



# Enhancing Ecological Thought Through Phenological Observation, Research, and Education: The National Phenology Network



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## What is Phenology?

Phenology is the study of periodic plant and animal life cycle events and how these are influenced by seasonal and year-to-year variations in climate. Examples include the timing of leafing and flowering, agricultural crop stages, insect emergence, and animal migration. All of these events are sensitive measures of climatic variation and change, are relatively simple to record and understand, and are vital to both the scientific and public interest.

## Phenology - A Critical Tool for Enabling Adaptive Responses to Climate Change

Phenology is:

- An integrator of climatic variation and change across scales
- Simple to record and understand
- Important to science, health, agriculture, natural resources, and recreation
- Phenology data + models = human adaptation to climate change

The USA-NPN is:

- A continental science and monitoring initiative
- Agencies, NGOs, academia, public
- Plants + animals; contemporary + legacy data
- On-line data entry, maps, downloads
- Integrates with other science networks
- Education: "more kids in the woods"
- Remote sensing facilitates scaling

## Volunteer & Education Networks: Citizen Science, Education, and Outreach



Project BudBurst is an on-line educational program targeting students and nature enthusiasts

- Began as a pilot program, April – June, 2007
- Students Observing Seasons, a suite of GK-12 education modules
- Phenology 101 and the Univ of Calif- Santa Barbara Phenology Stewardship Program - programs to facilitate integration of phenology studies into undergraduate curricula
- Masters of Monitoring, targeted to public and private institutions with docent programs
- Laboratory exercise for Teaching Issues and Experiments in Ecology (TIEE) focused on phenology of flowering in Colorado (in development)

Students, Check it Out!

[www.budburst.org](http://www.budburst.org)

## On-line Resources for Educators National Phenology Network Educators' Clearinghouse

[www.usanpn.org/?q=educator\\_clearinghouse](http://www.usanpn.org/?q=educator_clearinghouse)

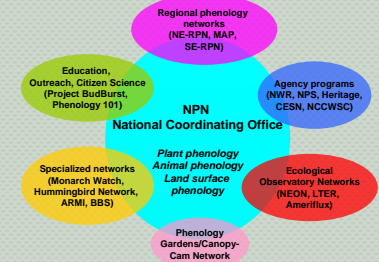


Photo credit: Ross Franklin

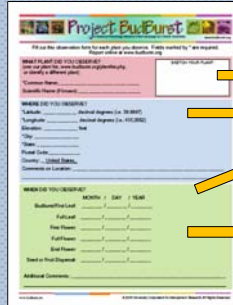
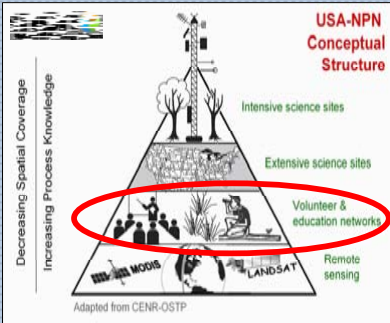
A large part of the USA-NPN network structure is based upon the involvement of educational institutions and volunteer organizations from across the U.S. that can motivate and organize people of all ages to actively observe and learn about the seasonal changes of the ecosystem around them. This Educators' Clearinghouse webpage has been created to gather educational materials (lesson plans, activity guides, syllabuses, project design plans, etc.) in order to provide a convenient and growing collection of resources on phenology learning both inside and outside of the traditional classroom setting.

If you have any materials that you would like to contribute to the NPN Educators' Clearinghouse please contact us (see *textbox* in lower right). We are continually adding more information to this webpage, so be sure to bookmark and visit often!

The USA-NPN is a collaborative partnership that includes federal agencies, the academic community, and the general public, all working together to monitor and understand the influence of seasonal cycles on the Nation's biological resources.



Sponsors provide support for USA-NPN activities either through direct funding or substantial in-kind support or cooperation. Collaborators work closely with USA-NPN on specific projects with defined activities and deliverables. Participants collect and/or contribute data or value-added products to USA-NPN.



## Students (of ALL ages!) record observations

What plant did you choose to observe?

Where in the U.S. are you located?

When did you observe your plant(s)?

What did you discover?!

- Buds opening
- Leaves unfolding
- First flower
- Peak floral display
- Last flower
- Seeds or fruits

## Why employ citizen scientists?

- Distributed data collection network across the entire U.S.
- Casual observers become dedicated observers
- Engagement in meaningful activities
- Education/awareness engenders science literacy
- Increases number of long-term phenology datasets and analyses through formal and informal science education programs
- Generation of political/policy support
- Historic/baseline data (pre-network)
- Potentially rich datasets collected by individuals
- Engenders self-directed, voluntary learning using inquiry-based approaches
- Provide training in the tools and applications of phenological studies to citizens
- Enhances opportunities for public to interact with professional scientists

## The USA-NPN database organizes four types of phenology observations:

- 1) Local intensive science sites focused on process studies at science networks such as NEON, LTER, and Ameriflux
- 2) Extensive sites focused on widespread standardized monitoring such as the National Park Service and the U.S. Fish and Wildlife Refuges
- 3) Volunteer and education networks such as the NPN-affiliated Project BudBurst and Lilac Program
- 4) Landscape monitoring with remote sensing that extend surface observations

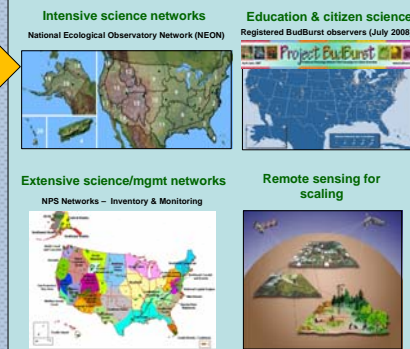


Photo credit: DeeDee Amber



## Coming soon to [www.usanpn.org](http://www.usanpn.org) - USA-NPN Wildlife Phenology Program

In addition to the established NPN Plant Phenology Program, we are developing a Wildlife Phenology Program that will record observations of animal taxa across the nation. This program will increase opportunities for students and citizen scientists to contribute to the growing body of knowledge on how mammals, insects, birds, fishes, amphibians and reptiles respond to climate signals.

## NATIONAL PHENOLOGY NETWORK (USA-NPN) NATIONAL COORDINATING OFFICE

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