PLANT PHENOLOGY

AIM

To monitor the flowering times for indicator plant species in order to track how flowering phenology is responding to climate change.

RATIONALE

The plants chosen as indicator species for this protocol bloom every spring, largely in response to rising temperatures. Reporting blooming times on the PlantWatch species found in your community aids in the understanding of how common plants are responding to climate change - and track where changes are taking place in Canada, and at what rate.

BACKGROUND

Scientists that have been tracking the flowering dates of plants and have found that climate change can be affecting blooming times. They predict that the greatest increases in temperature will be in Western and Northern Canada, while some parts of Eastern Canada actually may be cooling, thus trends in plant phenology will differ across the country. Plantwatching broadens and enriches reporting on observed changes so that scientists are better able to understand how climate is impacting the blooming times of plants in Canada.

The act of plant watching has had a long tradition and rich history. In 1750 the Swedish scientist and artist Linnaeus turned plantwatching into a systematic science. He made calendars of flowering times for 18 places in Sweden, also noting the exact climatic conditions at these times. This research was the foundation of modern plant phenology which spread too many European countries and revealed, over the centuries, that some spring wildflowers are super-sensitive weather instruments.

Over one hundred years ago, Nova Scotia's Superintendent of education, Dr. Alexander H. MacKay had students collect plant, animal, agricultural and weather phenology observations from 1897-1923. In 1987 the Alberta Wildflower Survey started and blossomed into a programme that initiated Alberta PlantWatch. The Alberta programme then advised in the creation of Nova Scotia and Newfoundland PlantWatch. Today there are PlantWatch programmes in each Province and Territory. Most of these are administered nationally as part of the NatureWatch Programme. NatureWatch provides suites of monitoring protocols which encourage researchers, education centres, naturalists and other organisations or individuals to engage in monitoring indicators for environmental quality.

CHECKLIST OF MONITORING ACTIVITIES

- Select monitoring site location(s) and complete the site description datasheet.
- Become familiar with indicator plant identification and recording criteria (available online).
- Monitor site and record blooming/leafing dates during the spring.
- Manage data sets.
- Send a copy of data to the EMAN Coordinating Office or submit observations online at http://www.plantwatch.ca.

EQUIPMENT

Data Sheets
Pens/Pencils
Nails, hammer & tree tag (for tree species)
Wire and plastic/metal tags (for plants)
Camera (optional)

LOCATION

In the summer/fall season prior to beginning monitoring, locate areas where PlantWatch indicator species for your province are present (see plant list in Appendix A). If possible, choose specimens that are growing in an easy-to-access, flat area. Plants on a cool, north-facing slope usually flower later; and those on a warm, south-facing slope bloom earlier than plants on level ground. Avoid sites which may have unusual temperature or light conditions such as valleys, or sites near streetlights, buried steam pipes, concrete foundations or paved parking lots and roads.

Once a site or multiple sites are selected, record information about the site and its location (latitude/longitude) using the *site description datasheet*.

For trees and large shrubs, you may temporarily mark an individual plant by nailing in an aluminium tree tag into the indicator plant, as long as you have permission to do so. For smaller plants, find a typical patch of the species to observe, label your plant (or patch of plants) with a plastic or metal tag which can be strung around the plant or patch with wire. Mark tag with site number, plot number and your initials so that are confident you are observing the same plants on each visit, and from year to year.

If you are associating a plant phenology monitoring programme with a forest biodiversity plot, choose indicator species found adjacent to the plot. Do not choose species inside the biodiversity plot as this will increase traffic in the area under study. Mark the location on a plot map for observation in subsequent years.

SAMPLING METHODS

Timing and Data Collection

- Become familiar with the plants understudy and what is recorded for each specific species. You can monitor as many or as few species as you like. Information on recording details for individual species can be found at http://www.plantwatch.ca under “Plant Descriptions”.
  - For most plants, first bloom is recorded. First bloom is when the first flower opens, revealing the stamens inside. In some cases you will report first bloom when flowers have opened in three different places on your shrub or tree, or in three places within the patch of plants you are observing. In other species such as with larch, aspen and lodgepole pine, this is recorded when first pollen is shed.
  - Mid bloom is also recorded later in the spring. This is usually recorded when 50% of the flowers are opened on the observed plants though there are exceptions with many species. Again, for species such as aspen, larch and lodgepole pine, mid-bloom is when 50% of male cones are shedding pollen.

