PlantWatch NL:

Our Plants and Climate

Change







Environment Environnement Canada



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This resource kit will also be available electronically at www.mun.ca/botgarden

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Acknowledgements

Since 1998, approximately 30 observers from across Newfoundland and Labrador have been monitoring plant blooming times and contributing their data to the national PlantWatch program; logging nearly 1500 observations. These observations help PlantWatch scientists track climate change patterns within the province and around the country. We acknowledge those efforts and thank all of the volunteer observers who enthusiastically monitored and reported blooming dates over the years and encourage them to continue to monitor plants in the future.

Recognizing that PlantWatch affords many opportunities for teachers and students to utilize the outdoors as a natural classroom, we envisioned the PlantWatch NL school program: "Our Plants and Climate Change". The involvement of schools in other provinces across Canada in the PlantWatch program and the development of a similar national publication also inspired the undertaking of this project. An initiative to develop a teacher's resource kit relevant to the PlantWatch indicator plants in this province was proposed providing countless real-life experiences for teachers and students across the province. The program would incorporate an understanding of the province's large geographic landmass along with its diverse ecosystems and the unique climatic variations that exist within the regions of the province.

Many individuals and organizations have contributed time, money, and expertise to the development of this teacher's resource kit. We would like to take this opportunity to thank everyone who assisted in any way to make "Our Plants and Climate Change" resource kit available to teachers and students across the province.

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Memorial University of Newfoundland



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PlantWatch NL: Our Plants and Climate Change



What is PlantWatch?



PlantWatch is part of a national volunteer webbased monitoring program designed to help identify ecological changes occurring in our environment. It is one of several NatureWatch monitoring programs supported by Environment Canada.

The PlantWatch program had its beginnings in 1995 at the Devonian Botanic Garden, a research and

educational facility of the University of Alberta. It initially started as a result of the Alberta Wildflower Survey which later became known as "Alberta PlantWatch". In 2001, Environment Canada, Nature Canada and E. Beaubien, founding member of the Alberta PlantWatch Survey partnered to develop a national

PlantWatch program. Most provinces and territories now have volunteer coordinators, including Newfoundland and Labrador.

PlantWatch is a phenology program. *Phenology* is the study of the seasonal timing of events in the lives of plants and animals. PlantWatch provides an opportunity to link students and members of the general public as "eyes of science," tracking early spring blooming plants.



PlantWatch observers select one or more of the key indicator plants found in their community, garden, or region and report the blooming times using the Internet. The blooming dates are posted in tables and maps on the national PlantWatch website at www.plantwatch.ca

The PlantWatch program identifies common plant species across much of Canada as well as regionally-relevant plant species that are valuable indicators of climate change. For a list of plants relevant to Newfoundland and Labrador, refer to the PlantWatch Photo ID cards appended in this resource kit or in the *Key Indicator Plant Species* section of this guide.

Why Watch Plants?

The PlantWatch program is a hands-on program that actively engages

students and their teachers in the collection of scientific data. By working in partnership with PlantWatch scientists, students and teachers are contributing their observations to the development of new scientific knowledge regarding climate change and the issue of global warming.

Participating in the PlantWatch program provides teachers with the opportunity to develop student abilities and to enrich student understanding



of science. As students focus on the process of investigation, they develop the ability to ask questions, investigate aspects of the world around them and use their observations to construct reasonable explanations for the questions posed. The process of scientific inquiry is linked to an important real-life issue: the effect of climate change on local plant life. By encouraging observation of plants within the local environment, the PlantWatch program helps students develop a lifelong appreciation of the natural world. Students utilize the basic skills of scientific inquiry such as observing, classifying, communicating, measuring, predicting, hypothesizing, inferring, defining, as well as interpreting, analyzing and evaluating data.

PlantWatch in Newfoundland and Labrador

In the fall of 1997, I attended the first Canadian Botanical Conservation Network (CBCN) workshop in which Liette Vasseur presented a talk on the Nova Scotia PlantWatch program. Since I had been collecting plant blooming data at the MUN Botanical Garden since 1995, I felt it was a great initiative for this province. After discussion with botanists and other experts in the field, a

selection of plants was chosen for the province's PlantWatch program. The program has been based at the Memorial University of Newfoundland Botanical Garden, Memorial University of Newfoundland since 1998. Madonna Bishop, Provincial PlantWatch Coordinator

Welcome to PlantWatch NL:

"Our Plants and Climate Change"

PlantWatch is a national volunteer plant phenological monitoring program

which helps identify the seasonal timing of life cycle events. PlantWatch Newfoundland and Labrador (NL) is a provincial branch of PlantWatch, where volunteers from St. John's to Goose Bay have been watching plants since 1998.



PlantWatch NL presents many opportunities for students, teachers, and families in this province to: enjoy nature and observe plants just outside your door; contribute scientific data by recording blooming dates of various plants; and help PlantWatch scientists understand how our natural environment is changing because of global warming. Are plants blooming earlier than they were 50 years ago? Is climate change having an impact on the blooming time of plants in this province? Are trends in the timing of spring changing in northern regions? These are just some of the questions that your data will contribute to in the coming years.

As a PlantWatch NL observer, you become, like many students across the country, the "eyes of citizen scientists". By watching plants, you can learn about Newfoundland and Labrador's botanical diversity and help scientists track the effects of global warming and climate change in your own province.

The purpose of this resource kit is to assist teachers in involving their students in the PlantWatch NL program. The lessons and activities are intended to provide students from Grades K - 12 with knowledge of how to PlantWatch;

the rationale for PlantWatching; information on native plant species and diverse ecosystems; as well as create an awareness of the impact of climate change at the local level. The lessons and activities are designed to supplement the provincial school curriculum. Curriculum connections for each activity are appended. The activities can be used across the curriculum incorporating objectives from language arts, math, social studies, art and technology.

While most of the content has been written for teachers, it can be used directly in class with students. The kit includes: a teacher's

guide that provides background information; key lessons on how to observe and report blooming dates; activities to extend various concepts pertaining to plants; class sets of PlantWatch NL photo ID cards; and a classroom poster for recording observations.



The "*Key Activities*" within this guide can be modified to meet the needs of all learners within the classroom, and are intended to be completed in sequential order. A number of "*Suggested Extended Activities*" provide additional activities for further investigation into concepts addressed in the activity, and are easily adapted for differentiated instruction. The extended lessons are designed such that they can be conducted as stand alone activities or as part of a larger thematic module. The photo ID cards are laminated and are intended to be used while outside. The classroom poster is in chart format with a special dry-erase protection. This allows the students to continuously record observations directly on the chart and re-use the chart in future years.

How to use this Resource Kit:

- Read the introduction: PlantWatch NL: Our Plants and Climate Change.

- Select one or more of the plant species for observation. Ideally this will be a plant species that can be found within a short distance of your school grounds so that it can be checked every 1-2 days during blooming time.

- Read the plant description for each plant you have chosen to observe. A

description of plants is provided on the Photo ID Cards (8 ½ x 11). Note things such as when it blooms, what the leaves look like, and the habitat where it can be found. As each plant is different, read also the "How to Observe" notes.

- Review the "Key



Activities". Note – key activities are generally completed in sequential order. Activities can be modified to best suit the learning needs and abilities / interest for your classroom.

- Review the "Suggested Extended Activities".

- Review the Grade-level Observation Form and Classroom Poster.

- Review the PlantWatch website: www.plantwatch.ca to familiarize yourself with how to submit data and for further information on PlantWatching.

Activities / Lesson Plan: Format

The activities and lesson plans in this resource kit are created to assist teachers with the pursuit of PlantWatching. They are designed to supplement curriculum objectives in an engaging and interactive way. Each of the *Key Activities* will lead the teacher through the "how to" of PlantWatching, while the *Suggested Extended Activities* provide further inquiry into concepts addressed in the activity, and are easily adapted for differentiated instruction. The activities and lessons are presented in the format outlined below; some include corresponding student activity sheets.

Purpose:	Describes the relevance of the activity to students' lives and
	presents the rationale for conducting the activity.
Grade Level:	Suggests the appropriate learning levels, organized by
	grades from K - 12. Activities can be easily adapted for
	differentiated instruction.
Subject Area(s):	Lists the disciplines to which the activity specifically applies,
	though many activities can be used across the curriculum.
Objectives:	Describes the qualities or skills students should possess
	after participating in the activity. The objectives supplement
	the provincial curriculum for which the activity was designed.
Group Size:	Indicates whether the activity is intended for whole class
	instruction, small group, or independent study. Most
	activities have elements of each.
Duration:	Approximate time needed to complete the activity.
Skills:	Describes the basic skills of scientific inquiry.
Materials	
Required:	Lists supplies needed to conduct the activity.

Teacher's Note / Background Information:

Provides information about the activity concepts or teaching strategies.

Procedure: Guides the teacher through step-by-step process of the activity. The activity may be divided into various parts and may involve varying duration to complete the activity based on grade level.

Suggested Extended Activities:

Provides additional activities for further exploration into concepts addressed in the activity.

Teacher Reflection:

Indicates a time for teachers to reflect on what the students learned; how the activity was conducted; and any modifications or recommendations for future use of the activity.



School Year at a Glance:

Please note that all of the following can be done during the spring,

however some teachers may wish to spread the stages out over the school year.

The following is a guideline to incorporate the PlantWatch program into your

classroom throughout the school year.

Fall (September - December)

- Read the (grade-level) PlantWatch letter and introduction to the program
- Select a plant to observe
- Select activities to work on with the class
- Review the Photo ID cards with the students

- Locate the plants near the school and tag up to five numbered patches (ie, 5 patches of coltsfoot, 5 patches of strawberry) or

an individual woody plant

- Sketch or photograph the habitat

Winter (January - April)

- Determine the latitude and longitude for the tagged plants, and record other environmental details concerning their position

- Register for PlantWatch, and record your observer number
- -Sketch / Photograph the habitat
- Do the "Leafing Out" activity

Spring (May - June)

- Check plants every 1 – 2 days once flower buds start swelling

- Become familiar with the definitions of first and mid bloom (and for some plants, leafing) for your selected plant

- Sketch or take photos of the same plant or branch before, during and after bloom

- Check your chosen plants: when first bloom happens, note date, weather for week before flowering, etc

- Complete the student observation form
- Submit your data online using your registration number
- Repeat steps when mid bloom occurs

- Check the web to see your school's data posted in tables and maps, as well as other observers' data



Key Indicator Plant Species: PlantWatch NL

The plants selected for PlantWatch are called *Key Indicator Species*. In order to be useful as key indicator species for spring phenology, selected plants must have certain qualities including: perennial growth, widespread distribution, easily identifiable plants with lack of look-alike species and a short spring blooming period.



There are 18 plant species selected for observation and are tracked through the PlantWatch NL program. 14 of these are *native plants* occupying a variety of *habitats* found throughout Newfoundland and Labrador including boreal forest, bogs, meadows, barrens, and tundra. Four of the selected plants are *introduced* species; two of which are planted as garden ornamentals while two others are introductions from Europe and common to disturbed areas throughout the province.

A brief overview of the Newfoundland

and Labrador PlantWatch species follows. For further information and more specific descriptions please refer to the PlantWatch Photo ID Cards appended.

We appreciate your contributions to PlantWatch NL!



Aspen poplar (Populus tremuloides)

In Newfoundland and Labrador, it is known as trembling aspen. It is found throughout the island of Newfoundland and southern Labrador. It is most common in the north – central part of insular Newfoundland. This tree is either male or female – only the male trees are observed for PlantWatch. It will flower early in the spring. Blooming is completed before leaves emerge.

Did you know: Trembling aspen is so called because its leaves flutter and tremble in a light breeze.

Paper Birch (Betula papyrifera)

Birch occurs throughout Newfoundland - it is more plentiful in the central and western parts of the island. It extends north to about 57 degrees latitude in Labrador. It is the Province's most common hardwood species. This deciduous tree has white bark when mature and dark reddish-brown bark when it is young. The male and female flowers are in separate catkins on the same twigs.



Did you know: Paper birch is used to make canoes, snowshoes, and baskets? Birch sap is collected in Newfoundland to make syrup.

Blue-bead lily (Clintonia borealis)

This plant is low growing with yellowish-green flowers. The fruit is small, shiny and blue, appearing later in the summer. It will flower late spring.

Did you know: The fruit of this lily is poisonous to humans?



Bunchberry (*Cornus canadensis*) In Newfoundland and Labrador this

plant is also known as crackerberry. It is a low growing woodland plant that has a single cluster with four showy white bracts that look like petals. The true flowers are in the centre and are green, purple, or cream-colored. The flower blooms May – June. The edible, tasteless, fruit

are bunches of red berries that appear later in the summer.

Did you know: Tiny insects can trigger an explosive opening of mature bunchberry flowers, and are showered with pollen as they fly away?





Cloudberry (Rubus chamaemorus)

This plant is commonly known as the bakeapple in Newfoundland and Labrador. It is a low-growing creeping perennial that is either male or female. Only the female plant bears fruit that ripen in July. They are generally found in bog habitats. The flowers bloom June – July. The yellowish berries are used in many recipes and are a delicacy among locals and tourists alike.



Did you know: Bakeapple is called a "pioneer plant" because it can quickly colonize an area following a fire or logging? The plant however, does not flower until about seven years after germination.

Coltsfoot (Tussilago farfara)

This plant was introduced to Newfoundland by European settlers during the early

1900's. Coltsfoot is usually the first small herb to flower in the spring. The flowers appear before the leaves develop. They bloom from March – May. They are found in Insular Newfoundland including western Newfoundland (includes southwest extending through Gros Morne National Park); northwest Newfoundland; southern Newfoundland; and eastern Newfoundland (includes southeast). It is considered an invasive plant in many areas.



