



## 2009 Annual Report

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## USA National Phenology Network

# 2009 Annual Report

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This report complies with the US Geological Survey Fundamental Science Practice Standards. It has undergone peer and policy review and approval.

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## LETTER FROM THE EXECUTIVE DIRECTOR



The National Coordinating Office of the USA National Phenology Network saw remarkable growth in 2009, considering that we formally opened our doors for operation in August 2007 and that the first formal planning for a national network for phenology was initiated in 2005. In fact, this first annual report describing the progress of the Network reflects improvements in strategic planning and organization that really congealed in 2009.

During 2009, most of our efforts focused on the development and implementation of a unique online phenology monitoring system that allows participants across the nation to record the phenological status of a suite of indicator plant species using standardized protocols. In short, we shifted from event-based monitoring (whereby the date of a particular defined event occurred) to status-based monitoring (whereby observers record whether or not they made an observation, and if so, the status of the organism on any date). This reflects a major conceptual leap for phenology participatory monitoring programs that greatly improves the utility of phenological data for science and management, and it called for a full overhaul of our online interface for data entry. As part of the overhaul, we reorganized our website, which is now our primary tool for communication with our stakeholder community.

We went live with the new website and monitoring protocols on March 2 with a press release that was picked up by media outlets across the country. On March 6, I had the (somewhat terrifying) pleasure of appearing on the National Public Radio program *Science Friday* with Ira Flatow. Staff at the office, who were still tweaking the website behind the scenes, reported that as I shared the URL ([www.usanpn.org](http://www.usanpn.org)) with Ira, the website slowed perceptibly, then crashed because of the flood of traffic for which we were obviously unprepared. We'd been "slashdotted"—victims of our own success. We quickly addressed the technological issues behind the site crash, and are pleased that several thousand registered individuals across the nation reported several hundreds of thousands of phenological observations during the year.

But we are much more than a participatory (aka citizen science) monitoring program: Another key conceptual and practical advance was to develop our "business-to-business" model, wherein we provide a suite of services to other organizations or agencies interested in the practical application of phenology information for science, management, or education. These services include the identification of indicator species, the development and promulgation of standardized monitoring protocols and data standards, the management and provision of historical and contemporary phenology data and information, and communication, coordination, and collaboration among partners and stakeholders. To this end, we've created many new relationships with



*Cascades frog (Lithobates cascadae). Amphibians such as the cascades frog are especially sensitive to temperature changes, breeding earlier under warmer spring conditions. Photo by Geoffrey A. Hammerson.*

agencies, organizations, and networks to facilitate integration and interoperability of phenology data and information for a variety of applications across a broad range of spatial and temporal scales.

Our short- and long-term activities are guided by vision and mission statements updated in 2009, and a five-year strategic plan that guides our annual implementation activities. A stakeholders' workshop in 2010 will play a pivotal role in defining the direction of the Network, and the role of the National Coordinating Office, as we move toward the implementation of a new national biological monitoring network.

In sum we are excited to have the opportunity to contribute to a better understanding of how ecosystems are responding to environmental variation and climate change. Through our own programs, and in collaboration with affiliated projects and partners, individuals of all ages and experience levels can help increase our understanding of the natural world. Individual and group engagement increases science and climate literacy while contributing data and information directly to basic and applied science. And through the visualization and decision-support tools in development, and the new Animal Phenology Program coming in 2010, we will engage even more people, as well as enhance management decisions under changing climate conditions.

I invite you to read more about our activities, products, and outcomes for 2009 in the following pages, and to learn more about our future goals and directions by referring to our strategic plan ([www.usanpn.org/results/reports](http://www.usanpn.org/results/reports)).

I look forward to sharing further advancements with you in 2010!

Sincerely,



Jake F. Weltzin  
USA-NPN Executive Director

## THE USA NATIONAL PHENOLOGY NETWORK

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*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 USA-NPN appear in the box to the right.

The USA-NPN 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 USA-NPN. 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 USA-NPN. Coordinating office staff also facilitate basic and applied research related to phenology, and the

### Research Priorities

- Determine spatial and temporal trends in phenology across the nation.
- Use phenology as an indicator of species and habitat vulnerability to environmental variability and climate change.
- Determine the relationship between phenology and ecosystem processes and services.
- Optimize and standardize methodologies and data for local to international projects.
- Integrate with existing research, decision-support, and education/youth programs.

### Monitoring Priorities

- Organize and enhance historic and contemporary data on phenology for plants, animals, and landscapes for research and decision-support.
- Promote internationally consistent terminology and definitions for monitoring phenology.
- Develop and promulgate methods, standards, and protocols for phenology monitoring across scales from organisms to landscapes, by existing or new monitoring programs.

development and dissemination of decision-support tools, educational materials, and activities.

To maximize the long-term (i.e., 30+-year) potential of the USA-NPN to serve scientists, resource managers, policy-makers and the public, the coordinating office staff developed a Strategic Plan to guide its operations and programmatic development between 2010 and 2015 (*USA National Phenology Network Strategic Plan, 2011-2015*, [www.usanpn.org/results/reports](http://www.usanpn.org/results/reports)). This annual report is organized to describe progress in 2009 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.

## INFORMATION MANAGEMENT SYSTEM

Data management and information sharing are central to the USA-NPN mission. The National Coordinating Office staff develop, implement, and maintain a comprehensive information management system to serve the data and information sharing needs of the USA-NPN, including the collection, storage, and dissemination of phenology data, access to phenology-related information, tools for data interpretation, and general online communication among partners of the USA-NPN.

