Vision and Objectives

National Phenology Network (NPN)
Definition of Phenology

- **Phenology** which is derived from the Greek word *phaino* meaning to show or to appear, is the study of plant and animal life cycle events, which are triggered by environmental changes, especially temperature. Thus, timings of phenological events are ideal indicators of global change impacts.

- **Seasonality** is a related term, referring to similar non-biological events, such as timing of the fall formation and spring break-up of ice on fresh water lakes.
Phenological Research

- Traditional approach: agriculture-centered, and local-scale events
- Recent approach: Earth systems interactions, and global-scale events
- Question: What roles for phenology in current and future agricultural research?
Critical Research Areas

- Atmosphere-Biosphere Interactions
- Long-term Organism response to Climate Change
- Global Phenology Databases for monitoring and management
Integrated Approach

- Satellite Observations (MODIS-NDVI/EVI)
- Indicator Species Phenology
- Native Species Phenology
#1 Issue: Lack of Data!

- Surface phenological data is virtually non-existent in the USA
- A National Phenology Network can profoundly affect the future course of bioclimatic research in the USA
Vision of a USA National Phenology Network (NPN)

- a continental-scale network observing regionally appropriate native plant species, cloned indicator plants (lilac +?), (and selected agricultural crops?)
- designed to complement remote sensing observations
- data collected will be freely available to the research community and general public
Addressing new continental-scale questions
The National Phenology Network (NPN) exists to facilitate collection and dissemination of plant phenological data to support climate change research.

NPN asks individuals to select appropriate plant species to observe, and then encourages them to submit the data they collect each year over the Internet. The program includes indicator plants (principally lilacs, that facilitate comparisons between sites) and native plants suited to each location.

Phenology is the study of plant and animal life cycle events, which are triggered by environmental change, especially temperature. Wide ranges of phenomena are included, from first openings of leaf and flower buds, to insect hatchings and return of birds. Each one gives a ready measure of the environment as viewed by the associated organism. Thus, timings of phenological events are ideal indicators of the impact of local and global changes in weather and climate on the earth's biosphere.
Select appropriate native species
Submit data over the Internet

Cloned Lilac Observation Form

Station Number
Observer Name
E-mail
City
State
First leaf
95% leaf
1st bloom
Full bloom
End bloom

Submit data

Photo Credit: Mark D. Schwartz

UW-Milwaukee Geography
Critical Research Areas

- Atmosphere-Biosphere Interactions
- Long-term Organism response to Climate Change
- Global Phenology Databases for monitoring and management
Diurnal Range Change with Lilac First Leaf

Source: Schwartz 1996, Figure 3
Comparative Net Ecosystem Exchange

Days after Spring Index First Bloom

Mean Daily NEE (umol/m²/s)

-18 -16 -14 -12 -10 -8 -6 -4 -2 0 2 4 6

Park Falls, WI
M-Monroe, IN
H. Forest, MA
Oak Ridge, TN
Comparative Net Ecosystem Exchange
Annual “Downturn” Rates

Days after SI First Bloom that NEE = 0

Park Falls, WI
M-Monroe, IN
H. Forest, MA
Oak Ridge, TN

Days after SI First Bloom that NEE = -5
NPN Contributions

- Facilitate understanding of plant phenological cycles and their relationship to climate (energy balance, carbon flux, and “traditional” measures)
Critical Research Areas

- Atmosphere-Biosphere Interactions
- Long-term Organism response to Climate Change
- Global Phenology Databases for monitoring and management
Terrestrial Biosphere
Dynamic Change Detection

- Satellite Phenology
- Simulated Phenology (Models)
- Cloned Species Phenology
- Native Species Phenology
Cloned lilac first leaf and first bloom dates at a single station in Vermont
Simulated phenology developed from lilac and honeysuckle data combined with climate data

Source: Schwartz and Reiter 2000, Plate 4 (updated)
Integrated Species Indices (ISI)
southwestern Wisconsin
NPN Contributions

- Comprehensive evaluation of satellite-derived measurements
- Evaluate impacts of longer growing seasons on pollinators, cattle, crop and forest pests, wildfires, carbon storage, and water use
Critical Research Areas

- Atmosphere-Biosphere Interactions
- Long-term Organism response to Climate Change
- Global Phenology Databases for monitoring and management
SI First Leaf Date 1961-2000 Slope

Slope:
- < -0.3
- -0.3 to 0
- 0 to 0.3
- > 0.3

UW-Milwaukee Geography
North. Hem. SI First Leaf Date Departures

Adjusted R-square = 0.362 (0.307)
Slope of reg. line = -0.119 (-0.111)
NPN Contributions

- Detection of long-term phenological trends in response to climate variability/global warming
Future NPN Contributions

- Interpretation/Comparison of satellite phenology with “spatially concentrated” surface data
- Interpretation of “ripple effects” in biomes and managed systems
Workshop Issues

- Native species selection for regions
- Expansion of indicator plants to entire country
- Web-based reporting and feedback system
- Network infrastructure design and function
- Collaborative and cooperative agreements
- Deployment and development strategies
- Public engagement and awareness