Did you know: European settlers used coltsfoot for its medicinal properties and therapeutic uses during the early 1900's?



Partridgeberry (*Vaccinium vitis-idea*) This low evergreen shrub is also known as lingonberry or lowbush cranberry in some places. The tiny pink or white flowers resemble drooping bells and appear in small clusters at the tips of branches. The fruit is bright to dark red, ripening in August or September. It is an important shrub found

throughout Newfoundland and Labrador.

Did you know: The partridgeberry is harvested during the fall and supplies local and foreign markets? The tart berries are used in many recipes.

Dandelion (Taraxacum officinale)

This common herb was introduced to the province from Europe. They grow almost everywhere, but are common in lawns and other disturbed areas. The main flowering is spring, but scattered blooms continue all summer long.

Did you know: The name dandelion comes from the French, dents de lion, which means "teeth of the

lion", and refers to the jagged edges on the leaves of the dandelion plant?



Labrador Tea (*Rhododendron groenlandicum*) Labrador tea is an evergreen shrub found throughout Newfoundland and Labrador, often found on moist to wet soils. The five-petalled, white flowers occur in rounded clusters at the branch tips. Bloom time is generally June – July. It has recently become one of the province's native Rhododendrons.

Did you know: Labrador tea leaves can be steeped in boiling water to make tea.

Larch (Larix laricina)

Found in most of Newfoundland and Labrador, this med-sized coniferous tree is also known as tamarack. In the fall, the needles turn yellow and fall from the tree. Male and female cones can appear on the same branches. Only male cones are observed for PlantWatch. They generally bloom from April – May.



Did you know: Larch is a cone-bearing deciduous tree? In this province, Larch is often called 'juniper'.

Lilac (Syringa vulgaris)

This ornamental shrub was brought to Canada from Europe. The small fragrant flowers grow in clusters, and can vary in color (depending on the variety). They generally bloom May – June.

Did you know: The common purple lilac was one of the first plants most commonly brought to Canada by

homesick settlers? Bushes can still be seen thriving near abandoned pioneer homesteads.

Red Maple (Acer rubrum)



This small – med-sized deciduous tree is commonly found in moist soils, but can also thrive in drier habitats. It can be found throughout much of Newfoundland, being most common in western and central parts of the island. It is not found on the Northern Peninsula or in Labrador. The flowers appear before the leaves. The slender twigs are

shiny and dark red with whitish dots. The leaves are red-tinged in spring, green in summer and bright red in the fall. The flowers emerge in early spring and form dense, short-stalked clusters. The male and female flowers usually grow on different branches of the same tree, but can appear on separate trees. The male flowers are red and are the only flowers observed for PlantWatch.

Did you know: Red maple bark was once used to make dark red, brown or black dyes?

Rhodora (Rhododendron canadense)

This small shrub is commonly found in bogs and is a member of the heath family. It is found throughout most of Newfoundland but rare on the Northern Peninsula. It is not found in Labrador. The flowers form clusters of two-to-three flowers, have rosepurple petals and long stamens. They bloom generally from May – June.



Did you know: The rhodora is one of this province's native Rhododendrons? A rare form of the white rhodora can be found at MUN Botanical Garden.

Starflower (Trientalis borealis)

This is a common woodland plant that has starshaped flowers – almost the first to appear on the forest floor every spring. The flower generally blooms May – June.

Did you know: The roots of this plant were used by Aboriginal hunters to make a smoke mixture to attract deer?





Twinflower (Linnaea borealis)

This trailing evergreen occurs throughout Newfoundland and most of Labrador. It is found mostly in coniferous forest but also occurs on wet heaths, fens and alpine barrens. The pink flowers bloom from May – July.

Did you know: The twinflower is named after Carl Linnaeus, the founder of our scientific naming system? It is also the floral emblem of MUN Botanical Garden.

Weeping Forsythia (*Forsythia suspensa*) This deciduous shrub is a member of the olive family. It is native to Asia, and is commonly planted as a garden shrub. The yellow flowers appear in early spring before the leaves emerge. The flowers bloom from April – May.



Did you know: Weeping forsythia is considered

one of the 50 fundamental herbs in traditional Chinese medicine? The roots, leaves, flowers and fruit are all used medicinally. Children often refer to this plant as the "inside out plant" because of the emergence of flowers before the leaves.



Wild Strawberry (Fragaria virginiana)

This is a small herb that grows in woods or fields often forming little colonies. Each plant has three to five white flowers (each with five petals). The fruit resembles mini store-bought strawberries. They generally bloom April – May.

Did you know: Wild strawberries have more vitamin C per gram than oranges?

Sweetgale (Myrica gale)



This deciduous shrub is sometimes called bogmyrtle in Newfoundland and Labrador. It grows in wet habitats around ponds, rivers and bogs. They produce non-drooping catkins as a flowering structure, with male and female catkins usually on separate plants. The male flowers are yellow with reddish scales, crowded at the end of each twig. The female flowers are similar to male flowers but

are ruby red. Only male flowers are observed for the PlantWatch program. Sweetgale is very common throughout Newfoundland and occurs north to about 57 degrees latitude in Labrador.

Did you know: The oil of the sweetgale plant was once thought to strengthen hair and make it grow?

The Importance of PlantWatch Data

Blooming times and leafing out in spring occurs largely in response to how warm the weather has been before these events? Such studies illustrate how much warmth (measured in *heat units*) is needed to get different plant species to flower. Spring phenological data for plants is essential to help answer the question, "With the predicted global warming, is spring arriving earlier"? Because most climate studies require an average of 30 years of meteorological data (Beaubien, 2002), a longer period of data collection is necessary for this province. Student contributions to this data will provide important information for scientists in the years to come.

By collecting long-term phenological data, we can track plant responses to changes in climate. Phenology can also help farmers more accurately time their planting activities. As plants and insects are both developing in response to spring temperatures, it can be very useful to use bloom times to predict the best timing for control of pests. By treating weeds or insect pests at their most vulnerable stage, farmers can be more effective and boost their profits while minimizing environmental impacts. In addition, foresters can use the data to

correctly time seed-collection field trips, or to treat insects with a biological control.

The data collected can also contribute to a healthier environment for those who suffer from allergies. Pollen warnings for example, can alert those with allergies and help them prepare in advance for any outdoor activity. For the tourism industry and parks departments, blooming dates can be used to predict the best times to photograph flowers, or to predict the behaviors of animals such as bears whose movements depend on the growth stage of their plant food. Because plant and insect development are linked, blooming times can also provide information on the best time to participate in recreational activities such as when to go fly-fishing.



			l	_ink	s by	/ Ac	tivit	y ar	nd G	irad	е		
Key Activity	K	1	2	3	4	5	6	7	8	9	10	11	12
Key 1 Spring Detectives	V	V	V	V	V	V	V						
Key 1 Becoming Part of the Team								V	V	V	V		\checkmark
Key 2 Location, Location, Location	V	V	V	V	V	V	V	V	V	V	V	V	V
Key 3 Reporting to the Class	V	V	V	V	V	V	V	V	V	V	V	V	V
Key 4 Reporting your Data	\checkmark	V	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	V		\checkmark	\checkmark	\checkmark	\checkmark
			Sug	geste	ed Ex	tend	ed Ac	tiviti	es				
Growing Plants from Seed		V	V	$\overline{\mathbf{v}}$	V		V						
Biology of a Flower							V	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	V
Biodiversity Identification					V	V	V	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
Weaving the Web of Life	V	\checkmark	V	V	V	V	V	,	,	,	,		
Leafing Out Growing	V	√	V	V	V	V	V	√	V		$\frac{}{}$		$\sqrt{1}$
Degree Summation										,	,		
Converting Degrees and Minutes										V	V	\checkmark	V
Calculating Averages								\checkmark	V	V		\checkmark	V
Marking your PlantWatch Location								V		\checkmark	\checkmark	\checkmark	V
Nature By Numbers	V	\checkmark	\checkmark	V	V	\checkmark	V	\checkmark	V	V		\checkmark	V
Spring Survey				\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark





Key Activities



Key Activity 1 - *Spring Detectives!* (Grade K-6)



Purpose: The overall purpose of this lesson is to stimulate students' interest in plants, and to encourage them to use their senses to demonstrate curiosity about and interest in the natural world. Through discussion and

exploration, students will identify the names of the seasons; use their senses to identify various signs of spring (or current season) including spring plants; and understand what plants need to grow. This introductory activity also encourages students to further investigate and understand how climate and weather affects living things. The intent is to stimulate an interest in plants and the natural world and to encourage participation in the PlantWatch NL school program, "Our Plants and Climate Change".

Subject Area(s): Science, Language Arts, Art Objectives – students will:

- List the names of the seasons
- Identify signs of spring
- Observe, using one or a combination of the senses
- Define "plant" and describe ways that plants meet their needs
- Understand that climate and weather affect plant growth

Group Size: Whole class

Duration: One – two class periods or more depending on the grade level **Skills:** Inferring, Communicating, Observing, Comparing

Materials Required:

- PlantWatch Photo ID Cards
- PlantWatch Letter (appropriate to grade level)
- Appropriate dress for outside
- Guide to nature hiking (optional)

Teachers Note / Background Information:

This activity is divided into several parts, and depending on the grade level, teachers may wish to conduct these activities over a period of several days or as part of a larger unit on the study of plants. Remind students of the safety rules when going outside. The guide to conducting a nature hike is appended.

While the students may not find any of the key indicator PlantWatch species while on the hike, the teacher should be familiar with the area and in a prior visit, found several patches of plants or a tree to observe – keep these in mind for your PlantWatch study. As you come upon any PlantWatch plants, draw attention to them and review the characteristics of the plants listed on the reverse side of the PlantWatch photo ID cards.

Procedure:

A. Tell students that today we are going to talk about plants and springtime. Begin with a class discussion about spring. Ask students, "How do we know it is springtime"? Make a list of ideas. What are plants and animals doing in the spring? Ask students how they feel in the spring? Ask them to consider and compare each season in nature to a day in their life. The morning might represent spring (a time for waking up); afternoon might symbolize summer when we are active and full of energy – playing and having fun; the evening may represent fall –a time to prepare for bedtime and relaxation; and the night might represent winter – a time for rest and to sleep. While some teachers may wish to conduct this activity as a discussion exercise, some may wish to complete the appended worksheet, "It's Springtime".

Without plants, we would not exist. But what is a *plant*? Plants are living things that can produce their own food. Discuss this with students. Have them generate ideas about what they believe a plant is. Ask students to suggest some

of the different kinds of plants they know. Students will likely list plants such as sunflowers and dandelions. Ask students, "What do plants need in order to grow"? Plants need sunlight, water, air, and space. Ask students "why do you think springtime is important to plants". Encourage students to think about the kind of weather we experience in Newfoundland and Labrador and help them make the connection to the growing season, and the importance of sunlight and temperature to plants.

B. Introduce the PlantWatch program to the students, and review the PlantWatch photo ID cards. Class sets of laminated ID cards are included in the resource kit. Ask: Do you think any of these plants grow in our community / near our school / near your home? How can we find out?

Tell students that today they will take a walk outside in the schoolyard or on a nearby trail. Ask them to become "*Detectives*" as they look for clues of springtime and for any of these special plants along the way. Remind students that we must respect nature. We should try to be as quiet as possible and remind them of the earlier discussion about springtime and what plants and animals are doing. As they walk along, ask students to look for clues or signs that tell us it is spring. Remind them to look for any of the plants on the PlantWatch ID Cards. As children find clues of spring and investigate plants, stop to discuss each response – encourage students to touch / smell only the plants that are safe. Some things to look for include trees that have leaves, animal tracks, flowers budding, etc.

Choose a place to stop and ask students to listen to signs of spring. Invite students to close their eyes as they listen to the sounds around them. Give students a moment and then ask what sounds can they hear that sound like spring (ie, water running, gentle breeze, birds singing, etc)? Ask students to smell spring? Does it smell fresh? Can you smell the fragrant early spring flowers? Ask students to tip their face to the sky? What does it feel like? Is it warm – can they feel the sunshine on their face?

Back in the classroom review all the clues they found while on the walk. Some teachers may wish to provide students with a copy of the "*It's springtime*"

worksheet or younger students can draw of picture of 'spring' based on what they observed outside.

C. Review the PlantWatch photo ID cards, and discuss any found on the walk. Read the appropriate grade-level PlantWatch letter. Invite students to choose a plant or two to observe (keep in mind the proximity to the school and the location of the plant as you will need to be able to visit the plants several times each week.

Suggested Extended Activities:

Biodiversity Identification

Spring Survey



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Key Activity 1 - *Becoming Part of the Team: Our Plants and Climate Change!* (Grade 7 - 12)



Purpose: The overall purpose of this lesson is to stimulate students' interest in plants and the natural environment, and to provide an introduction to the PlantWatch NL program, "Our Plants and Climate Change". A nature hike will help students with simple plant identification and ecosystem discovery.

Subject Area(s): Science, Language Arts

Objectives – students will:

- Become familiar with various different ecosystems
- Identify local plants
- Identify biotic factors in an ecosystem

- Realize that *abiotic* factors such as weather (temperature, precipitation and humidity) affect a plant's growth and bloom time

- Become familiar with the PlantWatch NL program

Group Size: Whole class

Duration: One class period or more depending on the grade level

Skills: Inferring, Communicating, Observing, Comparing

Materials Required:

- PlantWatch Photo ID Cards
- PlantWatch Letter (appropriate to grade level)
- Appropriate dress for outside
- Guide to nature hiking (optional)

Teachers Note / Background Information:

Remind students of the safety rules when going outside. The guide to conducting a nature hike is appended.

