



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. 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 US over \$120 billion annually.¹ Resource managers can use phenological information to guide early detection and control activities.

Eradicating *Verbesina* from Midway Atoll NWR

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 of this problematic plant on the Refuge.²

Controlling buffelgrass in Saguaro National Park

Buffelgrass (*Pennisetum ciliare*) is a critical threat to the native vegetation communities of the Sonoran desert, including Saguaro National Park. Using phenology observations collected via *Nature's Notebook*, precipitation data, and satellite imagery, USGS scientists identified the sequence of rainfall events that

trigger conditions that maximize 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 Woolly Adelgid biocontrol in New York

Hemlock woolly adelgid is an insect pest that kills hemlock trees by preventing new twig and needle growth. The New York Department of Environmental Conservation, in collaboration with Cornell University, is developing a biocontrol agent to fight this pest. Volunteers in New York are collecting phenology observations of the adelgid use *Nature's Notebook* to guide the release of these biocontrol agents at the time when adelgids are most vulnerable to the treatment.

Supporting Tribal Sovereignty

Indigenous self-determination includes the right to determine the framework under which we collaborate. We have agreed to a framework of relationship and responsibility through the Indigenous Phenology Network. Our priorities are those of 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 harvested the Anishinaabeg in the Great Lakes Region.

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.

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

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 endangered lesser long-nosed bats (*Leptonycteris 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*.⁵

Evaluating changes within migratory bird flyways

At the request of the National Wildlife Refuge System Inventory & Monitoring Program, USGS and USFWS are examining shifts in seasonality across the entire Refuge System and investigating a century's worth of environmental change along the four major North American Flyways. Preliminary results indicate that 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.⁶

Forecasts for Managers

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. Diverse 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.⁷

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

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 & 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.⁸

Improving aeroallergen predictions

Many phenological events, including opening flowers and pollen release, can be predicted from antecedent and concurrent environmental conditions such accumulated heat in the winter and spring seasons. The USA-NPN is developing seasonal predictions of pollen release in 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 United Kingdom-based 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.⁹

References

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