Recent applications of continental-scale phenology data for science and resource management

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National Coordinating Office

The USA-NPN offers scientifically rigorous observation protocols, raw data with metadata, and other data products in support of science, research, and decision making.

We encourage you to explore and utilize these resources!

USA-NPN Mission

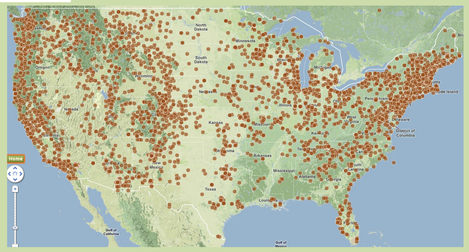
The USA-NPN—a network of scientists, resource managers, educators, and volunteer observers supported by a National Coordinating Office—serves science and society by collecting, organizing and distributing phenological data and information to stakeholders to aid decision-making and adaptation to variable climates and changing environments.

Online plant and animal phenology observation program

nature's notebook — A project of the USA-NPN

Scientifically vetted protocols for:

- 673 plant species
- 272 animal species



USA-NPN Observation Protocols

•Employ s*tatus* monitoring, characterized by repeated assessment of the status (presence vs. absence) of multiple phenophases of an individual or species over time

•Include standards for documentation of the degree to which a phenophase is expressed via animal *abundance* and plant phenophase *intensity* estimates

•Enable estimation of uncertainty in derived dates of onset and end of phenophases

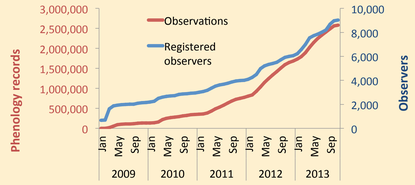
•Can capture multiple episodes of a phenophase within a single season

•Especially well-suited for integrated multi-taxa monitoring across broad spatial and temporal scales

From Denny et al. 2014, International Journal of Biometeorology

USA National Phenology Database

- **11,989 registrants at 13,423 sites**
- **26,127 organisms**
- **>3,990,000 data records**
- **FGDC-compliant metadata and documented methodology**
- **Data available for download: www.usanpn.org/results/data**
- **Summarized data and other data products coming soon!**



Improving predictions of vegetation change under future climate change scenarios

A research team from the U of Alaska-Fairbanks and USGS recently used data collected by participants in *Nature's Notebook* to more accurately predict vegetation growth under future climate change scenarios.

Leaf phenology data collection by species and across the varying Arctic landscape were critically important to these predictions.

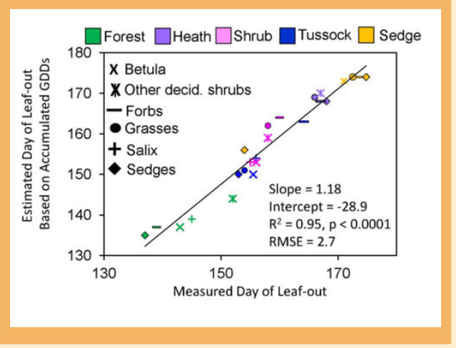


Figure 1. Measured mean day of leaf-out (Julian day) based on observational data versus the estimated mean day of leaf-out calculated using growing degree days for 5 plant functional types. Error bars represent the standard deviation. From Euskirchen et al. 2013.

Developing Spring Indices to evaluate impacts of false springs and extreme weather events

Using weather station data, a team of scientists affiliated with the USA-NPN has established relationships between accumulated spring-season warmth and leaf-out and flowering in plants nationwide.

These relationships, known as the Spring Indices (SI), can be used to assess the timing of spring across the nation for the current year as well as years past.

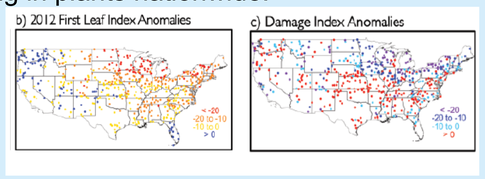


Figure 2. (b) Map of first leaf index anomalies (in days) with respect to the 1981-2010 climatology. (c) Values of the damage index with respect to the 1981-2010 climatology, which measures the anomalous number of days between the last freeze event date and the first leaf index date. From Ault et al. 2013.

Photo: Geoffrey M. Henebry

Using the SI, the team demonstrated that 2012 was the earliest spring over the continental U.S. on record. This team will continue to develop the Spring Index indicators in support of the US National Climate Assessment.

Developing models to predict leaf-out timing in deciduous trees

A team of researchers at Princeton University, led by David Medvigy, developed a nuanced model to predict the timing of leaf-out in the future. This team tested how well the model performed by comparing the predictions of leaf-out of deciduous trees from recent years to observations that *Nature's Notebook* participants had reported for the same species.

The team's projections suggest:

•By the end of the century, trees will leaf out in the spring up to a month or more earlier than they do presently

•Trees in northern latitudes will show a greater advancement than those in southern regions

Photo: Ellen G. Denny

•This will result in a shorter span of time between leaf-out in the south and the north than we currently experience (i.e., acceleration of the "green wave"), which could affect interacting plant and animal species as well as global carbon cycling.

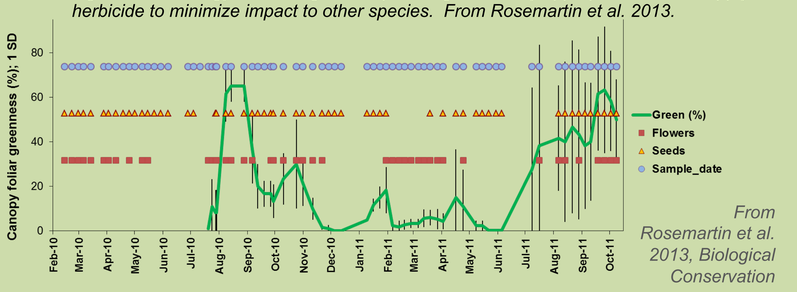
From Jeong et al. 2013, Geophysical Research Letters

Supporting decision-making in natural resource invasive species management

Buffelgrass, an aggressive non-native species, is spreading rapidly and introducing fire to the sensitive Sonoran Desert. Fires fueled by buffelgrass can be devastating to sensitive desert plants as well as adjacent homes and structures.

Herbicide is a preferred treatment option due to rugged and inaccessible terrain. Treatments should be scheduled to maximize buffelgrass greenness while minimizing damage to native species.

Figure 3. Phenology monitoring can help managers identify appropriate times to apply herbicide to minimize impact to other species. From Rosemartin et al. 2013.



From Rosemartin et al. 2013, Biological Conservation

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