Procedure:

A. Take students outside on a nearby nature trail. Begin with a general discussion about ecosystems. What are *ecosystems*? There are five major

ecosystems in Newfoundland and Labrador: the boreal forest; wetlands (bogs, fens, marshes); barrens or heathlands; freshwater systems (lakes, rivers and ponds); and the Atlantic Ocean. If possible, visit several types of ecosystems and note the differences in the vegetation. Encourage students to consider the



plants and animals that inhabit the various ecosystems. The following are some guiding questions for discussion: what do plants need to survive; what special adaptations or features do you think these plants have or need in order to survive in their habitat; how do living things interact within the ecosystem; what factors affect the plant growth in the ecosystem – introduce or review the concept of biotic and abiotic factors.

B. The shrubs or trees that are found in these ecosystems are among the 18 *key indicator species* chosen for the PlantWatch program in Newfoundland and Labrador. Introduce students to the PlantWatch program by reading the introductory letter (appropriate to grade level). Review the PlantWatch Photo ID cards to help students identify the plants while outside as well as understand some of their general characteristics and the habitats or ecosystems in which they grow. Class sets of laminated photo ID cards are included in the resource kit.

C. Using the PlantWatch ID cards, choose one or more of the species that grow in the nearby area for observation. Ask students: what kind of light does the plant receive in this ecosystem; does it grow under the shade of trees or in an open field; is it exposed to wind; what adaptations do you think this plant

has that will enable it to survive in this ecosystem; what kind of moisture does the plant receive and what kind of temperature is it exposed to in this area?

D. If the climate in Newfoundland and Labrador became more wet (with more rain) or drier, how do you think it would affect the plant species that you have chosen to observe? If the climate suddenly became hotter with more sun and higher temperatures, how would this affect the blooming time or distribution of these plants in the province?

Ask, do people and animals depend upon these plants for food and shelter? How would they be affected if the balance of an ecosystem is disturbed?

Suggested Extended Activities:

Biodiversity Race

Marking Your PlantWatch Location!

Teacher Reflection:

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Key Activity 2 - *Location, Location, Location, Location!* (Grade K - 12)



Locating and Tagging PlantWatch Plants **Purpose:** The purpose of this lesson is to locate, identify and tag chosen plants for PlantWatch observation. Students will make

qualitative observations by describing the plants

and their habitats.

Subject Area(s): Science, Language Arts, Social Studies, Art

Objectives – Students will:

-Begin a PlantWatch journal

-Prepare tags / labels for selected PlantWatch species

-Locate PlantWatch species

-Sketch / photograph PlantWatch species and their habitat

-Record observations

Group Size: Small groups (the number & size of groups will depend upon the number of plants observed and the class size)

Duration: One class period (approximately one hour)

Skills: Observing, Identifying Plants, Sketching, Map-making, Recording

Materials Required:

- PlantWatch photo ID Cards
- Appropriate dress for outside
- Plastic nursery tags (make your own from recycled plastic containers such as

ice cream containers)

- -Surveyor's flagging tape / string
- Permanent markers

- Hole punch
- Student Journal Entry Form
- Digital Camera
- Field Guides (optional a suggested list is provided)
- -Compass (optional)
- -Hand-held Magnifying Lens

Teachers Note / Background Information:

The Best Location to Observe Your Plants:



It is best to choose plants that are growing in an area that is relatively flat and easy to access. If you must choose plants that are located on a hill, the amount of sunlight they receive will vary, depending on which direction the slope is facing. Older students may use a compass to indicate the direction of the slope face, and note it on your observation form.

It is best to choose plants that are located on a warm, south-facing slope. North-facing slopes are generally cooler and plants tend to flower later in the season. Avoid sites which may have unusual temperature or light conditions such as concrete foundations or paved parking lots and roads as well as near buildings. Bring along a pocket field guide to assist with identifying local wild plants (a list of suggested field guides is provided).

Assigning Plant Numbers:

When tagging larger woody plants such as lilac, trembling aspen, birch, larch or red maple, assign each plant a number such as Larch 1; Larch 2; Larch 3, and so on. Write the plant name and number on the label or flagging tape. When you report on the observation form in activity three, you will need to record this number in the "Name of Plant" section. Also keep a record of your numbers in case the tags are removed.

For the location section of the student observation form, teachers can record the latitude and longitude (depending on grade level). Younger students can record direction (North, West, South, and East). This can be printed on the tags for younger students.

Suggested Field Guides

Titford, Bill & June. 1995. <u>A Traveler's Guide to Wild Flowers of</u>
<u>Newfoundland</u>. (ISBN 0-9699459-0-6)
Ryan, Glen. 1995. <u>Native Trees and Shrubs of Newfoundland and Labrador</u>.
Hammond, Phyllis. 2000. <u>Traveling with Wildflowers from Newfoundland to</u>
<u>Alaska</u>. (ISBN 1-55081-169-X)
Scott, Peter; Black, Dorothy. 2008. <u>Wildflowers of Newfoundland and Labrador</u>. (ISBN 978-0-9783381-6-9)
Peterson, R.T., McKenny, M. 1968. <u>A Field Guide to Wildflowers: Northeastern</u>
<u>and North-Central North America</u>. (ISBN 0-395-18325-1)
Johnson, D et al 1995. <u>Plants of the Western Boreal Forest & Aspen Parkland</u> (ISBN 1-55105-058-7)

Procedure:

A. Preparing the Tags & Journal Entry

Divide the students into groups (depending on the number of plants / locations being observed / class size). Choose or call for volunteers who will be responsible for checking on the plants at least every 1 – 2 days when the time for flowering nears, and report any changes they observe to the class – choose two students per group to act as recorder and reporter. Teacher may wish to change up periodically so that all students are provided an opportunity to participate in the recording and reporting process. Note: teacher should pre-determine the sites before taking younger children outside – possibly numbering the sites.

Begin the activity by preparing tags for each woody plant or patch of plants selected. Cut tags from recycled plastic ice-cream containers or similar items. Label the tag with the plant name and a number (see assigning plant numbers in the background section). Hole punch the tag near the top such that a string can be threaded through for attaching to the plant branches. *Note: use a permanent marker for writing on the tags.*

Journal Entry: Each member of the group should begin a journal entry. A Student Journal Entry Form is appended. Include in the first entry the plant name being observed as well as the plant number and date the plant is tagged. Make a prediction as to when the plant will begin to bloom. (The prediction may be based on the weather for the past two weeks – month). Students will add to their journal as the program progresses.

B. Locating & Tagging the Plant

Take students outside to a nearby trail, Local Park, or the school grounds to locate and tag their chosen PlantWatch species - the teacher should pre-select these sites before taking the class outside. Assign each group to a plant type and location. Remind students to bring along their journal entry form and a pencil for sketching. Older students may wish to use an existing journal.

Bring along the PlantWatch photo ID cards and any Field Guides (optional) for review. When in the vicinity of the plant locations, review the PlantWatch notes on the reverse side of the ID card. Discuss briefly with students the habitat in which the plant is growing, the approximate bloom time and what the leaves look like. What kind of habitat is it, what other plants and animals would you expect to find in such a habitat? Is this habitat important to people? Why do you think so?

It is important to tag plants early in the season before they begin to bloom. If you are doing the PlantWatch program as a year-long program, you may want to tag the plants in the fall (see *School Year at a Glance* section of this guide). Attach the plant tag to the selected woody plant or plant patch. For woody plants, try to put the tag around a healthy branch and in a location where students will find it easily when the leaves emerge, and in a place that is not easily visible by members of the general public.

When tagging smaller patches of plants, it is important to choose a patch that has flower buds or one that has evidence of present or past fruit such as berries, seeds, etc. Attach a piece of brightly colored surveyors tape to the plant tag. This will help you locate the patch of plants at a later visit. Place the tag into the ground near the back of the plant, away from public view and to ensure it isn't a tripping hazard for passerby's.

Have students sketch the plant and the surrounding habitat on their Journal Entry Form. Use hand-held magnifying lens' to get close-up inspections of the plant. Students may also wish to take photographs. Show the plant's true flowers and leaves or even a mature tree with bark coloring in the photo (younger students may want to do a bark rubbing of the tree). This will help to compare the plants life stages as it begins to leaf out and bloom – it is a good idea to sketch or photograph the flower buds every 1-2 days as they grow. Make a sketch map of the area to help locate the plants another time in case the tags are removed. Record the weather conditions on the journal entry form, and indicate whether it is warm, cold, frost, sunny, raining, windy, and temperature (if known).

Suggested Extended Activities:

Leafing Out Marking Your PlantWatch Location

Teacher Reflection:

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Key Activity 3 - Reporting to the Class

(Grade K-12)

Purpose: To observe and record changes in the life cycle of a plant. Students report back to the class any changes they may have observed in their selected plant(s).

Subject Area(s): Science

Objectives – students will:

-Review general characteristics of selected plants
-Sketch / photograph changes in the life cycle of selected plant

- Use a variety of means to communicate their observations to the rest of the class

-Chart the changes in plant growth

-Complete the Student Observation Form

Group Size: Whole group / small groups

Duration: Several class periods (for the duration of the blooming period)

Skills: Observing, Recording, and Communicating

Materials Required:

- PlantWatch photo ID cards
- -Camera (optional)
- Student Journal Entry Forms
- Student Observation Forms
- Classroom PlantWatch Chart Poster

Note: Student Observation Forms are appended and are based on grade level.

Procedure:

In order for students to report accurate blooming dates for their plant, it is important that they are able to recognize the various flowering stages of their selected plant.



Review the background information on the PlantWatch photo ID cards for the plant(s) your class is observing. Here you will find general information on the plant as well as descriptions of the leaves, flowers, fruit, habitat, and definitions of *first flowering* and *mid flowering*. Illustrations and color photos are also available on the PlantWatch website at www.plantwatch.ca

Students should visit their plants every 1 - 2 days when the *flower buds* begin to swell, noting the changes in the plant growth by sketching these changes or taking photos.

Have students from each group periodically report on their plants to the class. Use the Student Observation Form to gather and record the data. Each group will then choose a medium of their choice in which to communicate their results.

Chart the information on the classroom poster including information such as the species name, first bloom, mid bloom and leaf out (if applicable). Older students should also note latitude and longitude and any environmental details such as exposure, slope, weather, and habitat.

Suggested Extended Activities:

Calculating Growing Degree Summation (GDS) The Biology of a Flower

Teacher Reflection:

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Key Activity 4 – *Reporting Your Data!* (Grade K-12)

Purpose: To assist PlantWatch scientists by collecting and submitting flowering observation data. The class must be registered as an observer before data can be submitted to the PlantWatch website. The teacher will register the class.

Subject Area(s): Science, Math

Objectives – students will:

-Register as a PlantWatch observer
-Complete Observation Form
-Submit PlantWatch data online
Group Size: Small groups
Duration: One Class Period (approximately 50 minutes)
Skills: Calculations, Data Entry
Materials Required:
- Grade level PlantWatch Observation Forms



Procedure:

How to Register:

The class must be registered as an observer before data can be submitted to the PlantWatch website. The teacher will need to log on to www.plantwatch.ca and continue to the section "Submit Observations". Teacher will be asked to enter a 10-digit observer number. This number will allow you to enter your observation information. It is suggested that you use your area code and telephone number (no spaces or hyphens). The number will be easy to remember and it will also enable the national coordinator to determine the geographic location of participants. Note, you do not have to register each time



you submit new data, but you will need to log-in. Thus, it is important to keep track of your number so that you can use it when sending data and locations for future observations.

Continue to complete all fields (school name can be entered in the Last Name field). You can edit your profile information by clicking "edit profile". Review the PlantWatch Observer Form or the PlantWatch website "Submit Observations" section with students. Read the *How to Complete the Observation Form.*

How to Complete the Observation Form:

(Please note the observation form on the website varies slightly from that which is appended in this guide – teacher may choose to use either form) Observer – complete the contact information

- A. Plant Observed Write in the name of the plant species you observed. Remember to use the plant name and the number assigned during the first activity. The PlantWatch Observation Form (appended) is used to report observations of one plant or patch of one species and is based on grade level.
- B. Flowering Phase Complete the date (month/day/year) for each phase (ie, first bloom / mid bloom) on the same sheet. If first bloom for your plant was April 15, 2010, record 04/15/2010; if mid bloom was April21, 2010, record 04/21/2010.
- C. Leafing If you are reporting on lilac, red maple or trembling aspen, leafing is the day when, in at least three places on your observed plant, the first leaves have unfolded. For larch, the tufts of needles have just started loosening and spreading.
- D. Plant Location Having accurate location information for flowering plants is very important to PlantWatch scientists. They will need this information to use and map students' flowering observations. The GPS activity in this resource kit will help to mark and locate plants. Please provide decimal degrees with 4 decimal points (ie, 54.9211 minutes latitude, or -115.2166 minutes longitude). Use the formula given in Converting Degrees and

Minutes activity in the *Selected Extended Activities* section of this guide, the "dms" button on a calculator or use an on-line converter (ie, www.fcc.gov/mb/audio/bickel/DDDMMSS-decimal.html) to convert degrees, minutes and seconds to decimal degrees (ie, 54 degrees 55 minutes 16 seconds = 54.9211 degrees), which are the most useful for mapping. Note that in Canada longitude is entered as a (-) value. The submit Observation section of the PlantWatch website has tools which allows you to look up your latitude and longitude. Google Earth is also an excellent tool to find latitude and longitude (http://earth.google.com/).

