chilling prior to sowing. Most seed catalogues or seed packets will note which temperature is best for germinating a particular annual.

Light is the next critical factor. Some seeds require exposure to light if they are to germinate. Such seeds should not be covered with soil. On the other hand, other seeds require absolute darkness with exposure to light preventing their germination. For those seeds which require darkness, you can place newspapers over their pots to block the light. Be sure to remove the newspapers as soon as the seeds sprout.

Once the seeds germinate, they will require high light levels if they are to grow into sturdy plants. Too often the home gardener cannot supply sufficient light to keep plants healthy. In Newfoundland, our lack of sun in spring only worsens this problem. A way to overcome this problem is to grow plants under artificial light.

Another way to encourage sturdy plants is to grow them under cooler temperatures. Too much heat will result in soft, spindly growth. Another factor contributing to spindly growth is overcrowding. When seedlings are large enough to handle, make sure you thin them. Cell-packs make this easy since only one seedling is placed in each cell. In flats, make sure there is about 2 ½ inches between plant (or more if they are large-growing varieties).

If seedlings were sprouted in just vermiculite or perlite, they need to be planted in an organic soil mix once they are large enough to handle. This mixture could include one part peat, one part loam and one part perlite or you can buy pre-mixed planting soil.

Since the flats/cell-packs contain such a small volume of soil, the growing seedlings will quickly exhaust any nutrients dissolved in the growing media. The application of fertilizer can help compensate for this. A liquid fertilizer or water-soluble powder is the best. A balanced fertilizer, such as 20-20-20 is a good choice. Always follow manufacturer's instructions when fertilizing.

Transplanting

Before transplanting from your relatively warm growing area indoors to the cool and windy outdoors, you need to harden-off your plants. This process will gradually acclimatize your plants to the rigours of outdoor life.

Initially, expose your plants to a couple of hours of outdoor conditions. Avoid exposing them to full sun for the first couple of days. As the week progresses, gradually increase their exposure to outside light conditions, including more direct sun (remember to expose them slowly to full sun or their leaves will scorch).

When your plants are outside they will dry out very quickly, so be sure to check the moisture levels regularly. If the weather is dry, they may require daily watering.

When you are ready to transplant, make sure the plants are well watered. If your plants are growing together in a flat, the best way to separate them is to use a sharp knife and cut between each plant as you would cut a cake. The end result is each plant having its own block of soil. This method will cut

many roots, but new roots will quickly grow and help establish the new transplants. Plants in cell-packs need only be punched-out of the cells.

It is best to transplant on cool, cloudy days. *Never transplant on a hot, sunny day!* Remember to properly space the plants to ensure they spread to their full potential. Water well. The application of a transplant fertilizer may be beneficial at this stage.

Seeds That Require Light For Germination	Seeds That Require Dark For Germination
<ul style="list-style-type: none"> ● <i>Ageratum</i> ● <i>Coleus</i> ● <i>Impatiens</i> ● Livingstone daisy ● <i>Nicotiana</i> ● <i>Salvia</i> ● Shirley poppy ● Snapdragon ● Strawflower ● Sweet alyssum 	<ul style="list-style-type: none"> ● <i>Calendula</i> ● <i>Chrysanthemum</i> ● Cornflower ● Globe amaranth ● <i>Lavatera</i> ● Pansy/Viola ● <i>Phlox</i> (annual) ● <i>Salpiglossis</i> ● Sweet pea ● <i>Verbena</i>

Annuals which may be directly-sown outside in Newfoundland

- | | |
|---|---|
| <ul style="list-style-type: none"> ● Annual candytuft ● California poppy ● <i>Calendula</i> ● Cornflower ● Evening-scented stock | <ul style="list-style-type: none"> ● Nastursium ● <i>Nigella</i> ● Pansy/Viola ● Sweet alyssum ● Sweet pea |
|---|---|

Easiest “home grown from seed” annuals overall for Newfoundland

- | | |
|--|--|
| <ul style="list-style-type: none"> ● Annual candytuft ● California poppy ● <i>Calendula</i> ● Cornflower ● Evening-scented ● Stock | <ul style="list-style-type: none"> ● Marigold (French) ● Nastursium ● Pansy/Viola ● Snapdragon (dwarf) ● Sweet Alyssum ● Sweet Pea |
|--|--|

Appendix 3 Plant Propagation

Tim Walsh, Nursery Manager

Divide and Conquer (Propagation by Division)

One of the easiest and most common means of increasing many herbaceous perennials is by splitting or dividing into two or more individuals. Each new division consists of roots and shoots or a piece of a crown which will develop shoots.

Reason For Division

- the plant is getting too large
- the plant is becoming “burned-out” - dead in the centre, but healthy around the outside edges
- you want to plant a piece in a different part of your garden
- share with a friend

Cruel to be Kind

Division consists of digging up a plant with a sharp spade and/or fork, slicing or dividing the root ball into two or more pieces, then replanting in renewed soil.

Timing is Everything

The best time to divide plants is in early spring. The second best is early fall. Generally speaking you would divide spring blooming plants in the fall and summer, and fall blooming plants in the spring, however there are exceptions.

A New Lease on Life

When replanting the divisions, it is a good idea to amend the soil beforehand with compost, leaf mold, peat moss or well rotted manure. Space the pieces about 15 to 20 cm apart for smaller pieces, and a foot apart for larger pieces. A sprinkle of bone meal in the hole before planting will help establish new roots. Roots should be spread out as best as possible, not just poked in the hole in a tangle. Firm soil around the roots to avoid air pockets that can fill with water and cause root rot.

Points to Ponder

A common mistake is to make the divisions too big. In most cases, the best results come from smaller divisions with fewer stems. This gives the opportunity for newer shoots to develop out into fresh soil. Usually outer portions of the main clump are likely more vigorous than weaker inner parts.

Water Water Everywhere

Always water-in the transplants even in damp weather. The water will not only provide needed moisture to the disturbed root system but also help to settle the soil around the roots.



Making the Cut (Propagating by Cuttings)

Start them off Right

- Choose disease free material
- Make sure all tools and pots are sterile (sterilize tools and pots using a bleach solution of 15ml bleach per litre of water)
- Use a well drained, watered, sterilized soil mixture (1:1 Pro Mix[®] plus perlite)
- Use a very sharp blade to prepare cuttings

Making the Cut

- Collect cuttings from parent plants. Take cuttings a little longer than needed allowing for trimming later
- Prepare cuttings by making an angled cut just below a desired leaf node
- Stand prepared cuttings in water before sticking

Sticking it to 'em

- Remove cutting from water onto paper towel to tap-dry cut end
- Dip the cut end in rooting hormone (powder or gel)
- Using a pencil, make a hole in soil to insert the cutting
- Insert cutting deep enough so that at least one leaf node is in contact with the soil
- Firm soil around the cutting with pencil to remove any air pockets and ensure cutting is in good contact with soil
- After all cuttings are stuck, place pot inside a clear plastic bag and close using a twist-tie

The Waiting Game

- Place bag in high light but not direct sun with bottom heat if possible
- Check periodically to let in fresh air and check for water

All Grown Up

- After roots are visible in the bottom of the pot, remove pot from bag. Let cuttings develop furthermore until a good root mass has developed.
- Fertilize every two weeks using 10.52.10 water soluble fertilizer to help develop root system
- Separate each cutting and pot up into individual pots



Seed Savvy (Propagation by Seed)

Getting the Goods

- choose seed from a reputable company
- check that seed is fresh
- store seed dry and preferably in the dark until sowing time
- some seeds have a shorter life span. Be sure to sow before seed viability is lost

Starting Them Off Right

- be sure to use clean containers/pots/trays/flats (sterilize with bleach solution - 2 tbsp bleach per litre water)
- use sterile soil mix to prevent damping-off (a soil borne fungi which destroys young seedlings by attacking soft tissue)
- fill pots with soil mixture allowing room at top to cover seeds
- moisten mixture and allow it to drain
- sow seeds thinly on surface
- cover seed if necessary with soil/vermiculite/sand
- label
- cover with plastic/glass
- place in appropriate light requirements
- when germinating starts, remove cover



Leaving the Nest

- after germinating and when seeds have developed its first set of true leaves(the first set after the cotyledons, or seed leaves), it's time to transplant, (sometimes called prick out)
- again use sterilized container/pots/flats and reputable soil mix
- hold seedling by its leaves and loosen soil with fork - no fancy tool needed here!
- place new seedling in soil being careful to cover all roots
- label
- water using water soluble fertilizer high in phosphorus (10.52.10) to help establish root system. In 2-3 weeks, switch to balanced formula (20.20.20)
- place in high, but not hot, light

The Special Treatment

Some seeds need special treatment, for example:

- snapdragon seeds need 48 hours in freezer before sowing
- peas benefit from a soaking overnight before sowing
- seeds of some native plants need cool/moist period(stratification) in order to break dormancy
- lettuce needs light to germinate

Appendix 4

Plants for Attracting Wildlife to the Schoolyard

Todd Boland, Research Horticulturist

Natives/Naturalized

Common Name	Latin Name	Use
Alder	<i>Alnus species</i>	seeds for birds; butterfly host
Black Knapweed (F)	<i>Centaurea nigra</i>	nectar; butterfly host; seeds for birds
Chokecherry	<i>Prunus virginiana</i>	fruit for birds; butterfly host
Chuckley-pear (F)	<i>Amelanchier species</i>	fruit for birds; butterfly host
Dandelion (S)	<i>Taraxacum officinale</i>	nectar
Dogberry (F)	<i>Sorbus species</i>	fruit for birds; butterfly host
Fireweed (Su)	<i>Chamerion angustifolium</i>	nectar
Joe-pye Weed (Su)	<i>Eupatorium maculatum</i>	nectar
Lance-leaved Goldenrod (F)	<i>Euthamia graminifolia</i>	nectar
Meadowsweet (F)	<i>Spiraea alba</i>	nectar; butterfly host
New York Aster (F)	<i>Aster novi-belgii</i>	nectar
Ox-eye Daisy (Su)	<i>Leucanthemum vulgatum</i>	nectar
Pearly Everlasting (F)	<i>Anaphallis margaritacea</i>	nectar; butterfly host
Pin Cherry (F)	<i>Prunus pensylvanica</i>	fruit for birds; butterfly host
Pink Clover	<i>Trifolium pratense</i>	nectar; butterfly host
Purple-stemmed Aster (F)	<i>Aster puniceus</i>	nectar
Rough-stemmed Goldenrod (F)	<i>Solidago rugosa</i>	nectar
Scotch Lovage	<i>Ligusticum scoticum</i>	butterfly host
Sweet Rocket (S)	<i>Hesperis matronalis</i>	nectar
Tansy Ragwort (F)	<i>Senecio jacobaea</i>	nectar
Trembling Aspen	<i>Populus tremuloides</i>	butterfly host
Willow (S)	<i>Salix species</i>	butterfly host
Wintercress (S)	<i>Barbarea vulgaris</i>	nectar
Yarrow (F)	<i>Achillea millefolium</i>	nectar

(S) – spring blooming (May-June)

(Su) – summer blooming (July-August)

(F) – fall-blooming (September-October)

Ornamentals (Available at Nurseries)

Common Name	Latin Name	Use
Candytuft (S)	<i>Iberis sempervirens</i>	nectar
Chives (Su)	<i>Allium schoenoprasum</i>	nectar
Drumstick Primrose (S)	<i>Primula denticulata</i>	nectar
Fleabane (Su)	<i>Erigeron speciosus</i>	nectar
Garden Phlox (F)	<i>Phlox paniculata</i>	nectar
Gloriosa Daisy (F)	<i>Rudbeckia species</i>	nectar
Leopard's Bane (S)	<i>Doronicum species</i>	nectar
Masterwort (Su)	<i>Astrantia maxima</i>	nectar
New York Aster (F)	<i>Aster novi-belgii</i>	nectar
Pasqueflower (S)	<i>Pulsatiila vulgaris</i>	nectar
Perennial Cornflower (S)	<i>Centaurea montana</i>	nectar
Pinks (Su)	<i>Dianthus species</i>	nectar
Rock-cress (S)	<i>Arabis alpina</i>	nectar
Sea-holly (F)	<i>Eryngium planum</i>	nectar
Serviceberry (F)	<i>Amelanchier species</i>	butterfly host; fruit for birds
Shasta Daisy (S)	<i>Chrysanthemum maximum</i>	nectar
Showy Stonecrop (F)	<i>Sedum spectabile</i>	nectar
Spiked Speedwell (Su)	<i>Veronica spicata</i>	nectar
Spirea (Su-F)	<i>Spiraea cultivars</i>	nectar
Spring Heath (S)	<i>Erica carnea</i>	nectar
Willow (S)	<i>Salix species</i>	butterfly host; nectar

(S) – spring blooming (May-June)

(Su) – summer blooming (July-August)

(F) – fall-blooming (September-October)

Appendix 5

Fall is the Time of Year to Prepare the Garden for Spring

Carl White, Head Gardener

September

In September take care of deadheads on all perennials as they finish flowering by removing faded flowers. This will stop the plants from producing seed and the energy saved will go back into the roots and buds for next year. Cut and fertilize the lawn to encourage good root growth to help winter survival and provide for quick green up in the spring. Use 10-6-4 fertilizer at a rate of 7 kg per 100 sq. m (15lbs. per 1,000 sq. ft.)

October

In October lift and store tender corms and tubers of dahlias and gladiolus after the tops have been killed by frost. These should be lifted and left to dry on newspapers in a garage or basement for a couple of days. Brush the dried soil off and cut off any damaged parts with a sharp knife. Store in flats, covered with dry sawdust or wrapped in newspaper or hang in mesh bags. Place in a cool, dry, dark place that is not subjected to freezing.

Plant spring flowering bulbs. Bulbs should be planted in clumps rather than singly or in straight rows. Taller types can be planted at the back of a perennial bed. Use odd numbers in the clumps because, for some mysterious reason, bunches of three, five or seven look better and more natural than fours, sixes or eights. Dig a hole in a sunny spot large enough to accommodate the clump. Work a little bone meal into the soil and the bottom of the hole. Arrange the bulbs in the bottom of the hole and backfill with good soil. The planting depth depends on the size of the bulb. The best rule of thumb is to dig about twice their diameter.

Clean up perennial beds. If you have kept the garden deadheaded, you won't have much to do. There is no need to cut the stalks down to the ground. Leave them as they will catch the snow and help protect the crowns. Any fallen leaves or broken stalks can be collected and added to the compost pile. Any diseased or infested foliage should be removed and bagged for the garbage. The old stalks are more easily removed from the plants in the early spring. This will also give you something to do on those nice spring days when you want to be out in the garden.



The seed pods of a Chinese lantern add beautiful fall colour

November

In November water evergreens and broadleaf evergreens (like rhododendrons) well before freeze up. Even if it has been raining off and on, you should ensure that these plants have good moisture content as it is all they will get until spring thaw. Rake up leaves. This is a good way to make your own leaf mold. Make rows of leaves on the lawn, put a bag on your mower's discharge and run over the leaves until they are all shredded into the bag. This will help the decomposition process when you add them to your compost.

Hill up roses. Cover the plant with a pile of soil to about 7.5 cm above the graft union (that knotty thing on the main stem just above the roots). This will help protect the plant during the freeze-thaw cycle. Prune hybrid teas to 25 cm. Provide winter protection for shrubs.

Evergreens should be wrapped with burlap (not plastic) for some protection from drying winds. If they're in a sheltered area, then netting can be used to hold branches together as protection from heavy snow and sleet. Rhododendrons should be protected by tepees of stakes or little fences covered with burlap.

Large shrubs can have their branches tied to each other to help support the snow load. Burlap strips or old pantyhose works well for this. Trees and shrubs that are in locations that drift in or are in danger of having snow fall off the house should be given extra protection. Covering flowerbeds with evergreen boughs is a tradition in many Newfoundland gardens. Fir boughs are preferable, because spruce boughs lose their needles rapidly once they dry. The idea is to place them after the ground has frozen to keep the soil frozen until spring thaw. Large boughs can be stuck vertically in the ground to provide winter protection for plants like heathers and dwarf rhododendrons.



Gardens need extra care in the fall, but can still look pretty!

Appendix 6

Tips on Growing Rhododendrons in Newfoundland

Todd Boland, Research Horticulturist

Newfoundland is one of the few areas in Canada where rhododendrons can be successfully grown, with proper care and preparation. They are very versatile and can be used in a variety of ways in the garden.

Native Rhododendrons

Newfoundland and Labrador has four native rhododendron species; rhodora (*Rhododendron canadense*), lapland rosebay (*R. lapponicum*), Labrador tea (*R. groenlandicum*, formerly known as *Ledum groenlandicum*) and northern Labrador tea (*R. tomentosum* ssp. *subarcticum*, formerly known as *Ledum palustre*). Rhodora is common throughout most of the island, except on the Great Northern Peninsula. Labrador tea is province-wide but the lapland rosebay is limited to serpentine and limestone barrens of western Newfoundland, the Great Northern Peninsula, and Labrador. The northern Labrador tea is found only in northern Labrador. All of these shrubs put on a beautiful display each spring in our flower garden area. They are related to blueberries, partridgeberries, sheep laurel, heaths and heathers. These plants all belong to the heath family, called the Ericaceae and are commonly referred to as ericaceous shrubs.



