USA National Phenology Network Supports Decision Making

The USA National Phenology Network is a federally-funded, national-scale science and monitoring initiative focused on phenology as a tool to understand how plants, animals, and landscapes respond to environmental variation and change.

By collecting, storing, and sharing plant and animal phenology data and derived data products, we support decision-making for a wide range of natural resource management and human health concerns at local to national scales. Through the plant and animal phenology program, Nature's Notebook, and via the USA-NPN website, the Network offers flexible mechanisms, tools and capacities for data collection, management, access, and visualization.

This information sheet describes how our partners have used tools and capacities provided by the USA-NPN to meet their decision-making needs.

Invasive Species Detection and Control
Invasive species cost the United States over $120 billion annually.[1] Resource managers can use phenological information to guide early detection and control activities.

Eradicating *Verbesina* from Midway Atoll National Wildlife Refuge
By tracking the phenology of invasive *Verbesina encelioides* using *Nature's Notebook*, staff at Midway Atoll National Wildlife Refuge have been able to determine when to schedule removal to efficiently eradicate remaining patches.[2]

Controlling buffelgrass in Saguaro National Park
Buffelgrass (*Pennisetum ciliare*) is a critical threat to the native vegetation communities of the Sonoran desert, at Saguaro National Park. Using phenology observations collected via *Nature's Notebook*, precipitation data, and satellite imagery, US Geological Survey scientists identified the sequence of rainfall events that trigger conditions that maximize effectiveness treatment for this species while minimizing impacts to native vegetation.[3]

Understanding mechanisms of invasion
Invasive shrubs are becoming increasingly common in eastern forests. By leafing out earlier in the spring, these plants shade the forest floor at times when native herbs, tree seedlings, insects, and reptiles require direct sunlight. Through the Shady Invaders project, Penn State University researchers and *Nature's Notebook* volunteers are evaluating the impact of invasive shrubs on deciduous forest ecosystems.[4]

Informing Hemlock Wooly Adelgid biocontrol in New York
Hemlock woolly adelgid (*Adelges tsugae*) is an insect pest that kills hemlock trees (*Tsuga* spp.) by preventing new twig and needle growth. Forest managers and tree care specialists need to know when to release insect predators of this pest. Through a collaboration with the New York Department of Environmental Conservation and Cornell University, volunteers in New York are collecting phenology observations of the adelgid using *Nature's Notebook* to determine when adelgids are most vulnerable to treatment.

Supporting Tribal Sovereignty
Indigenous self-determination includes the right to determine the framework for collaboration.[5] In working with Native American tribes and indigenous people, the USA-NPN has agreed to a framework of relationship and responsibility through the Indigenous Phenology Network. Our priorities are adopted from our collaborators: climate resilience for indigenous communities, intergenerational transfer of knowledge and appropriate use of the tools of Western science.

Great Lakes Indian Fish & Wildlife Commission uses USA-NPN protocols to look for possible changes in the phenology of plants in the Great Lakes Region which might necessitate changes in the timing of traditional harvests.

Wakarusa Wetlands Phenology Trail at Haskell Indian Nations University was established to enable students to combine learning from elders with data collected via *Nature's Notebook* to understand the life cycles of culturally-significant plants, including willow for building material and wild strawberry as a food resource.

Virtually InterConnected Tree Gardens are being developed by a coalition of tribes and tribal colleges with Native Hawaiian leadership to increase food security, build community and study the phenology of natural and cultivated systems.

Supporting Species Management
US land management agencies are tasked with conserving, protecting, and enhancing wildlife, plants, and habitats. Phenology data and information can support these efforts.

Tracking food resources for endangered migratory bats

The US Fish & Wildlife Service is seeking to better understand where and when nectar sources are available for recently de-listed lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae*) while they are in southern Arizona raising their young. Volunteer observers are tracking the timing of food availability over the course of the summer and fall seasons using *Nature's Notebook*.[6] Since this campaign launched in 2017, seven partner organizations have joined and observations have been collected at nearly 50 locations.

Evaluating changes within migratory bird flyways

At the request of the National Wildlife Refuge System Inventory & Monitoring Program, USGS and US Fish & Wildlife Service are examining shifts in seasonality across the entire Refuge System, and investigating a century of environmental change information along the four major North American Flyways. The start of spring is advancing at a greater pace in higher latitudes than in lower latitudes, which could impact migration and breeding success. This information will support management and conservation for these vulnerable species.[7]

Forecasts for Managers

Advance warning of key events or anomalous conditions, even of a few days, can dramatically enhance planning. The USA-NPN is delivering short-term forecasts for a variety of phenomena.

Understanding the impacts of an early spring

Spring arrived weeks early across the southeastern U.S. in 2017, and the progression of the start of the season was captured in the USA-NPN's Status of Spring maps. A wide range of stakeholders used the maps to anticipate the societal and economic impacts of this very early spring, including anticipating early appearance of turf grass pests, potential damage to fruit trees, an early start to the allergy season, and implications for livestock managers.[8] Early springs can also result in increased recreational uses of public lands earlier in the season, with associated pressures on natural resources, facilities, and infrastructure.[9]

Improving inland water quality by effectively timing street sweeping

Homeowners in St. Paul, Minnesota, are tracking the timing of leaf drop in their neighborhoods using *Nature's Notebook* and municipal public works departments are using this information to effectively schedule street-sweeping activities. Removing the leaves quickly keeps them out of storm drains and ultimately out of surface water bodies, leading to improved water quality.

Human Health and Safety

The timing of phenological transitions in plants and animals can have direct effects on human health and well-being. The USA-NPN aims to deliver relevant phenology information to enhance human health and safety.

Preventing auto accidents caused by insect swarms

Every year, millions of mayflies emerge from the Mississippi River in short-duration events. Mayfly swarms can cause driving hazards such as low visibility and slick road conditions. The US Fish and Wildlife Service is tracking the timing of mayfly emergence events along the Upper Mississippi River corridor using *Nature's Notebook* to advise managers when to take measures to ensure the public's safety such as turning off lights on bridges and encouraging drivers to stay off roads inundated with mayflies. Minimizing the accumulation of mayflies on bridges can save up to $4,000 in cleanup costs per bridge.[10]

Improving aeroallergen predictions

Many phenological events, including opening flowers and pollen release, can be predicted from prior and concurrent environmental conditions such as accumulated heat in the winter and spring seasons. The USA-NPN is developing seasonal predictions of pollen release for the most allergenic plants including maples, oaks, and birches.

Predicting the spread of ragweed, a particularly troublesome allergen

Using data contributed to *Nature's Notebook*, a research team projected the future spread of allergenic ragweed (*Ambrosia artemisiifolia*). This troublesome species is anticipated to spread hundreds of miles northward in coming decades.[11]

Join Us!

We are keen to partner with organizations to collect or use phenology data and information. Our staff will work closely with you to identify the best ways to leverage USA-NPN resources to accomplish your organization's goals.

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CONTACT:

Jake F. Weltzin, US Geological Survey
Program Manager, Status & Trends Program
Executive Director, USA National Phenology Network
1311 East 4th Street, Tucson, AZ 85721
(520) 626-3821
jweltzin@usgs.gov