- For tree species and lilac, leafing dates are reported. Leafing date criteria depend on the individual species, however leafing is usually recorded with the first leaves push out of the bud and unfold completely in 3 places.

- Start watching your plant closely in spring, checking for swelling flower buds. It is important to visit your plants at least every few days to catch the first day they bloom.
- Record first bloom, mid bloom and leafing dates according to the specifications for the indicator plant species under study.
- Record any environmental details listed on the data sheet. This includes notes on weather, the plant's habitat and any other interesting information on insects or animals affecting the plant. Spend some time during spring and summer observing the plants in full leaf and bloom so you can easily recognize them and return to observe them early next spring!

Plant-etiquette: Please do not collect wildflowers. This weakens the plants and robs them of the energy needed to bloom the following year. Wildflowers are best enjoyed in their native habitat!

Please direct any questions to your regional coordinator (http://www.naturewatch.ca/english/plantwatch/program_coordinators.html) or EMAN Coordinator Office (eman@ec.gc.ca).

DATA ANALYSIS

Chart the dates of the first bloom, mid-bloom and leafing times for each year. These dates can show a pattern over time of earlier or later blooming dates in Canadian terrestrial systems.

DATA MANAGEMENT AND SHARING

Hard copies of the data should be kept for future use. Submit online data at http://www.plantwatch.ca. Hard copies can be sent to the Ecological Monitoring and Assessment Network (EMAN) in order to allow for regional, provincial and national comparison of plant phenology.

EMAN Coordinating Office
Canada Centre for Inland Waters • 867 Lakeshore Road • Burlington • Ontario • L7R 4A9
Phone: 905 336 4414 • Fax: 905 336 4499 • Email: eman@ec.gc.ca

REFERENCES

PlantWatch. 2000. Devonian Botanic Garden. World Wide Web http://www.devonian.ualberta.ca/pwatch/

APPENDIX A- Indicator Plant List

The following is a list of the indicator plants chosen for PlantWatch. Specific plants were chosen for each province/territory.

Information and photographs for each plant species can be found on the PlantWatch website at http://www.naturewatch.ca/english/plantwatch/learn_plants.asp, or in the PlantWatch booklet available through EMAN Coordinating Office and the Canadian Nature Federation.