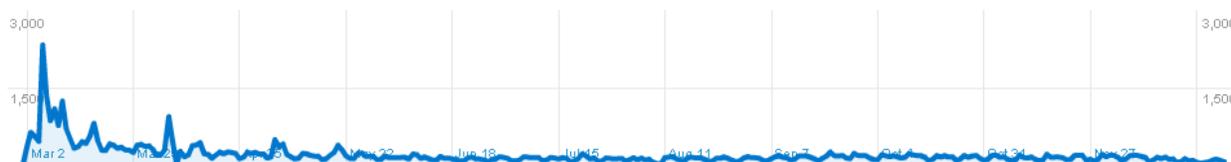
The vision for the Information Management System (IMS) includes components for data storage, such as the National Phenology Database (NPD), and a variety of online user interfaces to accommodate data entry, data download, data visualization, and catalog searches for phenology-related information. The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

## 2009 ACCOMPLISHMENTS

### Launched reorganized website

A revised and reorganized USA-NPN website went live on March 2, 2009. Improvements included a new online user interface, named MyNPN, to simplify the data-entry process and improve data quality. The changes facilitate the future collection of animal phenology data. In addition, a shared login between Drupal, the content management system, and MyNPN, the user interface, was implemented. The website is now the NCO's primary tool for communication with our broad and distributed stakeholder community.

**Website visitation statistics (March 2, 2009–December 31, 2009).** Source: Google Analytics.



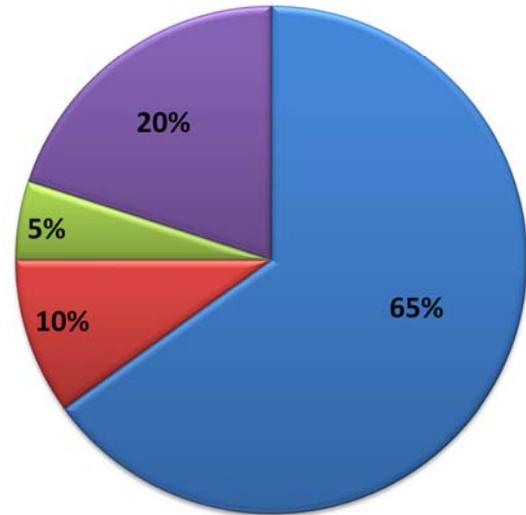
From the date the website went live on March 2 until the end of the calendar year, the site experienced 58,002 visits and 282,759 pageviews. Website visitation showed a dramatic spike following the website release and supporting press release in March. A second spike occurred on April 6, following the release

of a USA-NPN highlight on the website of The Wilderness Society. Visitation gradually tapered off over the course of the year.

A large percentage of visitors returned to the site many times. Over 4,000 visitors returned to the site 15 times or more over the course of 2009 (which probably reflects registered observers entering data on their organism). In addition, nearly 40% of site visits were 60 seconds or longer in duration. Over 50% of visits involved two or more pageviews during the visit. The most commonly viewed content on the site pertained to the monitoring program. Visits averaged between five and seven minutes on the USA-NPN site, suggesting that visitors were interested in learning more about the program and/or about phenology in general.

**Visits to [www.usanpn.org](http://www.usanpn.org)**  
(Jan 1 - Dec 31, 2009)

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



#### **Updated data model**

National Coordinating Office staff updated the National Phenology Database data model to accommodate animal phenology and secondary information at the site, species, individual, and observation level. We also initiated the necessary modifications for the ingestion of historic data.

#### **Upgraded website to Drupal 6**

The USA-NPN website was upgraded from Drupal v5 to v6 to extend the functionality and security of the site.

#### **Made preliminary data accessible**

National Coordinating Office staff made data from the National Phenology Database accessible to staff via MySQL workbench for preliminary quality control review and application development purposes.

#### **Created dynamic species pages**

Content from the formerly static species profile pages is now served dynamically through a combination of the Drupal database and the National Phenology Database.

#### **Reviewed website for usability testing**

The USA-NPN website and data entry interface were reviewed for usability by University Information Technology Services at the University of Arizona. Findings are guiding site improvements and reorganization.

#### **Web-enabled phenology bibliography online**

National Coordinating Office staff web-enabled an extensive phenology bibliography, contributed by David Inouye, University of Maryland, on the USA-NPN site ([www.usanpn.org/resources/biblio](http://www.usanpn.org/resources/biblio)).

### **Created Animal Phenology Program interim webpage**

The NCO created an Animal Phenology Program webpage on the USA-NPN website to describe the status of development and review of the program.

### **Implemented USA-NPN intranet**

National Coordinating Office staff created an intranet to enable file-sharing and centralized access for staff and affiliates.

### **Scoped visualizations**

National Coordinating Office staff created mock-ups of phenology data visualizations and tools planned for the USA-NPN website.

### **Implemented server maintenance**

National Coordinating Office staff secured a contractor to address server outage issues and ensure proper server maintenance.

