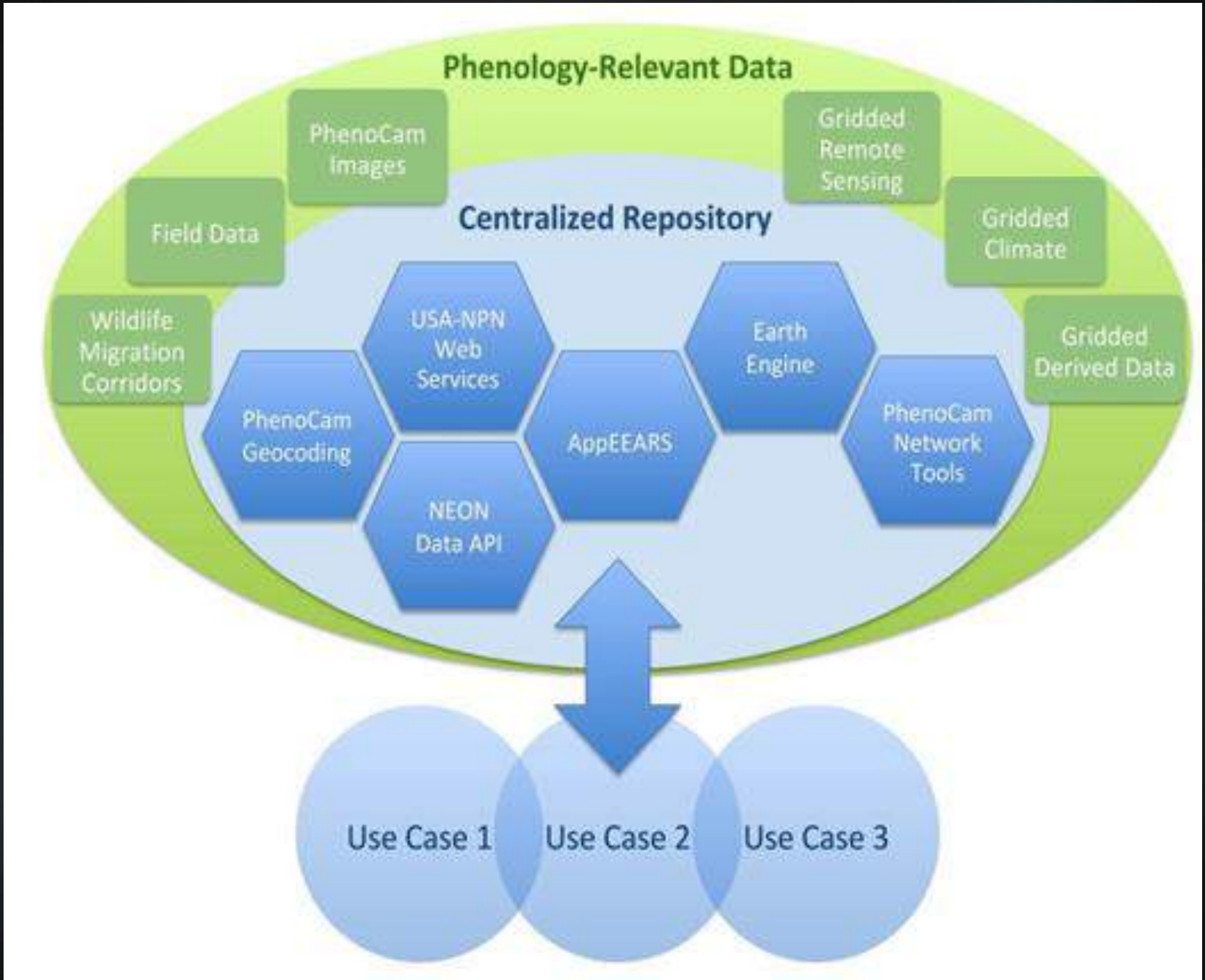
APIS: Advanced Phenological Information System

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.


Phenology-Relevant Data
PhenoCam Images
Gridded Remote Sensing
Field Data
Gridded Climate
Wildlife Migration Corridors
Gridded Derived Data
Centralized Repository
USA-NPN Web Services
Earth Engine
PhenoCam Geocoding
AppEEARS
PhenoCam Network Tools
NEON Data API
Use Case 1
Use Case 2
Use Case 3

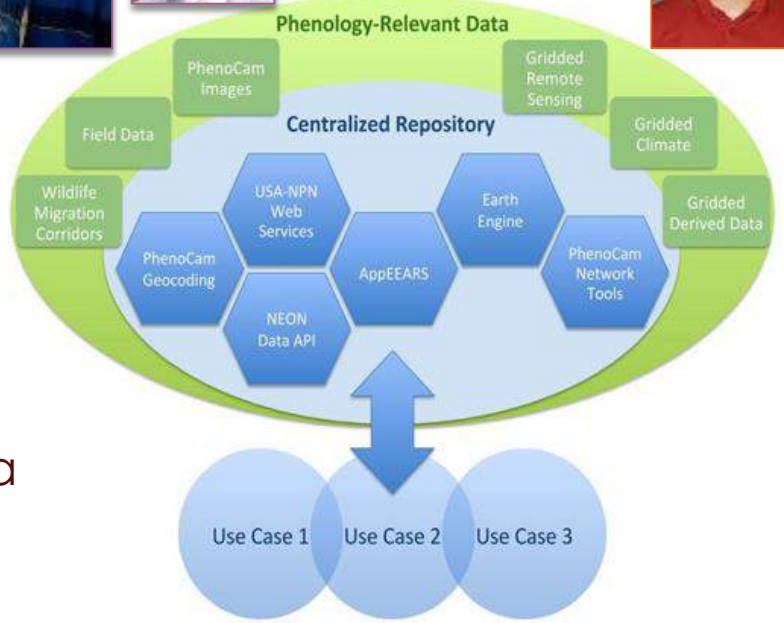
Jeff 

Brian 

Tom 

Bobbi Jo 

Aaron 



Kathy

Theresa

Jake

Lee

Luke

Dave

Colin 

Andrew

Kyle 

Katharyn

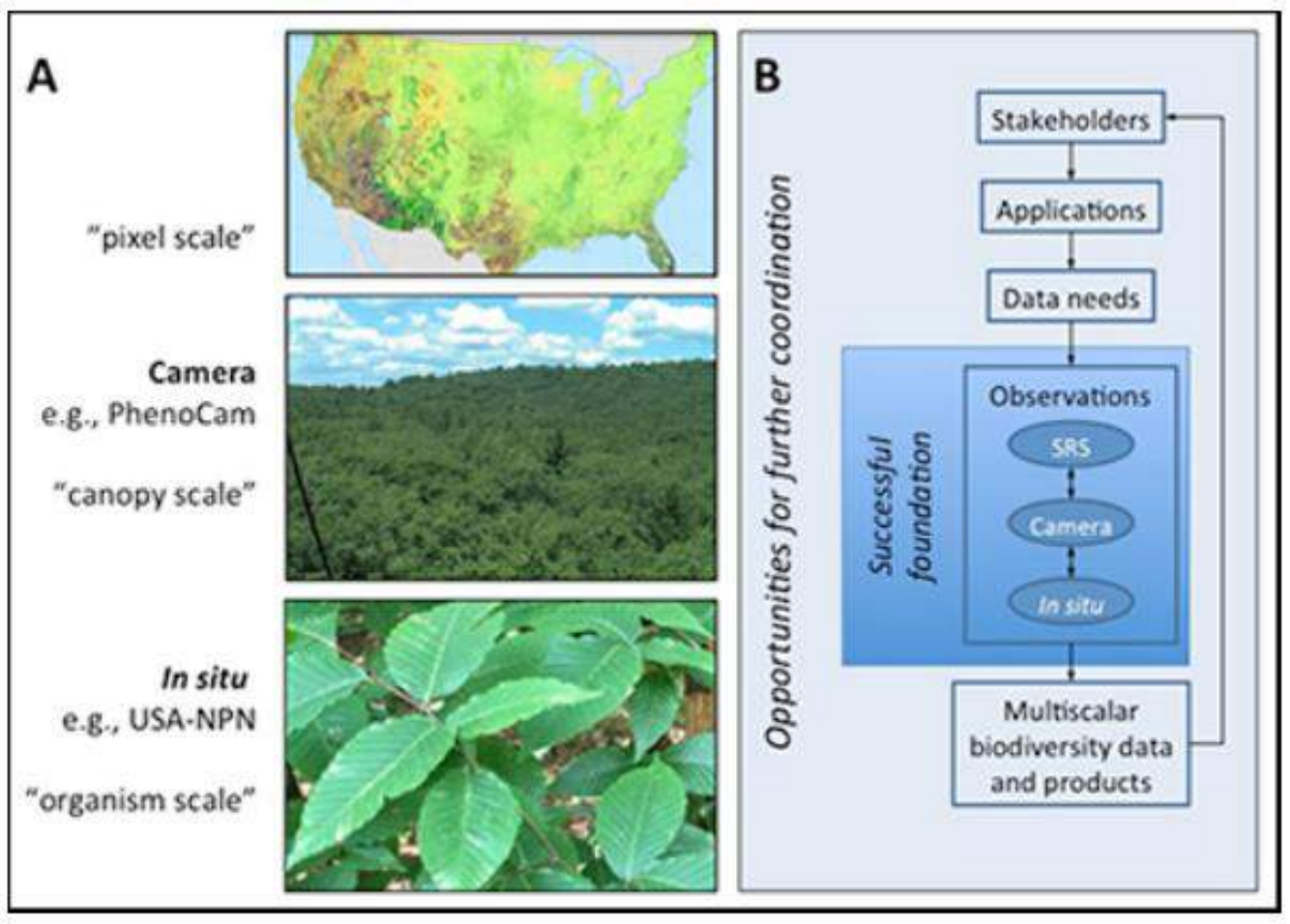
Background

BIOGEOSCIENCES Meeting Report

Integrating Multiscale Seasonal Data for Resource Management

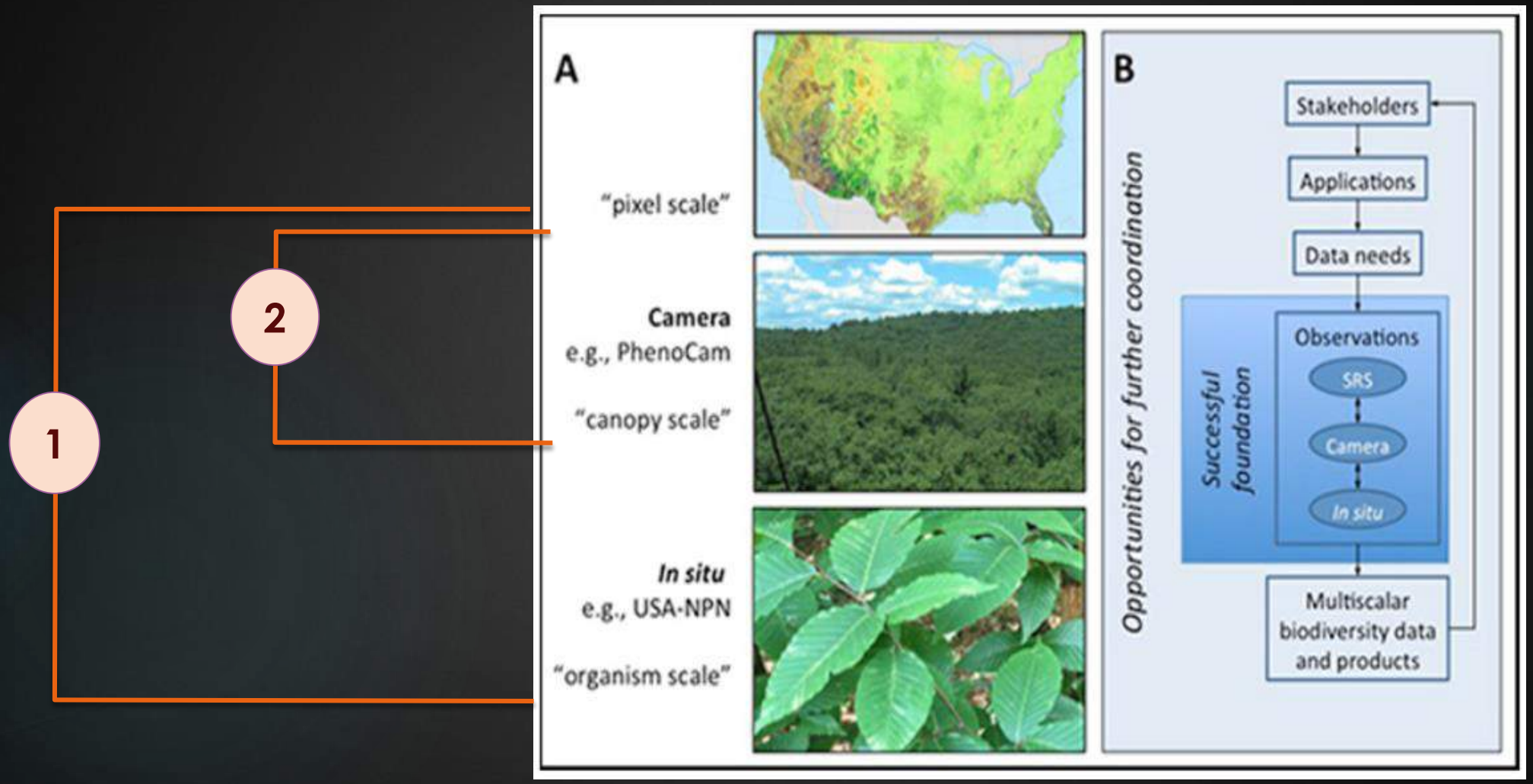
Workshop on Phenology at Scales from Individual Plants to Satellite Pixels; Cambridge, Massachusetts, 21–23 June 2016

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."

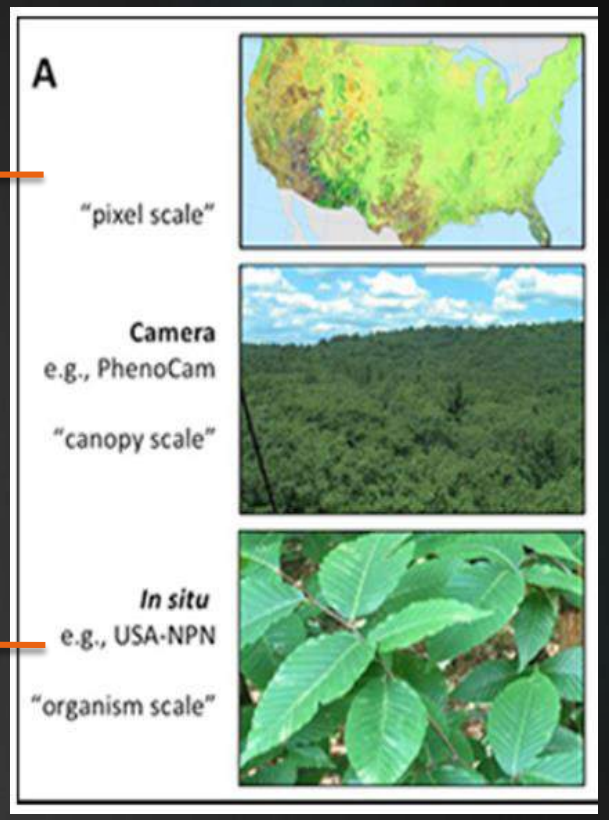
Today's tutorial



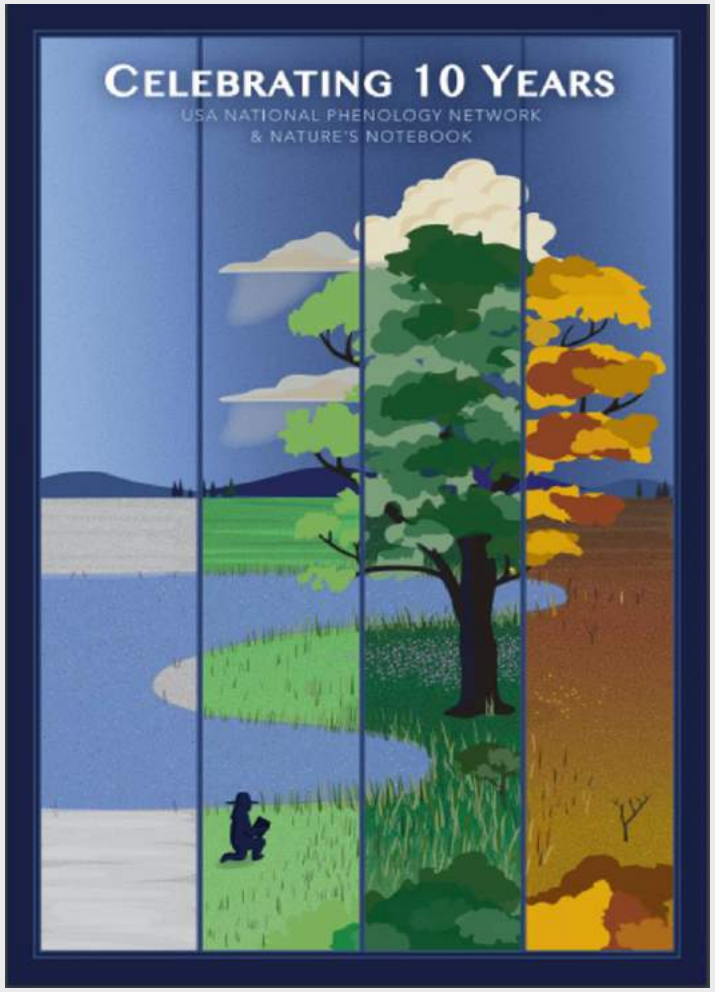
Use case 1

- 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

1



USA-NPN Mission



Collect • Store • Share
Phenology data and information

Advance Science

Inform Decisions

Communicate & Connect

10 year anniversary nature's notebook

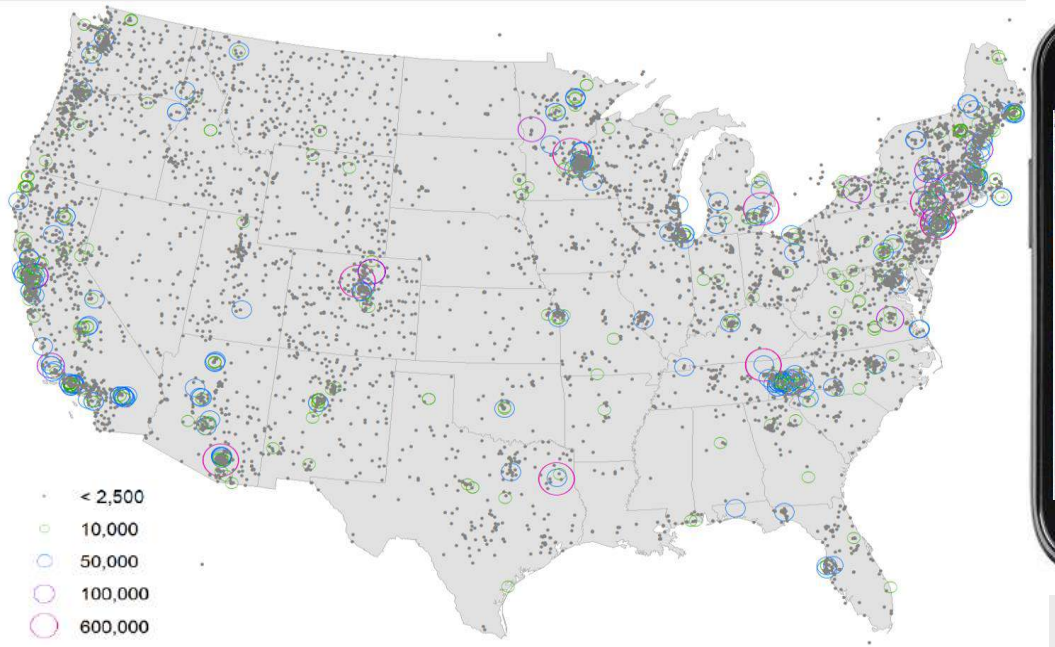
> 13,000 active observers

> 11,000 active sites

~ 15 million records

> 60 publications

68 data products



nature's notebook

10 year anniversary






	Date:
Do you see...	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

USA-NPN Home | Nature's Notebook Home | Help

SEARCH

USA npn National Phenology Network

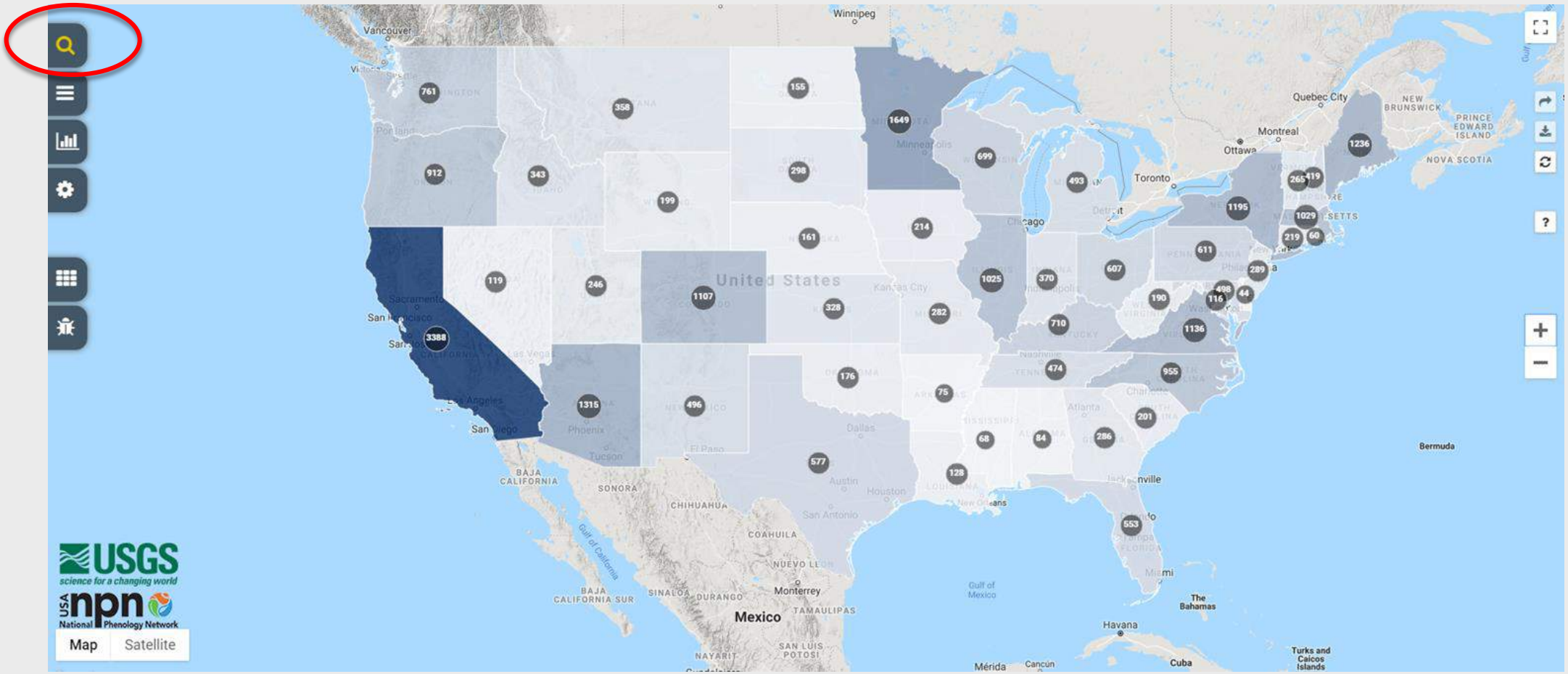
ABOUT US | PARTNER | DATA | PUBLICATIONS | NEWS AND EVENTS

Home » Visualization Tool

VISUALIZATION TOOL

Data

- Explore Data
- Observational Data
- Models and Maps
- Visualization Tool
- Data Quality


Winnipeg
Vancouver
Quebec City
Montreal
Ottawa
Toronto
Chicago
United States
Mexico
Monterrey
Havana
Bermuda
The Bahamas
Cuba
Turks and Caicos Islands
Gulf of Mexico
Gulf of California
BAJA CALIFORNIA
SONORA
CHIHUAHUA
COAHUILA
NUEVO LEON
TAMAULIPAS
SINALOA
DURANGO
BAJA CALIFORNIA SUR
NAYARIT
SAN LUIS POTOSI
Mérida
Cancún
NEW BRUNSWICK
PRINCE EDWARD ISLAND
NOVA SCOTIA
761
358
155
1649
699
912
343
298
493
1236
265
419
199
1195
1029
214
161
219
60
611
119
246
1107
1025
370
607
289
498
116
44
190
328
282
710
1136
3388
474
955
176
75
1315
496
201
68
84
286
577
128
553
Map
Satellite
USGS
science for a changing world
USA npn
National Phenology Network

Need to hit + to get to further filters below

Filter

Select up to ten (consecutive) years

2018 - 2018 +

Animal Types

None Selected

Plant Types

None Selected

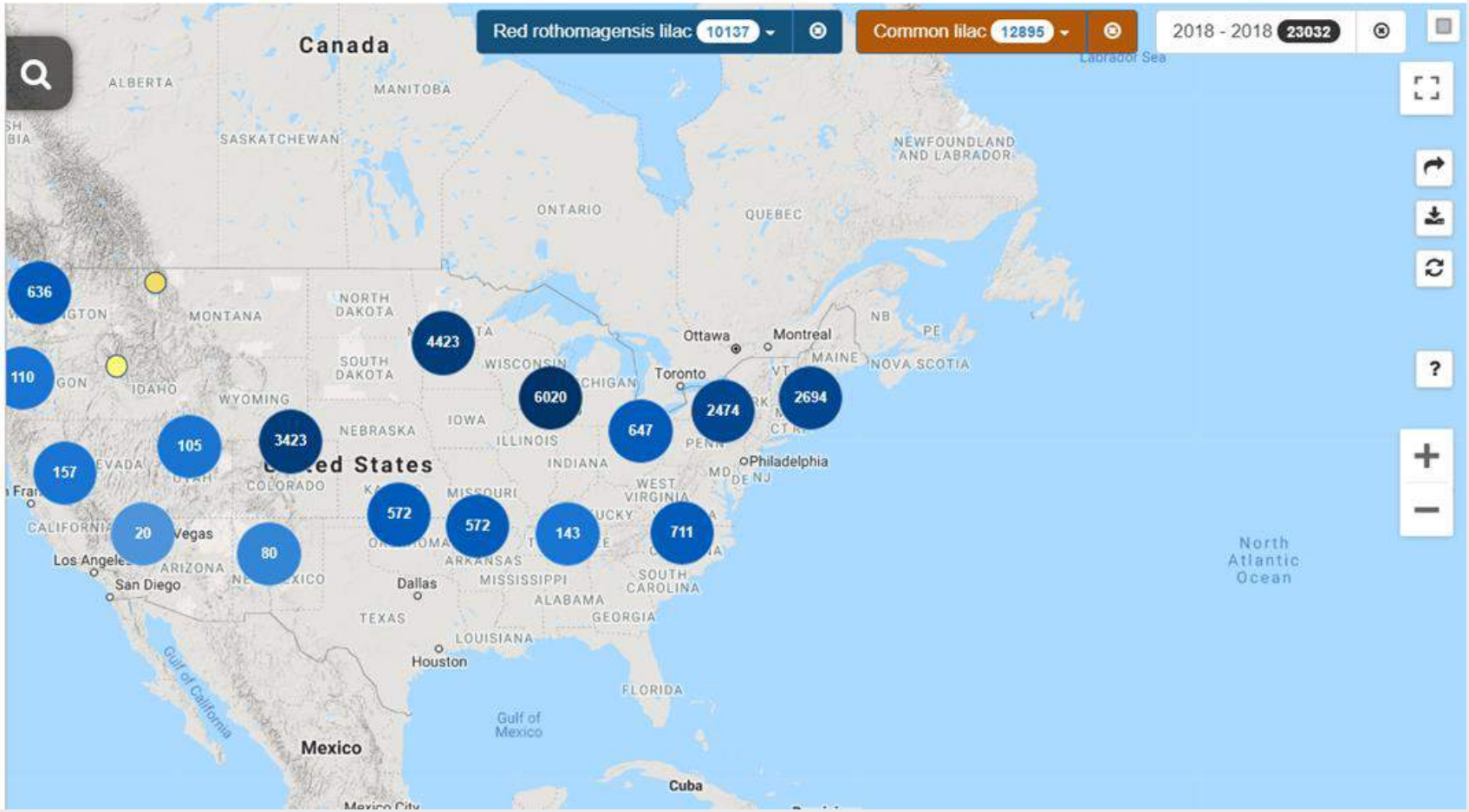
Partners

None Selected +

Species

Common lilac (149895),
Red rothomagensis lilac (89165) +

Execute Filter



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

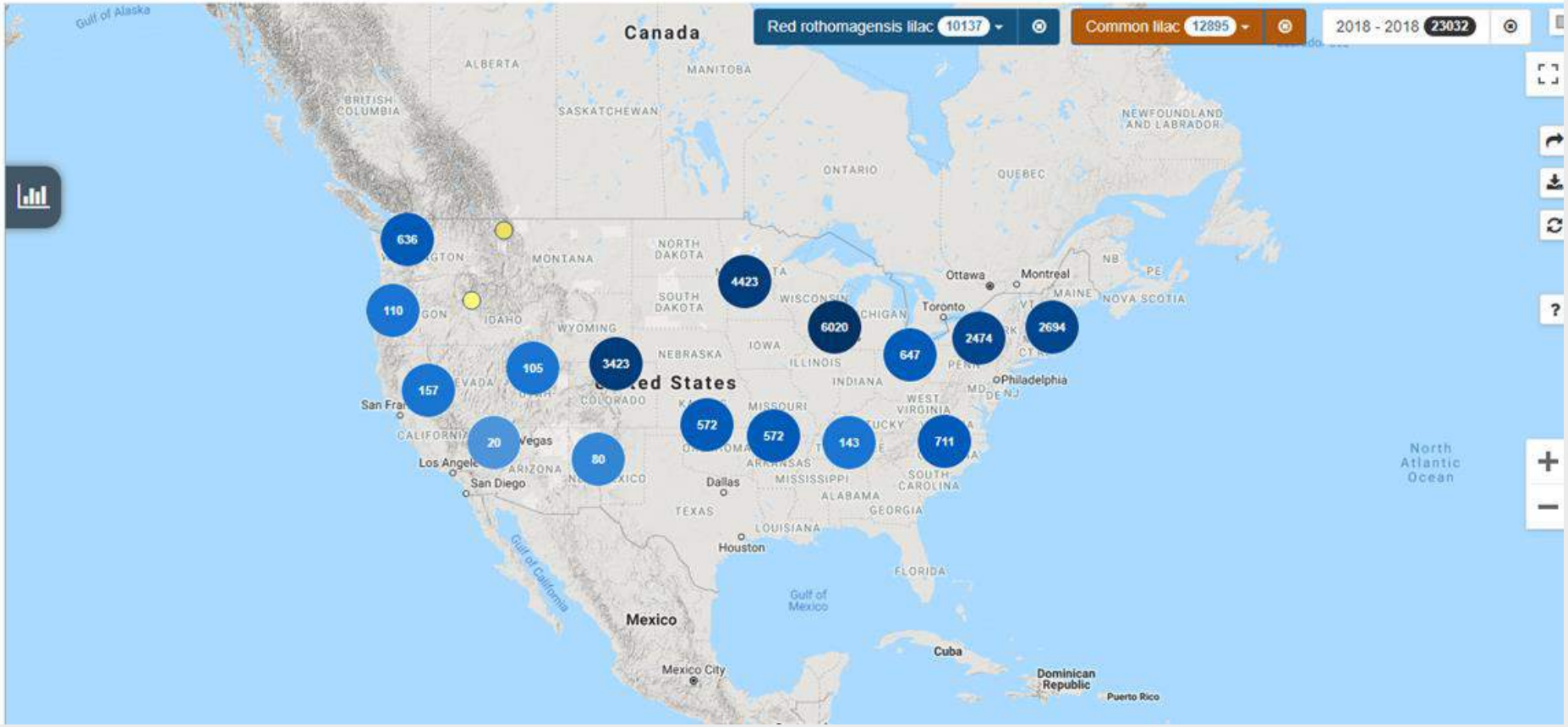
This visualization illustrates the daily timing of phenological activity for selected species and phenophases. Horizontal bars represent the annual patterns at a site to region for up to two years.

Activity Curves

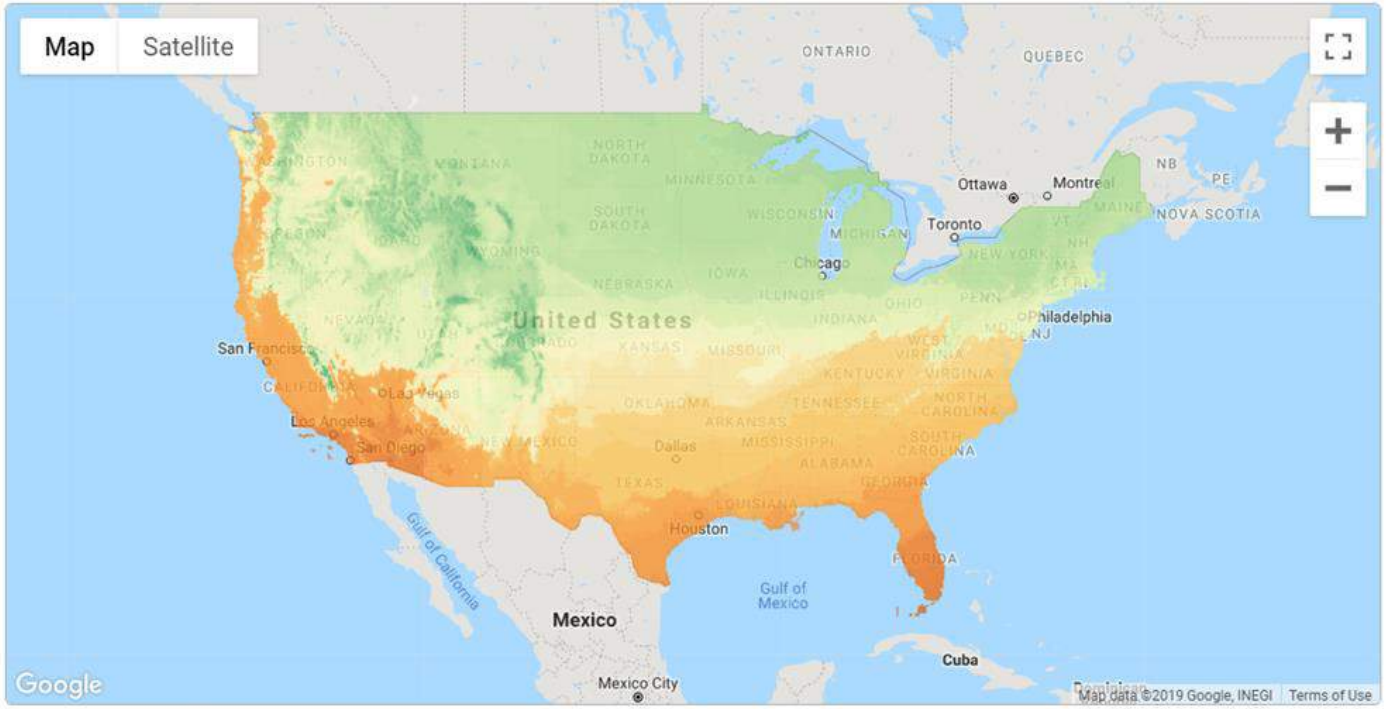
This visualization plots annual patterns of the timing and magnitude of phenological activity, based on proportion of "yes" records, animal abundances per hour and other metrics. Data are summarized at a weekly, biweekly or monthly scale for one or more sites, for up to two species, phenophases, or years.

Maps

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



Phenology Maps



USA National Phenology Network, www.usanpn.org

Select Gridded Layer

More Info on Phenology Maps

Category

Spring Indices, Historical Annual

Layer

First Leaf - Lilac

Year

2018

Opacity

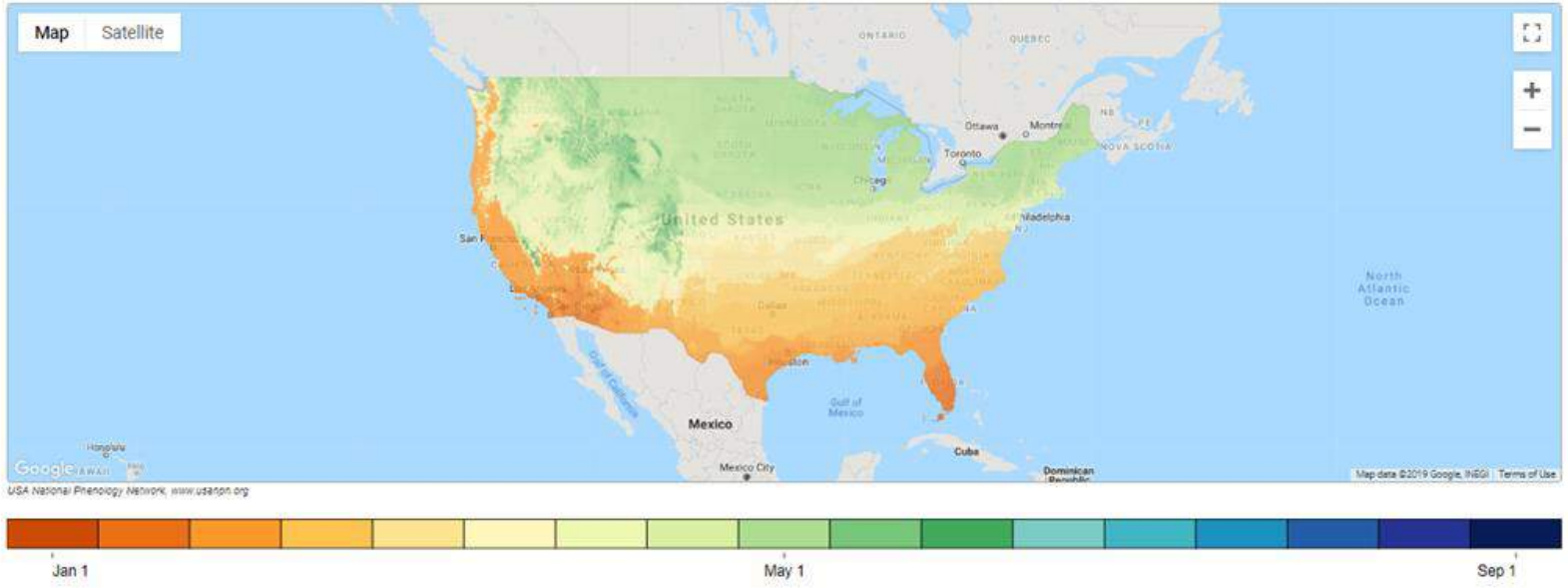
0 75 100

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

Phenology Maps



USA National Phenology Network, www.usanpn.org

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Plot Observed Onset

Species

Red rothomagensis lilac

Phenophase

Breaking leaf buds

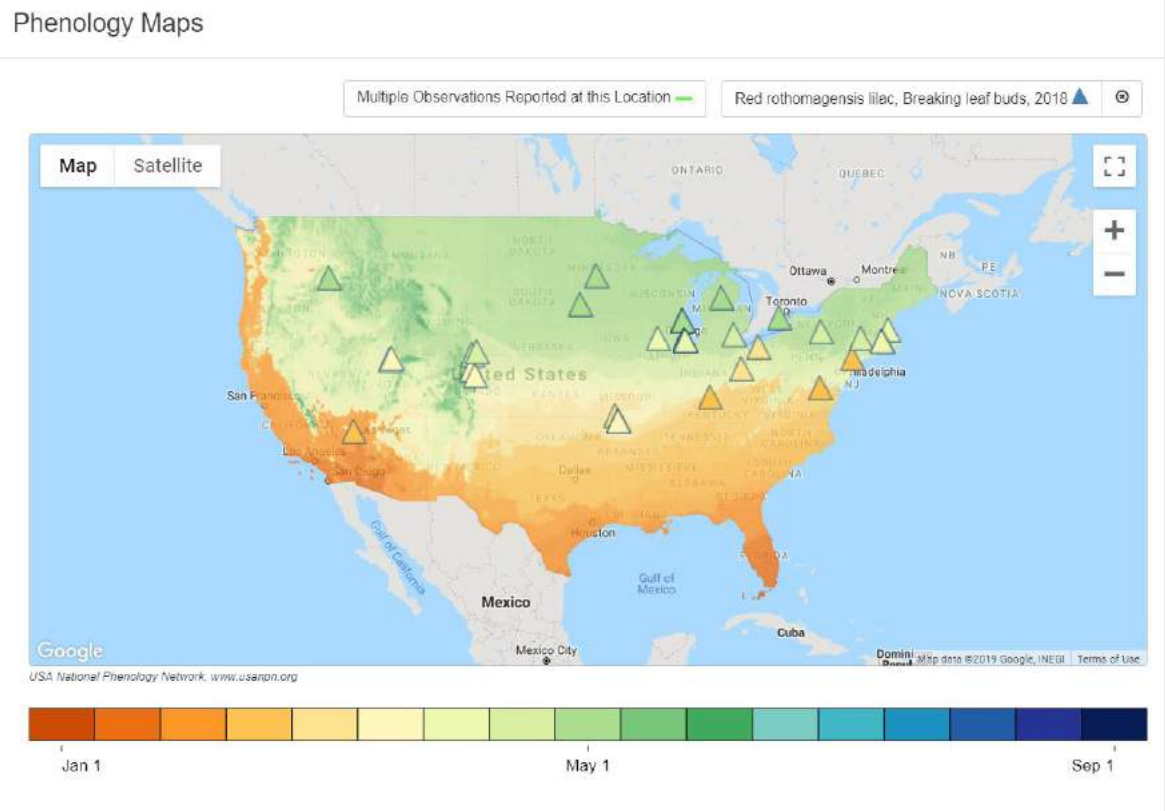
Year

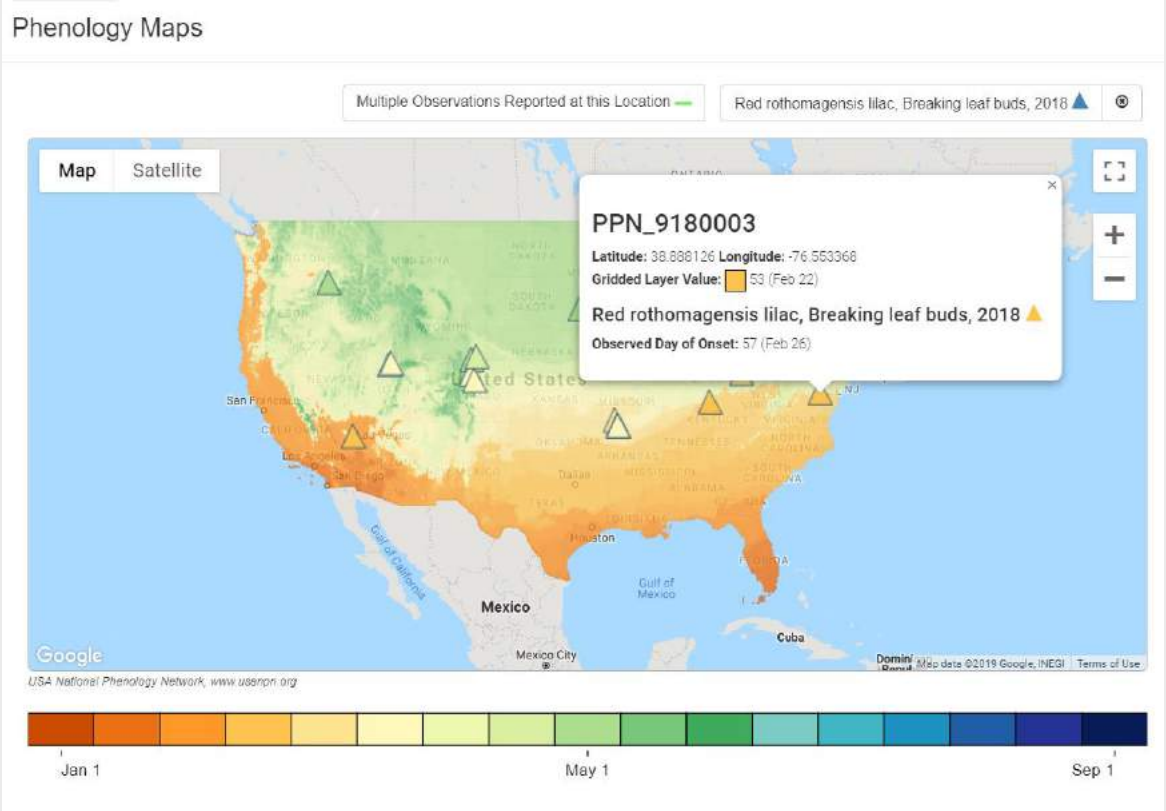
2018

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
Map
Satellite
ONTARIO
QUEBEC
Ottawa
Toronto
NOVA SCOTIA
San Francisco
Los Angeles
San Diego
Dallas
Houston
Gulf of California
Gulf of Mexico
Mexico
Mexico City
Cuba
Google
Map data ©2019 Google, INEGI
Terms of Use
USA National Phenology Network, www.usanpn.org
Jan 1
May 1
Sep 1


Phenology Maps
Multiple Observations Reported at this Location
Red rothomagensis lilac, Breaking leaf buds, 2018
Map
Satellite
PPN_9180003
Latitude: 38.888126 Longitude: -76.553368
Gridded Layer Value: 53 (Feb 22)
Red rothomagensis lilac, Breaking leaf buds, 2018
Observed Day of Onset: 57 (Feb 26)
Mexico
Mexico City
Cuba
Google
Map data ©2019 Google, INEGI
Terms of Use
USA National Phenology Network, www.usanpn.org
Jan 1
May 1
Sep 1

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.

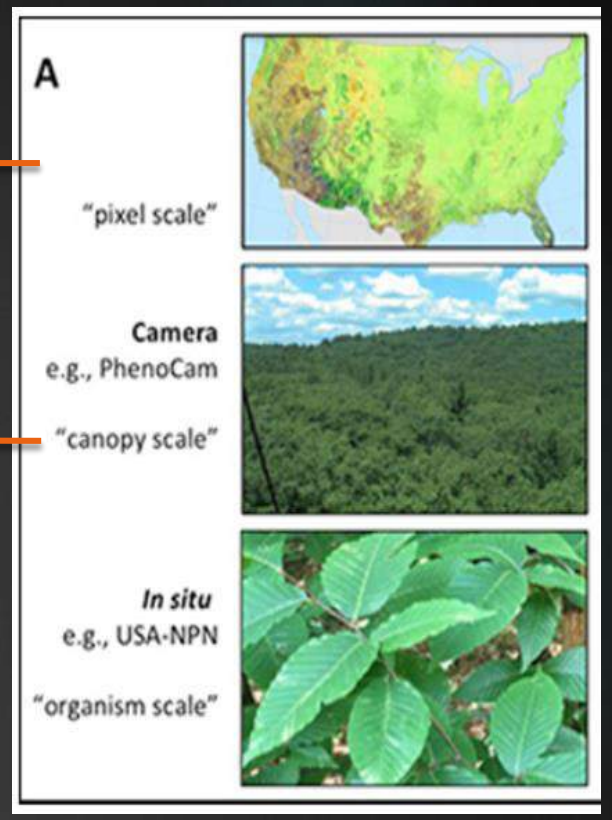
- Stream incoming data results directly to file for easier management or large data sets.

- Direct integration between raster data products, including remote sensing variables, and NPN ground-based observation data

Use case 2

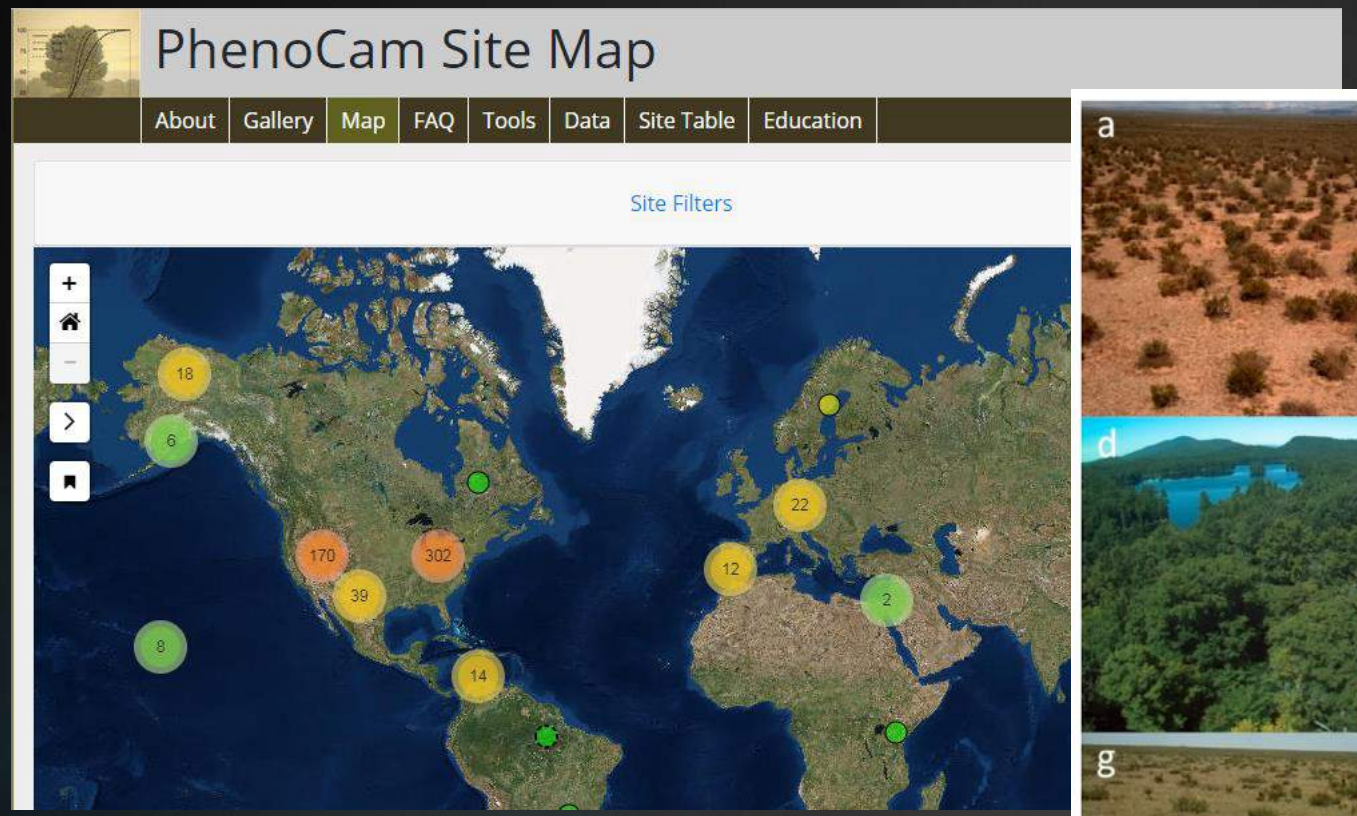
- Brief overview of the Phenocam Network
- Tutorial on the PhenoSynth r-shiny app to view and analyze coincident phenocam and MODIS time series data.

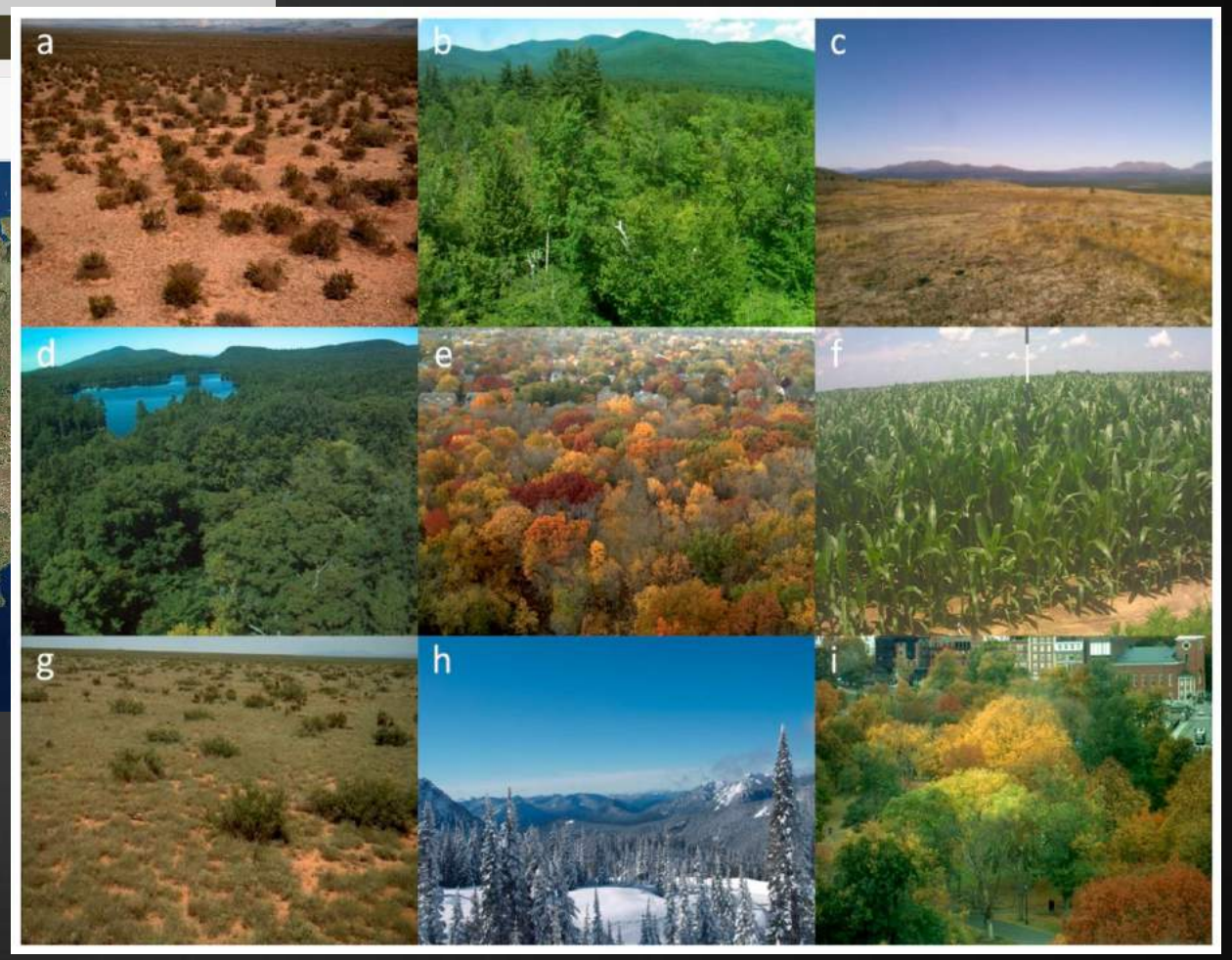
2



phenoSynth

The Phenocam Network

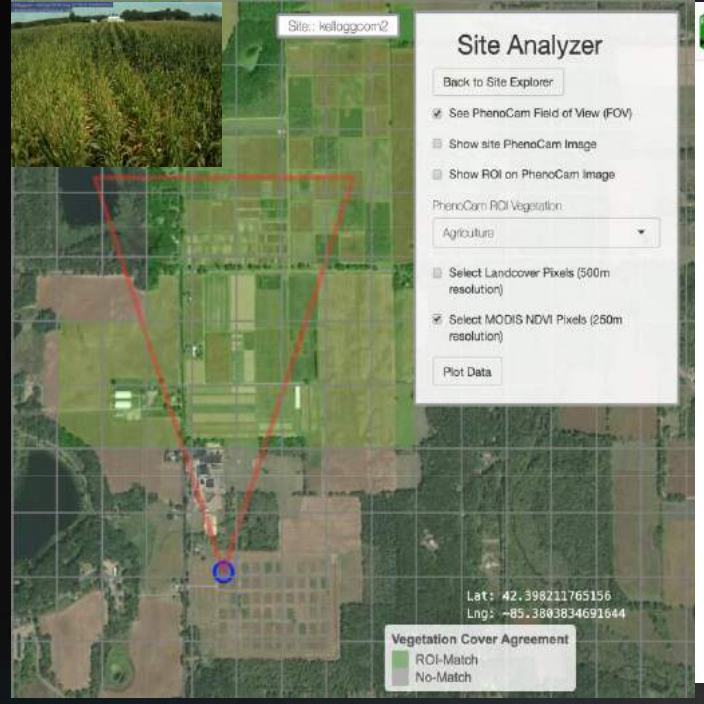


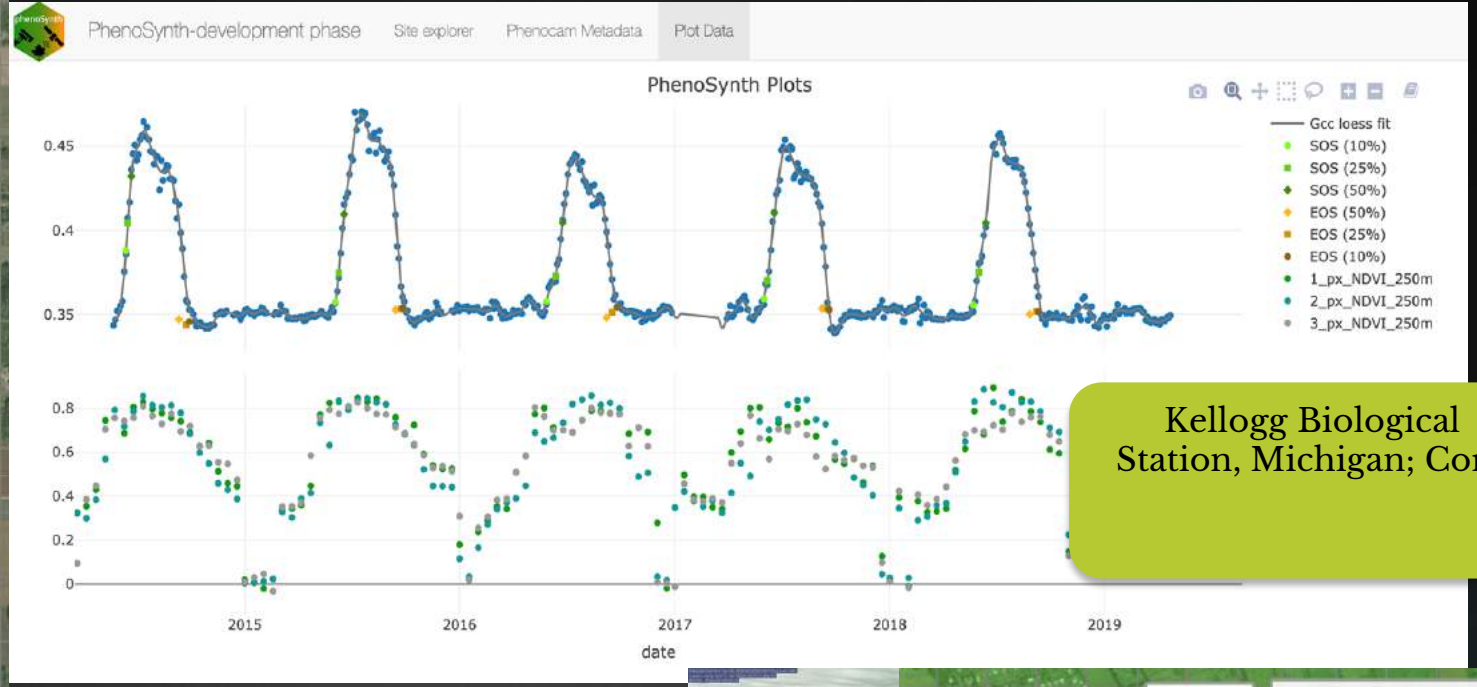


A network for over 400 near-surface remote sensing cameras acquiring hyper-temporal resolution

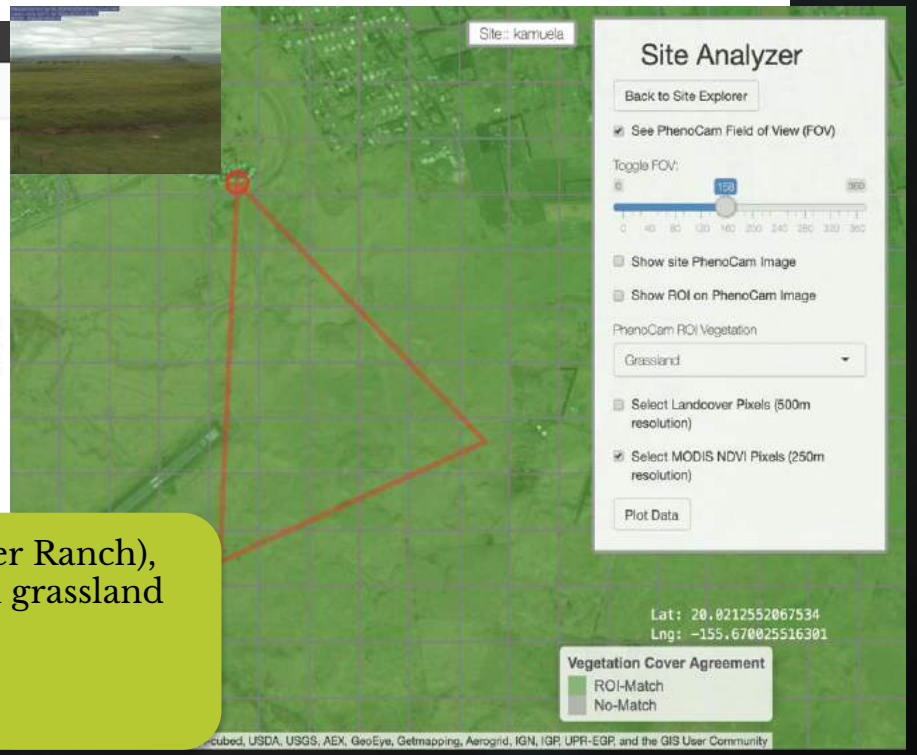
Go to phenosynth demo…

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





Kellogg Biological Station, Michigan; Corn



Kamuela (Parker Ranch), Hawaii; tropical grassland

Contacts:

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