

Diverse approaches to engaging undergraduate students with real-world phenology data

Theresa Crimmins¹, Erin Grady¹, Emily Mohl², Kim Quillin³ & Tiffany Schriever⁴

¹USA National Phenology Network

² St. Olaf College

³ Salisbury University

⁴ Western Michigan University

GORDON AND BETTY
MOORE
FOUNDATION



 **USGS**
science for a changing world

USA npn 
National Phenology Network
usanpn.org



Phenology in the classroom

A great way to engage students in a hands-on way with climate change



Collect, Store, Share Phenology Data & Information

Informing
Decisions



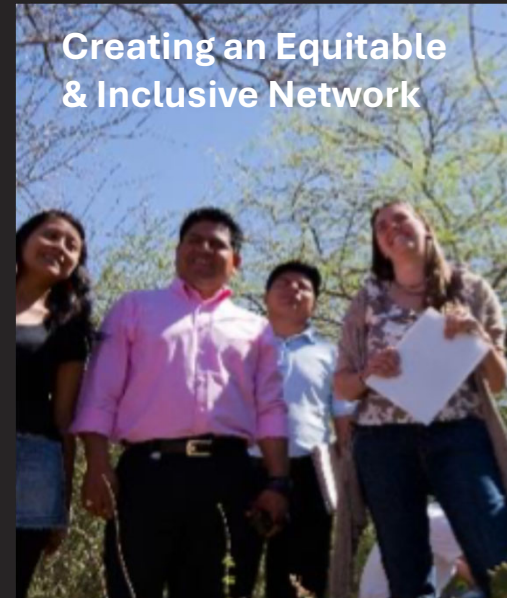
Advancing
Science



Communicating
& Connecting



Creating an Equitable
& Inclusive Network

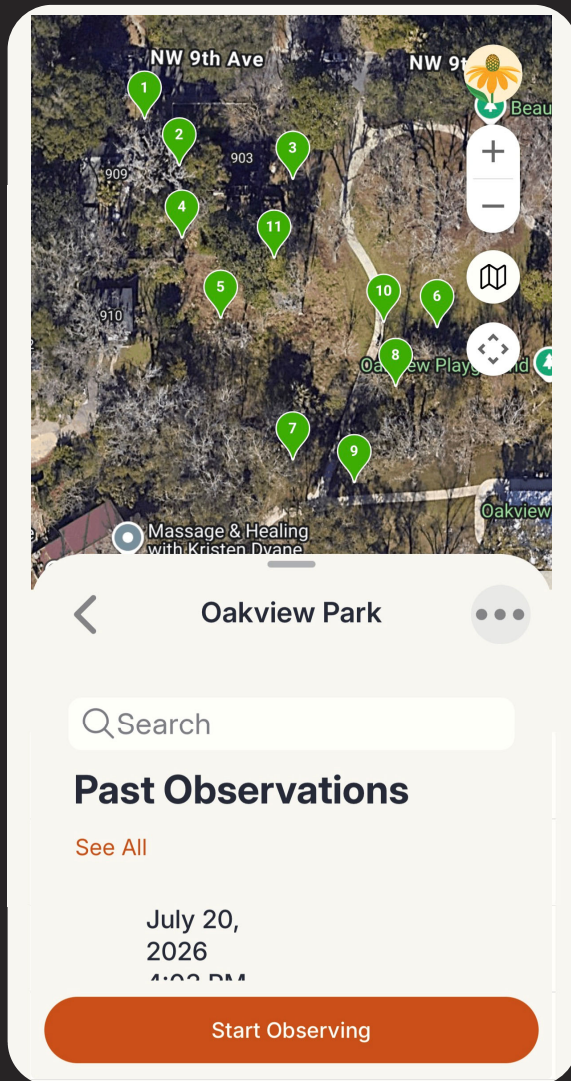




nature's notebook

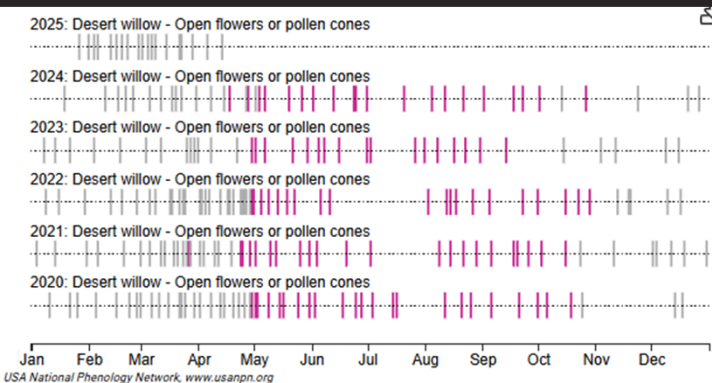
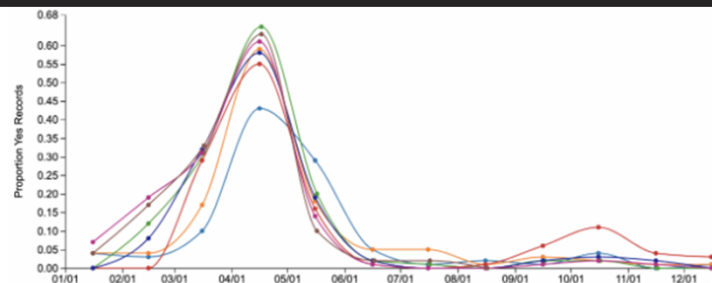
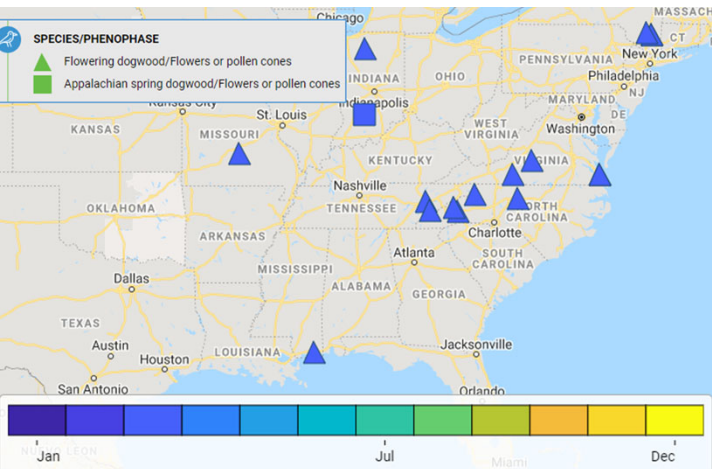
- Published observation protocols (Denny et al. 2014)
- 1900+ species of plants and animals
- Status & intensity/abundance

The screenshot displays the Nature's Notebook mobile application. At the top, a map shows several location pins. Below the map, a card titled 'Oak near fence' with the subtitle 'My Frontyard' is visible. The card has three tabs: 'PLANTS' (selected), 'ANIMALS', and 'VISIT DETAILS'. Under the 'PLANTS' tab, there is a date and time stamp 'Jan 12 5:46 PM'. Below this, a photo of a tree is shown