

Implementing a regional phenology network: the California Phenology Project

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*UC Santa Barbara, National Park Service,
USA National Phenology Network*



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Scope of the California Phenology Project (CPP)



establish a coordinated phenological monitoring network,
covering a large geographic area and sampling across key
environmental gradients

Outline

- Intro to the USA-NPN phenology protocols
- Summary of CPP data
- Case studies:
 - Latitudinal gradient
 - Elevation gradient
 - Rainfall pulses
 - Continental extent
- Summary and next steps



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USA-NPN Protocols



Species: common cowparsnip
 Nickname: HELA2 (#64)

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

Species: California live oak
 Nickname: QUAG1 (#62)

Do you see...?	
Breaking leaf buds	y n ? _____
Young 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 ? _____
	y n ? _____
	y n ? _____
	y n ? _____
Check when data entered online:	<input type="checkbox"/>



USA-NPN Protocols

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.

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

One or more open, fresh flowers are visible on the plant. Flowers are considered "open" when the reproductive parts (male stamens or female pistils) are visible between or within unfolded or open flower parts (petals, floral tubes or sepals). Do not include wilted or dried flowers.

What percentage of all fresh flowers (buds plus unopened plus open) on the plant are open? For species in which individual flowers are clustered in flower heads, spikes or catkins (inflorescences), estimate the percentage of all individual flowers that are open.

Less than 5%; 5-24%; 25-49%; 50-74%; 75-94%; 95% or more;

Pollen release

One or more flowers on the plant release visible pollen grains when gently shaken or blown into your palm or onto a dark surface.

How much pollen is released?

Little: Only a few grains are released.; **Some:** Many grains are released.; **Lots:** A layer of pollen covers your palm, or a cloud of pollen can be seen in the air when the wind blows;

Fruits

Fruits

One or more fruits are visible on the plant. For *Baccharis pilularis*, the fruit is very tiny and seed-like and is crowded into a small spent flower head. The seed-like fruit has a tuft of white hairs and changes from yellow-green to tan or light brown, and drops or is blown from the plant. Do not include empty flower heads that have already dropped all of their fruits.

How many fruits are present?

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

Ripe fruits

One or more ripe fruits are visible on the plant. For *Baccharis pilularis*, a fruit is considered ripe when it has turned tan or light brown, or when it readily drops or is blown from the spent flower head when touched. Do not include empty flower heads that have already dropped all of their fruits.

What percentage of all fruits (unripe plus ripe) on the plant are ripe?

Less than 5%; 5-24%; 25-49%; 50-74%; 75-94%; 95% or more;

Recent fruit or seed drop

One or more mature fruits or seeds have dropped or been removed from the plant since your last visit. Do not include obviously immature fruits that have dropped before ripening, such as in a heavy rain or wind, or empty fruits that had long ago dropped all of their seeds but remained on the plant.

How many mature fruits have dropped seeds or have completely dropped or been removed from the plant since your last visit?

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

USA-NPN Protocols

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) and the USA-NPN website (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.



Miguel Viera

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.



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"



Crystal Anderson

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.