A topographic map has a scale of 1:50,000 are very useful to get accurate locations of plants. Many people now have a "GPS" (Global Positioning System: a small hand-held receiver that calculates your latitude and longitude using satellite signals) for geo-caching, hiking, etc. They will be able to help by giving you the location of your site, and then just report at the bottom of the form under the Comments section of Optional Details, the distance and direction of the plants from the nearest highway or town.

Elevation, taken from a map, is also useful information for research on plant flowering times. Because air cools when altitude increases, flowering in higher places is often later than at low altitudes. This effect can often be seen by hikers on a mountain trail – the plants of a species may be in full bloom at the start of the trail but only in bud higher up.

- E. Habitat Type Indicate the type of habitat your plant was observed.
- F. Optional Details Information on a plant's exposure to sun (shading, angle of slope and aspect of slope the direction the slope faces) and weather before flowering helps us understand how plants may have been affected by their location or this year's weather. To find which direction the slope or forest edge faces hold a compass, stand with your back to the plant and face directly downhill or at 90 degrees to the forest edge. The direction you are facing is the direction to record.

G. Comments Section - students could contribute any of the following information:

-details about the location of plants

-notes on any interesting insects observed on the plants (butterflies, caterpillars, ants, beetles, etc)

-weather observations (or the calculated growing degree days to flowering see Calculating Growing Degree Summation activity in the *Suggested Extended Activities* section of this guide)

Whether some flower buds were lost to hungry animals
the average flowering times for first or mid flowering for all the plants of one species (if they are all within the same area: ie, within a circle of 1000 meters diameter and within 50 meters of each other in elevation)
any other comments or suggestions

How to Add Plant Locations:

Once the class has been registered, you will need to add a location for each individual plant or patch of plants observed. Enter unique latitude and longitudes for each watched plant, along with as much other data as possible. To access the on-line tools for latitude and longitude click on "*Click here to find / enter your location*" on the submit observation section of www.plantwatch.ca This will launch a pop-up screen where you can search for your location either by a) entering the latitude and longitude directly, b) by searching from a nearest named place or c) by zooming in from a map of Canada. Each option will allow you to visualize the plant location on a map. Use this to verify your location. Once you are satisfied you have identified the site, click "Confirm Location". This will automatically fill in the latitude and longitude section of the page. Using Google Earth, a GPS, or other tool will help to identify the latitude and longitude more specifically.

Once you have saved a location, it will appear as an option under "Location" for future entries. If you have made an error in your location information, you can edit it by clicking "edit location".

Submit a PlantWatch Observation:

Select from the drop down menus provided, all of the blooming event information about the specific plant your have monitored. You will need to repeat this for each individual watched plant.

You can edit your observation after it has been submitted by clicking "view / edit" under the "Observations" section. You can also download all of your data to a spreadsheet by clicking "download" and following the instructions.

Send the data to PlantWatch as soon as one of the tagged plants reaches first flowering. Keep sending data as the plants all reach first and mid bloom. Complete one form for each tree (ie, trembling aspen, larch), bush or patch observed. Just press "send" after completing your report on a plant and a confirmation page will appear. Complete another observation form if you have a date to report for another plant. To contact the PlantWatch NL coordinator by email: mbishop@mun.ca

Suggested Extended Activities:

Growing Degree Summation Converting Degrees and Minutes Calculating Averages

Teacher Reflection:

Science Connections...

There are numerous opportunities to explore science concepts from elementary school to university levels while participating in the PlantWatch NL program. Science activities such as biology, ecology, weather and climate can be integrated with geography, math, technology, language arts, and social studies, to form the basis for an integrated thematic study.

. In creating this resource kit, we focused on outcomes in the science curriculum, specifically for the following units:

- Kindergarten: Exploring the World with our Senses
- Grade 1: Needs and Characteristics of Living Things; Daily and Seasonal Changes
- Grade 2: Growth and Changes; Air and Water in the Environment
- Grade 3: Plant Growth and Changes; Exploring Soils
- Grade 4: Habitats and Communities
- Grade 5: Weather
- Grade 6: Diversity of Life
- Grade 7: Interactions within Ecosystems
- Grade 8: Environmental Interactions
- Grade 9: Reproduction
- Science 1206: Sustainability of Ecosystems
- Science 2200: Ecosystems
- Biology 2201: Biodiversity

There are several science concepts that can be explored in the PlantWatch NL program:

-The importance of plants to people and animals

-Plants and our natural environment

-Plant Adaptations and requirements for growth

-Seeds and seed dispersal

-Plant life cycles

In the following activities, the relationships between the key indicator PlantWatch plants, people and wildlife (including herbivores and pollinators) are explored, as well the plants' adaptations to cope with changes in light, water or temperature. Because blooming occurs largely in response to heat, weather calculations can permit predictions of blooming time. Shifts to earlier blooming in some areas have been noted, and tracking this spring phenology can provide a focus for studies of climate change issues.

All about Plants

Plants play an important role in the lives of people and animals, and they are an essential part of our natural environment. Like animals, plants have special parts and adaptations that help them survive and thrive in certain habitats; they have fundamental requirements that need to be satisfied in order for them to grow and thrive; they use special techniques to ensure their seeds are dispersed to proper growing sites; and plants go through different growth stages. A complete sequence of growth stages is called a life cycle.

The importance of plants to people:

Plants provide us with oxygen to breathe, food, shelter, clothing, fuel, medicine, and cosmetics. They are used in special celebrations and are part of traditions and rituals. They are also used for aesthetic purposes. The following PlantWatch species are used to illustrate some of these concepts. We often plant flowers in our home gardens, school grounds, and around our community to make our surroundings aesthetically pleasing and welcoming. The common purple lilac is one such plant. This hardy (zone 2) plant is a beautiful and fragrant garden shrub that has been thriving in many Newfoundland and Labrador gardens for hundreds of years. While the lilac continues to be a common garden plant today, it can still be seen growing in old abandoned homesteads. Lilac is a horticultural woody plant that has many **cultivars**.

Wild Strawberry is a wonderful food enjoyed by many songbirds, snowshoe hare, and squirrels. Humans also enjoy the berries and they can be eaten either raw or cooked. They are very nutritious rich in vitamin C, calcium, and potassium.

Partridgeberries are an important shrub found throughout Newfoundland and Labrador. These berries are harvested during the fall and supply local and foreign markets. The tart berries are used in many recipes served both at home and to tourists travelling to the province.

Bunchberry is yet another plant that can be eaten raw or cooked. Many people have used the bunchberry, both eating them raw and cooking, then generally straining them for sauces and puddings. While bunchberry is generally tasteless, they are often mixed with other fruit.

While Larch is not edible, it has been used widely as a building material. Its hard wood has been used by many local people for slide runners and boat keels.

The bark of trembling aspen was once used as famine food by First Nations people and its leaves were used medicinally to relieve the itch of insect stings. Canoe paddles and teepee poles were also commonly made from aspen wood.

The importance of plants to our natural environment:

Plants make oxygen. All green plants, when exposed to light, produce oxygen while consuming carbon dioxide in a process called **photosynthesis**. At night when the light is gone, they use oxygen to **respire**. However, plants produce a lot more oxygen than they consume, providing all living things on Earth with the oxygen they need to live.

Plants also play an important role in preventing soil erosion. Some plants have deep roots to ensure that even in dry years they can find enough moisture. Trembling Aspen have roots that can push up new buds or suckers if a forest or grass fire sweeps through and kills the part of the plant above ground. These roots hold the soil together and absorb water in times of heavy rain.

Pollinators are insects that pollinate flowers. Flowers are important to insects such as bees, wasps and butterflies both as a source of nectar (sugar) and pollen (rich in protein and fat). In turn, the insects move pollen to different flowers. Bees often carry yellow or orange balls of pollen on their legs. This **cross-pollination** is necessary in many plant species for seeds to develop. Pollination is an example of how plants and insects help each other. Lilac shrubs for example are often visited by swallowtail butterflies; bees love dandelions; while small flies and insects generally pollinate bunchberry.

If pollination by insects does not occur, some flowers can fertilize itself. Trembling aspen trees are either male or female, but only male trees are observed for PlantWatch. The male trees can start to release pollen before many female trees' catkins are receptive or ready for pollination. The fuzzy male catkins of the Trembling aspen emerge in late winter and lengthen in early spring. The red / pink pollen sacs release pollen into the air. The catkin eventually dries up and falls off the tree. In **self-fertilization**, no mixing of different genes occurs. Thus self-pollination results in less genetic variability in the population and a decreased ability to withstand more extreme conditions. It does however; ensure continuation of a species when conditions are not favorable for cross-pollination.

Adaptations and special features help plants survive and thrive in certain habitats:

The PlantWatch species have unique characteristics that students can observe, identify and discuss.

Why is the bark of Trembling aspen green inside?

The thin layer of green tissue just under the bark allows the tree to convert light to food or sugar by the process of photosynthesis. Even before the leaves emerge; the tree can take advantage of spring warmth and light. To protect the bark from sun scald, the south-facing side of the tree often has a white powder on it that acts as a sunscreen.

Why do bakeapples have bowl-shaped leaves?

Bakeapples have bowl-shaped leaves that act like parabolic lens which allows the flowers to become warmer than the air circulating around it. This is advantageous in the northern cool climate to pollinators. They are also a low growing plant which is beneficial in their often windy habitats.

What is special about the bunchberry?

Bunchberry has the distinction of being the fastest plant on earth due to explosive opening of pollen sacs within the flowers, triggered by insects. In less than a half a millisecond, pollen is ejected with an acceleration of 800 times the force experienced by astronauts during launch.

Why does Labrador tea have fuzzy foliage?

Because Labrador tea is an evergreen shrub it has the advantage of an early start to the growing season. Its leathery leaves can tolerate high UV light in its northern habitat. The narrow, hairy leaves enable it to reduce the amount of wind blowing over them preventing transpiration.

Why does Partridgeberry leaves turn purplish in the winter?

Despite it being an evergreen shrub, in the winter the Partridgeberry leaves turn a purplish color acting as an antifreeze agent. This is advantageous in the spring as it allows the leaves to warm up faster and enjoy and early start to the growing season. Each plant has a temperature range in which it grows best. Spring flowering perennials need a certain amount of heat to bloom. How does temperature affect these plants? Complete the Growing Degree Summation activity to calculate the heat necessary to get their chosen plant to bloom. What are the local conditions (habitats) where the plants are growing? How are the plants like others in the same area? How are they different?

Plants use different techniques to make sure their seeds are moved to good growing sites. Compare the seed dispersal of aspen poplar and dandelion to that of bunchberry or red maple (or other PlantWatch species). How are they different? How do you suppose the seeds are dispersed? Complete the *Growing Plants from Seed* activity to discuss further seed dispersal.

Plants go through different growth stages. A complete sequence of growth stages is called a life cycle. Observe and describe the life cycle of a PlantWatch species (use words / sketches).

Create a school PlantWatch garden using the species that naturally occur in your area. Students can observe the plants at all the stages of their life cycle. The MUN Botanical Garden has a limited number of Birch, wild strawberry and larch to help get you started. For information on how to obtain these plants, contact Madonna Bishop at the Garden at mbishop@mun.ca

Memorial University of Newfoundland Botanical Garden Inc. Memorial University of Newfoundland, St. John's, NL A1C 5S7 Phone (709) 737-8590 Fax (709) 737-8596 <u>www.mun.ca/botgarden</u>

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Suggested Extended Activities





Growing Plants from Seed (Grade K - 6)

Purpose: In this activity, students are provided a hands-on experience of planting seeds, monitoring seedlings as they grow, and plotting the results over time. They will understand that all seeds are different in terms of size, shape, texture, and color, and that seed germination is variable.

Subject Area: Science

Objectives – students will:

-Categorize seeds

-Discuss how seeds are dispersed

-Understand what plants need to grow

-Plant seeds

Group Size: Small groups / individual

Duration: One class period

Skills: Observing, Classifying, identifying plants

Materials Required:



- Various seeds from a reputable company or seeds collected from nature (be sure to use proper etiquette when collecting native / wild seeds)

- Clean sterile pots (sterilize with bleach solution – 2 tablespoons of bleach per one liter of water – one pot per student)

- Sterile potting mix
- Watering can

- Ice cream containers (or a similar object to use as labels)

Procedure:

Discover the parts of the seed. Have a variety of seeds on hand and begin the activity with a class discussion about seeds. Are all seeds the same? How are they different? Show students a variety of seeds and have them arrange them into various categories (ie, hard, soft, round, oval, smooth, rough, etc).

Tell students that we wear a coat to protect us from the cold. A seed also has a coat to protect itself. Inside the seed, there is an **embryo** which is the beginning of a new plant. This starts to grow when the soil around the seed is warm and

damp. At first, the baby plant feeds on the food stored inside the seed. But as soon as the first leaves open, it begins to make food for itself.

In a brain storming session, discuss how seeds are dispersed. Some seeds such as dandelions grow their own fluffy parachutes and send seeds floating through the air. Maple trees seeds' have wings, which spin them to the ground like tiny helicopters; while other plants are dispersed with the help of animals and people.

Ask students what plants need to grow (soil, water, sunlight, space, etc). Tell students that today they will become gardeners, and begin taking care of special plants. The class will have to tend the plants every day, perhaps create a rotating schedule of "Gardener's of the Day". Their job will be to check to see if the plants have germinated or need watering.

Set up various stations to include pots, soil, seeds, a watering can, and labels. It may be helpful to have various stations with the same kind of plant (ie, station A – Beans, Station B – Peas, Station C – Sunflower). Students will move through their desired station. Have students fill the pots with soil, allowing room at the top to cover seeds. Moisten the soil thinly on the surface. Cover the seed with soil. Make a label for each flower pot and include the name of the seed, when it was planted (the plant's birthday) and the students' name. Place the label inside the flower pot. Labels can be made from recycled plastic ice cream containers or similar objects.