next to the text 'Oak near fence valley oak' and the scientific name 'Quercus lobata'. To the right of the photo is a blue pin icon with the number '1'. Below the photo and text are four buttons: 'History', 'Definitions', 'Mark All No', and 'Clear'. Further down, the section 'Do you see...' contains two checkboxes. The first checkbox is for 'Breaking leaf buds' and the second is for 'Leaves'. Each checkbox has three response buttons: 'Yes', 'No', and 'Not Sure'. At the bottom of the screen, there are navigation arrows and a 'Finish' button.



Nature's Notebook relevant features

- Highly flexible
- Instructors can see students' observations
- Students can observe independently or in small groups
- Build a local, long-term phenology record
- Easy to navigate to plants
- Levels of observation complexity



Data access and visualization

- Data visualization tool
- Data query builder
- R package: *rnpr*



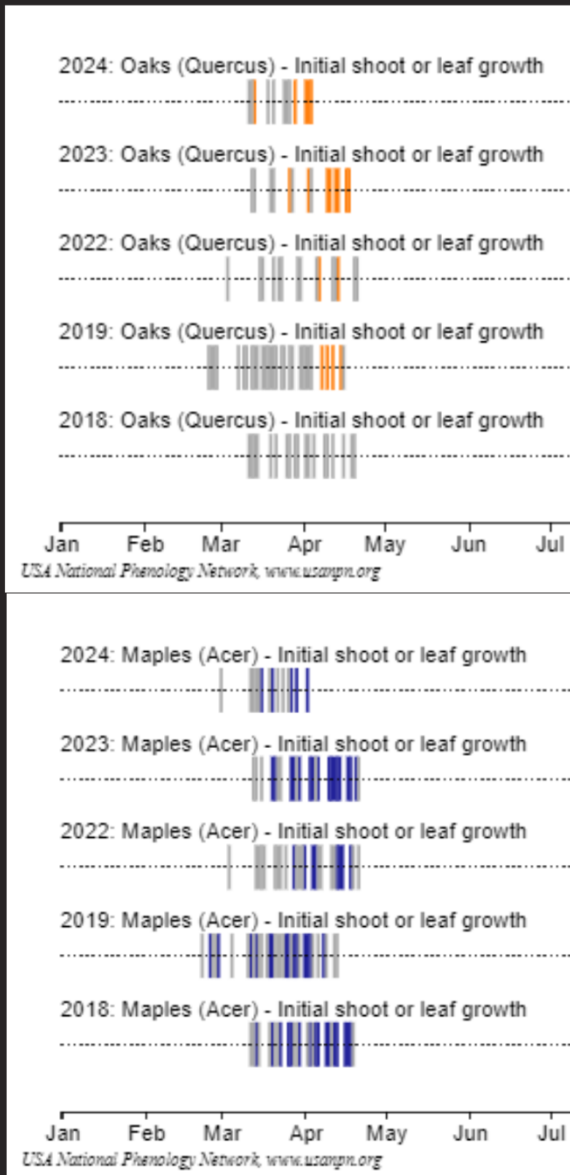
Case study 1: Western Michigan University

- Introductory-level biology course
- 6-week climate change unit
- Students track tree and bird phenology in teams
- Ask & answer questions of their own choosing

Case study 1: Western Michigan University

- Is the timing of leaf budbreak changing?
- Do younger trees leaf out earlier than older trees?
- Is bird activity related to daylength?
- Do native and non-native plants differ in their leaf-out timing?

