

## Appendix 2: John Muir National Historic Site CPP Monitoring Guide

Version 1

### Revision History Log:

Version #	Revision Date	Author	Changes Made	Reason for Change
1.00		Matthews		

***Phenological monitoring guide:  
John Muir National Historical Site (JOMU)***

A designated monitoring site of  
The California Phenology Project (CPP)



# Contents

I. Introduction .....	4
II. JOMU Points of Contact .....	5
III. CPP Species Monitored at John Muir National Historic Site.....	6
a. Blue elderberry ( <i>Sambucus nigra</i> ssp. <i>cerulea</i> ) .....	6
b. Blue oak ( <i>Quercus douglasii</i> ) .....	7
c. California bay ( <i>Umbellularia californica</i> ) .....	7
d. California buckeye ( <i>Aesculus californica</i> ).....	7
e. California live oak ( <i>Quercus agrifolia</i> ).....	7
f. California wild rose ( <i>Rosa californica</i> ).....	8
g. Common snowberry ( <i>Symphoricarpos albus</i> ) .....	8
h. Coyotebrush ( <i>Baccharis pilularis</i> ).....	8
IV. JOMU Monitoring Locations and Maps .....	17
V. Frequency of Monitoring and Estimated Time Investment .....	21
VI. Datasheets and Data Entry.....	22
VII. Preliminary Phenological Calendars for JOMU focal taxa: estimates of phenophase onset and duration .....	23
VIII. Suggestions for Interpretative Programs for the Public .....	28

## I. Introduction

**Phenology** is the study of the timing of seasonal biological events such as the flowering and fruiting of plants; the annual emergence of insect pollinators and pests; and the migration of birds and mammals. With funding from the National Park Service (NPS) Climate Change Response Program, the *California Phenology Project (CPP)* ([www.usanpn.org/cpp](http://www.usanpn.org/cpp)) was launched in 2010 as a pilot project to develop and test protocols and to create tools and infrastructure to support long-term phenological monitoring and public education activities in California's national parks. On-the-ground pilot activities focused on seven California parks: Joshua Tree National Park (JOTR), Santa Monica Mountains National Recreation Area (SAMO), Golden Gate National Recreation Area (GOGA), John Muir National Historic Site (JOMU), Lassen Volcanic National Park (LAVO), Sequoia and Kings Canyon National Parks (SEKI), and Redwood National Park (REDW).

Products of the pilot period include a *Plant Phenology Monitoring Protocol* (with step-by-step instructions for conducting monitoring) and *park-specific monitoring guides* for each of the seven pilot parks. This monitoring guide is meant to serve as a reference for CPP participants who are observing plants at *John Muir National Historic Site (JOMU)*. It identifies and describes all of the CPP and USA-NPN resources that observers will need to get started monitoring plants at JOMU (e.g., where are the JOMU monitoring sites located, how to access USA-NPN datasheets, where to download CPP species profiles). It also covers all of the basic information that new NPS staff need to know about the CPP monitoring at their park. This guide, however, is not meant to replace participation in an official training event, nor is it meant to provide detailed background information about phenology and the USA-NPN monitoring protocols. Please refer to the CPP *Plant Phenological Monitoring Protocol* for detailed monitoring instructions (download the most recent version here: <http://www.usanpn.org/cpp/resources>). For more information about the USA-NPN monitoring protocols, visit the USA-NPN's *How to Observe* webpage (<http://www.usanpn.org/how-observe>). To learn more about phenology, visit the CPP ([www.usanpn.org/cpp](http://www.usanpn.org/cpp)) and USA-NPN websites ([www.usanpn.org](http://www.usanpn.org)), where you can download newsletters, project briefs, presentations, and more (<http://www.usanpn.org/cpp/resources>).

The goals of the *California Phenology Project* are to: (1) recruit and to train NPS staff in the Divisions of Resource Management, Education, and Interpretation; formal and informal educators; students; and the public in the skills needed for recording and interpreting phenological data; (2) establish baseline phenological patterns and track long-term phenological trends to document the effects of climate change on wild plants and animals; and (3) guide adaptive management of California's natural resources. For a detailed description of the CPP's scientific goals, please refer to the *Plant Phenology Monitoring Protocol*.