Plant Species		
Common Name	**Scientific Name**	**PlantWatch Province**
Aspen Poplar / Trembling aspen	*Populus tremuloides*	YK, NT, BC, AB, SK, MB, ON, QC, NB, NS, PEI, NL
Bearberry / Kinnikinnick	*Arctostaphylos uva-ursi*	YK, NT, NU, BC, AB, SK, MB, ON, QC, NB, NS, PEI
Bedstraw, Northern	*Galium boreale*	AB
Blue-bead Lily / Clintonia	*Clintonia borealis*	ON, QC, NB, NS, PEI, NL
Bluets	*Houstonia caerulea*	NS
Bunchberry / Crackerberry	*Cornus Canadensis*	YK, NT, BC, AB, SK, MB, ON, QC, NB, NS, PEI, NL
Buttercup, Sagebrush	*Ranunculus glaberrimus*	BC
Choke Cherry	*Prunus virginiana*	AB
Cloudberry / Bake-apple / Salmonberry	*Rubus chamaemorus L.*	YK, NT, NU, MB
Coltsfoot	*Tussilago farfara*	NS, NL
Cranberry / Lowbush cranberry / Lingonberry	*Vaccinium vitis-idaea*	UK, NT, NU, MB
Dandelion	*Taraxacum officinale*	YK, NT, BC, AB, SK, MB, ON, QC, NB, NS, PEI, NL
Labrador Tea	*Rhododendron groenlandicum* Formerly *Ledum groenlandicum*	YK, NT, NU, BC, AB, SK, MB, ON, QC, NB, NS, PEI, NL
Larch / Tamarack/ Hackmatack	*Larix laricina*	YK, NT, BC, AB, SK, MB, ON, QC, NB, NS, PEI, NL
Lilac, common purple	*Syringa vulgaris*	YK, NT, BC, AB, SK, MB, ON, QC, NB, NS, PEI, NL
Lodgepole Pine / Shore Pine	*Pinus contorta*	BC, AB
Lupine, arctic	*Lupinus arcticus*	YK
Maple, Red / Swamp maple	*Acer rubrum*	SK, MB, ON, QC, NB, NS, PEI, NL
Mayflower / Trailing arbutus	*Epigaea repens*	NS
Mountain Avens / Arctic and alpine dryad / White mountain avens	*Dryas integrifolia / D. octopetala*	YK, NT, NU, BC, AB, MB, ON, QC
Prairie Crocus / Prairie anemone / Pasque flower	*Anemone patens*	YK, NT, AB, SK, MB
Queen's cup / Bride's bonnet	*Clintonia uniflora*	BC
Rhodora	*Rododendron canadense*	NB, NS, PEI, NL
Saskatoon / Serviceberry / June-berry	*Amelanchier species*	YK, NT, BC, AB, SK, MB, QC
Saxifrage, prickly / Three-toothed saxifrage	*Saxifraga tricuspidata*	YK, NT, NU, MB
Saxifrage, purple / French knot moss	*Saxifraga oppositifolia*	YK, NT, NU, BC, AB, MB, ON, QC

Solomon's Seal, star flowered / Solomons plume / Wild spikenard	*Maiathemum stellatum* Formerly *smilacina stellata*	AB
Starflower	*Trientalis borealis*	NB, NS, PEI, NL
Strawberry, wild	*Fragaria virginiana / vesca*	YK, NT, BC, AB, SK, MB, ON, QC, NB, NS, PEI, NL
Sweetgale / Bayberry / English bog myrtle	*Myrica gale*	NL
Trillium / White trillium	*Trillium grandiflorum*	ON, QC
Twinflower	*Linnaea borealis*	BC, AB
Water Lily, white	*Nymphaea odorata*	ON, QC
Wolf Willow	*Elaeagnus commutate*	AB

EMAN Ecosystem Monitoring Partnership

PLANT PHENOLOGY DATA SHEET

OBSERVER INFORMATION

NAME:	ADDRESS:
CITY/TOWN:	PROV./TERRITORY & POSTAL CODE:
PHONE NUMBER:	EMAIL:

PLANT LOCATION

SITE NAME:	**CLOSEST CITY/TOWN:**	**PROVINCE/TERRITORY:**
LATITUDE & LONGITUDE:	**ELEVATION (IF KNOWN):**	

PLANT INFORMATION

COMMON NAME:	SCIENTIFIC NAME:	
Leafing (dd/mm/yy)	**First Bloom Date (dd/mm/yy)**	**Full Bloom Date (dd/mm/yy)**

HABITAT (check all applicable boxes)

Habitat Type		Slope	Exposure
✍ Deciduous forest	✍ Marsh, bog, wetland	✍ Flat area	✍ Sunny & open area
✍ Coniferous forest	✍ Farmland	✍ Gentle slope	✍ in half shade
✍ Mixed forest	✍ Residential garden/lawn	✍ Steep slope	✍ shaded all day
✍ Tundra/barren	✍ Schoolyard	*Slope Facing:*_____ (N, NE, E, SE, S, SW, W, NW)	
✍ Grassland	✍ Other:_____		

DESCRIBE WEATHER CONDITIONS AT FIRST BLOOM (warm/raining/overcast etc):

ATTACH PHOTOGRAPHS OF OBSERVATION AREA HERE
(Digital photos can be uploaded and submitted to http://www.plantwatch.ca)