USA npn National Phenology Network

Phenology: The Seasonal Pulse of the Biosphere

What is Phenology?

All around us, plants and animals live their lives in rhythm with the rise and fall of the seasons. Lilacs bud and finally bloom, filling the air with a fragrant perfume that many of us associate with spring's arrival. Butterflies emerge from their cocoons, and sandhill cranes spiral the thermals, responding to climatic signals that it is time to migrate again.

Phenology is the study of the seasonal timing of these cyclical life events, which also include bird, fish, and mammal migrations; insect emergence; plant leafing, blooming, fruiting, and changing of leaf colors in autumn; egg-laying; and emergence from hibernation. Phenological events are clearly vital for the functioning of natural ecological systems. In turn, they affect the goods and services provided by our natural world, such as the production of food and water, health, conservation, and recreational activities. Phenological events are sensitive to weather and climate, which makes them an important living barometer, or indicator, of their environment. Because these environments are changing through human activities including global climate change, we can track phenology of plants and animals to learn more about our natural world and how we can adapt to these changing environments.

What is USA-NPN?

The **USA National Phenology Network (USA-NPN)** is a new partnership among federal agencies, colleges and universities, other schools, land-management agencies, citizen volunteers, and others to monitor and understand the influence of seasonal cycles on the nation's biological resources. The USA-NPN will provide phenological information that can be used to understand the role of the timing of life-cycle events in the biosphere. By establishing a nationwide network of phenological observations, these observations can then be used for decision-making purposes that will help us adapt to changing environments.

Why is it Important to Have a National Phenology Network?

Numerous plant and animal species throughout the world are being affected by climate change. For example, many plants and animals respond to warmer winter and spring temperatures by shifting the timing of activities such as migrating, flowering or breeding. Such shifts in activity have already been noted across many parts of the world, including the timing of fish, mammal and bird migrations, insect emergence and flight, honey production, and flowering and leafing of many kinds of plants.

At the same time, many natural events such as insect breeding and some bird migrations are based on daylength rather than temperature. This can result in ecological mismatches; for example, flowers may bloom before their pollinators arrive, leaving both out of luck. In other cases, migratory birds may arrive on their summer breeding grounds after their primary food source has come and gone. Such mistimed behavior has already been noted across many parts of the world.

Just as national networks of weather stations and stream gauges are critical for providing national weather, climate, and water services, a coast-to-coast phenology science and monitoring network will be critical for understanding and predicting how plants and animals respond to global climate change, and will help us adapt to ongoing and future climate change. A national phenology network is also important for monitoring and predicting drought, risk of wildfire, biological invasions, and the spread of diseases.

Why Participate?

USA-NPN is enlisting professional and citizen scientists, students, stewards of public and private lands, amateur naturalists, gardeners, and other outdoor enthusiasts. By joining the USA-NPN, you can help compile information on phenological responses to weather and climate. You can make a difference by recording your observations, which will then be used to provide information for a wide range of decisions made routinely by individual citizens and by the nation as a whole.

How can I Participate?

Register now at **www.usanpn.org** and enter your observations for the USA-NPN Plant Phenology Programs online. In addition, we are searching for historical plant phenology datasets, so if you have a dataset you'd be willing to share, please let us know. We are in the process of developing a parallel nationwide Animal Phenology Program, so stay tuned...

For more information, visit the USA-NPN at www.usanpn.org, or contact Jake F. Weltzin, the USA-NPN Executive Director, at:

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Of Birds, Bees, and Plants: The USA-NPN at Work

In Tucson, Arizona, it is March, and already a few flowers are popping open on the creosotebush shrubs of this Sonoran desert town. Other creosotebushes are waiting for the opportune time to initiate budburst, and the dedicated students at Sunnyside High School are watching and waiting. Once a week they trek out to their field site in a creosotebush shrubland not far from their school. Armed with phenology monitoring sheets, they carefully inspect the plants to see if buds, flowers, or fruits are present.

The creosotebush *(Larrea tridentata)* is a good plant for them to study: it is the most widespread plant in the Mojave, Sonoran, and Chihuahuan deserts. When rains fall in the desert, the aroma of the resinous creosotebush leaves saturates the air with the smell of rain, a common scent to any desert-dweller. These highly drought-tolerant plants are important to desert ecosystems: they provide shelter and food for wildlife, stabilize soil in places where many other plants cannot grow, and produce abundant pollen for many insects. In fact, more than 120 different bee species depend on the repeat-blooming flowers of the plant for food, with 22 of these species relying solely on the creosotebush for their nectar. Still, scientists do not specifically know just what triggers the creosotebush to bloom when it blooms, and what might happen to the many pollinators that depend on the plant should its bloom time shift significantly because of climate change.

The students, working with their classroom teacher and University of Arizona (UA) graduate student researcher Lisa Benton, are ambitious – by contributing their observations to USA-NPN and to Project BudBurst **(www.budburst.org)**, a citizen science project managed by the University Corporation for Atmospheric Research, University of Montana, and the Chicago Botanic Garden, they hope to help uncover the mystery behind the repeat-bloom of the creosotebush. Benton and her academic advisor, UA Assistant Professor Dr. Shirley Kurc, hypothesize that temperature initiates the first bloom in the spring and that deep soil moisture, made possible by large monsoon rainstorms, controls repeat blooms in the summer. The core field site for this project, south of Tucson, makes use of advanced instrumentation, including atmospheric sensors, soil probes and automated repeat photography to investigate this question more fully.

These students, their teachers, and UA professors and graduate students are part of a growing cadre of volunteer and professional scientists who are helping researchers better understand the influence of seasonal cycles on the nation's essential biological resources.