## **II. JOMU Points of Contact**

### **JOMU CPP contacts:**

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### III. CPP Species Monitored at JOMU

There are 8 species targeted for monitoring at John Muir National Historic Site: Blue elderberry (*Sambucus nigra* ssp. *cerulea*), Blue oak (*Quercus douglasii*), California bay (*Umbellularia californica*), California Buckeye (*Aesculus californica*), California live oak (*Quercus agrifolia*), California wild rose (*Rosa californica*), Common snowberry (*Symphoricarpos albus*), and Coyotebrush (*Baccharis pilularis*).

The two-sided CPP species profiles for each species are available for download from the CPP website (front and back images are also included below): <http://www.usanpn.org/cpp/AllSpecies>. CPP species profiles include a brief description of each species, as well as photos for most phenophases. Please note that some profiles are missing photos of observed phenophases-- we encourage CPP participants to continue collecting photos and updating the species profiles.

Table 1. CPP species monitored in JOMU, with their USA-NPN protocol category and the other National Parks where they are monitored. (Abbreviations used: LAVO=Lassen Volcanic National Park; JOMU= John Muir National Historic Site)

Common Name	Scientific Name	USA-NPN Protocol Category	Parks
Blue elderberry	<i>Sambucus nigra</i> ssp. <i>cerulea</i>	Deciduous Trees & Shrubs	JOMU, SEKI
Blue oak	<i>Quercus douglasii</i>	Deciduous Trees & Shrubs	JOMU, SEKI
California bay	<i>Umbellularia californica</i>	Broadleaf Evergreen Trees & Shrubs	JOMU
California buckeye	<i>Aesculus californica</i>	Deciduous Trees & Shrubs	JOMU, SEKI,
California live oak	<i>Quercus agrifolia</i>	Broadleaf Evergreen Trees & Shrubs (with pollen)	JOMU, SAMO, GOGA
California wild rose	<i>Rosa californica</i>	Deciduous Trees & Shrubs	JOMU
Common snowberry	<i>Symphoricarpos albus</i>	Deciduous Trees & Shrubs	JOMU
Coyotebrush	<i>Baccharis pilularis</i>	Broadleaf Evergreen Trees & Shrubs (with pollen, no leaf buds)	JOMU, SAMO, GOGA, REDW

To see the complete list of CPP focal species, please visit <http://www.usanpn.org/cpp/AllSpecies>

A brief description of the four species targeted for monitoring at JOMU is provided below.

**3.1 Blue elderberry (*Sambucus nigra* ssp. *cerulea*; SANI)** is a shrub in the Caprifoliaceae family. It is common throughout California, occurring across a broad latitudinal range. It is easy to identify, although a recent history of taxonomic uncertainty may result in some confusion (the taxon was incorrectly referred to as *Sambucus mexicana* in many parts of California, although *S. mexicana* is a taxonomic synonym for a species that does not occur in CA). SANI is easy to grow

(e.g., it grows quickly from seed to maturity) and is a good candidate for use in phenology gardens. *Sambucus* species were used by Native American for medicinal purpose and as a food source, and elderberry fruit is edible and used today in jams and wine. SANI is also a species of management concern. It is the food plant of the rare Valley Long-Horned Beetle and for many other wildlife species. The SANI flowers are insect pollinated, and fruits are animal and gravity dispersed. SANI is commonly used in restoration.

**3.2 Blue oak (*Quercus douglasii*; QUDO)** is a deciduous tree, with leaves that are typically shallowly lobed and blue-green on the upper-side. Male flowers are borne in slender drooping catkins that originate in the axils of the previous year's leaves, while female flowers form from leaf axils of the current year. Flowering typically occurs from late March to mid-May, with abundant acorn crops produced every 2-3 years, with bumper crops every 5-8 years (mast years). Blue oaks are widespread, but endemic to California. They are generally found on the dry, low to mid elevation slopes that surround the Central Valley. Blue oak woodlands form extensive stands on the state's interior foothills, but they are also scattered across other areas of the state, reaching as far north as Shasta County and as far south as Los Angeles County. Native cultures relied heavily upon blue oak acorns for food and used various parts of the tree for a great number of uses including medicine (arthritis), dyes, utensils, games, toys, basketry, firewood, and many other daily uses.

