

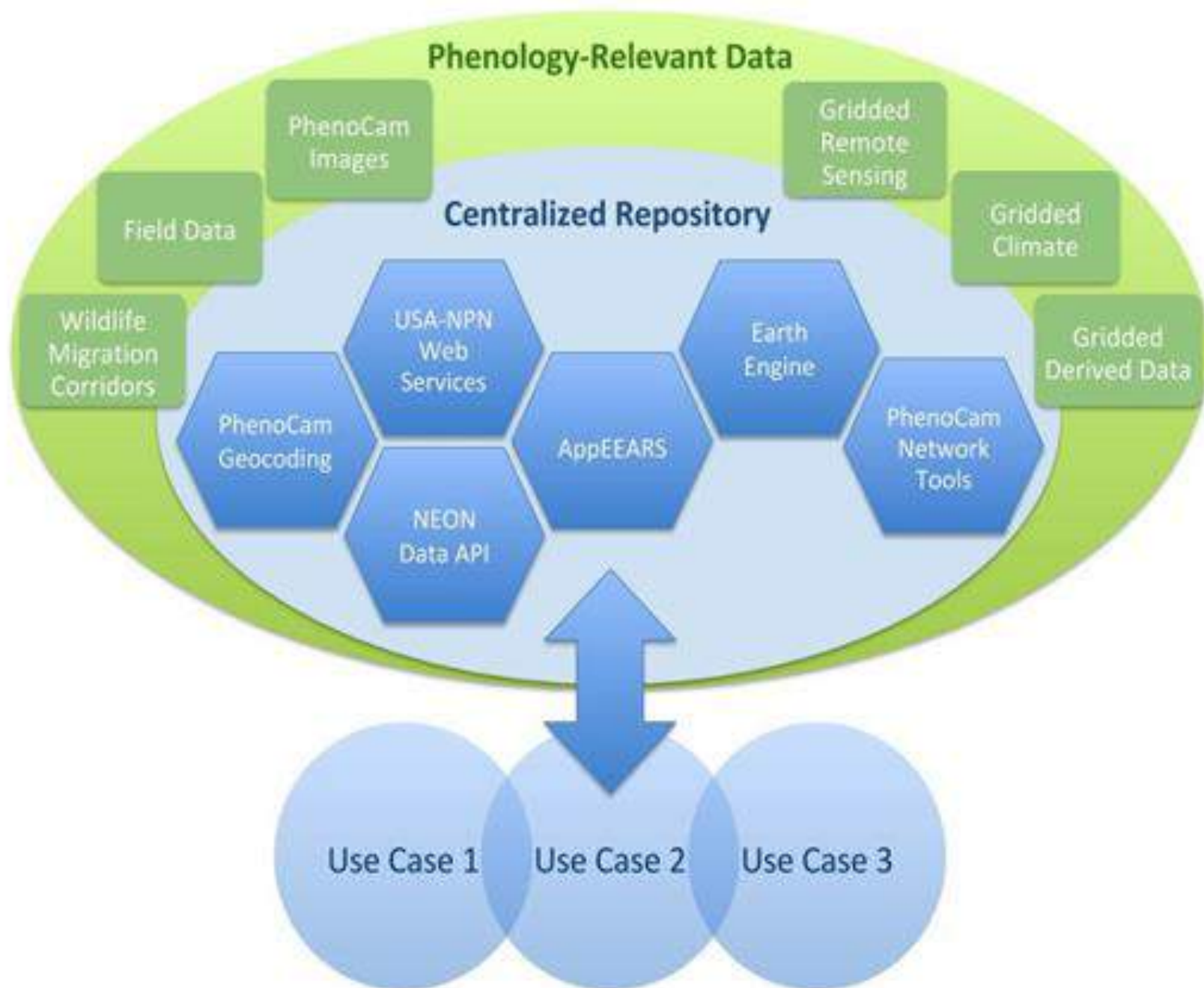
APIS: Advanced Phenological Information System

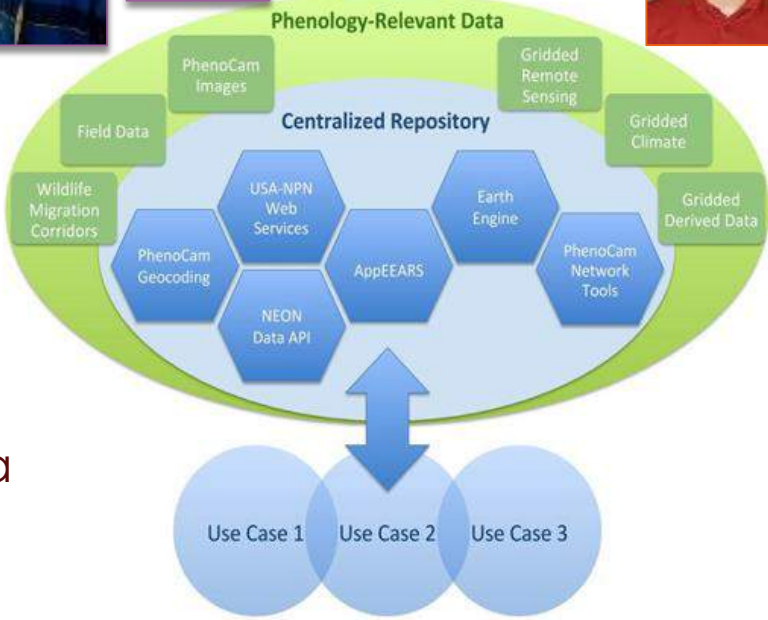
BY JEFF MORISETTE, KATHARYN DUFFY, KYLE ENNS, AND LEE MARSH
...AND THE APIS TEAM

TRAINING AND TUTORIAL SESSION
NASA BIODIVERSITY AND ECOLOGICAL FORECASTING TEAM MEETING
MAY 21-23, 2019
ARLINGTON, VA

Background

- ▶ There are currently several fairly advanced phenology-related datasets.
- ▶ But integration is currently lacking.
- ▶ So the APIS project is developing tools for more synthesis.





