



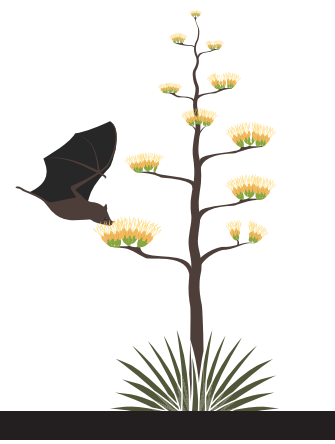
The USA National Phenology Network serves science and society by promoting a broad understanding of plant and animal phenology and its relationship with environmental change.

2017

Annual Report

Taking the Pulse of Our Planet





LETTER FROM THE EXECUTIVE DIRECTOR



Phenology... is perhaps the simplest process in which to track changes in the ecology of species in response to climate change.

Rozenzweig et al.,
Intergovernmental Panel on Climate Change, 2007



Greetings! I am so pleased to share with you some of the key accomplishments of the USA-NPN in 2017. We continued to grow, we enhanced our data products and tools to support decision making and scientific discovery, and we expanded opportunities for *Nature's Notebook* participants and partners.

Spring of 2017 was an incredibly exciting time for us. Our Spring Index maps were referenced widely as spring appeared weeks early in much of the U.S., appearing in hundreds of local to national media outlets including NPR's *All Things Considered*, The Weather Channel, The Today Show, the *Washington Post* and *The New York Times*. Stakeholders used the maps to anticipate how this very early spring could affect insect pests in turf grass, frost damage to fruit trees, the intensity of the allergy season, livestock management, and the presence—or absence—of azalea flowers at the Masters Golf Tournament!

The value of our Spring Index maps was recognized as a 2017 Outstanding Achievement by the Renewable Natural Resources Foundation, which awards "interdisciplinary achievements with an emphasis on the application of sound scientific practices in managing and conserving renewable natural resources."

We also expanded the capacity we can offer to partnering organizations. In 2017, we launched two new campaigns focused on species of concern. Our "Flowers for Bats" campaign supports a US Fish & Wildlife Service monitoring program for the lesser long-nosed bat and their nectar resources in Arizona. Another, campaign, "Nectar Connectors," engages observers across the nation to better understand the availability of resources for monarch butterflies and other pollinators.

It's hard for me to believe that 2018 will mark the 10th anniversary of the USA-NPN and *Nature's Notebook*! We are grateful to be part of such a diverse community, and are enthusiastic to serve your phenological needs for another 10 years and beyond!

Sincerely,

Jake F. Weltzin
Executive Director

41

Certified Local
Phenology Leaders

192

Local Phenology Programs
submitting data in 2017

132

Local Phenology Programs
that have submitted data
in three or more years

18%

Increase in records
submitted over 2016

2.9 M

Phenology records submitted

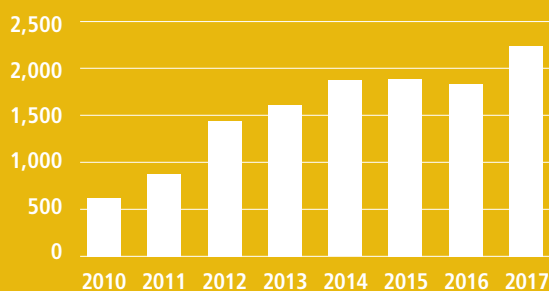
16%

Increase in participants
over 2016

NATURE'S NOTEBOOK'S 2017 ACHIEVEMENTS

22%

Increase in sites submitting
data over 2016



Active Sites

11

Publications using
contemporary data,
models & data
products in 2017

47

Publications using
contemporary data,
models & data products
(all-time)

25

Data products
released in 2017

ADVANCE SCIENCE

Parasitic plants derive nutrients from other living plants, typically to the detriment of these hosts. Though these plants are widespread and diverse, their ecology is generally poorly understood.

The USA-NPN aims to improve understanding of plant and animal phenology as a key response to environmental variation and change.

Researchers from the University of Arizona evaluated the timing of flowering and fruiting in desert mistletoe (*Phoradendron californicum*) across five host plant species: desert ironwood, blue palo verde, foothills palo verde, catclaw acacia, and velvet mesquite to better understand the reproductive biology of this common desert parasite. By combining their observations of mistletoe phenology with observations of leaf, flowering, and fruit phenology of host plants collected by *Nature's Notebook* participants, the researchers revealed unique patterns in the timing and sequence of flowering in mistletoes and their host plants. Specifically, peak flowering for mistletoe plants found on mesquite plants occurred weeks later than mistletoes on all other host plants. However, mesquite was among the earliest host plants to flower.

This work enhances our basic understanding of parasitic plants by highlighting the diversity of strategies these plants utilize to maintain reproductive success. It also depicts the type of discoveries that are possible because of the data being collected, maintained, and delivered by the USA-NPN.

Yule, K.M. and J.L. Bronstein. 2017. Reproductive ecology of a parasitic plant differs by host species: vector interactions and the maintenance of host races. *Oecologia*. DOI: 10.1007/s00442-017-4038-6.

Left photograph of mesquite tree with desert mistletoe by **Kelsey Yule**

Background photograph of desert mistletoe by **Sundry Photography**



INFORM DECISIONS

Golden crownbeard (*Verbesina encelioides*) is a troublesome, invasive plant at Midway Atoll National Wildlife Refuge. This fast-growing plant forms dense stands that disrupt and degrade surface-nesting seabird habitat, and has been linked to decreased reproductive success and survival in albatross.

The USA-NPN provides phenological information to inform risk management, the conservation and management of natural resources, and human health, recreation and land use decisions in variable and changing climates.