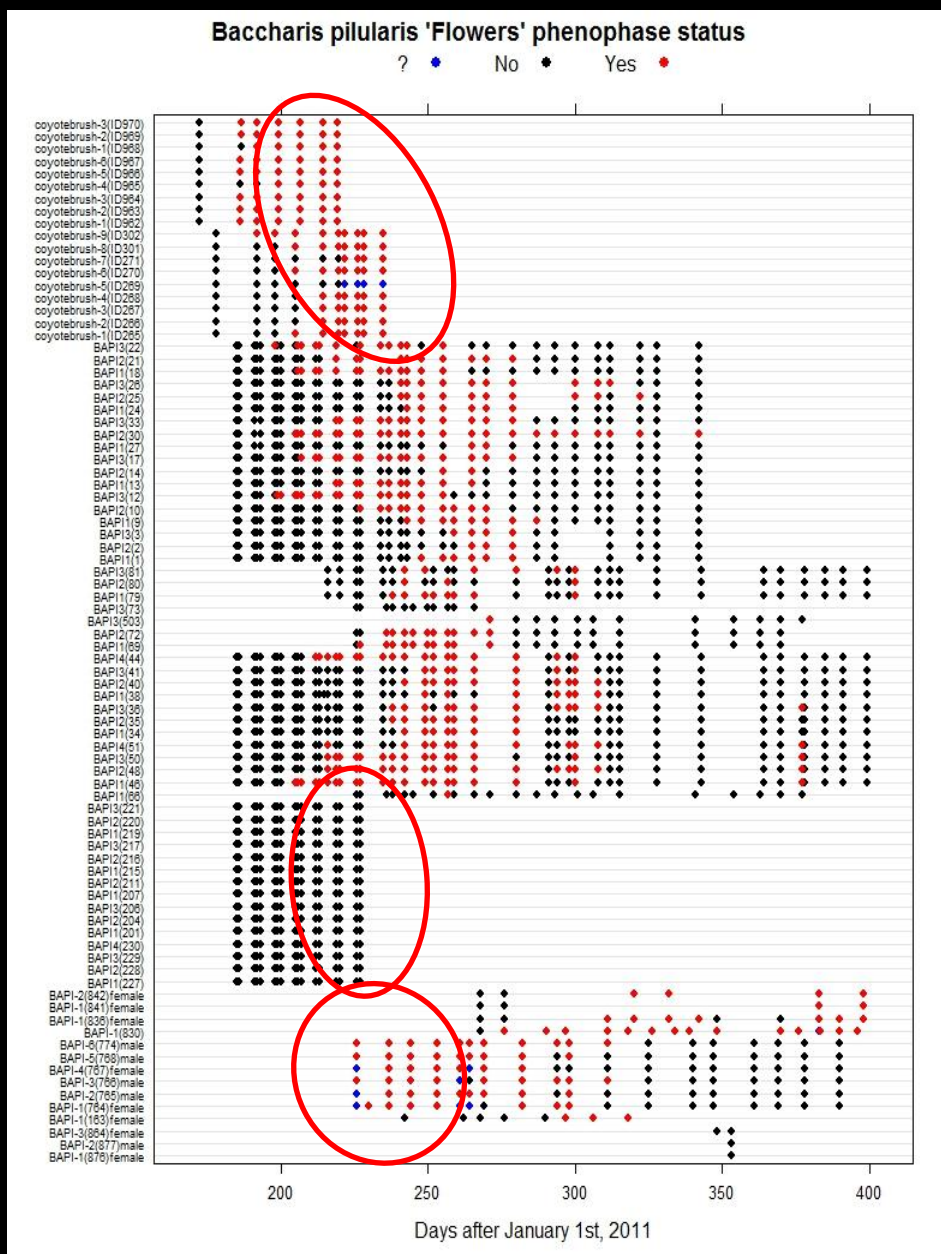


Steven Krause

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**

USA-NPN Protocols



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- Intro to the USA-NPN phenology protocols
- Summary of CPP data
- Species case studies:
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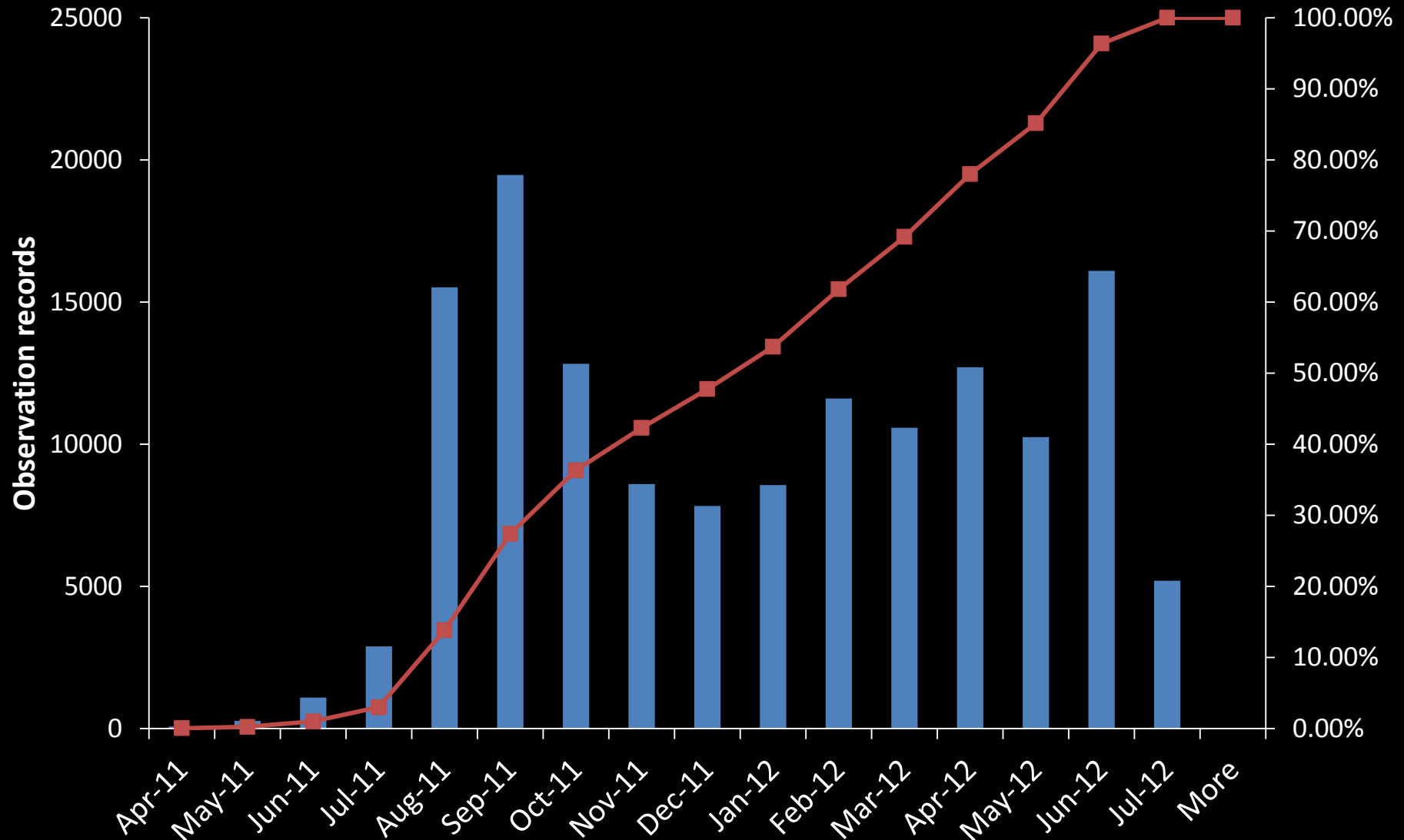
Summary of the data

- 30 species
 - herbaceous perennials, evergreen shrubs and trees, deciduous shrubs and trees.
 - 8 are monitored in multiple parks.
- > 950 tagged monitored individuals
- > 22,000 observations
- > 160,000 observation records
- In 2011 accounted for 22% of USA-NPN database