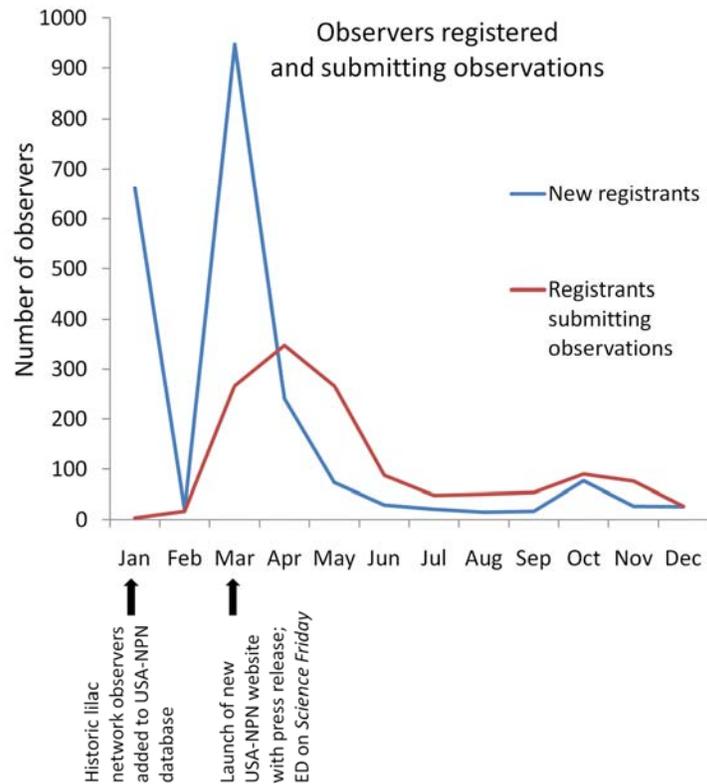
## **DEVELOPMENT OF THE NATIONAL PHENOLOGY MONITORING SYSTEM**

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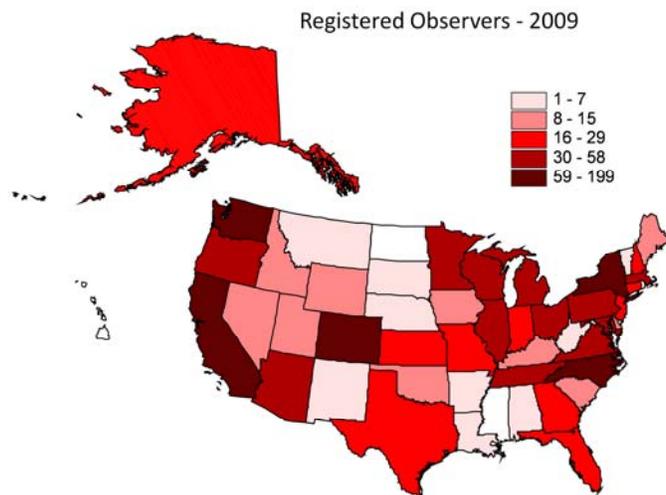
An essential activity of USA-NPN is the collection of contemporary and historic phenology data. The National Coordinating Office staff provide and promote vetted, well-documented, flexible phenology monitoring system, the National Phenology Monitoring System (NPMS). Implementation of this system in monitoring 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.

The first fully functional version of the USA-NPN online user interface to facilitate standardized monitoring of plant (and in 2010, animal) phenology was released in March 2009 and was named “MyNPN.” Through MyNPN, phenology observers could 1) register as an observer with the USA-NPN; 2) register one or more sites where they are observing plant phenology; 3) register one or more individual plants under observation; and 4) enter phenology observations. In spring 2010, MyNPN underwent a significant revision and was re-released as part of the USA-NPN plant and animal phenology observing program we now call Nature’s Notebook.

The graph on the following page shows observers registering and submitting data via the USA-NPN online monitoring program, by month, in 2009. In January, nearly 700 observers of historic lilacs were incorporated into the USA-NPN database, driving up the number of registrants in this month. Registration was also strongly influenced by a March press release and the appearance of the USA-NPN Executive Director on NPR’s *Science Friday*. The number of individuals submitting phenology observations shows a distinct seasonal pattern.

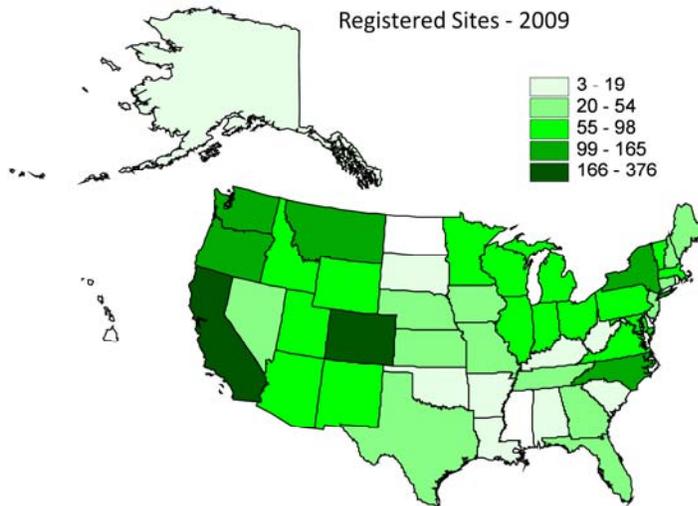


In 2009, 2,154 individuals registered as observers with the USA-NPN Plant Phenology Program via MyNPN. The map at right shows the number of registered observers by state for 2009. Activity by registered observers in 2009 is summarized in the 2009 Data Summary Report (*USA-NPN 2009 Data Summary*, [www.usanpn.org/results/reports](http://www.usanpn.org/results/reports)).



Twenty-six percent of all registered observers this year reported information on at least one individual plant. Observations were reported on 133 species of plants. Observers reported phenology observations for an average of nine days of the year. In total, USA-NPN observers submitted 17,688 plant observations (an observation is a report of a suite of phenophases for an individual plant on a given day).