Rhododendron lapponicum



Rhododendron canadense

Rhododendrons inhabit areas throughout the northern hemisphere, with most evergreen rhododendrons being native to northwest China while the deciduous azaleas are mostly from the eastern United States. However, some rhododendrons extend into the arctic-circle while others grow in the sub-tropical mountains of Indonesia.

Site Conditions

Rhododendrons and azaleas prefer a climate which is temperate in winter while being moist and relatively cool in summer. Many gardening books on rhododendrons will suggest planting them in light shade but in Newfoundland these shrubs flower most profusely when exposed to full sun for at least half a day.

It is important to locate your rhododendron in a sheltered location. If either rhododendrons or evergreen azaleas are exposed to strong winds, they will quickly die, especially in winter. The evergreen types are very susceptible to winter burn due to the cold, dry, desiccating winds of January and February. In early spring, strong winds (even if not too cold) together with strong sun can result in leaf scorch.

Therefore, western, north-western or northern exposures are poor locations for these shrubs unless they are surrounded by taller shrubs or trees. An eastern to southern exposure is ideal. Deciduous azaleas can better tolerate exposed locations, but even they benefit from at least some shelter.



Rhododendron 'Scarlet Wonder'

Soil Requirements

Generally, rhododendrons prefer an acidic soil which is rich in organic matter. In Newfoundland, most of our soils are naturally acidic. Books may suggest you add sulphur to the ground to help increase acidity, but this is not needed (or recommended) in Newfoundland. It is especially important not to add the soil acidifier aluminum sulphate (used to make hydrangea blossoms 'bluer'); it is toxic to rhododendrons.

The soil should retain moisture, yet be well-drained. Rhododendrons and azaleas will not tolerate dry conditions nor will they survive in water-logged areas. At the Botanical Garden, we use the following soil mixture:

- 2 parts peat
- 1 part loam
- 1 part leaf mold
- 1 part coarse sand

Old compost or manure is also beneficial.

Planting

It is always important to remember that rhododendrons and azaleas have a very small and very fragile root system. Rhododendrons are generally sold as container-grown plants. Make sure the root ball is moist before planting and do not remove the plant from its container until you are ready to place it in the ground.

The planting hole should be dug about 15 cm deeper and twice the diameter of the container in which the plant was grown.

If the plant is especially root-bound, gently pry apart the outer roots to help loosen them. If very pot-bound, then use a sharp knife and make three or four, 2-5 cm longitudinal wedges from the root ball. This may seem drastic but the severed roots will stimulate the production of new roots. If planted in the root-bound condition, the plants will be very slow to become established.

To plant, add about 15 cm of prepared soil into the planting hole. Then position the plant in the hole and backfill with prepared soil. The shrub should be at the same depth as it was in its container.

It is beneficial to place a 3-5 cm layer of leaf mold or old compost around the base of a newly planted or established shrub. This mulch will help to maintain soil moisture, keep the ground cool and keep weeds to a minimum.

Care and Maintenance

Keeping in mind that rhododendrons have shallow roots, surface cultivation around their roots is not recommended. However, replacing the mulch around their base each year is beneficial.

During most summers, extra watering will not be needed. However, if conditions remain dry for over a week a thorough watering would be advantageous.

Fertilizers may not be needed if your mulch is from compost or old manure. If the shrub does not seem to be thriving, the application of a specific rhododendron fertilizer, at manufacturer's recommended level, can be added in spring.

Pruning is generally not required unless you wish to remove a branch to help maintain the shape of the plant. If a plant is old and straggly, it can be cut back to within 1 - 2 feet of the ground. However, after such drastic pruning, several years may pass before they resume flowering.

Rhododendrons and azaleas produce flower buds in the summer prior to flowering. Thus, any pruning in summer or fall may result in the removal of next year's flowers. The only yearly pruning which needs to be practiced is the prompt removal of faded flower heads. Cut these faded trusses just above the uppermost leaf.



Rhododendron 'Bellefontaine' is a large hybrid bred in Nova Scotia

Winter Preparation

Unless your planting site is very sheltered, winter protection is a must. There are several ways to achieve this protection.

Dwarf rhododendrons or young plants can be protected by placing evergreen boughs around the plants. A teepee-fashion works well. In the Botanical Garden, we often use latticework as winter protection. This latticework is either placed in a teepee-fashion, or as a lean-to if plants are growing near the foundation of a building.

Larger plants can have a boxed framework built around them. This frame is then covered in burlap. **DO NOT USE PLASTIC.** The idea is not to warm the shrubs, but to protect them from excessive wind and sun. Do not tightly wrap shrubs in burlap, as is often done with other evergreens, such as yews or cedars. Rhododendrons do not appreciate being strangled in winter.

Such protection is not as necessary for deciduous azaleas. Winter burn and sun scald of leaves is not a problem. However, flower buds can be damaged by cold winds if plants are in an exposed location. Sheltering plants under burlap or boughs is recommended if exposure poses a potential problem.

Rhododendron Selections

Rhododendrons, as a genus, are divided into four main groups: the elepidotes (large leaves and flowers, 'standard' rhododendrons), the lepidotes (small-leaves and flowers, mostly dwarf evergreen types), deciduous azaleas and evergreen azaleas.

Within the groups, there are hundreds of species and/or hybrids. However, there are far more 'tender' varieties of rhododendrons than hardy ones. Generally, local nurseries only sell the hardier varieties.

Elepidote Selections

The best elepidote rhododendrons for our area are the so-called 'Iron-Clad' rhododendrons. They are selections developed from *Rhododendron catawbiense*, a species that is native to the mountains of the Appalachians in eastern USA. They are listed as hardy to zone 4b. Selections within this group include 'English Roseum', 'Roseum Elegans', 'Grandiflorum', 'Boursalt', 'Album' and 'Catalgla'. Other hardy hybrids which have performed well at the Botanical Garden include 'Nova Zembla' (red), 'Scarlet Wonder' (red), 'Firestorm' (dark red), 'Henry's Red' (bright red), 'Susan' (lilac-blue), 'Hong Kong' (lemon yellow), 'Grand Pre' (pink), 'Janet Blair' (light lavender-pink), 'Roslyn' (purple-violet), 'Golden Gala' (pale yellow), 'Vernus' (lavender-pink) and 'Wyandanch Pink' (dark pink).



R. 'English Roseum' (left) and 'Janet Blair' (right) are examples of elepidote rhododendrons

Recently there have been a number of Finnish hybrids which have become locally available. These are equally as hardy as the 'Iron-Clads' but are often more compact in habit. These include 'Mikkeli' (light pink), 'Elvira' (red), 'Helsinki University' (pink), 'Haaga' (light pink), 'Pohjola's Daughter' (white, flushed pink), 'Peter Tigerstedt' (white) and 'Hellikki' (violet-red).

A final group of hardy large-leaved rhododendrons are the 'Yak' hybrids, developed from the species *R. yakushimanum*. The species itself is very worthwhile, as the new foliage emerges covered in white to cream felt-like hairs (tomentum). These hairs eventually wear off but the undersides maintain a thick, dense, cream-coloured felt layer (indumentum). These features make this species and many of its hybrids valuable as foliage plants as well as for their flowers. Colour-wise, the 'Yak' hybrids are essentially white or shades of pink. The closely related species, *R. bureavii*, has even more spectacular foliage as the newly emerging leaves are covered in cinnamon-coloured tomentum and indumentum. Some hybrids to consider are 'Teddy Bear', 'Golfer', 'Mist Maiden', 'Fantastica', 'Yaku Angel' and 'Yaku Prince'.



Rhododendron yakushimanum has lovely flowers and foliage

Lepidote Selections

Most lepidotes are dwarf-sized plants but the one notable exception is the popular PJM series. These rhododendrons are among the earliest to bloom (mid-May) with small, somewhat rounded leaves and small trusses of purple flowers. Their leaves often turn shiny purple, maroon or reddish during the winter. There are several similar hybrids in the PJM series which differ primarily in floral colour. All are quite hardy for our area. And although the leaves and flowers are small, the plants themselves may reach 5 feet or more. Popular cultivars include 'P. J. Mezitt' (purple-pink), 'Aglo' (bright pink), 'Olga' (medium pink) and 'Thunder' (dark purple).



Rhododendron 'P.J. Mezitt' is a popular cultivar whose foliage turns purplish-brown in winter

There are some excellent rock garden rhododendrons among the lepidotes. *Rhododendron impeditum* is one of the lowest, with tiny blue-green leaves and tiny clusters of purple-blue flowers in mid-May. 'Ramapo' and 'Purple Gem' are a little bigger with purple-pink flowers. Other hybrids we grow at the Botanical Garden include 'Wren' (yellow), 'Patty Bee' (yellow), 'Tottenham' (bright pink), 'Jenny' (lavender-pink), 'Dora Amateis' (white), 'Isolla Bella' (cream, flushed pink), 'Madison Snow' (white) and 'Ginny Gee' (two-tone pink and white).



Rhododendron 'Ginny Gee' (left) and 'Patty Bee' are commonly available lepidotes

Deciduous Azaleas

The vast majority of deciduous azalea species are hardy in the St. John's area and many are hardy throughout the Island, with the exception of the Great Northern Peninsula. As a result, many hybrid azaleas are fine additions to our garden landscape. Since they lose their leaves in winter, the deciduous azaleas are generally more wind-tolerant than evergreen rhododendrons. They also have the added bonus of wonderful fall colour as the leaves turn red to wine-burgundy. Azaleas also offer brilliant yellow and orange shades that are not available in hardy evergreen rhododendrons.

Traditionally, the standard deciduous azaleas were either hybrids developed in Belgium (Ghent hybrids) or England (Knap Hill and Exbury hybrids). All of these are suitable for the St. John's area. Hybrids to consider include 'Narcissiflorum' (double yellow), 'Oxydol' (white, yellow blotch), 'Gibraltar' (orange), 'Fireball' (orange-red), 'Strawberry Ice' (pink), 'Cecile' (salmon-pink), 'Cannon's Double' (double, cream and pink) and 'Klondyke' (yellow-orange).



Rhododendron 'Narcissiflorum' (left) and 'Balzac' (right) are examples of deciduous azaleas

For colder areas of the Island (including the St. Anthony area), there are a group of very hardy azaleas which have been developed in Minnesota. There are collectively referred to as the 'Northern Lights' hybrids. They include the word 'lights' in the hybrid's names and include 'White Lights', 'Lemon Lights', 'Golden Lights', 'Spicy Lights', 'Mandarin Lights', 'Rosy Lights', 'Orchid Lights', 'Northern Hi-Lights' and 'Western Lights'.

Evergreen Azaleas

These azaleas can produce some of the most spectacular displays of any rhododendron, literally smothering themselves in blooms. Unfortunately, very few are hardy in our area. Essentially, we are restricted to hybrids developed from the hardiest species *R. kiusianum*. The only one likely to be available in local nurseries is 'Komo Kulshan'.

Appendix 7

Gardening in Raised Beds

Carl White, Head Gardener

At the Botanical Garden we grow all our vegetables in raised beds. A raised bed is a prepared area with a soil level that is higher than the surrounding soil. We love our raised beds and here are the reasons why:

Improved Soil Conditions

Compaction of the soil can reduce crop yields dramatically. Water, air and roots have trouble moving through soil that has been packed down by implements and human feet. You can avoid this problem by constructing beds that are 1.2 m (4 ft.) maximum in width and narrow enough so that you never have to walk on the soil. Raising the soil depth makes it easier to grow root crops such as carrots and beets. Raised beds are the answer for areas that have poorly drained soils. Building up the soil level allows plant roots to develop in soil above the soggy zone. The small area of a 1.2 m X 3 m (4 ft. x10 ft.) bed is easier to manage in regards to soil structure, nutrient- holding capacity and drainage.

Expanded Season

When the soil is elevated it dries more quickly and warms up faster. You can plant earlier in the spring and harvest later into the fall. In wet seasons, the soil will dry out faster, allowing for planting between rainfalls. Raised beds can increase soil temperatures by 4-6 °C over ground level soil temperatures.

Maintenance

Once constructed, raised beds are easier to prepare and care for during the growing season. With all your crops in their own little space you can manage the soil in each bed to suit each crop. Intensively planted raised beds provide dense foliage cover which shades out much of the weed growth. The narrow linear shape of the bed makes the use of row covers and plastic mulches easy. Slug traps can be placed on walkways to 'head 'em off at the pass' before they reach the beds.

Higher Yields

Better root growth from improved, deeper soils means more production per square foot of garden. Raised beds do not need the usual space between rows as no walking is done in the bed. Vegetables can be planted in raised beds at higher densities- hopefully spaced just far enough to not be crowded and close enough to shade out weeds.

Disadvantages

Like many other gardening techniques, raised beds have a couple of disadvantages. The close spacings can promote plant diseases by reducing air circulation and allowing plants to remain damp longer after rain or watering. Normally, with the amount of wind we have here, air circulation is not a problem. Another problem might be the watering requirements. Raised beds will dry out faster than in-ground beds. It is not uncommon for us to water the vegetable garden every day during hot sunny weather. Soaker hoses and mulches can cut down on the time and amount of water you use.

Construction and Layout

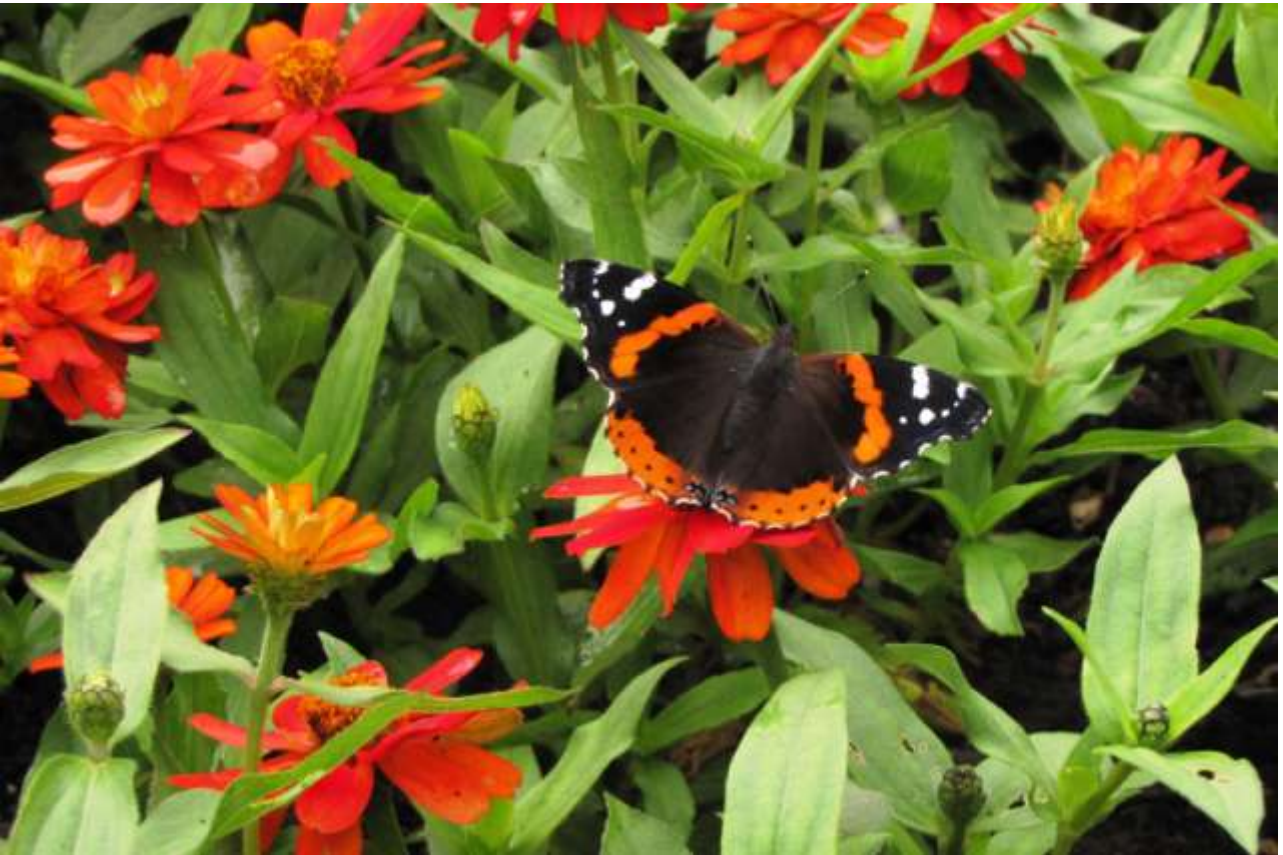
Our beds are constructed of 0.6 m X 3.65 m (2 ft. x12 ft.) planks, on edge. We have painted the outsides and left the insides untreated. We don't want nasty chemicals leaching into the soil to be taken up by our veggies. Avoid pressure-treated lumber and stay away from creosote coated beams. The life span of an untreated plank is 6-8 years, not bad considering all the advantages of this system. Layout follows general vegetable garden guidelines. Orient beds in north- south lines to take advantage of maximum sunlight. Plant taller crops on the eastern side to avoid shading lower crops.

One final note and my favourite reason for using raised beds. You don't have to bend over so far! Yes, one foot higher makes it a lot easier if you are doing it all day.



