USA National Phenology Network

2022 ANNUAL REPORT

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USA-NPN 2022 Annual Report | FROM THE DIRECTOR

Greetings! I take great pleasure in sharing updates and reflections on 2022 with you; this past year has been one of growth and positivity.

A major win for our team last year was the addition of Samantha Brewer, our volunteer engagement coordinator. If you are involved in *Nature's Notebook*, no doubt you have interacted with Samantha. She brings an abundance of energy, enthusiasm, and fresh ideas to the program, including raising our profile on Instagram! We were also very fortunate to have Nathan Acosta, our talented web developer, join us in 2021. Nathan has been instrumental in our massive website overhaul that will be going live in Spring 2023. Finally, we are truly grateful to have garnered congressional support in the FY23 budget led by Representative Raúl Grijalva. These funds, plus contributions from USFS, USFWS, NSF, USGS, and USDA will keep us on a growth trajectory in the coming year.

The launch of the *Nature's Notebook* Observer Certification Course was a significant milestone in 2022. This Course ensures that observations are of the highest possible quality and therefore appropriate for use in science and management. Anyone can take the course, and even if you've been an observer for many years, you may learn something new! This past year we also launched three new observation campaigns in collaboration with partners: The Redbud Phenology Project, Desert Refuge, and Quercus Quest. These efforts generate crucial data that help answer open questions.

I am filled with gratitude for all our supporters, partners, participants, and collaborators. It is because of the efforts of this entire community that the USA-NPN continues to flourish. Thank you for your support today and every day.

Warmly,

Theresa Crimmins
Director, USA National Phenology Network

USA-NPN 2022 Annual Report | BY THE NUMBERS

3,736
Active *Nature's Notebook* Observers
25,275 all time

3.9 M
Phenology Records
32 M all time

6
Data products updated to the new climate normal
97 total data products served

16
Publications using contemporary data, models, data products
127 all time

201
Active Local Phenology Programs
457 all time

20
Local Phenology Leaders Certified
188 all time

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USA-NPN 2022 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.

Daylength is a key factor in regulating when plants initiate growth in the spring and terminate activity in the fall. What if the natural daylength is disturbed by artificial light from cities? Using data on dozens of species and hundreds of sites in the *Nature's Notebook* dataset, Lin Meng and colleagues found that the presence of artificial light advances breaking leaf buds by nine days on average and delays leaf color change by six.

This research demonstrates that climate change isn't the only factor influencing plant phenology. Author Lin Meng won the 2021 Science & SciLifeLab Prize for Young Scientists for her work on phenology (read her prize-winning essay in *Science*).

"Phenological change is less explored in cities because we don't have enough observations. The USA-NPN's *Nature's Notebook* data allowed me to examine how urban environments affect phenology by providing valuable urban phenology data. That's how trees talk to us."

— Lin Meng, Vanderbilt University, lead author

Meng et al. 2022, https://doi.org/10.1093/pnasnexus/pgac046

USA-NPN 2022 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.

Despite tens of millions of people in the U.S. suffering from seasonal allergies, monitoring of airborne pollen concentrations in this country is limited. Observations of flowering status of oak trees contributed to *Nature's Notebook* have the potential to help address this gap.

A recent investigation revealed a strong relationship between the peak in airborne pollen documented at monitoring stations and the timing of peak flowering in the surrounding region. These results indicate that flowering observations contributed to *Nature's Notebook* can play an important role in forecasts of pollen concentrations. Ongoing work is focused on refining these relationships for additional species.

"We found that flowering observations predict airborne pollen concentrations, opening possibilities for more sophisticated and comprehensive estimates of airborne pollen concentrations. These pollen predictions would have meaningful public health benefits and showcase yet another use for citizen science observations. We couldn't have made these models without the dedicated observers that contribute flowering observations to *Nature's Notebook*."

— Dan Katz, Cornell University, lead author

Katz et al. 2022, doi.org/10.1007/s10453-022-09774-3

Photo Credit: Andrew Hipp (left) Famartin, CC BY SA 4.0 (right)

USA-NPN 2022 Annual Report | COMMUNICATING & CONNECTING

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

Observers at the Arnold Arboretum have been tracking tree phenology since 2016. Despite the relocation of the group's founding researcher to another institution several years ago, the volunteers have soldiered on, continuing data collection as the "Tree Spotters."

Dozens of Tree Spotters trained early in the program have continued observing the phenology of trees, reading and discussing relevant books and articles, inviting scientists to share about their research, and engaging volunteers and visitors in activities like Tree Mob, where they gather around a tree they track to learn about its natural history and economic value. The Tree Spotters were awarded the USA-NPN's 2021 PhenoChampion as exemplary program that shows a dedicated group of volunteers can overcome challenges, maintain a critical long-term dataset, and create excitement in learning about phenology.

"I've started to really 'see' trees since I started tree spotting with *Nature's Notebook*. It's because of the education I've received as a participant in this program that I understand trees better."
— Geri Lambert, Tree Spotter

Photo Credit: Suzanne Mrozak

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USA-NPN 2022 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.

Indigenous people are original phenologists on this continent, and many Indigenous communities sustain rich, interconnected and practical knowledge of seasonal cycles. Relationships built over the last 10 years through the Indigenous Phenology Network have led to increasingly rich collaborations. In this work, the USA-NPN pays careful attention to data sovereignty, with thoughtful approaches to data sharing.

In a recent paper, USA-NPN and the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) staff shared highlights and lessons learned from this work, including GLIFWC's approach to data sovereignty and the best option to manage their sensitive phenology data.

"USA-NPN has begun the work of collaborating with native people and organizations in a good way. Our interactions with the staff at the USA-NPN have been valuable and enlightening. They have been respectful of our needs regarding Indigenous data sovereignty and have spent time listening and brainstorming with us on how best to support and include native nations in their work while ensuring that Tribal data is protected and Tribal needs are met." —Hannah Panci, GLIFWC

Crimmins et al. 2022, https://doi.org/10.1093/biosci/biac061