Culminates in an oral presentation





Salisbury University Phenology Project map

Case study 2: Salisbury University

- Semester-long introductory-level (200 level) biology course
- Students work in teams, identify a question
 - Abiotic drivers
 - Urban heat island effect
 - Microclimate effects
- Culminates in poster presentations



Case study 2: Salisbury University

"It was fascinating to see how my local observations could play a part in broader scientific research"

"It was really cool to have my "own" tree to study and observe"

"Being part of the SUPP project made me feel as though I have a greater sense of purpose"





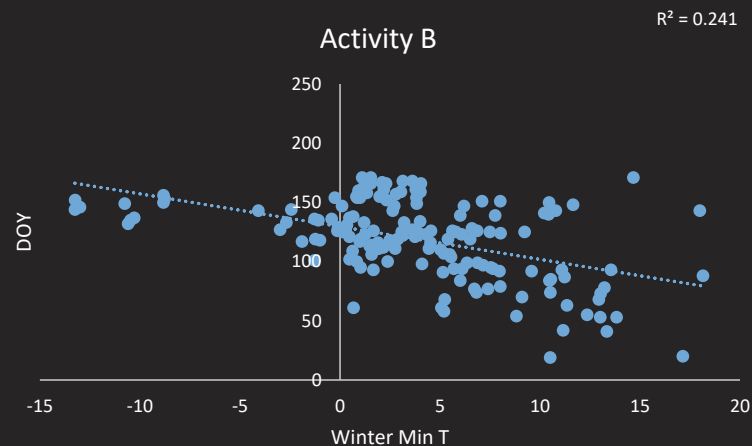
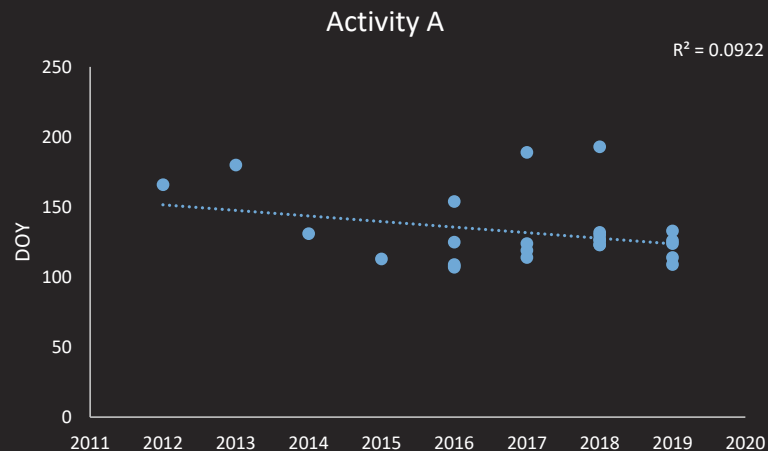
Corydalis ambigua
<https://www.flickr.com/people/15905103@N00>

Case study 3: St Olaf's College

- Focus is on data analysis and interpretation
- 3 activities, ~4h total (2-4 class periods)
- Scaffolds students to read scientific papers and interpret typical plots

Case study 3:

St Olaf's College



- **Activity A:** plot activity (DOY) over time (year)
- **Activity B:** plot activity (DOY) versus abiotic variables
- **Activity C:** repeat Activity B with data of own choosing – download, clean, and plot data from USA-NPN's Phenology Observation Portal (POP)



<https://www.neepix.com/photo/958969/bumble-bee-bumblebee-insect-flower-bumble-bee-bumble-bee-free-pictures-free-photos>

Case study 3: St Olaf's College

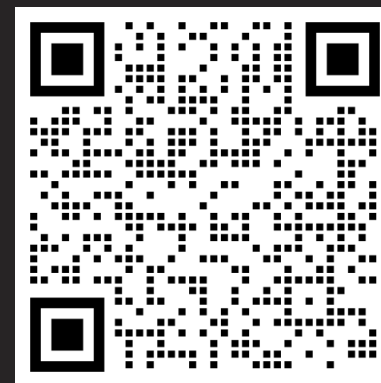
Insights:

- Data are messy; can be a challenge
- Phenology is a familiar and straightforward concept, and yet surprisingly complex
- A great way to engage students in hands-on work with large datasets



Further resources and opportunities

- Great flexibility to build phenology observing & analysis into courses
- Growing community of educators; growing number of resources





You're invited to our Phenology Meet Up!

Tuesday, August 4th

12:00-1:30pm

Sundeck Hospitality Suite 6339

Meet other researchers, educators,
students, and practitioners whose
work involves phenology

Bring your own lunch



Thank you

theresa@usanpn.org

Sign up for our
newsletters:



USA npn 
National Phenology Network
usanpn.org