**3.3 California bay (*Umbellularia californica*; UMCA)** is an aromatic evergreen shrub or tree with greenish to reddish brown bark. It can grow up to 30 meters tall. The shiny smooth leaves are 3 to 10 cm long. The small yellow-green flowers are arranged in round inflorescences, and each flower has both female and male parts. The solitary fruits are 2 to 2.5 cm and resemble an olive. Native Americans made tea from the root bark and used the leaves to control biting insects. The leaves were also used medicinally by Native Americans to treat headaches and rheumatism. California bay is used extensively in restoration projects.

**3.4 California buckeye (*Aesculus californica*; AECA)** is deciduous large shrub or small tree that is widespread throughout California and parts of southwest Oregon. California buckeye is an early indicator of spring, and when in bloom, its distinctively large spike of flowers can easily be seen as one drives past it on the hillsides. It is one of the first trees or shrubs to leaf out in the spring and one of the earliest to drop its leaves in the summer. Buckeye plants begin to enter dormancy in the late summer or fall, depending on its local climate. Buckeyes growing in the hotter and drier areas begin to drop their leaves in mid- summer, while those in coastal regions tend to retain their leaves until mid-autumn. California buckeye's large brown nuts were an important food source for indigenous California tribes. After a lengthy leaching process to remove the poisonous toxins found in the raw seeds, the grounded flour was cooked and eaten. The plant was also used for medicinal purposes (e.g., the seeds were used to treat hemorrhoids and the bark was used to treat snakebites). Many tribes also poured the mashed nuts into quiet pools to stupefy or kill fish. California buckeye was selected for monitoring by the CPP for its showy flowers, the distinctive nature of the deciduous phase, and large, attractive fruits. Visitors are naturally drawn to this plant and are interested in its life cycle.

**3.5 California live oak (*Quercus agrifolia*; QUAG)** is a dominant tree in the lower-elevation mixed evergreen woodlands of California. It is easy to identify with lots of potential for exploring

interactions with animals (e.g., moths and caterpillars). It is a species of management concern for a variety of reasons, including the spread of sudden oak death (SOD), predicted range shifts (e.g., models predict range expansion in some coastal National Park units, such as Point Reyes), and its importance to wildlife (e.g., coast live oak communities support many bird species, including two federally endangered species, Bell's vireo and least tern). It is also commonly used in restoration projects. QUAG is widespread in California's public lands (e.g., it is found in 8 National Park units and 11 UC Natural Reserves) and is currently monitoring at Golden Gate NRA, Santa Monica Mountains NRA, and John Muir NHS.

**3.6 California wild rose (*Rosa californica*; ROCA)** is a shrub in the Rosaceae family. It often forms thickets, and its prickly grey-brown stems are strongly curved. The leaves are made up of smaller toothed leaflets that are often hairy or glandular. There are 1 to 20 flowers per inflorescence, and each flower is generally pink with petals that are 10 to 20 mm long. Each rose has five petals. The fruits, called rose hips, are 8 to 20 mm long and turn red when ripe; the fruit is an important food source for wildlife and are high in vitamin C. Rose hips can be dried for tea and used in jellies and sauces.

**3.7 Common snowberry (*Symphoricarpos albus*; SYAL)** is a densely branched deciduous shrub that grows between 0.6 to 1.8 meters tall. It can form thickets with creeping underground stems. The small but showy flowers are white to pink and have both male and female parts. These flowers occur in small clusters of 8 to 16 along the stems and are insect-pollinated. The round fruit is 8 to 12 mm long. The berries are an important food source for birds and mammals (note: the berries can be toxic to humans, causing vomiting and dizziness), and the floral nectar is an important resource for butterflies and moths. Native Americans used SYAL medicinally and for arrowshafts, brooms, and shampoo.

