



2010 Annual Report

July 2011

usannpn.org

USA-NPN Programmatic Series 2011-003

Suggested citation: USA-NPN National Coordinating Office. 2011. USA National Phenology Network 2010 Annual Report. USA-NPN Programmatic Series 2011-003. www.usanpn.org.

Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Although this report is in the public domain, permission must be secured from the individual copyright owners to reproduce any copyrighted material contained within this report.

TABLE OF CONTENTS

LETTER FROM THE EXECUTIVE DIRECTOR	3
THE USA NATIONAL PHENOLOGY NETWORK	4
INFORMATION MANAGEMENT SYSTEM	5
2010 ACCOMPLISHMENTS	5
NATIONAL PHENOLOGY MONITORING SYSTEM	8
2010 NATURE’S NOTEBOOK ACTIVITY	8
2010 NPMS ACCOMPLISHMENTS	10
PARTNERSHIPS AND COLLABORATIONS	11
2010 ACCOMPLISHMENTS	11
OUTREACH, EDUCATION AND TRAINING	16
2010 ACCOMPLISHMENTS	16
RESEARCH	21
2010 ACCOMPLISHMENTS	21
DECISION SUPPORT	22
2010 ACCOMPLISHMENTS	22
2010 ACCOMPLISHMENTS	23
ACKNOWLEDGMENTS & CONTRIBUTORS	24

LETTER FROM THE EXECUTIVE DIRECTOR

Greetings! I am excited to share with you the 2010 accomplishments of the USA National Phenology Network. The Network continues to grow in many ways, including the amount of data we are making available, partner organizations we are engaging, and staff members employed.

One of our key accomplishments this past year was the creation of a separate identity for the USA National Phenology Network plant and animal phenology observing program. After much internal debate, we christened the program *Nature's Notebook* and developed a corresponding logo. This unique identity acknowledges the phenology observing program as a project of the Network.



In March, we also unveiled phenology monitoring protocols for nearly sixty animal species, making *Nature's Notebook* the first program to accommodate both plant and animal phenology. We also invested effort into overhauling our website, reorganizing content and re-theming the site to make it both more user-friendly and more attractive. Another major milestone we reached this year was making *Nature's Notebook* data available online. Users may now download contemporary *Nature's Notebook* data from the Network website (www.usanpn.org/results/data).

This year marked the second year that our phenology observing program, now known as *Nature's Notebook*, was functional. We saw continued growth in the number of participants, registered sites, and data submitted. In fact, we saw a nearly 60% increase in the total number of observation instances reported via *Nature's Notebook* from 2009 to 2010.

In an effort to continue to build on our partnerships, we hosted a stakeholders workshop and invited participants from across the country to express their needs to us. The outcomes from that workshop are shaping our future efforts. We also forged new partnerships with non-profit organizations, government agencies, and even a for-profit entity whose members will send phenology observations directly into the National Phenology Database maintained by the Network from their website using our newly created web service (API).

In an effort to better train, support, and retain participants in *Nature's Notebook* and members of our partnering organizations, we developed a suite of training and outreach materials this past year, including training presentations, videos, fliers, and an in-depth handbook.

I invite you to read more about our activities, products, and outcomes for 2010 in the following pages. I welcome your feedback, and look forward to sharing further advancements in 2011!

Sincerely,

Jake F. Weltzin
USA-NPN Executive Director

THE USA NATIONAL PHENOLOGY NETWORK

Phenology refers to recurring plant and animal life cycle stages, such as leafing and flowering, the maturation of agricultural plants, the emergence of insects, and the migration of birds. It is also the study of these recurring plant and animal life cycle stages, especially their timing and relationships with weather and climate.

The USA National Phenology Network (USA-NPN) is a consortium of individuals and organizations that collect, share, and use phenology data, models, and related information. The Network serves science and society by promoting a broad understanding of plant and animal phenology and its relationship with environmental change. Operationally, the Network encourages people of all ages and backgrounds to observe and record the activity of organisms through space and time as a means to discover and explore the nature and pace of our dynamic world. In turn, the Network makes phenology data, models, and related information freely available to empower scientists, resource managers, and the public in decision-making and adapting to variable and changing climates and environments.

The research and monitoring priorities of the Network appear in the box to the right.

The Network consists of a National Coordinating Office (NCO), a Board of Directors, and many partners, including citizen scientists, resource managers, educators, scientists, and policy-makers. Partners represent a range of organizations, including public agencies, tribes, non-governmental organizations, specialized networks, industry, and academic institutions.

The National Coordinating Office is a coordination and resource center working to advance the mission of the Network. National Coordinating Office staff maintain a National Phenology Information Management System, promote the use of standardized approaches to monitoring phenologies, encourage the widespread collection of phenology data, and facilitate communication within and beyond the Network. Coordinating office staff also facilitate basic and applied research related to phenology, and the development and dissemination of decision-support tools, educational materials, and activities.

To maximize the long-term (i.e., 30+-year) potential of the Network to serve scientists, resource managers, policy-makers and the public, the coordinating office staff developed a strategic plan to guide

Research Priorities

- Determine spatial and temporal trends in phenology across the nation
- Use phenology as an indicator of climate change impacts on plants and animals
- Determine the relationship between phenology and population-, community-, and ecosystem-level processes, goods and services
- Optimize and standardize methodologies and data for projects at local to international scales
- Integrate with existing research, decision-support, and education/outreach programs

its operations and programmatic development between 2011 and 2015 (www.usanpn.org/results/reports).

This annual report is organized to describe progress in 2010 toward the seven key operational functions of the National Coordinating Office outlined in the strategic plan: the National Phenology Information Management System (IMS), the National Phenology Monitoring System (NPMS), Partnerships, Outreach and Education, Research, Decision-Support, and Operations and Governance. Over the course of the next 5 years, activities of the NCO will focus on programmatic development of the Information Management System, the National Phenology Monitoring System and the building of partnerships, and will facilitate outreach and education activities, research, and development of decision-support tools through collaborative partnerships. The *USA National Phenology Network 2009 Annual Report* is available at www.usanpn.org/results/reports.

INFORMATION MANAGEMENT SYSTEM

Data management and information sharing are central to the Network mission. The National Coordinating Office develops, implements, and maintains a comprehensive information management system to serve the data and information sharing needs of the Network, including the collection, storage, versioning and dissemination of phenology data, access to phenology-related information, tools for data interpretation, and general online communication among partners of the Network.

The USA-NPN's Information Management System includes components for data storage, such as the National Phenology Database, and a variety of online user interfaces to accommodate data entry, data download, data visualization and catalog searches for phenology-related information. The Information Management System is governed by a set of standards to ensure security, privacy, data access, and data quality.

