plantwatch

appendixes

Glossary

(includes botanical, biological and horticultural terms)

Alpine - High mountain regions, above the tree line

Alternate - Arrangement of leaves in which successive leaves arise at different levels on opposite sides of the stem (see also: "Opposite")

Ament - See "Catkin"

Anther - The pollen-producing structures, borne at the tip of a filament in male flower parts (stamens) (See flower diagram on page 4-5.)

Basal - Located at the base of a plant or plant organ

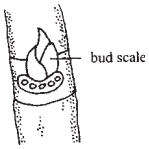
Beaked - Ending in a prolonged tip that resembles a beak

Blade - The whole green leaf, without the petiole or leaf stalk

Boreal Forest - The mainly coniferous or evergreen forest that covers much of Canada's northern regions

Bract - A small leaf beneath a flower or another plant organ

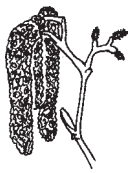
Bud Scale - A small, modified leaf that covers the bud



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

Carpel - The leaf-like organ of a flower that encloses one or more ovules (see "Pistil")

Catkin - A highly condensed cluster of (usually) unisexual flowers that lack petals



Circumpolar - A large region around either the North or South Pole; can refer to a plant that is distributed around the globe in northern regions

Clone - A stand or group of plants of one type (all have identical genetic material)

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. Larch is the only one which is not evergreen; 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)

Crown Division - Propagation technique where the base of a plant is divided into sections

Cultivar - A uniform group of cultivated plants obtained by breeding or selection, and propagated as a pure line

Day Neutral - When a plant's seasonal changes do not depend on how many hours of sunlight the plant receives

Deciduous - Falling off at the end of the growing season

Dormancy - Lack of plant growth during unfavourable environmental conditions

Dormant - For cells, buds, seeds, etc., the period before growth begins

Ecology - The science of the interrelationship of organisms and their environment

Elaiosome - Oily appendage of a seed (can be an "ant-snack")

Ethnobotany - The study of the relationships between plants and people

Evergreen - Plants whose leaves remain green throughout the winter

Female Tree - Trees that produce only female flowers (these flowers are imperfect; pistillate)

Filament - The stalk on which anthers are borne; anthers plus filament forms a stamen, the male part of a flower (See flower diagram on page 4-5.)

Fire-successional - Plants that are adapted to environments present after wildfire

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 (also called a peduncle)

Flowering Sac - See "Pollen Sac"

Foliage - Leaves

Forb - A term used in botany to refer to plants - many wildflowers, for example - that do not fit into other classes like trees, shrubs or grasses. Generally, a forb is a broad-leaved, non-woody plant that dies back to the ground at the end of every growing season.

Fungi - A group of non-photosynthetic organisms with chitinous walls that feed on organic matter (includes mushrooms)

Fungal Partners - Many plants have an important underground relationship with fungi; these organisms are known as fungal partners (symbionts)

Genetic Mutations - Changes in the hereditary information carried by an organism

Genetic Variation - The genetic differences between individuals of the same species

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

Glandular - A plant organ (e.g. leaf, stem) that possess specialized cells that secrete chemical substances

Graft(ed) - The joining of two separate plant parts, like root and stem, or a branch from one plant to a branch from another, so that they can regenerate and grow as one plant

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

Hair - Hair-like structures, also known as trichomes, that are attached to many plant parts

Hardwood Cuttings - Cuttings taken from older woody tissues of hardwood trees, used for plant propagation. Cuttings are usually taken in the winter from dormant plant parts (see "Dormant").

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.

Hermaphroditic - Plants that have flowers with male and female parts (see "Perfect Flowers")

Horticulture - The science of garden cultivation

Hybrid Vigour - The condition of a hybrid that is fitter than either of its parents

Hybridize - The process by which two plants with different genetic material produce offspring

Hydratode - Pore in the surface of a leaf through which minerals are extruded

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

ITEX - International Tundra Experiment

Julian Calendar - Calendar that marks the days from January 1st onwards; i.e. January 30 = day 30 and February 28 = day 59

Leaf Pore - Small opening on the leaf surface

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

Loam - Soil that has about equal proportions of sand, silt and clay

Male Tree - Trees that bear only male flowers

Matted - Plants that grow in a very dense and flat cluster, or mat

Microclimate - The climate of a small or limited space, e.g. the surface of the soil, or under the canopy of a small forest.

Native plant - A plant that occurred in a particular area before the arrival of European settlers in North America (i.e. 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

Open Pollination - Pollination in which the source of pollen is unknown

Opposite - Arrangement of leaves in which each pair is at right angles to the pair above and below (see also "Alternate)

Ovary - Part of the female flower parts, located at the base of the pistil and containing ovules (See flower diagram on page 4-5.)

Ovule - Structure within the ovary containing an egg cell

Parkland -In the Canadian prairie provinces, Parkland is a transitional natural region between the prairies to the south and the boreal forest to the north. Patches of open meadows alternate with forest of largely poplar trees, with spruce trees on cool, north-facing slopes.

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 (See flower diagram on page 4-5.)

Petiole - Stalk of a leaf

Phenology - Study of the seasonal timing of life cycle events, i.e. changes in plants and animals

Photoperiod - the number of hours of light that a plant receives in a day.

Photosynthetic - An organism that uses light energy to produce food

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

Phyllody - Process in which petals and sepals revert to leaves

Pistil - A collective term for all the female flower parts — stigma, style and ovary (See flower diagram on page 4-5.)

Pollen - Powdery contents of the anthers; a single pollen grain produces a pollen tube and sperm, and fertilizes ovules contained in a 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

Polyploid - An organism with three or more sets of chromosomes

Ramets - A large number of clonal shoots

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

Rootstock - Plant roots onto which shoots are grafted, in propagation

Root Cutting - Cutting taken from the roots, used in plant propagation

Runner - A long, slender branch that runs along the ground rooting at the nodes or tip (see "Node")

Scale - Any small, thin flat structure of a plant; a small outgrowth

Scree Slope - Mountain slope of small loose stones

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 (sperm) and the ovary (egg) belong to the same individual. Compare: Cross-pollination.

Sepals - Modified petal-like leaves, below the petals in a flower, often green and leaf-like (See flower diagram on page 4-5.)

Softwood Cutting - Cutting taken from emerging woody plant parts of softwood trees, used for propagation

Stamen - Collective term for male flower parts; includes filaments and anthers (See flower diagram on this page.)

Stigma - The receptive area of the pistil (top of the female flower part) where pollen lands or is deposited (see flower diagram A-8)

Stratification - Process in which seed is placed between layers of moist, cool soil to break dormancy

Stratification Period - The amount of time required to break seed dormancy and initiate germination

Style - Central, tube-like region of the female flower parts (See flower diagram on this page.)

Subalpine - Area in the higher mountain slopes just below the tree line and the alpine region

Succession - The process of development of vegetation involving changes of species and communities with time

Suckers - Shoots that arise from underground plant parts

Symbiont - An organism living in a relationship with another organism, where these two organisms live closely together for much or all of their lives, e.g. the fungi and algae in lichens

Tap Root - A large, vertical root arising from the main axis of the plant

Terminal - Structure borne at the tip of a plant stalk, leaf, etc.

