

# Phenology Monitoring On Refuges: Alaska

## The USA-NPN/Refuge Partnership: A commitment to science-based management

Best management practices and refuge goals are driven by science; a thorough understanding of the biological, as well as ecological, needs of natural resources is key to effective resource management. One component of this understanding is phenology, the study of naturally occurring lifecycle events. If land managers are interested in removing invasive plants before they begin to reproduce, phenology can be used to find the best time to increase removal efforts. If naturalists are interested in knowing when particular bird species will be present in a region, phenology can help them plan their visit accordingly.

The US Fish & Wildlife Service's National Wildlife Refuge System has partnered with the USA National Phenology Network (USA-NPN) to document changes in phenology across the Refuge System. Refuges utilize the USA-NPN's scientifically-vetted, species-specific monitoring protocols, data management infrastructure, and data visualization tools to make comparisons in plant and animal phenology across refuges and surrounding areas. Since 2009, refuge staff and citizen scientist volunteers have collected over 170,000 observations on focal plants and animals at 22 refuges.



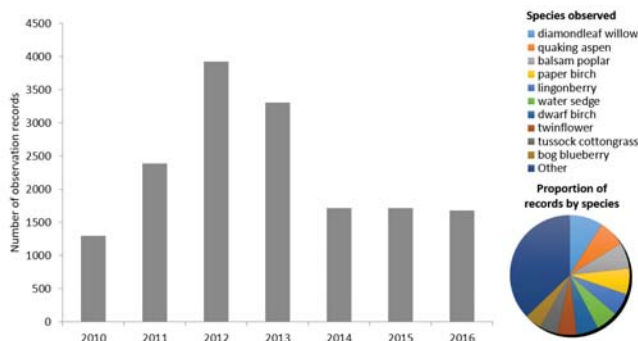
Phenological data can be used to improve our understanding of which climate cues and other external factors trigger key biological events such as migration and breeding, and the resulting impact on ecosystem dynamics such as water availability, carbon cycling, and disturbances such as fire and insect emergence.

## Nature's Notebook in Alaska

In 2010, the Arctic National Wildlife Refuge staff began collecting *Nature's Notebook* observations in regions around Alaska, rather than on the remote refuge, in order to contribute to the national monitoring effort and to observe potential ecological changes related to climate. Volunteers and Fish & Wildlife service staff from the refuge have since collected 16,019 observations on twenty-four different species across six different sites.

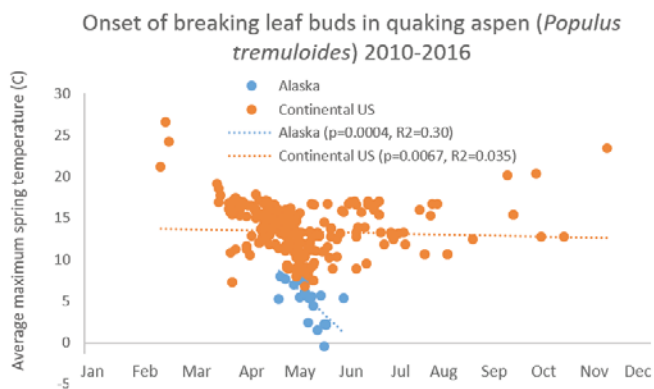
## Using *Nature's Notebook* in Alaska to look at patterns with climate: Diamondleaf Willow and Quaking Aspen

The diamondleaf willow (*Salix planifolia*) is an important food source for caribou, elk, beavers, and birds. By documenting the phenology of this species, we can better understand when leaves,



flowers, and fruits will be available for forage in areas around the Arctic NWR. On the graph below, we see that in 2015 and 2016, leaves emerged on willows starting in April. In 2015, the proportion of plants observed with leaves peaked in July, while in 2016, the proportion of reports of plants with leaves peaked in June.

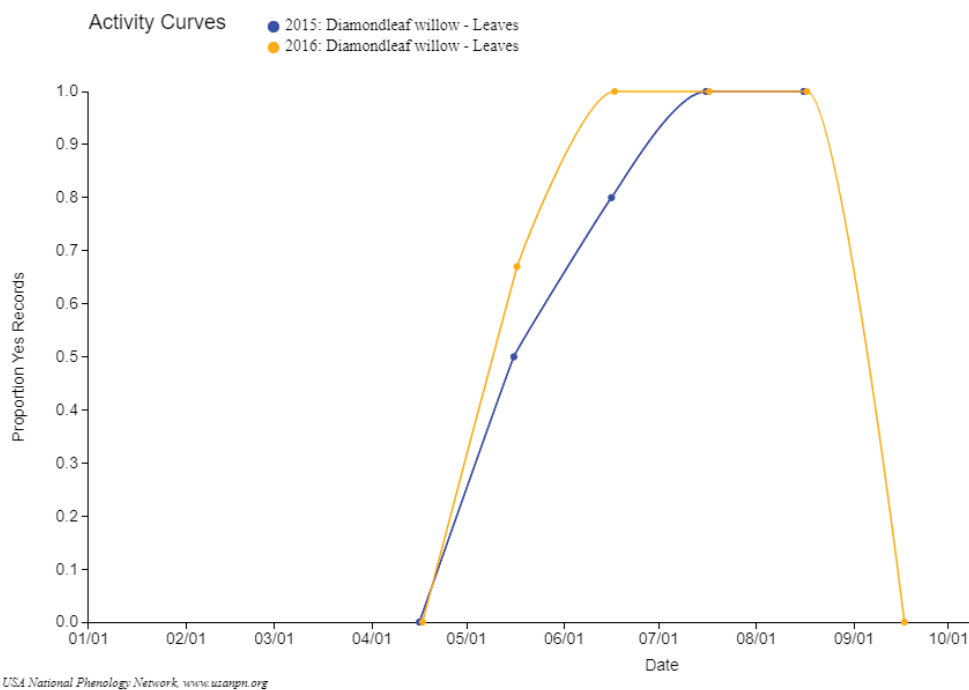
was chosen to be part of the USA-NPN's Greenwave Campaign, which tracks the spread of the onset of deciduous canopy trees across the US. These reports allow us to compare data collected by staff at the Arctic NWR to those from across the continental US.



By looking at the *Nature's Notebook* data from Alaska in combination with nation-wide efforts, we found a negative correlation between seasonal temperatures and onset of breaking leaf buds—suggesting that warmer years may lead to earlier onset in aspens. A shift to earlier leafing could alter the availability of food and shelter for wildlife on refuges and within the greater ecosystem.

The quaking aspen (*Populus tremuloides*) is an iconic tree generally found at elevations above 5,000 feet across the U.S. It is a food source and nesting habitat for wildlife including moths, caterpillars, butterflies, mammals and birds. The quaking aspen

Understanding how climate and phenology are interacting across the U.S. and around refuges is vital to natural resource management. *Nature's Notebook* provides an opportunity for refuges to involve staff and volunteers in science, as well as provides a framework to answer questions about climate impacts. With continued observations, *Nature's Notebook* can be implemented as a tool for community engagement and for tracking large-scale ecological changes, one observation at a time.



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