



USA **nprn** 
National Phenology Network

2023 ANNUAL REPORT



USA-NPN 2023 Annual Report | FROM THE DIRECTOR

Greetings! I am so pleased to share some highlights from the past year. First: we are hard at work seeking options to not only sustain the USA-NPN but expand it in the best ways. We are truly grateful to Representative Raúl Grijalva (AZ), who for the second time, led an effort to help us secure congressional support in the FY24 budget. We are also very thankful to the National Science Foundation for the opportunity to work with entrepreneurial and fundraising experts to identify opportunities and paths to program sustainability. This coming year is sure to be an adventure!

In other news: at long last, we released our new website! If you haven't yet seen all the new features — including an interactive map of Local Phenology Programs, Local Phenology Program profile pages, revamped educational resources, and lots more — don't walk, run to your browser and check it out.

In the past year, we also released new Pheno Forecast maps this year for red brome and emerald ash borer. As well, phenology data and information maintained by the Network featured in numerous news media and scientific publications, including the Fifth National Climate Assessment and the 2022 State of the Climate Report.

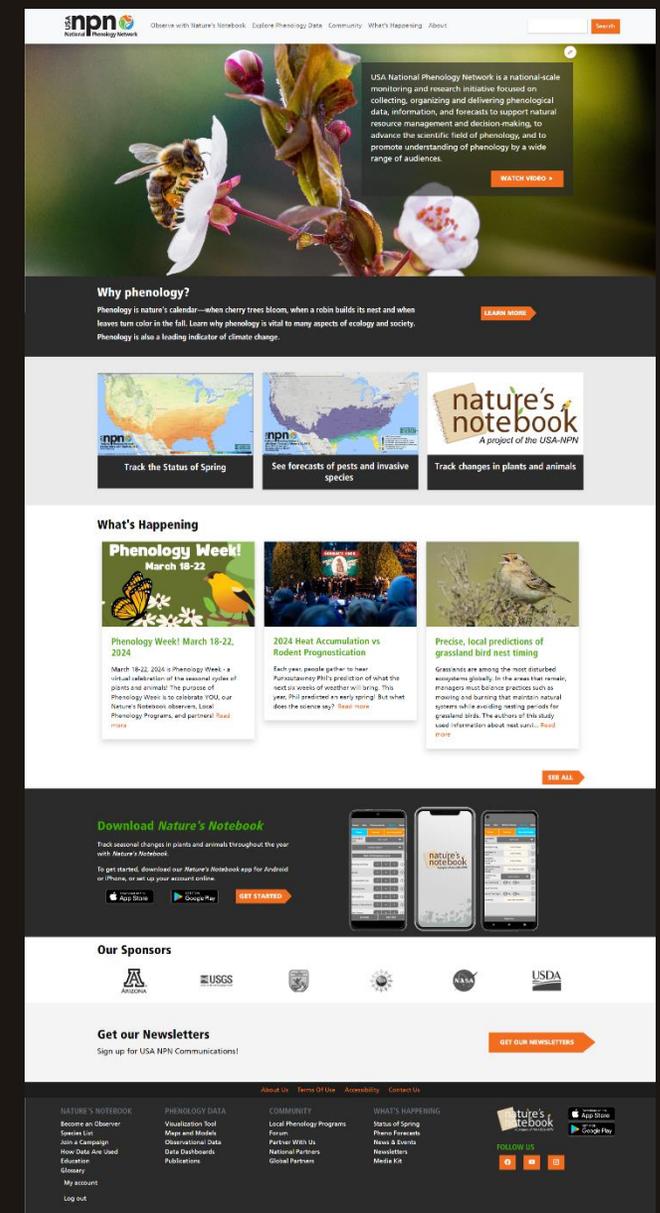
Finally, I'm so honored our team received the American Geophysical Union's Science and Society award in December. This award recognizes collaborative research, equitable distribution of research impacts, and the translation of scientific knowledge to serve society.

These achievements have been possible because of our many supporters, partners, participants, and collaborators. Thank you for your support today and every day.

Warmly,



Theresa Crimmins
Director, USA National Phenology Network



The screenshot shows the homepage of the USA National Phenology Network website. At the top, there is a navigation bar with the NPN logo and links for 'Home', 'About Us', 'Terms of Use', 'Accessibility', and 'Contact Us'. Below the navigation bar is a large hero section featuring a close-up image of a bee on a flower. To the right of the image is a text box describing the network's mission: 'USA National Phenology Network is a national-scale monitoring and research initiative focused on collecting, organizing and delivering phenological data, information, and forecasts to support natural resource management and decision-making, to advance the scientific field of phenology, and to promote understanding of phenology by a wide range of audiences.' Below this is a 'WATCH VIDEO' button. Underneath the hero section is a 'Why phenology?' section with a sub-header and a 'LEARN MORE' button. Below that are three interactive map tiles: 'Track the Status of Spring', 'See forecasts of pests and invasive species', and 'Track changes in plants and animals'. The 'nature's notebook' logo is also present. The 'What's Happening' section features three featured articles: 'Phenology Week! March 18-22, 2024', '2024 Heat Accumulation vs. Rodent Prognostication', and 'Precise, local predictions of grassland bird nest timing'. Below this is a 'Download Nature's Notebook' section with 'GET STARTED' buttons for Android and iPhone. The 'Our Sponsors' section lists logos for Arizona, USGS, NOAA, NASA, and USDA. The 'Get our Newsletters' section has a 'GET OUR NEWSLETTERS' button. At the bottom, there is a footer with various links and social media icons.