**3.8 Coyotebrush (*Baccharis pilularis*; BAPI)** is a shrub in the Aster family that is widespread and common in coastal California vegetation types. It is easy to identify, and not easily confused with other species. It flowers in the late summer through early winter, so it is a nice choice for CPP participants who want to monitor at that time of the year. Coyotebrush is dioecious, and BAPI observations can be used to explore how dioecious species respond to climate change. It is also considered an important "nursery" plant to species palatable to deer (e.g., allows oaks to grow above the browse line when oaks "hide" in coyote brush). It is widespread in California's public lands (e.g., it is found in 10 National Park units and 19 UC Natural Reserves) and is currently monitored at Redwood National Park, John Muir NHS, Golden Gate NRA, and Santa Monica Mountains NRA.



## Blue elderberry, *Sambucus nigra* ssp. *cerulea* species profile (Version 2; March 2012):

California Phenology Project:  
species profile for  
**Blue Elderberry**  
(*Sambucus nigra* ssp. *cerulea*)



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CPP site(s) where this species is monitored: Santa Monica Mountains National Recreation Area



Photo credit: flit (Flickr)

**What does this species look like?**

This deciduous shrub forms thickets with many branches and can have multiple trunks. It grows up to 8 meters tall. The leaves are subdivided into 5 to 9 leaflets with toothed edges. The small yellowish-white flowers are found in dense clusters. They are bisexual, having both male and female parts within each flower. The fruits are a dark blue berry displayed in clusters.

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

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**Species facts!**

- The CPP four letter species code for this species is **SANI**.
- The fruit is used to make wine, jellies, candy, pies, and sauces.
- Its wood is used to make combs, spindles, mathematical instruments, blowguns, flutes, and whistles.
- The bark is used to make a dye, and its leaves are used as an insecticide and medicinally.
- Several parts of the plant, including its unripe fruit, contain a poisonous alkaloid and cyanogenic glycoside.



Photo credit: James Gaither (Flickr)

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Photo credit: KQED Quest (Flickr)

**Where is this species found?**


- Found in openings in moist forest habitat and moist areas within drier, open habitats
- Associated with riparian plant communities
- Grows best on loam or sandy loam soils.
- Most common at low to mid elevations.

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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  
**Blue Elderberry**  
(*Sambucus nigra* ssp. *cerulea*)



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**Breaking leaf buds**

Crystal Anderson




**Leaves**

Brewbooks




**Increasing leaf size**

Crystal Anderson




**Colored leaves**




**Flowers or flower buds**

Forest & Kim Starr




**Open flowers**

Liz Matthews



**Fruits**

Liz Matthews



**Ripe fruits**

Liz Matthews

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.

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


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

Phenophases not pictured: **Falling leaves, Recent fruit or seed drop**


Version 2, March 2012

## Blue oak, *Quercus douglasii* species profile (Version 2, March 2012):

California Phenology Project:  
species profile for  
**Blue Oak**  
(*Quercus douglasii*)




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PARK  
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CPP site(s) where this species is monitored: Sequoia National Park and John Muir NHS

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**What does this species look like?**  
This deciduous tree is short and straight. It grows from 6 to 20 m tall and has thin and flaky light grey bark. The waxy bluish-green leaves are 3 to 8 centimeters long with wavy margins. This species is monoecious, having male and female flowers separate, but on the same plant. Male flowers are yellow green hanging catkins, and female flowers are small and solitary, growing in the axis of leaves. This species is wind pollinated. The acorns are 2 to 3 centimeters long and take one year to mature.


*When monitoring this species, use the USA-NPN deciduous trees and shrubs (with pollen) datasheet.*

Photo credit: loarie (flickr)

**Species facts!**

- The CPP four letter code for this species is QUDO.
- Exhibits masting behavior; all individuals in a population will have synchronized episodic acorn productions. This is thought to satiate seed predators so that some acorns can survive to germinate the following year.
- Susceptible to Sudden Oak Death disease, a plant pathogen that can have a devastating impact on forests.