2010 ACCOMPLISHMENTS

Created identity for *Nature's Notebook*

The Network recognized the need for a separate identity for the USA-NPN's plant and animal phenology observing program. A naming contest was held, and the name *Nature's Notebook* was selected. A logo was developed and incorporated throughout the website and in training and outreach materials.



Website redesign

The Network website was overhauled, with improved navigation and a new theme. Seven new content types were developed (workshops, podcasts/presentations, recent media, links, partners, partner services tool, phenology festivals, and other phenology monitoring programs), allowing easier access to information. Dynamic map tools were enabled to display phenology festivals and sites in *Nature's Notebook*.

Website visitation statistics (January 1, 2010–December 31, 2010). Source: Google Analytics.

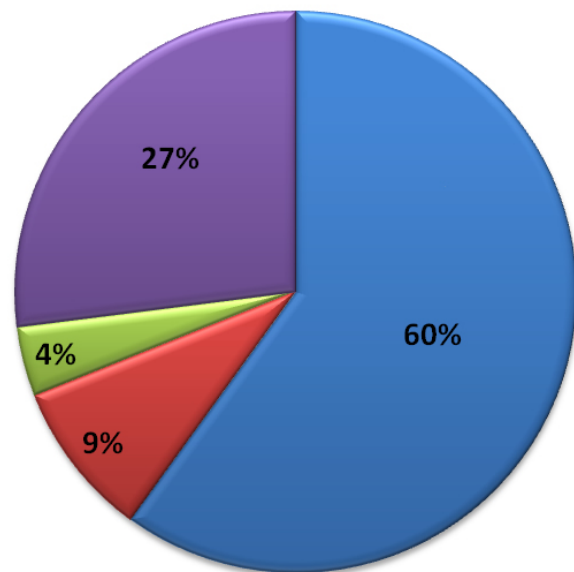


Over the course of 2010, the site experienced 68,366 total visits and 281,988 pageviews, a 15% increase in visits over 2009. Website visitation shows a distinct cyclical pattern, with low numbers occurring on Saturdays and Sundays. A seasonal pattern is also apparent, with greater numbers of visits occurring in the spring and fall months.

In 2010, 42,356 unique individuals visited www.usanpn.org, an 11% increase over 2009. Many of the visitors returned to the site, and nearly 5,000 visitors returned to the site 200 or more times. This likely reflects very dedicated registered observers entering data on their organisms. Aside from the www.usanpn.org homepage, the most commonly visited page was the species search page, followed closely by the *Nature's Notebook* "How to Observe" page. Visits averaged over four minutes and over 8,000 visits were over ten minutes, suggesting that visitors were familiarizing themselves with *Nature's Notebook* and/or using the website as a resource to learn about phenology in general.

Visits to www.usanpn.org
(Jan 1 - Dec 31, 2010)

■ 1 visit ■ 2 visits ■ 3 visits ■ 4+ visits



Review of Information Management System

A two-day workshop was held in July, 2010 to review and evaluate the USA-NPN Information Management System. Participants represented Cornell Lab of Ornithology, NEON, National Snow and Ice Data Center, Oak Ridge National Laboratory, LTER Network Office and USGS. A meeting report is being drafted (www.usanpn.org/results/reports).

Data Set Registry tool created

The Data Set Registry tool (www.usanpn.org/participate/dataset) allows individuals or institutions maintaining historic or contemporary phenology data sets to register these data sets. Registering a data set also creates a metadata record for the data set. The Registry tool also has an accompanying data set search page. The tool is a mechanism for individuals seeking data to connect with data holders. In 2010, 23 data sets were registered with the tool.

Historic lilac data integrated into USA-NPN database

Over 40,000 data records from the historic lilac observation network were integrated into the Network database.

Answered requests for data output

NCO staff provided ten customized data output files in response to individual requests.

Live USA-NPN data made available online

Users may now download contemporary *Nature's Notebook* data from the Network website (www.usanpn.org/results/data). FGDC metadata are available for these data in HTML or XML formats.

Historic and current protocols enabled in *Nature's Notebook*

The online *Nature's Notebook* interface was enhanced to accommodate changes made to observation protocols in 2009 (v0.1), 2010 (v0.2), and 2011 (v1.0). Observers logged into *Nature's Notebook* are now automatically provided with the protocol relevant to the date for which they are entering observations.

Web Service (API)

We are developing a web service that will allow participants in partner programs to contribute data to *Nature's Notebook* without leaving the partner website. A partner develops a user interface on the partner website which uses the Network web service to direct the data to the National Phenology Database. The web service offers the following functions: register a user, register a site, search our list of plant and animal species, register individual plants, access plant and animal phenology observing protocols, enter phenology observations. In addition, the service provides phenology observation data output for use in visualizations, analyses, or data integration projects.

Development of data visualizations initiated

Through a Request for Bid (RFB) process, Penn State University's Center for Environmental Informatics was secured as the contractor to develop the first set of data visualizations for *Nature's Notebook*. Contractors visited the National Coordinating Office in fall, 2010. Work was initiated; visualization tools will function on the Network website in early 2011.

Upcoming changes to protocols to accommodate intensity & abundance were scoped

In 2011, protocols will be enhanced with the opportunity for observers to report on the intensity of plant phenophases (e.g., canopy development, flower and fruit development and production) and animal protocols will be expanded to allow observers to report on the abundance of individuals. The changes to the IMS infrastructure to accommodate these enhancements were scoped and put into place on the DEV server. These changes will go live in spring, 2011.

Code maintenance upgrades, bug fixes, improved data management

NCO staff made upgrades to server software and created numerous views in the database.

Facebook page created

In fall, 2010, a Facebook page was created for the Network. The page is periodically updated with local observations of phenology, links to recent news and peer-reviewed scientific articles, and updates from the NCO.