Cover the flower pot with plastic or glass and place in appropriate light requirements. Consider using fluorescent lighting when germinating seeds. Fluorescent lights, especially tube lighting is the best form of artificial light to use in this application. The lights do not get hot and seedlings can be kept to within 6 inches of the lights. When germination begins, remove the plastic or glass covers. If fluorescent lighting is not available, place the pots on a window ledge on a sunny south facing window, but be careful of drafty windows.

It may be useful to initiate the assistance of older students or parents when watering as a strong water flow on the soil could unearth the seed, and cause problems with germination. Also, helpers can assist young children to write their own plant label, and put the label in the pot right away to avoid unclaimed pots and upset students later on.

Have older children chart the progress of their plant's growth on a daily / weekly basis.

Note: Teachers may wish to use old newspapers to make flower pots. Simply gather newspapers and using one sheet of newspaper, fold into thirds - lengthwise. Wrap the newspaper around a pop can and tape the seam where the newspaper meets. Fold the newspaper on the bottom of the pop can and tape into place. Pull the newspaper off the can and proceed to fill the 'green' flower pot with soil and plant a seed. Follow procedure as if using a plastic pot.

Teacher Reflection:

The Biology of a Flower (Grade 6-12)

Purpose:

The purpose of this activity is to have students dissect a flower to investigate each part; to understand how they grow; and reproduce. After all the parts have been identified, the students will create their own microscope slides using index cards. They will then have to compare how each part looks without a microscope verses how it looks using a microscope.

Subject Area: Science

Objectives – students will:

- Gain an appreciation of flowers
- Identify the parts of a typical flower
- Understand the function of each flower part

- Use lab tools appropriate for their grade level

- Create a microscope slide of their flower parts

Group Size: Whole Class / Small Groups

Duration: One Class Period

Skills: Performing, Recording, Analyzing, interpreting

Materials Required:

-Background information: The Biology of a Flower

-Index cards

-Tape

-Hole punch

-Flower part chart

- -Fresh cut flowers such as lily
- -Microscope(s) or hand held lens
- -Scalpel blades or plastic knives



Teachers Note / Background Information:

Flowers occur in a variety of sizes, colors, textures, and habitats. Flower are either **annuals** - complete their life cycle in one growing season; **biennials** – complete their life cycle in two seasons, or **perennials** - may take several to many years to complete their life cycles.

A flower is considered a "perfect flower" when it has all or some of the following features:

- Sepals typically consists of a whorl of three to five small, usually green, leaflet-like projections. Sepals cover the flower buds providing them with protection. Not all plants have sepals; some have sepals that are the same color as the petal. The sepal in some flowers may be fused together.
- 2. Petals are the colorful parts of the flower. The purpose of petals is to attract pollinators such as bees, wasps, butterflies, moths, and birds. As with sepals, the petals are often separate units, but in some flowers, the petals may be fused together into a single trumpet-shaped flower, and some flowers do not have petals at all.
- 3. **Stamen** is the male part of the flower made up of the **filament** (stalk) and the **anther**, which produces the pollen.
- 4. Pistel is the female part of the flower that is often shaped like a small closed-top vase and is made up of the stigma (sticky tip to catch the pollen), style (long stalk), and the ovule or ovary (contains the seeds that eventually develops into a fruit).

A flower is considered a perfect flower when it has male and female parts on the same flower.

Flowering plants are categorized into two major classes: **monocots** and **dicots**. They are distinguished from one another in terms of seedlings, flowers, and leaves. The chart below illustrates these differences.

Monocots	Dicots
Primarily herbaceous	May be herbaceous or woody
Include species that produce bulbs,	Includes many annual plants, flowering
grasses, orchids, irises	trees and shrubs
Seedling with one seed leaf (seeds	Seedling with two seed leaves (seeds
cannot be split when moistened – ie,	can be split when moistened – ie,
corn, wheat, barley)	peas)
Leaves are grass-like with parallel	Leaves are broad and branch into
veins (ie, Iris, Lily)	multiple veins (ie, alder, poinsettia)
Male flower parts occur in threes or	Flower parts mostly in fours or fives or
multiples of three (ie, Lily). The sepals	multiples of four or five (ie, cyclamen)
are often same color as petals.	Petals can be sometimes fused (ie,
	foxglove)

Caution:

Find out from students if there are any plant-related allergies. Scalpel blades are very sharp and must be handled carefully. Wash hands thoroughly after this exercise.

Procedure:

The teacher may wish to review the "Biology of a Flower" background information before beginning this activity. Begin the session with a brief discussion about flowers. This will allow the teacher to find out what the students already know about flowers and what they would like to know. Some guiding questions might include:

-Are all flowers the same?

-Do flowers grow all over the world – in different habitats?

-Why do you think flowers are important?

-Why do you think flowers occur in various colors and sizes?

-How do the shape of reproductive structures in flowers aid in their function?

A. Divide the students into pairs. Provide each group with one fresh cut flower (such as a lily) and a *Flower Part Chart* (appended). Review the parts of the flower with the group by doing this simple exercise. Explain to students that as they go through each part of the plant, they will tape the part in the appropriate space in their chart.

Ask "what do the petals do for the flower"? Accept all reasonable answers. Explain what the petal does for the flower. Pull petals off the flower and place on the flower part chart. What is remaining?

Tell students they are looking at two major parts of the flower: the stamen and the pistil. The anther and the filament make up the stamen. Pull the anther and the filament from your flower and place each part in the appropriate box on your chart.

The next major part of the flower is the pistil. The stigma, style and ovary make up the pistil. Carefully make a hole in the bottom of the flower (almost near the stem), open up and you will find something in the shape of either a "n" or "u". This is called the ovary. Explain the function of the ovary.

The top part of the long piece is called the stigma. Pull it off and place it in the appropriate box. Explain the function of the stigma.

The long piece that connects the stigma to the ovary is called the style. Explain the function of the style. Pull the style off and place it in the appropriate box.

Another important part of the flower is the sepal. Explain the function of the sepal. Pull the sepal off and place it in the appropriate box. Why do you think the flower has so many different parts?

Students have already broken the flower down into parts and the parts are visible to them on their chart.

B. Students will create microscope slides using a small piece of each flower part, index card strips, and tape. Discuss how each part looks under the microscope? Not under the microscope? Draw a picture of each part as you see it under the microscope. How do they differ? Discuss.

Biodiversity Identification: The Race is On! (Grade 4-12)



Purpose: A fundamental skill in the study of biodiversity is identification. We need to be able to differentiate between species in order to provide accurate inventories and monitoring programs. This activity is a fun and active ID test used to reinforce the skill. This activity is a great nature hike postactivity. The activity can also be done during the

winter using photos. For younger students – teacher could give them cards (photos) and students have to find their match. The activity can help to differentiate between species and to help students learn the scientific names of the species.

Subject Area: Science

Objectives – students will:

-Learn to differentiate between species

Group Size: Ideal size is 20 – 30 participants (divided into two teams)

Duration: One class period

Skills: Plant Identification

Materials Required:

-Samples of species previously covered in an identification-based program. These samples may include cut twigs and branches, cones, leaves, and pressed specimens. Photos may also be included if live materials are not possible to collect.

Procedure

Before beginning this activity, teacher should collect and laminate species photos or collect sample species – be sure to follow proper collecting etiquette before collecting in any area.

After completing an identification program such as a nature hike, samples or representations of the species covered are laid out on a table in the centre of a room or outdoor space. As part of the PlantWatch NL program, these samples may include twigs or leaves or pressed specimens that have been laminated, photos, or freshly cut specimens. They will be handled a bit roughly and so should be either protected or not of long-term interest.

Divide students into two equal teams, and then line them up parallel to the table, but on opposite sides. They should be equal distance from the table; depending on the size of the space they can be anywhere from 3-10 metres away from it. The teacher numbers off students on each side of the table, so that each team has a number 1 person, a number 2 person, and so on until each student has an assigned number.

To play, the teacher calls out a number and a species name (ie, number 2, balsam fir). The two students with that number race to the table and the first one to hold up the corresponding specimen is awarded the point for their team. Generally one specimen of each species is on the table, however two specimens of each could be set out and the first person to cross the line back to their team with the correct specimen is then the winner. All specimens are returned to the table.

The game continues until each student has had at least one turn. It works well when the number of specimens equals or exceeds the number of students on each team. However, more challenging specimens can be called more than once.

Teacher Reflection:

Weaving the Web of Life – The PlantWatch Way (Grade K-6)

Purpose: Plants and animals are connected in many ways. Each species is like a strand that makes up the larger web of an ecosystem or habitat. A plant or animal relies upon the health of an ecosystem for its survival and, in turn,

contributes to the overall health of that ecosystem. Whenever a thread becomes weak, or breaks, the whole web of life becomes that much more fragile. The purpose of this activity is to illustrate the concept of ecosystem health and the role of interdependence.



Subject Area: Science

Objectives – students will:

-Understand that plants and animals are connected to each other

-Define web of life

-Understand what happens to an ecosystem when a strand in the web of life is broken

Group Size: Whole Class

Duration: One Class Period

Skills: Communicating

Materials Required:

-Ball of string

-Web of life tags (prepared in advance)

-Name tag holders with strings

Teachers Note / Background Information:

Prior to playing this game, prepare identity tags that represent plants identified in the PlantWatch program as well as plants and animals found in your community. Examples may include: butterfly, bee, larch, bunchberry, lilac, dandelion, dragonfly, snowshoe hare, moose, blueberry, spruce tree, etc...

Procedure:

Invite students to form a large circle. Provide each student with an identity tag to represent some element of an ecosystem or habitat. Students should think about what they need or what needs it, in order to survive in their habitat. The teacher, who represents the sun, steps into the centre of the circle and begins to weave the web of life.

The sun (teacher) will pass the ball of string to some element of the habitat that needs the sun to survive, while holding on to one end of the string. (i.e, pass the ball of string to the dandelion or lilac). The teacher should say, "I am passing the string to the dandelion because it needs me to survive. " From there, ask the dandelion to pass the string to another element that might need it or vice versa. Follow the same procedure and continue passing the string, ensuring that each time the string is passed, it is justified. Challenge the students to try to make connections with everyone else in the circle, so that no element is left out. When all connections are made, ask students to examine the pattern they have just created. Explain that this web pattern exists between all the elements of an ecosystem (including your school grounds or nearby park). These patterns of interconnections are called the web of life.

Ask students to make a prediction about what would happen if one of the ecosystem elements was removed. Once all the elements have been used, the teacher will tell students that something has happened to this ecosystem. Using Newfoundland and Labrador as an example, tell students that there is more rainfall than normal this season and there are many floods. Ask students to think about what plants and animals might be affected (butterflies for example would not fly on rainy days). For each plant or animal that is affected, the student should release the string. Ask those students affected by the loss to explain how they were affected. It is important for students to understand that the destruction of a web of life could occur in any habitat or ecosystem. Relate the destruction to climate change.

Ask students how such destruction might affect humans? To conclude, facilitate a class discussion about climate change and how we can help in our actions to show how such things can be avoided. What do you think we can do to prevent this from happening?

Invite a guest speaker into your classroom to talk about climate change and the effects that climate change is having and we can do to help stop global warming.

One of the fundamental principles of ecology is that everything is connected to everything else. Every plant, animal and person is connected to other living things and to other parts of the natural environment. Our actions have an impact on the environment and other living things. We are part of the "web of life."

Teacher Reflection:

Leafing Out (Grade K-12)

Purpose: The purpose of this exercise is to illustrate the life cycle of a branch and to assist with plant identification.

Subject Area: Science, Language Arts, Art

Objectives – students will:

- -Collect branches for observation
- -Observe branches on daily basis
- -Sketch branches as they leaf out
- -Record changes in branches

Group Size: Whole Class / Small Groups



Duration: One Class Period for collection plus ongoing for observations

Skills: Sketching, Measuring, Observing, Comparing, Recording, Analyzing

Materials Required:

- A pair of sharp hand pruners or secateurs
- Jars of various sizes
- Copy of Ryan's Trees and Shrubs

Teachers Note / Background Information:

Using the Trees and Shrubs book will help with identifying the branches in this activity. Be sure to use proper pruning etiquette when cutting branches. **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 water. 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.

Let the students spend time every day examining each branch. Encourage 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).

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 could 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 limbs of trees 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.

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 have several plants, let the students compare the photos to the branch and if they can make the correct match. Compare sketches or photographs taken the first day the branches were immersed in water to when the leaves had 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.

Teacher Reflection:
Math Connections...

The PlantWatch NL program: Our Plants and Climate Change provide students at various grade levels with the use of real world experiences as they develop mathematical concepts. The connections provided in this resource kit follow the key-stage curriculum objectives (KSCO's) set out by the *Foundation for the Atlantic Canada Mathematics Curriculum*.

The activities and lessons in this resource kit:

- Engages students as active participants in the collection and analysis of scientific data

- Provides an opportunity for students to practice using their observation skills and to make accurate records

- Encourages students to report findings in a scientific manner

As PlantWatch citizen scientists, students must be able to portray their information in graphs that are easy for others to understand. The following skills listed below all involve mathematics and are transferrable to other fields of study and the PlantWatch program. These include: Measuring temperature, Addition, Subtraction, Division, Graphing, Calculating averages, Linear measurement, Data management (organize / display), and Latitude and Longitude calculations

Growing Degree Summation (GDS) (Grade 7-12)



Purpose: The purpose of this activity is to understand and determine how much heat is required for plants to bloom. Please keep in mind that some variations will occur throughout the province because of other local factors such as topography, variations of snow cover, weather

variation and events, as well as gardening techniques.