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**Where is this species found?**


- Endemic to California.
- Found on dry slopes, interior foothills, and woodland habitats.
- Covers the foothills surrounding the Central Valley of California.
- At elevations less than 1200 meters.

Photo credit: KQED Quest (flickr)


**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  
**Blue Oak**  
(*Quercus douglasii*)




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**Breaking leaf buds**




**Leaves**




Eugene Zelenko

**Increasing leaf size**



© Br. Alfred Brousseau, Saint Mary's College


**Colored leaves**



Eugene Zelenko

**Flowers or flower buds**


*The male inflorescence is a catkin which is initially compact and stiff, but eventually unfolds, lengthens, and hangs loosely from the branch. Female flowers are very small and petal-less, emerging from the growing stem at the point where a new leaf is attached.*



Keir Morse

**Open flowers**

*The male flowers will open once the catkin has unfolded and is hanging loosely. Female flowers are open when the pistils are visible, but will be very difficult to see where they are out of reach.*




Todd Hamilton

**When monitoring flower or flower bud abundance for this species, count each inflorescence as a single flowering structure!**

**When monitoring the proportion of open flowers, estimate the number of individual flowers that are open, not inflorescences! For big trees, estimate proportions of open flowers for a few branches and extrapolate for the rest of the tree.**

**Fruits**


*The fruit is an acorn that changes from green to yellowish-green to brown or dark brown.*



Eugene Zelenko

**Ripe fruits**

*The fruit is considered ripe when it is brown or dark brown.*



© 2007 Neal Kramer

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**Important Note:** USA-NPN flower and fruit phenophases are nested. If you say "Y" to "open flowers" you should also have said "Y" to "flowers or flower buds" and if you say "Y" to "ripe fruits" you should also have said "Y" to "fruits"


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

Version 2, March 2012


John Muir NHS Monitoring Guide (June 2013)- Page 10 of 28

# California bay, *Umbellularia californica* species profile (Version 1, May 2012):


California Phenology Project:  
species profile for  
**California laurel**  
(*Umbellularia californica*)



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CPP site(s) where this species is monitored: John Muir National Historic Site




Photo credit: Bri Weldon (flickr)

**What does this species look like?**  
This aromatic evergreen shrub or tree has greenish to reddish brown bark and can be up to 30 meters tall. The shiny smooth leaves are 3 to 10 cm long. 6 to 8 small yellow-green flowers are arranged in round inflorescences, and each flower has both female and male parts. The solitary fruits are 2 to 2.5 cm and resemble an olive.

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

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**Species facts!**

- The CPP four letter code for this species is **UMCA**.
- Native Americans made tea from the root bark and used the leaves to control biting insects.
- The leaves were used medicinally by Native Americans to treat headaches and rheumatism.
- Bay leaves are sold commercially as a food seasoning.
- California laurel provides cover for deer, black bear, and many species of small mammals.
- Used extensively in restoration projects.




Photo credit: Cliff Hutson (flickr)

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Photo credit: Tony Velois, National Park Service

**Where is this species found?**


- Occurs at elevations less than 1600 meters.
- Within California, distributed in the following bioregions: Northwestern California, Cascade Range Foothills, Sierra Nevada Foothills, San Francisco Bay Area, Outer South Coast Ranges, scattered in Transverse Ranges, Peninsular Ranges.
- Range extends to southern Oregon.
- Occur in canyons, valleys, and chaparral habitats.

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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 1 May 2012


California Phenology Project:  
species profile for  
**California laurel**  
(*Umbellularia californica*)



USA npn  
National Phenology Network

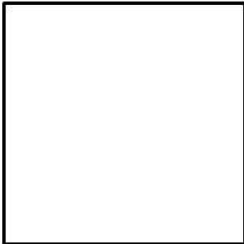


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Breaking leaf buds



Young leaves

Bri Weldon

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Flower buds

Joshua McDill

**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.



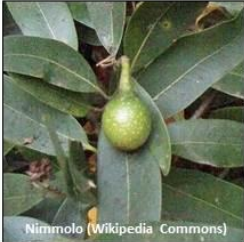
Open flowers

Do you see the anthers and stigma? 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!)