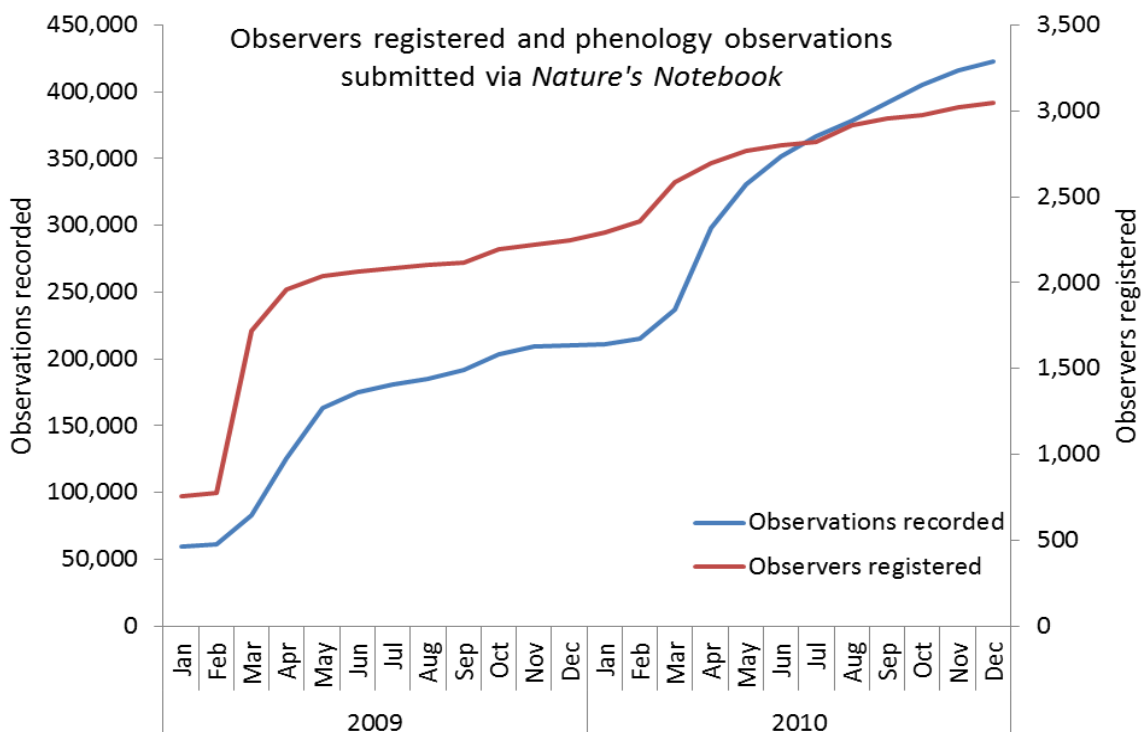
NATIONAL PHENOLOGY MONITORING SYSTEM

An essential activity of the Network is the collection of contemporary and historic phenology data. The NCO provides and promotes a vetted, well-documented, flexible phenology monitoring system, the National Phenology Monitoring System. Implementation of this system in monitoring programs across the nation will facilitate the widespread collection of integrated, high-quality ground observations of plants, animals, and (eventually) related biophysical factors. Data collected using this system (or “integrated” into this system after collection) will provide a valuable resource for research, decision support, and educational purposes.

2010 NATURE’S NOTEBOOK ACTIVITY

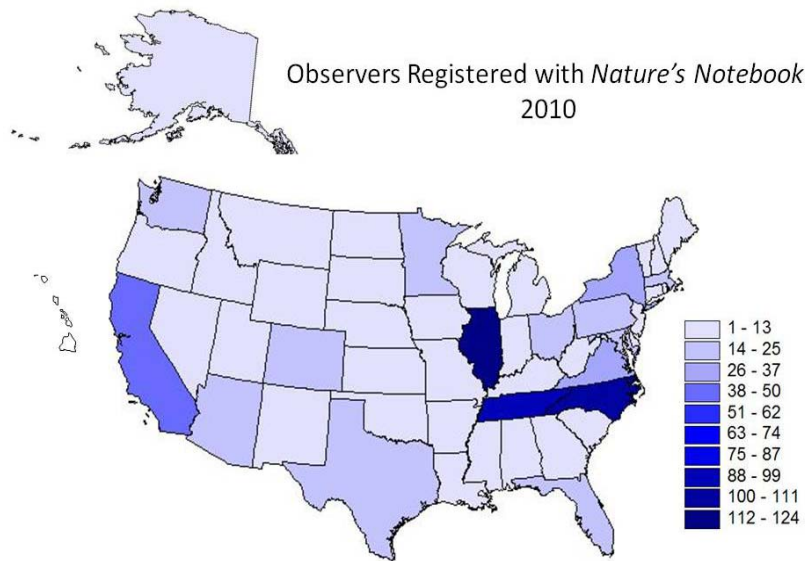
In spring 2010, the Network online user interface, named *Nature’s Notebook*, was expanded to facilitate standardized monitoring of animal phenology. Through *Nature’s Notebook*, observers can now 1) register as an observer with the Network; 2) register one or more sites where they are observing plant and/or animal phenology; 3) register one or more individual plants under observation; 4) create a checklist of animals they are observing; and 5) enter phenology observations.

In 2010, 796 observers registered as observers *Nature’s Notebook*, bringing the cumulative total number of individuals registered to nearly 3,000. Observers submitted over 400,000 data records, bringing the total number of phenology records in the National Phenology Database to nearly half a million records.



The map below shows the number of observers registering in 2010 by state. While all states except Hawaii have registered participants, the states showing the greatest numbers of new participants are

Illinois, North Carolina, and Tennessee. Activity by registered observers in 2010 is summarized in the forthcoming *2010 Data Summary* (www.usanpn.org/results/reports).

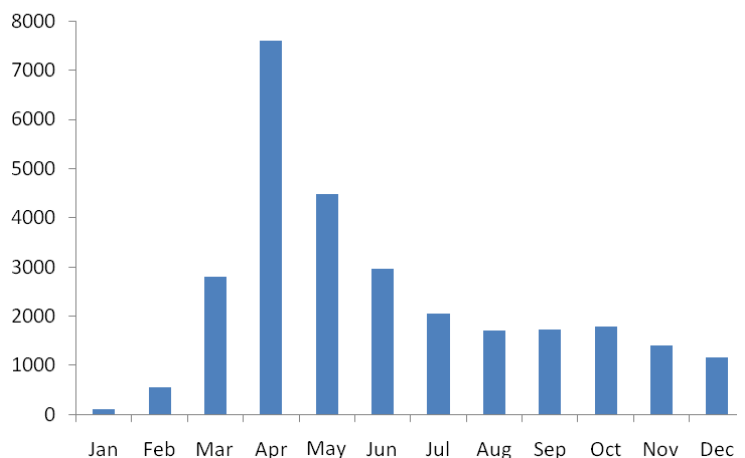


Last year (2009), a key area of development of the National Phenology Monitoring System was the decision to promote phenophase “status” monitoring instead of the traditional phenological “event” monitoring. This approach has a number of advantages over event monitoring (e.g., calculation of error, estimation of effort, “negative” or “absence” data, capture of multiple events and duration, flexibility of definitions for phenological metrics, adaptability for animal monitoring).