The map below displays phenology observation sites registered with the USA-NPN via MyNPN in 2009. In total, 3,334 sites were registered.



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 reflects a major conceptual leap for phenology participatory monitoring programs that greatly improves the utility of phenological data for science and management.

## 2009 ACCOMPLISHMENTS

### Developed plant program

Concurrent to the March re-launch of the USA-NPN website, and based in part by an external review facilitated by NatureServe in late 2008, National Coordinating Office staff revised and updated plant profile pages for all recommended species. Thirty-six species were added to the recommended plant list ([www.usanpn.org/species\\_search](http://www.usanpn.org/species_search)), bringing the total to 213. The 2009 list of taxa was reviewed for taxonomy concurrent with the Integrated Taxonomic Information System database. We also obtained permissions for all photos used on profile pages.

### Selected focal animal species

The National Coordinating Office and the U.S. Geological Survey contracted NatureServe to lead animal species selection and protocol development. A national panel of experts, including researchers, managers, and educators from a diverse set of federal and state agencies, academic institutions, and non-governmental organizations with knowledge in a wide range of taxonomic areas and fields, provided input on animals recommended for monitoring through the USA-NPN program. A list of 60 focal animal species ([www.usanpn.org/species\\_search](http://www.usanpn.org/species_search)), the criteria used to select them, and

Another key area of development of the National Phenology Monitoring System was the careful consideration of whether to promote phenological “event” monitoring or “status” monitoring. Instead of events, we recommend that people monitor phenological status, and used this approach for the new online interface.

### Status versus event monitoring

Phenological **event** monitoring involves precisely documenting defined points in the annual life cycles of plants or animals, such as first and last flowering, and first and last arrival of migratory animals. In contrast, **status** monitoring involves noting the phenological status (e.g., the presence of leaves, flowers, or fruits; singing or mating) of plants and animals during a series of repeated observations.

USA-NPN protocols are based on **status** monitoring.

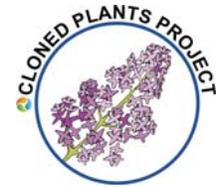
phenophases that would be appropriate for citizen scientists and professionals to monitor was submitted to the USA-NPN.

### Reviewed Animal Phenology Program

The Animal Phenology Program was reviewed by a panel of 20 scientists, managers, and educators convened by NatureServe. The review provided several recommendations regarding focal species, phenological phases to monitor, protocols for monitoring, and the broader goals of the program, which NCO staff are incorporating into the program for the 2010 season.

### Developed 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. In 2009, the USA-NPN's abilities to distribute cloned lilacs were expanded through a collaborative agreement with Jung Seed Company ([www.jungseed.com](http://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). The company sent out a mass emailing before the Memorial Day weekend to potential customers, and by mid-June, had sold 189 cloned lilacs to 89 individuals.



### Refined species protocols

National Coordinating Office staff are continuing to refine plant and animal phenology monitoring protocols to improve accuracy and usability, and to meet the needs of a variety of user groups—from educators to managers to scientists who need data for remote sensing applications.

### Drafted “The National Phenology Monitoring System, v0.1” report

National Coordinating Office staff drafted a report detailing plant species, protocols, monitoring approaches, and online instructions that were available for calendar year 2009. The report is available on the USA-NPN website at [www.usanpn.org/results/reports/](http://www.usanpn.org/results/reports/).

## PARTNERSHIPS AND COLLABORATIONS

The USA-NPN 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.

Through our partnerships, we seek to encourage and maintain the participatory spirit of the USA-NPN and the involvement of diverse user groups. National



Coordinating Office staff coordinate the efforts of USA-NPN partners to productively and efficiently advance the vision and goals of the USA-NPN; effective partnerships are critical to the success of the network.

## **2009 ACCOMPLISHMENTS**

Partnerships that were established or expanded in 2009 are described in the following section.

### **National Park Service**

The USA-NPN is working closely with the U.S. National Park Service (NPS) to engage park scientists, staff, and visitors in making phenological observations across park units and in the evaluation, interpretation, and communication of results. The USA-NPN and the National Park Service collaboratively developed an NPS/USA-NPN Strategy Document and an NPS/USA-NPN Action Plan. These documents articulate key areas requiring effort for successful large-scale phenology monitoring in parks.

In addition, the NPS and the USA-NPN are implementing regional pilot projects (described in more detail at [www.usanpn.org/nps](http://www.usanpn.org/nps)).

- **Northeast Pilot**

We initiated a collaborative phenology monitoring pilot project involving the Northeast Inventory & Monitoring Network and several parks in the northeast, the Appalachian Mountain Club, and the Appalachian Trail Conservancy to demonstrate how parks might incorporate phenology monitoring into regular park activities and how monitoring can benefit park research, management, and educational needs. A year-end report summarized findings and recommended project improvements and is being used to guide phenology monitoring in these parks in 2010 ([www.usanpn.org/files/shared/NPS\\_Northeast\\_Phenology\\_2009\\_Report\\_0.pdf](http://www.usanpn.org/files/shared/NPS_Northeast_Phenology_2009_Report_0.pdf)). Research is funded in part by a United States Geological Survey (USGS) National Park Monitoring Program (Status and Trends) grant.

- **California Pilot**

Led by the California Cooperative Ecosystems Studies Units and working with the USA-NPN, representatives from five California Inventory & Monitoring Networks and parks are coordinating plant phenology monitoring in California parks. The working group submitted proposals for funding to internal National Park Service calls to support these efforts.