Raised vegetable beds at MUN Botanical Garden

Chapter 2



Red admiral butterfly

Attracting Butterflies to the School Yard

Chapter 2: Attracting Butterflies to the School Yard

Butterflies have always been encouraged at MUN Botanical Garden. Indeed, our first curator, Bernard S. Jackson, did extensive research on our native butterflies, including suitable nectar and host plants, management practices, conservation, and species identification. The abundance of butterflies residing at the Botanical Garden is proof that these management practices can work in any garden.

As a word of note: Schools often raise butterflies from chrysalides (cocoons) utilizing purchased kits. The Garden does not recommend using kits which use monarch butterflies because this butterfly is not native to Newfoundland and their caterpillars feed exclusively on a single group of plants called milkweed (*Asclepias* spp.), another species not native to the province. Monarchs also migrate in the fall to an overwintering site in Mexico. Newfoundland was never part of their innate migration route nor are these butterflies used to crossing large bodies of water. Painted lady butterflies have also been used for such projects. They are native to Newfoundland and therefore they would be a more suitable species for using in these projects.

Scientists now know that butterflies can benefit us by acting as an early warning system. Just like the canaries that used to be taken down the mines to warn of dangerous gases, or caddis flies in a trout stream, variations in butterfly populations can indicate subtle environmental changes in time for us to act on them. Also, like bees and certain other insects, butterflies play an important role by pollinating many economically important plants.

Some butterflies are considered nuisances. The caterpillars of cabbage white butterfly can do serious damage to crops such as cabbage, turnip and broccoli. European skipper caterpillars can damage hay crops. Both of these butterflies are native to Europe and are considered aliens in our area. None of our native butterflies cause serious damage to commercial crops and most do not feed upon on garden ornamentals, preferring instead, native or naturalized wildflowers. As adult, they will nectar upon wildflowers but will also partake our garden ornamentals.

Butterflies, like all animals, are vulnerable to environmental changes, especially those created by humans. There are, fortunately, many areas of unspoiled and reasonably unaltered natural countryside still to be found in Newfoundland and Labrador. However, even locally, there have been changes in several areas and some provincial habitats are threatened. The establishment of a wildlife friendly garden in the schoolyard is one way to help undo some of the damage.

Butterfly Life Cycle

In order to understand how to attract butterflies to your garden, you need to understand their life cycle. A butterfly undergoes complete metamorphosis as it grows. Its four stages of development are:

1. Egg (ova) – the eggs are usually laid on leaves of certain plants; sometimes they are laid in the soil or at the bottom of a host plant (i.e. wild grasses).
2. Caterpillar (larvae) – when the eggs hatch, the caterpillar often feasts on the leaves of the plant it was born on.
3. Chrysalis (pupae) – at this stage, the pupae should not be disturbed.
4. Adult butterfly (imago) – the adult butterfly will search for food (nectar) and a mate.



Short-tailed swallowtail is an uncommon and beautiful native butterfly species

Location and Management

Butterflies are cold-blooded creatures and are only active during warm weather. As the scales on their wings are easily damaged by rain (and handling by humans) they avoid wet weather. Sunny, warm days are the preferred weather conditions for butterflies. In the wildlife friendly garden, provide a location that is sunny and reasonably sheltered, as unlike bees, butterflies are not strong fliers.

Butterflies are dependent upon plants throughout their juvenile (caterpillar) stage as well as their adult stage. The plants (referred to as 'host' plants) fed upon as larvae may be completely different from the plant species the butterfly nectars upon as adults. Most books which discuss butterfly gardening concern themselves with planting flowers that will act as a nectar source for the adult butterflies. Less often do they provide information on host plants for their caterpillars. **Appendix 4** does list some plants that could be incorporated into the wildlife friendly schoolyard.

Adult butterflies are overall easier to accommodate than their larvae. Butterflies are attracted to a wide variety of plants. The main criteria is that the flowers need to be held relatively flat. Butterflies need a landing pad of sorts. Bees often approach a flower from the side and they will crawl into tubular flowers. Butterflies approach flowers from above and generally land as they feed. Daisies of all sorts provide the perfect landing pad. Garden phlox and pinks (*Dianthus* species) are also ideal. Dandelions are perhaps one of the most important 'spring' nectar plants for butterflies. Heath (*Erica carnea*) is also an excellent spring nectar plant. **Appendix 4** will provide a longer list of both native and ornamental plants that act as nectar plants for butterflies.



American painted lady butterflies can be quite common in some seasons

Rough Meadows and Other Butterfly Habitats

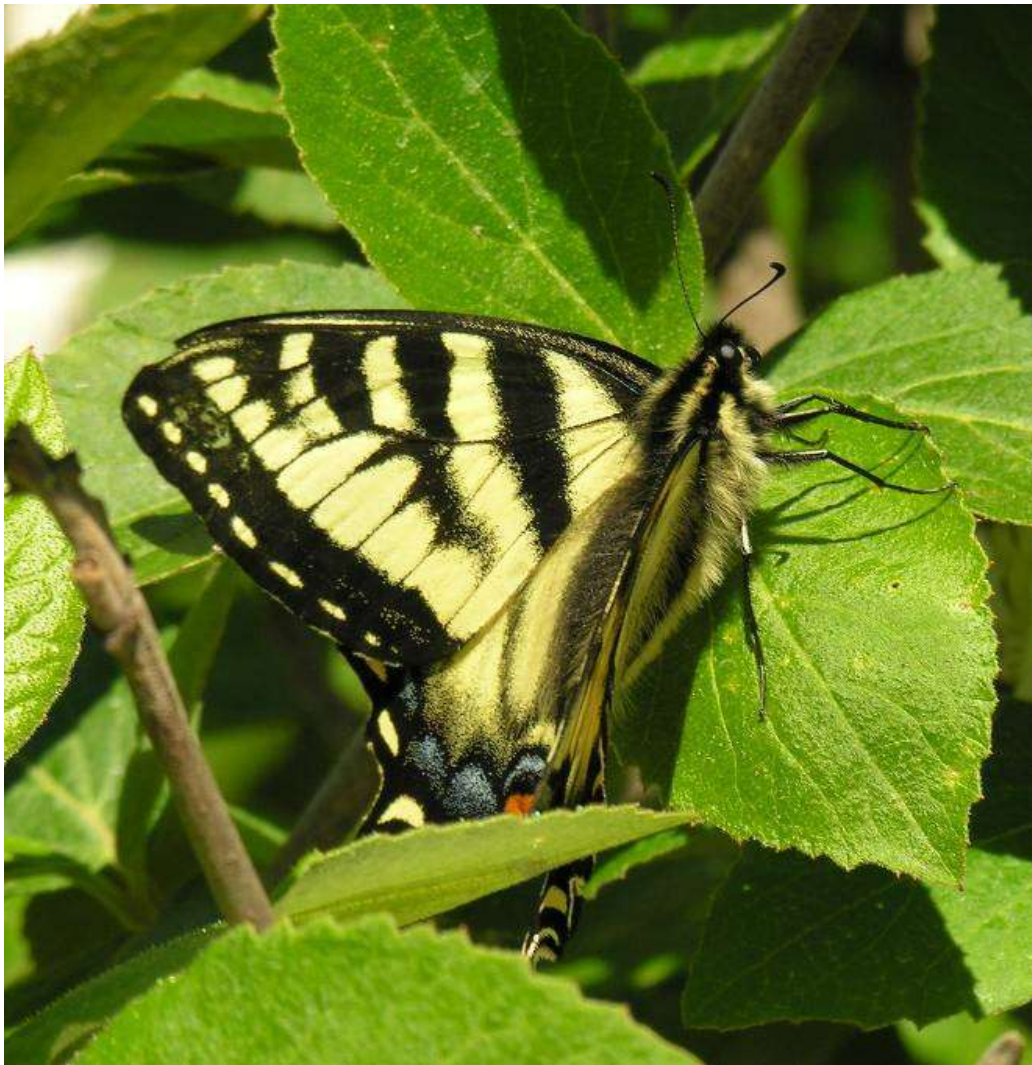
In addition to your flower beds, rough meadows provide habitat for a variety of nectaring insects, including butterflies. Rough meadows along roadsides, abandoned railways, scrublands and other waste areas, are often home to the greatest diversity of butterflies. Such areas are often populated by plants associated with sunny sites of mixed vegetation, including grass which has not been mowed. Adults feed from the blossoms and may lay eggs on any suitable host plants found in these areas.

If it does not already exist within the schoolyard, a small area of rough meadow would be worth creating. When you have collected the required plants or seeds to introduce, you need only to roughly disturb the surface in your chosen site and then go ahead and plant. The best times to plant the 'wild' meadow is early spring, before the plants have put on much growth, or later in the fall when they start to yellow. There is no need to fertilize or lime the meadows as our native or naturalized wildflowers are adapted to poor soils. Tall grass, which has not been mowed, is an excellent host plant for our little skipper butterflies and the seeds provide food for native birds.

Clumps of particularly useful plant life could be gathered from areas of the surrounding countryside that are being destroyed by road work, housing development, etc. and then transplanted onto the site. Remember that it is not considered ethical to rob native plant life from our countryside. Wild flower seeds could also be gathered and scattered over the area then lightly raked in. Generally speaking, here in Newfoundland such

areas are quickly colonized by a variety of useful ‘weeds’ suitable for sustaining the adult butterflies which would then leave you free to concentrate on the introduction of specific host plants if they did not appear naturally.

It is wise to stick to native plants if at all possible because native butterflies are adapted to such plants. Also, the intentional encouragement of alien species could cause problems for nearby farmers and may, in some instances, be illegal. In many areas of Canada, certainly here in Newfoundland, there are a number of alien ‘weeds’ that have been here so long and are so well established that it is difficult to think of them as anything other than native. The common dandelion and black knapweed are examples. A few native shrubs could be encouraged in certain patches of the meadows but take care not to create too much shade. Shrubs such as northern wild raisin (*Viburnum nudum ssp. cassinoides*), blueberry (*Vaccinium angustifolium*) and shrubby cinquefoil (*Potentilla fruticosa*) could be encouraged in the drier sites, whereas if there were any moist locations a few willows (*Salix* spp.) and mountain alder (*Alnus viridis ssp. crispa*) could also be planted. These shrubs are known host plants for the spring azure, tiger swallowtail, mourning cloak, green comma and the hummingbird hawkmoth.



Tiger swallowtail is among our more impressive butterflies

Damp areas are useful in butterfly management for they provide a suitable habitat for some useful butterfly vegetation. Caterpillar host plants such as willows (for mourning cloaks), alders (for green commas), violets (for fritillaries) and cranberry (for bog coppers), grow well in a moist environment. Some useful nectar sources, particularly the late summer flowering Joe-pye-weed (*Eupatorium maculatum*) grow well in a moist soil.

The natural edges of a deciduous and/or coniferous forest not only provide habitat for some butterfly species, but the trees can act as a wind-break for your garden. We have seen butterflies emerging from old stone walls and rock piles. This is why we left rock piles along the edge of some of the trails here in the Botanical Garden. Mourning cloaks, red admirals and Milbert's tortoise shells have been observed feeding on birch or willow sap here in the Botanical Garden. Mourning cloaks have also been seen feeding on the juice of dogberries (*Sorbus* sp). Red admirals have been attracted to bruised apples put out for them here at the Garden and a compost pile, located in a sunny, sheltered location, could indeed attract butterflies searching for food.

Wintering Sites

Butterflies that overwinter in the adult stage must do so in a place that offers protection from the inclement weather and from overwintering predators such as shrews, jays, etc. Examples include red admiral, green comma, Milbert's tortoiseshell and mourning cloak. Such butterflies usually spend the winter behind a piece of loose bark, inside a hollow tree and other natural recesses. An easy way to provide a winter site on the schoolyard is to construct a butterfly shelter. There have been butterfly shelters erected in several areas of the MUN Botanical Garden. Appendix 8 provides details on how to construct one.



Red admiral (left) and green comma (right) are butterflies that overwinter as adults

Appendix 8

The Log Pile as a Shelter for Butterflies

Bernard S. Jackson (Curator MUN Botanical Garden, 1971-1993)

Conventional stacks of sawed logs and pulpwood in forested areas, piles of lumber around rural sawmills, haphazard heaps of discarded timber adjacent to farms and homesteads – all provide sanctuary for a variety of small wildlife. Their potential as roosting and hibernation sites for certain species of butterflies, particularly members of the Nymphalidae, has been recognized for quite some time. Eighteen years ago, with this in mind and after witnessing the mourning cloak (*Nymphalis antiopa*), Milbert's tortoise shell (*N. milberti viola*), green comma (*Polygonia faunus*), and red admiral (*Vanessa atalanta*) utilizing such sites, I decided to erect similar structures at suitable locations throughout the Memorial University Botanical Garden, St. John's, Newfoundland. The use of log piles in wildlife management is not a new idea. However, all the piles I had seen were simply that – logs approximately six feet long stacked parallel on top of one another. This method offers a certain amount of cover but does not, in my opinion, take full advantage of the technique. I wanted to create as many dry, dark, secluded cavities as possible. Therefore, rather than just laying the logs lengthways on top of one another; I stacked them with each layer running in alternate directions.

You begin by making the bottom later as level as possible, with all pieces running the same way and three to twelve inches apart. Position the second row on top of the first, running in the opposite direction. Looking down on it you will get the impression of a series of squares. The third row should follow the direction of the first, the fourth the direction of the second and so on, until the stack is the height you want. Mine are approximately five feet high (the greater the diameter of the logs the fewer the number of cavities created). Before putting the last layer in place I cover the top of the pile with a layer of overlapping strips of roofing felt pinned down with large-headed roofing nails. This protects the cavities from rain and snow, yet allows good air circulation from the sides. I then put the final later of logs in position to stabilize the felt and offer some measure of camouflage. I have tried plastic sheeting in place of the more expensive roofing felt, but it tends to become brittle and disintegrate after a few years.

The correct placement of these shelters in the environment is important. Obviously, they must be situated where the butterflies will find them, so knowledge of local butterfly activity is necessary. I put mine on the edge zone of forest and rough ground grown up to grasses and forbs. I also placed them in sunny clearings among the deciduous scrub regenerating from a burned-out forest. Now I have some positioned away from the natural area of the Botanical Garden, quite close to the cultivated beds of nectar sources. I also have begun planting appropriate host plants against some of the woodpiles in the hope that final in star caterpillars will enter the cavities to pupate. In this way my efforts may benefit not only roosting or overwintering nymphalid adults but also their chrysalids and those of our short tailed swallowtail (*Papilio brevicauda*) and possibly tiger swallowtail (*P. glaucus canadensis*) as well. Also, by cultivating such host plants as stinging nettle (*Urtica dioica*), hops (*Humulus lupulus*) and garden lovage (*Levisticum officinale*) tucked in against the piles, a more natural, less obvious effect is created.

For some years I have been advising the use of these shelters both in Britain and North America, but I cannot say to what extent the idea has taken hold. Some sceptics may feel their value is debatable, and I must admit that I have never had the urge or inclination, especially in the depth of winter, to pull my log piles apart and record what I found. However, I have observed butterflies entering and exiting my log piles, and I do have sufficient confidence in their usefulness to have constructed many such structures throughout the Botanical Garden.

Such shelters are also of potential benefit to certain forms of wildlife other than butterflies. Many other insects, especially the bark and wood boring beetles, find a home there. Small mammals such as the meadow vole, red squirrel, snowshoe hare, and common chipmunk may utilize them as retreat cover, while insectivorous birds such as the winter wren may use them as foraging sites. The latter, if you are a butterfly enthusiast, is a doubtful blessing. I also wonder if some of the bats would find such shelters valuable.

Large piles, such as I have described, are possibly more appropriate to nature reserves, being somewhat overbearing in the average-sized urban or suburban garden. Nevertheless, it is possible that, on a smaller scale, they could prove a definite asset to the backyard butterfly gardener. Having witnessed Milbert's tortoiseshells emerging from dry stone walls, we have also built rock piles for the butterflies in our Botanical Garden. But that is another story.



Butterfly shelter at MUN Botanical Garden

Chapter 3



Black-capped chickadee on a seed bell

Attracting Birds to the School Yard

Chapter 3 – Attracting Birds to the School Yard

Birds that we can attract to our gardens, and hopefully schoolyards, fall into two main groups: the fruit-eaters and the seed-eaters. Fruit eating birds are primarily attracted to red berries. The best trees for attracting fruit-eating birds are dogberries (aka mountain-ash; *Sorbus* species). Dogberries are one of the most common trees in Newfoundland. Why is that? An old tradition in England was to plant a rowan (their name for dogberry) in your garden to keep the devil out. Perhaps early Newfoundlanders carried on that tradition. And of course, there is the story about dogberry production and the type of winter we can expect. To read more about this aspect of dogberries, please refer to **Appendix 9**, an article from *The Osprey* (Journal of the Newfoundland and Labrador Natural History Society). Hollies (*Ilex* species) and high-bush cranberry (*Viburnum trilobum*) are fruiting shrubs that also attract this group of birds.