Refuge staff at Midway Atoll have undertaken aggressive control efforts in recent years, reducing the cover of the plant by 99%. However, control efforts must be continued to minimize the spread of the remaining plants. Using *Nature's Notebook*, refuge staff are tracking crownbeard phenology to time herbicide treatment. By targeting the window between leaf out and seed development, the efficacy of treatment can be maximized.

This effort is an outstanding example of management decisions that can be enhanced by the capacity and information offered by the USA-NPN.

Learn more: fws.usanpn.org/midway-atoll-nwr

Nature's Notebook has been a turning point in our management of the invasive Verbesina. The tool helped us to get ahead of the game by understanding this species' phenology throughout the year and integrating it into the timing of control treatments.

Wieteke Holthuijzen, Kupu Americorps Intern 2016–17

Top photograph of golden crownbeard by **RukiMedia**

Middle photograph of golden crownbeard at Midway Atoll by **Dan Clark**

Bottom photograph of Wieteke Holthuijzen by **Ann Humphrey**



COMMUNICATE AND CONNECT

The USA-NPN Local Phenology Leader Certification Course is a 10-week course that supports project leads in establishing phenology monitoring at their site, creating education, science, and management materials, and connecting with other



Local Phenology Leaders. Since its inception in 2017, 71 individuals have completed the Course, gaining the skills need to develop a program plan, recruit volunteers, collect high-quality observations, analyze observation data, and collaborate with community partners.

The McDowell Sonoran Conservancy Phenology Program in Phoenix, Arizona is tracking phenology of desert plants including jojoba, saguaro cactus, and soap tree yucca to better understand the impacts of climate change and urban stressors on these important species. The data collected at this site contribute to an improved understanding of how the life cycles of plants in this area are changing.

Our organization is thrilled to participate in this phenology program. The data we are collecting will not only help understand trends and management implications at McDowell Sonoran Preserve but will also inform resource management across the Sonoran Desert. Many thanks to USA-NPN for its incredible support!

Tiffany Sprague

the Conservancy's Field Institute Manager and recent graduate of USA-NPN's Local Phenology Program Certification Course

Established in 2017 by a dedicated team of citizen scientists, this program has experienced rapid growth. Over 30 volunteers have been trained, and on average, more than two-thirds of these participants collect observations every month. Due to the public enthusiasm for this effort, group coordinators plan to add pollinator monitoring and to extend the opportunities to include younger visitors to the preserve in the near future.

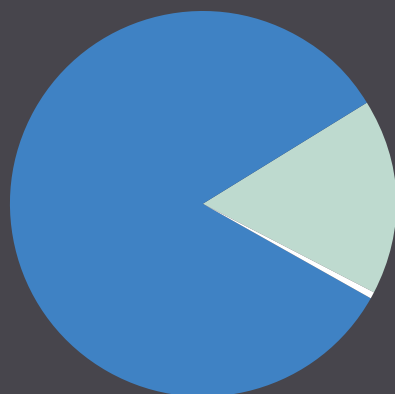


Photographs by **Debbie Langenfeld**

RESOURCES FOR FY 2017

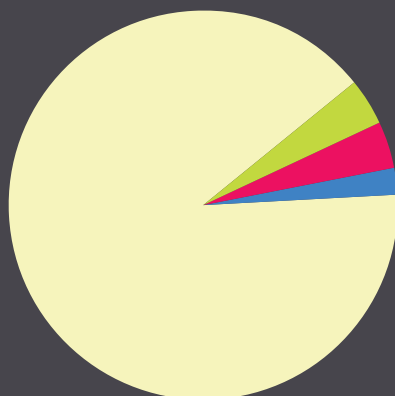
Base funding for operations is provided primarily by US Geological Survey. The USA National Phenology Network gratefully acknowledges the additional sponsoring organizations: University of Arizona, US National Park Service, National Aeronautics and Space Administration, National Science Foundation, and US Fish and Wildlife Service.

Our financial reporting follows the Federal fiscal year. The Network's constituent entities may have different fiscal years and reporting formats; each organization—and agreements between organizations for the Network's activities—provide for fiscal responsibility and accountability.



SOURCES

■	USGS Ecosystems Mission Area	\$763,688
■	US Fish and Wildlife Service	\$151,853
■	National Science Foundation	\$3,160
	TOTAL SOURCES	\$918,701



EXPENSES

■	USGS	\$36,582
■	University of Colorado	\$36,649
■	USGS Ecosystems Mission Area	\$19,351
■	University of Arizona	\$826,119
	TOTAL EXPENSES	\$918,701

THANK YOU

Partnerships are the heart of the USA-NPN, and participants are critical to *Nature's Notebook*. Together, we work to collect, store, and share phenology data and information. We are truly grateful for the support we receive, in its many forms, from our partners, participants, sponsors, and friends.

Our success is your success—thank you.

Our Sponsors



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Cover Photographs

Ian Grainger—Stamen of an azalea bloom

Joseph Sohm—Cows

Argo Fruti—Frost damaged apples

CALL TO ACTION

How do you know when spring has begun? Is it the appearance of the first tiny leaves on the trees, or the first crocus plants peeping through the snow? The Spring Indices are synthetic measures of these early season events in plants, based on recent temperature conditions. These models allow us to track the progression of spring onset across the country.

The Spring Index maps offered by USA-NPN shed light on when you can expect spring at your location and how this year's spring compares to normal. Check out our maps at www.usanpn.org/news/spring!

JOIN A CAMPAIGN

Nature's Notebook campaigns are a great way to learn about the phenology of species of special interest, and to see how the timing of their phenology changes over time. By collecting data for these campaigns, you also contribute to important scientific research.



Earn this badge by participating in the Flowers for Bats campaign! Sign up for a 2018 campaign at www.naturesnotebook.org!

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