### **U.S. Fish & Wildlife Service**

The USFWS has a strong interest in engaging staff scientists, staff, and visitors in making phenological observations across units and in the evaluation, interpretation, and communication of results. A draft strategy document describing how the USFWS and the USA-NPN may work together has been prepared. This document describes a long-term plan for developing relationships and activities that will encourage mutually beneficial activities between the two organizations. A page describing how the USFWS and the USA-NPN are working together is at [www.usanpn.org/usfws](http://www.usanpn.org/usfws).

- **Southern Coastal California Pilot**

USFWS Region 8 and the USGS Western Region co-funded a small, two-year pilot project to develop programs and activities (in collaboration with Project BudBurst, University of California, Santa Barbara, and the Ventura Fish and Wildlife Office) in southern coastal California, with a particular focus on engaging youth through phenology observation gardens (e.g., at elementary schools in Santa Barbara, and a Boys and Girls Club of America site in Oxnard).

### **The Wildlife Society**

The USA-NPN is working closely with The Wildlife Society to develop an Animal Phenology Program for implementation in 2010. With support from the USGS, the U.S. Fish and Wildlife Service, and in-kind contributions, The Wildlife Society provided a full-time coordinator for the program and additional funding for travel, cyber-infrastructure development, and other programmatic support. Their membership is also assisting with the selection of focal species for the program and the development of monitoring protocols.

### **National Ecological Observatory Network**

The USA-NPN is working closely with the National Ecological Observatory Network (NEON) to ensure that phenology monitoring at NEON sites is concordant with USA-NPN protocols. A page describing cooperative efforts between NEON and the USA-NPN is at [www.usanpn.org/neon](http://www.usanpn.org/neon).

### **Long-Term Ecological Research Network**

Building from previous efforts to engage LTER sites in collecting phenology observations following consistent methods, the USA-NPN hosted a working group at the LTER All Scientists Meeting in Estes Park, Colorado. Working groups focused on a) the use of phenology as a metric to gauge change; b) the use of phenology programs as tools for education; and c) the potential for the synthesis of phenology data sets already collected and held across the LTER. As a follow-up to this meeting, the USA-NPN created a “landing page” for LTER at [www.usanpn.org/lter](http://www.usanpn.org/lter).

### **Great Sunflower Project**

The USA-NPN is partnering with The Great Sunflower Project (GSP; [www.greatsunflower.org](http://www.greatsunflower.org)) to engage tens of thousands of citizen scientists to observe sunflower and bee activity. In 2009, 365 observers reported sunflower phenology observations via the GSP website. In addition, 16 observers registered with USA-NPN and submitted observations on an additional 16 (non-sunflower) plant species. Sunflower phenology data collected by members of the GSP are on the USA-NPN data page ([www.usanpn.org/data](http://www.usanpn.org/data)).



### **Biophysical Pilot Program**

The USA-NPN Biophysical Program was launched in January, with a primary goal of producing a template for integrated phenology and climatology monitoring. The USA-NPN and the Rocky Mountain Biological Laboratory (RMBL; Gothic, Colorado), developed an informal agreement to leverage a new meteorological monitoring project at RMBL by incorporating the monitoring of phenology (acoustic,

camera, and in-situ observations) to complement meteorological monitoring along an elevational gradient.

### **Biosphere 2**

A phenology garden, supporting signage, and an educational brochure highlighting the USA-NPN were installed at the Biosphere 2 facility in Oracle, Arizona.

### **The Wilderness Society**

In early April, The Wilderness Society (TWS) highlighted the USA-NPN participatory monitoring program on its website, resulting in over 1,200 visits to the USA-NPN webpage. A summary report of participation by members of The Wilderness Society was prepared and provided to TWS to guide interactions with this organization in 2010.

### **HoneyBeeNet**

The NPN has been exploring the potential for partnering with HoneyBeeNet (HBN), a NASA-based plant-pollinator project to better understand the nectar flow of plant species important to honeybees. Beekeeper participants in HBN will be invited to record plant phenology following USA-NPN protocols as they track hive honey production. Plant phenology data will be housed in the National Phenology Database.

### **Project BudBurst**

Project BudBurst is a separate program managed by the University Corporation for Atmospheric Research that uses participatory monitoring of plant phenology as a tool to engage, educate, and communicate with the public. Project BudBurst will contribute event-based phenology data to the National Phenology Database.

### **Freshwater Society**

The Freshwater Society ([www.freshwater.org](http://www.freshwater.org)), an NGO based in Minnesota and focused on the protection and rational management of freshwater resources, will be highlighting the USA-NPN in its 2010 annual wall calendar.

### **Other potential partners**

The USA-NPN continued to forge partnerships with external organizations and made preliminary or continued contact with PlantWatch (Canada); the Ecological Society of America's Strategies for Ecology Education, Diversity and Sustainability (SEEDS) Program; Nature Mapping; the Coalition for the Upper South Platte (CUSP); EarthTrek; RE Sources for Sustainable Communities; and the Arizona 4-H. Mechanisms for continued collaboration were identified, and the importance of continued communication was emphasized. In addition, we communicated with many individuals, including representatives of the NASA Goddard Space Flight Center, professors of citizen science at Polytechnic Institute of New York University and Rutgers University, private research and development entities, and individuals involved in the development of regional phenology networks.

### **Building a partnership framework**

The National Coordinating Office also worked to develop mechanisms to improve partnership opportunities and communications:

- **Partner services tool**

Work began on a dynamic tool to be hosted on the USA-NPN website to communicate the various services and products that the USA-NPN can offer to potential partner audiences (individuals, educators, and members of partner organizations).