Kathy



Theresa



Jake



Lee



Colin



Andrew



Kyle



Katharyn



Luke



Dave

Background

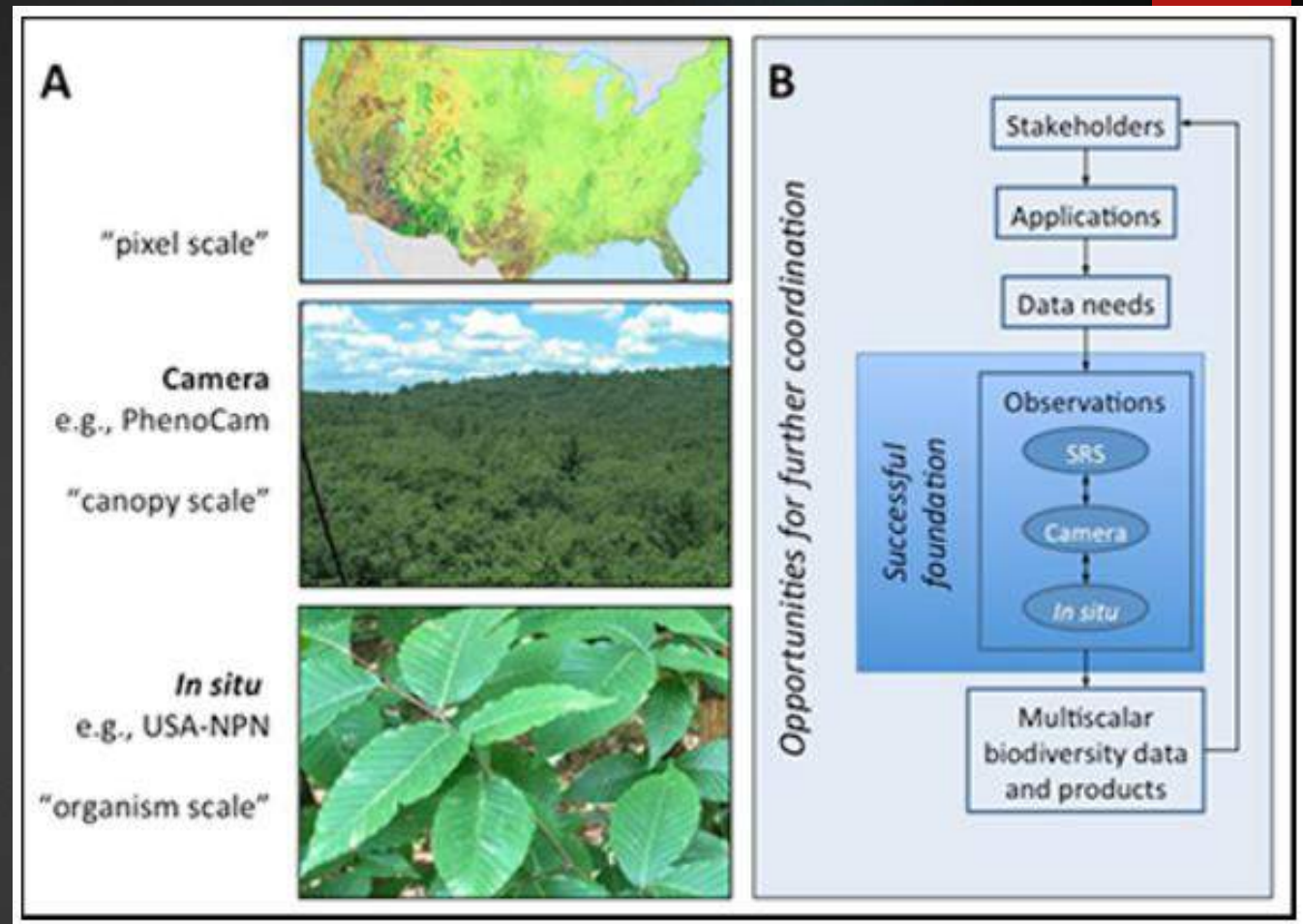
BIOGEOSCIENCES Meeting Report



Integrating Multiscale Seasonal Data for Resource Management

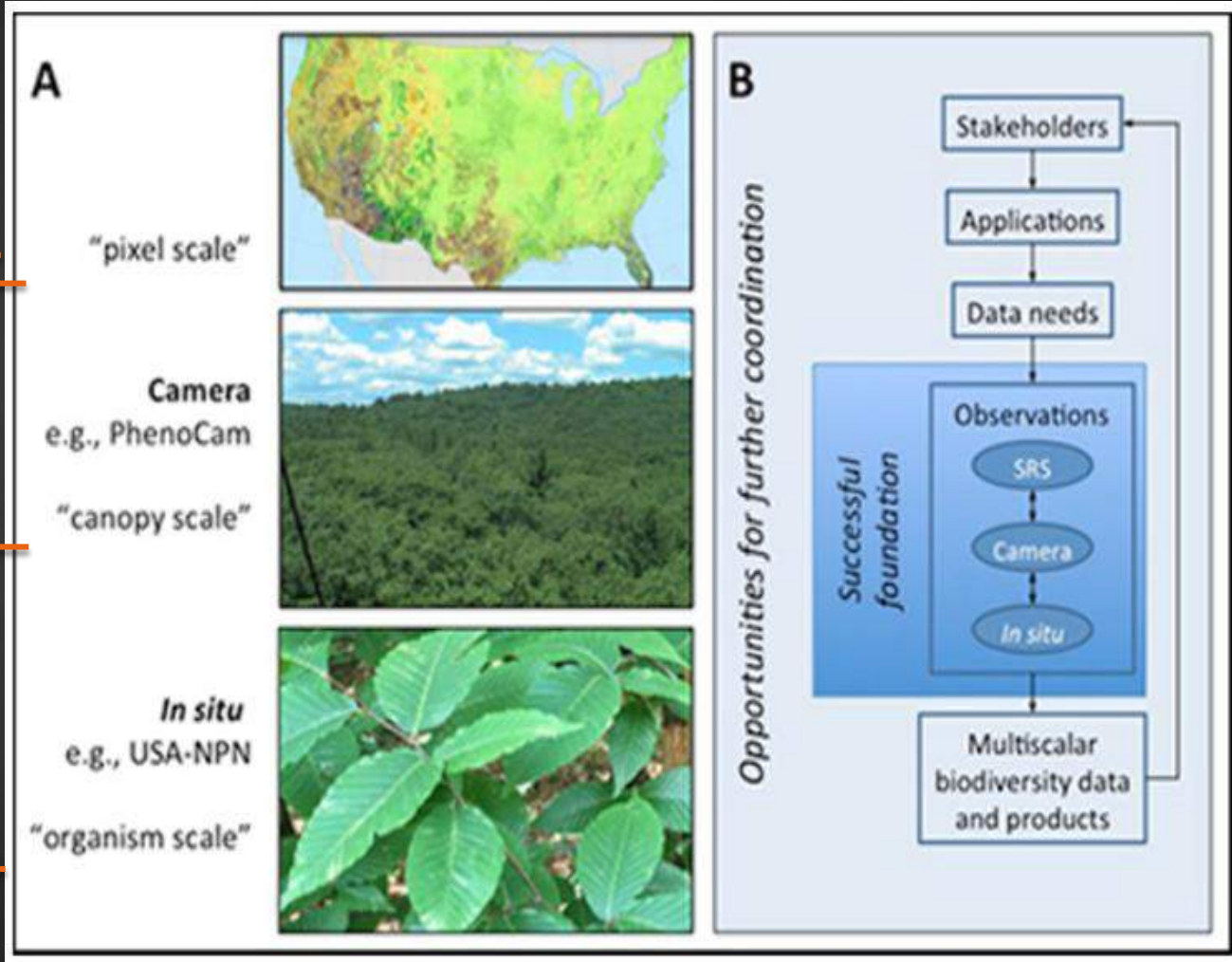
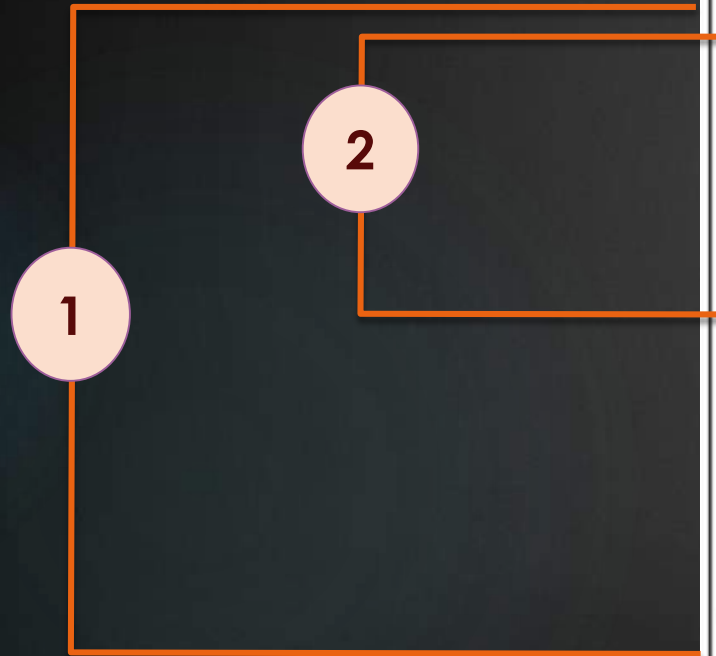
Workshop on Phenology at Scales from Individual Plants to Satellite Pixels; Cambridge, Massachusetts, 21–23 June 2016