USA-NPN 2023 Annual Report | BY THE NUMBERS

3,459

Active
Nature's Notebook
Observers
27,146 since 2009



4.3 M

Phenology
Records
35 M since 2009

4

New data
products
created
101 total data
products served



14

Publications using
contemporary
data, models, data
products
141 since 2009

176

Active Local
Phenology Programs
601 since 2010



30

Local Phenology
Leaders Certified
218 since 2016

USA-NPN 2023 Annual Report | ADVANCING SCIENCE

The USA-NPN offers data, models, tools, and resources that lead to advances in understanding of patterns and drivers to plant and animal phenology.

Dioecy, defined as distinctly male or female individuals in a species, occurs in only about 5% of species. However, phenology matters a lot to these plants: male and female trees must flower at the same time to ensure the next generation of trees. Further, for species relying on the wind to transfer pollen from male to female flowers, flowering must take place before leaves grow large enough to interfere.

A research team led by Yingying Xie at Northern Kentucky University and Daniel Park at Purdue University used herbarium specimens and observations of leaf and flowering phenology contributed by *Nature's Notebook* participants to determine the impacts of increased spring temperatures on leaf and flower timing in several poplar species. They found evidence of growing asynchrony between flowering in male and female trees as well as between flowering and leaf-out. While a decrease in interference from leaves is good news for these trees, a lack of overlap between male and female flowering could be a problem for their persistence in the future.



“Variations in phenological responses within and among species allow us to assess and predict climate change impacts. Observations from *Nature's Notebook* have been invaluable data in our in-depth investigations. Continued efforts to collect phenology data and associated traits will further improve our understanding in the complex nature in the changing environment.”

— Dr. Yingying Xie, Northern Kentucky University, lead author

Xie et al. 2023, <https://www.pnas.org/doi/10.1073/pnas.2306723120>



USA-NPN 2023 Annual Report | INFORMING DECISIONS

The USA-NPN provides relevant, timely phenological information to support decision-making in a wide range of applications based on needs expressed by various user groups.

Accurately predicting when insect pests undergo seasonal transitions can dramatically improve control measures. In collaboration with Oregon State University, we released an enhanced set of Pheno Forecast maps in 2023 to support emerald ash borer (*Agrilus planipennis*) control efforts.

Shaped by input from end users, the new maps predict the timing of both adult EAB emergence and egg hatch over the entire year. According to users, the maps are especially useful for research studies, including planning the timing of field visits. In areas where EAB infestations can't be controlled, the focus is on harvesting wood from an infested area before tree mortality occurs and financial value of softwood trees quickly declines. In both cases, phenological forecasts can help ensure that EAB is detected or managed early. Additional improvements to forecasts include their incorporation of establishment risk, in which areas where EAB experiences excessive heat or cold stress for the current year are excluded from the map.



“Forecasts may help surveillance teams in newly invaded locations such as the Portland, Oregon, area understand when to expect adult emergence and when to release biocontrol agents that target the larval stage.”

— Brittany Barker, Project Collaborator at Oregon State University

Barker et al. 2023, <https://www.frontiersin.org/articles/10.3389/finsc.2023.1239173/full>
Photo Credit: Eric R. Day, Virginia Polytechnic Institute and State University, CC BY 3.0 US DEED



USA-NPN 2023 Annual Report | COMMUNICATING & CONNECTING

The USA-NPN supports a greater understanding and appreciation for phenology among all inhabitants of the country.

Since 2019, observers with the Washington Square Park Eco Projects, led by Georgia Silvera Seamans, PhD, have collected data on twelve species of trees in this New York city public park. Participants gain a better understanding of urban phenology and provide community science opportunities for park users and neighbors.

Silvera Seamans also involves students from NYU's Ecological Field Methods class taught by Professor Katie Schneider Paolantonio in the Project. Following a lecture about tree identification and a walking tour of the park, students select a tree to monitor weekly throughout the Fall using the *Nature's Notebook* App. Visiting their trees every week, the students become attached to their tree as they watch it change over the semester. Washington Square Eco Projects was awarded the USA-NPN's 2022 Pheno Champion for their exemplary engagement of students and community members in phenology.



"At Washington Square Park Eco Projects, our *Nature's Notebook* monitoring program is one way we engage local New York City residents in community science and environmental education."

— Dr. Georgia Silvera Seamans

Photo Credit: Katie Schneider Paolantonio



USA-NPN 2023 Annual Report | GROWING AN EQUITABLE & INCLUSIVE NETWORK

The USA-NPN listens to diverse stakeholders, leading to a stronger network and an improved understanding and application of phenological information. The benefits of USA-NPN programs, tools, products and partnerships accrue to people from all backgrounds reflected in the US population.

A changing, unpredictable climate makes determining what to plant or when species will bloom and go to seed difficult. The Time to Restore project, led by USA-NPN, Tribal Alliance for Pollinators, Bosque Ecosystem Monitoring Program, Gulf Coast Phenology Trail, and Great Lakes Indian Fish and Wildlife Commission, seeks to help those undertaking ecological restoration make informed planting decisions that take these future climate changes into account.

This project engages end-users in shaping development of products through a series of workshops and quarterly calls. In our tribal engagement we follow the Guidelines for Considering Traditional Knowledges in Climate Change Initiatives and recommendations in David-Chavez & Gavin (2018), which include respectful relationships, reciprocity, careful observation, and a focus on resilience and learning from plants.



“Climate change has made it more difficult to predict when plants will bloom and when to collect seeds. The Time to Restore project will give us a better sense of how this timing will shift under future climate conditions.”

—Jane Breckinridge, Tribal Alliance for Pollinators

This work is supported by The Department of the Interior South Central Climate Adaptation Science Center, which is managed by the U.S. Geological Survey National Climate Adaptation Science Center. David-Chavez & Gavin 2018, <https://iopscience.iop.org/article/10.1088/1748-9326/aaf300>