This year we made the decision to add estimates of abundance or intensity to phenophase status and we started working on the protocols and approach to do this. Therefore, in 2011, observers will be able to report not only whether they see a phenophase occurring, but also to what degree the phenophase is expressed (e.g. how many flowers are open or how many frogs are calling). This reflects a major conceptual leap for phenology participatory monitoring programs that greatly improves the utility of phenological data for science and management.

Because NCO staff were still working to refine protocols and to add animal monitoring to *Nature's Notebook*, 2010 was still considered a pilot year for the program, and we did not market to large numbers of participants. Despite this fact, new and existing registered observers submitted 28,355 observation instances (an observation instance is a report of a suite of phenophases

Observation instances submitted



for an individual plant or an animal on a given day) using *Nature's Notebook*. Observations were reported for 179 species of plants and 58 species of animals. Observers reported phenology observations for an average of nearly ten days of the year. The graph above shows phenology observations submitted to *Nature's Notebook* by month in 2010.

2010 NPMS ACCOMPLISHMENTS

Expanded phenology monitoring program

In March, NCO staff unveiled phenology monitoring for 58 animal species, allowing multi-taxa monitoring through the single, consistent *Nature's Notebook* interface. Monitoring methods and supporting "How to Observe" instructions (www.usanpn.org/participate/observe) and FAQs were revised to accommodate animal monitoring methods. NCO staff also received profile and protocol information for an additional 100 animal species from NatureServe; these animals will be added to the Network database and made available for monitoring in early 2011. In addition, 38 plant species profiles were completed for the 2010 monitoring season. There are now a total of 252 species available for monitoring on the recommended plant list (www.usanpn.org/species_search).

Added species to accommodate special projects

NCO staff continue to add plant and animal species to the recommended species list (www.usanpn.org/species_search) based on requests from observers and partnering organizations and recommendations from NatureServe. In 2010, species were added to accommodate the Juniper Pollen Project, the Florida Phenology Network, and the Fireweed Network in Alaska. NCO staff also developed and prioritized a list of all plant and animal species that have been requested or recommended to-date.

Intensity/abundance estimates planned for addition to protocols in 2011

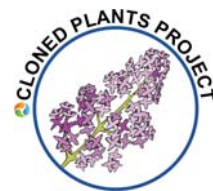
In 2011, protocols will be enhanced to allow observers to report on the intensity of plant phenophases and the abundance of individual animals. Intensity and abundance categories are under active development.

Refined plant species protocols

National Coordinating Office staff continued to refine plant phenology monitoring protocols to improve accuracy and usability. Improvements made in 2010 included species-specific phenophase definitions for ripe fruits, the addition of some phenophases and the clarification of definitions for others. These improvements will not be implemented in the *Nature's Notebook* interface until early 2011, since phenophase updates can not be made mid-season without causing confusion for our observers. After 2011, NCO staff expects to have very few changes to the plant protocols and phenophase definitions for plant groups already represented on the monitoring list.

Cloned Plants Program

Since 1961, the USA-NPN Cloned Plants Program (and its predecessors) have distributed cloned lilacs to interested observers to increase monitoring of a sterile lilac clone across the nation. Genetically identical cloned plants are being studied to remove the influence of genetic variation when comparing phenological responses in



plants across individuals and locations. The Network continues to distribute cloned lilacs through a collaborative agreement with Jung Seed Company (www.jungseed.com). Jung sells cloned lilacs to the general public for observation at an attractive price (\$20 for two lilac plants, plus \$5 for shipping).

PARTNERSHIPS AND COLLABORATIONS

The Network consists of individual and organizational partnerships within and between communities of researchers, land managers, policy-makers, citizen scientists, educators and others to achieve common phenology-related goals on a national scale. **Members** of the USA National Phenology Network include **Collaborating Individuals** and **Partners**. **Collaborating Individuals** are persons who are participating directly in Nature’s Notebook and other Network programs. We recognize the following types of **Partners**:



- **Geographic Affiliates** - geographically-organized groups ranging in scope from a town or university to several states, and organized for the purpose of monitoring plant and/or animal phenology, and that have established a relationship with the Network.
- **Collaborating Organizations** – Organizations that exist independently and have established a relationship with the Network to accomplish a wide variety of goals, including but not limited to engaging members in phenology monitoring, using the Network as an archive for phenology data, and pursuing joint funding proposals.
- **Collaborating Projects** – USA-NPN Collaborating Projects are variable and can address topics ranging from specific data collection efforts to the development of visualization tools. These efforts are typically short duration (lasting a few years), have specific goals, and are grant-funded.

Through our partnerships we seek to encourage and maintain the participatory spirit of the Network and the involvement of diverse user groups. The NCO coordinates the efforts of Network partners to productively and efficiently advance the vision and goals of the Network; effective partnerships are critical to the success of the network. The NCO aims to strike a balance between actively seeking key partners that help us most efficiently fulfill our Mission and Vision statements and working with partners that come to the Network seeking to work together.

2010 ACCOMPLISHMENTS

Hosted Stakeholders Workshop

National Coordinating Office staff hosted a workshop for approximately 50 Network stakeholders in Milwaukee, Wisconsin, September 22-24. Participants represented partnering agencies, citizen science programs, and researchers. Feedback received during the meeting is shaping Network priorities for 2011 and beyond. A draft meeting report is available online (www.usapnnpn.org/results/reports).

Partnership framework

The National Coordinating Office continued to use several mechanisms to improve partnership opportunities and communications:

- **Partner services tool**
A dynamic tool was implemented on the Network webpage to communicate the various services and benefits that the Network can offer to potential partner audiences. The tool is online at www.usanpn.org/participate/new-partners and is constantly being updated.
- **Partner prioritization**
A decision matrix was developed to support prioritization of Network partners for 2010. This matrix was updated and used to identify priority partners to pursue for 2011.
- **2010 Partner summary reports**
Summary reports are being prepared for key Network partners (e.g., Great Sunflower Project, Arbor Day Foundation) to synthesize efforts and outcomes from the 2010 monitoring season. These reports will be used to guide 2011 efforts with these partners.
- **Learn about other monitoring programs**
A dynamic tool was created to allow visitors to the Network website to learn about plant and animal phenology monitoring programs offered through other organizations (www.usanpn.org/participate/other-programs). Over 30 such programs are featured in this tool, and more are being added as they are discovered.

Key partnerships that were established or expanded in 2010 are described in the following section.