American robin and Bohemian waxwing are the most common local birds that partake of winter berries

Far more of our over-wintering feathered friends are seed-eaters. Generally they feed on insects during the summer months, but from late fall through to early spring, they will readily avail of bird feeders. The placement of bird feeders around the school yard is perhaps one of the easiest ways to attract wildlife during the long winter months. Chickadees, nuthatches, finches, sparrows, grosbeaks, juncos, woodpeckers and blue jays are the main birds to utilize winter feeders. Please note, if you decide to feed birds, you must continue to do so throughout the winter. Birds will come to frequent an area based on food supply. If in mid-winter you should stop feeding the birds, they may well starve if they cannot find another nearby source of food.

There are many styles of bird feeders. Silo or tube feeders are fine for smaller birds but larger birds like grosbeaks and jays, prefer open tray feeders. Commercial suet blocks often incorporate bird seed, dried fruit or peanuts. This will be used primarily by chickadees, nuthatches and woodpeckers. Commercial nyger seed 'socks' will be attractive to American goldfinch, common redpoll and pine siskin. Regardless to the feeder being used, avoid metal as bird's feet can sometimes get stuck to it.



American goldfinch on a nyger sock and white-winged crossbill at a suet feeder

Not all seed is created equal. ‘Cheaper’ seed mixes contain a high proportion of cracked corn or milo seed, neither which is used much by our local birds. Millet and black-oil sunflower are by far the best. Of course, certain birds do prefer one type of seed over another. For more detailed information on our local overwintering birds and the seed sources they prefer, please refer to **Appendix 10** at the end of this chapter. On the off chance your school is located next to a pond where ducks frequent, avoid feeding them bread. It is simply empty calories. Cracked corn, barley, wheat or oats are far more nutritious. Ruffed grouse will also utilize various grains.

Birds should not be feed in a location that places them in danger from predators. The main predator around the city and suburban gardens to be on the watch for are cats, therefore suitable precautions for the birds’ safety should be arranged. The feeder may be placed in the open, making it more difficult for the cat to approach unseen.

If you live in or near a wooded area you may find red squirrels turning up in your feeder. These animals will eat the larger seeds but are particularly fond of peanuts. Though they are attractive, interesting creatures, they are great destroyers of birds’ nests. For this reason they are a doubtful blessing and should not be encouraged. There are commercially available squirrel-proof feeders. One possible way to discourage them is to invert a metal funnel on the stake that supports the feeder. This will prevent squirrels from climbing the support pole and if they jump upon the metal cone from above, they will slip off the slippery surface.

Your winter feeder should be cleaned on a regular basis. Each time you add seed, the old seed and chaff should be scraped out and discarded. Scrubbing the inside of the feeder with a mild bleach solution on a regular basis will greatly reduce the risk of disease outbreak amongst the flock. Wet or mouldy food should always be discarded.

A last note about bird requirements; they do need a supply of water. If there are natural streams in the area, the birds will visit those. Bird baths are an option as well but are only effective when not frozen. A small aquarium heater can be used to keep bird baths ice-free during the winter months.



Black-capped chickadee (left) and slate-coloured junco (right) are among the most common feeder birds



Dogberries (*Sorbus* sp) can provide an important winter food source for many birds. Throughout North America, most people refer to this tree or shrub as a mountain ash, while the British refer to it as a rowan tree. If anyone knows why we locally call it a dogberry, please let us know. To this day, it is a mystery.

Appendix 9

Why did so few dogberries appear on trees this year?

(An article from *The Osprey*, Winter 2011)

Todd Boland, Research Horticulturist

Dogberry production in 2010 was at an all-time low, yet 2009 saw a bumper crop. Why? The reason for the lack of dogberries this past year may be due to a number of factors. First, fruit trees often have a natural cycle of fruit production with a good year followed by a poor one. Dogberry production was at a maximum in 2009 so the plants may be taking a rest of sorts this year. Producing flowers and fruit is energetically 'expensive' on plants.

Another factor to take into consideration would be the type of growing season in the previous summer. Many fruit trees produce their flowering buds (or fruit spurs) during the previous summer. If the weather is particularly good during a given summer, then the plants can produce maximum flower buds for the next season. Based on this theory, the summer of 2008 must have been ideal for flower bud production, leading to a bumper crop in 2009. The summer of 2009 must have been less than ideal so the trees did not produce as many flowering buds for 2010.

Perhaps the most important factor affecting berry production is the weather while the trees are blooming. The flowers of fruit trees, dogberries included, are pollinated by insects. If the weather is cold and wet during the flowering season, the insects will not be particularly active, thus little pollination will occur. If the weather is sunny and warm, then the insects will be very active with plenty of flower visits. This will lead to maximum pollination and hence a good fruit crop.

Having said all this, I expect all of these factors have a play, and perhaps other factors of which I am not even aware. I noticed this past year that few dogberries even produced flowers. This would support the first two factors I suggested. Those trees that did produce a reasonable crop of blooms had less berry production than usual, and I know the weather this June was wetter and cooler than June of 2009. This would support my third suggested factor.

How about berry production in 2011? My prediction is that there will be plenty of flowers on the trees next June. So let's hope the weather is kind during the flowering season. If so, this coming summer could see lots of berries, which will make the robins and waxwings very happy in the fall and winter of 2011-12. Goodness knows, they have slim pickings this year!

Appendix 10

Suggested Foods for Local Birds

Suggested Foods for Some Local Birds

	Beef suet fat scraps	Peanuts	Broken dog biscuits	Small seed mixtures	Chopped fruit and vegetables	Sunflower seeds	Peanut butter	Cracked corn	Mixed table scraps
Junco	▪	▪		▪	▪	▪	▪	▪	▪
Chickadee	▪	▪	▪	▪	▪		▪	▪	▪
Flicker	▪			▪					
Woodpecker	▪	▪		▪	▪				
Brown Creeper	▪			▪					
Purple Finch	▪	▪					▪		
Starling	▪				▪			▪	▪
House Sparrow					▪	▪	▪	▪	▪
Other Sparrows							▪		
Evening Grosbeak		▪				▪			
American Robin	▪			▪					▪
Pine Siskin							▪		
Pigeon					▪	▪	▪	▪	
Blue Jay	▪	▪			▪	▪		▪	▪

WARNING

If you are feeding birds as a school or group project, please be aware that some peanut allergies can be life threatening. Peanuts and peanut butter should be avoided if anyone in your group has allergies. Also check to see if your seed mixture was processed in a peanut-free facility.

Appendix 11

Merlin Silhouette

The following page has a silhouette, as seen in most of the windows in the MUN Botanical Garden Field Centre, which resembles that of a Merlin (a type of falcon). It is representative of local birds that overtake and kill other birds.

In many instances, this silhouette has saved the lives of birds that possibly would have flown into the mirror-like window had they not sighted the predator.

To make your own Merlin silhouette photocopy the following 8.5x11" page onto an 11x17" page (or increase by 129%) to represent its true size.



Merlin silhouette in the window at MUN Botanical Garden

MUN Botanical Garden

MUN Botanical Garden

Chapter 4



Bumblebee on a blue lacecap hydrangea

Attracting Bees to the School Yard

Chapter 4 – Attracting Bees to the School Yard

Do you want to attract bees to the schoolyard? With the seeming increase in the number of people with **allergic** reactions to bee and wasp stings, the idea of attracting bees may be somewhat questionable. Unfortunately, a wildlife enhanced schoolyard will inadvertently attract bees and wasps, so this aspect must be kept in mind.

Contrary to popular belief, bees will not go out of their way to sting you. Considering the amount of time our staff has spent in gardens full of bees, there have only been a couple of incidence where stings have occurred and when they did, it was due to accidentally grabbing a stem of a plant that had a bee attached to it. Out of fright, the bee did what nature intended – protect itself. Wasps, on the other hand, can be a little more temperamental and will sting without seeming provocation but again, this is a defence mechanism and it means there is probably a wasp nest nearby.

Wasps and bees are among the most important pollinators for plants. Indeed, most of our standard fruit crops would not be possible without the activities of bees. Wasps not only pollinate, but also feed on troublesome insects like aphids. There are several types of bees in Newfoundland. Some are quite tiny and rarely even noticed, yet they are particularly important pollinators of blueberries and partridgeberries. Bumblebees, due to their size, are the most obvious. It is rare that you will encounter honeybees; they are not native to Newfoundland. However, there are a few beekeepers in the province, particularly in the St. John's area. Honeybees will travel miles in search of suitable flowers so if there are beehives in your community, honeybees could appear in your schoolyard.

Bees will visit a wide variety of flowers but they prefer tubular flowers, especially those that are pink, purple or blue shades. Bees see particularly well into the ultraviolet wavelengths. Pink to blue flowers literally glow in their vision. Examples of such flowers include foxglove (*Digitalis purpurea*), delphinium (*Delphinium* spp.) and lungwort (*Pulmonaria* spp.). Rhododendrons are among their favourite flowering shrubs. Bees will also frequent the various 'daisy' plants – asters, goldenrods, leopard's-bane, cosmos...even dandelions (perhaps especially dandelions!).

Not only do bees need food but they also need a home. While honey bees make a hive the native mason bee uses holes in wood to raise their young. At the Botanical Garden we have built a "bee condo" for them (picture to the right). The condo can be protected from predators by surrounding it with wire mesh. Bare soil will also be used by the native digger bee which burrows into the ground to make its nest.



A bee condo

Chapter 5



A bat house can be seen (to the left of the upper window)
on the chalet in the Wildlife Friendly Garden, at MUN Botanical Garden

Attracting Bats to the School Yard

Chapter 5 – Attracting Bats to the School Yard

Attracting bats to our school yards is not often thought about. After all, they are only around at night. However, bats are worthwhile to have around as, in Newfoundland, they feed primarily on mosquitoes, blackflies and moths. The primary bat in Newfoundland is the little brown bat.

The following information about little brown bats in Newfoundland was gleaned from a fact sheet developed by the Newfoundland Bat Awareness Team (MUN Botanical Garden was a part of this).

Introduction

There are almost 1000 species of bats in the world, making up nearly a quarter of all mammal species. Bats are mammals because they give birth to live offspring and nurse their young, but bats are the only mammals that can truly fly. Their wings are membranes of skin and their tiny bodies are covered with fur.

Many think that bats are blind when in fact they can see quite well. Their remarkable sense of hearing makes them incredible night hunters. When a bat hunts at night, it emits sound pulses. These sounds reflect off objects and return to the bat's ears as echoes. Listening to the echoes, bats can then detect the exact location of their favourite food – flying insects. This built-in sonar system, called 'echolocation', allows bats to navigate and feed in the dark.

Bats are good creatures to have around. They help farmers by eating insect pests in crops, thus reducing the need to use harmful pesticides that damage our environment. In the tropics, bats pollinate flowers and disperse seeds of many tropical plants. Therefore bats will help to preserve our rainforests and maintain the earth's endangered ecosystems.

Little Brown Bat General Description

The little brown bat (*Myotis lucifugus*) is the most common bat on the island of Newfoundland and the only species known to live in Labrador. It can be a challenge to locate, observe, identify and census bats because of their nocturnal and secretive nature. When you can find them, they are likely to be flying around, zigzagging and diving in the dark of the night.

The little brown bat's fur colour can range from pale tan to reddish or dark brown and its ears and wings are dark brown to black. The little brown bat is a mere 9 cm in length. An adult weighs only 8 grams and can crawl through an opening as small as 1 cm in diameter. Their wingspan is 22-27 cm. The wings are membranes of skin, supported by forearms and elongated fingers that have evolved to form the support structure. The wings extend down the sides of the body to the legs. Besides flying, bats use their wings for crawling, catching prey and grooming. Little brown bats also have a membrane between their hind legs which helps them to manoeuvre in flight and to scoop up insects. Pregnant females also catch their newborns in this membrane.

The hind legs are used for perching and climbing and have become adapted for hanging upside down using little muscular effort. The toes have strong claws that curve under to hook onto rough surfaces.

These bats often live for 10 years or more. The record is a 30 year old banded little brown bat. When captured, it did not show any signs of old age; it was not fragile, weak and did not show worn teeth.

Habitat

In Newfoundland, little brown bats are found virtually anywhere there are trees, buildings or caves. During the year the bats will use two different types of roosts (places to rest or sleep). In the summer they will roost in buildings or trees. In many parks bats can be seen around your campfires or street lights. In winter, the bats need to find frost-free places in which to hibernate, such as caves, mineshafts, cellars, tunnels or unoccupied buildings.

Food

Little brown bats feed on flying insects: moths, beetles, mosquitoes and flies. A single bat can catch 600 mosquitoes in just one hour! Bats hunt for about two hours after sunset and two more hours just before sunrise. Between hunts, the bats rest in roosts – often crevices- where they form tight clusters. During the summer months, the bats consume about half their body weight in insects each night. This enables them to put on the body fat needed to survive months of hibernation.

Behaviour

When the weather turns cold and insects are scarce, the little brown bat goes into hibernation. The bats need to find a place when the temperature will remain constant at approximately 10°C and where the humidity is 78% or more. The high humidity helps to prevent water loss from the body surface (dehydration), a serious problem when you go weeks without drinking.

The bats crawl into small crevices or hook their claws into ceilings. Then they hang upside down and go into a state of deep hibernation. While in this sleep, all body functions are affected; the heart rate slows to 20 beats per minute, respiration decreases and the body temperature drops to within one degree of the surrounding air temperature. The bats can now survive six to eight months on very little energy. Bats do wake from time to time to urinate, drink and mate. Uninterrupted sleep averages 12 to 19 days but can last up to 83 days. Moisture from cave walls and condensation droplets on their fur are the usual sources of water during hibernation. Bats will awaken if disturbed in winter and this can be detrimental. If you discover a bat hibernation location in winter, avoid disturbing them.

In Newfoundland, in early April, the pregnant females begin their spring migration to summer roosting sites where they establish maternity colonies. The males either roost alone or form small separate colonies by themselves. The gestation period is generally two months. They generally give birth to a single pup each year, in June or July. A pup may weigh as much as 30% of the mother's weight; that's like a 120 pound woman giving birth to a 36 pound infant! For the first three to four days of its life, the pup hangs onto its mother, even when she is searching for food. The young bats fly on their own in about three weeks.

Threats

Bats worldwide are under serious threat, primarily from human activities. Traditionally bats have roosted in trees and caves but they have adapted to living in buildings because fewer trees and caves are available to them. This puts them in direct contact with humans. People harass and kill bats out of fear and ignorance. Most fear of bats is based on myths, legends and superstition. They do not get tangled in your hair; our native bats do not bite and drink your blood; our native bats are not carriers of rabies.

For many years the MUNBG has been attracting bats by providing daytime roosting sites through the construction of bat houses. **Appendix 12** provides information on how you can construct your own bat house.

Loss of habitats and use of pesticides seriously reduces the food supply for bats, adding to their survival pressures. Bats are most active at night since they are generally safe from predators during that time. Owls are their main predator but cats, rats, weasels, mink and even squirrels, will enter a bat roost during the day and feed upon the bats.



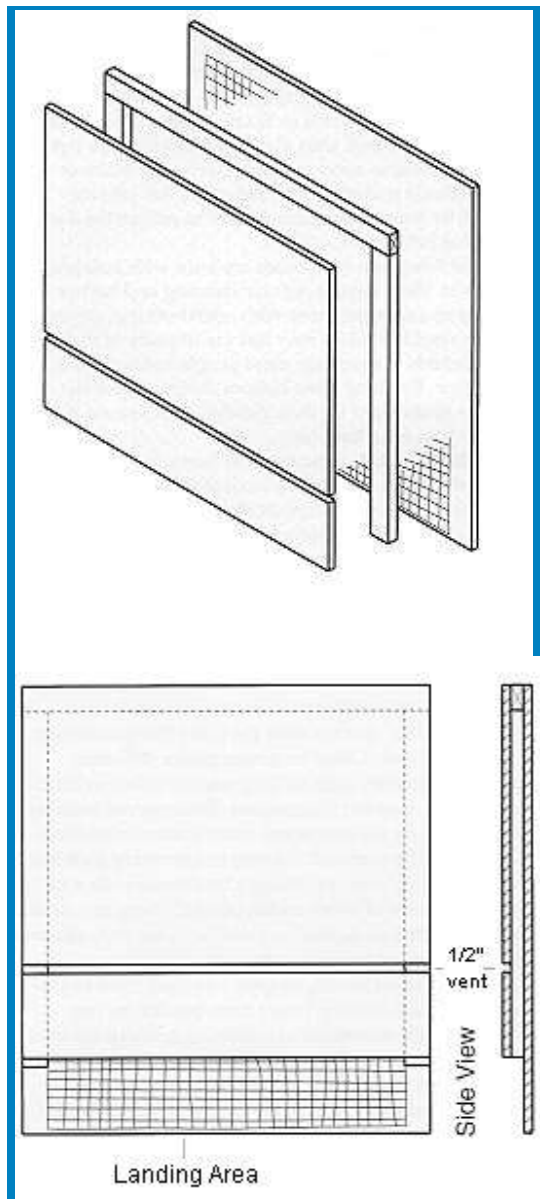
Little brown bat; photo by Bernard Jackson

Appendix 12

Bat House Plans

Provided with permission by Bat Conservation International
For more information on BCI, please visit, <http://www.batcon.org/>

SMALL ECONOMY BAT HOUSE



Materials Needed (makes 1)

- 1/4** sheet (2' x 4') 1/2" AC, BC, or T1-11 (outdoor grade) plywood. *DO NOT use pressure treated wood.*
- One** piece 1" x 2" (3/4" x 1 1/2" finished) x 8' pine (furring strip)
- 20-30** 1 1/4" coated deck or exterior-grade Phillips screws
- One** pint dark, water-based stain, exterior-grade
- One** pint water-based primer, exterior-grade
- One** quart flat water-based paint or stain, exterior-grade
- One** tube paintable latex caulk
- 1" x 3" x 28"** board for roof (optional, but highly recommended)
- Black** asphalt shingles or galvanized metal (optional)
- 6-10** 7/8" roofing nails (optional)

Recommended Tools

- Table saw or handsaw
- Caulking gun
- Variable speed reversing drill
- Paintbrushes
- Phillips bit for drill
- Tape measure or yardstick
- Scissors (optional)
- Staple gun (optional)

Construction Procedure

1. Measure and cut plywood into three pieces:
 - 26 1/2" x 24"
 - 16 1/2" x 24"
 - 5" x 24"

2. Roughen inside of backboard and landing area by cutting horizontal grooves with sharp object or saw. Space grooves about 1/2" apart, cutting 1/16" to 1/32" deep.