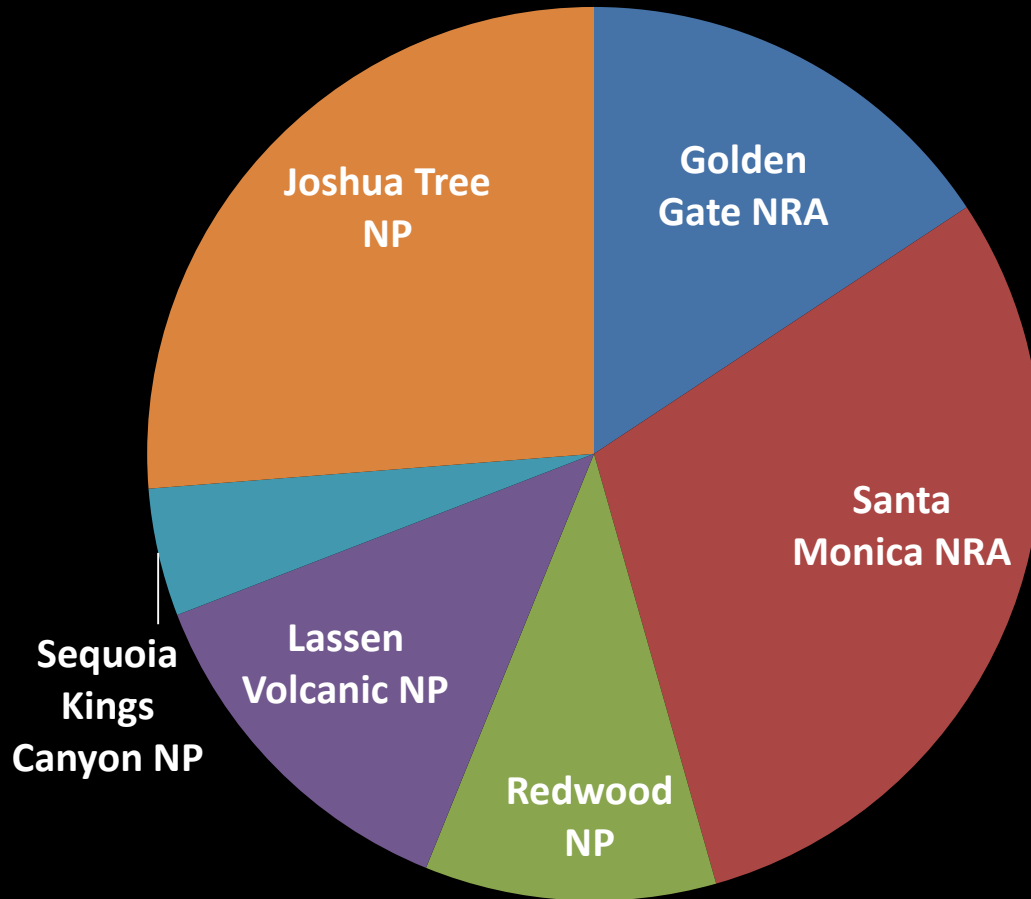
Summary of the data

CPP observations 2011-2012



Summary of the data

Proportion of observation records



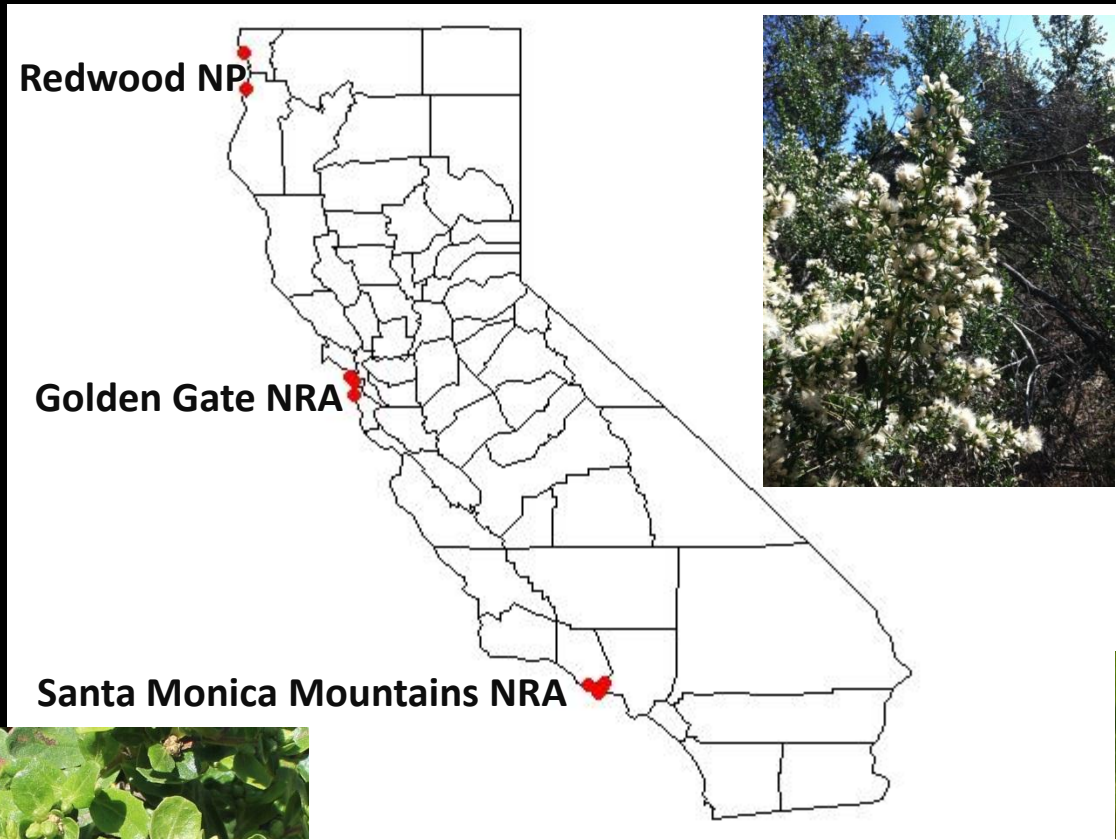
Outline

- Intro to the USA-NPN phenology protocols
- Summary of data: what we've collected so far
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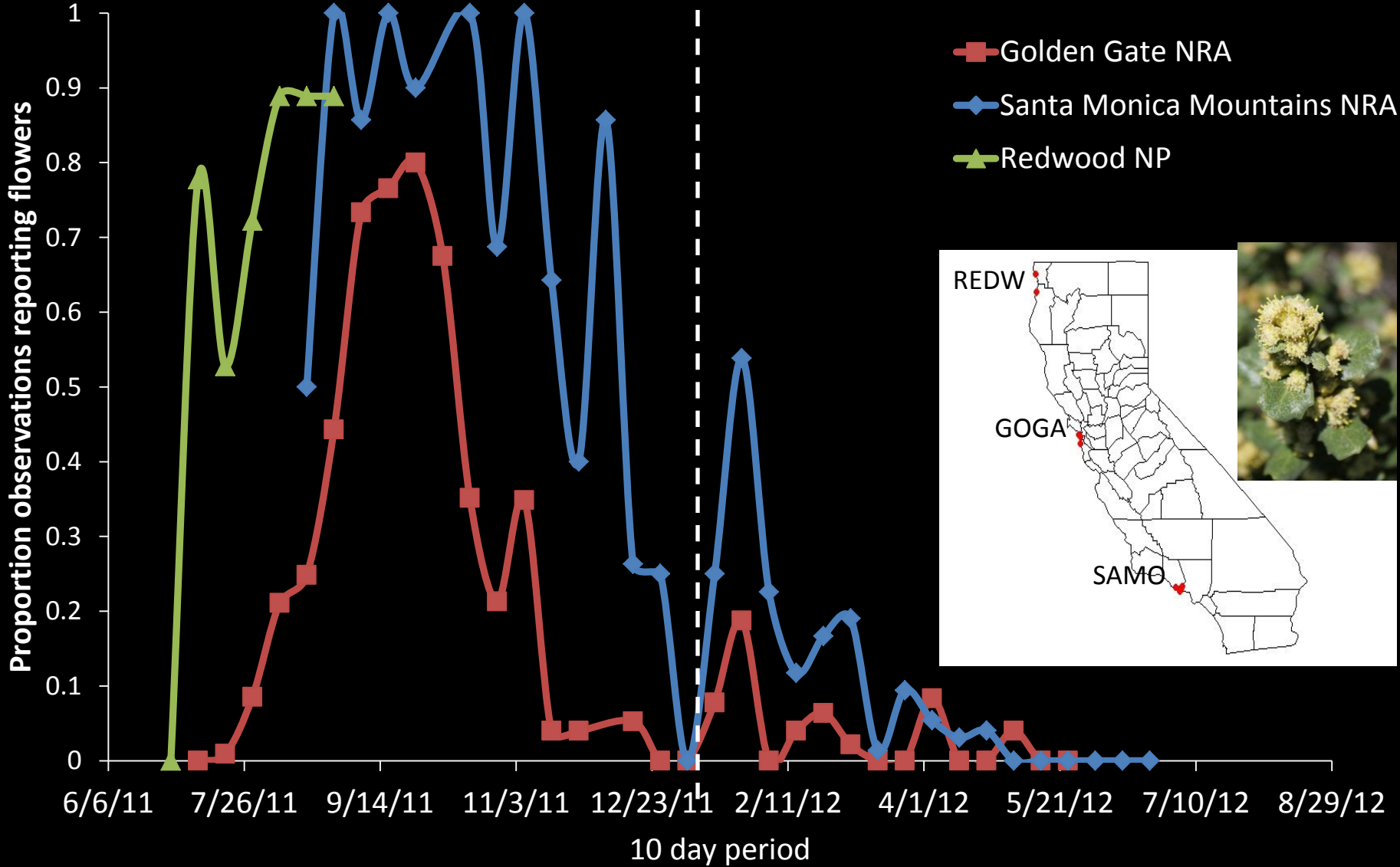
Patterns across latitude