The Arbor Day Foundation

The Arbor Day Foundation (ADF) has become a key Network partner. A pilot plant monitoring program called *Nature Log* and implementing USA-NPN protocols was advertised to 10,000 ADF members in spring 2010. ADF collected the hard-copy *Nature Log* datasheets and is currently entering data into a database for delivery to the NCO and long-term archive in the Network database. This program is planned for advertisement to all 1,000,000 ADF members in 2011.

YourGardenShow.com

YourGardenShow.com is an online resource for gardeners and offers visitors the opportunity to create online “glogs” (garden logs) to track their gardening activities. YourGardenShow.com (YGS) is highlighting the USA-NPN and *Nature’s Notebook* in the “Citizen Science” section of their site. Visitors to YourGardenShow.com will be invited to collect phenology observations of plants in their gardens and yards following USA-NPN protocols. National Coordinating Office staff members have developed a web service to be implemented by YourGardenShow.com that will allow visitors to the YGS site to submit phenology observations to the National Phenology Database directly from the YGS website. Because YGS is the first for-profit partner of the Network this relationship prompted the establishment of a Data Use Policy (<http://www.usanpn.org/terms>).

National Park Service

- **California Phenology Project**

The Pacific West Region of the National Park Service is in the initial stages of a 2.5-year project to develop integrated phenological monitoring across parks in California using funding received from the NPS Climate Change Response Program in 2010. The California Phenology Project (CPP) aims to incorporate public education and outreach along with sound scientific practices and outcomes to inform natural resource management for 18 NPS units in California. A scientific framework is being developed to articulate research and management questions of interest and to guide species selection. Project work initially will focus on plants in six pilot parks, encompassing desert, coastal and mountain areas, and builds upon existing monitoring protocols and programs of project collaborators. On-the-ground field testing of science and outreach protocols is planned for 2011 and 2012. Anticipated project outcomes include development of an easy-to-use phenology toolbox of science and outreach protocols, tools and products to guide other parks in the development of citizen-science based phenology projects. In 2010, NCO staff worked with the CPP team to establish a scientific framework for the project and to develop materials describing the effort. Relevant workshop reports and supporting materials are posted on the CPP page, www.usanpn.org/cpp.

- **Northeast Pilot**

A pilot project focused on plant and animal phenology and involving the Northeast Temperate I&M Network, Schoodic Research and Education Center, Appalachian National Scenic Trail, Appalachian Mountain Club, Appalachian Trail Conservancy, several national parks in the region, The Wildlife Society, and the USA-NPN continues to move forward. Several of these organizations are at various stages of developing and implementing programs to monitor the phenology of plants and animals. The goal of the pilot is to bring these organizations together and to create consistent monitoring protocols and to meet the various organizations' needs. This effort will also provide a template for similar coordinated monitoring efforts in other regions. Expected products include a draft 'field methods' SOP and perhaps other draft SOPs following Oakley *et al.* (2003) guidelines. Relevant materials and information are maintained on the project webpage, www.usanpn.org/netnproject.

Great Sunflower Project

The USA-NPN and the Great Sunflower Project partnered in 2010. Participants in GSP, who track bee visitation to sunflowers, are also invited to track the phenology of their sunflowers. A flyer explaining how to observe sunflower phenology following the USA-NPN protocol was included in the GSP sunflower seed mailing.

North American Pollinator Protection Campaign

In 2010, the USA-NPN became a partner of the North American Pollinator Protection Campaign (NAPPC). *Nature's Notebook* was highlighted on the Pollinator Partnership's website for National Pollinator Week (June 21-27).

Hummingbird Monitoring Network

The USA-NPN and the Hummingbird Monitoring Network (HMN) are working together to establish monitoring of hummingbird nectar plant phenology across the continent. A NCO staff member sits on the HMN/Western Hummingbird Partnership Education & Outreach committee and the Network has partnered with HMN and other partners on NSF funding proposals.

Federation of Earth Science Information Partners (ESIP)

The USA-NPN has become a Type II (Research) partner in the Federation of Earth Science Information Partners (ESIP) Federation. The Network is represented on the ESIP page at esip.esipfed.org/node/330. National Coordinating Office staff attended the summer ESIP Federation.

National Ecological Observatory Network

NCO continued to work closely with National Ecological Observatory Network (NEON) staff to ensure that phenology monitoring at NEON sites is concordant with USA-NPN protocols. NCO staff will develop protocols for any species NEON wishes to monitor.

The Wildlife Society

The Network continues to work closely with The Wildlife Society. With support from the USGS, the US Fish and Wildlife Service, and in-kind contributions, The Wildlife Society provided a full-time Science Coordinator for the NCO and additional funding for travel and other programmatic support.

Boys & Girls Clubs

A NCO student intern explored the potential for incorporating phenology monitoring using *Nature's Notebook* into lesson plans for the Boys & Girls Clubs of Tucson. The NCO intern will lead phenology lessons for B&G Clubs in Tucson in spring of 2011. This effort will serve as a model for how *Nature's Notebook* might be incorporated into B&G Club curriculum across the country.

Other potential partners

The Network continued to forge partnerships with external organizations and made preliminary or continued contact with the Association for Fish and Wildlife Agencies, Alaska Sea Life Center, Ferrum College, Yosemite National Park, San Diego Natural History Museum, Master Gardeners in Maine, Master Naturalists in Texas, the National Park Service Great Lakes Inventory & Monitoring Network, the Lewis & Clark National Historic Trail, River Partners, the Community Collaborative Rain, Hail and Snow (CoCoRaHS) Network, Ohio State Phenology Garden, the Wisconsin Purple Loosestrife program, Hawk-Owl Systems, Firefly Watch, the Galapagos Conservancy, the Arizona 4-H program, the Lacombe Heritage Center in Lacombe, Louisiana, and the Pima County, Arizona resource managers group.

Geographic affiliates

The National Coordinating Office is working to support the establishment and development of regionally- and locally-based phenology networks. These networks, formerly referred to as "regional phenology networks," are independent from the National Coordinating Office, though often work

toward similar goals. National Coordinating Office staff are working to ensure consistency in observation protocols used and to provide support, including use of the National Phenology Database as a long-term data repository.

In 2010, the NCO supported the establishment and development of several new geographic affiliates:

- **Alaska Fireweed Network**

The NCO participated remotely in organizing workshops for the Alaska Regional Phenology Network, subsequently renamed the Alaska Fireweed Network. National Coordinating Staff helped the network to define and implement a pilot monitoring program including six plant species and 11 animal species. NCO staff also created a "landing page" for the network (www.usanpn.org/ak-rpn).