- **Partner prioritization**

A decision matrix is being developed to support prioritization of USA-NPN partners in 2010. Factors being considered in the prioritization include how well the partnership aligns with USA-NPN goals as stated in the strategic plan, expected costs to partnering, and the level of commitment expressed to-date by the partner organization.

- **2009 Partner Summary Report**

A summary report of participation in the USA-NPN Plant Phenology Program by members of partner organizations was prepared for in-house use. The findings of this report are being used to shape partner engagement efforts for 2010.

### **Regional phenology networks**

The National Coordinating Office is working to support the establishment and development of regionally- and locally-based phenology networks. These networks, though independent from the USA-NPN National Coordinating Office, generally work toward the same goals. National Coordinating Staff are working to ensure consistency in data collection protocols used and to provide support, including encouraging use of the National Phenology Database as a long-term data repository.

- **Northeast Regional Phenology Network**

The Northeast Regional Phenology Network (NE-RPN) secured funding from the Northeastern States Research Cooperative and Microsoft Research to (a) facilitate the growth of the NE-RPN; (b) provide training, outreach, and research resources within the network; and (c) improve the quality of citizen science phenology data. Resources developed for the NE-RPN will be applicable to other groups interested in developing regional networks for phenology.

- **Florida/Southeast Regional Phenology Network**

A Florida Phenology Workshop was held in February; the workshop focused on developing phenology observation protocols, species lists, data portals, and a strategy for building a state-wide network for plant and animal phenology. Co-sponsors of the workshop included the USGS, the U.S. Fish and Wildlife Service, the University of Florida, and the Florida Fish and Wildlife Conservation Commission. Break-out sessions for 35 participants identified phenology needs by taxonomic group. Suggestions from the groups will guide priorities for developing the state-wide network.

- **Development of other regional phenology networks**

Enthusiasm has emerged for new and continued development of several other regionally based phenology networks with close ties to the USA-NPN. We communicated with Angela Evenden of the National Park Service, who has expressed interest in establishing an agency-based California Regional Phenology Network, and Mark Shasby of the USGS, who is interested in establishing an Alaska Regional Phenology Network. There was also interest in the establishment of a regional network for the southwestern United States. Because of the diversity of geographically based affiliate networks, and the limitations of staff, we have been considering the role of the NCO in supporting the establishment of “top-down”-style regional networks.

### **International collaborations**

In March, we initiated international collaborations with the COST 725 action, a European Union initiative, to coordinate phenology monitoring and research across the continent. Via the new GEO Ecosystems Task US-09-03d (Global Phenology Data), the USA-NPN is providing leadership for coordinated global phenology activities. In April, the USA-NPN co-convened a session on phenology and climate change at the European Geosciences Union. The co-sponsors of the EGU phenology session, PAGES (Past Global Changes) and iLEAPS (Integrated Land Ecosystem-Atmosphere Processes Study), have both expressed interest in providing support for an international workshop on phenology; in 2010, we will collaborate with European colleagues on developing a workshop proposal.

## **OUTREACH AND EDUCATION**

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The National Coordinating Office staff facilitate the development of outreach and educational materials to communicate with diverse audiences in support of the USA-NPN 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 (education outside of a school setting), and non-formal (taking place in a formal setting but not following a curriculum) education. National Coordinating Office staff also participate directly in outreach activities, defined as the dissemination of ideas and concepts that engage parties in a two-way conversation.

### **2009 ACCOMPLISHMENTS**

#### **Executive Director on National Public Radio**

On March 6, 2009, Jake Weltzin was interviewed by Ira Flatow on the live, nationally broadcast National Public Radio program, *Science Friday* ([www.sciencefriday.com/program/archives/200903062](http://www.sciencefriday.com/program/archives/200903062)).

#### **Education resources on USA-NPN website**

An Education section was created on the USA-NPN website for users to acquire phenology-related educational resources. The USA-NPN



Educator's Clearinghouse is a catalog of resources from other websites related to phenology and climate change education, as well as several materials from teachers and professors who have instructed classes on phenology topics.

### **Formal presentations**

National Coordinating Office 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 phenology-specific workshops and panels at several professional meetings in 2009:

- The USA-NPN organized a symposium and workshop on phenology at the 94th Annual Meeting of the Ecological Society of America. The USA-NPN also hosted a phenology-themed lunch, and several National Coordinating Office staff and affiliates presented at the meeting.
- The Third Annual Phenology Research and Observations of Southwest Ecosystems (PROSE) symposium, co-hosted by the USA-NPN, was held in Tucson in October.
- A Phenology Session at the American Geophysical Union annual meeting was co-sponsored by the USA-NPN.

### **Resources page**

A resources page housing training and outreach materials for use by USA-NPN partner organizations was created at [www.usanpn.org/resources](http://www.usanpn.org/resources).

### **Observer survey**

Two informal participant surveys were developed and implemented in 2009. One survey targeted the 486 observers who submitted data to the USA-NPN phenology monitoring program; the second targeted the 1,597 individuals who registered with the USA-NPN program but did not submit data in 2009. The surveys were advertised via direct mailing to registrants and the USA-NPN website and had completion rates of 37% for observers and 15% for non-observers. An in-house report (electronic supplemental material, [www.usanpn.org/results/reports](http://www.usanpn.org/results/reports)) summarizing findings will help guide development and improvements to the website and monitoring program into the future.