Tundra - A treeless region of the Arctic or subarctic

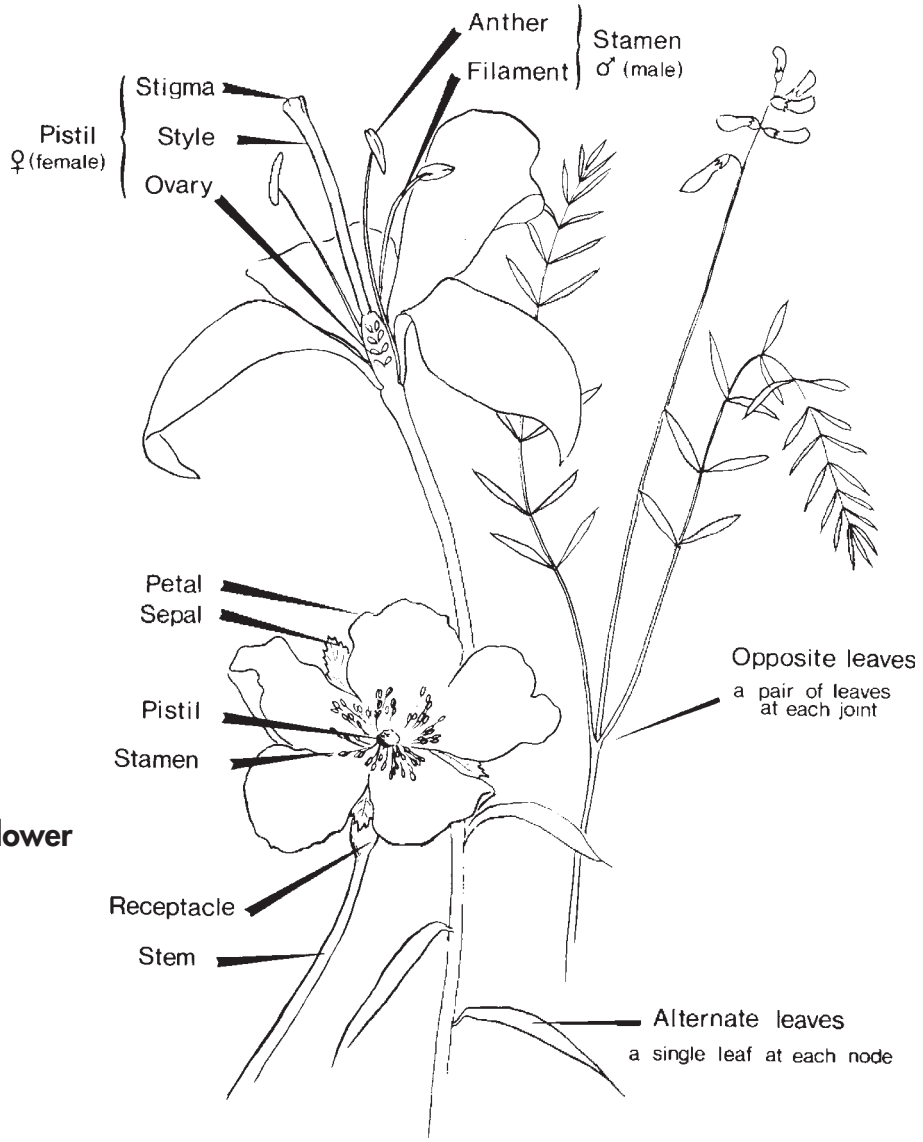
Variety - A taxonomic group within a species or subspecies, i.e., a uniform group of plants that differs slightly from another group within the same species

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

Whorl - A group of three or more plant parts arising from the same region (node) of the stem

Winged - Structure with a membranous expansion

Winter Buds - Buds present in winter



Parts of a typical flower

appendix two

Map Sources *for* Canada

Canadian map sales have been privatized.

For a regularly updated list of map sources for your territory or province, check the federal website:

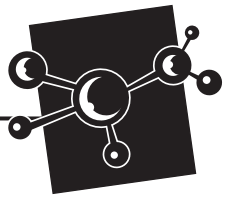
maps.nrcan.gc.ca

and select *Canadian topographic maps*, *map distributors*, and then, *regional distribution centres*.

appendix three

Pan Canadian Curriculum Connections

a. sciences k-12



Source: **Common Framework of Science Learning Outcomes, K-12,**
Pan-Canadian Protocol for Collaboration on School Curriculum, 1997.

Listed below are general and specific science outcomes related to Plantwatch, listed in order by grade level. Specific outcomes are examples of many to which Plantwatch could apply.

[**General (e.g., 100) /** Specific (e.g., 100-4):]

K to 3:

Science, Technology, Society, Environment/Knowledge

100 Investigate objects and events in their immediate environment and use appropriate language to develop understanding and to communicate results

- 100-4 Observe and identify similarities and differences in the needs of living things
- 100-5 Describe different ways that plants and animals meet their needs
- 100-6 Describe ways that humans use their knowledge of living things in meeting their own needs and the needs of plants and animals
- 100-23 Describe the position of an object relative to other objects or to an identified space, and place an object in an identified position
- 100-28 Identify and describe parts of plants and their general function
- 100-29 Identify and investigate life needs of plants and describe how plants are affected by the conditions in which they grow
- 100-30 Observe and describe changes that occur through the life cycle of a flowering plant
- 100-35 Investigate and describe how living things affect and are affected by soils

101 Demonstrate and describe ways of using materials and tools to help answer science questions and to solve practical problems

- 101-6 Describe ways of measuring and recording environmental changes that occur in daily and seasonal cycles
- 101-7 Observe and describe changes in the appearance and activity of an organism as it goes through its life cycle

102 Describe how science and technology affect their lives and those of people and other living things in their community

- 102-3 Observe and describe changes in sunlight and describe how these changes affect living things
- 102-4 Investigate and describe changes that occur on a daily basis in the characteristics, behaviours and location of living things
- 102-5 Investigate and describe changes that occur in seasonal cycles in the characteristics, behaviours, and location of living things
- 102-12 Describe ways in which plants are important to living things and the environment

103 Undertake personal actions to care for their immediate environment and contribute to responsible group decisions

103-2 Recognize that humans and other living things depend on their environments, and identify personal actions that can contribute to a healthy environment

103-7 Describe the effects of weather and ways to protect things under different conditions

Skills

200 Ask questions about objects and events in their immediate environment and develop ideas about how those questions might be answered.

200-1 Ask questions that lead to exploration and investigation

200-3 Make predictions, based on an observed pattern

200-4 Select and use materials to carry out their own explorations

201 Observe and explore materials and events in their immediate environment and record the results

201-5 Make and record relevant observations and measurements, using written language, pictures, and charts

201-6 Estimate measurements

202 Identify patterns and order in objects and events studied

202-1 Use personal observations when asked to describe characteristics of materials and objects studied

202-9 Identify new questions that arise from what was learned

203 Work with others and share and communicate ideas about their explorations

203-3 Communicate procedures and results, using drawings, demonstrations and written and oral descriptions

Attitudes

401 Show interest in and curiosity about objects and events in their immediate environment

402 Willingly observe, question and explore

406 Work with others in exploring and investigating

407 Be sensitive to the needs of other people, living things, and the local environment

Grades 4 to 6:

Science, Technology, Society, Environment

104 Demonstrate that science and technology use specific processes to investigate the natural and constructed world and to seek solutions to practical problems

104-4 Compare the results of their investigations to those of others and recognize that results may vary

104-5 Describe how results of similar and repeated investigations may vary and suggest possible explanations for variations

106 Describe ways in which science and technology work together in investigating questions and problems and in meeting specific needs

106-1 Describe examples of tools and techniques that extend our senses and enhance our ability to gather data and information about the world

107 Describe applications of science and technology that have developed in response to human and environmental needs

107-3 Compare tools, techniques and scientific ideas used by people around the world to interpret natural phenomena and meet their needs

108 Describe positive and negative effects that result from applications of science and technology in their own lives, the lives of others, and the environment

108-3 Describe how personal actions help conserve natural resources and care for living things and their habitats

108-4 Describe how technological products and systems can be used to conserve natural resources

108-5 Describe how personal actions help conserve natural resources and protect the environment in their region

Skills

204 Ask questions about objects and events in the local environment and develop plans to investigate those questions

204-2 Rephrase questions in a testable form

204-3 State a prediction and an hypothesis based on an observed pattern of events

204-5 Identify and control major variables in their investigations

205 Observe and investigate their environment and record the results

205-4 Select and use a tool for measuring

205-7 Record observations using a single word, notes in point form, sentences and simple diagrams and charts

206 Interpret findings from investigations using appropriate methods

206-1 Classify according to several attributes and create a chart or diagram that shows the method of classifying

206-2 Compile and display data, by hand or by computer, in a variety of formats, including frequency tallies, tables and bar graphs

206-3 Identify and suggest explanations for patterns and discrepancies in data

206-5 Draw a conclusion based on evidence gathered through research and observation, that answers an initial question

206-9 Identify new questions or problems arising from what was learned

207 Work collaboratively to carry out science-related activities and communicate ideas, procedures and results

207-1 Communicate questions, ideas and intentions, and listen to others while conducting investigations

207-2 Communicate procedures and results, using lists, notes in point form, sentences, charts, graphs, drawings, and oral language