Subject Area: Math

Objectives – students will:

- Understand that spring plants require a certain amount of heat before they will flower.

- Understand the concept of growing degree summation (GDS)

- Graphing daily average temperatures
- Identify seasonal patterns using past weather data

Group Size: Whole Class / Independent

Duration: One Class Period

Skills: Calculating (addition and division), graphing and use of Centigrade temperature scale

Materials Required:

- Chart of Daily Data (Temperature) Report for St. John's and Corner Brook (May / June 2009)

- Graph Paper

- Calculator (optional)

Teachers Note / Background Information:

Spring flowers will bloom after they are exposed to a certain amount of heat. The concept of **growing degree summation (GDS)** provides a way to add how much warmth or how many **heat units** a plant has been exposed to as

winter changes to spring and temperatures rise. These units of heat are often referred to as "growing degree-days". Plant growth in Newfoundland and Labrador probably begins when temperature rises above 0 degrees Celsius. However, for the purpose of this activity, we will use 5 degrees C as a base temperature (the minimum temperature at which plant growth starts – Environment Canada). This is the standard temperature used in agriculture. **Procedure:**

A. Determine the Daily Average Temperature

Begin the activity by having students review the data provided in Environment Canada's daily data report for May and June, 2009 for both St. John's and Corner Brook. Using the information students will determine the average (mean) daily temperatures for each day of May and June for each city. Determine the daily average temperature in any location by adding the daytime high (usually occurs in the day) and the daytime low temperature (usually occurs at night) and dividing by 2.

Graph the daily average temperatures for both cities for May / June 2009. Do the temperatures fluctuate over the two month period? Were there any days when the average temperature was below zero in May or June for either city? Which city had the warmest spring on average?

B. Calculate the growing degree summation (GDS) for each day of May and June, 2009 for each city. To do this:

Subtract 5 degrees from the mean temperature (calculated in part A) to determine the GDS (heat units) for that day. If the weather was cool and the average temperature was less than 5 degrees, then that day had no GDS, and does not count in your GDS calculations. (Do not add a negative GDS in your calculations; simply count these as zero GDS).

Example:

High or maximum temperature	15 degrees
Low or minimum temperature	3 degrees
	15 degrees + 3 degrees = 18 degrees
Mean temperature	18/2 = 9 degrees

Degree Summation Above 5 degrees 9-5 = 4 GDS on this date

Have students collect the high and low temperature data for your area for the last month. The daily high and low temperatures are generally published in daily newspapers or on the Environment Canada weather website. Use the confirmed temperatures listed for the previous day. Calculate the average (mean) daily temperature for each day. Graph the average daily temperatures so you can see how the temperatures fluctuated in your area over a period of one week / month. Calculate the GDS for each day in the same period.

Calculate the accumulated GDS for first blooming of plant(s) that you have chosen to observe. The accumulated GDS will tell students how much heat it takes that year for a particular plant to flower.

Example:

If there were 60 GDS for the location of your plant up to May 1, and the plant first bloomed on the evening of May 3, what was the total GDS (heat units) needed for first blooming?

Answer:

Heat units from days before May 1 = 60 Plus GDS above 5 degrees on May 1 = 5 Plus GDS above 5 degrees on May 2 = 4 Plus GDS above 5 degrees on May 3 = 7 Total GDS = 76

Question: The plant was in mid bloom late on May 7. What was the total GDS needed to reach full flowering?

Day	St. John's, NL			Corner Brook, NL				
2009	M	ay	Ju	ne	Ma	ay		June
	High	Low	High	Low	High	Low	High	Low
1	11.0	-1.4	23.1	5.8	11.2	-1.7	19.0	6.1
2	12.8	7.7	18.5	5.2	11.5	2.3	12.6	6.7
3	10.4	5.8	17.4	7.2	14.0	1.8	14.4	4.5
4	11.9	6.8	19.3	5.9	16.9	2.7	18.3	4.3
5	11.1	1.3	18.8	8.6	8.6	0.2	17.9	4.4
6	15.5	2.7	19.3	6.7	18.4	0.7	21.4	9.7
7	12.5	2.0	14.9	5.8	9.2	3.0	16.7	7.7
8	12.7	1.6	15.4	5.6	8.1	3.8	12.7	3.9
9	12.8	4.4	6.5	4.4	9.1	2.8	10.8	4.0
10	7.6	0.5	6.2	3.7	3.5	-0.6	14.8	3.8
11	4.8	-1.6	9.7	3.7	2.7	-3.1	16.4	5.8
12	8.8	-0.9	10.4	5.3	10.7	-4.1	13.8	8.5
13	15.5	-0.1	18.8	3.2	17.1	-0.2	17.0	8.3
14	21.3	5.4	8.7	1.5	20.2	4.3	14.3	3.0
15	16.7	6.9	12.8	2.0	11.8	2.7	19.4	2.8
16	16.4	4.5	17.0	5.1	13.6	0.6	20.2	4.0
17	18.9	2.6	19.1	6.2	16.0	1.1	22.4	7.2
18	21.1	11.4	20.2	8.1	17.2	2.5	26.1	11.1
19	20.1	13.8	26.4	7.2	5.2	1.6	25.4	11.8
20	16.3	2.7	22.3	9.4	7.4	-0.2	24.7	11.9
21	10.6	2.1	19.8	10.7	8.2	-0.8	25.0	11.7
22	23.1	3.0	16.5	10.0	15.6	2.7	25.8	10.9
23	13.7	0.3	20.9	9.9	7.0	-0.3	19.5	13.3
24	15.9	0.6	18.5	13.2	18.3	-0.4	18.7	12.1
25	12.3	0.3	23.6	14.6	13.5	1.5	24.5	16.6
26	4.8	-0.5	23.9	15.8	6.7	1.1	25.4	11.9
27	7.8	0.7	17.0	9.4	8.5	0.7	16.9	8.2
28	13.9	1.8	16.0	9.5	14.5	1.3	21.7	7.9
29	17.4	3.1	13.4	8.6	18.2	3.4	26.9	11.5
30	10.2	5.8	11.4	7.8	15.0	8.2	26.5	12.4

Daily Data Report for May / June 2009 (St. John's & Corner Brook)

Converting Degrees and Minutes to the Decimal Form



Purpose: PlantWatch can easily use your latitude and longitude if it is in decimal format (to at least two decimal places). To obtain a decimal version of degrees and minutes, you have to convert the minutes, which are normally expressed as a fraction of one

degree, into a decimal, and add this figure to the number of degrees. In one degree there are 60 minutes.

Subject Area: Math

Objectives – students will:

-Find the latitude and longitude for your school

-Convert latitude and longitude to decimal format

Group Size: Independent study or small groups

Duration: One Class Period

Skills: Calculating

Materials Required:

-Converting Degrees and Minutes to Decimal Form Worksheet (appended) -GPS Receiver

Teachers Note / Background Information:

Review the example with the students before having students complete this activity.

Procedure:

Review with students the formula for converting the latitude and longitude to decimal format. Review the example using MUN Botanical Garden's coordinates. Have students find the latitude and longitude for their school, either by using a GPS to mark the way points or use a google map to get the coordinates. Provide students with a copy of the worksheet chart and have them complete it. Using the coordinates from your observed PlantWatch species, convert the degrees and minutes to decimal form and include it on your observation form.

Example (using latitude only)

- 1. Start with degrees and minutes
- 2. Divide the minutes by 60
- 3. Add decimal minutes to degrees

MUN Botanical Garden in St. John's, Newfoundland & Labrador is located

47°34′20″N; 52°45′50″W

Converting the coordinates to decimal format:

Latitude:

Start with:	Convert to decimal form:			
47 degrees	= 34 minutes / 60 minutes	= 47 degrees		
34 minutes		+0.57 degrees		
N latitude		=47.57 degrees N latitude		

Calculating Averages

(Grade 7-12)

Purpose: The purpose of this activity is for students to familiarize themselves with and create a Julian calendar. Students will use the Julian calendar dates to average the flowering dates of observed plants, and report this average to the PlantWatch website.

Objectives – students will:

- Average the flowering date for an observed PlantWatch species
- Understand how a Julian calendar works
- Create a Julian calendar

Group Size: Independent or small groups

Duration: One Class Period

Skills: Addition and Subtraction

Materials Required:

- Paper / pencils or computer with spreadsheet program

Teachers Note / Background Information:

How to calculate an average flowering date:

For plants that all flower during one month

If the observed plants all flower during one month, students can find an average using the days of the month in which they were first flowering. For example, supposing there are five "first flowering" dates in June. The calculation is done as follows:

June (3+4+8+10+10)/5=7

June 7 is reported as the average first flowering date for the observed plant. If the number is a decimal, the number is rounded off.



Using a Julian calendar

To easily calculate the average date of a flowering stage (for example, first flowering), the Julian calendar is often used. Have students create their own Julian calendar for this year. In the Julian calendar, each day of the year has a number starting as follows:

January 1 = Julian day 1

February 1 = Julian day 32

March 1 = Julian day 60

December 31 = Julian day 365

This way of calculating dates is very useful when the dates to be averaged spans two months.

For example, April 29, May 2 and May 3 converted to Julian dates make averaging a simple mathematical problem. In a leap year (ie, 2004, 2008, 2012), when we have an extra day, February 29, you need to alter the calendar that March 1 = Julian day 61 and so on up to December 31 = Julian day 366. Determine the Julian day for each of your plants' first flowering date that you recorded. Find the average of these numbers by adding them together and dividing by the number of dates added.

Refer back to your Julian calendar to determine the month and day of this average Julian date.

Example: if the class observed five patches of coltsfoot in the year 2000 (a leap year), with first flowering dates of May 28, 30, and 31, and June 2, then the Julian day calculation would be as follows:

May 28 = Julian day 149

May 30 = Julian day 151

May 31 = Julian day 152

June 2 = Julian day 154

June 2 = Julian day 154

Total of Julian dates: (149+151+152+154+154=760/5days = Julian day 152 Therefore, May 31 is the average first flowering date for these five patches of coltsfoot.

Procedure:

To get a good idea of this year's blooming times in your area, it is best to observe several plants of your selected species. Blooming times vary between individual plants, and it is most accurate to report an average or mean of these flowering dates. Calculate an average first flowering date for observed plants that all flowered during one month.

Calculate the average date of a flowering stage (for example, first flowering) for observed plants, using a Julian calendar.

Report your calculations when you send in your PlantWatch data. When reporting blooming dates, students should put the average date of the same plant species under the Comments section on the Observation form (ie, "the average date of flowering for our five patches of coltsfoot was June 2").

Compare your flowering dates with other schools in your community or region. It may be a good idea to set up a "Plant Buddies" website in which students can discuss and compare their data with other schools across the province.

Teacher Reflection:

Marking your PlantWatch Location (Grade 6-12)

Purpose: Knowing the location of your PlantWatch species is very important data for research scientists. In this activity, students will learn how to document

the location of their PlantWatch species in latitude and longitude, using a GPS. This activity provides an introductory lesson to GPS (Global Positioning System) using the Garmin Etrex Legend H.

Objectives – students will:

- Define Global Positioning System (GPS)
- Define Universal Transverse Mercator (UTM)
- Understand how a GPS receiver works
- Use a GPS receiver to mark PlantWatch locations

Group Size: Whole Class / Small Groups

Duration: One Class Period– or longer depending on the grade level

Skills: Mapping, Technology

Materials Required:

GPS units (one per two students would be ideal but will vary depending on the class size)

Batteries

Baseball hat or use a student's hat

Procedure:

A. Describing your Position and the GPS Unit

Gather all students outside in a semi-circle (do not pass out GPS units until explanation has been given).

Ask students if they know what a GPS is and how it works? Tell students that a GPS means Global Positioning System. It is a tool that uses satellites to determine one's position on the planet.



Ask students if they can name either of the two systems that describe our position on the planet. Most students should know longitude and latitude; few will know the UTM (Universal Transverse Mercator) system.

Explain to students that the longitude and latitude system was historically developed to provide safe ocean navigation. Only one set of longitude / latitude coordinates describe only one point on the planet.

The UTM system, on the other hand is more useful for land navigation where an accuracy of one kilometer or less is desired. It is a global system of grid-based maps. One set of UTM coordinates describes 60 points on the planet.

Using a baseball hat, explain to students that with the UTM system, the Earth is divided in to sixty (60) panels, just like the hat is divided into six (6) panels. When UTM coordinates are communicated so is the panel number. For example, St. John's is in panel 22 and Corner Brook is in panel 21.

Ask students what they should carry when they go hiking in the woods in addition to a GPS? Remind students that a map and compass is especially important in case at any point your GPS or batteries fail. If you are navigating in the country, it is essential that you know how to use a map and compass and that you carry these with you even if you are also using a GPS.

B. Introducing the GPS Unit: A Tour of the Buttons

Divide students into small groups and provide each group a GPS unit (or one unit per student if the class is small or depending on the number of units available).



Start with the lower right (power button) and go through the buttons counterclockwise.

Power Button: Have students press and hold to turn the units on. (Depending on the GPS unit, you may have to press the button several times to get a brighter screen).

Quit / Page Button: Have students press to cycle through the main pages: map, compass, trip computer, and main menu pages. Tell students that they will use this button if they are ever on a page / menu that they want to exit from (like an escape button on a computer).

In / **Out Zoom Buttons:** Have students go to the map page and zoom out to see the island of Newfoundland. Zoom in to see their immediate location.

Menu / Find Button: Press and release to view the Options Menu to the current page. (Press the Quit / Page Button to leave menu options).