- **Old Dominion Phenology Network**

The Old Dominion Phenology Network, based at Old Dominion University in Virginia, engages students in tracking the phenology of several plants in the region following USA-NPN protocols.

- **PennPhen**

Based at Penn State University, PennPhen aims to provide a central repository for phenology data for the central Pennsylvania region. PennPhen has adopted USA-NPN protocols.

- **University of California-Santa Barbara Phenology Stewardship Program**

Led by Dr. Susan Mazer and Brian Haggerty at UCSB, the Phenology Stewardship Program at the University of California, Santa Barbara is a growing network of professional & citizen scientists, outdoor enthusiasts, and educators & students who are dedicated to observing seasonal biological events. In 2010, the decision was made to incorporate *Nature's Notebook* protocols into the UCSB Phenology Stewardship Program *Phenology Handbook* (www.ucsbphenology.christophercosner.com/The_Phenology_Handbook-Haggerty_Mazer_2008_v1.pdf), used by dozens of educators across the country.

Additionally, the NCO continued to support established USA-NPN geographic affiliates:

- **Northeast Regional Phenology Network**

The Northeast Regional Phenology Network (NE-RPN) is a cooperative network designed to coordinate phenological monitoring, facilitate data sharing and synthesize phenology data from the northeastern US and eastern Canada. The NE-RPN hosted a two-day citizen science workshop, "Integrating Citizen Science into the Scientific Monitoring of Phenology," in November, 2010 in Durham, New Hampshire. The workshop was co-sponsored by the National Park Service and focused on lessons learned from the pilot implementation of phenology monitoring in national parks in 2009 and 2010 and how similar programs might be implemented in other public settings.

- **Florida Phenology Network**

The NCO hosted George Kish, leader of the Florida Phenology Network, for a week to explore better integration of *Nature's Notebook* into efforts in Florida. The NCO provides ongoing support to efforts in Florida (e.g. online and print materials for education and outreach).

International Collaborations

NCO staff participated in the international "Phenology 2010" conference held in Dublin, Ireland. As a followup to the conference, NCO staff encouraged the establishment of a forum for continued discussion among the leaders of other national phenology networks to share experiences, strategies and technologies for phenological monitoring. A private "Phenology Network" group was created on LinkedIn for this purpose, and discussions have included strategizing for a global phenology visualization tool.

North American Bird Phenology Program

NCO staff hosted Jessica Zelt, coordinator of the Bird Phenology Program, at the National Coordinating Office for a week to orient her to on-site staff activities. The NABPP website underwent redesign and enhancements to the online data transcription process. Visibility of the USA-NPN was increased by adding logos, links, and information to the website. In addition, content and resources for users and online transcribers were increased. Constant Contact was implemented to manage newsletters. A new USGS fact sheet, brochures, and a poster describing the program were produced.

OUTREACH, EDUCATION AND TRAINING

The National Coordinating Office staff facilitate the development of outreach and education materials to communicate with diverse audiences in support of the Network's phenology monitoring efforts and to support scientific discovery and inquiry. Education is defined as the intentional facilitation of learning, generally through institutions. It encompasses formal, informal, and non-formal education. National Coordinating Office staff also participate directly in outreach activities, defined as the dissemination of ideas and concepts that engage the parties in a two-way conversation.

2010 ACCOMPLISHMENTS

Developed *Nature's Notebook* training materials

A series of training materials were created to assist observers in familiarizing themselves with *Nature's Notebook*:

- **Narrated training videos and presentations**

A series of eight training videos in Shockwave Flash format were created and posted online (www.usanpn.org/training_videos) to help *Nature's Notebook* participants familiarize themselves with how to set up their site and begin observing. The presentations used to create the eight training videos were also made available as Powerpoint presentations with embedded

scripts (www.usanpn.org/training_videos), intended for use by group leaders wanting to give training presentations on *Nature's Notebook* to their members.

- **Quick-start guide**

A one-page guide providing an overview of the steps involved in observing phenology via *Nature's Notebook*.

- **“How to Observe” Handbook**

A detailed, user-friendly, step-by-step document for use by participants in *Nature's Notebook*. Participants can download a PDF of the document and print it out for their personal use.

Promotion of *Nature's Notebook*

Nature's Notebook was advertised through several media outlets and online mechanisms in 2010:

- Posted *Nature's Notebook* on Citizen Science Central (www.birds.cornell.edu/citscitoolkit)
- Posted *Nature's Notebook* on ScienceForCitizens.net
- Article on *Nature's Notebook* appeared in *LTER Network News* (news.lternet.edu/Article2263.html)
- Article on *Nature's Notebook* in the *Wildlife Professional* (www.usanpn.org/files/shared/files/TWP_USA-NPN_Article.pdf)

Promotion of USA-NPN

The USA National Phenology Network was advertised through several mechanisms in 2010:

- **USA-NPN promotional video** – Working with NCO staff and USA-NPN board members, a University of Arizona student film crew produced a 13-minute video introducing the USA National Phenology Network and incorporating video clips of Joseph Caprio, Julio Betancourt, Mark Schwartz, Jake Weltzin and others (www.usanpn.org/about).
- **Media center** - A resource page was created for members of the media, providing logos, communications standards, outreach materials, and contact information for the Network, NCO, and *Nature's Notebook*.
- **USA-NPN YouTube Channel** – A USA-NPN YouTube channel was created. Content includes *Nature's Notebook* training videos, the USA-NPN promotional video, and clips from NCO staff members' presentations.
- NCO staff registered the USA-NPN with the Climate Adaptation Knowledge Exchange (www.cakex.org)
- A USA-NPN Facebook page was created
- The NCO regularly twitters under the username "USA_NPN"

USA-NPN Reports and Other Products

USGS Fact Sheets

- “The USA National Phenology Network – Taking the Pulse of Our Planet” USGS Fact Sheet has received FSP review; EPN formatting and USGS Fact Sheet number are still pending

- “Hydrology, Phenology and the USA National Phenology Network” Fact Sheet was completed (Fact Sheet 2010-3083) and was highlighted on USGS home page

NCO Reports

The NCO developed a Programmatic Report Series, intended as an outlet for synthetic work and targeted toward the general public, potential funders, and *Nature’s Notebook* participants. The NCO also developed a Technical Report Series, intended as an outlet to document methods and results and targeted toward data users, researchers, and individuals interested in a high level of detail. Uniform formatting guidelines and authorship and attribution policies were developed and documented for both report series. Several reports were produced within these series in 2010:

- *2009 Annual Report*. USA-NPN Programmatic Series 2010-001. This report underwent review in the Fundamental Science Practices and is published online at www.usanpn.org/files/shared/files/USA-NPN%202009%20Annual%20Report%20FINAL%209-13-10.pdf.
- *USA-NPN Strategic Plan, 2011-2015*. USA-NPN Technical Series 2010-002. This report will undergo review through the Fundamental Sciences Practices in 2011. A draft is published online at www.usanpn.org/files/shared/files/USA-NPN_Strategic_Plan_2011-2015_8-27-10.pdf.
- *The National Phenology Monitoring System, v0.1*. USA-NPN Technical Series 2010-001. This report, documenting the content of the *Nature’s Notebook* online program in 2009, underwent review in the Fundamental Science Practices and is published online at www.usanpn.org/files/shared/files/Thomas_NPMSv0.1-FINAL.pdf.
- *2009 Data Summary*. USA-NPN Technical Series 2010-002. This report will undergo review through the Fundamental Sciences Practices in 2011. A draft is published online at www.usanpn.org/files/shared/files/2009%20Data%20Report%209-17-10.pdf.
- *2009 Observer Survey Report*. USA-NPN Technical Series 2010-003. This report will undergo review through the Fundamental Sciences Practices in 2011. A draft is published online at www.usanpn.org/files/shared/files/USA-NPN%202009%20Observer%20Survey%20Report%20DRAFT%209-13-10.pdf.
- *The National Phenology Monitoring System, v.1.0 (working title)*. NCO staff also began work on a document describing the USA-NPN’s standard methods for monitoring plant and animal phenology following Oakley *et al.* (2003) guidelines. The document is designed to be used by researchers and wildlife managers who wish to monitor phenology on their own (rather than through the *Nature’s Notebook* online program) according to methods that are scientifically sound and that allow their observations to be integrated with other phenology monitoring results from across the country. The Network will continue to refine the document and have it reviewed externally over the coming months.

USA-NPN Briefs/Information Sheets

The NCO is currently develop several briefs and information sheets to better communicate various aspects of the Network and the value of phenology data.

- A two-page information sheet highlighting the use of phenology as an indicator of climate impacts on ecosystems and people

- A brief on the development of the wildlife phenology portion of the Network (currently in draft form)
- Information sheets describing how phenological responses to climate change are important to people and ecosystems and comparing the scientific value of various methods of observing phenology (currently in draft form)

2011 outreach campaign planning

To increase participation in *Nature's Notebook* following major changes to the user interface and monitoring protocols and the development of visualization tools scheduled for spring 2011, NCO staff developed a plan for a 2011 outreach campaign, identifying recruitment, retention, and participation goals. Lists of targeted populations, partner groups, advertisement outlets, and organizations were developed and text describing the program was developed.

***Nature's Notebook* retention efforts**

In an effort to retain registered participants in *Nature's Notebook*, NCO staff undertook several activities:

- The top 100 *Nature's Notebook* observers of 2010 were notified of their status and mailed 2011 *The Wildlife Society* wall calendars
- Observer newsletters were electronically mailed quarterly to thousands of registered *Nature's Notebook* observers. Newsletters are archived on the Network webpage (www.usanpn.org/newsletters)
- Partner newsletters were electronically mailed periodically to representatives of Network partnering organizations. Partner newsletters included planned changes to the IMS and monitoring system components, announcements about funding opportunities, and employment opportunities.
- Partnering groups expressing interest were sent packets containing *Nature's Notebook* information sheets, flyers, tip sheets, and bookmarks (hundreds were mailed)

USA-NPN and *Nature's Notebook* promotional materials developed

To both recruit and retain program supporters and *Nature's Notebook* participants, lapel pins, tote bags, pens, mugs, USB drives, and stickers featuring the USA-NPN and *Nature's Notebook* logos were designed and are distributed at conferences, meetings, and trainings.

Formal presentations

National Coordinating Staff made over 50 formal presentations at scientific meetings, conferences, and public venues across the U.S. and internationally.

Professional meeting organization

The National Coordinating Office coordinated or led phenology-specific workshops at several professional meetings in 2010:

- **Phenology 2010 (Dublin, Ireland)**
NCO staff coordinated a one-day Land Surface phenology validation meeting linked to the broader phenology-related conference in June, 2010.

- **US International Association of Landscape Ecology**
NCO staff led a breakout discussion on coordination of US land surface phenology products
- **Phenology Research and Observations of Southwest Ecosystems (PROSE) Symposium**
The Network co-sponsored the fourth annual PROSE conference held in Tucson in October. NCO staff were part of the planning committee.
- **Ecological Society of America**
NCO staff hosted a workshop on participating in *Nature's Notebook*, organized an evening poster session on phenology, a citizen science symposium, a phenology brown bag lunch, and presented and participated in several phenology sessions over the course of the conference.
- **The Wildlife Society Annual Meeting Workshop**
NCO staff led a half-day workshop and also gave a formal presentation on participating in *Nature's Notebook* at the TWS Annual Meeting in Snowbird, Utah.
- **Rocky Mountain Science and Sustainability Network's Summer Academy**
NCO staff established a partnership with the RMSSN and led a workshop on *Nature's Notebook* for 26 college students from groups of people traditionally underrepresented in science. Participants subsequently implemented *Nature's Notebook* as a part of their summer internships at parks, refuges, and other programs across the country.

NSF education proposal

- NCO staff and collaborating organizations submitted a proposal to the NSF Climate Change Education Partnership program, proposing to use phenology as a theme to communicate climate change science to a wide variety of audiences. The Wildlife Society is the lead organization, and other partners include the Cornell Lab of Ornithology, Institute for Learning Innovation, U.S. Fish and Wildlife Service, and National Park Service.

Observer survey

An informal observer survey was developed and implemented at the conclusion of the 2010 monitoring season. The results of the survey are currently being compiled. Findings will help guide improvements to the *Nature's Notebook* user interface, training and outreach materials, and user support into the future.

Media

- The USA National Phenology Network was mentioned in 15 articles and media outlets (Google News search for 1/1/2010 to 12/31/2010)
- A subset of recent media reports can be found at www.usanpn.org/archive/recent-media

RESEARCH

An important aspect of the National Coordinating Office is the facilitation of basic and applied research on all aspects of phenology and on the relationship of phenology to rapidly changing environmental conditions and climate. In addition, the IMS and NPDb, which serve as a centralized hub for phenology-related data and information, are key services provided by the National Coordinating Office to scientists, resource managers and policy-makers. National Coordinating Office staff also facilitate communication among researchers, works to identify key gaps in our understanding of the role of phenology in natural and managed ecosystems, and supports coordination of research to fill those gaps.