Knowledge

300 Describe and compare characteristics and properties of living things, objects and materials

300-2 Compare the structural features of plants that enable them to thrive in different kinds of places

300-13 Describe weather in terms of temperature, wind speed and direction, precipitation, and cloud cover

300-15 Describe role of a common classification system for living things

301 Describe and predict causes, effects and patterns related to change in living and non-living things

301-1 Predict how the removal of a plant or animal population affects the rest of the community

301-2 Relate habitat loss to the endangerment or extinction of plants and animals

301-5 Describe effects of wind, water and ice on the landscape

302 Describe interactions within natural systems and the elements required to maintain these systems.

302-1 Identify a variety of local and regional habitats and their associated populations of plant and animals

302-3 Classify organisms according to their role in a food chain

Attitudes

409 Appreciate the role and contribution of science and technology in their

understanding of the world

412 Show interest and curiosity about objects and events within different environments

413 Willingly observe, question, explore and investigate

415 Consider their own observations and ideas as well as those of others during investigations and before drawing conclusions

416 Appreciate the importance of accuracy and honesty

418 Work collaboratively while exploring and investigating

419 Be sensitive to and develop a sense of responsibility for the welfare of other people, other living things, and the environment

To the end of grade 9:

Science, Technology, Society, Environment

109 Describe various processes used in science and technology that enable us to understand natural phenomena and develop technological solutions

109-3 Describe and explain the role of experimentation, collecting evidence, finding relationships, proposing explanations and imagination in the development of scientific knowledge

109-8 Describe scientific inquiry, problem solving and decision-making, and provide examples where they may be applied

110 Describe the development of science and technology over time

110-6 Explain the need for new evidence in order to continually test existing theories

112 Illustrate how the needs of the individual, society and the environment influence and are influenced by scientific and technological endeavours

112-6 Provide examples of how Canadian research projects in science and technology are supported

112-12 Provide examples of Canadian contributions to science

Skills

208 Ask questions about relationships between and among observable variables and plan investigations to address those questions

208-1 Rephrase questions in a testable form and clearly define practical problems

208-5 State a prediction and hypothesis based on background information or an observed pattern of events

208-8 Select appropriate methods and tools for collecting data and information, and for solving problems

209 Conduct investigations into relationships between and among observations, and gather and record qualitative and quantitative data

209-1 Carry out procedures controlling the major variables

209-2 Estimate measurements

209-4 Organize data using a format that is appropriate to the task or experiment

210 Analyse qualitative and quantitative data and develop and assess possible explanations

210-2 Compile and display data, by hand or computer, in a variety of formats, including diagrams, flow charts, tables, bar graphs, line graphs, and scatter plots

210-7 Identify, and suggest explanations for, discrepancies in data

211 Work collaboratively on problems and use appropriate language and formats to communicate ideas, procedures and results

211-2 Communicate questions, ideas, intentions and results, using lists, notes in point form, sentences, data tables, graphs, drawings, oral language and other means

211-3 Work cooperatively with team members to develop and carry out a plan, and trouble shoot problems as they arise

Knowledge

304 Explain and compare processes that are responsible for the maintenance of an organism's life

304-2 Identify the roles of producers, consumers and decomposers in a local ecosystem, and describe both their diversity and their interactions

304-3 Describe conditions essential to the growth and reproduction of plants and microorganisms in an ecosystem, and relate these conditions to various aspects of the human food supply

305 Explain processes responsible for the continuity and diversity of life

306-1 Describe how energy is supplied to, and how it flows through, a food web

306-2 Describe how matter is recycled in an ecosystem through interactions among plants, animals, fungi and microorganisms

306-3 Describe interactions between biotic and abiotic factors in an ecosystem

Attitudes

426 Confidently pursue further investigations and readings

428 Consider observations and ideas from a variety of sources during investigations and before drawing conclusions

429 Value accuracy, precision and honesty

b. mathematics k-12

Source: *The Common Curriculum Framework for K- 12 Mathematics,* Western Canadian Protocol for Collaboration in Basic Education, June 1995

The *Introduction to the Western Canadian Protocol* states that math education must prepare students to "use mathematics confidently to solve problems" and "become mathematically literate adults, using mathematics to contribute to society." Plantwatch provides an opportunity to fulfill these goals.

Listed below are General Learning Outcomes satisfied by the Plantwatch project, with examples of expectations from all four substrands and from various grades. Plantwatch relates similarly to many expectations in other grades.

[**SUBSTRAND** / OUTCOME / *Example of expectations*]

NUMBERS

CONCEPTS:

Use numbers to describe quantities

Represent numbers in multiple ways

Example: Grade 2 — Recognize and apply whole numbers from 0-1000 and explore fractions (halves, thirds, quarters)

OPERATIONS:

Demonstrate an understanding of and proficiency with calculation

Decide which arithmetic operations can be used to solve a problem and then solve the problem

Example: Grade 7 — Illustrate the use of rates, ratios, percentages and decimals in solving problems

PATTERNS AND RELATIONS

PATTERNS:

Use patterns to describe the world and to solve problems

Example: e.g., Grade 5 — Construct, extend and summarize patterns, including those found in nature, using rules, charts, mental mathematics and calculators

SHAPE AND SPACE

MEASUREMENT:

Describe and compare everyday phenomena, using either direct or indirect measurement

Example: Grade 3 — Estimate, measure and compare, using whole numbers and primarily standard units of measure

TRANSFORMATIONS

Perform, analyze and create transformations

Example: Grade 4 — use numbers and direction words to describe the relative positions of objects in two dimensions, using everyday contexts

STATISTICS AND PROBABILITY

DATA ANALYSIS

Collect, display and analyze data to make predictions about a population. (Note: Plantwatch relates to all grades K-10).

Example: Grade 8 — Develop and implement a plan for the collection, display and analysis of data, using technology, as required. Evaluate and use measures of central tendency and variability

c. language arts k-12

Source: *The Common Curriculum Framework for K-12 English Language Arts,* Western Canadian Protocol for Collaboration in Basic Education, 1998 (draft)

The *Introduction to the Western Canadian Protocol* states that "Language enables students to play an active role in various communities of learners within and beyond the classroom." Plantwatch provides an opportunity for students to use language as active members of one such community of learners.

Listed below are examples from various grades of the ways in which General Learning Outcomes are satisfied by the Plantwatch project, in all six language arts. Plantwatch relates similarly to many expectations in other grades, with varying difficulty depending on the grade. The arts are listening and speaking, reading and writing, and viewing and representing.

The protocol states, **Students will speak, listen, read, write, view and represent to**

1. Explore thoughts, ideas, feelings and experiences

Discover and Explore

e.g., Grade 2 — Use a variety of forms to organize and give meaning to familiar experiences, ideas and information

e.g., Grade 10 — Seek and consider others' ideas through a variety of means (such as…Internet discussion groups…) to expand understanding

Clarify and Extend

e.g., Grade 3 — Arrange ideas and information in more than one way to make sense for self and others

e.g., Grade 5 — appraise ideas for clarity and ask extending questions

2. Comprehend and respond personally and critically to oral, print, and other media texts

Respond to texts

e.g., Grade 7 — Experience texts from a variety of genres (such as journals, nature programs, etc. …) and cultural traditions

Understand Forms and Techniques

e.g., K-12 — Create original texts to communicate ideas and demonstrate/enhance understanding of forms and techniques, (such as visual art, poems, charts, posters, descriptions. documentary videos, essays…)

3. Manage ideas and information

The Plantwatch project fits especially well with this outcome. Among the skills developed through Plantwatch, the following are specifically mentioned as Language Arts outcomes for all grades: "…to activate prior knowledge, ask questions, define directions for inquiry, gather and evaluate information… manage time, meet deadlines,…and discover additional areas for investigation." Working with others, using language to focus research, and communicating through technology are also listed as language skills to be acquired.