Enter / **Rocker Button:** Rock up, down, right or left to move through lists; highlight fields, onscreen buttons or icons; or move the map panning arrow. Have students pan around on the map page.

Press in and release to enter highlighted options and data or confirm on-screen messages. (Make sure to press straight in on this button or it will pan away from where you mean to click).

C. Introducing the GPS Unit: Touring the Pages

The Satellite Page:

Press the page button to reach Main Menu. Use Rocker / Enter button to select "Satellite".

The Satellite Page will be similar to this and provides a visual of the satellites being tracked.

The circles indicate the pattern of satellites in the sky over our head that the GPS is connecting to.

There are 24 GPS satellites circling the earth all

sending out signals at the same time. Your GPS unit will calculate the time difference for the signals to arrive from the satellites it is connected to calculate your position.

You need to be connected to at least four satellites for your GPS to work. The bars show a strong enough connection.

Ask: is everyone connected with at least four satellites?



Press the Page Button to reach the main menu page and cycle through until you reach the Map Page.

The Map Page:

The Map Page will be similar to this (with a line map of your area). It displays roads, landmarks, and the shape of the landscape.

The black arrow shows your location.

Press the in / out zoom buttons. The number at the bottom left shows the scale of the map. Have students note what the numbers are as they zoom out to 8 km and then zoom in to 20 m. What happens when the unit changes from km to m?

Use the Rocker button to move around on the map. Press

the Page / Quit button to return to your present location.

The Navigation / Compass Page:

The Navigation page will be similar to this. The arrow will appear only when you have initiated a Go To and it will guide you to your destination (you will learn how to create a "Go To" in Part IV of this activity).

Ask your students to start walking. How fast were they travelling?

D. Marking and finding a Waypoint:

Explain to students that a GPS will find one's position on the Earth. Everything else including speed and direction is calculated from your position. Next to telling you where you are on the Earth, the greatest power of a GPS is bringing you to a known point. These points are called **waypoints** and can be entered manually or by using the unit to mark your present position.

Lead the students for a short walk and stop between .5 and 1 kilometer from the school. Students must bring along their GPS units for this activity.

Map Page

Distance

1.53

Speed 4.5h

Final ETA ETE 02:20% 00%51



Compass Page





Explain: You're out in the woods and you've found a very unique plant – something you've never seen before. You did not bring your camera with you and you know you cannot pick the plant but you want an expert to see it to identify it. You want to mark this spot to be able to get back to it within the next few days so you can take photos or even better, bring along the expert. Finding the location when you return will not be easy in this forest. Students will enter their current location as a *waypoint* on the GPS so they'll be able to find the site again when they return.

Take a look at the surroundings and note any special features. This is important since your GPS will not take you back to the exact spot where you are.

How to mark your current location as a waypoint:

Turn on your GPS unit:

While on the MAP PAGE press and hold the ENTER/ROCKER button until the MARK WAYPOINT PAGE appears.

At the top of this page you'll see the default Waypoint name (a three digit number), the time, location and elevation associated with your waypoint. (Remember the number of this waypoint) Make sure that "OK" is highlighted and press the ENTER/ROCKER button save the waypoint.

Lead the students back to the school.

Explain that since it is still very early in the day, you decide to go back to the forest. This time armed with your camera!

Once again turn on your GPS unit. Create a "GO TO" to navigate back to your waypoint (the unique plant).

How to create a "GO TO" to navigate back to your waypoint:

Press and hold the MENU/FIND button until the FIND menu appears. Use the rocker key to select Waypoints. Select your waypoint from the list. Ensure "Go To" is highlighted at the bottom of the page and press the ENTER/ROCKER button. Press QUIT/PAGE button to bring you to the compass page. The compass will only work once you are moving. Watch the compass as you start walking and follow the arrow to the unique plant. When you arrive back at your destination press MENU/FIND button and select "Stop Navigation".

Mark the location of your PlantWatch plant for Observation:

(Repeats the above activity for more practice)

Select a tree or plant near the school, in a local park, or a natural area, and walk to it. Explain to students that they will be observing and recording the bloom time of this plant over the next few days / weeks. They will need to record the location of these plants for further study. Take a look at the surroundings and note any special features.

Turn on your GPS unit. Mark the location of the plant. While on the Map page press and hold the ENTER/ROCKER button until the Mark Waypoint page appears. Edit the name of the waypoint: highlight waypoint name and enter to open the on-screen key pad. Call this waypoint "Plant1" or the name of the plant being observed and the number - ie, Larch 1). Press ok to confirm changes. Lead students back to the school.

Turn on your GPS unit. Create a "Go To" to return to your waypoint (the plant) Press and hold the MENU/FIND button until the Find menu appears. Select Waypoints.

Select your Waypoint from the list. Ensure "Go To" is highlighted at the bottom of the page and press the ENTER/ROCKER button.

Follow your way back to the plant waypoint using either the map page (follow the arrow) or the compass page (follow the compass).

Stop Navigation when you arrive at the waypoint (press MENU/FIND and select "stop navigation").

Include the latitude and longitude on your PlantWatch Observation Form and classroom chart. Complete the activity "Converting Degrees and Minutes to the Decimal Form".

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Nature by Numbers

(Grade K-12)

Purpose: The purpose of this activity is to develop children's curiosity towards plants diversity and observation skills. Students will discover how plants are diverse through mathematics. The intent of this activity is to introduce the concept of numbers found in the natural world, and to encourage curiosity, wonder and necessity of the diversity of different plants.

Subject Area: Math

Objectives – students will:

- Develop a curiosity towards plant diversity

- Experience the concept of numbers found in the natural world

Group Size: Small Groups

Duration: One Class Period

Skills: Observation, Numeracy

Materials Required:

- Small sheets of paper for the children to mark numbers from 1-20 (or more)

- Something hard to write on (i.e.: clipboard)
- Pencils for the class

Teachers Note / Background Information:

The teacher will divide the students into pairs, and assign 2 or 3 sets of pairs to go searching with a parent volunteer or their teacher. Set some kind of boundaries to keep the students within view at all times. Give the groups as much time as they need to have discovered at least 5 to 10 items.

Procedure:

Arrange for the class to visit a location on the school grounds or nearby trail where there is a diversity of plants/habitats. Suggest to the students that plants have numbers hidden in them everywhere- ask the students where they

90



might find things in sets of 2 (i.e.: a twig branching into a fork, a bundle of red branches, a twinleaf leaflets, twinflower blossoms, etc). Ensure the class knows they are looking for natural things occurring in pairs or triplets, etc, not the actual number hiding in the garden.

Present the activity as a kind of scavenger hunt for the hidden numbers and patterns in nature, starting at the number 1 and counting as high as they can find. Encourage the students to write the name of, or draw a small picture of the found item representing each number. Parent helpers may be able to help younger students with this activity.

Follow-up/Discussion:

Bring the class back into a seated (or standing) circle. Ask all the pairs who found something occurring singly to raise their hands (hopefully, all will do so). Get a few pairs to share what they found, asking "Who else found that too?" Continue this as high as you can go.

If the group is still engaged, ask individuals, which was their favourite plant? Why? What surprised them about their search for numbers? Encourage even the quieter students to share what they liked. When time is up, or stories have run out, congratulate everyone for doing a great job.

Consider pointing out that the garden makes sure to have lots of different kinds of plants, and with so many kinds of plants, we can be sure to find all kinds of patterns just like nature does in the wild.

Teachers Reflection:





Social Studies & Language Arts Connections...

Spring Survey (Grade 3-12)

Purpose: Climate is the general pattern of weather in a region, based on a minimum of 30 years of records. Because several weather patterns tend to be similar over a long period of time, we are able to predict, with some accuracy, when certain changes in nature will take place in different locations. Phenology is the study of seasonal timing on life cycle events in plants and animals. Historical phenology records can provide evidence of the effects of climate changes over time.

Students are introduced to seasonal changes and the concept of phenology by surveying others about the signs of spring and making their own predictions. Use this activity in the fall or winter to introduce phenology to your students and get them thinking about seasonal change.

Objectives – students will:

-Make predictions about the timing of spring

-Record predictions -Interview others to make predictions

Group Size: Independent

Duration: One Class Period

Skills: Predicting, Communicating,

Interviewing

Materials Required:

- Survey Question Sheet (appended)

Teachers Note / Background Information:

Teachers will need to photocopy the Survey Question Sheet (one survey for each student).



Procedure:

Choose several local signs of spring that can be easily observed, and have the students predict when those events will occur. These signs may include the arrival of migratory birds (ducks, robins), changes in weather, the appearance of leaves and flowers, or changes in human behaviour (changes in clothing, seasonal sports, farming practices, etc).

Ask students the following guiding questions:

- When will the first spring migrants be sighted?
- When will the last snow on the school ground melt?
- When will the first mosquito appear?
- When will soccer season begin?
- When will farmers plant the first spring crops?
- When will ice on the lakes disappear?

Record the students' predictions on a calendar and encourage the students to report any sightings or observations of the predicted events.

Have students conduct a survey of their parents, grandparents or other students to learn about local signs of spring. The purpose is to find out how local people identify the arrival of spring and to discover when local people expect seasonal events will occur.

Have students share the results of their survey with the class. In discussing the results of the survey, be sure to point out how some events can be predicted with great accuracy (ie, the spring equinox, the next full moon, the last day of school before summer vacation). The timing of other events (bird migrations, frog calling, flowering dates, and planting times) may vary from year to year, often depending on the weather. Weather conditions include such things as air temperature, precipitation and wind.

Invite a local naturalist to talk with the class about when certain signs of spring will appear or plan a field trip to a natural park for an interpretative tour and to discuss signs of spring. Memorial University of Newfoundland Botanical Garden offers a "Signs of Spring" program.

Appendix

PlantWatch Letter (K-6)

PlantWatch Letter (7-12)

It's Springtime

Student Observation Forms

Flower Part Chart

Spring Survey

Converting Degrees and Minutes to Decimal Form

Guide to Nature Hiking

Proper Etiquette for Cutting Branches

PlantWatch NL Crossword

PlantWatch NL Word Search

PlantWatch Photo ID Cards

Glossary

References

PlantWatch Letter (Grade K-6)



PlantWatch NL MUN Botanical Garden Memorial University of Newfoundland St. John's, NL A1C 5S7

Dear Students:

I would like to introduce myself and a special program to you called PlantWatch NL, "Our Plants and Climate Change".

My name is Madonna Bishop, and I have always been interested in plants. Plants fascinate me; some have bright beautiful colors, some plants move with the sun; some plants have flowers that smell very pretty, and there are even some plants in Newfoundland and Labrador that eat bugs! Can you believe it? Did you know that we also have plants in Newfoundland and Labrador that cannot be found anywhere else on earth? Yes, that's right! The Braya plants for example live on the Great Northern Peninsula. Does anyone know the special plant that is a symbol of Newfoundland and Labrador – I'll give you a hint, its leaves are shaped like a pitcher or a jug for holding water! That's right; it's called the Pitcher Plant.

Did you know that plants are pretty special and important for people and animals too? They give us so much – like oxygen to breathe, food, fuel, shelter, tools, and even our medicines. Did you know that even some of our clothing comes from plants? We even use plants and flowers in our special celebrations. Plants are the source of all life on this planet!

Global warming or climate change can change our natural environment forever. Temperature and the weather can have an impact on our plants – it can determine where plants grow and when they bloom. Scientists have been studying the changes in our environment because of global warming for many years. Are plants blooming earlier or later in Newfoundland and Labrador? Will some of our plants be lost forever because they cannot adapt to the changing climate? Will new plants move in? Will animals have to move to another habitat or home to find food and shelter? These are just some of the questions that scientists are asking every day. That's why I'm writing you this letter boys and girls. I'm hoping you, your classmates, and your teacher and maybe even your family will participate in this fun and exciting program called PlantWatch NL!

Students all across Canada are helping PlantWatch scientists track special plants. That means we need volunteers just like you to become "citizen scientists". Together we can record plant blooming times to help scientists around the world to better understand the effects of climate change. Tracking plant changes in the spring time and writing down what you see can really make a difference. It is amazing to see the differences from year to year and from one place to another place.

All you have to do is select one plant (or more) that you want to observe from the PlantWatch ID cards, keep track of when it blooms, and send your information to the PlantWatch website. It's that easy!

The information that you collect is very important. Plants flower in response to warmth, and these blooming dates can help scientists track the results of a warm or cold winter and spring. It will help us know more about our weather and the changes in climate in this province. Your plant observations will also help farmers know about when it's a good time to plant crops, fertilize, and to control pests. We can even help people with allergies because we can alert them to pollen warnings. I hope you will enjoy plant watching as much as I do, and thank you for joining the PlantWatch NL team. Your help and participation are greatly appreciated.

Happy Plant Watching!

Madonna Bishop PlantWatch Coordinator of NL MUN Botanical Garden

PlantWatch Letter (Grade 7-12)



PlantWatch NL MUN Botanical Garden Memorial University of Newfoundland St. John's, NL A1C 5S7

Dear Students:

I would like to introduce myself and a special program to you called PlantWatch NL, "Our Plants and Climate Change".

My name is Madonna Bishop, and I have always been interested in plants. As a child, I spent a lot of time outside, and that is when my love of nature and my fascination with plants began. Just like you, I studied biology and earth science in school, and later I went to University and became a biologist. Plants are the source of all life on this planet! They give us so much – oxygen, food, fuel, shelter, tools, and even our medicines. Did you know that even some of our clothing comes from plants? We even use plants and flowers in our special celebrations.