Tony Velois

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


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Fruits

the fruit is small, fleshy and "olive"-like and changes from green to dark purple or deep brown-purple.

Nimmolo (Wikipedia Commons)



Ripe fruits

The fruit is considered ripe when it has turned dark purple or deep brown-purple...

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

Tony Velois


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


Version 1 May 2012

## California buckeye, *Aesculus californica* species profile (Version 2, March 2012):


California Phenology Project:  
species profile for  
**California Buckeye**  
(*Aesculus californica*)



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**CPP site(s) where this species is monitored:** Sequoia National Park; John Muir National Historic Site




Photo credit: Martin Jambon (flickr)

**What does this species look like?**

This deciduous species is a large shrub or tree, up to 12 meters tall. The leaves are palmate (the leaflets emerge from a single point) and made up of 5 to 7 leaflets, each 6 to 17 cm long. Flowers are white to pale rose-colored, with petals 12 to 18 millimeters long. The flowers are clustered in an erect inflorescence with many showy, ill-smelling flowers. Only the flowers at the tip of each inflorescence are fertile and produce fruit. Each fruit contains one large (2 to 5 cm) glossy brown seed.

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

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**Species facts!**

- The CPP four letter code for this species is **AECA**.
- The bark, leaves, stems, fruit, and seeds of this plant contain toxic glycosidal compounds.
- Native Americans used the ground seeds to poison fish, but the seeds could also be used for food when leached of their poison and mashed.
- Although honeybees are the primary pollinator of buckeye, the nectar and pollen can be toxic to them.




Photo credit: randomtruth (flickr)

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Photo credit: James Gaither (flickr)

**Where is this species found?**


- This species is endemic to California.
- It is found in dry slopes, canyons, and the edges of streams.
- Found at elevations less than 1700 meters

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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  
**California Buckeye**  
(*Aesculus californica*)



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Terrie Schweitzer

**Breaking leaf buds**


A leaf bud is considered "breaking" once a green leaf tip is visible at the tip of the bud, but before the first leaf from the bud has unfolded to expose the leaf stalk or base. Can you see the leaf tips emerging from the bud in this picture?



Eugene Zelenko


**Leaves**

Can you see the base of the leaflets? New leaflets may need to be bent backwards to see whether the petiole is visible.




Liz Matthews

**Increasing leaf size**



Cliff Hutson


**Colored leaves**



Devra

**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.




Dawn Endico

**Open flowers**

Do you see the pollen-producing anthers protruding from the flowers? **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 for "flowers or flower buds"



Eugene Zelenko

**Fruits**

The fruit is a large, leathery capsule that changes from green to tan or grayish-tan and splits open to release a large seed when ripe.



randomtruth

**Ripe fruits**

A fruit is considered ripe when it splits open. **Note:** fruit phenophases are nested; if you record Y for "ripe fruits" you should also record Y to "fruits"

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Phenophases not pictured: **Falling leaves, recent fruit or seed drop**

Version 2, March 2012


John Muir NHS Monitoring Guide (June 2013)- Page 12 of 28

## California live oak, *Quercus agrifolia* species profile (Version 2, March 2012):


California Phenology Project:  
species profile for  
**California Live Oak**  
*(Quercus agrifolia)*



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




Photo credit: randomtruth (Flickr)

**What does this species look like?**

This large evergreen tree has a dark grey, stout, short trunk and wide spreading branches. The leathery leaves are shiny on the upper surface and dull on the lower surface, which is covered with fuzzy hairs. The leaf margins are spiny and holly-like. The individuals are monoecious; each tree bears both male and female flowers but the male flowers produce only anthers and the female flowers produce only pistils. The yellow-green male flowers are clustered in elongated, drooping catkins that are 4-10 cm long, and the female flowers are clustered in reddish green spikes.