Plan and Focus

e.g., Grade 6 — Use personal knowledge: summarize and focus personal knowledge of a topic to determine information needs

Ask questions: formulate relevant questions to focus information needs

Create and follow a plan to collect and record information within a pre-established time frame

Select and Process

e.g., Grade 6 — Answer inquiry and research questions using a variety of information sources (such as…skilled community people,…the Internet…)

Use a variety of tools to access information and ideas

Organize, Record and Evaluate
e.g., Grade 6 — Organize information and ideas using a variety of strategies and techniques

Record information: make notes on a topic, combining information from more than one source; reference sources appropriately

4. Enhance the clarity and artistry of communication

Present and Share
e.g., Grade 4 — Effective oral and visual communication: describe and explain information and ideas to a particular audience

5. Celebrate and Build Community

Encourage, Support and Work with Others
e.g., Grade 7 — Contribute to group efforts to reach consensus or conclusions

appendix four

Alberta Curriculum Connections

a. elementary grades

1. Science Grades 1-6 Alberta Elementary Science Curriculum

Grade 1 Seasonal changes
Needs of animals and plants

Grade 2 Hot and cold temperatures

Grade 3 Animal life cycles

Grade 4 Waste and our world (recycling in nature)
Plant growth and changes

Grade 5 Weather watch
Wetland ecosystems

Grade 6 Evidence and investigation
Trees and forests

2. Social Studies (1990 curriculum)

Grade 4 *Alberta: Geography and People:* environments can effect the way people live lifestyle and environment are affected by natural resources conservation is important to Alberta's future

People in History: how they used plants

Comparative study with Quebec: habitats, bloom dates, life cycles in the two provinces

Grade 5 *Canada Geography:* explore habitats, flowering dates in various regions

3. Art (January 1995 curriculum)

COMPONENT ONE: Analyzing Structures in Nature

Level One (grade 1, 2):

Natural forms have common physical attributes according to the class in which they belong

Natural forms are related to the environment in which they originate

Natural forms have different surface qualities in colour, texture, and tone (e.g. bark varies between old and young trees, and between types of trees))

Natural forms display patterns and make patterns (e.g., leaf rubbings could be done)

Level Two (grade 3, 4)

Each class of natural forms has distinguishing characteristics

Natural forms are related functionally to their environment

Change in natural forms occurs over time (e.g. bud to the opening of flower)

Level Three (grade 5, 6)

Natural forms can be examined for less visible characteristics (e.g., rubbings of leaf veins could be done)

A form can be examined synthetically to see how the parts make up the whole

Natural forms reveal many different structures (skeletal, spiral, orbital, radial, floating, grid, fan, concentric, faceted, etc.) (e.g. compare different leaves or flowers)

b. grades 7-9

Alberta Science Program of Studies

GENERAL LEARNER EXPECTATIONS

NATURE OF SCIENCE

Attitudes

Students will be encouraged to develop

1. Curiosity about events and objects in the natural world
2. Appreciation of the beauty and complexity of the natural world

Science Inquiry Skills

Students can:

1. Formulate questions
2. Propose ideas: hypothesizing and predicting
3. Design experiments (see ideas following)
4. Gather data
5. Process data (organize and present; check trends on Internet maps)
6. Interpret data; develop explanations for spring timing in different areas of Canada.

SCIENCE, TECHNOLOGY AND SOCIETY

Attitudes

2. Students should develop an appreciation of the contributions and limitations of scientific and technological knowledge to the societal decision-making process (2).

   Plantwatch flowering data can be used for agriculture, forestry, medicine, and other fields. Bloom times provide best timing predictions for seeding, pest control, allergy avoidance, etc. (See introduction to Plantwatch).

SPECIFIC LEARNER EXPECTATIONS: GRADE 7

1) CHARACTERISTICS OF LIVING THINGS

Skills

Observation, responses to environment

The emphasis is on observation, organizing and presenting data, and experimental design. Students could observe native plants on north- versus south-facing slopes — which would they predict would have earlier flowering?

Students could describe and compare life cycles/ development, and discuss adaptive behaviours; e.g., flowering as a response to temperature.

Concepts

Through Plantwatch, students will recognize the role of observation, classification and interpretation in the scientific study of living things. They can identify and describe characteristics of living things; in particular their ability to grow and reproduce; their ability to respond to environments (different microclimates); and their ability to produce food.

The concept of stimulus and response is used in interpreting the behaviour of organisms in relation to changing environmental conditions, and students are expected to "identify examples of stimulus-response patterns in the behaviour of organisms". In Plantwatch they can ask

a) is timing of flowering dependent on how much warmth the plant has been exposed to?

b) what happens to the bloom time if there is a snow storm just as buds are about to open?

4) TEMPERATURE AND HEAT MEASUREMENT

Students could measure maximum and minimum temperatures using a max-min thermometer and calculate how much heat their observed plant needs to flower.

Here is a good place for a global warming experiment:

Put a little plastic wall around some prairie crocus plants, to simulate greenhouse conditions. Putting a bag around some lilac branch tips could also be tried. (Poke some

Note: Selected components of this program have been extracted below, and the original numbers kept.

holes in bag; the lilacs need air flow). Is the flowering for these plants/ branches speeded up?

SPECIFIC LEARNER EXPECTATIONS: GRADE 8

5) GROWING PLANTS

Attitudes

Students develop:

Awareness that the distribution and growth of plants is affected by human intervention . Prairie crocus habitat is greatly diminished on the prairies due to ploughing for agriculture. Saskatoon needs edges of forest, of which much has been cleared for agriculture. Trillium requires rich forest soils.

Skills

Students study plant structures and functions:

They could use any of the Plantwatch species, or compare the species. Prairie crocus is a herbaceous plant that dies back to the ground each fall; whereas lilac is a woody shrub that stays alive, but bare of leaves, in winter.

Students could compare leaf shapes, plant sizes, life strategies, or the various fruit forms.

e.g., **prairie crocus, aspen poplar and dryad** have feathery or fuzzy seeds dispersed by wind; **saskatoon** seeds are dispersed by birds or mammals that eat the berries;

Lilacs and purple saxifrage have a dry capsule with seeds that fall to the ground, or the seeds are eaten and transported by birds or mammals. Saxifrage seeds are blown over the snow by winter winds.

Students conduct plant observation and growth activities. Students could acquire some of the key indicator plants and establish a Plantwatch garden, or collect seeds and try to grow seedlings.

Concepts

1. Plant breeding leads to specialized plants.

A comparison of lilac varieties in the school neighbourhood would be a good project. Look at variation between cultivars in colour, numbers and arrangements (single vs. double flowers) of petals, and leaf shape.

2. Propagation

A germination study could be done using collected seeds

3. Life processes

Students could predict and interpret responses of plant structures to varying environmental conditions. Flower buds swell and open in response to warmth; students could discuss the effects of cold versus hot weather shortly before flowering

4. Survival of plant forms

Many native species, such as prairie crocus, have lost considerable habitat to agriculture. They need unploughed prairie soils to do well. Will they become endangered plants?

5. Parts of a flower or plant

Students could identify and describe flower or plant parts

6) INTERACTIONS AND ENVIRONMENTS

Attitudes

1. Students develop awareness of the complex interrelationships among living things and their environment.

e.g., Students could study the dependence of all native plants on fungal partners in soil to find enough water and nutrients.

The importance of temperature in controlling flowering time could be examined.

Concepts

1. *Students are expected to measure abiotic factors (e.g., temperature)*

2. *Interdependence* — Students need to be able to recognize food chain relationships within an ecosystem. Insects visiting flowers can be observed, and consumers of fruits or seeds listed.

3. *Environmental needs of living things* — Students could identify and describe habitats and micro-habitats; recognize specializations appropriate to an organism in a particular habitat.

Note: Selected components of this program have been extracted below, and the original numbers kept.

e.g., **Prairie crocus** in open prairie. The surface covering of white fine hairs of this plant reflects light and protects it from intense spring light, and, keeps air movement away from plant tissue (water loss due to drying spring winds is dangerous for plants). Hairs also contain a toxic substance to discourage creatures who would like to eat the flowers.

Saskatoon buds and new leaves are well protected by dense white hairs;

White dryad has strong leathery leaves that resist wind abrasion and dryness.

Aspen poplar has a photosynthetic layer under the outer bark that allows the tree to produce food in early spring before leaves have emerged. Perhaps this attribute is the reason this tree can grow so far north in North America!

Lilac has numerous bud scales that protect growing points from winter winds and snow crystals driven by the winds.

SPECIFIC LEARNER EXPECTATIONS: GRADE 9

1) DIVERSITY OF LIVING THINGS

Examine variation in living things. Compare the plant species in their growth form, habitats and life history, and predict adaptive responses to weather, fire, etc.

