

## Grade Level

Grades 5-8

## Background

Ecosystems are biological communities of interacting organisms and their physical environment. An important ecosystem in Illinois, and surrounding states, are oak tree savannah ecosystems. “Oaks provide food and shelter for wildlife, perform valuable functions, and are a source of natural beauty for the enjoyment of the region’s residents. A lack of oak regeneration is paramount to the challenges that oak ecosystems face. Without age diversity in our oak population, we run the risk of losing this vital regional resource.” ([Oak Ecosystems Recovery Plan](#)). Initiatives in the field of phenology, the study of cyclic and seasonal natural phenomena, especially in relation to climate and plant and animal life, now allow for more advanced analysis of ecosystems such as oak tree savannah. For example, is climate change shifting phenophase observational data for trees such as oaks? What effects could early spring arrivals have on species dependent on oak trees? In this lesson, students have the opportunity to identify species interactions in an oak tree ecosystem, analyze phenology data, and describe causes and effects associated with phenological mismatches, the phenomenon of food and habitat being available at different times than those to which species are most recently adapted to.

## Key Words

Phenology, phenophase, ecosystem, ecological mismatch, climate change, citizen science

## Learning Objectives

1. Identify plant and animal species present in oak tree ecosystems.
2. Graph and analyze plant phenology data.
3. Draw conclusions about how climate and climate change affect plant phenology.

## Guiding Questions

1. What species are present in oak tree ecosystems, and how do they rely on one another?
2. What variables explain the differences in the arrival time of phenophases of oak tree species?

## Next Generation Science Standards

### MS-LS2-4 Ecosystems: Interactions, Energy, and Dynamics

- Students who demonstrate understanding can: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
- LS2.C: Ecosystem Dynamics, Functioning, and Resilience
  - Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.

## Resources

### Websites

- [Chicago Wilderness](#)
- [USA National Phenology Network](#)
- [Nature's Notebook](#)

### Primary Source Documents

- [Oak Ecosystems Recovery Plan](#), SUSTAINING OAKS IN THE CHICAGO WILDERNESS REGION, Funded by
- USDA Forest Service and US Fish & Wildlife Service Lead collaborators: Lake County Forest Preserve District & The Morton Arboretum
- [Climate change vulnerabilities within the forestry sector for the midwestern United States](#), white paper prepared for the U.S. Global Change Research Program National Climate Assessment Midwest Technical Input Report

## CONDUCTING THE ACTIVITY

### Time Required

One 90-minute or two 45-minute sessions

### Materials needed

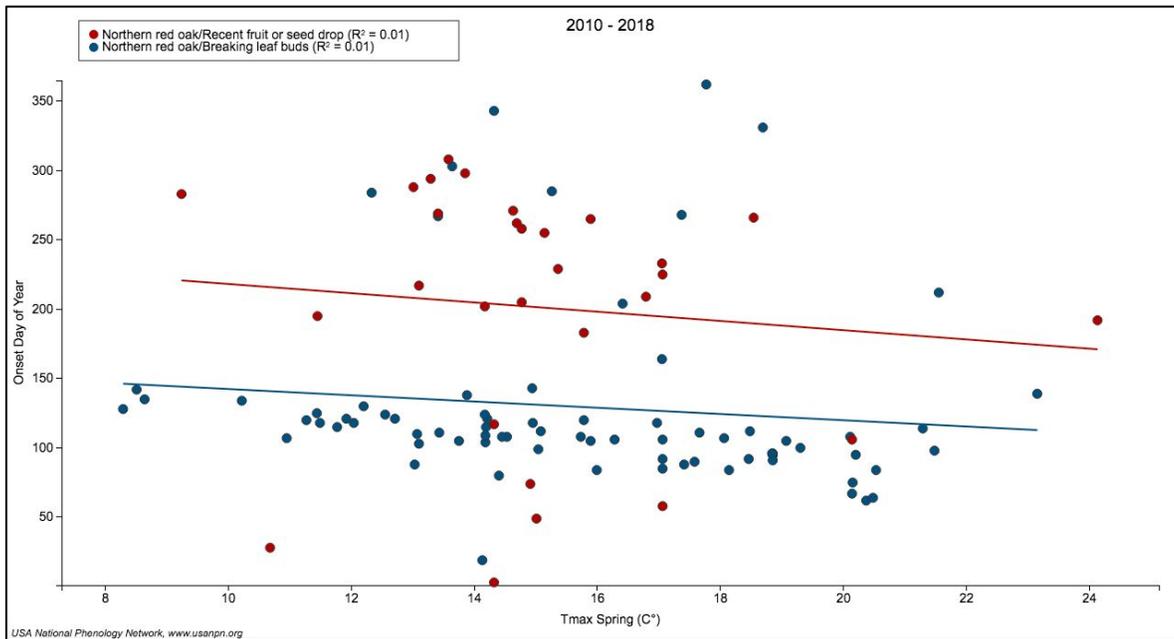
Computers

### ENGAGE (Connect to prior knowledge)

- Video - [Phenology and nature's shifting rhythms - Regina Brinker](#)
  - Solicit student reactions and questions to videos
  - Define ecological mismatches
- Question: Identify species-species dependencies.
  - Examples: <http://www.pbs.org/wgbh/nova/nature/population-ecology.html>

### EXPLORE (Hands-on learning)

- USA National Phenology Network Visualization Tool ([usanpn.org/data/visualizations](https://usanpn.org/data/visualizations))
  - Introduce Visualization Tool to students
  - **Activity** - Create a Scatter Plot showing onset of phenophases vs. Variables of Choice
    - Maximum Spring Temperature, Latitude, Precipitation, etc.
    - See example on next page
  - Evaluate and identify trends in first flowering dates for a selected species
  - Focus on local data and oak tree species



### **EXPLAIN (Listening and communicating understanding)**

- Allow students time to describe what they've learned
  - Write a summary explaining the potential effects of climate change (increasing temperatures, early spring onset, etc.) on an oak tree ecosystem.

### **EXTEND (Group projects, real world connections)**

- How can we apply this in our daily lives?
  - Produce a list of actions that may need to be considered in making future decisions.
    - Health of other ecosystems?
    - Personal gardening/pollinators?
    - Management practices associated with planting tree species?

### **EVALUATE (Summarize, check for understanding, assess)**

- [Phenology Quizlets \(quizlet.com/244985976/phenology-flash-cards/\)](https://quizlet.com/244985976/phenology-flash-cards/)
- Student Reflection