Tracking nature's pulse to assess climate change response across California landscapes and national parks

AT A GLANCE

What: Protocol and infrastructure development to support integrated phenology science & education programs across California's national parks.

Who: Open for participation by professional scientists, citizen scientists, educators, students, and the public

When: Three-year pilot project 2010 - 2013

Project website: **www.usanpn.org/cpp**

Background

Phenology is the study of seasonal or periodic biological events such as flowering, leaf-out, insect emergence, and animal migration. Put simply, phenology is the science of the seasons.

The status of plants and animals across the seasons is very dynamic and is closely linked to climatic and ecological variables. Consequently, tracking the phenology of plants and animals is a compelling way in which to study how living systems are functioning in response to climate variability and, over the long-term, to climate change.

Easy to observe and simple to record, phenology offers an intuitive approach for people in all walks of life to learn about the rhythms and natural processes of their local environment while observing directly the important links between the living world and the climate system.

In order to assess the effects of climate change on California's extraordinary biodiversity and natural resources, the National Park Service (NPS), the Phenology Stewardship Program at the University of California, Santa Barbara (UCSB-PSP), and the USA National Phenology Network (USA-NPN) have established **The California Phenology Project.**

The California Phenology Project (CPP)

With funding from the NPS Climate Change Response Program, the CPP was launched in 2010 as a 3-year pilot project to develop and test protocols and to create tools and infrastructure to support long-term phenological monitoring and public education activities in California national parks. The CPP is a collaboration among 19 parks, two Research Learning Centers (RLCs), five Inventory & Monitoring (I&M) Networks, and the Californian Cooperative Ecosystem Studies Unit (CESU). The CPP is partnered with the USA-NPN, a national consortium of organizations and individuals that collect, share, and use phenological data to better understand resource responses to changing climates and environments.

A primary focus of the effort is to recruit and engage state residents and visitors in the collection and interpretation of phenological data. On-the-ground pilot activities are currently focused in seven parks (see map), however, project products and infrastructure are being designed to support monitoring and educational activities for 19 California NPS units and parks in adjacent states.

By incorporating sound scientific practices with public education and outreach, the project aims to assess how phenological data can be used to understand the effects of changing climatic conditions on California's diverse landscapes and to inform park resource management.

Initial CPP efforts are focused on plants. Animals will be added as resources become available.

To date the CPP has:

- Established a scientific framework and questions to guide park-based phenological monitoring;

continued...

NPS vegetation ecologists recording the vegetative and reproductive phenology of green leaf manzanita (*Arctostaphylos patula*) near a climate station at Lassen Volcanic National Park. During the 2011 field season, over 5,000 observations were recorded across the California pilot parks and reported to the USA National Phenology Network's online database. Photo: Brian Haggerty.

CPP accomplishments continued...

- Conducted informational webinars to introduce park resource management, interpretive staff, and partners to the CPP;
- Engaged park staff and botanical experts in a biogeographically-based process for selection of plant species for monitoring in 19 California parks;
- Designed and field-tested integrated phenological monitoring for >500 individual plants representing 27 species across 7 California pilot park units (see map);
- Provided a suite of online and hardcopy tools for phenological monitoring, including maps, photos, species descriptions, and field guides;
- Facilitated routine and standardized recording of phenological observations, and the reporting of those data to an online user interface and database managed by the USA National Phenology Network (*Nature's Notebook*);
- Produced a report summarizing opportunities for developing phenology-based climate change interpretation, education, and citizen science programs in California national parks (based on discussions with park interpretive staff);
- Applied and tested different approaches for engaging citizens, students, educators, and informal science education institutions in hands-on phenological monitoring;
- Developed a variety of education and outreach materials and curricula linking phenology to understanding ecological response to changing climatic conditions;
- Initiated partnerships with NatureBridge, the University of California Natural Reserve System, and the California Native Plant Society to cultivate phenological and climate change literacy among scientists, educators, and the public through coordinated training and educational materials and other activities;
- Identified "legacy" phenological datasets in California to provide a historical context for current monitoring and educational activities; and
- Developed and launched a project website to serve as an overall resource in supporting CPP-related monitoring and outreach activities and to document project progress.

The California Phenology Project is integrating phenology science and education programs across 19 NPS units - including 7 pilot parks (dark green) - spanning five Park networks and desert, coastal, and mountain biogeographic regions.