Attitudes

Students are expected to develop an awareness and appreciation of the diversity of life forms and their interrelatedness (1), and an awareness of the effects of human actions in increasing or decreasing the diversity of living things (5).

Skills

2) Proposing ideas

- Students can hypothesize about the relationships among specific living things (plants and fungal partners; plants and pollinators)
- Students can predict adaptive responses of plants and animals, e.g., to climate warming; will flowering occur earlier and earlier as a result of warming?

4) Gathering data:

- Students can observe and describe the distribution of living things in an environment,

  e.g., wildflowers (such as prairie crocus) in a meadow; saskatoon and other shrubs at the forest edge; trillium in shady moist mature forest; purple saxifrage in rocky tundra; and common purple lilac in a garden.

Concepts

Students could explore variation in plant structure and function. They could identify and describe examples of mutual dependency between animals and plants, e.g., pollinators such as bees, flies and butterflies, and Plantwatch flowers; migrating robins and saskatoon berries.

3) HEAT ENERGY

Transfer and conservation of heat energy

The prairie crocus tracks the sun like a parabola or satellite dish, concentrating maximum energy on the plant centre (where seeds form) and sometimes raising the internal temperature 10°C degrees above the outside temperature. In the cold, early spring, insects take advantage of the warmth by staying inside the flower in sunny but cool weather.

Control of heat transfer

The hairs on the outside of the flower parts of prairie crocus protect the plant from drying winds by preventing air currents from getting close to petal surfaces.

Students could design a greenhouse structure to artificially warm parts of their observed plants, to discover the effect of increased warmth on flowering timing. (Increased warmth should cause earlier flowering.)

Note: Selected components of this program have been extracted below, and the original numbers kept.

c. charts of curriculum fits for grades 3-12

SS = Social Studies • **M** = Math • **LA** = Language Arts • **SC** = Science • **H** = Health • **OE** = Outdoor Education • **G** = General

grades 3-6

Page	Section Title	Concept #	Suitable for Grades: 3	4	5	6	Unit/Links
3-2	Science Concept 1: Plants	1: Plants are important to humans	SS				
3-2	Science Concept 1: Plants	1: Plants are important to humans	H	H	H	H	
3-2	Science Concept 1: Plants	2: Plants are an important part of the natural environment See first bullet - Plants make oxygen	SC				
3-2	Science Concept 1: Plants	2: Plants are an important part of the natural environment See second bullet - Plants play an important role in preventing soil erosion	SC				Rocks & Minerals
3-5	Science Activity 1: Plants and Ecology - All My Relations		SC				Animal Life Cycles
3-7	Science Activity 2: Weather		SC	SC	SC	SC	
3-7	Science Activity 2: Weather				SC		Unit on Weather
3-9	Science Activity 3: Reading About Climate Change		SS	SS	SS	SS	
3-17	Science Activity 4: Forests: Discussion and Investigation					SC	
3-19	Science Activity 5: Developing a Phenology Calendar			SC	SC	SC	
3-47	Language Arts Activity 1: Descriptions			LA	LA	LA	"Create, read and interpret non-prose..." not specifically covered in any L.A. curriculum

grades 7-9

Page	Section Title	Concept #	Suitable for Grades: 7	8	9	Unit/Links
3-2	Science Concept 1: Plants	1: Plants are important to humans	SS			Past, Present, Future
3-2	Science Concept 1: Plants	1: Plants are important to humans	H	H	H	
3-2	Science Concept 1: Plants	2: Plants are an important part of the natural environment See second bullet - Plants play an important role in preventing soil erosion	SC			Rocks & Minerals
3-2	Science Concept 1: Plants	2: Plants are an important part of the natural environment See third bullet - Pollination		SC		Unit 4: Plant Management
3-2	Science Concept 1: Plants	3: Plants have special parts and adaptations... Why is the bark of aspen poplar green inside?	SC			Unit 1: Living Things (Structural Adaptations)
3-2	Science Concept 1: Plants	3: Plants have special parts and adaptations... Why is the bark of aspen poplar green inside?		SC		Unit 4: Plant Management
3-2	Science Concept 1: Plants	3: Plants have special parts and adaptations... Why is the prairie crocus so furry?	SC			Unit 1: Living Things (Structural Adaptations)
3-2	Science Concept 1: Plants	3: Plants have special parts and adaptations... Why do prairie crocus and white dryad flowers turn to face the sun?	SC			Unit 1: Living Things (Movement)
3-2	Science Concept 1: Plants	3: Plants have special parts and adaptations... Why do trilliums flower so early?	SC			Unit 1: Living Things (Structural Adaptations - Growth)
3-2	Science Concept 1: Plants	3: Plants have special parts and adaptations... Why do purple saxifrage and white dryad plants stay so small?	SC			Unit 1: Living Things (Structural Adaptations - Growth)
3-2	Science Concept 1: Plants	4: Plants have essential requirements...		SC		Unit 6: Environmental Interactions
3-2	Science Concept 1: Plants	5: Plants use different techniques...	SC			Unit 1: Living Things
3-5	Science Activity 1: Plants and Ecology - All My Relations		SC			Abiotic Factors
3-5	Science Activity 1: Plants and Ecology - All My Relations		SS			
3-5	Science Activity 1: Plants and Ecology - All My Relations			SC		Unit 6: Environmental Interactions

SS = Social Studies • **M** = Math • **LA** = Language Arts • **SC** = Science • **H** = Health • **OE** = Outdoor Education • **GEN** = General

grades 7-9...cont'd

Page	Section Title	Concept #	Suitable for Grades: 7	8	9	Unit/Links
3-5	Science Activity 1: Plants and Ecology - All My Relations		OE	OE	OE	
3-7	Science Activity 2: Weather	1: Weather data measurement…	G	G	G	Process Skills
3-7	Science Activity 2: Weather	2: Predicting the timing of bloom…	G	G	G	Process Skills
3-7	Science Activity 2: Weather	3: Students can use their temperature data…		SC		Unit 4: Plant Management (Conditions for Germination)
3-9	Science Activity 3: Reading About Climate Change				SC	Last Unit on Environmental Science
3-9	Science Activity 3: Reading About Climate Change		SS	SS	SS	
3-9	Science Activity 3: Reading About Climate Change	Climate change is a reality! (esp. last italicized sentence)			SS	Economic Factors
3-15	Science Concept 2: Trees and Forests	1: Our Plantwatch trees and shrub species are valuable! See third bullet: As part of a life-supporting environment			SC	Classification of plants and animals
3-15	Science Concept 2: Trees and Forests	2: A variety of plants and animals…		SC		Unit 6: Environmental Interactions
3-15	Science Concept 2: Trees and Forests	3: Trees play an important role in nutrient cycles		SC		Unit 4: Plant Management Unit 6: Environmental Interactions
3-15	Science Concept 2: Trees and Forests	Box: Trees are defined as perennial plants…	SC			Unit 1: Living Things
3-17	Science Activity 4: Forests	1: Forests are used for…			SC	Unit 6
3-17	Science Activity 4: Forests	2: Different animal and plant species…		SC		Unit 6: Environmental Interactions
3-17	Science Activity 4: Forests	3: Fire can be helpful to many forests		SC		Unit 6: Environmental Interactions
3-19	Science Activity 5: Developing a Phenology Calendar		SC	SC	SC	
3-19	Science Activity 5: Developing a Phenology Calendar		OE	OE	OE	
3-27	Mathematics Activity 1: Growing Degree Summation				M	
3-29	Mathematics Activity 2: Calculating Averages		M			
3-31	Mathematics Activity 3: Graphing and Mapping		SC	SC	SC	
3-31	Mathematics Activity 3: Graphing and Mapping				M	Process skills
3-42	Social Studies: All Activities			SS		Topic A (a perfect fit!)
3-47	Language Arts Activity 1: Descriptions		LA	LA	LA	"Create, read and interpret non prose…" not specifically covered in any L.A. curriculum
3-49	Language Arts Activity 2: Celebrating Spring				LA	

grades 10-12

Page	Section Title	Concept #	Suitable for Grades: 10	11	12	Unit/Links
3-2	Science Concept 1: Plants		SC			
3-2	Science Concept 1: Plants	1: Plants are important to humans	H	H	H	
3-7	Science Activity 2: Weather		SC			
3-9	Science Activity 3: Reading About Climate Change		SS	SS	SS	
3-9	Science Activity 3: Reading About Climate Change	Box: The consequences of global warming	SC			
3-19	Science Activity 5: Developing a Phenology Calendar		SC	SC	SC	

appendix five

Saskatchewan Curriculum Connections

a. plantwatch and the Saskatchewan Science Curriculum

The Plantwatch Program can be incorporated into the science curriculum at several different grade levels. Specific teaching units where the Plantwatch Program would be useful are listed below.