Eos, 98, <https://doi.org/10.1029/2017EO065709>.



“Real-time phenological monitoring can contribute to improved management of ecological systems in the face of increasing climate variability and change.”

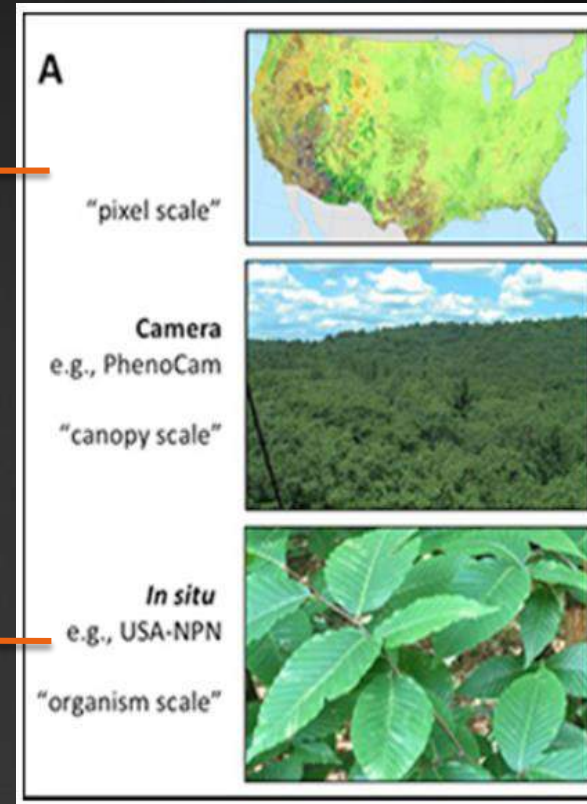
Today's tutorial



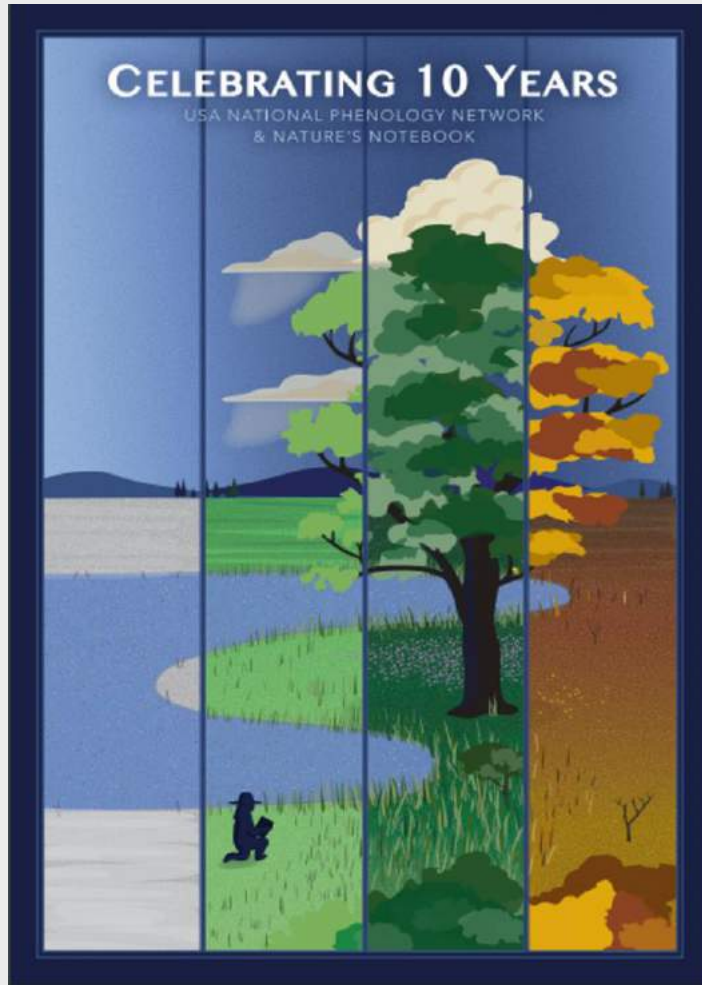
Use case 1

- ▶ using Nature's Notebook to record blooming dates
- ▶ using the USA NPN's visualization tool to associated field data with gridded products
- ▶ using r code to allow machine services to the USA NPN data and provide more customization and automation to the user's analysis

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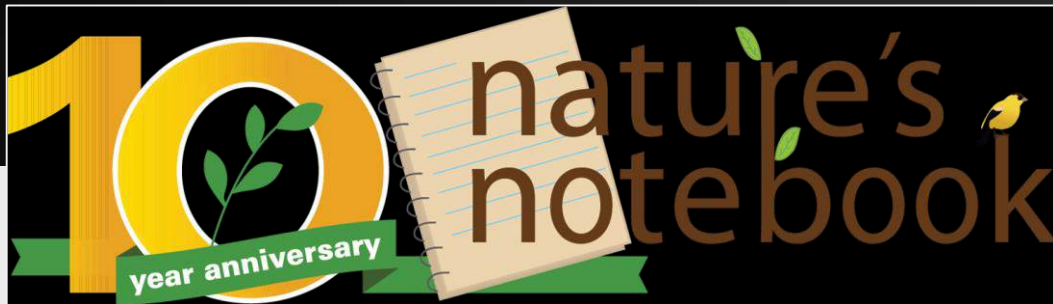