*When monitoring this species, use the USA-NPN broadleaf evergreen (with pollen) trees and shrubs datasheet.*

**Species facts!**

- The CPP four letter code for this species is QUAG.
- This oak is very fire resistant. Adaptations to fire include evergreen leaves, thick bark, and the ability to sprout post-fire from the roots, trunk, and upper crown.
- Individuals can live up to 250 years.
- Susceptible to Sudden Oak Death disease.
- Wind pollinated.
- Each acorn takes a full year to develop from a pollinated flower.




Photo credit: randomtruth (Flickr)

**Where is this species found?**

- In valleys, slopes, mixed-evergreen forest, and woodlands at elevations less than 1500 meters.
- Endemic to California; found in North Coast Ranges, Central Western California, and SW California.
- Occurs on soils ranging from silts and clays to weathered granite.





Photo credit: Jerry Kirkhart (Flickr)


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  
**California Live Oak**  
*(Quercus agrifolia)*



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**Breaking leaf buds**


*This phenophase can be difficult for this species; remember, you can circle ? if you are unsure of what you are seeing!*



Crystal Anderson

**Young leaves**

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




Crystal Anderson

When monitoring **flower or flower bud abundance** for this species, count each inflorescence as a single flowering structure!

**Flowers or flower buds**

*The male inflorescence is a catkin, which is initially compact and stiff, but eventually unfolds, lengthens, and hangs loosely from the branch. Female flowers are very small and petal-less, emerging from the growing stem at the point where a new leaf is attached.*




Bri Weldon

**Open flowers**

*The male flowers will open once the compact catkin has unfolded and is hanging loosely. Female flowers are open when the pistils are visible, but will be very difficult to see where they are out of reach.*


When monitoring the **proportion of open flowers**, estimate the number of individual flowers that are open, not inflorescences! For big trees, estimate proportions of open flowers for a few branches and extrapolate for the rest of the tree.



Ralph Waycott

**Fruits**

*The fruit is an acorn that changes from green to light brown.*



Ralph Waycott

**Ripe fruits**

*The fruit is ripe when it is light brown and drops from the plant. Since fruits (acorns) drop from the plant when ripe, do not observe the Ripe Fruits phenophase for this species. (Leave this line on the datasheet blank.)*

Instead of recording ripe fruits, observe **Recent fruit or seed drop** (as pictured above).




Phenophase not pictured: **Pollen release**

Version 2, March 2012

John Muir NHS Monitoring Guide (June 2013)- Page 13 of 28

# California rose, *Rosa californica* species profile (Version 1, May 2012):

California Phenology Project:  
species profile for  
**California Wildrose**  
*(Rosa californica)*

---

CPP site(s) where this species is monitored: John Muir National Historic Site




Photo credit: Paula Kate Marmor

**What does this species look like?**

This shrub often forms thickets, and its prickly grey-brown stems are strongly curved. The leaves are made up of smaller toothed leaflets that are often hairy or glandular. There are 1 to 20 flowers per inflorescence. Flowers are generally pink with petals that are 10 to 20 mm long. Each rose has five petals and the flower has an open form. The fruits, called rose hips, are 8 to 20 mm long and turn red when ripe.

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

---

**Species facts!**

- The CPP four letter code for this species is **ROCA**.
- The fruit, or rose hips, have high vitamin C content
- Rose hips can be dried for tea and used in jellies and sauces.
- The fruit is an important food source to wildlife year round.
- Edible members of the Rose family include apple, peach and cherry.




Photo credit: Terrie Schweitzer

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Photo credit: Tony Velois, National Park Service

**Where is this species found?**




- Found at elevations less than 1600 meters.
- Generally found in moist areas, especially streambanks.
- Distributed throughout California, with the exception of desert regions and high mountain regions.
- Also found into southern Oregon and Baja California.

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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 1 May 2012

California Phenology Project:  
species profile for  
**California Wildrose**  
*(Rosa californica)*

---

**Breaking leaf buds**




Bri Weldon

**Increasing leaf size**

**Colored leaves**

**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




Tony Velois

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

**Fruits**

The fruits are very tiny and seed-like and are enclosed in a fleshy, berry-like "hip" that changes from green to pinkish to reddish-orange or red.