Grade Four Optional Unit:
Plant Diversity

Grade Five Core Unit:
Plant Structure and Function

Grade Five Optional Unit:
Communities and Ecosystems

Grade Six Core Unit:
Ecosystems

Grade Six Optional Unit:
Earth's Climate

Grade Six Optional Unit:
Plant and Animal Adaptations

Grade Nine Core Unit:
Saskatchewan - Environment

Grade Nine Optional Unit:
The Atmosphere

Science 10 Core Unit:
Earth/Environmental Science
(Topic A-2. The Greenhouse Effect)

Science Foundational and Learning Objectives: grades 4 - 10

The Plantwatch Program could be used to meet the following Science Foundational and Learning Objectives[1] at various grade levels.

Grade Four Optional Unit on Plant Diversity

1. Appreciate the diversity of plants
   - 1.1 Examine a variety of flowering plants
   - 1.2 Identify the main parts of a flower
   - 1.3 Identify distinguishing characteristics of different types of flowering plants
2. Examine various types of plant adaptations
   - 2.1 Give examples of how plant adaptations help plants to survive under certain conditions
   - 2.3 Identify plant adaptations based on climatic conditions
   - 2.4 Explain plant adaptations based on seasonal changes
3. Appreciate the value of plants
   - 3.1 Develop a sense of respect for all living things
   - 3.2 Explain ways in which plants enable other living things to survive
   - 3.3 Explain how plants can be affected by changes in the environment

Grade Five Core Unit on Plant Structure and Function

1. Describe the characteristics of vascular plants
   - 1.1 Identify the roots, stems, leaves and flowers of plants

1. These Science and Foundation Learning Objectives are taken from:
   Saskatchewan Education. Science: A Curriculum Guide for the Elementary Level. Revised 1995.
   _____. Science: A Curriculum Guide for the Middle Level. September 1993.
   _____. Science 10: A Curriculum Guide for the Secondary Level. September 1991.

2. Explain some of the functions of the roots, stems, leaves, and flowers of plants
   - 2.3 Observe and describe plant adaptations

Grade Five Optional Unit on Communities and Ecosystems

2. Investigate and describe the ecosystem of the local community
   - 2.1 Identify and describe the animal and plant populations in the local community
   - 2.3 Trace changes in the local ecosystem

Grade Six Core Unit on Ecosystems

1. Recognize the factors that influence the size of a population
   - 1.1 Identify abiotic factors within an ecosystem
   - 1.2 Show how the abiotic factors in an ecosystem contribute to the support of life
   - 1.3 Give examples of interactions among biotic factors in an ecosystem
2. Recognize that a change in an ecosystem can affect life
   - 2.1 Identify some ways in which an ecosystem can change
   - 2.3 Appreciate the fragile nature of ecosystems
3. Develop responsibility for the protection of the environment
   - 3.1 Recognize that the environment needs to be protected
   - 3.2 Investigate the impact that humans have on ecosystems
   - 3.3 Recognize the role that humans play in protecting or destroying ecosystems
   - 3.4 Identify ways to protect the environment
   - 3.5 Demonstrate an involvement in environmental protection

Grade Six Optional Unit on Earth's Climate

1. Identify the factors that stabilize climate
   - 1.1 Explain how latitude affects climate
3. Recognize long-term climatic patterns.
   - 3.1 Recognize that climatic change can take place over prolonged periods of time
   - 3.3 Evaluate theories of climate change

Grade Six Optional Unit on Plant and Animal Adaptations

1. Explain the responses of plants to environmental stimuli
   - 1.1 Analyze structural variations in plants
   - 1.5 Describe seasonal responses in plants

Grade Nine Core Unit on Saskatchewan - Environment

1. Recognize the diversity of the ecological regions of Saskatchewan
   - 1.2. Compare the climate and native plants of the regions
   - 1.4 Observe and describe the characteristics of the local area
2. Explore the effects of human activity on the landscape

Grade Nine Optional Unit on The Atmosphere

1. Understand the dynamic nature of the atmosphere
   - 1.1 Discover how weather information is gathered
   - 1.3 Describe the Saskatchewan climate
2. Recognize the effects of human activity on the atmosphere
   - 2.1 Identify some air pollutants
   - 2.2 Describe the effects of air pollutants
   - 2.3 Distinguish between local and global effects of pollutants

Science 10 Core Unit on Earth/Environmental Science

(Topic A-2. The Greenhouse Effect)

A1 Appreciate the complexity within natural systems

A2 Examine the impact of historical and contemporary human activity on the biosphere

A2.9 Investigate predictions regarding climatic changes resulting from the Greenhouse Effect

factors of scientific literacy in Plantwatch

The major purpose of science education in Saskatchewan is the development of scientific literacy among students. The various factors of scientific literacy[2] *which are emphasized in the Plantwatch Program are listed here.*

A3 holistic
A4 replicable
A5 empirical
A8 tentative
B1 change
B2 interaction
B4 organism
B5 perception
B10 cause-effect
B11 predictability
B14 cycle
C2 communicate
C3 observe and describe
C4 work cooperatively
C6 question
C7 use numbers
C10 predict
C12 interpret data
C14 problem-solve
C15 analyze
C18 use time-space relationships
D3 impact of science and technology
D4 science, technology and the environment
E2 use natural environments
E5 computer interaction
E10 measure temperature
F2 question
F3 search for data and their meaning
F4 value natural environments
G1 interest
G2 confidence

[2] Saskatchewan Education. *Science: A Curriculum Guide for the Elementary Level.* Revised 1995. Please refer to this document for a more complete explanation of the factors of scientific literacy.

b. common essential learnings

The Plantwatch Program offers several opportunities for including the Common Essential Learnings defined by Saskatchewan Education and developing student skills in these areas.

Communication

The Plantwatch program provides opportunities for students to communicate and share information with scientists and students in other parts of Canada through the use of computers. The Plantwatch Program also provides opportunities for students to develop written and oral communication skills.

Critical and Creative Thinking

The Plantwatch program provides opportunities for students to apply critical thinking skills to a real life problem and to gain an understanding of how scientific knowledge is produced. There are also opportunities for creative expression through the arts or environmental action.

Independent Learning

The Plantwatch Program introduces students to opportunities for lifelong learning about plants and natural history. It also encourages students to become engaged contributors to the production of new knowledge.

Personal and Social Values and Skills

The Plantwatch Program provides opportunities for students to examine the values and skills needed to address the challenge of a changing global environment.

Technological Literacy

The Plantwatch Program familiarizes and actively engages students in the use of computer information networks. The study of climate change also encourages students to examine the environmental impacts of industrial technologies.

appendix six

Horticultural Appendix

a. establishing a Plantwatch garden

Introduction

This guide will serve as a resource to teachers in the Plantwatch Program who are interested in learning more about the cultivation and growth requirements of these key indicator plants. Some participants may find that their access to the plants in the wild state is limited (e.g., urban classrooms often cannot find prairie crocus). One solution is for schools to create their own garden areas, using plants from the Plantwatch program and others that are native to their area. This approach not only provides special places in which to observe and record the timing of natural phenomenon such as plant phenology, but also gives opportunities for creating wildlife habitat (for birds, butterflies, etc.) and increasing local biodiversity.

Students are able to observe daily the changes in the Plantwatch species and accurately report the flowering stages. They will see first hand the effect of weather events such as spring snow storms or frosts on their plants. Temperature records from the site or nearby will provide highly useful information on the amount of heat needed for flowering. If students have access to the school grounds over the summer, they will see all stages of growth — from first buds, to flowers, to ripe fruit, as well as leaf colouring, and discover some of the insect partners that these plants attract.