2010 ACCOMPLISHMENTS

NCEAS Workshops

- NCO staff assisted co-Principal Investigators B.I. Cook & E.M. Wolkovich in preparing the proposal “Forecasting phenology: Integrating ecology, climatology, and phylogeny to understand plant responses to climate change” submitted to the National Center for Ecological Analysis and Synthesis (NCEAS). The project aims to explore the methods for forecasting phenology and the consequences of phenological changes. The proposal was successful, and NCO staff members Abraham Miller-Rushing and Theresa Crimmins are participating in the working group.
- “Plant phenological sensitivities to climate: A cross-site, cross-species approach.” B.I. Cook, E.M. Wolkovich, J. Davies, October 18-22, 2010, Tucson, AZ.

Land Surface Phenology

The NCO continued collaboration with NASA Goddard Space Flight Center colleagues on an algorithm paper for a land surface phenology product. Two reviews have been returned and we are working on addressing their comments and concerns.

University of Arizona Phenoclimatologist position

Several NCO staff members participated in candidate interviews for the new Phenoclimatologist position at the University of Arizona, established via a cooperative agreement between USGS and the University of Arizona.

Philosophical Transactions themed issue

A special phenology issue of the *Transactions of the Royal Society (B)* was released on Sept 6th (rstb.royalsocietypublishing.org/content/365/1555.toc). An NCO staff member led the compilation of the special issue and authored or co-authored several papers therein.

DECISION SUPPORT

National Coordinating Office staff facilitate efforts within the Network to develop phenology-related decision-support tools (such as models, visualizations, data summaries, and syntheses) and provide a clearinghouse for these tools. These efforts serve to inform decisions made by resource managers, health officials, community and national planners, and other decision-makers.

2010 ACCOMPLISHMENTS

Juniper Pollen Project

The USA-NPN is a co-investigator on a NASA-funded project entitled, “Integration of Airborne Aerosol Prediction Systems and Vegetation Phenology to Track Pollen for Asthma Alerts in Public Health Decision Support Systems.” Through this effort, the Network is collaborating with scientists at a number of institutions to model pollen release and concentrations in near real-time and inform public health decisions and alerts. The role of the Network is to engage observers in submitting observations of juniper pollen development and release.

In 2010, NCO staff created a logo for the Juniper Pollen Project (JPP) and posted it to the JPP page (www.usanpn.org/juniper_pollen_project). NCO staff also developed engagement and training materials specific to the JPP including a flyer, a one-page “quick-start” guide, and a scripted training presentation. The JPP was also added to the “Featured Projects” box on the Network homepage.

OPERATIONS AND GOVERNANCE

The USA-NPN consists of a National Coordinating Office, a Board of Directors, and many sponsoring and collaborating partners. The National Coordinating Office staff develop, maintain, and promote the use of standard monitoring methods and an information management system, and will be guided by the vision, mission, goals, and objectives of the five-year strategic plan. The Board provides leadership and guidance regarding the activities of the Network, and the National Coordinating Office in particular, by holding regular board meetings, convening topic-related committees and working groups, and communicating with the National Coordinating Office and its partners. The continuing operations of the National Coordinating Office depend on financial and in-kind support from sponsoring partners.

An Executive Committee serves as the primary governing body of the Network. This committee consists of the 12-member Board and the National Coordinating Office Executive Director and Assistant Director. The Executive Director is appointed by the appropriate official of an external supporting agency or organization after consultation with the Board, and will be advised by the Board. The Assistant Director is appointed by the Executive Director after consultation with the Board. The USA-NPN Constitution and By-Laws describe the rules of governance for the Network, and are available on the website (www.usanpn.org/about). The Executive Director and Assistant Director are primarily responsible for directing the operational activities of the Network through the National Coordinating Office.

2010 ACCOMPLISHMENTS

Project and contact management

The NCO implemented contact management software (HighRise) and project management software (BaseCamp).

Policy development

Several NCO policies were developed and implemented in 2010:

- NCO Publishing and Authorship policies
- Good Samaritan Content Policy
- USA-NPN Data Use Policy
- USA-NPN Data Attribution Policy
- *Nature's Notebook* Use Policy
- For-Profit Company Policy

Proposal development

National Coordinating Office staff led or participated in the development of over five funding proposals in 2010, including calls from the National Science Foundation, NASA, and other agencies. National Coordinating Staff also furnished letters of support for several grant proposals in 2010.

Board of Directors

Brian Wee of the National Ecological Observatory Network, Inc. (NEON) was elected to the Network Board of Directors to replace Sandra Henderson, whose term expired in 2010.

Staff

In 2010 staff roles in the National Coordinating Office focused on program development (i.e., by Program Coordinators), project management (for individual projects), and support services (www.usanpn.org/about/staff). Staff in 2010 included:

- Executive Director (1.0 full-time equivalent, FTE)
- Assistant Director (0.25 FTE)
- Program Coordinator – Taxonomic specialist for plants (0.25 FTE)
- Program Coordinator – Taxonomic specialist for animals (0.5 FTE)
- Monitoring Design Specialist (0.5 FTE)
- Partnerships Coordinator (0.5 FTE)
- Communications (0.25 FTE)
- Information Technology Project Manager (0.5 FTE)
- Programmer/Developer (1.0 FTE)
- System Administrator (0.02 FTE, contracted)

Budget

Base funding for NCO operations is provided primarily by USGS. From 2007-2008, support came from USGS's Shared Program Costs managed by the Executive Leadership Team. In 2009, funding came

primarily from the Biology Resources Discipline (BRD; \$406K). In 2010, BRD provided \$374K, the National Climate Change and Wildlife Science Center provided \$200K and the Climate Effects Network provided \$250K for a total of \$904K from USGS. Each year about one-half of the base support is used to fund an ongoing cooperative agreement at the University of Arizona. Limited in-kind contributions from a variety of organizations are not included.

The USA National Phenology Network gratefully acknowledges the following sponsoring organizations: The US Geological Survey, University of Arizona, University of Wisconsin-Milwaukee, The Wildlife Society, US National Park Service, National Oceanic and Atmospheric Administration, National Aeronautics and Space Administration, National Science Foundation, Oak Ridge National Laboratory, and US Fish and Wildlife Society.

ACKNOWLEDGMENTS & CONTRIBUTORS

Theresa Crimmins co-developed and synthesized content and drafted the report. Jake Weltzin co-developed content, provided reviews, and shaped the document. Ellen Denny, Carolyn Enquist, and Alyssa Rosemartin co-developed report content and provided reviews.