CPP protocols & available tools

A major goal of the CPP is to create protocols that can be repeated at any location to design and establish parallel phenological monitoring programs. Materials documenting the CPP protocols, as well as tools for monitoring and education, are available on the CPP website, including:

- Documented methods for coordinating the design and implementation of phenological monitoring programs, including managing the selection of species and monitoring sites, and labeling plants for monitoring;
- Downloadable monitoring tools including datasheets, species profiles with phenophase photo guides, and print-ready and online interactive maps of monitored plants and sites (GPS coordinates also available);
- A wide range of downloadable phenology science and education guides and activities including standards-aligned lesson plans for K-12, interactive hands-on activities for all ages, annotated lectures for university and public audiences, data-driven analytical exercises, and graduate-level seminar modules; and
- Materials for half-day to all-day training workshops geared toward scientists or interpreters including agendas, annotated presentations, and discussion topics.

California Phenology Project

Project Update

National Park Service
U.S. Department of the Interior

Promoting climate change literacy

The CPP has developed and implemented a variety of educational, outreach, and scientific training activities to help cultivate phenological and climate change literacy among the NPS workforce, park partners, and the public. NPS staff from all levels within Natural Resources and Interpretation attended the CPP's train-the-trainer workshops at each pilot park, where they were engaged in hands-on training and brainstorming activities focused on observing the effects of climate change on natural resources through phenological monitoring. Following these workshops, NPS staff have helped to raise public understanding of climate change and its effects on parks through phenology-based civic engagement practices and programs to enlist public participation in the CPP. The CPP website is facilitating the sharing of training and educational resources among NPS staff and the public.

CPP Sustainability

The CPP team has initiated development of a strategy for sustaining phenological monitoring in parks and reserves beyond this three-year pilot project. In addition, the team is exploring opportunities to engage additional partners in the project to ensure a successful long-term monitoring effort that provides an informative and useful information base for understanding and managing natural resources within California in the face of changing climate. Please let us know of your interest and ideas as we move forward!

More Information

Project website: www.usanpn.org/cpp

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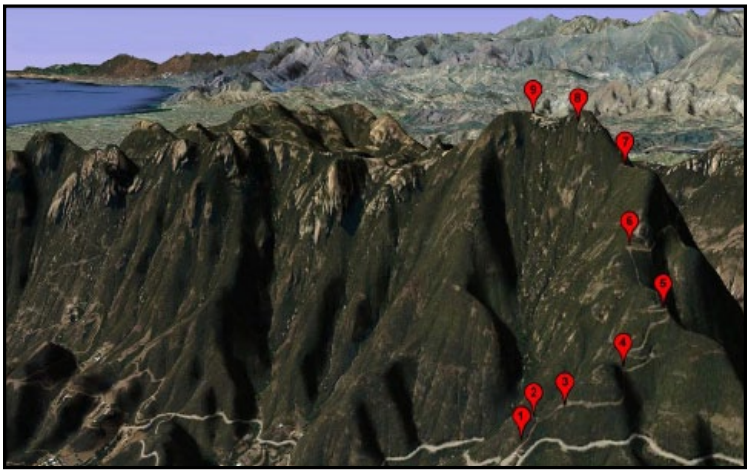
This project is funded by the National Park Service, Climate Change Response Program.

November 2011

Train-the-trainer workshops were tailored for each pilot park during 2011, bringing together natural resource and interpretation staff in addition to staff from nearby parks and cooperators from other agencies and educational institutions. Each full-day workshop included a morning presentation and discussion about the links between phenology and climate change and the CPP's goals and progress. The afternoon session included hands-on practice with phenological monitoring (including recording data and reporting observations to the USA-NPN's online database) and brainstorming activities for integrating phenology-based activities into existing and new programs. Photos: Brian Haggerty.



One of 20 phenological monitoring locations established among the CPP pilot parks. With the Pacific Ocean and the greater Los Angeles area in the background, this GoogleEarth image shows nine phenological monitoring sites along the 1100' elevation gradient of Sandstone Peak at Santa Monica Mountains NRA (SAMO). At each site, multiple individuals for each of several plant species are tagged for monitoring. GPS coordinates for each tagged plant and GIS-based maps at the site, trail, and park scales are available on the CPP website for each pilot park, as are customizable GoogleEarth maps. SAMO education partner NatureBridge has integrated phenological monitoring on this trail into weekly educational programs. Map: Brian Haggerty.