3. Apply two coats of dark, water-based stain to interior surfaces. Do not use paint, as it will fill grooves, making them unusable.
4. Measure and cut furring into one 24" and two 20 1/4" pieces.
5. Attach furring strips to back, caulking first. Start with 24" piece at top. Roosting chamber will be 3/4" wide (front to back).
6. Attach front to furring strips, top piece first (don't forget to caulk). Leave 1/2" vent space between top and bottom front pieces.
7. Caulk around all outside joints to further seal roosting chamber.
8. Attach a 1" x 3" x 28" board to the top as a roof, if desired (optional, but highly recommended).
9. Paint or stain exterior three times (use primer for first coat).
10. Cover roof with shingles or galvanized metal (optional).

Optional Modifications to the Small Economy Bat House

1. Wider bat houses can be built for larger colonies. Be sure to adjust dimensions for back and front pieces and ceiling strip. A 3/4" support spacer may be required in the center of the roosting chamber for bat houses over 24" wide to prevent warping.
2. Two bat houses can be placed back to back, mounted on poles. Before assembly, a horizontal 3/4" slot should be cut in the back of each house about 9" from the bottom edge of the back piece to permit movement of bats between houses. Two pieces of wood, 1" x 4" x 4 1/4", screwed horizontally to each side, will join the two boxes. To provide additional roosting space, leave a 3/4" space between the two houses, and roughen the wood surfaces or cover the back of each with plastic mesh. (Do not cover the rear exit slots; see item 4 below).
One 1" x 4" x 34" vertical piece attached to each side over the horizontal pieces blocks light, but allows bats and air to enter. A galvanized metal roof, covering both houses, protects the center roosting area from rain. Eaves should be about 3" in southern areas and about 1 1/2" in the north.
3. Ventilation may not be necessary in cold climates. In this case, the front should be a single piece 23" long. **Smaller bat houses like this one will be less successful in cool climates. However, those mounted on buildings gain heat faster, maintain thermal stability better and are more likely to attract bats.**
4. Durable plastic mesh can be substituted for roughening to provide footholds for bats. Attach one 20" x 24 1/2" piece to backboard after staining interior, but prior to assembly.

Chapter 6



A composter at MUN Botanical Garden

Composting

Chapter 6 – Composting

Three Cheers for Composting!

Welcome to the world of composting. When MUN Botanical Garden was created in 1971, our first challenge was soil, or the lack thereof. There was no soil located on site that could be utilized to build flower beds, plant trees or grow any plants. In fact, the existing soil was contaminated with lead, devoid of nutrients, compacted and in some locations, strewn with buried garbage. So, we composted. And we have been composting ever since, creating most of the soil we use in our flower gardens today.

As a centre for education and research, the Botanical Garden has also been teaching composting, not just to the home gardeners but to everyone, including school children. Our *Three Cheers for Composting* program is popular with children of all ages, especially in our Junior Naturalist Summer Camp program.

When building a school garden, it is essential to create a compost pile; not just to provide your garden with soil (which it will). In order to demonstrate principles of conservation and stewardship, it is important for students to perform hands-on activities which support conservation. By reducing the amount of organic matter being dumped in the landfill and reducing the amount of garbage we produce, students immediately recognize the value (and power) of taking action to create a change in their school and local community. It is also important for students to experience the seasonal cyclic changes in nature and gardening; of spring growth and winter die-back. Collecting and composting garden debris, just as everything in nature is composted, enables students to connect to this concept very clearly.

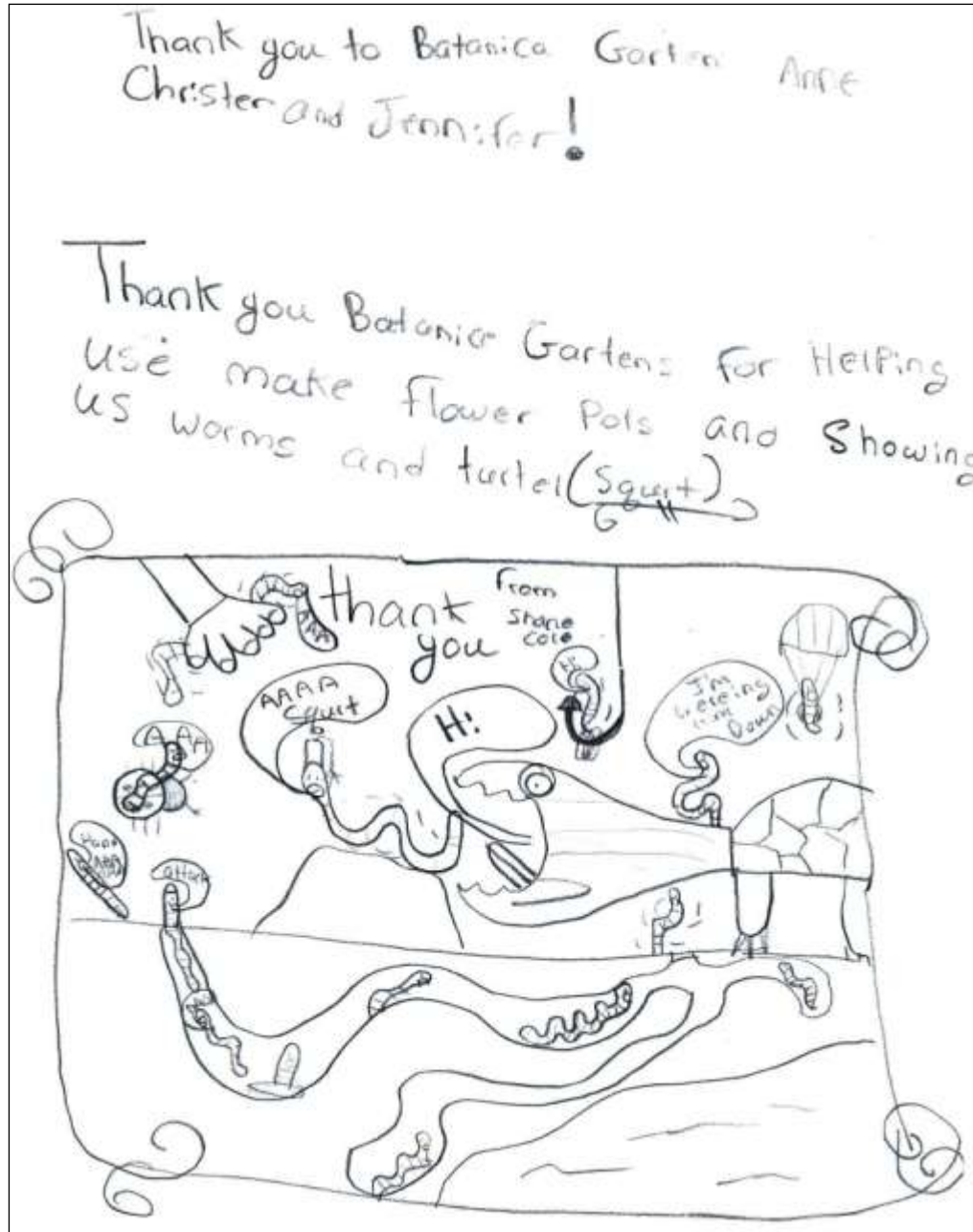
Composting can also happen throughout the entire school year. And it can happen right inside the school, in the teachers' lounge and in every classroom. Vermicomposting or composting with red wiggler worms, is happening right now in many classrooms in Newfoundland and Labrador. The worm bin is used cross-curricular, as a learning tool. More importantly, the students are welcoming the worms into their classroom; feeding them, caring for them, monitoring their habitats and happily sharing their lunch scraps with them. The students adopt these critters as pets. Over the years, artwork created by students about their worms has clearly demonstrated how these students feel about a creature normally ignored, reviled or stepped on in the school yard. Education staff at the Botanical Garden have also been surprised to hear reports from parents of summer camp participants that their children ask for healthier lunches, so they can also participate in the feeding and care of worms. In other words, worms can't eat chips and candy bars, so students don't want to either!

Most importantly, however, composting inside or outside the school is fun, once you get the hang of it. Your classroom worm bin will quickly become a source of discovery, delight, and hands-on fun. Stewardship happens naturally; and so does learning. When caring for worms, children are convinced they know one worm from the other, and will even name them. The reality is that the death of a worm will not cause the trauma often experienced with other classroom pets. One teacher attending our teacher training workshop explained to our group that her worms graduate with her class every year and the students proudly demonstrate to their new teacher how capable they are in worm care! Needless to say, this level of excitement and enthusiasm quickly spreads to their homes and the local community.

Perhaps one of the proudest moments ever witnessed in a school community was at the opening of a new school garden. While the garden itself was tiny, part of the ceremony involved several groups of primary and elementary school children carrying buckets of the rich organic compost (which their worms had created)

and dumping it into the beds. You could see they fully realized they were stewards of their garden. (And in case you are wondering, while this garden is located next to a street, no vandalism has occurred. It is respected and cared for by the local community).

Composting is a way in which people use the natural process of decay to produce a rich, fertile soil. Composting is also fun! Students will get to touch dirt, hold worms, build compost piles, set-up and explore worm bins, analyze what they've eaten for lunch, and plant seeds. While doing all of this, children learn a new appreciation of natural cycles and resources, and the importance of respecting our environment.



The worm's world through the eyes of a child, as a result of an educational outreach program which included vermicomposting

Appendix 13

Composting 101

Anne Madden, Education Coordinator

Nature: The Great Recycler

Nothing in nature is wasted or sent to a landfill. Nature recycles organic material (anything produced by a living organism) through a combination of biological and chemical processes. Microorganisms, insects, and worms help decompose (break down) dead plants and animals, returning nutrients to the earth so that other plants may grow. When we compost at home and work, we are utilizing these natural processes. The following series of leaflets have been created to show you how simply it can be done and steps to ensure your success.

Composting is Easy!

Composting your yard and kitchen waste doesn't have to be expensive or inconvenient. A compost bin can be as simple as a chicken-wire enclosure or a hole dug in the ground. Why not visit the compost demonstration garden here at MUN Botanical Garden to get some ideas for your own house or apartment.

The Benefits of Compost

Adding kitchen and garden wastes to a compost bin reduces the volume of garbage sent to landfills each year. Here in the province of Newfoundland and Labrador we are becoming increasingly aware of the problem of landfills running out of space, leaching pollutants to the surrounding environment, all the while costing towns and municipalities large tax revenues. A landfill is viewed as a blot on the landscape and few of us want to live next to one. Since almost 50% of our wastes are made of organic matter, which can be composted, everyone can play an active role in decreasing the size of our landfills.

Adding organic waste to a composter also enables us to return valuable organic matter back to the earth. When compost is added to soil, it can become a very useful and valuable source of nutrients. Here are some examples:

- Many areas of Newfoundland and Labrador have poor soil. Finished compost, when added to soil is a valuable source of nitrogen, potassium and phosphorus, as well as trace elements such as iron, manganese, copper, zinc and boron. These are all very important for plant growth. Purchasing fertilizers and soil can be expensive in our province. Composting is not.
- When organic matter is added to soil, as in the case of adding compost, it helps soils hold or retain water. This means you will not have to water your garden as much or as often. (Even during wet weather we often experience drying winds throughout our province).
- When you apply chemical fertilizers to your garden, the rain will sometimes wash them away. To re-apply is often a time consuming and expensive task. Compost helps bind or hold the nutrients in the soil. Not only do they not wash away, but the valuable nutrients are then available as needed, over the long term.

- When you mix compost with your soil, you loosen the soil and help increase the air spaces. The compost itself is in turn made up of a variety of particle sizes and a large number of microorganisms. Increased air spaces and a greater amount of microbes mean less compact soil, healthier plants, and easier growth for roots. Healthier plants in turn mean less diseases and greater resistance to pests. Better root growth not only helps your plants thrive, but enables it to withstand the effects of our winter 'freeze and thaw' weather, when plants can literally be pushed out of the ground if the roots are too shallow.
- Every season, compost created from deciduous leaves (called leaf mold) is mixed with peat and other soil amendments, and is spread across our flower beds at MUN Botanical Garden. Not only does this add much needed organic matter to our flower beds, the compost acts like a mulch, smothering emerging weeds and discouraging the growth of others.
- Adding compost to your garden soil also stretches the growing season both in spring and fall. This is important in our province during our short growing season. The darkened soil absorbs more heat from the sun. Soil rich in humus warms up faster in the spring and stays warm longer in the fall.
- Adding compost to your soil adds many beneficial microorganisms to your garden and creates an environment conducive to their growth.



Children love to get their hands in soil. There's no limit to the activities they can enjoy when composting and gardening.

Let's Compost!

The following is a list of items that can be composted. The smaller the item, the faster the compost process. Therefore, it is recommended that you try to shred, crush or cut items into smaller pieces if possible.

Kitchen Wastes:

Fruit peelings and scraps*
Vegetable peelings and scraps
Eggshells
Tea bags
Coffee grounds
Used paper coffee filters
Stale bread*
Cooked pasta (No sauce!)
Paper napkins, paper towels
Shredded paper / cardboard packaging

Yard Wastes:

Lawn clippings
Leaves
Plant debris
Old potting soil

Household Items:

Houseplant trimmings
Pet fur
Dryer lint
Hair
Shredded newspaper and cardboard
Vacuum bag contents
Wood ashes
Sawdust and wood shavings

A Word of Caution:

You may want to avoid composting some items marked by an asterisk* if you intend to use your bin in an educational setting, such as a classroom. Items such as bread can produce dangerous mould spores that can be inhaled by children or members of the public if they are investigating or studying your bin. This recommendation could also apply to parents of young children. Also, certain acidic fruits such as orange rinds may be slow to compost and fruit flies and mould could become a problem if the bin is opened regularly. At MUN Botanical Garden we avoid putting such items in our education composts. However, we do put them in a compost bin that is not available to the children.

Did You Know?

30 – 50% of household garbage is organic material that can be composted.

What NOT to Compost

While the following items will decompose, they can cause problems. To avoid pests and odours it is best NOT to add the following:

- Dairy products (milk, cream, yoghurt)
- Meat, cheese, fish, bones
- Fats (including grease, oil, lard, butter, margarine, or mayonnaise)
- Sauces that include any of the above
- Pet wastes

Also avoid adding:

- Large pieces of wood, thick branches, or heavy cardboard – these will take a long time to decompose and will take up space in your bin.
- Invasive weeds such as morning glory or gout weed
- Plastic, rubber, metals, glass and ceramics will not decompose.

Browns & Greens

Composting works faster and smells better when you add your compost materials in layers of "browns" and greens".

Browns are dry, absorbent and fibrous. They are also rich in the element carbon which is an essential energy source for the decomposing organisms in your pile. These include dry leaves and grass, straw, wood chips, sawdust, shredded paper, cardboard and egg cartons.

Greens are fresh, moist materials rich in nitrogen. Nitrogen is vital for growth and reproduction of the decomposing organisms. Without it, they cannot break down materials high in carbon. Greens include fresh grass clippings, plant trimmings, fruit and vegetable scraps, coffee grounds, tea bags, egg shells and houseplants.

The Compost Bin

When starting a compost project at home or work, the selection of a compost bin is an important decision. There are a large variety of bins to choose from, and your choice is up to you. However, there are other considerations, such as its location and size, which should be considered carefully before proceeding. Here are some tips to help your decisions.

Location of the Compost

In the province of Newfoundland and Labrador we often experience long winters, cool springs and cold, wet autumns. Therefore, to extend the compost season as long as possible, it is very important to position your bin in a sunny, sheltered spot. The warmer temperatures will encourage greater microbial activity, which will speed the compost process. A compost bin located in the shade will remain cool, lengthening the process.

While a sunny location is important, your bin should also be accessible and convenient to use. Many families keep a small waste collection bin near the kitchen door, and empty this once a week in the compost bin positioned further away. The choice is yours.

A well drained area is also essential. Many people find it more convenient to raise the bin slightly off the ground using pieces of wood or a pallet.

Size of the Compost

While the size of your bin is related to the amount of material you wish to compost, a popular compost bin size is approximately 30 inches (76 centimetres) wide by 30 inches deep by 30 inches high. When your compost bin is smaller, the pile does not tend to heat up or "cook" properly and a bigger pile may be harder for many people to manage.