### **USA-NPN fact sheet and bookmarks**

An updated USA-NPN fact sheet and a series of four phenology-themed bookmarks are under development for production in 2010.

### **Training presentations and videos**

A series of training presentations (as slides) were developed for use by partners. These presentations are intended for non-NCO staff to present information on phenology, the USA-NPN, and the USA-NPN phenology monitoring program to others. Narrated training videos were created based on these presentations.

### **Identity package**

An identity package was developed for USA-NPN collaborators who do outreach on our behalf. This package includes instructions on the appropriate use of the USA-NPN logo, title, and communication standards, including key phenology-related messages.

### **Outreach publications**

- An update on the progress of the Animal Phenology Program and the effort to pilot phenology monitoring in northeastern national parks was submitted to *The Wildlife Professional*.
- Two short articles on the development of the Animal Phenology Program were published in *The Wildlifer*, the newsletter of The Wildlife Society.
- Two short pieces, one focused on the USA-NPN program and website, and a second focused on the USGS' Remote Sensing Phenology website, were published by the *Bulletin* of the Ecological Society of America under "Ecology on the Web."
- The USA-NPN program and efforts to collaborate with the National Park Service in the northeastern states have been highlighted in the summer issue of the Northeast Temperate Inventory & Monitoring Network newsletter, *The Temperate Times*.
- The USA-NPN contributed an invited article, "Introducing the USA-NPN Biophysical Program," to *Mountain Views*, the newsletter for the Consortium for Integrated Climate Research in Western Mountains (CIRMOUNT).

### **Newsletters**

The NCO initiated a quarterly newsletter for our observers and partners in the final quarter of 2009. Newsletters are archived on our website at [www.usanpn.org/newsletters](http://www.usanpn.org/newsletters).

### **Southwest geographic concentration**

Working with a local affiliate, National Coordinating Office staff launched a concentrated effort to increase participation in the USA-NPN monitoring program in Arizona, New Mexico, and Colorado.

### **Prototype iPhone app**

A prototype data entry application for the iPhone was developed in collaboration with Natural Guides and the University of Chicago.

### **Media**

- National Coordinating Office staff distributed three press releases through the USGS:
  - A formal announcement of the USA-NPN
  - An announcement of the North American Bird Phenology Program
  - An announcement of the USGS/University of Florida Phenology Program and website
- A USGS podcast of Executive Director Jake Weltzin, "Help Us Keep an Eye on Climate Change," accompanied the first USA-NPN press release. Podcast downloads broke records for USGS podcast downloads three times in one week. The file is at: [www.usanpn.org/files/shared/files/20090302\\_85\\_Phenology\\_Climate\\_Change.mp3](http://www.usanpn.org/files/shared/files/20090302_85_Phenology_Climate_Change.mp3).

- The USA National Phenology Network was mentioned in over 37 articles and media outlets (Google News search), including the *Washington Post*, the *Los Angeles Times*, the *Kansas City Star*, the *Huffington Post*, the *Seattle Times*, and the *Tampa Tribune*, as well as *EP Magazine*, *Backpacker Magazine*, and *Wired*.
- Other high-profile media interviews included *Arizona Illustrated* (Arizona NPR television), KOLD TV News (Tucson), and NPR's *Science Friday*.

A subset of recent media reports is at [www.usanpn.org/rm](http://www.usanpn.org/rm).

## RESEARCH

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An important contribution made by National Coordinating Office staff is the facilitation of basic and applied research on all aspects of phenology and on the relationship of phenology to rapidly changing climate. In addition, the information management system and National Phenology Database, which serve as a centralized hub for phenology-related data and information, are key services provided by the NCO to scientists, managers, and policy-makers. National Coordinating Office staff also facilitate communication among researchers, work to identify key gaps in our understanding of the role of phenology in ecosystems, and actively facilitate research to fill those gaps.

### 2009 ACCOMPLISHMENTS

#### **Third USA-NPN Research Coordination Network Meeting**

The third meeting stemming from the National Science Foundation-funded Research Coordination Network of the USA National Phenology Network (NSF Grant #0639794) was held in Milwaukee, Wisconsin, in October 2009. The theme of the meeting was "Toward a National Phenological Assessment." Several working groups were formed, and short-term (three- to six-month) products aimed at advancing understanding needed to launch the first National Phenological Assessment were envisioned. The meeting is summarized in the 2010 *EOS* article by G.M. Henebry, "Toward a U.S. National Phenological Assessment" (91:5).

#### **Arizona-Sonora Desert Museum data set**

The Arizona-Sonora Desert Museum (ASDM) recently received funding to make a 30-year record of flowering phenology available online. Information technology professionals from ASDM are working closely with National Coordinating Office staff to ensure that the data are made available via the USA-NPN website for download and follow the USA-NPN data model and metadata standards.

#### **Development of Land Surface Phenology Program**

A strategy was developed and implemented to promote and enhance programs related to the remote sensing of phenology on local, regional, and national scales. A basic land surface phenology and remote sensing phenology page on the USA-NPN website was created and populated.

#### **North American Bird Phenology Program**

The NCO developed a plan to integrate the North American Bird Phenology Program (BPP);

[www.pwrc.usgs.gov/bpp/index.cfm](http://www.pwrc.usgs.gov/bpp/index.cfm)) into the USA-NPN to ensure the sustainability and timely completion of this USGS project; we worked with the USGS to acquire funds for the program through 2010. The BPP provides an online interface for volunteers to transcribe data from scanned index cards (approximately 6 million total) that contain information on bird migration times across North America from 1880 through 1970. In 2010, we will fully integrate BPP into the USA-NPN as a data rescue project, and will use it as a model as we develop a program for the rescue of other historic phenology data sets.