USA-NPN Mission

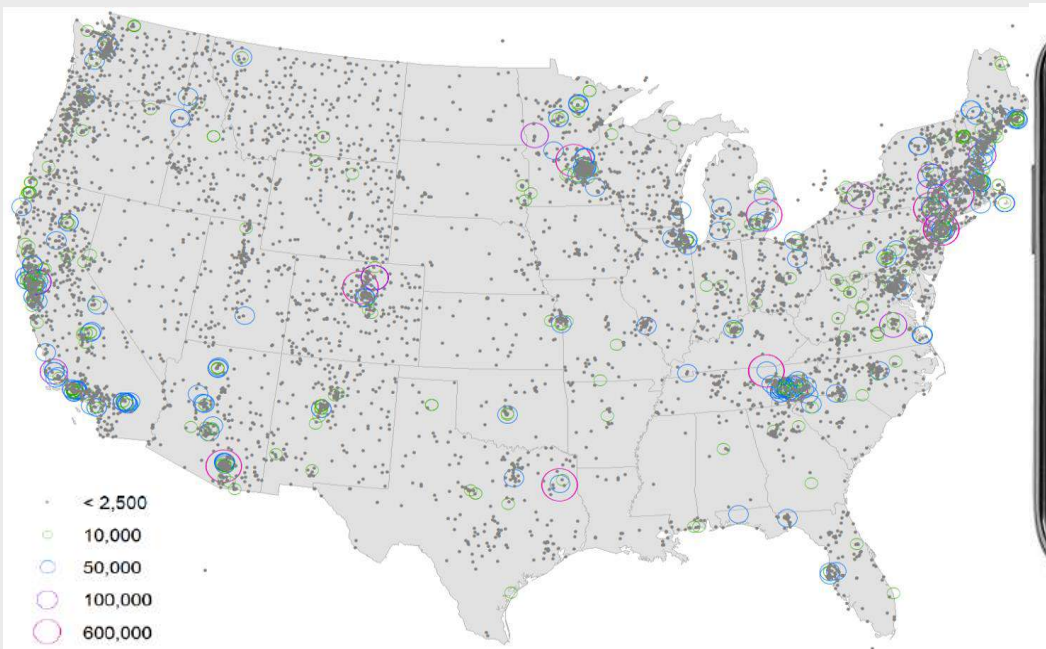


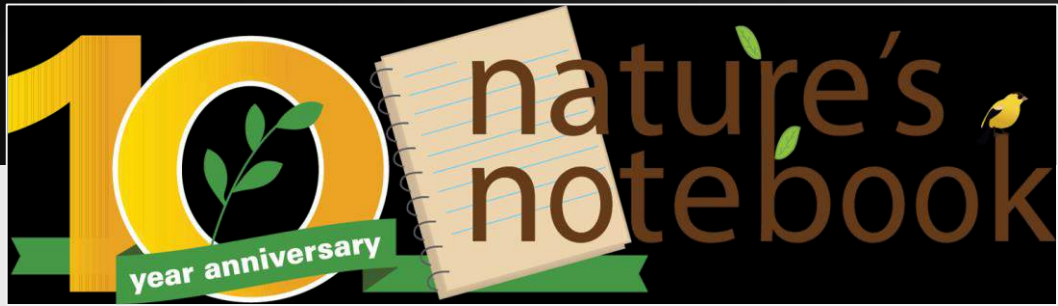
*Collect • Store • Share
Phenology data and information*

*Advance Science
Inform Decisions
Communicate & Connect*



- > 13,000 active observers
- > 11,000 active sites
- ~ 15 million records
- > 60 publications
- 68 data products





Do you see...	Date:
	Time:
Breaking leaf buds	y n ? ____
Leaves	y n ? ____
Increasing leaf size	y n ? ____
Colored leaves	y n ? ____
Falling leaves	y n ? ____
Flowers or flower buds	y n ? ____
Open flowers	y n ? ____
Pollen release	y n ? ____
Fruits	y n ? ____
Ripe fruits	y n ? ____
Recent fruit or seed drop	y n ? ____

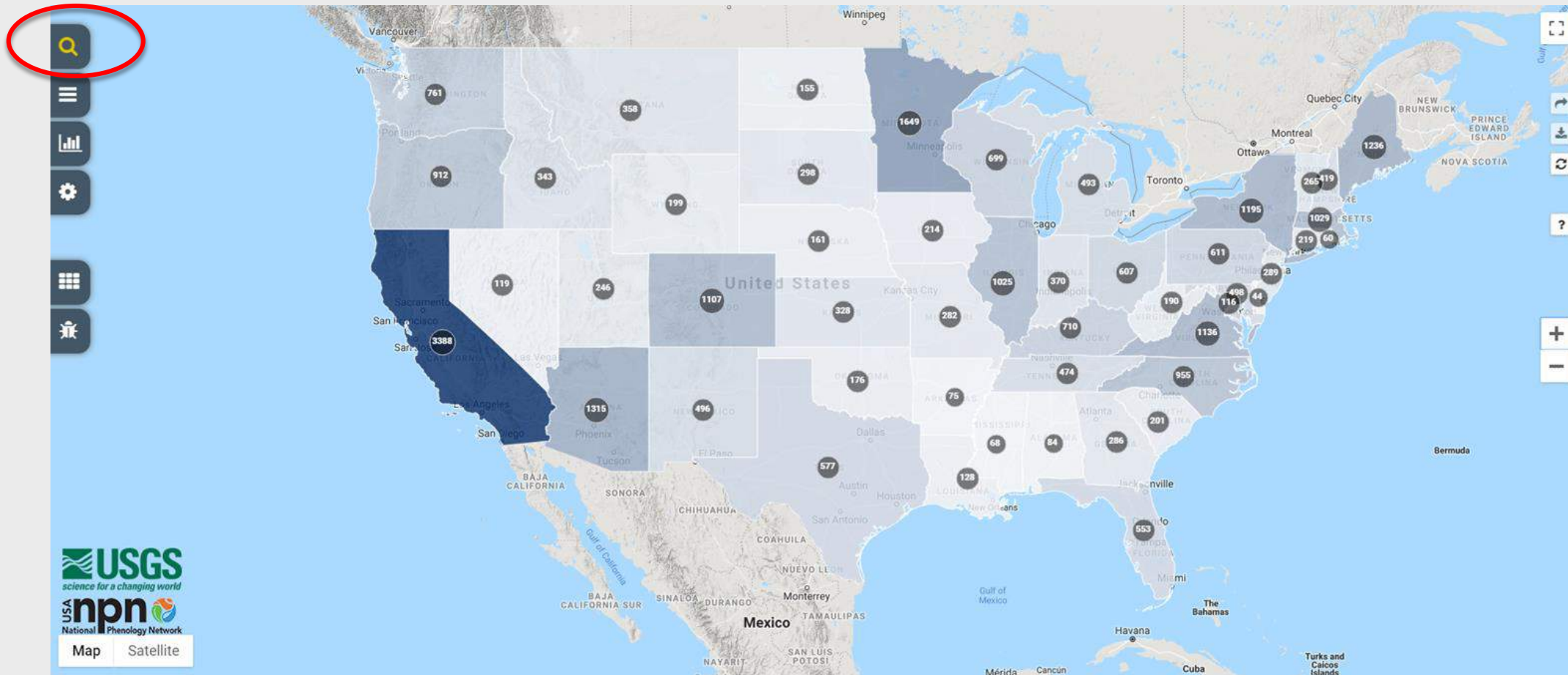


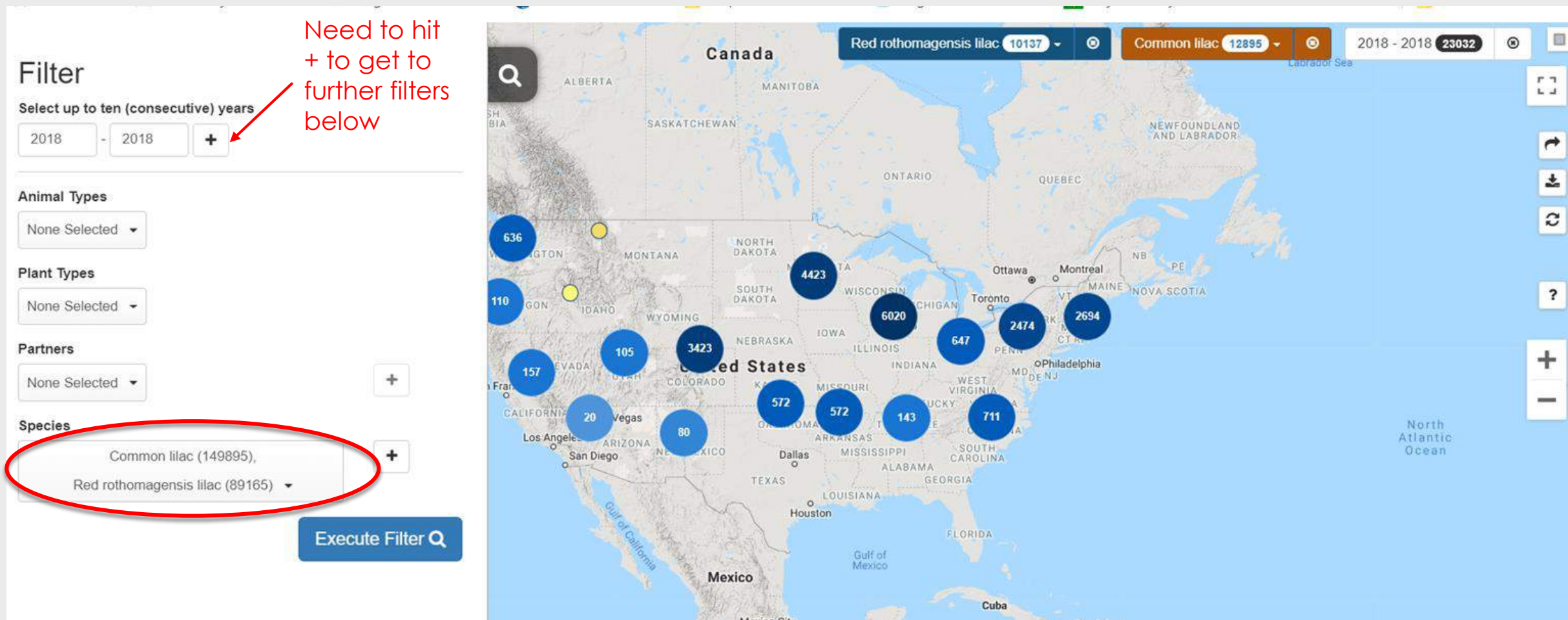
Start at www.usanpn.org
Select "Visualization Tool" from the
dropdown menu

DATA ▼

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The screenshot shows the USA-NPN website interface. At the top, there is a navigation bar with links for "USA-NPN Home", "Nature's Notebook Home", and "Help", along with a search box. The main navigation menu includes "ABOUT US", "PARTNER", "DATA", "PUBLICATIONS", and "NEWS AND EVENTS". The "DATA" menu is expanded, showing a list of options: "Explore Data", "Observational Data", "Models and Maps", "Visualization Tool", and "Data Quality". The "Visualization Tool" option is highlighted. Below the navigation, the breadcrumb "Home » Visualization Tool" is visible. The main content area features a map of North America with a green button labeled "GO TO VISUALIZATION TOOL" overlaid on it. The USA-NPN logo is prominently displayed on the left side of the page.





Visualizations

Scatter Plots

This visualization plots selected geographic or seasonal climatic variables against estimated onset dates at a site to region for individuals or sites for up to three species, phenophases or years.

Calendars

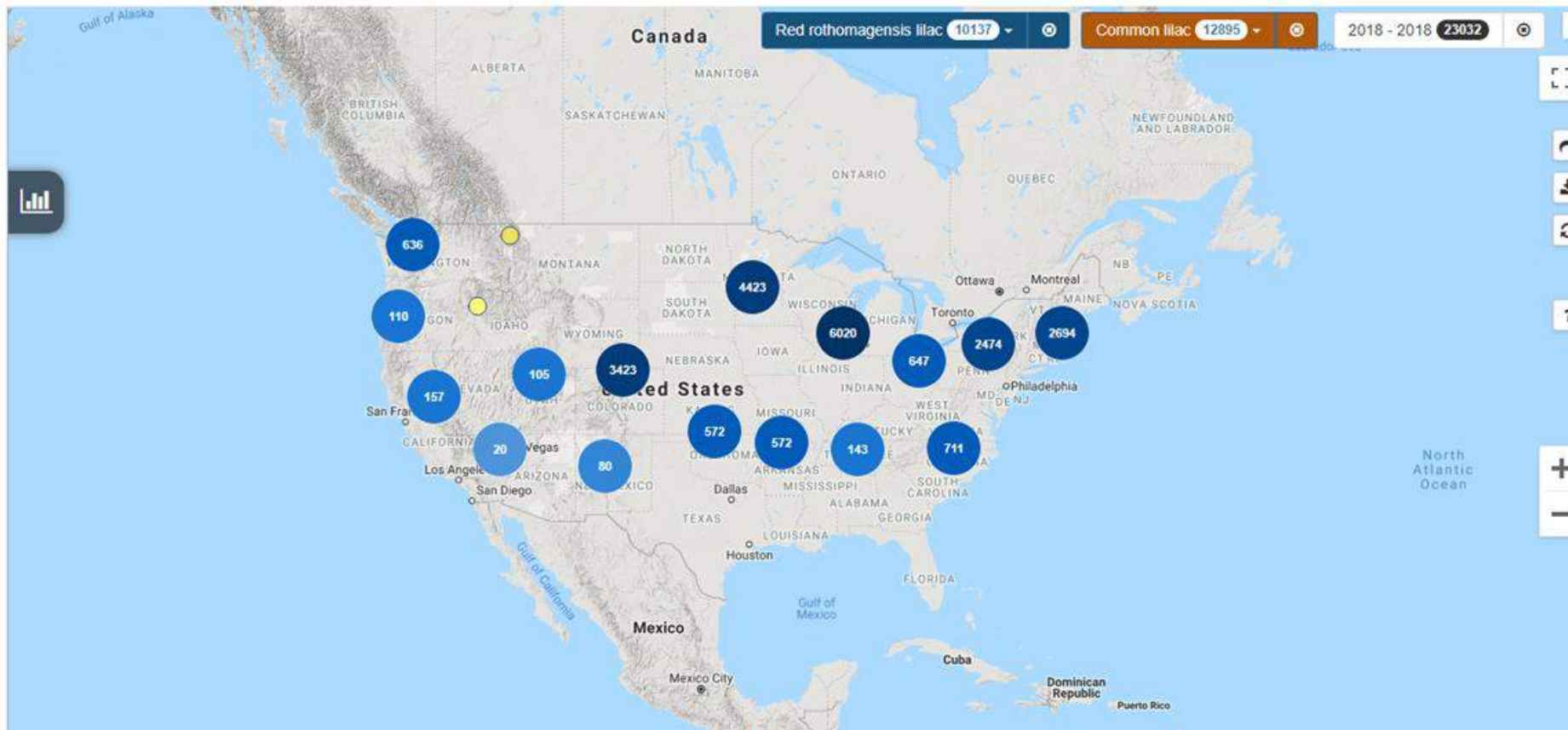
This visualization illustrates the daily timing of phenological activity for selected species and phenophases. Horizontal bars represent the annual patterns at a site to region for up to two years.

Activity Curves

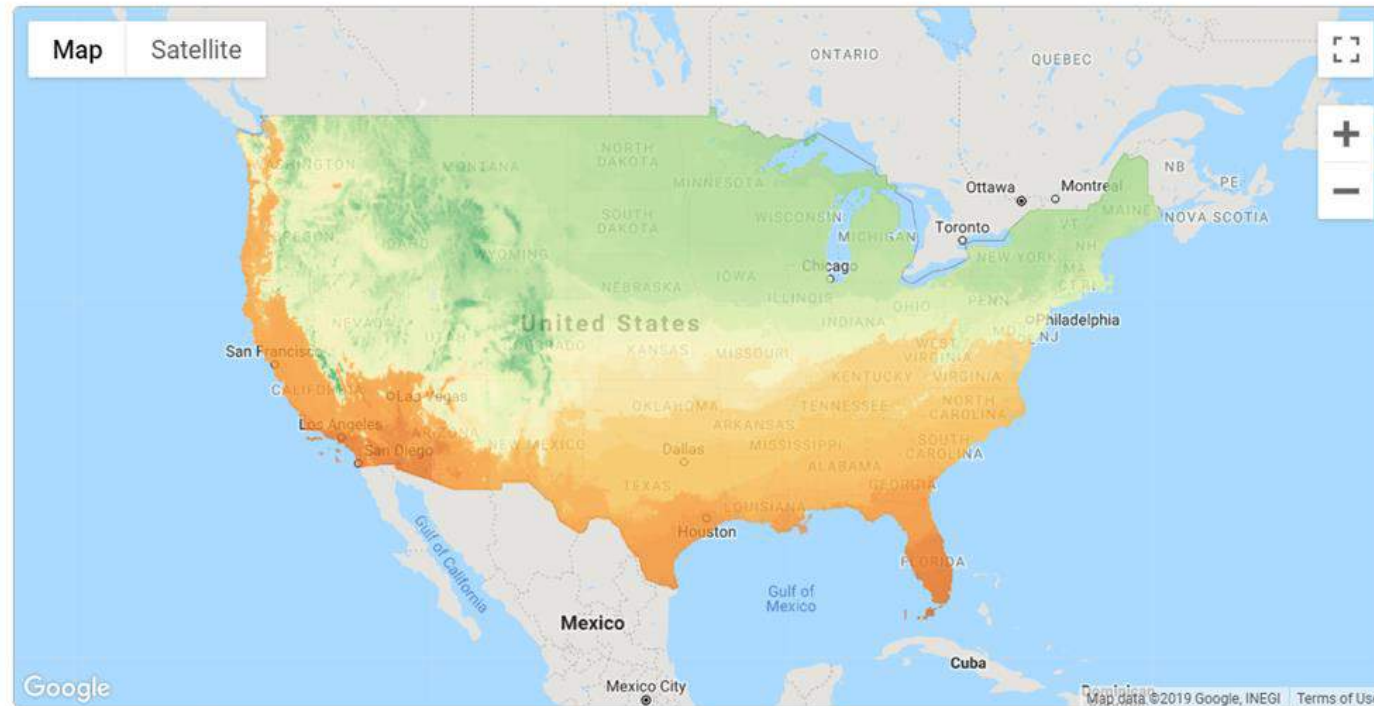
This visualization plots annual patterns of the timing and magnitude of phenological activity, based on proportion of "yes" records, animal abundances per hour and other metrics. Data are summarized at a weekly, biweekly or monthly scale for one or more sites, for up to two species, phenophases, or years.

Maps

This visualization on maps ground-based observations overlaid with USA-NPN phenology maps, including Accumulated Growing Degree Days and Spring Index models.



Phenology Maps



Select Gridded Layer

[More Info on Phenology Maps](#)

Category

Spring Indices, Historical Annual

Layer

First Leaf - Lilac

Year

2018

Opacity

0

75

100

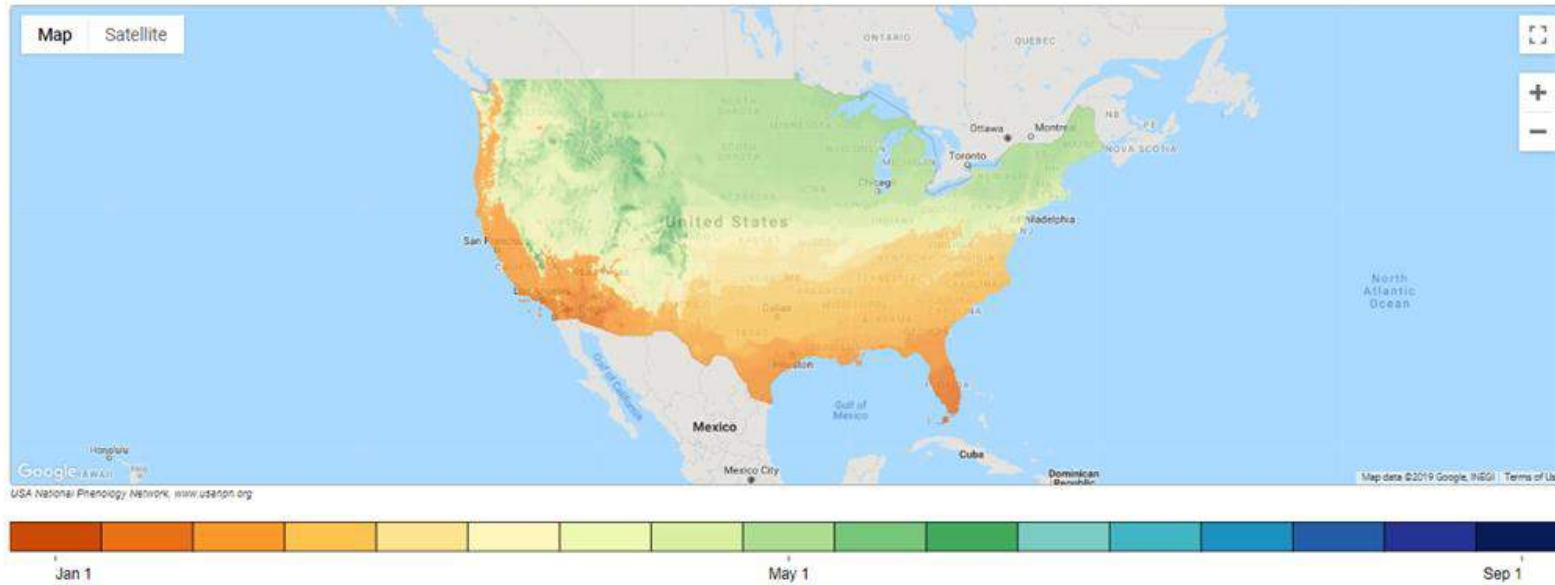
Range

Jan 1

Sep 1

This layer is an annual representation of the days of year that the requirements for the first leaf Spring Index were met for Red Rothomagensis lilac, available from 1981 to last year, calculated using PRISM Tmin and Tmax data. The Extended Spring Indices are models that predict the "start of spring" (timing of leaf out or bloom) at a particular location. Unless otherwise stated, all data, metadata and

Phenology Maps



Select Gridded Layer

More Info on Phenology Maps

Category

Spring Indices, Historical Annual

Layer

First Leaf - Lilac

Year

2018

Opacity

0

75

100

Range

Jan 1

0

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

This layer is an annual representation of the days of year that the requirements for the first leaf Spring Index were met for Red Rothomagensis lilac, available from 1981 to last year, calculated using PRISM Tmin and Tmax data. The Extended Spring Indices are models that predict the "start of spring" (timing of leaf out or bloom) at a particular location. Unless otherwise stated, all data, metadata and related materials are considered to satisfy the quality standards relative to the purpose for which the data were collected. Although these data and associated metadata have been reviewed for accuracy and completeness and approved for release by the U.S. Geological Survey (USGS), no warranty expressed or implied is made regarding the display or utility of the data on any other system or for general or scientific purposes, nor shall the act of distribution constitute any such warranty.

Plot Observed Onset

Species

Red rothomagensis lilac

Phenophase

Breaking leaf buds

Year

2018

+

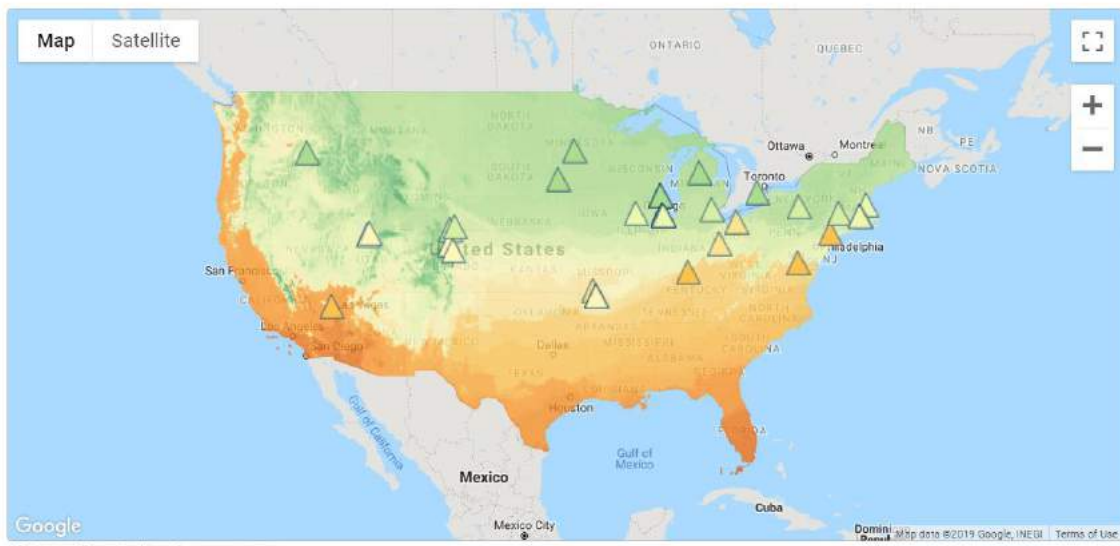
Plot data

Need to hit + to get to further filters below

Then, select "Plot Data"

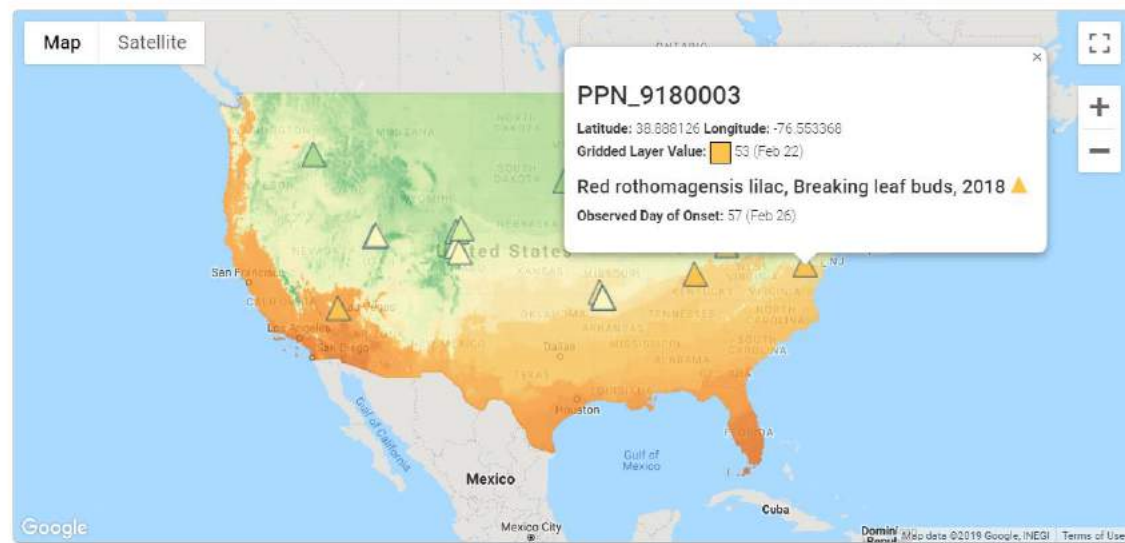
Phenology Maps

Multiple Observations Reported at this Location  Red rothomagensis lilac, Breaking leaf buds, 2018  



Phenology Maps

Multiple Observations Reported at this Location  Red rothomagensis lilac, Breaking leaf buds, 2018  



Go to r package demo...

(r code provided to meeting participants)

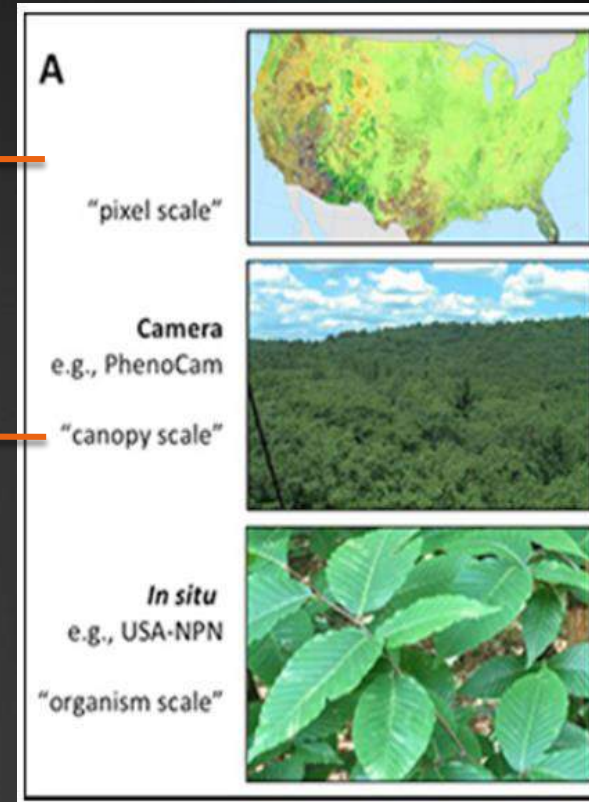
- Easily integrate NPN ground-based observation records and phenometrics into analyses using robust, and fully customizable search parameters.
- Stream incoming data results directly to file for easier management or large data sets.
- Direct integration between raster data products, including remote sensing variables, and NPN ground-based observation data

Use case 2

- ▶ Brief overview of the Phenocam Network
- ▶ Tutorial on the PhenoSynth r-shiny app to view and analyze coincident phenocam and MODIS time series data.



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The PhenoCam Network

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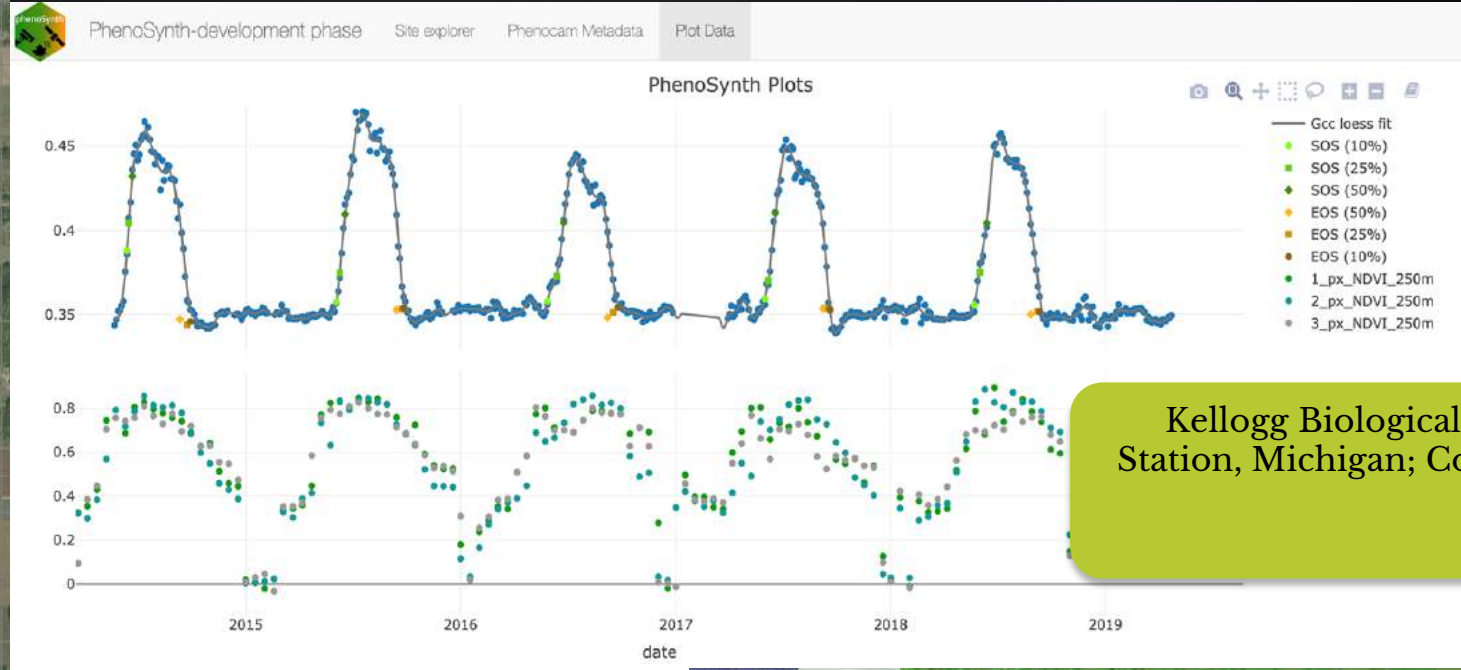
The image displays the PhenoCam website interface. At the top, the title "PhenoCam Site Map" is followed by navigation tabs: "About", "Gallery", "Map", "FAQ", "Tools", "Data", "Site Table", and "Education". Below the navigation is a "Site Filters" section. The main feature is a world map with colored circles indicating the locations of 400+ cameras, with numbers like 18, 6, 170, 302, 39, 12, 22, 8, 14, and 2. To the right of the map is a gallery of nine images labeled a through i, showing diverse landscapes: a) arid scrubland, b) dense green forest, c) open grassland, d) forest with a lake, e) autumn forest, f) cornfield, g) grassland, h) snowy mountain landscape, and i) urban area with trees.

A network for over 400 near-surface remote sensing cameras acquiring hyper-temporal resolution

Go to phenosynth demo...

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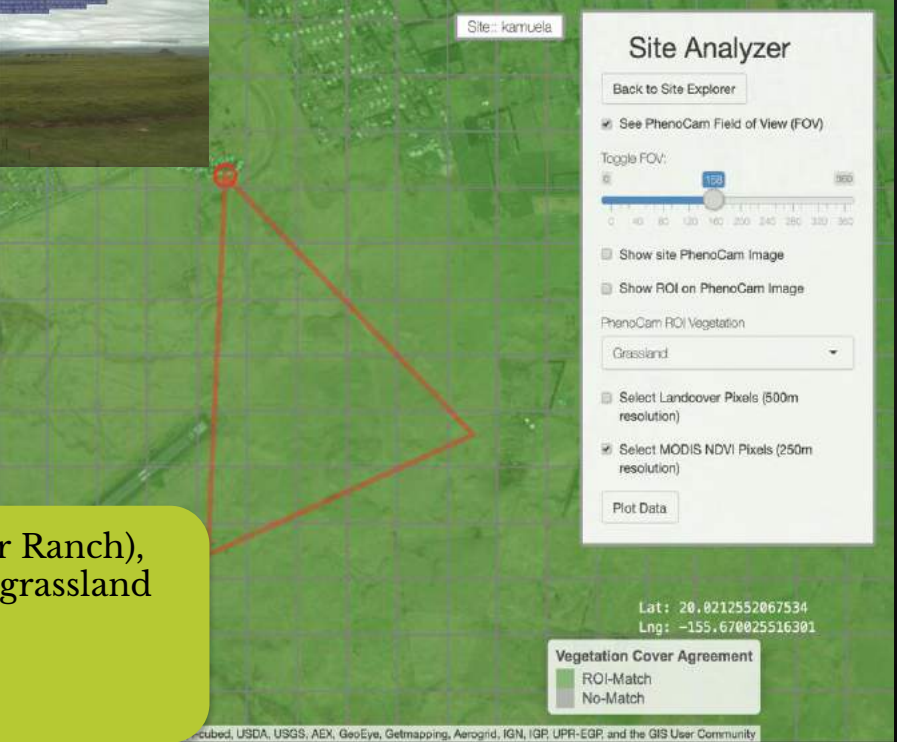
<http://phenocam.nau.edu/phenosynth/>



Kellogg Biological Station, Michigan; Corn



Kamuela (Parker Ranch), Hawaii; tropical grassland



Contacts:

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rNPN package
Lee Marsh
lee@usanpn.org

Phenosynth
Katharyn Duffy Woods
kdw223@nau.edu
and
Kyle Enns
kenns@usgs.gov

Jeff Morisette, jeffrey_morisette@ios.doi.gov, 970-787-0008.