However, if you plan to compost on a larger scale, you can adjust your bin size accordingly, or create more than one bin.

Type of Compost Containers

The type of container you use is a personal choice. It has been our experience at MUN Botanical Garden that the simplest model is usually the best choice. Depending on the location of your bin, you may decide on an attractive looking bin, or a purely functional one. Why not drop by the compost demonstration garden located outside the Friends' wildlife garden here at MUN Botanical Garden to get some ideas.

To Purchase or Build?

Many ready-to-use models are available for purchase from hardware and garden centers. At times the large variety can be confusing. It is best to select a type that fits your budget, keeping in mind that a compost bin does not have to be expensive. As long as it is sturdy, the correct size, and has a lid that will stay put, it should work. Some plastic bins may not be rodent-proof. If rodents are a problem, simply lining your bin with chicken wire can do the trick. Here are a sample of some of the many types of composts that can be used.

Converted Garbage Can

By simply puncturing holes in a metal or plastic garbage can, you can create a bin. You may want to cut out the bottom, add some wire mesh and raise it slightly off the ground using pieces of wood or a pallet.

Wire-mesh Container

You can build a bin by simply tying together 3-4 feet of wire mesh into a circle. You may wish to secure it to the ground to ensure it doesn't tip over. The advantage of this model is the excellent air flow and affordable price.

Wooden Pallet Container

This simple, cost-effective model also recycles wooden pallets, which are sometimes available for free from retail outlets. Simply position four pallets in an upright position, and tie together to form a square. You can add a pallet floor for stability.

Compost Pile

While definitely not wind or rodent proof, the simple compost pile costs nothing, requires no set-up and works well. Because it is considered by some to be unattractive, it may be better situated in an out-of-the-way location. Ideally, it should be in a sheltered spot to prevent the wind from blowing it away. For aesthetics, you may wish to limit this type of composting to leaves, grass and other yard waste.

Rotating Barrel

This type of bin can be purchased or made. It is rotated by simply turning a handle, making aeration and mixing an easy task. Education staff here at the Garden have noticed children (and adults) really enjoy using this composter.

Building Your Compost Pile

Once you have decided on an appropriate bin, locate it in a suitable area, and started collecting your compost items, you are ready to start piling it up. Keep in mind that there are three key ingredients in maintaining a compost bin. These ingredients are:

1. The right amount of "greens" and "browns"
2. The right amount of oxygen
3. The right amount of moisture

Browns & Greens

Composting works faster and smells better when you add your compost materials in layers of "browns" and "greens".

- Browns are dry, absorbent and fibrous. They are also rich in the element carbon which is an essential energy source for the decomposing organisms in your pile.
- Greens are fresh, moist materials rich in nitrogen. Nitrogen is vital for growth and reproduction of the decomposing organisms. Without it, they cannot break down materials high in carbon.

Browns

Dry Leaves
 Dry Grass
 Straw
 Wood chips
 Sawdust
 Shredded paper / cardboard / egg cartons
 Shredded newspaper

Greens

Fresh grass clippings
 Plant trimmings
 Fruit / vegetable scraps
 Houseplants
 Tea Bags
 Egg Shells
 Coffee Grounds

If you have too little nitrogen, the microbes cannot break down the carbon, and the composting process will slow down. Conversely, if there is too much nitrogen for the microbes to use, the nitrogen will be lost to the atmosphere as ammonia gas.

Oxygen

The microorganisms that do much of the work in your compost bin are living creatures. Like many living creatures, they require oxygen to survive. The process of creatures using air when they break down material is called aerobic decomposition. If not enough air is provided, organisms that do not require oxygen survive and the process of anaerobic (without oxygen) decomposition occurs. Not only is this process much slower, but bad odours are often produced.

Moisture

The microorganisms that do much of the decomposition work also need water to survive, as do all living creatures. If your compost pile is allowed to dry out, the microbes cannot work or survive. Conversely, too much moisture is also not recommended. If a compost is water-logged or too wet, all the air spaces fill with water, which promotes decomposition without air, which in turn slows the process and produces a bad odour.

As you can see, oxygen and moisture are linked when keeping a compost pile. Here are a few tips to help prevent problems:

- If possible, turn your compost regularly with a pitchfork to keep air circulating through the layers.
- Keep your pile as moist as a wrung-out sponge. You may have to water it during dry weather, and turn it if there's lots of rain.

When aerobic (using oxygen) microorganisms have sufficient browns, greens, air and moisture, they give off heat when they are active. Detecting an increase in temperature is a simple method to determine if your compost is working. While using a thermometer is more accurate, you can often detect the heat by simply feeling inside your compost. The heat has an added advantage. The combined heat of millions of microorganisms will speed the decomposition process. It can also make your compost hot enough to kill unwanted spores, seeds, and harmful bacteria.

Humus: Garden Gold!

The finished product of the composting process is sometimes called humus. It should be dark in color, crumbly in texture, with an earthy smell. Compost is considered mature humus when the biological process of decomposition has slowed. Most particles of waste should be completely broken down.

Using compost before it is ready is not recommended and can in fact harm your garden plants. When the organic matter is breaking down, microbe activity is still very high. These microbes will use up oxygen needed by plant roots to grow. Also, if the browns or carbon continue to break down, it will take important nitrogen from the soil, leaving the roots deficient in nitrogen.

Generally, with proper maintenance, you'll be able to collect your first batch of soil-enriching humus within a summer. With fewer turnings and without layering, the process may take up to two years. The time involved will vary greatly according to a number of factors. These are:

- The ratio of browns and greens (carbon and nitrogen)
- The amount of moisture
- The amount of oxygen
- The temperature of the compost pile
- The particle size of your waste

Gardeners who simply can't wait might consider having two bins, side by side – one for fresher material, and one to sit and "mature".

Using the Finished Product

Compost should not be considered a fertilizer in itself. Most fertilizers have higher levels of some elements than most compost. However, added to soil, compost does increase the organic matter or nutrients in the soil. Hence, it could be considered an excellent amendment or additive.

Winter Composting

The winter weather in Newfoundland and Labrador can start early in fall and last throughout spring. While the process of decomposition will slow down greatly or even stop when temperatures drop, you can continue adding waste to your compost pile throughout the winter. Even in mid-winter the large leaf piles at MUN Botanical Garden remain warm in the middle, indicating decomposition is occurring.

Here are some winter-composting tips:

- Position your compost bin in a sunny, wind-sheltered spot.
- Make sure your bin is accessible in the snowy weather.
- In the fall, remove finished compost and dig it into your flower and vegetable beds.
- Stockpile bags of leaves, and use them throughout the winter to layer with the "greens" as usual.
- Start a worm compost bin or vermicomposter inside your house. As long as you keep the worms warm, they will break down your kitchen waste for you throughout the year.

If you decide to stop composting in the winter, you can store your kitchen scraps in a covered bucket or garbage bin outside. When spring arrives, dig them into your heap and cover them with a layer of soil or dry leaves. Keep in mind that kitchen scraps are high in nitrogen and need to be mixed with lots of dry leaves, grass, paper or other "browns" in order to compost properly.

Vermicomposting: Composting with Worms

Worms can turn kitchen waste into a nutrient-rich soil conditioner called vermicompost. Vermicompost is a mixture of worm castings (droppings) and decomposed organic material. This small-scale form of composting is ideal for apartment-dwellers and those who lack space for an outdoor compost bin. Vermicomposting also extends the composting season, an important consideration in our northern climate. Worms kept indoors will continue to consume waste when outside compost piles are frozen.

What You Will Need

1. Container

The size of the container and the number of worms needed depends on the amount of waste added. Try to get a rough estimate of the amount of kitchen waste you produce in a week. A worm bin should be about a foot deep and provide one square foot of surface area per pound of waste.

Number of People	Quantity of worms	Bin size
1 or 2	1 lb	1 ft x 1.5 ft x 2 ft
2 or 3	1 lb	1 ft x 2ft x 2 ft
4 or 6	2 – 3 lb	1ft x 2ft x 3.5 ft

Plastic bins are suitable for a small number of worms but they may require drainage holes. Wooden boxes are more absorbent and provide better insulation.

Worms like a dark, moist environment. Cover your bin with a piece of moistened burlap sacking and a sturdy lid.

The location of your bin is important to the success of the project. A worm box makes an excellent addition to any kitchen, basement, laundry room, shed, or garage. Outdoor bins should have a lid and the worms need to be protected from extreme temperatures. Select a shady location and move them indoors when winter comes. We have noticed at MUN Botanical Garden that they do not like drafts or cold temperatures and will actually migrate from the bin if they are not comfortable. Worms are cold-blooded creatures which require some external heat to stay active. However, they should never be placed directly near a heat source.

2. Worms

Red wigglers (*Eisenia fetida* and *Lumbricus rubellus*) are the best worms for vermicomposting. They are much smaller and thinner than earthworms and they don't seem to mind being kept in captivity. Some people call them "redworms", "manure worms", "brandling worms", or "trouters".

The red wigglers used at MUN Botanical Garden were supplied by Trouters Special Worm Farm in Bay Bulls. They have been raising and selling worms and vermicomposting in Newfoundland for many years.

3. Bedding

Your worms will eat everything you put in the bin, including their bedding! Use a variety of materials to provide them with more nutrition. The following materials make an ideal bedding:

- Shredded newspaper
- Shredded cardboard
- Shredded fall leaves
- Chopped straw
- Dried grass clippings
- Peat moss

Fill you bin three-quarters full with damp bedding (not too wet!) and fluff it to create air spaces. You should wait for 48 hours before adding your worms in case the bedding mixture starts to heat up as it decomposes.

Add a couple of handfuls of sand or soil to provide your worms with grit for their digestive systems.

4. Food Waste

Feed your worms the same kitchen waste that you would add to your outside compost heap. Bury wastes and vary the location of each deposit to avoid overloading your bin. Finely chopped food will be broken down more quickly than large chunks. Do not add meat, fish, dairy products, or fats. Citrus fruit peels take a long time to break down so add them sparingly.

Harvesting Vermicompost

Red wigglers will convert waste into vermicompost within a few months. The compost is ready to be harvested when there's little original bedding left and the food scraps have been converted to brown and earthy-looking worm castings.

Move the finished compost to one side of the bin and place new bedding in the space created. Bury fresh food waste in the new bedding. Your worms will gradually migrate to the new food and fresh bedding, leaving the finished compost to be skimmed off.

Using Vermicompost

Sprinkle into a seed row when planting
 When transplanting, add a handful of vermicompost to the hole.
 Use as a top-dressing or mulch around the base of plants
 Mix half and half with potting soil for your houseplants.

Vermicompost Potting Mix Recipe

¼ part worm castings for nutrients
 ¼ part peat moss to help hold moisture
 ¼ part perlite to aerate the soil
 ¼ part sand or garden soil for bulk

Did You Know?

In addition to the worms, vermicompost contains other living creatures called microorganisms. They are organisms such as bacteria and fungi that are too small to see without a microscope. There are over ten million microorganisms in each gram of compost! These microbes are very important to the compost process.

Common Questions...

Will it smell?

Not if air can circulate through the layers.

- Drill holes in plastic bins and line with mesh
- Raise the bin above the floor
- Choose bedding that will not mat down (newspaper tends to get soggy)
- Turn the bedding every two weeks
- It is best to compost only recommended wastes. Dairy products, fats, and meats can cause unpleasant odours.

How can I avoid fruit flies?

Fruit flies can become a problem if a high amount of fruit waste is put in the compost. The problem may be compounded if the lid is opened quite frequently as in a classroom setting. The following procedures may prevent this problem:

- Bury all food waste
- Avoid adding too much slow-decomposing fruit waste like citrus peel
- Don't overload your bin
- Keep the surface of the compost covered with a piece of burlap and a lid.

To Solve a Fruit Fly Problem:

- Place a flypaper coil next to the box or spray the surface with a fine mist of Safers soap every second day for one week.
- Try a fruit fly trap: Cut a plastic pop bottle in half and fill the bottom with an inch of vinegar. Fit the top of the bottle upside down into the bottom so that the neck is just above the vinegar.

Did You Know?

A red wiggler can consume its weight in organic material every day!

Compost versus Fertilizer

Plants need water, sunlight, and nutrients to grow. Three important nutrients are nitrogen (N), phosphorous (P), and potassium (K).

Nitrogen (N) is used to make protein and chlorophyll by the plant. It is important for good leaf development and vegetative growth. Too little nitrogen causes slow, spindly growth. Leaves may turn yellow due to lack of chlorophyll – the green pigment which helps plants make food.

Phosphorous (P) is vital for the growth of root and stem systems. When little of this nutrient is present in the soil, seedlings may not become well established.

Potassium (K) plays an important role in the plant's metabolism. It is involved in resistance to chill, drought, and disease. Lack of potassium may result in brown, scorched patches on leaves. Leaves may also roll inwards or downwards.

Compost also provides nutrients, but usually at lower concentrations than chemical fertilizers.

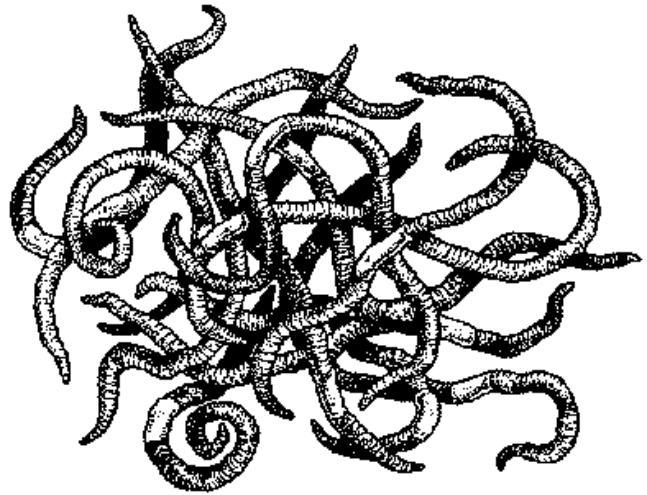
Compost does, however, release nutrients to plants over the long-term, whereas chemical fertilizers are a short-term solution and must be reapplied regularly over the growing season. Extensive use of chemical fertilizers has also been linked to environmental degradation. Excess fertilizer can leach out during rain and end up in local rivers and ponds. Fertilization does not replace the value of soil improvement, which involves adding organic material.

Worms: A Gardener's Best Friends

Worms dig tunnels which allow air and water to penetrate the soil and improve root development. They are also living miniature compost factories! During digestion they secrete chemicals which free nutrients necessary for plant growth. Worm castings (or droppings) contain five to eleven times more available nitrogen, phosphorous, and potassium than the soil they ate to make the castings.

A Word about Good Worm Stewardship...

By removing worms from their natural habitat, you're taking responsibility for their care and well-being. Worms, like any creature kept in captivity, will die if neglected. Before starting your vermicomposting project, please ensure that everyone involved is ready to be a good worm steward!



The Biology of Worms:

Worms can live up to about a year in a worm bin. Because the worm's body is about 90 percent water, if a worm dies in the worm bin, it will shrivel up and become part of the compost rather quickly.

Worms are hermaphrodites, which means they are both male and female at the same time. However, worms still need to mate. Two worms attach to each other for a few minutes, and several days later, both produce a cocoon or egg case. The cocoon eventually separates from the worm. Inside the cocoon, two to five baby worms may be found. The baby worms live in the egg case for at least three weeks, sometimes longer depending on the surrounding conditions. In the winter time, for example, baby worms may stay in the cocoon for many weeks until the temperature warms up again. When the baby worms eventually crawl out, they are the thickness of a piece of thread and about 1 centimetre long. Usually the worm appears white, as they have not yet developed enough blood (pigmentation) to be seen. In two or three months, worms are mature.

True or False?

- Worms breathe through their skin? True
- Cutting a worm in half will make two worms (Cutting a worm in two will eventually kill it.) False
- Red wigglers can eat their weight in food every day True
- Worms have teeth False
- Worms are blind True
(Worms don't have eyes and so they cannot see. They are, however, sensitive to bright light – that's why they burrow into the earth.)

Worm Facts:

- **How long does a worm live?**

In the wild, most worms live for a year. Worms must survive cold weather, droughts, and predators. In captivity, some worms have lived for as long as four and a half years!

- **What does the early bird have in common with the worm?**

Both birds and worms have a muscular gizzard which contains small particles of grit. When the muscles of the gizzard contract, these hard particles help grind food into smaller bits, which are easier to digest. Worms in captivity need to be provided with a handful of sand or grit to help them digest your kitchen waste.

- **Have you ever wondered why worms are slimy?**

Worms need air to survive, but unlike people, they don't have lungs. Instead they breathe through their skin! Oxygen enters their bodies by dissolving in the moist layer that covers them. If a worm dries out, it can't breathe.

Did You Know?

The longest worm on record was found in South Africa and measured 6.7 meters (22 feet) in length!

A Note To Educators:

Bookings are accepted from schools, youth groups, families and community organizations to visit the Garden and receive one of many garden and nature programs available, including the Three Cheers for Composting program.