Baccharis pilularis coyote brush



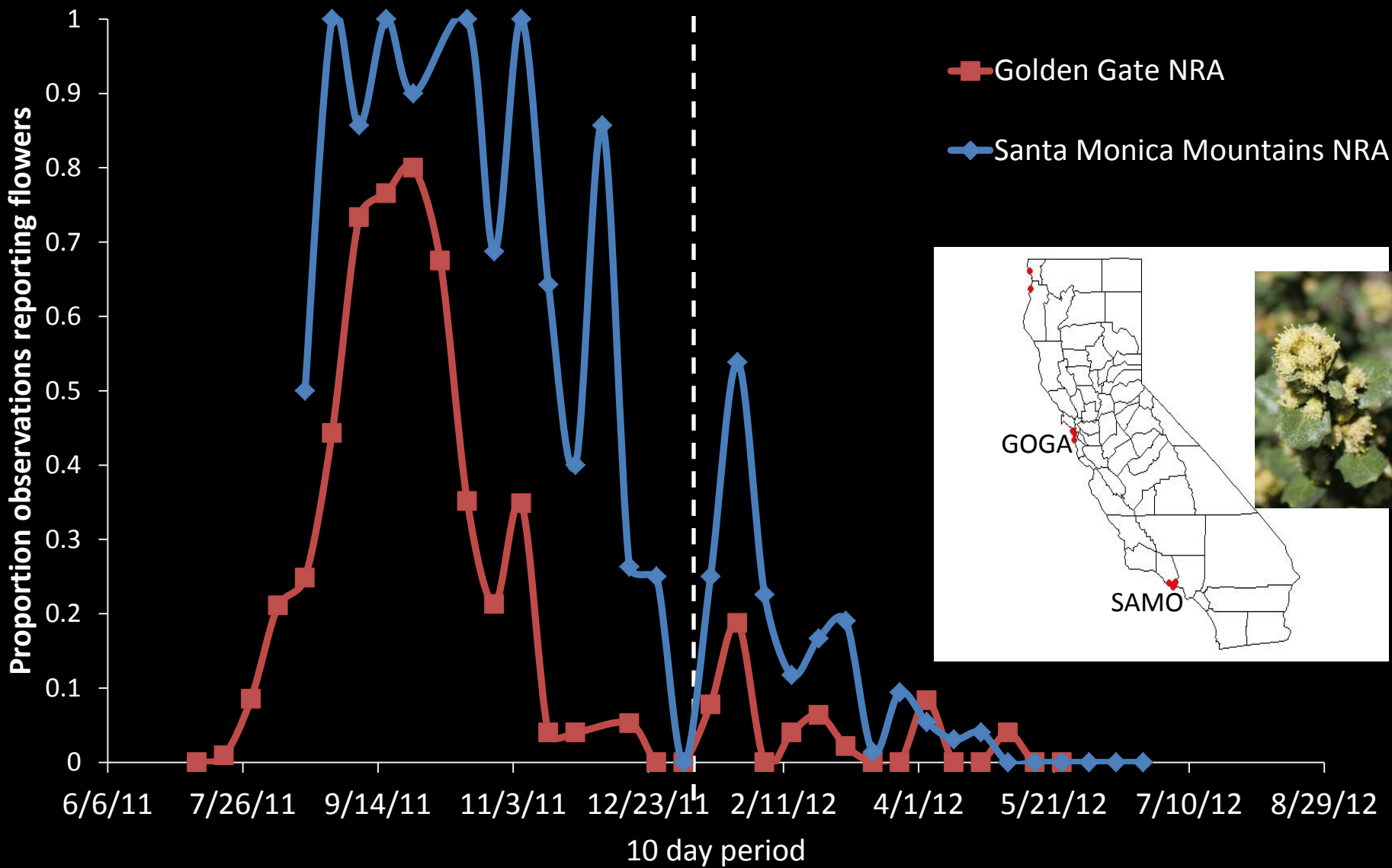
Patterns across latitude

Baccharis pilularis



Patterns across latitude

Baccharis pilularis



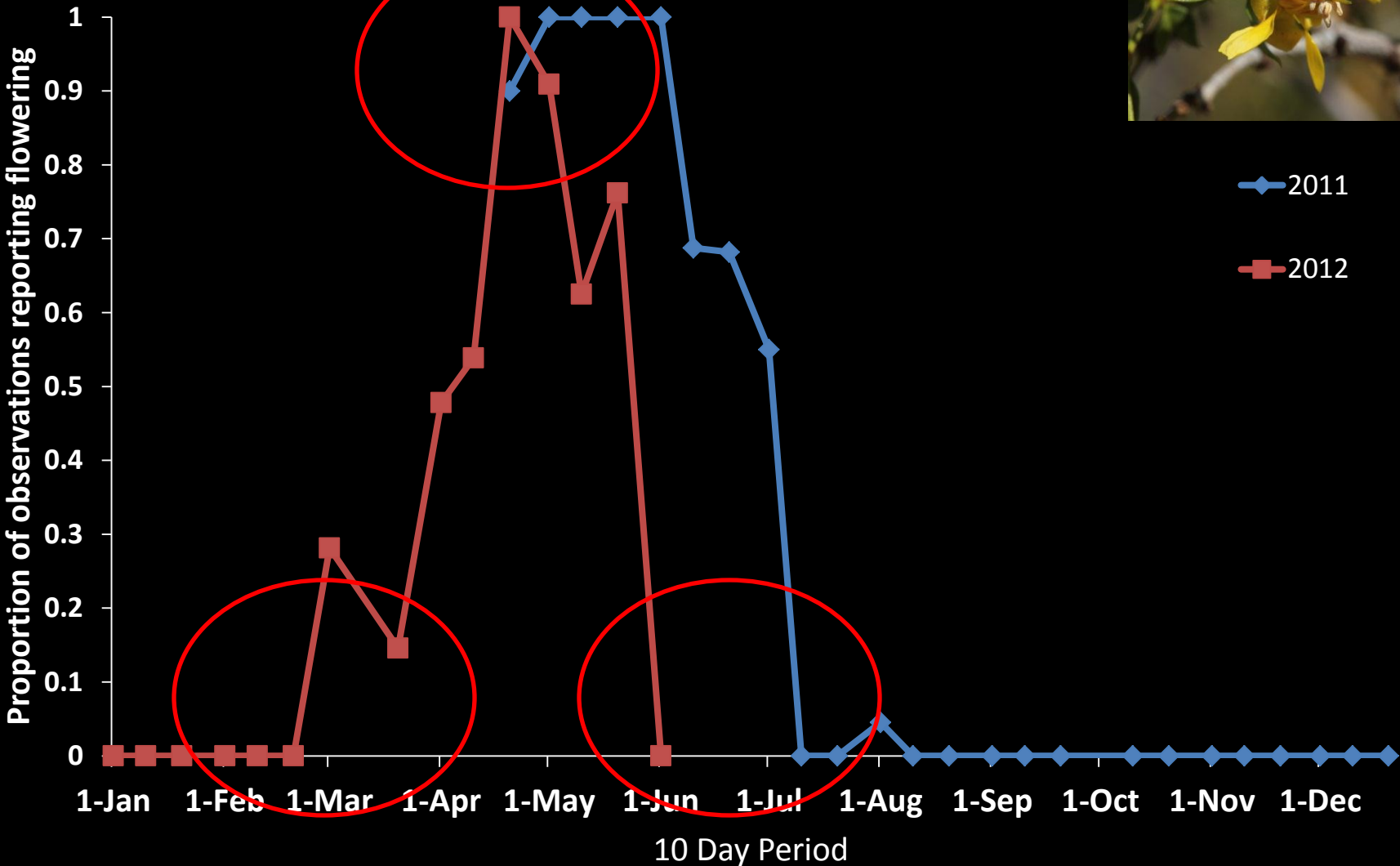
Patterns across elevation

Larrea tridentata, Joshua Tree NP