Creating garden spaces in communities need not be an overwhelming task, if all the factors are considered. The benefits of such a project go far beyond the project itself, as communities become involved with the land, its rhythms and its diversity. Natural areas offer a rich learning environment that can lead directly to a stronger environmental ethic for all who become involved.

Creating Garden Spaces

Individuals, communities or schools considering the creation of school garden spaces need to ask themselves some important questions. Assistance in answering these questions can be obtained from many sources-individuals, organizations and printed materials.

1. What is the purpose of the garden space? Are you going to just plant certain Plantwatch species for observation, or are you going to expand your garden area to include other native plant species?
2. Is there a plan in place? Does the plan include a budget, a realistic time line, use of the expertise of other people who have initiated such garden spaces, and opportunities for learning about the plants and their requirements?
3. Has an appropriate site been located, taking into account the soils, topography and present condition of the land, along with the requirements of the plant communities you'd like to establish? If possible, sites should be located at least 3 m-5 m (10-15 ft.) away from buildings (to avoid hot microclimates), and away from sidewalks or roads. Consideration should also be given to ease of watering, and ways in which the site can be protected from students' outdoor play activities.

4. What kind of site preparation considerations are there? Proper cultivation of an area, to control weed growth, is necessary prior to the planting of a garden. The soil should be well-packed with rollers before seeding, and have appropriate soil amendments added before planting live plants. Because native plants are well adapted to low fertility, they do not require heavy fertilization (which may only encourage the growth of weedy, non-native species). Possible use of herbicides should be considered carefully: restrict your choices to those that pose no threat to sensitive native wildflowers, and consider the possible threats to human and ecosystem health.
5. What species are you going to plant? For certain Plantwatch species, see section B following: "How to Grow the Plantwatch Species."
6. What planting methods are you going to use? The methods will vary, depending on whether you are working with seeds or live plant material. Things to consider would include best dates for planting and any special techniques for specific plants.
7. What kinds of long-term management strategies do you need to consider? Young shrubs of saskatoon and lilac may take three to four years before they begin flowering. How will we maintain weed control - by hand or mowing? Keep in mind that drought-adapted species such as saskatoon, prairie crocus, or white dryad should not be overwatered once established. How will the garden space be protected from unwanted intrusions?
8. How will you achieve public involvement and support? Can you involve a variety of people (principal, school staff, grounds crew, local business people)? How will you educate others about your project? Finding funding for school gardens is relatively simple because these projects have so many benefits. Sources that we know have funded similar projects include The Evergreen Foundation and Shell (see resource list for addresses).

b. how to grow some of the Plantwatch species

(lilac, prairie crocus, saskatoon, white dryad, and white trillium)

ALL WORDS HIGHLIGHTED IN BLUE CAN BE FOUND IN THE GLOSSARY (APPENDIX 1).

Common Purple Lilac

For those who want to plant new lilacs to observe, a recommended **cultivar** for Plantwatch observers is the early-flowering and popular *Syringa vulgaris* "Charles Joly", originally developed in 1896 in France by Lemoine. The flowers of this species are reddish-purple, slightly redder in colour than most common purple lilacs, but suitable for Plantwatch because they are early blooming and many nurseries have them for sale. Make sure your lilac is growing on its own roots, not **rootstocks**.

Common purple lilac (*Syringa vulgaris*) can be planted individually or in a line to form an unclipped hedge. Lilacs should be grown in fertile, moisture-retentive soil that is neutral to alkaline not acidic. They will thrive in sun or partial shade but grow best in full sun. In a new garden be careful not to plant any trees in the vicinity of your lilacs. Over the years these trees will grow and eventually shade the lilacs, which then will produce fewer and fewer flowers. If your lilacs do get shaded, transplant them to a sunnier site. During dry spells, lilacs benefit from regular watering, particularly young or recently transplanted plants. This shrub is relatively free from major pests, but watch out for leaf miner and lilac borer.

Pruning

Lilacs should be pruned every five to ten years to maintain a good shape. Lilacs flower on the previous year's growth, so they should not be

pruned in any way until after the flowers have died. The spent blossoms should be removed every year, to prevent seed formation and to stimulate flower bud formation. Prune immediately after flowering occurs in spring because next year's buds will form on the new wood that grows after flowering. Don't prune in autumn as it will remove next year's flower buds.

One or more of the older main stems at the base of a plant may be removed in pruning and some of the remaining stems trimmed back to maintain the size and shape desired. Remember, never remove more than one third of a lilac bush at any one time. Cut a branch back only to the first **node**, where new buds can be seen. If branches are cut back beyond this point, next year's flowers will be lost.

After being transplanted, it may take several years for some lilacs to produce flowers. Occasionally, a lilac may bloom the first year after being transplanted because the buds were set up in the nursery before the plant was bought. Usually, such a plant will not flower again for about three or four years, assuming the plant is growing in the full sun, and has a good supply of nutrients and moisture. Once a plant does begin to flower, it will continue to do so for many years.

The ultimate size of a mature lilac is one factor limiting the number of lilacs that any garden can satisfactorily hold. Because under ideal conditions common purple lilacs can reach a height of 2.5 m to 4 m (8-13 ft.), and have a spread of 6 m to 7 m (20-23 ft.), one has to be careful not to plant too many lilacs in a small, city garden.

Growing lilacs from seed

Lilacs can be grown from seed. If **open-pollinated seed** is used there is no way of knowing if the new plant will be similar or quite different from the parent plant. Seed can be collected in the autumn, then dried, and the seed stored in a cool, dry place until February. Lilac seed requires a wet/cold **stratification** period to break the seed's natural **dormancy**. Seed may also be sown directly in the garden in the autumn. After the first freeze, the bed should be covered with a light mulch. In the spring, this mulch should be removed, and the bed should be shaded as the seedlings appear because these seedlings scorch very easily in direct sun.

Prairie Crocus

This welcome little sign of spring is sometimes difficult to grow in a garden. It can be started from seed collected from the wild, or purchased from nurseries specializing in native plants and seeds.

Please do not attempt to transplant plants from the wild to the garden. This usually fails, and it contributes to loss of biodiversity in our remaining natural habitats**!**

Growing prairie crocus from seed requires patience because not all the seeds will germinate the first year and because the plants are deep-rooted and slow to mature. Native plant seeds usually require **stratification** before planting, to break their natural **dormancy**; that is, they must be exposed to a cold and damp period prior to planting. To stratify prairie crocus seed, place the seed in a clean zip-loc bag or film container with a little sterilized dampened sand and refrigerate it from one to three weeks. Then plant the seeds in flats — they do not compete very well with other plants. Ideally, these plants should be grown in nursery conditions for the first year or two, and then transplanted to a garden in late fall or early spring.

Habitat Requirements

Prairie crocus likes a sandy soil that is never wet for more than a few hours. Once the plant has a well-established root system, do not water it during the summer unless the soil becomes very dry.

This plant needs to be planted in an open area with full sun. After a year or two, like other wild plants, it becomes dependent on **fungal partners** in the soil. Seedlings will flower in three or four years.

Note: In central Alberta, seed is best collected from the wild in June, when it is ripe.

Saskatoon/Serviceberry

Saskatoon is an excellent ornamental shrub for the garden. It is **hardy**, that is, it can withstand cold winters and drought, and is easily propagated, with fragrant showy flowers, edible fruit and attractive fall **foliage**. It also attracts birds! Many different varieties have been produced by horticulturalists for commercial and garden use. If you'd like one in your own garden, saskatoon plants are available from many plant nurseries, in several different sizes and varieties. Plants that are old enough to produce flowers are, of course, more useful for the Plantwatch project.

Saskatoons can be started in several different ways including from seed, **suckers, root cuttings, softwood cuttings, hardwood cuttings**, and **crown division**. Saskatoon twigs can also be **grafted** onto other trees like apples and pears. When seeds are used, some of the plants grown from a batch of seed will be different from the parent stock.

When choosing a saskatoon for your garden, Plantwatch recommends the cultivar, "Smoky", as this **variety** blooms early. Choose plants that are not **grafted**. When plants arrive, remove them from the root trainer, and completely cover the root plug with soil. Firm soil around roots. Water as soon as possible, making sure that roots do not become exposed in the process. It usually takes the first year for the plants to establish their roots, so good care (e.g. occasional watering, effective weeding) at this time will ensure healthy plants for the future. Shallow cultivation is important, to protect the fragile roots, and to keep competing weeds from gaining a foothold.