For more information please check our website at: www.mun.ca/botgarden

Chapter 7



Materials used to make recycled flowerpots

Activities and Resources

Chapter 7 – Activities and Resources

From Garden to Classroom Outreach Program Activities and Resources

From Garden to Classroom outreach program incorporates environmental stewardship practices which have been promoted and used at MUN Botanical Garden since its inception in 1971. The Garden's education programs are the basis for many of these outreach activities.

We hope the *From Garden to Classroom* outreach program will provide a unique opportunity to engage young people in hands-on activities, which may encourage proactive attitudes and behaviours in areas of environmental protection, conservation and enhancement.

These hands-on activities are curriculum-designed; while all programs supplement the science curriculum, we encourage teachers to make connections to other subject areas.

Feedback, stories and suggestions are always welcome and are an integral part of the development of this education program. Comments may be forwarded to Anne Madden, education coordinator, MUN Botanical Garden, amadden@mun.ca.

PlantWatch Resource kits are now available from MUN Botanical Garden for teachers and students across Newfoundland and Labrador. Each kit includes information about the national PlantWatch program, lesson plans and activities to enhance the learning experience, plant identification cards and a classroom poster. While the PlantWatch program has its basis in the sciences, connections have also been made with Social Studies, Language Arts, Math, Technology and Art curricula. If you would like to participate in the program and receive a class kit, please contact Madonna Bishop, PlantWatch Newfoundland and Labrador coordinator at the MUN Botanical Garden 864-3328 or mbishop@mun.ca.

Additional activities and resources will be posted online, modified and updated throughout this year (2011). Educators are encouraged to use these resources as they undergo this modification process. Because input from educators is an integral component of this development process, participants are encouraged to provide feedback.

Outreach Education Program is offered by MUN Botanical Garden
This program is supported by the Natural Sciences and Engineering Research Council (NSERC)
PromoScience Funding Program.

Recycled Flowerpots

If you grow plants from seed, you always need more pots. Making flower pots out of newspaper is a simple and inexpensive way to make starter pots while also reusing newspapers. You can also use the pots to transplant seedlings started elsewhere.

You will need:

- Old newspapers
- Masking tape
- Small empty container such as a plastic juice or water bottle. A pop or soup can may also be used, but be careful of sharp edges.



What to do:

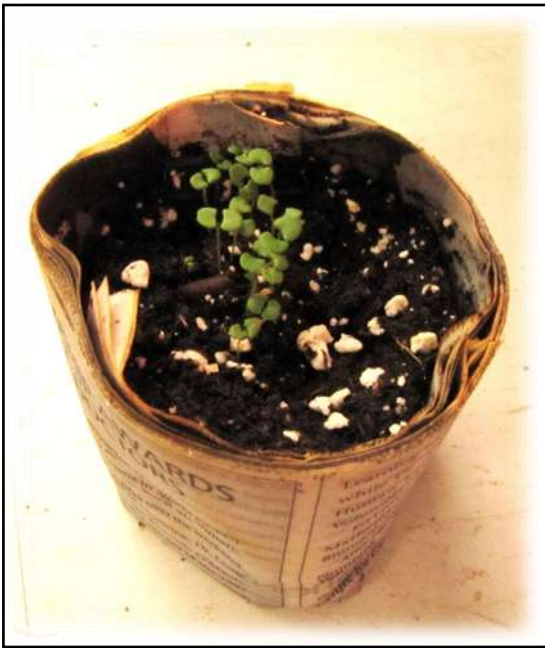
1. Fold a sheet of newspaper lengthwise so it is 8-10 cm (3-4 in.) wide. (Fig. 1)
2. Roll the newspaper around the bottle so that you have a cylinder. (Fig. 2)
3. Tape the edges of the newspaper together.
4. Using the bottle to hold the paper's shape, fold in one end of the cylinder down to make the bottom of the pot. Tape securely.



Figure 1



Figure 2



Notes:

We have been doing this activity with adults and children at MUN Botanical Garden for over twenty years. You can be creative and make larger pots; be sure to reinforce the larger pot with extra layers of newspaper. We find the smaller pots are easier for children to handle.

These little pots can be used to start a variety of seeds. When the seedlings are big enough to be transplanted, you can simply take the masking tape off and gently peel away the paper.

The pots do dry out more quickly than plastic pots, so keep an eye on your seedlings.



Your Feedback is Welcome:

"From Garden to Classroom" outreach program incorporates environmental stewardship practices which have been promoted and used at MUN Botanical Garden since its inception in 1971. The Garden's education programs are the basis for many of these outreach activities. We hope the "From Garden to Classroom" outreach program will provide a unique opportunity to engage young people in hands-on activities, which may encourage proactive attitudes and behaviours in areas of environmental protection, conservation and enhancement. The hands-on activities are curriculum-designed: while all programs supplement the science curriculum, we encourage teachers to make connections to other subject areas.

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From Garden to Classroom



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Budding Botanists

Anne Madden, Education Coordinator

Introduction

MUN Botanical Garden is committed to providing research and education which supports the conservation of plant diversity and its sustainable use. Integral to the research and education is a knowledge, understanding, and concern for plants, their habitats, and the threats they face. Yet it is evident that as our world becomes more modern, our relationship with the plant world weakens. Within communities around the world, local skills and knowledge of plant lore, including its uses, properties, and even basic identification are all but disappearing.



This fact is alarming, considering that the implementation of biodiversity conservation and sustainability depends upon an informed, concerned community of citizens promoting these principles. How many of us think of plants when we eat? Yet all the food we eat, directly or indirectly is derived from plants. Our air, medicine, clothing, and building materials depend on plants. Today, more than ever, our leisure and recreation is linked to our natural environment. Simply put, will the children of today grow up to be a generation of policy makers and decision-makers that neither know nor care about our environment? Will they be unaware of the link between human survival and sustainable development?

Unfortunately, the answer could be yes unless our attitudes on plant education change drastically. While it is acknowledged that the need for change starts in the classroom, what steps have been taken to effectively enhance and increase botany in the curriculum? More importantly are teachers, particularly early childhood, primary and elementary, adequately trained in this field of science? Feedback from teachers, youth group leaders and even parents indicate that they are not. School administrators are already faced with such overwhelming concerns as decaying infrastructures, teacher shortages, overcrowding and loss of music and art programs. Plant education is just not a priority.

As educators, what can we do? Start with the basics. Utilize an activity that can teach us, the teachers, and open the eyes of many students, from pre-school onward. The following activity has been a mainstay of the Botanical Garden's education program for almost 40 years. It is easy, simple, inexpensive and can use materials recycled from home, work or school. While using this activity in the classroom may not make a budding botanist out of every student, it will certainly be a good first step in creating a generation of conservationists.

BUDDING BOTANIST ACTIVITY: Springing Into Leaf (&/or Flower)

Materials:

- A pair of sharp hand pruners or secateurs
- Jars or containers of various sizes
- I also highly recommend obtaining a copy of *Native Trees and Shrubs of Newfoundland and Labrador*, by A. Glen Ryan

Procedure:

Cut some small branches or twigs from a tree or shrub. Put a wet rag or paper towel around the end until you get it into water. Simply re-trim the twig edge if it dries out. If possible, make a note of where you found the plant, its height, width and general characteristics (i.e. drooping stems, bright red branches, etc.). A photograph of the entire plant will enhance the classroom follow-up.

In The Classroom:

Place the branches in a jar filled with room-temperature water. Place the jar near a window if possible. Check the water levels daily. If the water gets sour, wash the jar with hot, soapy water, rinse well and add the water and plant again. It's that simple! Observe what happens daily.

Some Advice on Collecting Plant Materials:

When cutting a branch from a tree or shrub, it is important to minimize damage to the plant. Using sharp hand-pruners, remove branches to their points of origin or attachment. When you prune the branch back to another branch, or prune a branch from the trunk, you are thinning. This can actually encourage growth throughout the tree and can help with better air circulation, improved sunlight penetration, and less wind resistance. Never remove several branches from a single plant (unless you are an experienced pruner). If the plant is young and/or it is the only one of its kind in an area, I usually leave it alone. Also, do not try to cut large branches. Smaller twigs are easier to handle and their removal will cause less damage to the plant. Never twist or snap off the branch, as this will also damage the tree.

Plants should never be tampered with in any parks, nature reserves, public gardens, or private property without prior permission. Let your friends, neighbours and co-workers know you will accept donations. When collecting plants, sketches or photographs of the original plant can enhance the learning later on in the classroom.

What Is Happening?

The students will see some cone-shaped knobs or buds sitting at the tip of each branch (the terminal buds) and sometimes along the sides of the branches (lateral buds). Explain to the students that these contain "spring", or this season's leaves and stems and sometimes flowers. They were actually formed on the tree in the fall.

Have the students look closely under the bud. You should see a leaf-scar, or mark left when the leaf fell off last fall. Buds and leaf scars vary from plant to plant and can help you identify the plant, even before the flowers and leaves emerge. This bud-opening process is something magical that happens on tree and shrub limbs every spring. Each day, re-examine the twigs. Over time, the buds which are usually small and dark, will swell, turn green and open to reveal an emerging leaf or flower. Continue to make observations, measure and record results. Don't forget to stand back and admire "spring" as it blooms in your classroom. Ask the students to express how it makes them feel – verbally, through poetry, drawings, etc.

Let The Fun Begin!

Let the children spend time every day examining each branch. Encourage touching, smelling, sketching, measuring, tabulating and graphing the data. Digital photos are a wonderful way to record the changes. Magnifiers make it even more interesting.

At first glance the description of one twig will match the description of another (i.e. brown, woody, etc.). As they look closer and start making comparisons, their observational skills will greatly improve. Do plants and animals depend on each other? Find out by placing a white sheet of paper under the jar to see if your branch had any hitchhikers (you may see tiny dark specks called frass or insect droppings).

Some European and Scandinavian countries celebrate spring traditions by decorating branches of deciduous trees placed in water. Have the students investigate these customs as part of social studies. Do different countries use different trees? Create decorations for your branches in the classroom. These decorations can make lovely gifts.

Freshly emerged leaves and flowers on a chuckley pear or other common Newfoundland shrub or garden plant look beautiful, especially after a long winter and they can brighten any room. As the leaf and flower buds swell and open, ask the students to describe how this makes them feel. Do the fresh green leaves remind them of spring? Name the four seasons of the year, identify characteristics of each season and compare them. If these buds formed last year, has the tree been ready and waiting for spring all this time?

Ask the students if we can manipulate how the buds open. Temperature (of the room and water), light, and the amount and quality of water are just some factors that can be varied. Positioning the branches in different parts of the classroom may also affect results. For example, if new leaves open on a branch placed in a hot window, will the leaves shrivel? Will it do better or worse if you vary the amount of water in the jar? What if the water quality varied? If we add tiny amounts of salt or oil to the water, does this affect the plant? Do you think the salt and oil spilling off roadways affects plants in the wild? Collect and decorate "vases" for the classroom using recycled materials. See how creative the containers and the decorations can be. The sky is the limit here.



Identification of your Plant:

Compile all the data once the leaves and/or flowers have emerged. (The plant piece will eventually die and can be discarded into a compost bin.) When analyzing the data, see if the plant can be named or identified from your observations. If not, do not worry. The main objective of this project is to learn to be skilled plant observers, not memorize names. The students will actually get to know their branch quite well.

Ask the students to speculate (i.e. hypothesize) on how the entire plant really looks. Is it tall, short, and bushy, etc? If you have photos of the plant growing outside or can bring the children to the tree or shrub, so much the better. You may find that they will get quite excited, like meeting an old friend. Play nature detectives: if you trimmed branches from several plants, let the students compare the photos to the branch to see if they can make the correct match. Compare sketches or photographs taken the first day the branches were immersed in water and compare with the plant once the leaves have emerged. Can they match them correctly?

If you cannot identify your plant, feel free to assign your own common name, based on its physical characteristics, where you found it, feedback from the students, etc. The class can even hold a vote. You can explain that all plants have two sets of names: its scientific name, which is its official name; and common names, which vary from community to community. In Newfoundland and Labrador we have many unique common names that are understood only by the local people. If you have a native tree or shrub, it will be depicted in the book “Native Trees and Shrubs of Newfoundland and Labrador” by A. Glen Ryan.

How will you know if it is native or an introduced plant? There is no simple answer to this question. If it is growing in a garden, there is a good chance the plant is not native (but there are no guarantees). Similarly, if it is growing behind your cabin, it might be native. Having said that, garden escapes are common, even from one hundred years ago, so any plant growing near an old settlement, graveyard or cow pasture could be introduced. Local gardening centers, gardening clubs and botanical gardens can help you identify your plant. Try to supply a synopsis of your data, including sketches and photographs if available to aid in identification. The good news is, you and your students will quickly become skilled observers and you will learn each plant’s identity as you go.

The Botanical Garden will continue to develop local resources in the future. An excellent on-line reference source is “The Digital Flora of Newfoundland” website (<http://www.digitalnaturalhistory.com/flora.htm>)

Your Feedback is Welcome:

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Memorial University of Newfoundland Botanical Garden Inc., as part of the university's inclusive community, is a not-for-profit corporation that creates and inspires understanding, appreciation and conservation of plants in gardens and natural areas to further Memorial's mission of research, education and outreach.



From Garden to Classroom



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Sprouting Seeds

Sprouting beans in a clear container lets you see the roots and leaves emerge from the seed.

You will need:

- A clear container made from glass or plastic, such as a disposable cup or a jar
- Paper towel
- Three or four seed beans (not cooked beans) such as peas or beans*
- Water
- Spray bottle

**Dried peas and beans from the grocery store can be safer for young children to handle, as packaged seeds may be treated with fungicides to increase germination rates.*

What to do:

1. Place a strip of paper towel all the way around the inside of the jar.
2. Scrunch up some more paper towel and put it inside the first strip so it fills up the jar.
3. Spray the paper towel until it is damp but not wet. If you can see standing water at the bottom of the jar, it is too wet. Drain out any excess water.
4. Place the seeds between the paper towel and the jar so you can see them clearly.
5. Place your container in an area that is free from drafts and keep damp.



What you will see:

As the beans absorb water they will get bigger until a little root comes out. Then the bean will start to send up little leaves. When the leaves poke out above the paper towel, you can carefully take them out and plant them in some potting soil.

Sprouting Seeds Method #2

Another way to sprout seeds is in a clear plastic bag. Place a folded piece of paper towel inside the bag, and spray until damp, but not too wet. Place the seed on the paper towel and put in an area that is free from drafts and keep warm. Check the bag daily to ensure the paper towel does not dry out. Within a few days the seed will start to send out little roots and shoots. When the leaves have emerged from the seed you can plant it in some potting soil where it will continue to grow.

Extend the learning:

- Germinate the seeds under different conditions to see how *abiotic* (i.e. non-living) factors affect growth. For example, germinate the seeds in light, in darkness, at varying temperatures, etc.
- Try this activity with a variety of seeds; younger children find larger seeds easier to handle. A soup mix containing a variety of dried beans is fun to use, as are sunflower seeds, and dried corn. If there are no peanut allergies, try growing bird seed. Packaged seeds are also easy to use; be sure to wash hands after handling.
- Younger children may enjoy testing objects to see if they are indeed seeds. Watch non-germinating objects carefully for mould and discard if mould appears.
- Test to see if a seed came from a monocot (the embryo has a single cotyledon or leaf seed) or a dicot (the embryo has two leaf seeds or cotyledons). Germinate corn (monocot) and peas or beans (dicots) and compare the differences.
- Allow your plant to grow; water and tend it, including providing a tall stick for your climbing plants to wrap around and take hold. Vary the growing conditions (i.e. *abiotic* or non-living factors) for the plant to see if you can affect growth (i.e. temperature, light, nutrients, water, etc.).
- When the flower is produced, examine it with a magnifying glass. Can you see the male and female parts of the flower? If you brush the male pollen onto the female part of the flower (pollination), a fruit (i.e. a pea or bean pod) will form. Examine the seeds inside the fruit. If you grew peas or beans, you can even eat them!
- When students are caring for the plants, encourage them to measure and chart the changes and growth. Record findings with digital photography and drawings.
- Discussions of the changes can lead to opportunities for more science experiments. Encourage the students to ask questions and test their hypotheses.



Your Feedback is Welcome:

"From Garden to Classroom" outreach program incorporates environmental stewardship practices which have been promoted and used at MUN Botanical Garden since its inception in 1971. The Garden's education programs are the basis for many of these outreach activities. We hope the "From Garden to Classroom" outreach program will provide a unique opportunity to engage young people in hands-on activities, which may encourage proactive attitudes and behaviours in areas of environmental protection, conservation and enhancement. The hands-on activities are curriculum-designed; while all programs supplement the science curriculum, we encourage teachers to make connections to other subject areas.

Feedback, stories and suggestions are always welcome and are an integral part of the development of this education program. Comments may be forwarded to Anne Madden, education coordinator, MUN Botanical Garden (amadden@mun.ca).



From Garden to Classroom



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Going on a Nature Walk with Children

Anne Madden
 Education Coordinator

At MUN Botanical Garden, nature walks have always been an integral component of our education programs. When the Garden opened its gates over 30 years ago, visiting schools and youth groups were our main audience. Today, even though we have expanded our offerings to include Parents and Tots, Junior Naturalist Camps, and Sunday Family Days, to name a few, the nature walk has proven time and again to be the highlight of the program, enjoyed by adults and children alike.