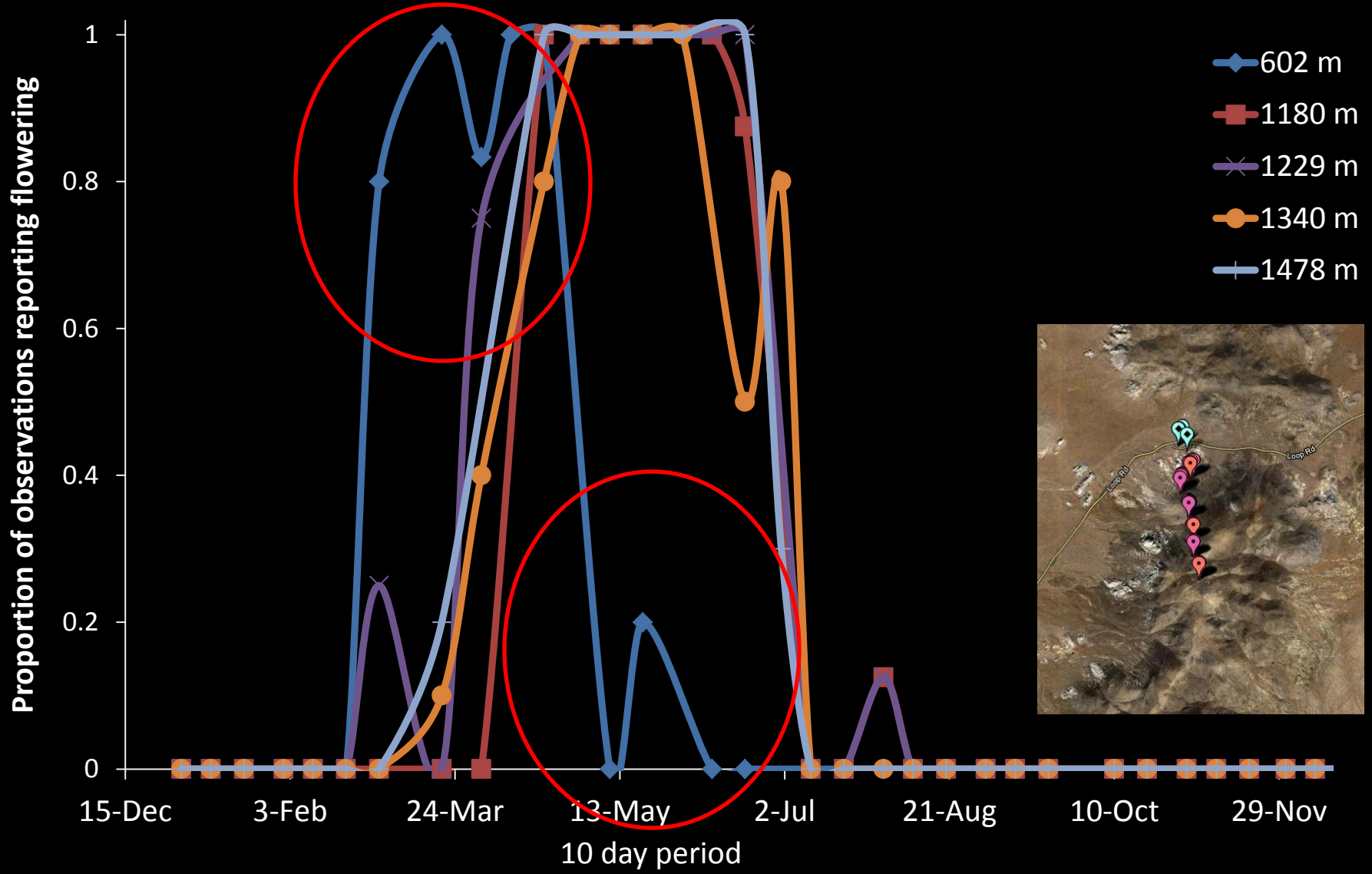
Patterns across elevation

Larrea tridentata, Joshua Tree NP



Patterns across elevation

Larrea tridentata



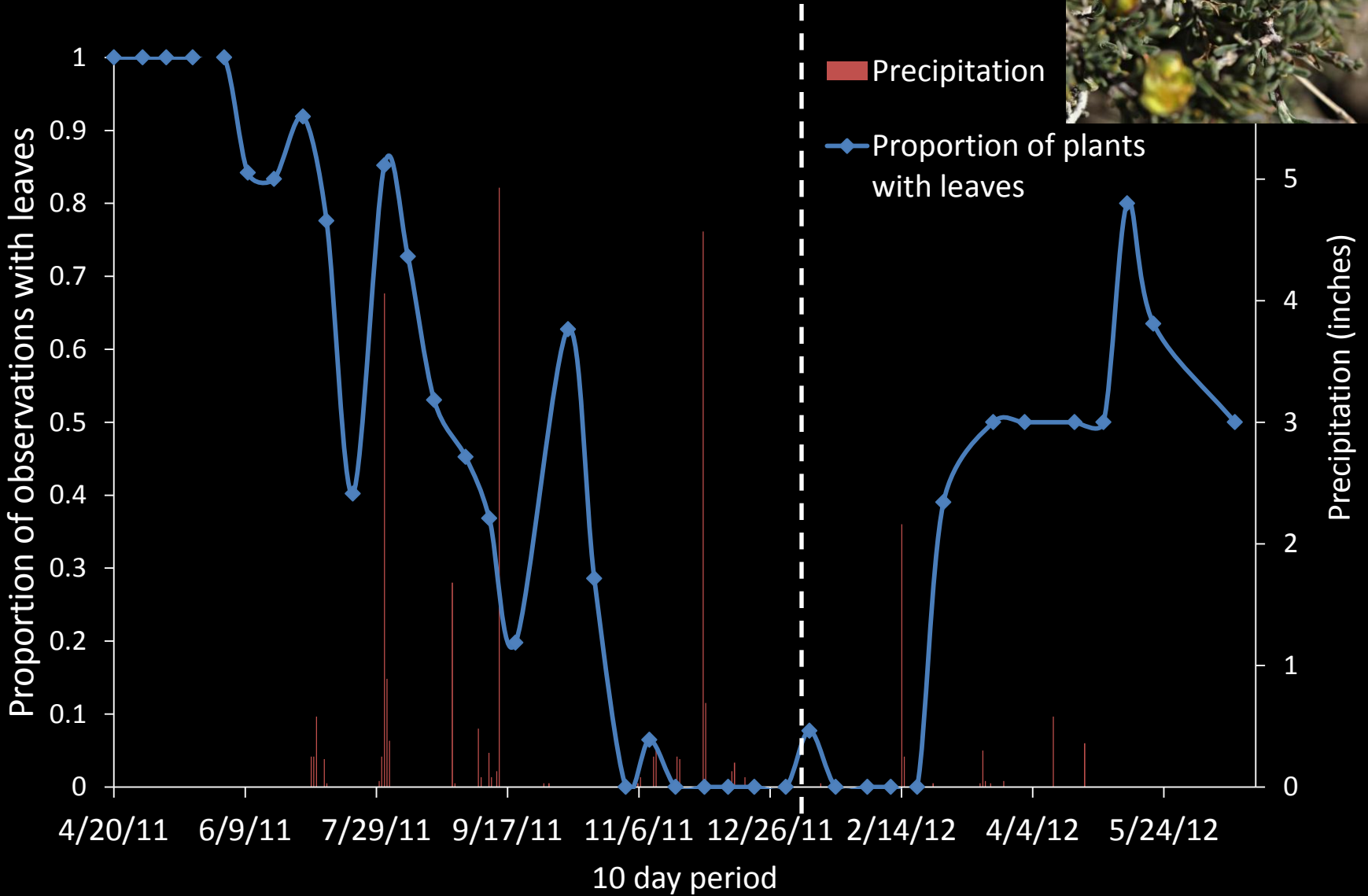
Response to precipitation

Coleogyne ramosissima



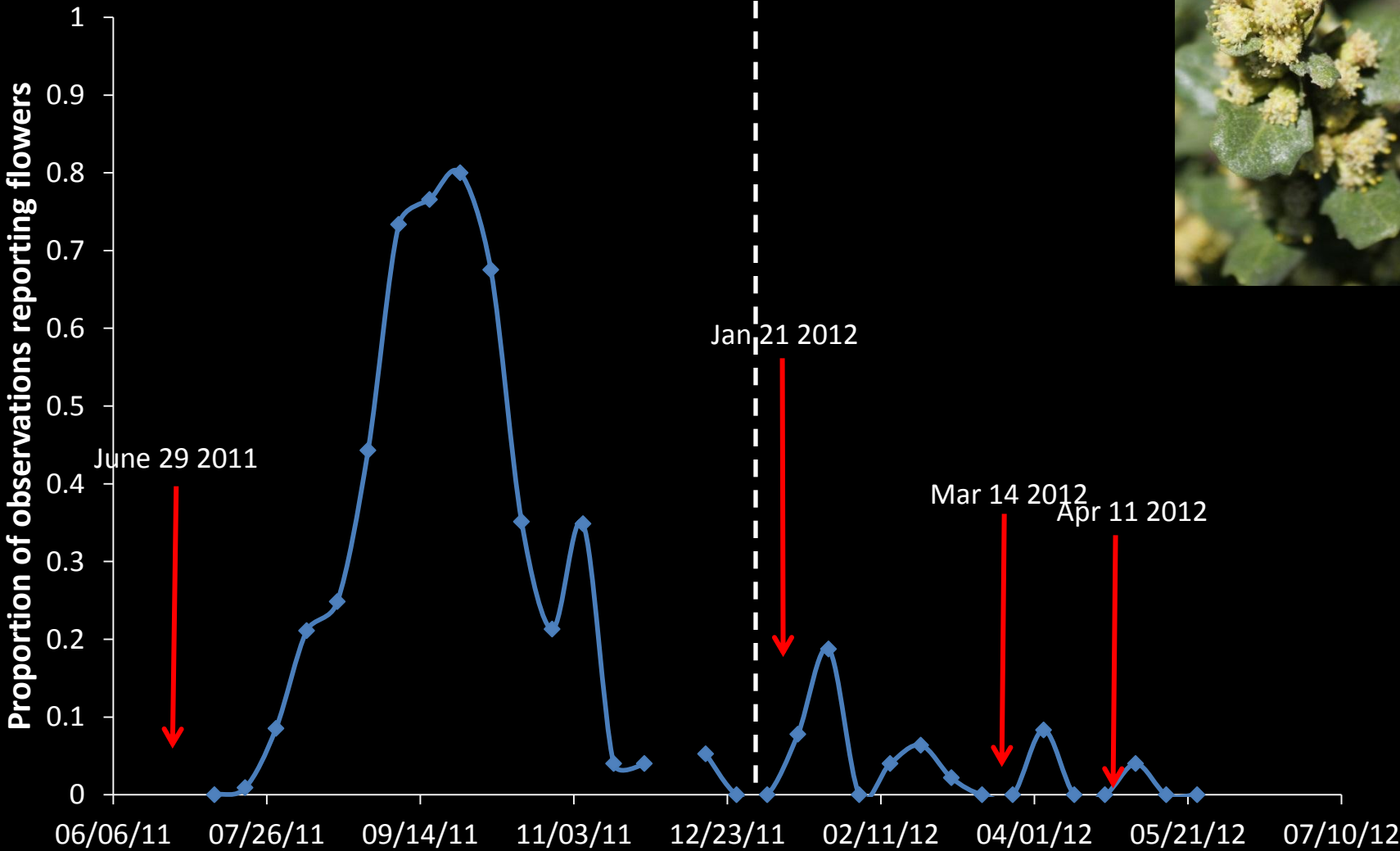
Response to precipitation

