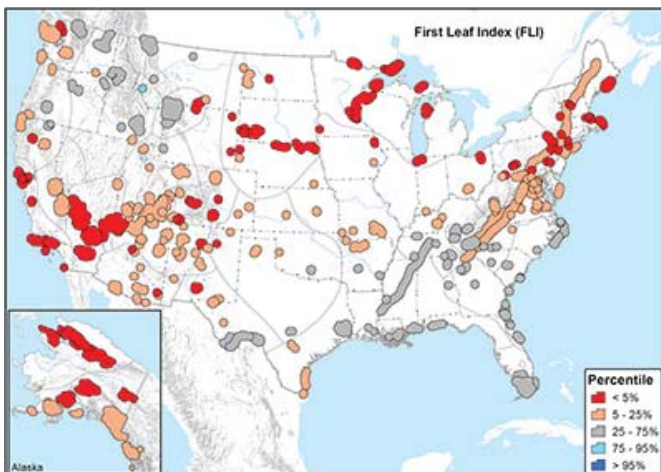# National Park Service and the USA National Phenology Network

## Helping the National Park Service Achieve Its Mission

Understanding the seasonal cycles of plants and animals, how they are changing, and how these changes can inform management, operations, and interpretation is critical to the mission of the National Park Service (NPS): to preserve unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations.

## Improving Resource Management and Operations

Phenology information provided by the USA National Phenology Network (USA-NPN) informs almost all typical NPS resource management practices—e.g., the management of invasive species, wildfire risk, wildlife, and water resources—as well as planning activities, such as identifying vulnerable species, anticipating future conditions, and developing annual work plans.



First Leaf Index (FLI)

Percentile
< 5%
5 - 25%
25 - 75%
75 - 95%
> 95%

Alaska

Spring is advancing in 3 out of 4 national parks studied, and is now arriving extremely early (exceeding 95% of historical conditions) in 53% of parks. The USA National Phenology Network provides essential monitoring and research to help park managers anticipate and respond to these changes[1].

With earlier springs come longer growing seasons, which influence many basic aspects of managing national parks, including timing of peak visitation, the timing of staffing and facility needs, and strategies for managing water and landscaped areas. The USA-NPN provides phenology information that is essential for intelligent planning of future park staffing, budgeting, and operations.
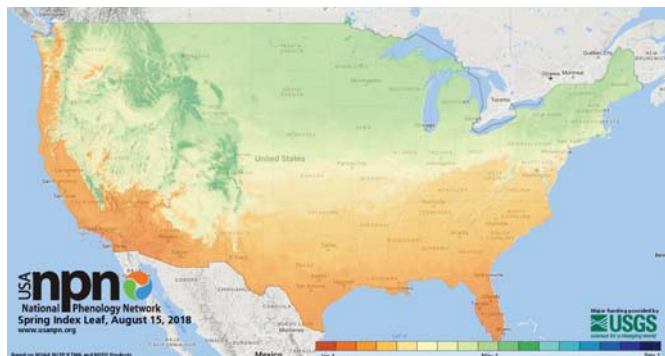
### Why Phenology?

Observations of phenology describe key aspects of ecological variability, and serve as indicators of climate change impacts on park ecosystems. Phenology is an essential biodiversity variable that aids in understanding species interactions, water availability, carbon cycling, and disturbances such as fire and pest outbreaks—the temporal component of nearly all ecosystem functions. Knowing whether flowering is becoming asynchronous with arrival of pollinators, or whether leaf out tracks with earlier snowmelt, helps managers understand the threats to ecosystem integrity.

## Engaging the Public in Science

Phenology is one of the best ways to engage people of all ages in science. Day visitors, school groups, volunteers in parks (VIPs), and local community members can all contribute observations and learn about how park ecosystems are changing. By participating in phenology citizen science and associated programming, volunteers can see first hand how science informs park management and become better stewards.

## Engaging the Public in Science

The USA-NPN relies on peer-reviewed, published protocols that maximize information quality and content and permit different kinds of analysis. The USA-NPN also provides robust information management tools and data products that are peer-reviewed and compliant with federal information policy, ensuring data quality, discovery, accessibility, reuse, and long-term curation. USA-NPN infrastructure complies with the Privacy Act and Paperwork Reduction Act (OMB Control #: 1028-0103).

The USA-NPN has developed short-term springcasts that use weather data to forecast the onset of spring across the country. USA-NPN data are also used in models of longer-term changes in phenology. These forecasts provide essential tools for planning resource management and other parts of park operations.

## Cost-Effective Information

By providing standards, information management, data products, and syntheses that encourage participation by hundreds of scientists and thousands of volunteers, the USA-NPN provides roughly $330,000 worth of information each year. USA-NPN protocols are used by scientists and citizen science volunteers around the country, resulting in a broader value of $2.8 M worth of data that can be leveraged by NPS for landscape and national-scale inference. The number of USA-NPN-informed publications, briefs and data products increase each year.

## USA-NPN in National Parks

- Over 2 million phenology records have been collected at NPS units.
- 230 species of plants and animals are monitored at NPS units.
- USA-NPN and NPS have published analyses of trends in phenology for 276 parks and publish forecasts of spring onset for all park units.

## On-the-Ground Examples

Great Smoky Mountains National Park uses Nature's Notebook to track the phenology of 54 species of plants and animals across an elevational gradient, building on a long-term data set that extends back to the 1980s. Park staff, visitors, and students all participate in the study. Preliminary analyses of deciduous trees indicate that leaf-out is earlier with warmer winters and springs, while increased precipitation may delay leaf-out.

Seven national parks in California are working together with the USA-NPN to assess phenology of plant species across latitudinal, elevational, and rainfall gradients. The study helps to understand complex responses to drier and warmer conditions, including assessments of which species might be most vulnerable to a changing climate[2].

Acadia National Park is working with the USA-NPN and other partners to test how best to use phenology data to identify vulnerable species, find potential temporal mismatches between species, and inform plant restoration projects..



A park ranger and visitors observe pine phenology in Lassen Volcanic National Park. Photo credit: NPS

## Plans for the Future

The USA-NPN will continue to improve the delivery of phenology information for park resource management, interpretation and education, and operations. Ongoing communication between Network staff and park staff will help us deliver phenological information in ways that suit manager needs. The USA-NPN will continue to create opportunities to engage the next generation of park stewards in citizen science. Together USA-NPN and NPS will cultivate and grow the community of researchers, managers, and educators that will help the NPS achieve its mission of conservation and public enjoyment.

## References

1. Monahan W B et al. 2016. Ecosphere 7: 10.
2. Mazer SJ et al. 2015. Ecosphere 6: 98.

**Find out more at nps.usanpn.org**
**Contact nps@usanpn.org**

**We are grateful to the many park collaborators and observers who make this effort possible.**