Growing Saskatoons From Seed

Saskatoons can also be grown from seed. (See Ethical Guidelines for Collecting Plant Material, following.) Collect the fruit when it is ripe and freeze it. In the fall, or when you are ready, extract the seed from the fruit pulp (add the fruit to water in blender, use a few brief pulses to avoid damaging the seed, then pass the liquid through a sieve). Don't allow seed to dry as deep **dormancy** may result. Soak the seed 24 hours, then place it in small zip-lock bags with moist sand (four parts sand to one part seed) and place the bags in a refrigerator for four to five months. Occasionally examine the bags for germinating seeds. Plant when a seed germinates and the first root is seen. When potting new plants handle the plant very gently to avoid breaking growing tips.

Alternatively, cleaned seed can be sown in the fall and pots placed outside to take advantage of natural stratification. **Germination** will occur the following spring.

White Dryad

Dryads are attractive as garden plants because of the neat, trim leaves, abundant and long-lasting flowers and interesting seed heads. Several different commercial varieties are available.

To minimize human impact on natural habitats, please do not attempt to move plants from the wild. Adult plants are hard to transplant anyway because of their large branching **taproot** system**.**

Growing White Dryad From Seed

For most success, sow ripe seed in seed pans filled with sandy, well-drained soil. If you have older seed, this seed will need to be stratified. Put the seed in sealable plastic bags, and put them in a refrigerator for two months at 4°C. After **germination**, transfer the seedlings to individual pots. Because white dryad has a long tap root, letting the plants grow a while in pots will reduce the amount of damage that can occur when the plant is being transplanted into a garden. Plants grown from seed take many years to flower.

Habitat Requirements

The dryad grows in **alpine** and in northern regions, so it is adapted to cool, dry places. It can tolerate moderate drought, and alkaline soils. If you want to grow white dryad in more southern, warmer places you must try to duplicate its favoured growing conditions as much as possible.

First, you need to ensure that your soil is quite coarse in texture so it has adequate drainage.

Dryads like to be slightly dry, which can be facilitated if you add pebbles with a little peat moss to your soil. Or, you can plant white dryad in a rock garden among pebbles where there is good drainage but enough moisture to keep the soil from becoming too dry.

Second, your plants need to be protected from the hot afternoon sun, so pick a spot that is shaded in the afternoon but will expose the plants to sun in the evening and/or morning.

Third, these plants do not thrive in conditions of shade or competition with other plants. These plants have a long branching **tap root**.

White Trillium/Western Trillium

Trilliums can be grown in your garden; the problem is to get them started in the first place.

Do not try to transplant trilliums from the forest to the garden. It is very important to protect these species in the wild!

Forest wildflowers can take up to 15 years to flower and therefore are not economical for commercial greenhouses to grow from seeds or cuttings. For this reason some nurseries dig plants from the wild for resale, a practice that is a great threat to the biodiversity and health of our forests. FloraQuebeca, a Quebec conservation group, therefore recommends no selling or buying of forest flowers such as trillium, ladies' slipper, dog-tooth violet, or spring beauty. In British Columbia, western trillium is one of three plant species (with western flowering dogwood and Pacific rhododendron) protected by provincial law.

Growing Trilliums From Seed

If you still wish to grow trilliums and are very patient, they can be started from seed. Seeds should be harvested as soon as the capsules are ripe, and immediately planted. Germination is more likely if the seeds have experienced a frost, so it is better to sow in the fall. For germination to be successful, it is important that the seed be kept damp. Trilliums can take 15 years to flower after the seed germinates. Seedlings survive best in open soil away from plant competition, and away from heavy leaf mould.

Habitat Requirements

This plant is suitable for the shade garden, planted with other species that like cool damp conditions, such as primroses. Trilliums require a semi-shady location with good drainage, in neutral to slightly acid soils with some well-rotted leaf mould (avoid heavy clay or sandy soils). The protection of trees or shrubs and a constantly moist soil will produce a healthier plant.

Some seed sources for the prairie provinces (most suitable for prairie crocus and saskatoon):

Alberta:

ALCLA Native Plant Restoration Co., Calgary, Alberta -(403) 282-6516

Coyote Coulee, Cessford, Alberta - (403)566-2485

Eagle Lake Nurseries and Sod Farms, Strathmore, Alberta -(403) 934-3622

Parkland Nurseries, Red Deer, Alberta - (403) 346-5613.

Saskatchewan:

Blazing Star Wildflower Seed Co., St. Benedict, Saskatchewan - (306) 289-2046

Miller's Native Plant Nursery, Saskatoon, Saskatchewan - (306) 374-4785

Manitoba:

Prairie Habitats, Argyle, Manitoba - (204) 467-9371

c. ethical guidelines for collecting Native Plant material

Native

Definition: "indigenous, or originating in a certain place". A native ecosystem is one dominated by native plants; animals, insects, and microorganisms that occurred together in North America before the arrival of European settlers.

Guidelines

- Use seed or buy plants from a reputable nursery that propagates from seed or cuttings, and does not dig plants from the wild for sale.
- Select plants that are from your ecological region (e.g. Eastern Deciduous Forest, Short-Grass Prairie, Boreal Forest, etc.).
- Purchase seed of local origin (within your ecological region and within a 300 km radius of where the seed will be used). Use weed-free seed.
- Do not collect from restricted areas (it is illegal to collect from areas such as National and Provincial Parks). Obtain permission to collect from local landowners.
- Collect seeds or cuttings, not entire plants. Whole plants should not be removed from the wild (i.e. no wild-dug plants).
- Collect undamaged, ripe seeds (firm, plump and dry). For plants like prairie crocus and white dryad, they will be very loosely attached, ready to blow away.
- Leave 50% of the seed in place to allow natural propagation, and to provide food and habitat for insects, birds and small mammals.
- Do not intensively collect seed in the same area year after year.
- In areas that may be subjected to further collecting by the general public or where grazing reduces natural regeneration, collecting should be minimal (from no more than 10% of the plants).

Source: Alberta Native Plant Council (ANPC), and Native Plant Society of Saskatchewan Inc.

See the web page **www.anpc.ab.ca/guide.htm** for more details on "guidelines for the collection and use native plants."

d. resources

Print Materials

1. Gerling, H.S., M.G. Willoughby, A. Schoepf and C. & K. Tannis.1996. A Guide to using Native Plants on Disturbed Lands. Alberta Agriculture, Food and Rural Development and Alberta Environmental Protection. ISBN 0-7732-6125-7. 247 pages.

2. Morgan, J.P., D.R. Collicut and J.D. Thompson. 1995. Restoring Canada's Native Prairies: a Practical Manual. Winnipeg, Manitoba. ISBN 1-896520-09-X. 44 pages.

3. "Native Plant Source List and Collection and Use Guidelines". Lists sources of Alberta native plants and seeds. Write to: ANPC, Garneau P.O. 52099, Edmonton, Alberta. T6G 2T5, or see webpage: www.anpc.alberta.ca

4. Stoyke, G.1996. Environmental School Program: A Teacher's Guide. Available from The Devonian Botanic Garden, University of Alberta, Edmonton, Alberta. T6G 2E1. $18.95 plus shipping/ handling.

Organizations

1. Alberta Native Plant Council, Garneau, P.O. Box 52099, Edmonton, Alberta, T6G 2T5
   http://www.anpc.ab.ca

2. Native Plant Society of Saskatchewan, c/o Andy Hammermeister PAG Coordinator, Native Plant Society of Saskatchewan Inc.
   Ph: (306) 668-3940
   Email: info@npss.sk.ca
   Fax: (306) 373-4462
   URL: www.npss.sk.ca
   Mail: P.O. Box 21099 Saskatoon SK S7H 5N9

3. The Evergreen Foundation:
   http://www.evergreen.ca
   355 Adelaide Street West, S-5A, Toronto, Ontario. M5W 1S2
   Phone: (416) 596-1495
   OR
   106 - 163 West Hastings Street, Vancouver, B.C. V6B 1H5 (phone: (604) 689-0766).

4. Shell Environmental Fund, Box 100, Stn. M., Calgary, Alberta T2P 2H5