Coleogyne ramosissima



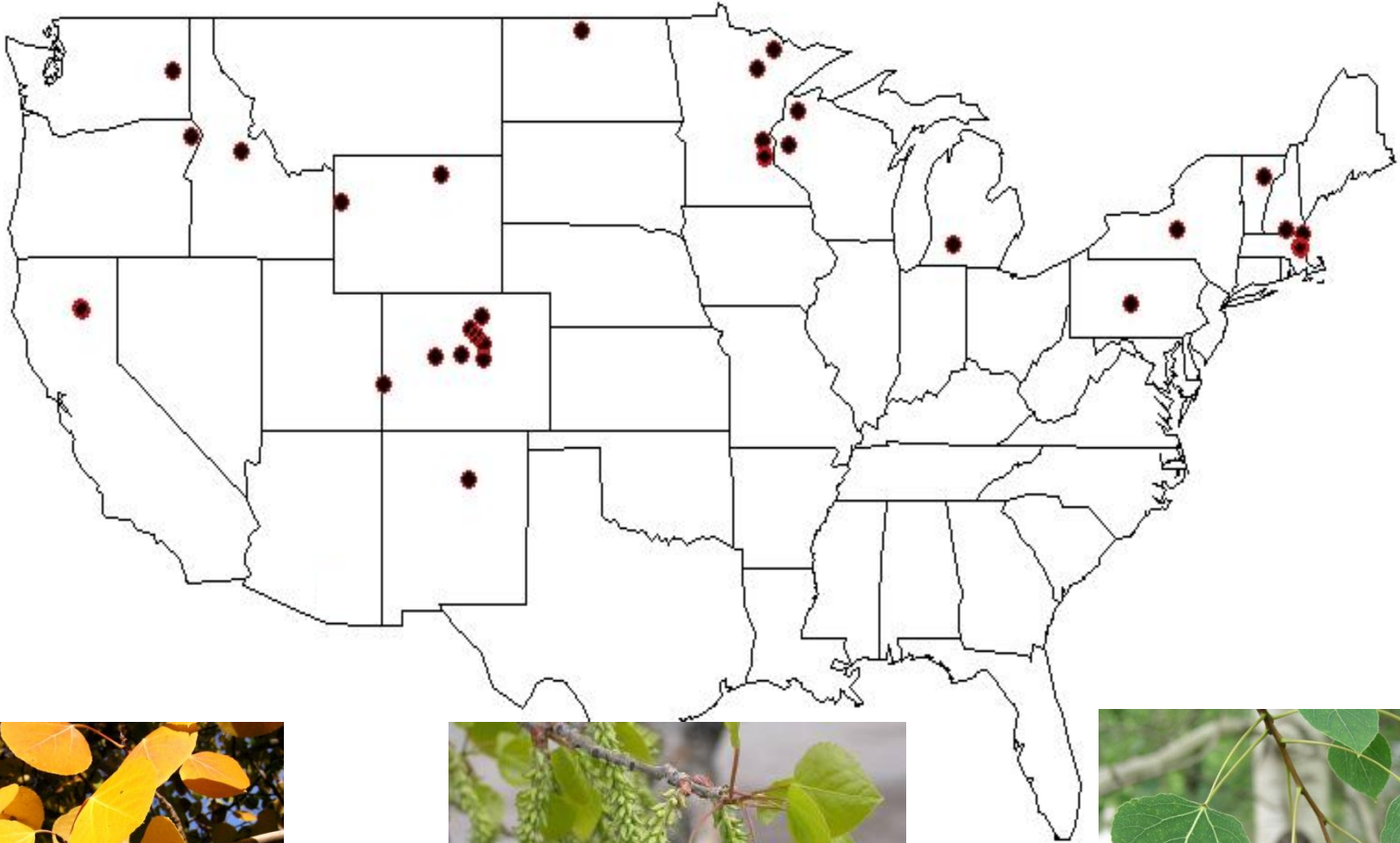
Response to precipitation

Baccharis pilularis, Golden Gate NRA

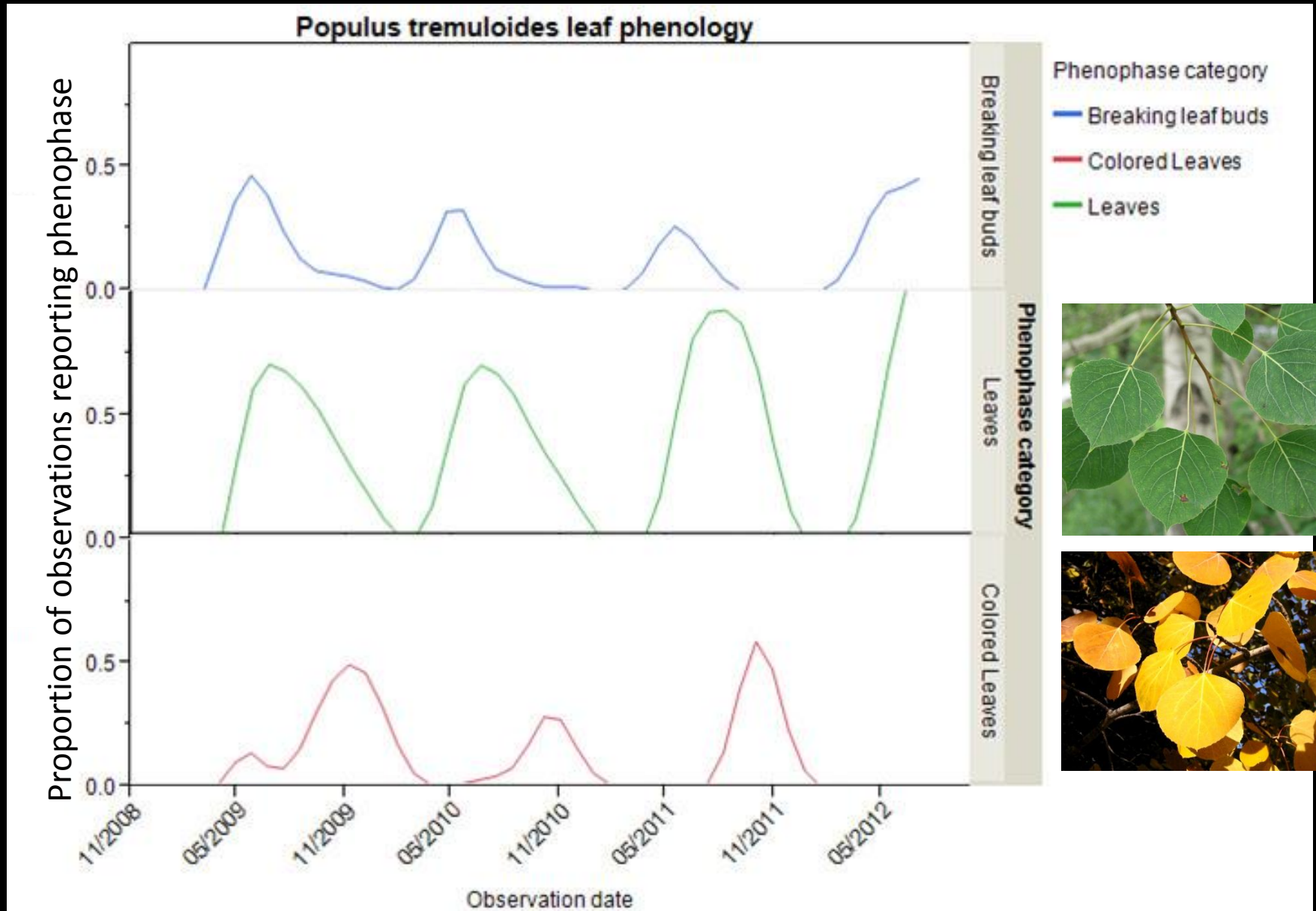


Continental patterns

Populus tremuloides



Continental patterns



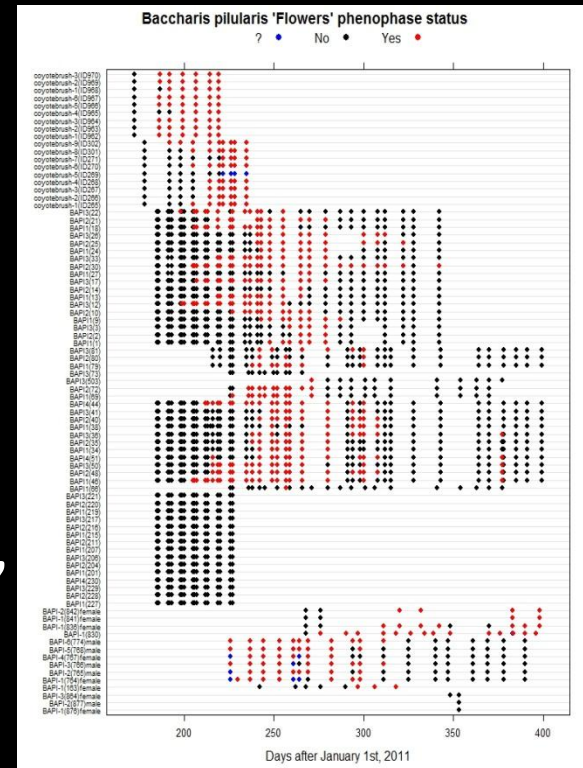
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Summary

- One year of pilot data yields insights into phenological patterns and responses to environment
 - Latitude
 - Elevation
 - Precipitation pulses
- Challenges in identifying and characterizing phenological onset, peak and duration



Next steps

- Continue to collect data and expand network
- Use climate data (e.g., PRISM) to characterize variation between sites
- explore relative responsiveness of phenology to temperature and precipitation within populations and species.

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