## DECISION SUPPORT

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National Coordinating Office staff facilitate efforts within the USA-NPN 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. The National Coordinating Office staff determined that developing species lists, protocols, databases, and web access were more important objectives than the development of decision support tools in 2009. These developments will form the foundation for decision-support tools in the future.

### 2009 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 USA-NPN 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 USA-NPN will be to develop species profiles and protocols specific to the plants of interest and to engage observers in submitting observations of juniper pollen development and release. To kick off the effort, a page specific to the Juniper Pollen Project was created on the USA-NPN website ([www.usanpn.org/juniper\\_pollen\\_project](http://www.usanpn.org/juniper_pollen_project)).

## OPERATIONS AND GOVERNANCE

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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 USA-NPN, 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 USA-NPN. 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 USA-NPN, and are available on the website. The Executive Director and Assistant Director are primarily responsible for directing the operational activities of the USA-NPN through the National Coordinating Office.

## **2009 ACCOMPLISHMENTS**

### **Mission and vision statements**

NCO staff created mission and vision statements for the USA National Phenology Network. These statements have been approved by the USA-NPN Board of Directors.

### **Strategic plan**

National Coordinating Office staff completed a draft five-year strategic plan for the organization (please see electronic supplemental material, [www.usanpn.org/results/reports](http://www.usanpn.org/results/reports)). The plan was reviewed by the USA-NPN Board of Directors and USGS staff and is guiding allocation of resources and prioritization of National Coordinating Office staff actions. The strategic plan will be released in 2010 for broad vetting culminating in a stakeholders' workshop, whereupon it will be updated to reflect the needs of the USA-NPN stakeholder community.

### **Board of Directors**

In October, the annual USA-NPN Board of Directors (Board) election was held during the annual meeting of the Executive Committee (composed of the Board, the USA-NPN Executive Director, and the USA-NPN Assistant Director). New members elected to the Board include Patty Glick of the National Wildlife Federation and Inigo San Gil of the Long-Term Ecological Research Network. In addition, the Board approved the addition of Federal Liaisons to the Board (for federal employees to serve in a non-voting capacity), and added two new Federal Liaisons: Kevin Kilcullen of the U.S. Fish and Wildlife Service and Tim Owen of the National Oceanic and Atmospheric Administration (NOAA). Members of the Board, and their terms, are posted on the USA-NPN website ([www.usanpn.org/about/board](http://www.usanpn.org/about/board)).

### **Proposal development**

National Coordinating Office staff led or participated in the development of over seven funding proposals in 2009, including calls from the National Park Service, the USGS, and the National Science Foundation. National Coordinating Office staff also provided letters of support for more than five grant or fellowship proposals in 2009.

### **Staff**

In 2009 staff roles in the National Coordinating Office focused on program development (i.e., by Program Coordinators), project management (for individual projects), and support services. Staff in 2009 included:

- Executive Director (1.0 full-time equivalent, FTE)
- Assistant Director (0.25 FTE)
- Program Coordinator – Taxonomic specialist for plants (0.5 FTE)
- Program Coordinator – Taxonomic specialist for animals (1.0 FTE)
- Partnerships Coordinator (0.5 FTE)
- Information Technology Project Manager (0.5 FTE)
- Monitoring Design Specialist (0.5 FTE, contracted)
- Programmer/Developer (0.5 FTE, contracted)
- System Administrator (0.2 FTE, contracted)
- Webmaster/User Services (0.5 FTE, contracted)
- Communications (0.25 FTE)

National Coordinating Office staff are listed on the USA-NPN website ([www.usanpn.org/about/staff](http://www.usanpn.org/about/staff)).

### **Budget**

Base funding for NCO operations is provided primarily by the USGS, in particular the Biology Resources Discipline (BRD) and, until 2009, the Shared Program Costs managed by the Executive Leadership Team. The USGS expects the National Coordinating Office to leverage additional support for operations from collaborating organizations, including federal science and management agencies, academia, and non-governmental organizations. Each year, about one-half of the base support is used to fund the ongoing cooperative agreement between the USGS and the University of Arizona for the operations of the National Coordinating Office centered at the university.

In federal fiscal year (FY) 2009, base support for NCO operations by the USGS totaled \$406K. Resources for associated activities (provided by the USGS, the Oak Ridge National Laboratory, the National Park Service, the University of Arizona, Microsoft Research, and the Northeastern State Research Cooperative) totaled \$1,164K. Pass-through resources for special projects (provided by the USGS and NASA) totaled \$662K. Limited in-kind contributions by a variety of organizations are not included.

For comparison purposes, in FY 2008, base support for operations totaled \$672K, resources for associated activities totaled \$1,104K, and pass-through resources totaled \$191K. In FY 2010, base support totaled \$904K, and pass-through resources totaled \$531K. In FY 2011, a budget line-item will be established for the NCO by USGS Biological Resources Discipline, with a base of \$300K.

We estimate that NCO base operations will require a total of \$1.6M to \$2.2M per year, depending on focus and activities, for sustainable operations.

## CONTRIBUTIONS & ACKNOWLEDGMENTS

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Theresa Crimmins co-developed and synthesized content and drafted the report. Jake Weltzin co-developed content, provided reviews, and shaped the document. Ellen Denny, Mark Losleben, Abe Miller-Rushing, Alyssa Rosemartin, and Kathryn Thomas co-developed report content and provided reviews.

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