Newfoundland and Labrador has a great diversity of plants, and the province is home to some of the coolest plants on earth. Our provincial floral emblem, the Pitcher Plant, is so named for its pitcher-shaped leaves to hold water and is a carnivorous plant. Did you know that we also have plants in Newfoundland and Labrador that cannot be found anywhere else on earth? Yes, that's right! There are actually three very rare plants that inhabit the limestone barrens on the Great Northern Peninsula: two of these are considered endangered (Long's braya and the barrens willow) while a third plant called Fernald's braya is considered threatened. There are also plants in Newfoundland and Labrador that can tell us a lot about climate change.

Global warming or climate change can change our natural environment forever. Temperature and the weather can have an impact on our plants – it can determine where plants grow and when they bloom. Scientists have been studying the changes in our environment because of global warming for many years. Are plants blooming earlier or later in Newfoundland and Labrador? Will some of our plants be lost forever because they cannot adapt to the changing climate? Will new plants move in? Will animals have to move to another habitat or home to find food and shelter? These are just some of the questions that scientists are asking every day. That's why I'm writing you this letter. I'm hoping you, your classmates, and your teacher and maybe even your family will participate in this fun and exciting program.

Students all across Canada are helping PlantWatch scientists track special plants. That means we need volunteers just like you to become "citizen scientists". Together we can record plant blooming times to help scientists around the world to better understand the effects of climate change. Tracking plant changes in the spring time and recording what you see can really make a difference. It is amazing to see the differences from year to year and from one place to another place.

All you have to do is select one plant (or more) that you want to observe from the PlantWatch ID cards, keep track of when it blooms, and send your information to the PlantWatch website. It's that easy!

The information that you collect is very important. Plants flower in response to warmth, and these blooming dates can help scientists track the results of a warm or cold winter and spring. It will help us know more about our weather and the changes in climate in this province. Your plant observations will also help farmers know about when it's a good time to plant crops, fertilize, and to control pests. We can even help people with allergies because we can alert them to pollen warnings. I hope you will enjoy plant watching as much as I do, and thank you for joining the PlantWatch NL team. Your help and participation are greatly appreciated.

Happy Plant Watching!

Madonna Bishop PlantWatch Coordinator of NL MUN Botanical Garden

Student Name

It's Springtime!

I know it is springtime when

In spring, I feel

In spring, plants are

In spring, animals are

I like spring because

Draw a picture of spring

Plant Name:	
Student Name:	_

Observation	Form	(K-2)
-------------	------	-------

Draw plant here
Day 2
Draw plant here

	Day 3
	Day 0
Draw plant here	
	Day 4
Draw plant here	

		103
	Day 5	
Draw plant here	Day 6	
Draw plant here		

	104
The name of my plant is	
My plant first bloomed on	······································
	(Date)
My plant had half of its flowers on	
	(Date)
My plant had leaves on	
	(Date)
My favorite part about watching this plant was	
	····

Observation Form (3-6)

Student Name(s)):				3 1 5 7 5	· · · · · · · · · · · · · · · · · · ·
Plant Species: _						
First Bloom Date	:					
Mid Bloom Date:						
Leaf Out Date: _						
Location (noted	on tag): _					
Comments:						
Please Circle:						
Exposure:	1sunny/o	pen	2half s	sun/shade		3full shade
Slope/Direction:	4flat area	L	5gentl	e slope		6steep slope
Plant Location:	7away fro	om building	j s		8withi	n 10m of wall
Weather:	9hot	10cold	11ave	rage temp	12dry	13rainy
Plant Habitat:	15forest	16shri	ub	17bog/wetla	nd	18roadside

19garden 20other_

Draw your plant here	Draw your plant here	Draw your plant here
Date:	Date:	Date:

Plant:		leacher /	Volunteer Ob	servation Form
First Bloom Date: _				
Mid Bloom Date: _				
Leaf Out Date:				
Location(Lat./Long):			
Comments:				
Please Circle:				
Exposure: 1 sun	ny/open	2 hal	lf sun/shade	3 full shade
Slope/Direction:	4 flat area	5 gentle slo	pe, faces 6	steep slope, faces
Plant Location:	7away from	buildings	8	8 within 10m of wall
Weather (week be	fore flowerir	ng): 9 hot 1 13 rainy	0 cold 11 avera	ige temp 12 dry
Plant Habitat:	15 forest 19 garden	16 shrub 20 other	17 bog/wetland	d 18 roadside
Gender:	Male Fema	ale		
Digital Photo Date	es:			
1. 2. 3. 4. 5. 6. 7.		8 9 10. 11. 12. 13. 14.		

*Suggestion: Take a photo every day you observe (even those days when no changes have been made) and compile them at the end of its blooming season. You can use them in order and animate it to show it in action...from first bloom to leaf out as an instant replay!

Flower Part Chart	Name	
Petals	Anther	Filament
Stigma	Style	Sepal

Spring Survey

Name _____

Name of Interviewee _____

My class is conducting a survey on the predictions of the arrival of spring in our community. We thank you for taking the time to help us with this survey. The purpose of our survey is to find out how local people identify the arrival of spring and to discover when local people expect seasonal events will occur.

Please complete this sentence as many times as you wish:

"I Know that winter is over when..."

Please complete this sentence as many times as you wish:

"I know that spring has arrived when..."

What are the signs of spring here in April?

What are the signs of spring here in May?

What things do you do in the spring, and how do you know when to do them?
Converting Degrees and Minutes to Decimal Form Worksheet

Name

A. Using a GPS or Google Map, find the latitude and longitude for your school.Use the chart below to convert the degrees and minutes to the decimal format.

Latitude:

Start with:	Convert to decimal form:		
degrees	= minutes / 60 minutes	=degrees	
minutes		+ decimal minutes	
N latitude		= degrees N latitude	

Longitude

Start with:	Convert to decimal form:	
degrees	= minutes / 60 minutes	= degrees
minutes		+decimal minutes
longitude		= degrees longitude

B. Find the latitude and longitude for your observed PlantWatch species, and convert the degrees and minutes to the decimal format. Include the information on your Observation form.

Latitude

Start with:	Convert to decimal form:	
degrees	= minutes / 60 minutes	= degrees
minutes		+ decimal minutes
latitude		= degrees N latitude

Longitude

Start with:	Convert to decimal form:	
degrees	= minutes / 60 minutes	= degrees
minutes		+decimal minutes
longitude		= degrees longitude

Guide to Nature Hiking By Anne Madden

At MUN Botanical Garden, nature walks have always been an integral component of our education programs. When the Garden opened its gates in the 1970's, 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. Nature walks provide the perfect opportunity to teach across the curriculum, including Language Arts, Social Studies, Art, Health, and even Math. The learning opportunities derived from a nature walk are endless and only limited by one's imagination.

MUN Botanical Garden and many other facilities offer schools a variety of curriculum-based 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 or scientist. 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. 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 children, and some may find it difficult to focus the first time out. It may be preferable to keep the first excursion very short and very simple (without any high expectations for anyone). Students will adapt quite quickly to this type of activity, and over time both teacher and student will grow to be "expert nature detectives".

If you are fairly new at nature walks, 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, nearby City Park, or natural trail will be logistically easier to arrange and any discoveries will be all the more exciting to the children. 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, may require permits 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.
- 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. 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. Consider the interest of all students - while one group of children 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 student needs to bring.

Recommend:

- Each student is 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.
- Magnifying glasses can help make things fun.
- 4. Before your Walk (Pre-Activity)

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.

Outline all the rules beforehand.

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.
- 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.
- 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?

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

It is important to have an activity and / or game to use during the nature walks. While any number of activities can easily be incorporated into the walk, it is important to keep 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.

6. Back To Class

Discuss the trip and encourage students to reveal their likes and dislikes. Their feelings can be conveyed in artwork, journal entries, reports, poems and even fictional stories. Display their work.

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.

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 moments 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. Happy Trails!

Proper Etiquette for Cutting Branches

(by Anne Madden)

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, 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.

Plant 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, drawing, sketching or photographing the original plant can enhance the learning.

Glossary

Abiotic – non-living (or was never living) factors (temperature, sunlight, moisture, etc.)

Adaptation (to climate change) - Adaptation to climate change is any activity that reduces the negative impacts of climate change and / or takes advantage of new opportunities that may be presented

Alternate – Arrangement of leaves in which successive leaves arise at different levels on opposite sides of the stem

Anther – The pollen-producing structures, borne at the tip of a filament in male flower parts (stamens)

Basal – Located at the base of a plant's stem or plant organ

Biodiversity – the variety of life on earth, measurable as the variety within species, between species, and the variety of ecosystems

Biotic – living factors (plants / animals)

Botany – the study of plant life, its structure and function

Boreal Forest – the mainly coniferous or evergreen forests that covers much of Canada's northern regions

Bract – a small leaf beneath a flower or another plant organ

Capsule - a dry fruit that releases seed through slits or pores

Catkin – a highly condensed cluster of (usually) unisexual flowers that lack petals

Cluster – a tightly packed group of flowers

Colony – a group of plants that all have the same genetic material

Conifer – belonging to the order Coniferales, these plants are mostly evergreen with cones and narrow, pointed, often needle-like leaves. Pine, larch, spruce, fir and cedar are all conifers; it sheds its needles annually

Creeping – growing along or near the surface of the ground

Cross-pollination – the process by which pollen is carried from the stamens of one plant to the stigmatic surface of another plant (compare with self-fertilization)

Deciduous – falling off at the end of the growing season

Evergreen - plants whose leaves remain green throughout the winer

Female Tree – trees that produce only female flowers (these flowers are imperfect since they have one sex only; pistillate)

Filament – the stalk on which anthers are borne; anthers plus filament form a stamen, the male part of the flower

Floret - individual flower in a cluster

Flower Bud – undeveloped flower

Flower Stem – the stalk by which a flower is attached to the rest of the plant

Foliage – leaves

Germination - the first stage in the growth of a seed into a seedling

Growing Degree Summation (GDS) – a way to measure the warmth to which a plant has been exposed. The GDS is calculated by summing average daily temperatures for a given time period

Habitat - the natural home of an organism

Hardy – plants adapted to cold or otherwise adverse conditions

Heat Unit – temperature affects the rate of plant growth. The amount of accumulated temperature a plant has been exposed to in spring time can be measured in heat units. It is measured through growing degree summation

Indicator Plant – In phenology studies, a plant useful as a "biological measuring stick," (its growth occurs in response to a combination of weather and environmental factors, and certain growth phases are easily defined and recognized

Julian Calendar – Calendar that marks the days from January 1 onwards (January 30 = day 30 and February 28 = day 59)

Key Indicator Species – plants selected for inclusion in the PlantWatch program

Lenticel – Small dot or spot on the bark of a young twig that allows gas exchange between the stem and the atmosphere

Life Cycle – The entire sequence of phases in the growth and development of any organism from birth to reproduction, maturity and death

Male Tree – Trees that bear only the male flowers

Native Plant – A plant that occurred in a particular area before the arrival of European settlers in North America (not introduced by settlers)

Nectar – A sugary liquid secreted by a flower's nectaries

Node – The point on a stem from which a leaf grows; nodes are spaced along stems with internodes between them

Nodules (of a root) – Swollen areas of the root that contain a bacterial symbiont

Opposite – Arrangement of leaves in which each pair is at right angles to the pair above and below

Ovary – Part of the female flower parts, located at the base of the pistil and containing ovules which can become seeds

Ovule – Structure within the ovary containing an egg cell

Perennial – Plants which grow and reproduce for many years, from the same roots. Perennial plants are usually woody

Perfect Flowers – Flowers with male and female reproductive organs

Petals – Modified leaves, usually the conspicuous, brightly coloured structures above the sepals in a flower

Petiole - Stalk of the leaf

Phenology – Study of the seasonal timing of life cycle events (growth stages or changes in plants and animals)

Photosynthesis – The process by which plants, algae and some bacteria convert light energy into the chemical energy stored in sugars

Pistil – A collective term for all the female flower parts: stigma, style and ovary

Pollen – Powdery contents of the anthers; a single pollen grain produces a pollen tube and sperm, and fertilizes ovules contained in the plant's ovary

Pollen Sac – The pollen-containing sac of the anthers

Pollination – Process by which pollen is transferred from the male parts (stamen) to the female parts (stigma) of a flower

Respiration – Physiological process in plants and animals in which oxygen is consumed in the final step of metabolizing sugars

Rhizome – A stem which grows horizontally in the soil, bearing buds from which shoots grow

Runner – A long, slender branch that runs along the ground rooting at the nodes or tip

Seed Capsule - Dry fruit that releases seed by way of pores or slits

Seed Head – A cluster of fruit or seeds

Seed Pod – General term for any dry fruit that opens to release seeds

Self-fertilize – Fertilization in which the pollen and the ovary belong to the same individual (compared with cross-pollination)

Sepals – Modified petal-like leaves, below the petals in a flower, often green and leaf-like

Stamen – Collective term for male flower parts: includes filaments and anthers

Stigma – The receptive area of the pistil (top of the female flower part) where pollen lands or is deposited

Stratification – Process in which seed is placed in moist, cool soil to break dormancy

Stratification Period – The amount of time required to break seed dormancy and start germination

Style – Central, tube-like region of the female flower parts

Suckers – Shoots that arise from underground plant parts

Variety – A taxonomic group within a species or subspecies (a uniform group of plants that differs slightly from another group within the same species)

Vegetative Reproduction – Process through which plants increase in number without fertilization

 $\ensuremath{\textbf{Whorl}}-A$ group of three or more plant parts arising from the region (node) of the stem

Winter Buds - Buds present in the winter

References

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Plant Biodiversity Website www.plantbiodiversity.ca

Environment Canada Website www.ec.gc.ca