While it is obvious that a nature walk is a welcome change from the classroom, an opportunity to get outside, enjoy some fresh air and get some exercise, its real benefits go much deeper. In fact, a simple nature walk can open one's senses to the natural world in a way few other activities or games ever could. This awareness stimulates a natural curiosity, a love of learning, and may initiate a very positive and long-lasting personal connection to our natural environment. Over time, a heightened sense of respect, caring and appreciation for our world, our natural habitats and the creatures that inhabit them will also be fostered.

But the benefits do not end there. Teachers, particularly in primary and elementary education must teach a wide variety of subjects, not just science, and may question when Language Arts and Social Sciences are to be covered if time is spent on a nature walk. Over the years, education staff has been called upon and have quite successfully developed nature walks that integrate a variety of subject areas, even math! The learning opportunities derived from a nature hike are endless and only limited by one's imagination.

MUN Botanical Garden and many other facilities offer schools a variety of curriculum-linked education programs that include a guided nature walk. While all teachers are welcome to book a program with us, we do not want the nature walk experience to end there. Instead, we encourage all teachers, from Kindergarten to secondary levels, to branch out on their own and make the nature walk a regular experience with students. The leader does not have to be a botanist, scientist or any kind of expert. In fact, many teachers may be surprised to find they learn with the students. In turn, students enjoy learning with the teacher and occasionally, through sharing experiences, they may take on the role of educator.

The following outline is intended as an introduction for educators, and youth group leaders who would like to incorporate nature walks into their curriculum or program. Parents may find some of the information helpful as well. The Garden's education staff welcomes inquiries and feedback. Experience is often the best teacher. So please remember: there is no right or wrong method to leading a walk, and each teacher will develop their own style. Students will also vary in their responses. Have fun with it. The rest will follow.

Teacher Tips:**1. Select a Route**

Please keep in mind that this type of outing may be a very new experience for many students, and some may find it difficult to focus the first time out. I find it is often preferable to keep the first excursion very short and very simple (without any high expectations for anyone). The students will adapt quite quickly to this type of activity, and over time both teacher and child will grow to be “expert nature detectives”.

If you are fairly new at this, pick a familiar route. You will be more comfortable leading a group through familiar terrain, and will probably have more interesting stories to recount from your own experiences. Children find human history, particularly your own, to be a fascinating point of discussion, and love to hear about “the old days.”

You do not need pristine wilderness with spectacular views to lead a fun walk. In fact, exploring your school yard, or nearby city park will be logistically easier to arrange and any discoveries will be all the more exciting to the students. A nature walk right in your city or town is also fun, and opens everyone’s eyes to the fact that nature is everywhere, even if it is just ‘weeds’ growing in the cracks of the sidewalk.

If you are planning a trip to a park or nature reserve, please contact their staff ahead of time, particularly if you would like the children to do some activities, including collecting. Some parks have restricted access or may even be closed on certain days. Others may charge admission. Most parks do have regulations regarding collecting, so it is always best to check with local authorities first.

If you want to allow the children some free time to play and explore, not all parks are suitable and many have strict rules regarding staying on the trails, etc. Also, you want to make sure children will not get lost or encounter a dangerous situation. Again, your school yard or local park sometimes offers the best location.

2. Preparation

It is always best to plan your route ahead of time, particularly with children’s groups. Points to consider: Is transportation required to the site? If not, is it safe to walk to the site (sidewalks, crosswalks, etc.)?

- If transportation is required, is it available? Is there adequate parking?
- Is the route appropriate for your age group? Is it too long, too steep, slippery, near dangerous areas, etc.? Would extra adults be required to ensure safety? Particularly near populated areas, ensure there is no glass or other litter that could cause an injury.
- Check the trail surface. Is the area known to be muddy after a rainfall? If so, make sure your group wears appropriate footwear.

Going on a Nature Walk with Children (continued)...

Walk your route several times if possible. Note any areas you would like the children to explore, collect from, etc. Seasonal changes can occur quickly, especially in the spring. What was once brown earth can be suddenly covered in new tiny green seedlings. (Note: Children enjoy returning to an area to discover changes during the seasons).

· Check your school or organization's policy on outings. Transportation, insurance, extra supervision, allergy alerts and use of permission forms are just some of the policies you should be aware of before venturing out.

Be prepared for changes in your itinerary. I usually plan more stops and activities per walk than are needed. That way, if you must cancel one activity, you have other options to fall back on. It has also been my experience that while one group of students will enjoy one aspect of your walk, another group will not be as interested. So it is always best to be flexible. If you find your group is particularly interested in one area or activity, it may be to your advantage to keep with that area as long as interest is high, even if it means some activities are dropped.

3. Get the Group Prepared

Make a list of what each child needs to bring. It has been my experience that less is better in this situation.

Recommend:

- Each student should be dressed for the weather, including appropriate footwear, hat and layered clothing.
- Provide a container for your collections.
- Bring snacks if you plan to stop and eat. Don't forget to pack up your garbage.
- Something dry to sit on (i.e. a plastic grocery bag) is often useful.
- The leader should also bring a small first aid kit, just in case.

Other tips:

- Activity or question sheets, etc. can help keep the children focused on the activity.
- A homemade map can be a lot of fun.
- Have extra gear on hand if you can - very rarely do all children come prepared. Letters home may help.
- Cheap magnifying glasses can help make things fun.

4. Before Your Walk

Time spent preparing the class for the trip, even a short one, is well worth the effort. Not only will students understand more fully what is expected from them, it can actually increase interest and excitement. Time should also be spent addressing any fears or concerns.

Explain in detail the intended route, duration and activities. This will alleviate everyone asking the same questions over and over. Encourage the students to think about what they may see, hear and smell today.

Going on a Nature Walk with Children (continued)...

Classroom Activity:

If you find it a challenge to have every student come prepared for your hike, there is a simple activity you can do. Present two packed knapsacks to the class or group. One knapsack should be over-filled with inappropriate items (the sky is the limit here; the sillier the better). The other should contain items needed for the outing (snack, bottle of water, hat, rain jacket, etc). Unpack each knapsack and let the students decide what should stay and what should go. Older students can prepare these as an assignment. The group can provide feedback after a hike and make suggestions for materials to bring along.

Rules:

Outline all the rules beforehand. I find it helps to be firm at the beginning, making it clear that only those that follow the rules can participate in the activity. Allowing time for discussion of safety rules does help the student remember them and provides an opportunity to express opinions and reservations.

An example of some safety rules:

1. Stay with your partner and/or hold your partners' hand at all times.
2. While walking, everyone is expected to stay in line (or be a caterpillar).
3. Stay with the group at all times.

While safety is a top priority, it is also important to impress upon them the importance of being a friend to nature and the community. A walk with your group through a park or any area should not disrupt others and should not cause harm. At MUN Botanical Garden, we teach the following rules of respect as a guideline for interacting with each other and our community.

SOME RULES OF RESPECT:

1. We will treat everyone and everything as we would like to be treated.
2. We will not pick or collect anything, unless our leader gives us permission.
3. We will stay on all paths and trails at all times and will only wander off if given permission to do so. To avoid damaging plants and tiny creatures, we will try to step gently at all times.
4. Any live animals (i.e. bugs) that are collected will be handled gently and released as soon as possible. (It is not advisable to try to collect any birds, amphibians or mammals, or stinging insects).
5. We will try to keep voices low so animals do not get scared away and others in the park are not disturbed by the noise. If we are very quiet, we may spot more wildlife.

Going on a Nature Walk with Children (continued)...

6. This park (or school grounds, playground, etc.) is home for some plants and animals. Today, we are the visitors. When visitors come to our own home, how do we like them to behave? What are some things you like or dislike visitors doing in your home? Do you think the plants and animals (and other park users) would like us to behave a certain way today?

7. Generally, by connecting the student's home and community to that of a plant or animal's habitat, they will understand more clearly how their behavior can have a positive or negative effect on their surroundings.

5. On the Walk

A sample of some activities and games used on nature walks at the Botanical Garden has been included in this section. Feel free to modify them to suit your needs. Garden staff would love to hear your suggestions and feedback.

While any number of these activities can easily be incorporated into the walk, I do stress the importance of keeping initial experiences simple. As mentioned previously, a nature walk may be a new experience for many students. By keeping the first outing short and not too strenuous, many common problems can be avoided. One game that I recommend be tried on every outing, particularly the first, is the sensory warm-up game, described below. We play it with almost all the children's groups that visit the Garden. The contrast in behaviours and attitudes before and after the game can be quite dramatic.

Sensory Warm-up Game

This game has been adapted from the wonderful book *Sharing Nature with Children, Volume 1*, written by Joseph Cornell. (For more information, please check the Sharing Nature Foundation website at <http://www.sharingnature.com/index.htm>)

Most people are not used to listening and looking for wildlife. The best way to be a nature detective is to 'sharpen the senses'. We need our eyes, ears and even noses open, but it might be best to keep our mouths closed. Once we talk, we are distracted and we cause others to be distracted. Most importantly, we will miss any wild creatures around us. By playing sensory games, we reveal more clearly to the students what is happening around us. It has been my experience, with the nature camps at the Botanical Garden, children will become very keen to observe their surroundings once they realize how much fun it is.

The simplest warm-up game (and my favorite) is played as followed:

1. Explain the following rules first.
2. Instruct all participants to stand in a comfortable position.; once comfortable, their feet must remain still.
4. Ask everyone to make two fists and hold up their hands so they are visible to the leader.
5. No talking at all, please.
6. Explain that every time a noise is heard, they are to count silently, using their fingers.
7. Once they have counted to ten, they must silently wait for the rest of the group to finish.
8. Final rule: The game is played with eyes closed.
9. Go over the steps one more time, leaving the eyes for last (make sure everyone is comfortable with this).
10. Start the game with "Ready, set, listen".

Play only for as long as the game holds their interest. For older students, they can be called "out" if they move, talk or open their eyes. Play the game in the classroom before and after the recess bell sounds. Students quickly realize that by not talking and "turning off" all their senses, except hearing, they discover many sounds around them that

Going on a Nature Walk with Children (continued)...

they were not aware of. They will notice that even when they did not speak or move, they could still hear each other. Discuss which sounds you heard and point to the directions the sounds seem to come from.

Scavenger Hunts

Scavenger hunts can be played several ways. The easiest method is to give the children a list or set of instructions of objects to find (I spy). For example: Count the evergreen (or Christmas) trees; count the trees with red / yellow / brown leaves; find the tallest tree (or building) and count the benches near it; or count the number of red (or yellow, or green, etc.) objects you can find. Another variety of this game is to actually collect the objects. Common objects to collect would be leaves, twigs, seeds, rocks, soil (bags required), moss, etc. In a controlled area you could also instruct them to use other senses besides sight. For example, to rub the tree needles between their fingers and smell, feel the wood on the bark of a tree, listen to the rustle of the leaves, etc.

“Un-nature” Walk

Find objects not associated with nature; objects could include fences, benches, signs, etc. Be careful the children don't handle litter. A popular activity with our summer camps each year is to set out silly objects on the trail and let the children find them. They love this game and over time develop keen observational skills. Some objects can be easy to find, while others can be more challenging. Place them everywhere from the ground up to the trees.

Nature Detectives

Give students samples or pictures of objects (i.e. dried leaves, seeds, etc.). Their mission is to find the objects. Have them use a map or make one to find the object. A variety of this game is to give each pair or group of children a different object. Another variety is to just reveal clues about the object, or a scrambled word list, and they must figure it out.

Nature Art

Ask students to collect objects (i.e. leaves) that they can use to create a collage or craft. As part of a math exercise, have the children sort, measure, and compare their collections before they create with them.

Story Time

No matter what the age group, I have found that students love to have a story time when outside. If possible, this is an ideal time to eat snacks. The break is very refreshing, particularly for younger students and it is often during this quiet time that we notice birds and other critters. If your walk has a theme, a story will enhance the theme even more. Older students may like to invent stories related to the site.

Photography

If available, using a camera can be a fun way to record findings and experiences. Digital cameras reduce the cost of processing and let you view your images immediately. The images can be used in a multitude of ways, even on your own website! This activity can also be incorporated into their technology program. Primary and elementary students can post photos on the wall and write text to explain their discoveries and experiences during the hike.

Creature Counting

How many trees, bugs, birds or even dead leaves can you find? Observe them and record your findings (digital cameras are great for this). If you can safely touch and measure, do so. If you are looking at trees, do bark rubbings. If listening for birds, try to quietly imitate their songs.

Going on a Nature Walk with Children (continued)...

Plantwatch

This program enlists volunteer observers to record flowering dates (phenology) of early-flowering plants in spring. This data is combined with nationwide data and used to track any climate change that may be occurring. For more information on Plantwatch Newfoundland and Labrador, please visit www.mun.ca/botgarden. You may also contact Madonna Bishop, PlantWatch Newfoundland and Labrador coordinator at the MUN Botanical Garden, 864-3328 or mbishop@mun.ca, for more information or a copy of the Plant Watch teacher's kit.

6. Back to Class

Discuss the trip and encourage children to reveal their likes and dislikes. Their feelings can be conveyed in artwork, journal entries, reports, poems and even fictional stories. Display their work. Make a webpage or PowerPoint presentation. Be sure to use any photos taken on your hike.

Sort, measure, count, compare and record any collections. These are all activities that children love to do with any new found 'treasures'. Communication of their findings can be facilitated with a variety of graphs, tables, etc. Use their treasures to create decorations, crafts or simply to create collections.

Try to name and/or describe any creatures found. Don't worry if you don't know the exact name of the species. Make up your own name, based on your observations. This is a wonderful activity to do with trees and shrubs throughout the school year. Each time you visit the plant, seasonal changes can be observed and noted. Conduct research in the library to see what else you can learn about your subject.

If you have chosen to participate in Plantwatch, tagging your plant and visiting your observation area on a regular basis is fun for all students.

Creating a "Nature Notes" or a scrapbook of their findings, observations, feelings and creations is an excellent activity to tie it all together and create some lasting memories.

Finally, make plans for another walk in the near future. This time, let the students help you, including selecting a theme, and planning activities. Create maps, research the history of the area, or select a story to be read on the next trip. If you are returning to an area, ask the students if they can suggest ways to encourage or help the local wildlife. If seasonal changes have occurred, discuss what impact that may have had on the area.

Eventually, you may feel comfortable enough to initiate a nature walk on a moment's notice. Taking advantage of an unexpected mild sunny day in the middle of winter, or spontaneously embarking on an expedition, will not only lead you and your students on the road to learning, but will create lasting memories for all.

Finally....

If you are a teacher or youth leader and have led a hike into your school yard or beyond, we would love to hear from you. Please share your stories, suggestions and ideas with us. If you use this resource information for your group, class or simply with your own children, we would very much appreciate your feedback. Happy Trails!

Breaking Ground Teacher's Workshop Helpful Web Resources

Atlantic Canadian Organic Regional Network (ACORN): <http://www.acornorganic.org/events.html>

Atlantic Canada Organic Regional Network - Newfoundland & Labrador (ACORN-NL):
<http://acornnl.wordpress.com/>

Bat Conservation International Inc.: <http://www.batcon.org>

Canadian Biodiversity Institute – School Grounds Greening:
<http://www.biodiversityonline.ca/schoolgrounds/index.html>

Canadian Government funding sources: <http://www.ec.gc.ca/financement-funding/>

Canadian Parks and Wilderness Society (CPAWS-NL): <http://www.cpawsnl.org>

Canadian Wildlife Federation: <http://www.cwf-fcf.org/en/index.html>

Compost Council of Canada: <http://www.compost.org/>

Conservation Corps Newfoundland and Labrador: <http://www.conservationcorps.nf.ca>

Convention On Biodiversity: <http://www.cbd.int/2010/welcome/>

Digital Flora: <http://www.digitalnaturalhistory.com/flora.htm>

EcoACTION: <http://www.ecoaction.gc.ca/index-eng.cfm>

Evergreen – School Ground Greening: <http://www.evergreen.ca/en/programs/schools/>

Food Education Action – St. John's (FEASt): <http://www.feastnl.ca/>

Food Security Network of Newfoundland and Labrador: <http://www.foodsecuritynews.com/>

Hinterland Who's Who: <http://www.hww.ca>

MI Ocean Net: <http://www.mi.mun.ca/mioceannet/>

MMSB: <http://www.mmsb.nf.ca/>

MUN Botanical Garden Inc.: <http://www.mun.ca/botgarden/>

Natural History Society of Newfoundland and Labrador: <http://www.nhs.nf.ca/>

Nature Canada: <http://www.naturecanada.ca/>

Nature Conservancy of Canada: <http://www.natureconservancy.ca>

Newfoundland and Labrador Environmental Network: <http://www.nlen.ca/>

Newfoundland and Labrador Horticultural Society: <http://nfldhort.dhs.org>

Newfoundland and Labrador Wildflower Society:

C/O MUN Botanical Garden

Memorial University of Newfoundland

St. John's, NL, A1C 5S7

Newfoundland Nature: <http://nlnature.com/>

Northeast Avalon Atlantic Coastal Action Program: <http://www.naacap.ca/>

Tree Canada: <http://www.treencanada.ca>

Xerces Society: <http://www.xerces.org/>

Breaking Ground Teacher's Workshop Helpful Print Resources

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Notes: