

# Phenology and Public Participation in Scientific Research

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# OUTLINE

- What is phenology?
- How is phenology related to climate and climate change?
  - Case studies
- California Phenology Project (CPP)
- USA National Phenology Network (USA-NPN)
- Incorporation of phenological monitoring into outdoor education programming
- Your creativity here: break-out sessions to invent and practice ways of introducing phenology to kids



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# Phenology is the science of the seasons



Spring wildflowers



Foliage color change



Migration patterns

**PHENOLOGY** is the study of recurring plant and animal life cycle stages (phenophases)



# Phenology is the science of the seasons



Spring wildflowers



Foliage color change



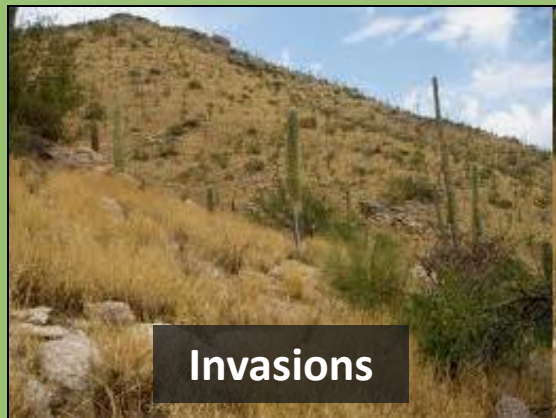
Migration patterns

## *Other examples?*





## HAZARDS



## CULTURE



## HEALTH



***Timing and abundance  
are important***

Phenological indicators used by fisherman:  
plant phenophases can predict the best time to hunt

Fisherman in w. Canada know that pickerel (*Esox lucius*) run  
when the southern cottonwood (*Populus balsamifera*)  
disperses its seeds



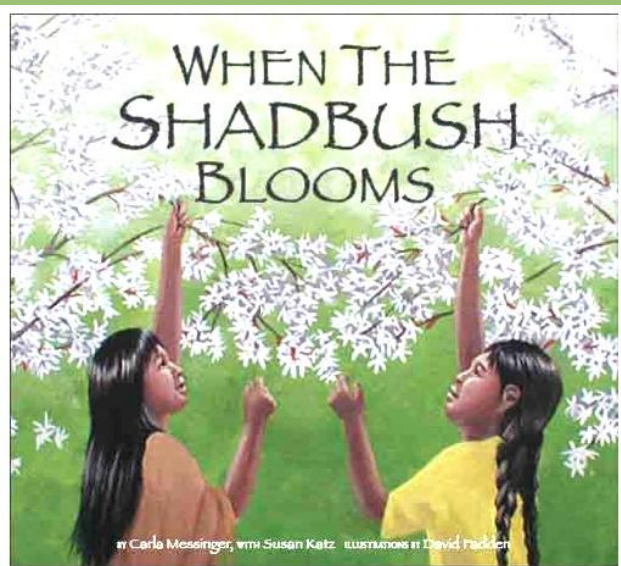
Beaubien, E.G. 1991. Phenology of Vascular Plant Flowering in Edmonton and across Alberta. MS thesis, University of Alberta.

Lantz, T. C. and N. J. Turner. 2003. Traditional phenological knowledge of aboriginal peoples in British Columbia. Journal of Ethnobiology 23: 263-286.



Phenological indicators used by fisherman:  
plant phenophases can predict the best time to hunt

Fisherman on the east coast of Canada would not fish for shad (*Alosa sapidissima*) until after the shadbush (*Amelanchier* spp.) flowered.



Phenological indicators used by hunters:  
plant phenophases can predict the best time to hunt

Okanagan indians used blooming of mock-orange  
(*Philadelphus lewisii*) as an indicator that marmots  
were fat and ready to hunt.



Gavin Davies

Turner et al., 1980. Ethnobotany of the Okanagan-Colville Indians of British Columbia and Washington. Occ. Pap. Brit. Col. Prov. Mus. No. 21., Ministry of Provincial Secretary and Government Services Provincial Secretary, Victoria, B.C.



Phenological indicators used by hunters:  
plant phenophases can predict the best time to hunt

Comox indians use oceanspray (*Holodiscus discolor*)  
flowering as an indicator of the best time to dig for butter  
clams (*Saxidomus gigantea*)





# Phenological indicators used by indigenous people: plant phenophases can predict harvest times of animals

The Nuu-Chah-Nulth tribe of Vancouver Island used the ripening of salmonberries (*Rubus spectabilis*) to predict the return of adult sockeye salmon (*Oncorhynchus keta*) to freshwater.



Bouchard & Kennedy, 1990. Clayoquot Sound Indian Land Use. Report prepared for MacMillan Bloedel Ltd.  
Peacock, S. L. 1992 Piikani Ethnobotany: Traditional Plant Knowledge of the Piikani Peoples of the Northwest Plains. MS thesis, University of Calgary.

# Phenological indicators used by indigenous people: plant phenophases can predict harvest times of animals

The Blackfoot tribe of s. Alberta and Canada used the flowering of the buffalo bean (*Thermopsis rhombifolia*) to indicate that bison males (*Bison bison*) had eaten enough spring browse to be ready to hunt (their meat was sufficiently marbled with fat).





Phenological Indicators used by indigenous people:  
plant phenophases at one location can predict harvest  
times for plants at another location

Wampanoag tribe of Cape Cod (Massachusetts) claimed that  
the best time to plant corn was when the leaves of white  
oak (*Quercus alba*) were the same size as the footprint of a  
red squirrel (*Tamiasciurus hudsonicus*)





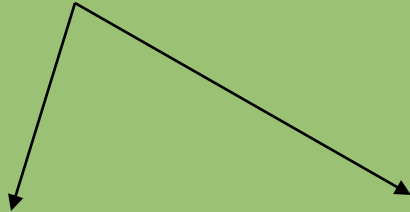
# Phenological Indicators used by indigenous people: plant phenophases at one location can predict harvest times for plants at another location

The Tubatulabal tribe of Kern County (CA) used the ripening of coffeeberry fruits (*Rhamnus californica*) at low elevations to indicate that pinyon pine (*Pinus monophylla*) seeds in the mountains were ready to harvest.





*Plants & animals are very dynamic over the seasons*



**Vegetation**

**Reproduction**

**(Leaves)**

**(Flowers, Fruits)**





# Vegetative phenology: importance

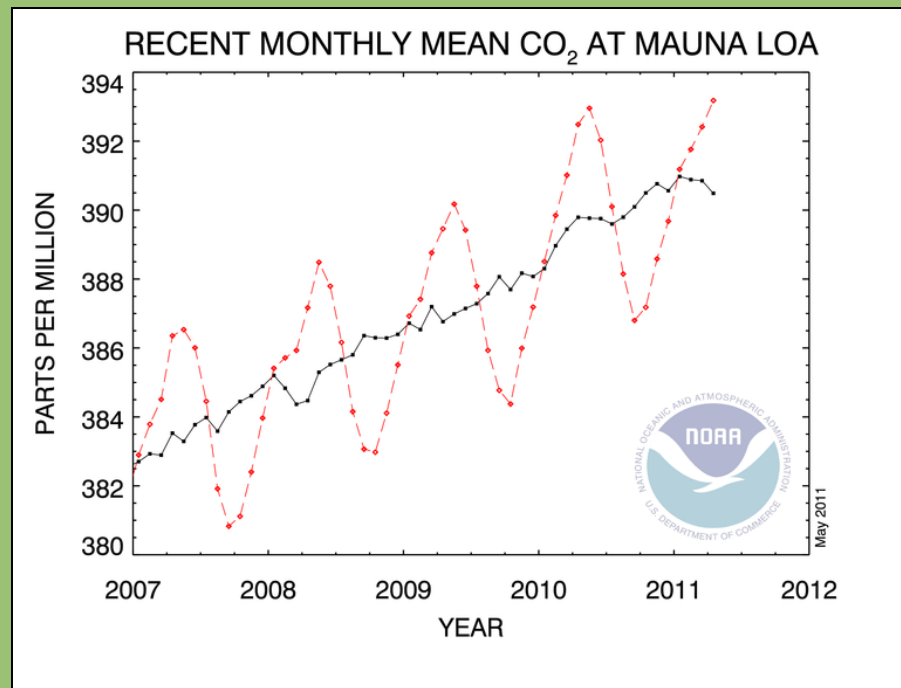
Leaves provide:

energy to the plant for reproduction & growth

food for herbivores

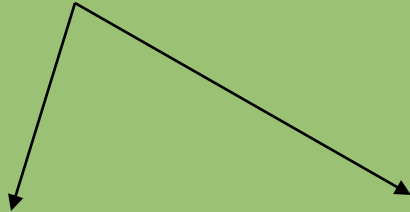
shade and protection for understory animals

Carbon sequestration...





*Plants & animals are very dynamic over the seasons*



**Vegetation**

**Reproduction**

**(Leaves)**

**(Flowers, Fruits)**





# Flowering phenology: importance

Plant reproduction depends on flowers → fruits

Flowers provide nectar & pollen for pollinators

Provide fruits & seeds for animals



**Phenological patterns are important (economically and biologically)**



**In your neck of the woods....**



**Can you provide an example of the biological, agricultural, or economic importance of phenology?**

**Are there ways in which phenology was important to your parents or grandparents but that we currently ignore?**



**Phenological patterns are important (economically and biologically)**



**Phenology is also...**



**....sensitive to climate, and**

**....sensitive to climate change**

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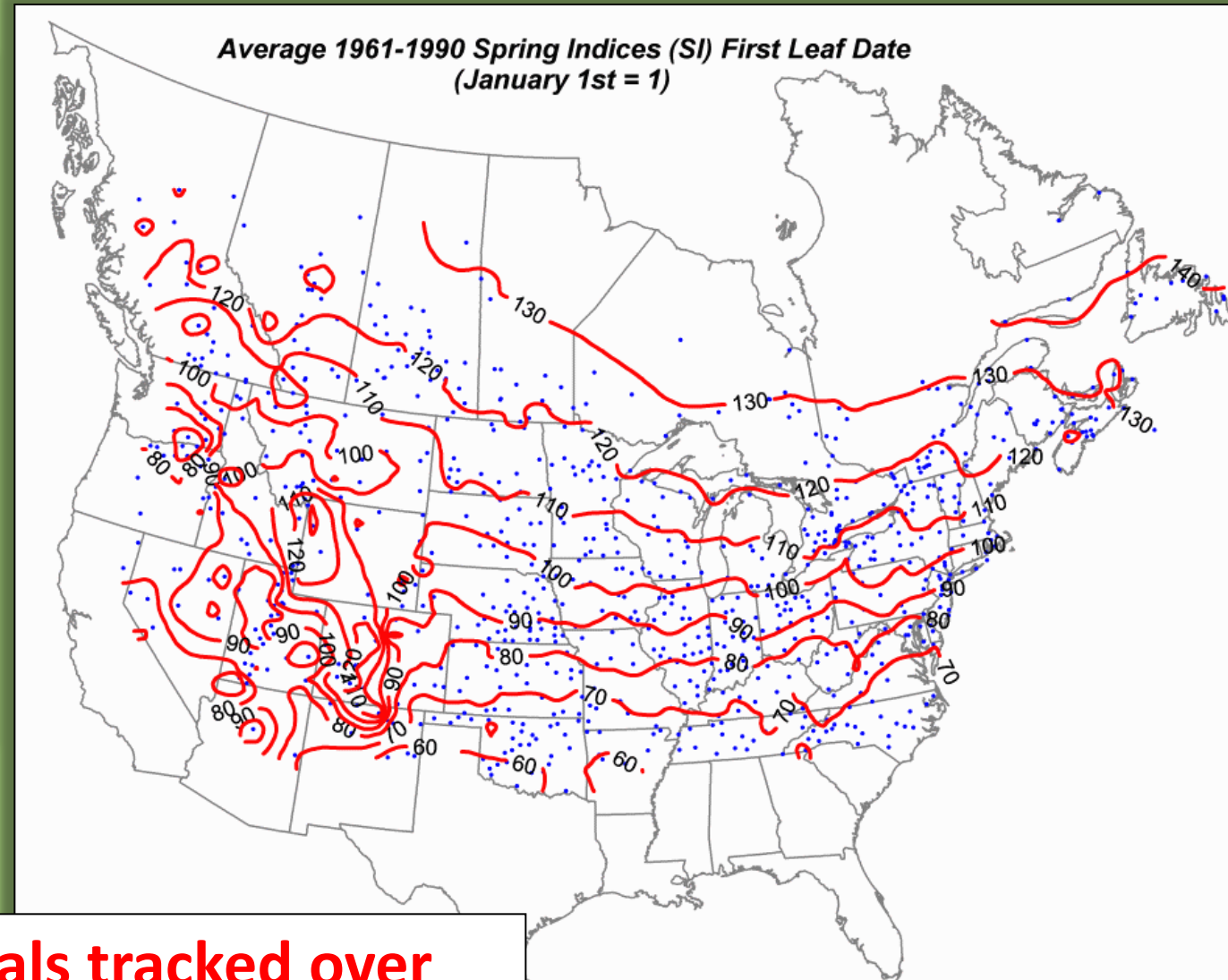
# Common Lilac Monitoring Nationwide

- The first phenological monitoring effort in the U.S.
- 1950's - 1990's: ~3500 private citizens monitored lilac plants in backyards and gardens
- Each year, they sent postcards reporting the date of first bloom to Professor Joe Caprio at Montana State Univ.
- First bloom dates of these lilacs have been used:
  - To show the effects of elevation and latitude on the onset of spring
  - To generate predictive maps for safe sowing dates
  - To assess climate change throughout the U.S.

# Common Lilac Leaf Phenophases



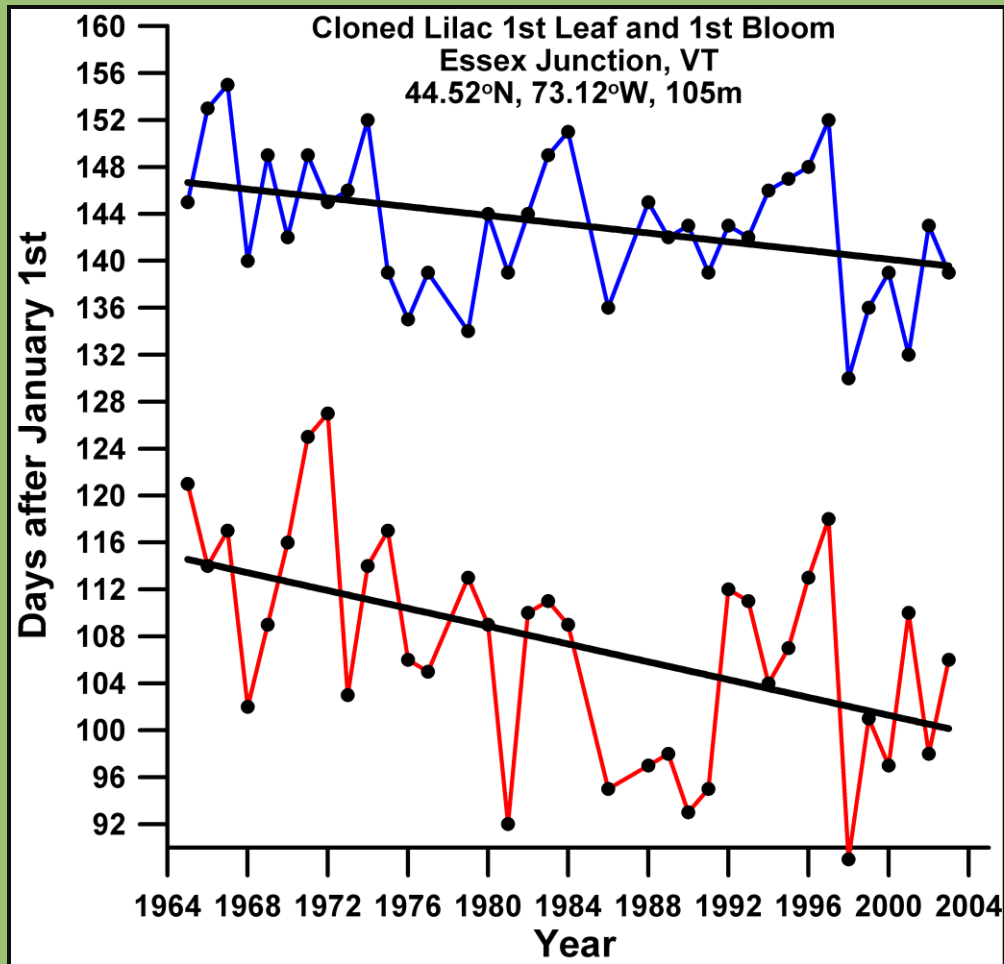
# Common Lilac Monitoring Nationwide



Many individuals tracked over time... what about one individual?



# Phenology is an indicator of environmental change



*Phenology for one Lilac individual*

Date of first flower

Date of first leaf

Phenological events in this lilac have advanced as the climate has warmed

# Phenology – How does it affect:

- Species interactions
- Human activities



# “Phenological mismatches” may cause population crashes



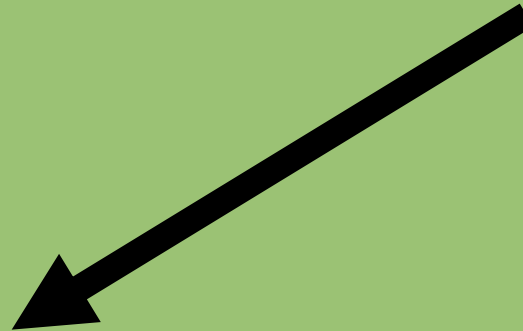
**Leafing out earlier**

**English oak**



**Emerging earlier**

**Winter moth**



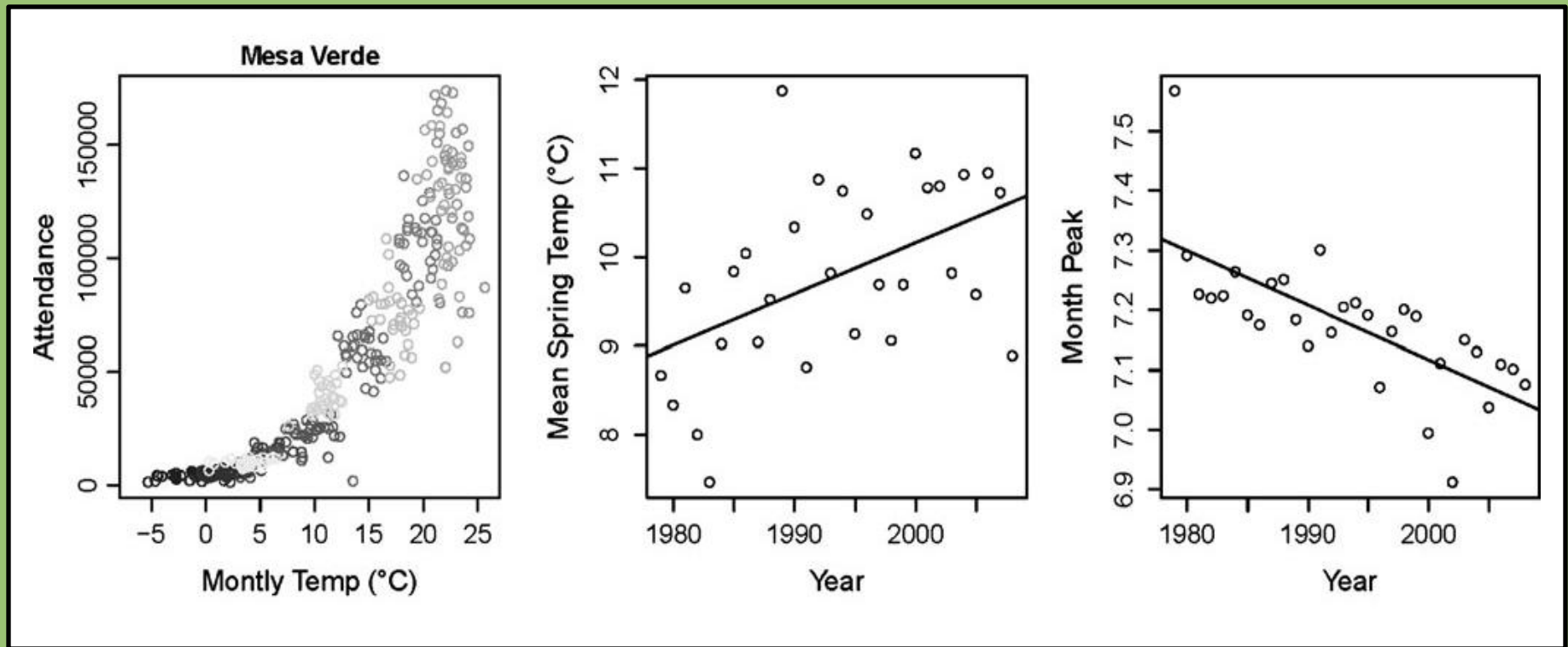
**Pied flycatcher**

**Migrating the same time  
each year**

**Bird populations have declined by 90% where food for nestlings is peaking earlier in the season and the birds' arrival and breeding events are now mistimed.**



# Climate change may drive shifts in human behaviors



*From 1979 to 2008, peak attendance at Mesa Verde National Park changed from July 10 to July 1 (the average shift was 4 days).*

*Of the nine national parks that have experienced significant temperature increases since 1979 (out of 27 examined), 78% exhibit shifts in the timing of peak abundance.*

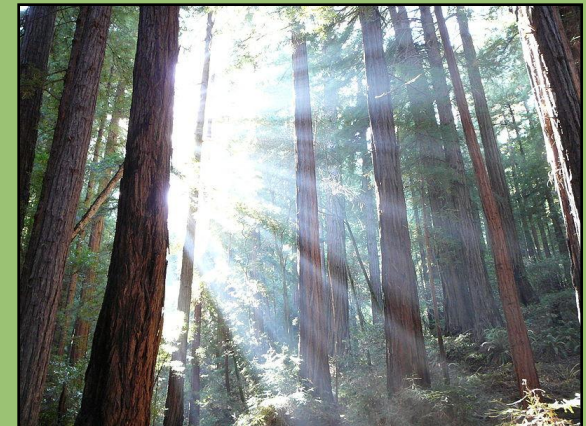
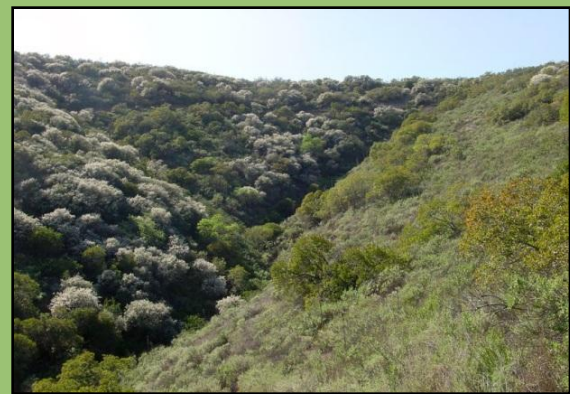
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# California Phenology Project







# California Phenology Project: Goals

establish a California-wide phenological monitoring network to monitor across a large geographic area and along key environmental gradients



*allow the CPP and each park to:*

- (1) address important scientific questions,
- (2) guide resource management decisions, and
- (3) engage and educate people of all backgrounds and ages about phenology and climate change research through Citizen Science!**



# Monitoring by Citizen Scientists

1. Visit and monitor labeled and mapped plants: each plant is visited frequently when it is phenologically active  
(e.g., CPP plants in National Parks)
2. Visit and monitor labeled (unmapped) plants whenever it's convenient  
(e.g., Plants in a schoolyard)
3. Visit and monitor unlabeled plants whose location you're familiar with  
(e.g., the big tree at the corner)
4. Visit and monitor unlabeled plants one time, or opportunistically  
(e.g., plants you encounter while hiking the Pacific Crest Trail)



# CPP: monitoring infrastructure

**REDW**



**GOGA**



# CPP: monitoring infrastructure





# CPP: outreach and education





# CPP: outreach and education

Phenology education materials available on the CPP website:

- Lesson plans for primary educators
- Activities for formal and informal education settings
- Undergraduate lecture series
- Readings and discussion questions for advanced undergraduate or graduate seminar in phenology

## ETHNOPHENOLOGY

*A hands-on nature exploration activity designed to engage participants in observing plant phenology while investigating how traditional cultures remedied health ailments with seasonally-available wild plants*



“Ethnobotany” – the study of cultural uses of plants

“Phenology” – the study of seasonal plant and animal activities



### Planting Memories: Santa Barbara Edition

A memory matching game filled with plants that grow in our own backyard



California Poppy Open Flower

© Br. Alfred Brousseau, Saint Mary's College



California Poppy Buds

© Jo-Ann Ordano, California Academy of Sciences

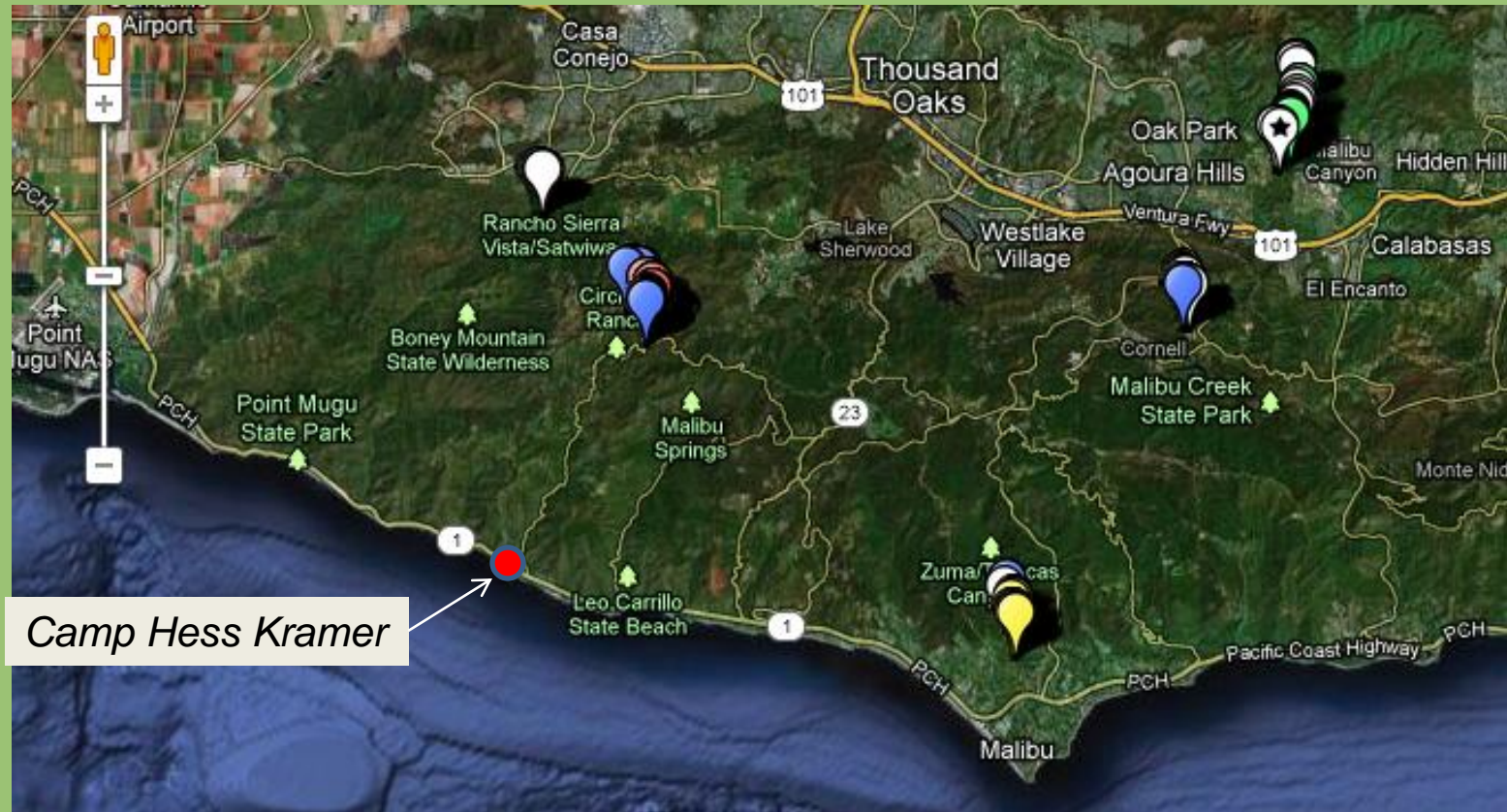
# California Phenology Project

[www.usanpn.org/cpp](http://www.usanpn.org/cpp)

- Tools for monitoring: maps, monitoring guides, species profiles, and more
- Phenological education materials for formal and informal settings
- Powerpoint presentations
- DRAFT CPP Interpreters' Guide
- *Instructions for joining the CPP listserv*

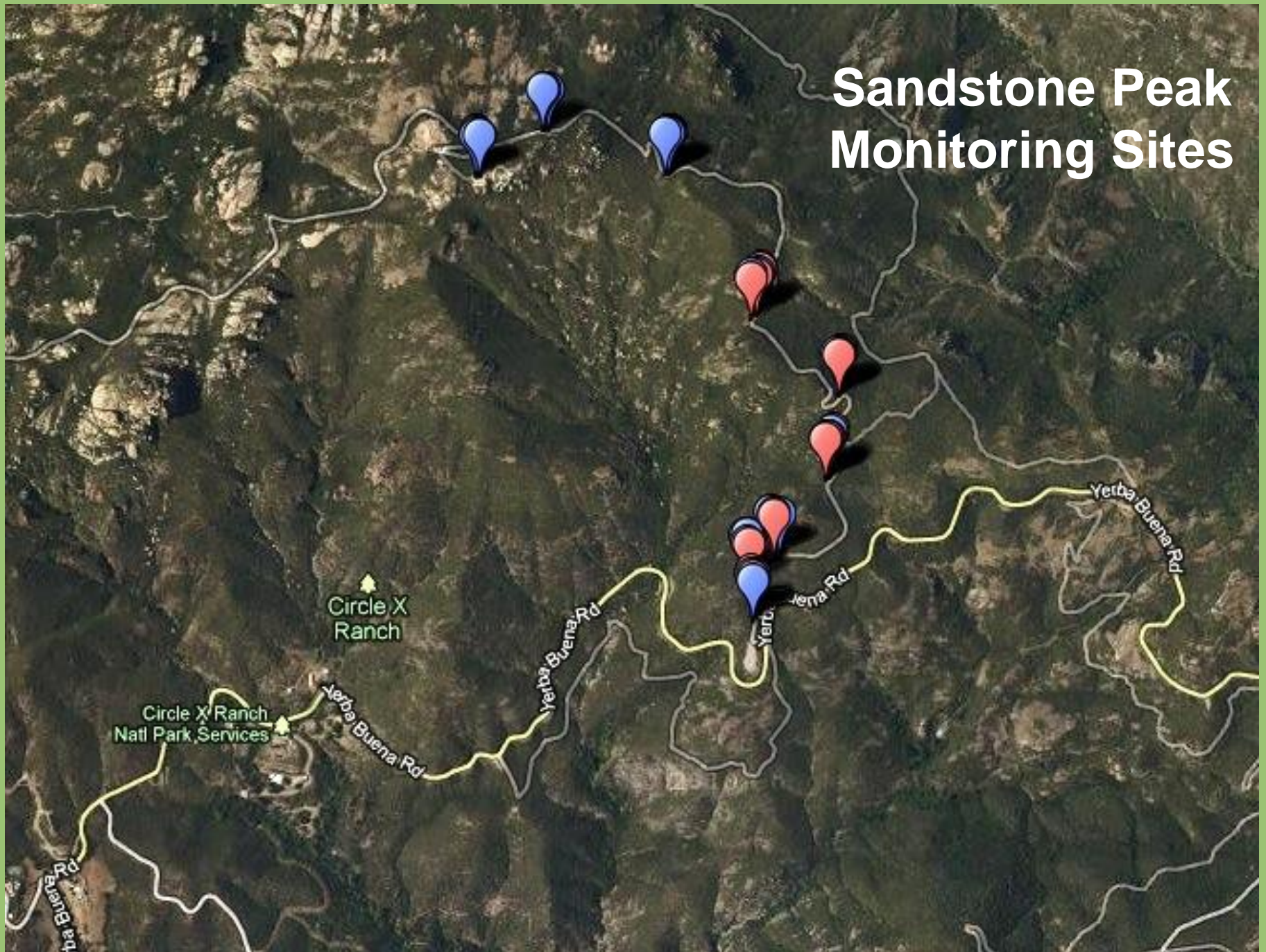
# CPP at Santa Monica Mountain NRA (SAMO)

- Naturebridge monitoring two species at Sandstone Peak (right up the road!)
- Ecohelpers program monitors one species at Zuma Canyon
- CSU- Channel Islands undergraduate class leading student groups at Rancho Sierra Vista





# Sandstone Peak Monitoring Sites





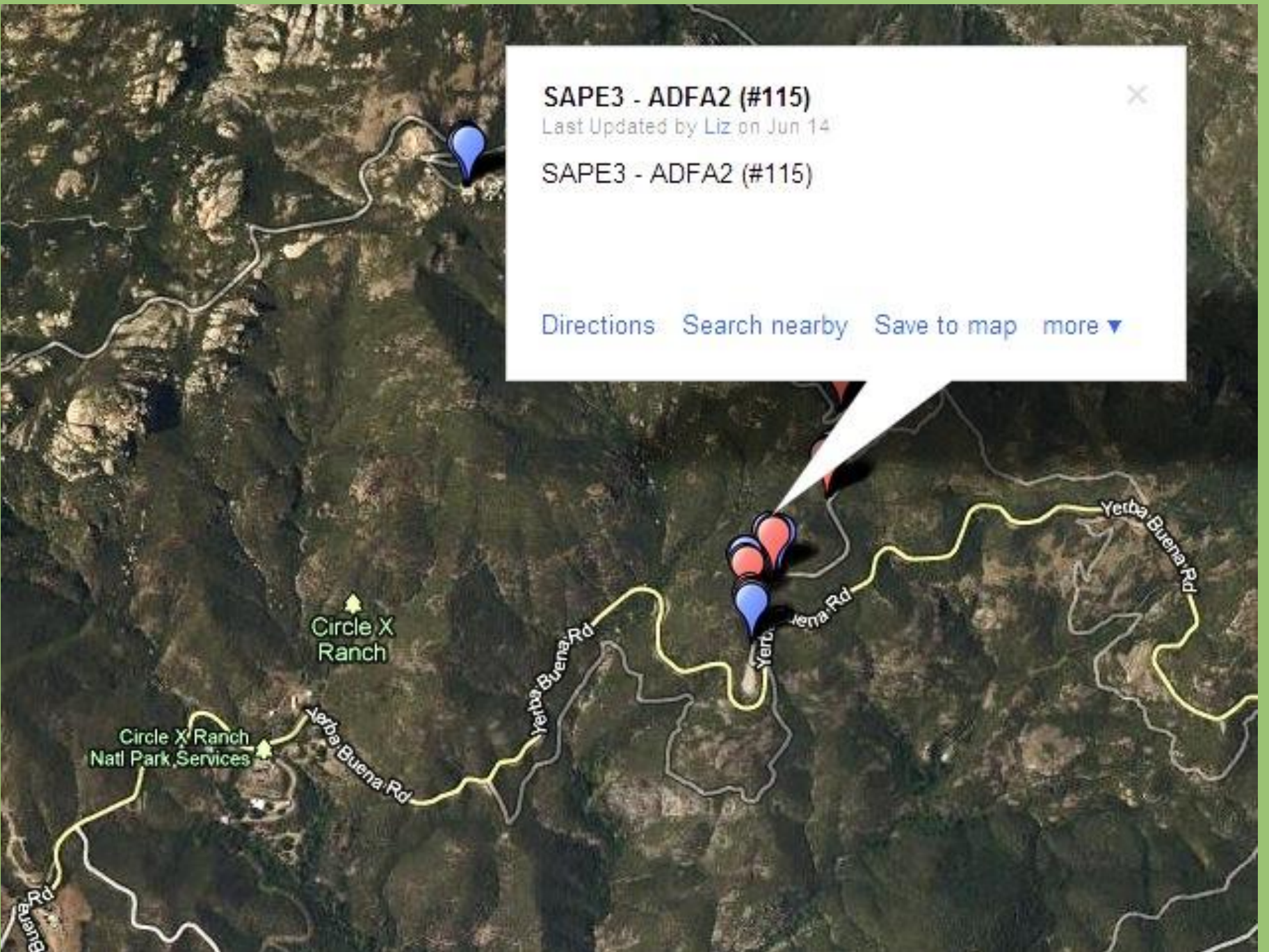
**SAPE3 - ADFA2 (#115)**



Last Updated by Liz on Jun 14

**SAPE3 - ADFA2 (#115)**

[Directions](#) [Search nearby](#) [Save to map](#) [more](#) ▼



Circle X Ranch

Circle X Ranch Natl Park Services

Yerba Buena Rd

Yerba Buena Rd

Yerba Buena Rd

Yerba Buena Rd

Yerba Buena Rd



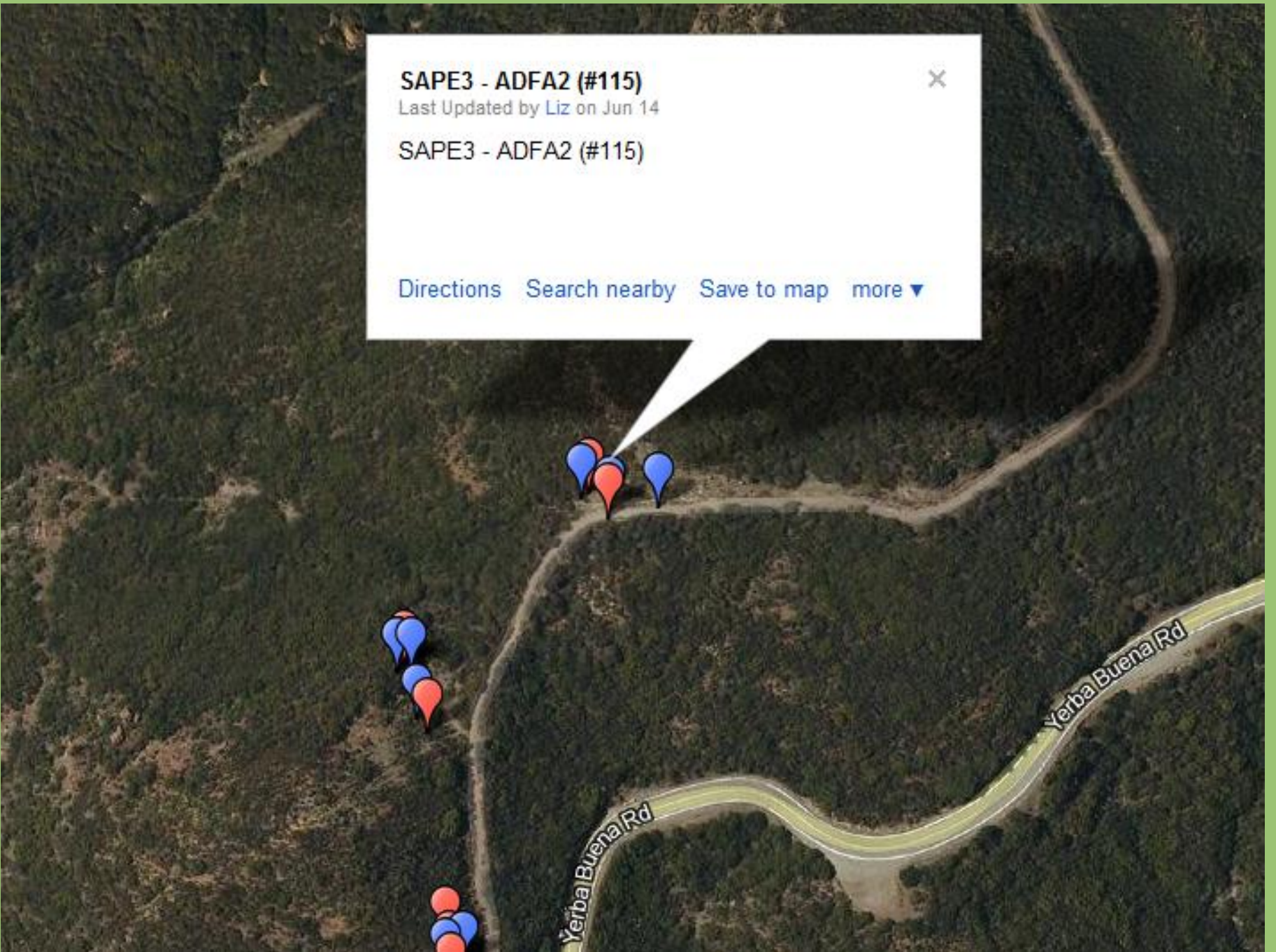
**SAPE3 - ADFA2 (#115)**



Last Updated by Liz on Jun 14

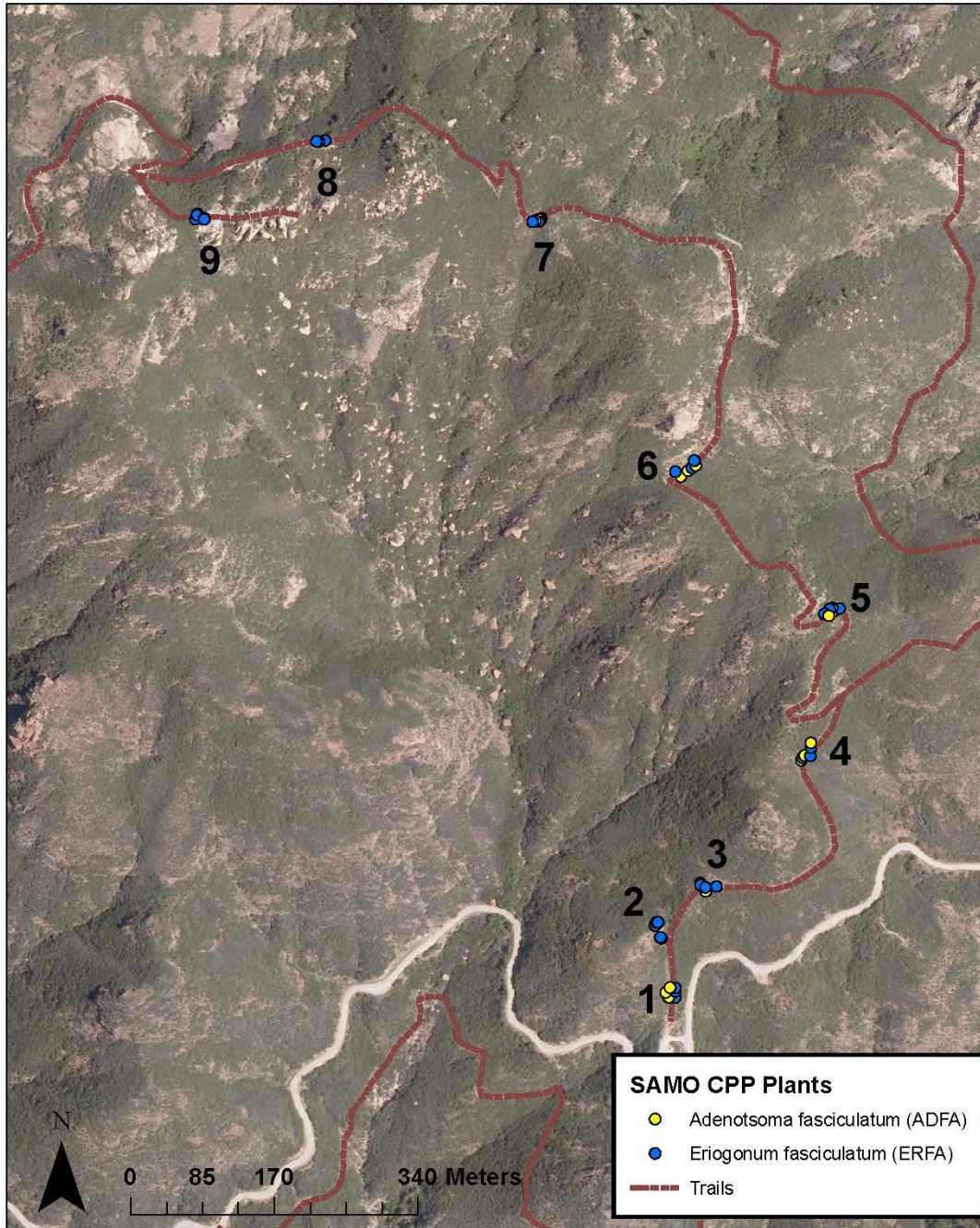
SAPE3 - ADFA2 (#115)

[Directions](#) [Search nearby](#) [Save to map](#) [more](#) ▼



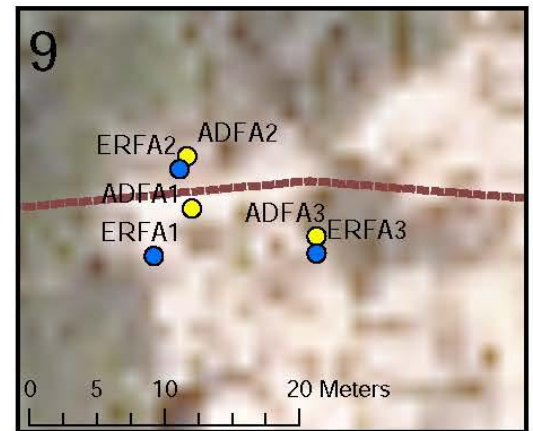
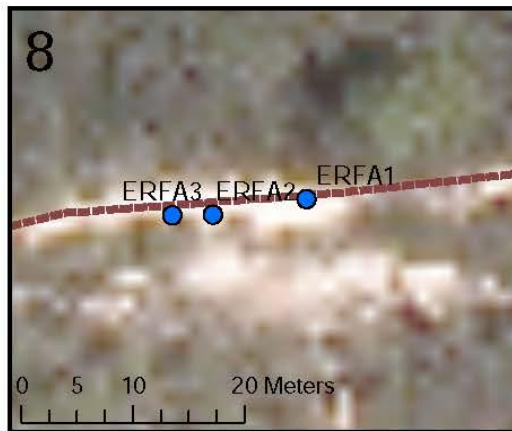
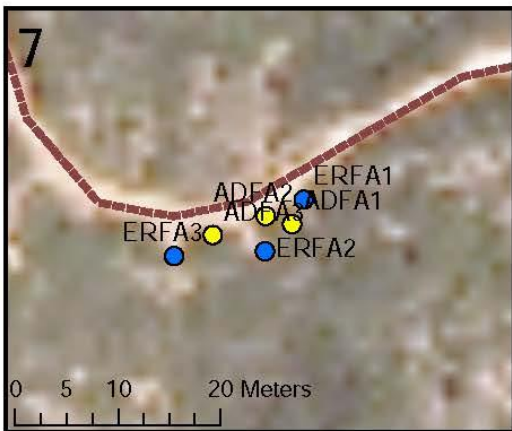
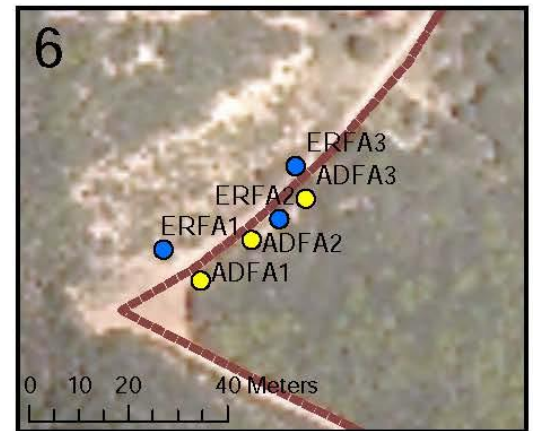
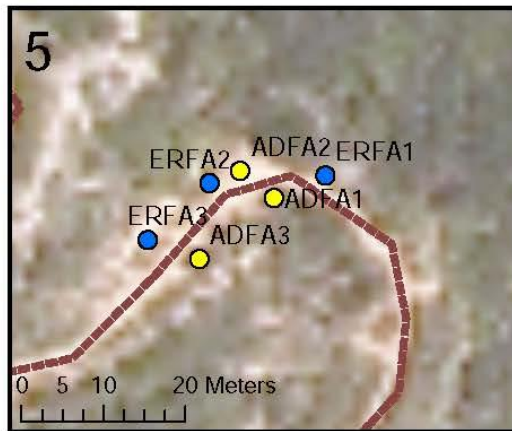
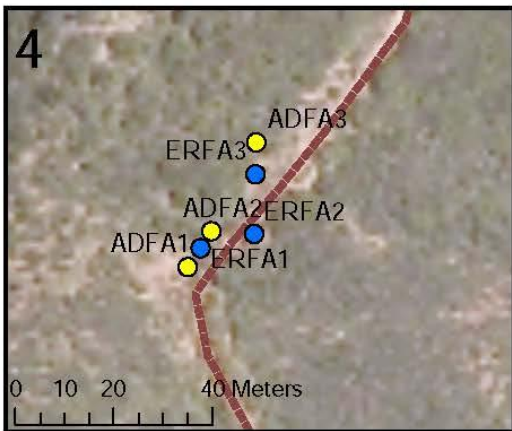
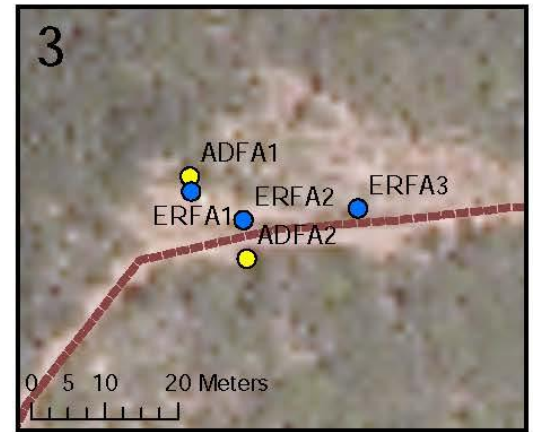
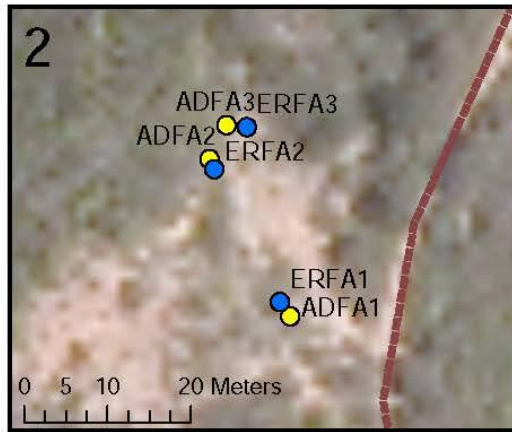
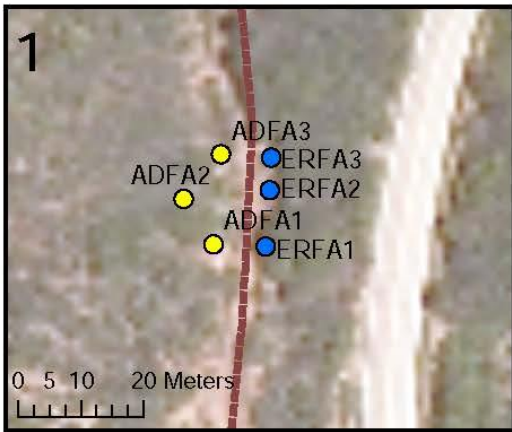


# CPP SAMO Sandstone Peak Monitoring Sites





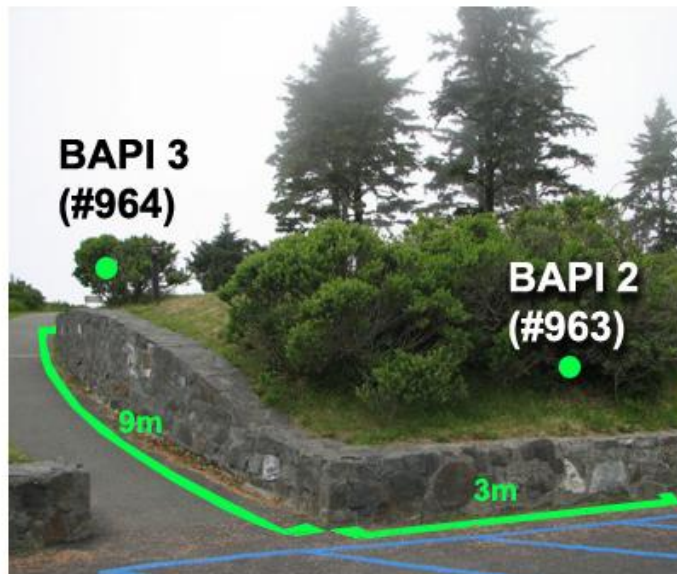
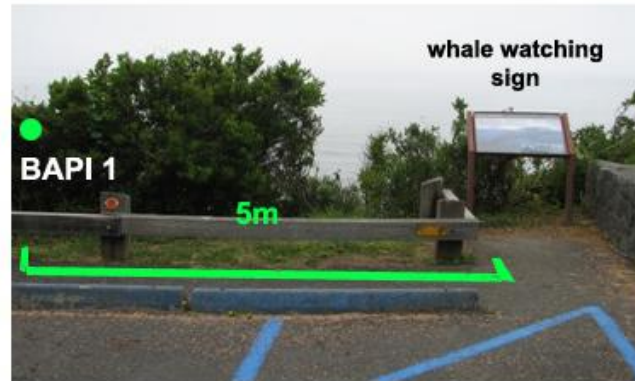
# CPP SAMO Sandstone Peak (SAPE) Monitoring Sites and Plant



# CPP Tools for Monitoring

## CPP - REDW - CBO 1 - (BAPI 1 - 6)

### Coyote Brush (*Baccharis pilularis*) Crescent Beach Overlook





# CPP Tools for Monitoring

**Species:** Coast Live Oak (*Quercus agrifolia*)

**Group Name:** \_\_\_\_\_

**Site:** Lobos Dunes-Mountain Lake (LDML)

**Subsite (#):** \_\_\_\_\_

## Phenophases



**Young leaves:** A leaf is considered young once the leaf stalk (petiole) or leaf base is visible, but before the leaf has reached full size or turned the darker green color of mature leaves on the plant.

**Fresh flower:** The flowers of the oak tree are pendulous strands of catkins (think of a strand of beads).

**Fresh fruit:** Look inbetween the leaf stalk and the main stem (the leaf armpit) to find *fresh* fruits developing.

**Ripe fruit:** The ripe fruits of the oak are acorns.

**Plant Number** \_\_\_\_\_

Do you see...? (Circle Y or N)

How many do you see?  
Less than 3 (<3); 3 to 10; More than 10 (>10)

Young leaves	<b>Y or N</b>	_____
Fresh flower	<b>Y or N</b>	_____
Fresh fruit	<b>Y or N</b>	_____
Ripe fruit	<b>Y or N</b>	_____

**Plant Number** \_\_\_\_\_

Do you see...? (Circle Y or N)

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Young leaves	<b>Y or N</b>	_____
Fresh flower	<b>Y or N</b>	_____
Fresh fruit	<b>Y or N</b>	_____
Ripe fruit	<b>Y or N</b>	_____

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Fresh fruit	<b>Y or N</b>	_____
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# nature's notebook

a project of the USA-NPN

[www.usanpn.org](http://www.usanpn.org)

- 500+ plant species
- 160+ animal species
- Core protocols



1   
Search  
plants &  
animals

2   
Learn  
how to  
observe

3   
Register  
yourself

4   
Start  
reporting

# USA-NPN: Nature's Notebook

Standard protocols for plants, animals, and landscapes



Each life form is monitored for a different set of phenophases:

- Evergreens
- Cacti
- Conifers
- Deciduous
- Forbs
- Grasses
- Annual wildflowers





# Using USA-NPN datasheets



***Baccharis pilularis***  
Coyotebrush



# Using USA-NPN datasheets



## *Baccharis pilularis* Coyotebrush

**Trees and Shrubs** *Broadleaf evergreen  
(with pollen, no leaf buds)*

	Date:	Date:	Date:	Date:	Date:	Date:
Do you see...	Time:	Time:	Time:	Time:	Time:	Time:
Young leaves	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y
Flowers or flower buds	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y
Open flowers	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y
Pollen release	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y
Fruits	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y
Ripe fruits	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y
Recent fruit or seed drop	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y
Check when data entered online:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

**Comments:**



# Using USA-NPN datasheets



Coyotebrush  
(*Baccharis pilularis*)



## Phenophase Definitions

### Directions:

As you report on phenophase status (Y, N or ?) on the datasheets, refer to the definitions on this sheet to find out what you should look for, for each phenophase in each species. To report the intensity of the phenophase, choose the best answer to the question below the phenophase, if one is included. Feel free not to report on phenophases or intensity questions that seem too difficult or time-consuming.



	Date:	
Do you see...	Time:	
Young leaves	y n ? _____	y
Flowers or flower buds	y n ? _____	y
Open flowers	y n ? _____	y
Pollen release	y n ? _____	y
Fruits	y n ? _____	y
Ripe fruits	y n ? _____	y
Recent fruit or seed drop	y n ? _____	y
Check when data entered online:	<input type="checkbox"/>	

Comments:

## Leaves

### Young leaves

One or more young, unfolded leaves are visible on the plant. A leaf is considered "young" and "unfolded" once its entire length has emerged from the breaking bud so that the leaf stalk (petiole) or leaf base is visible at its point of attachment to the stem, but before the leaf has reached full size or turned the darker green color or tougher texture of mature leaves on the plant. Do not include fully dried or dead leaves.

How many young leaves are present?

Less than 3; 3 to 10; 11 to 100; 101 to 1,000; 1,001 to 10,000; More than 10,000;

## Flowers

### Flowers or flower buds

One or more fresh open or unopened flowers or flower buds are visible on the plant. Include flower buds that are still developing, but do not include wilted or dried flowers.

How many flowers and flower buds are present? For species in which individual flowers are clustered in flower heads, spikes or catkins (inflorescences), simply estimate the number of flower heads, spikes or catkins and not the number of individual flowers.

Less than 3; 3 to 10; 11 to 100; 101 to 1,000; 1,001 to 10,000; More than 10,000;

### Open flowers

# CPP species profiles

## California Phenology Project: monitoring guide for Coyotebrush (*Baccharis pilularis*)



**CPP site(s) where this species is monitored:** Golden Gate National Recreation Area, Redwood National Park, Santa Monica Mountains National Recreation Area



Photo credit: stonebird (Flickr)

### What does this species look like?

This shrub can be up to three meters tall. The leaves are toothed, oval, and sticky. Coyotebrush is dioecious, meaning that each plant either produces flowers with only male parts or with only female parts. The male flowers produce yellow pollen and appear yellowish from a distance, and the female flowers produce fruit and are white. The flower heads appear round and disc-like.

When monitoring this species, use the USA-NPN **broadleaf evergreen (with pollen, no leaf buds) trees and shrubs datasheet**.

### Species facts!

- The CPP four letter code for this species is **BAPI**.
- BAPI is a member of the sunflower family (Asteraceae).
- This species arrives as a secondary pioneer species after fire or grazing.
- *Baccharis* derives from the Greek word "bakkaris", referring to plants with fragrant roots, and *pilularis* refers to sticky globs on the flower buds.
- Native Americans used the heated leaves to reduce swelling, and the wood to make arrow shafts and houses.
- This species is an important nectar source for wasps, flies, and butterflies.



Photo credit: Jerry Kirkhart (Flickr)



Photo credit: KQED QUEST (Flickr)

### Where is this species found?

- Found in many habitats including coastal bluffs and oak woodlands.
- Found from 0 to 750 meters elevation, but occasionally up to 1500 meters.
- This species is occasionally found on serpentine soil.

For more information about phenology and the California Phenology Project (CPP), please visit the CPP website ([www.usanpn.org/cpp](http://www.usanpn.org/cpp)) and the USA-NPN website ([www.usanpn.org](http://www.usanpn.org))

## California Phenology Project: monitoring guide for Coyotebrush (*Baccharis pilularis*)



**Young leaves**  
Young leaves are generally thinner and lighter colored than mature leaves.

Brian Haggerty



Crystal Anderson

The flowers pictured to the left have only male parts (anthers) and will not produce fruit.



Crystal Anderson

The flowers pictured to the right have only female parts and will produce fruit. Each flower may produce a single seed.



### Flowers or flower buds

When monitoring flower abundance for this species, count each inflorescence as a single flowering structure! For example, if there are two inflorescences with many flowers or buds each, then abundance should be recorded as <3.

Miguel Viera



Steven Krause

### Open flowers

Can you see the anthers or stigma? Proportion of **open flowers** should be recorded at the scale of individual flowers, not inflorescences (i.e. count individual flowers!)  
**Note:** flower phenophases are nested; if you record **Y** for "open flowers" you should also record **Y** for "flowers or flower buds"



### Fruits

The fruit is a tiny, one-seeded capsule tipped with a tuft of white hairs. Fruits are grouped in a seed head and change from yellow-green to tan or light brown as they ripen. When fully dry, the fruits are blown from the plant.

Crystal Anderson



Steven Krause

### Ripe fruits

The fruit is considered ripe when it is tan or light brown.  
**Note:** fruit phenophases are nested; if you record **Y** for "ripe fruits" you should also record **Y** to "fruits"

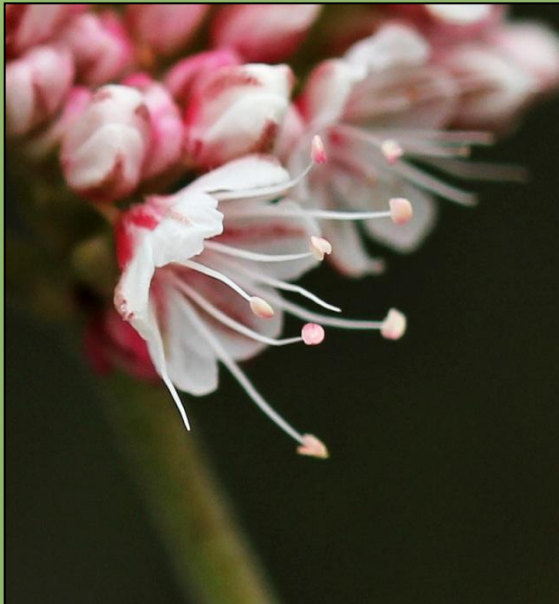
Phenophases not pictured: **Pollen release, Recent fruit or seed drop**



# Using USA-NPN datasheets



*Eriogonum fasciculatum*  
California buckwheat



# Using USA-NPN datasheets



## *Eriogonum fasciculatum* California buckwheat

### Trees and Shrubs *Semi-deciduous*

**Directions:** Fill in the date and time in the top rows and circle the appropriate letter in the column below.

**y** (phenophase is occurring); **n** (phenophase is not occurring); **?** (not certain if the phenophase is occurring).

Do not circle anything if you did not check for the phenophase. In the adjacent blank, write in the appropriate measure of intensity or abundance for this phenophase.



**Nickname:** \_\_\_\_\_  
**Species:** Eastern Mojave buckwheat  
**Site:** \_\_\_\_\_  
**Year:** \_\_\_\_\_  
**Observer:** \_\_\_\_\_

	Date:	Date:	Date:	Date:	Date:	Date:	Date:	Date:
Do you see...	Time:	Time:	Time:	Time:	Time:	Time:	Time:	Time:
Young leaves	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____
Leaves	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____
Flowers or flower buds	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____
Open flowers	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____
Fruits	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____
Ripe fruits	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____
Recent fruit or seed drop	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____	y n ? ____
Check when data entered online:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Comments:**



# CPP species profiles

## California Phenology Project: species profile for Eastern Mojave Buckwheat (*Eriogonum fasciculatum*)



**CPP site(s) where this species is monitored:** Santa Monica Mountains National Recreation Area, Joshua Tree National Park



Photo credit: Stan Shebs

### What does this species look like?

This perennial shrub can be up to 2 meters tall and 3 meters wide. The leaves are clustered at branch nodes and are leathery in texture; some varieties have white fuzz below, whereas others are glabrous. Leaves are a grey-green color, and rolled along the edges. The small flowers are 2.5 to 3 millimeters diameter, white to pinkish in color, and arranged in a dense clusters.

When monitoring this species, use the USA-NPN **semi-deciduous trees and shrubs** datasheet.

### Species facts!

- The CPP four letter code for this species is ERFA.
- This species was used by Native American groups to treat headaches, diarrhea, and wounds.
- This species is visited by a variety of butterflies, and is an important source of nectar for honeybees in dry areas.
- Can form associations with mycorrhizal fungi to aid in seedling survival and the colonization of new sites.



Photo credit: Brian Haggerty



Photo credit: wanderingnome (Flickr)

### Where is this species found?

- Found in dry slopes, washes, and canyons.
- A member of sagebrush scrub, desert scrub and coastal sage scrub plant communities.
- Found at elevations less than 2300 meters.
- In California, it is distributed in the Southern Sierra Nevada, Central West CA, Southwestern CA, East of Sierra Nevada, and Deserts.

For more information about phenology and the California Phenology Project (CPP), please visit the CPP website ([www.usanpn.org/cpp](http://www.usanpn.org/cpp)) and the USA-NPN website ([www.usanpn.org](http://www.usanpn.org))

Version 2, March 2012

## California Phenology Project: species profile for Eastern Mojave Buckwheat (*Eriogonum fasciculatum*)



Cait McHugh and Anjaneta Garcia

### Young leaves

Young leaves are generally thinner and lighter colored than mature leaves.

Similar to other species in Mediterranean and desert ecosystems, Buckwheat may respond to precipitation events with a flush of new leaf production. If water becomes unavailable after growth is initiated, however, then leaf expansion may be arrested, resulting in many small leaves on the plant. These responses to water availability (initiation of growth followed by arrested growth when the resources give out) can be confusing for observers. If you are unsure of what you are seeing, do not hesitate to circle ? on the NPN datasheets. With more experience, you may be able to distinguish between newly produced young leaves vs. old, small leaves. As you observe this species throughout the year, take note of the differences between new and old leaves—color, texture, and size can all be used to identify young leaves!



Brian Haggerty

### Flowers or flower buds

When monitoring flower or flower bud abundance for this species, count each inflorescence as a single flowering structure! For example, if there are two inflorescences with many flowers or buds each, then abundance should be recorded as <3.



Brian Haggerty

### Open flowers

You can see the pollen-producing anthers emerging from the flower in the photo to the left. Proportion of open flowers should be recorded at the scale of individual flowers, not inflorescences (i.e. estimate the proportion of individual flowers that are open!).

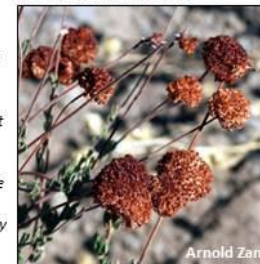
Note: flower phenophases are nested; if you record Y for "open flowers" you should also record Y to "flowers and flower buds"



Steve Berardi

### Fruits

The fruit is tiny and capsule-like, partially enclosed in a spent flower base (calyx), with many such spent flower bases tightly clustered together. The spent flower base changes from green to light brown or rusty brown as it dries out.



Arnold Zane

### Ripe fruits

A fruit is considered ripe when the spent flower base enclosing it has turned light brown or rusty brown.

Note: fruit phenophases are nested; if you record Y for "ripe fruits" you should also record Y to "fruits"

The green, pre-ripe fruit phenophase may be difficult to identify on this species. Remember you can circle ? if you are unsure of what you are seeing!

Phenophases not pictured: **Leaves, Recent fruit or seed drop**

Version 2, March 2012

# OUTLINE

- What is phenology?
- How is phenology related to climate and climate change?
  - Case studies
- California Phenology Project (CPP)
- USA National Phenology Network (USA-NPN)
- **Incorporation of phenological monitoring into outdoor education programming**
- Your creativity here: break-out sessions to invent and practice ways of introducing phenology to kids





# Phenology and Public Participation in Scientific Research.... in Outdoor Education





- NatureBridge inspires personal connections to the natural world and responsible actions to sustain it.
- National Park Service Park Partner
- NPN Partner
- 4.5 campuses
  - Yosemite NP
  - Golden Gate NRA
  - Olympic NP
  - Santa Monica Mountains NRA, Channel Islands NP
  - Prince William Forest NP





# Why “PPSR”?

- Why not Citizen Science?
  - PPSR community - More inclusive of the variety of ways public does science (informal, formal)
  - Not just students, or citizens, or scientists

NatureBridge

–

More  
inclusive of all  
our  
participant  
types  
(students,  
adults.





# Citizen Science Central

- ✓ Choose a question
- ✓ Form a team
- ✓ Refine protocols
- ✓ Recruit participants
- ✓ Train participants
- ✓ Accept data
- ✓ Analyze data
- ✓ Disseminate results
- ✓ Measure effects

Good PPSR has these components....





# Phenology as PPSR

- Age appropriate , kids already know it
- Connects well with other common topics
  - cycles, weather
- Tangible
- Observable
- Hands-On
- Meets many CA Science Standards
- Precursor to teaching about climate, climate change, local examples
- Empowering – taking action
- Builds science literacy in participants
  - contributing in a *meaningful* way
- Career experience



# NatureBridge's PPSR Goals

- Cross Campus comparison
- Tracking latitudinal seasonal change
- Supporting partnerships and collaboration in scientific community
- Repeatable student experience at different campuses, biomes
- USE THE DATA we take
  - make meaning!
  - Change over time!
- Officially nerd out





# PPSR and Outdoor Ed

- Kid friendly – language, data sheets, methods
- Visuals
- Adapt to different ages (know your audience)
- Staff Training and “buy in”
- Dedicated staff for data entry, follow through
- Consistency of monitoring – schedule
- Commitment

Now for the fun!





# Getting in Touch

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- **Meg Jakubowski – Santa Monica Mountains**  
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