Jerry Kirkhart

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



Phenophases not pictured: **Falling leaves, Recent fruit or seed drop**

Version 1 May 2012

John Muir NHS Monitoring Guide (June 2013)- Page 14 of 28

## Common snowberry, *Symphoricarpos albus* species profile (Version 2, July 2012):

California Phenology Project:  
species profile for  
**Common snowberry**  
(*Symphoricarpos albus*)


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**CPP site(s) where this species is monitored:** John Muir National Historic Site

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Photo credit: Gertrud K (flickr)

**What does this species look like?**  
This deciduous shrub or tree is densely branched and grows between 0.6 to 1.8 meters tall. It can form thickets with creeping underground stems. The small but showy flowers are white to pink and have both male and female parts. These flowers occur in small clusters of 8 to 16 along the stems and are insect-pollinated. The round fruit is 8 to 12 mm long.

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

---

**Species facts!**

- The CPP four letter code for this species is SYAL.
- Native Americans used this species medicinally and for arrowshafts, brooms, and shampoo.
- The berries can be toxic to humans, causing vomiting and dizziness.
- The berries are an important food source for birds and mammals. The floral nectar is an important resource for butterflies and moths.
- Re-sprouts from spreading rhizomes easily after fires.



Photo credit: onok (flickr)

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Photo credit: Lil worff (flickr)

**Where is this species found?**




- Favors well-drained, moist, fertile soils but also will grow on dry or rocky soils.
- Found in shady woods, streambanks, and northern slopes.
- Occurs at elevations less than 1200 meters.
- Naturally distributed throughout northwest, central-western, and southwestern California as well as north through Alaska and throughout Western U.S.
- Naturalized species in the Eastern U.S.

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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 July 2012

California Phenology Project:  
species profile for  
**Common snowberry**  
(*Symphoricarpos albus*)

---

**Breaking leaf buds**




born1945

**Leaves**

**Increasing leaf size**


**Colored leaves**

**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.*



Ken-ichi Ueda


**Open flowers**  
*Do you see the anthers or stigma? 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 )!*



Matt Lavin


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

**Fruits**  
*The fruit is berry-like and changes from green to white.*



Frank Vincentz

**Ripe fruits**  
*A fruit is considered ripe when it has turned white.*



Loarie

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


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Phenophases not pictured: **Falling leaves, Recent fruit or seed drop**


Version 2 July 2012

# Coyotebrush, *Baccharis pilularis* species profile (Version 3, April 2012):


California Phenology Project:  
species profile for  
**Coyotebrush**  
(*Baccharis pilularis*)



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**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: Jess Gambel

Insect gall (note: do not confuse galls for flower buds on this species!)

---




Photo credit: Jerry Kirkhart (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.

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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 3, April 2012


California Phenology Project:  
species profile for  
**Coyotebrush**  
(*Baccharis pilularis*)



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Brian Haggerty

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



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 and 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.




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: USA-NPN flower phenophases are nested; if you record Y for "open flowers" you should also record Y for "flowers or flower buds"

---




Steven Krause

BAPI flower buds; Do not mistake for a gall (pictured on the front)



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**

Version 3, April 2012

John Muir NHS Monitoring Guide (June 2013)- Page 16 of 28



## IV. JOMU Monitoring Locations and Maps

The CPP has established two monitoring locations at John Muir National Historic Site: Mount Wanda and Strentzel Meadow (Table 2; Figure 1). Maps for each monitoring site are available for download at <http://www.usanpn.org/cpp/JOMU/maps>

Table 2. JOMU monitoring locations, target plant species at each location (with number of targeted individuals), and the approximate phenologically active season for each phenophase category at each location. Estimates of the phenologically active season at each location are based on observations recorded in 2012 and should be revised as additional years are represented in the dataset.

	Location (4-letter code)	Target Species (# of individuals)	Year monitoring initiated	Approximate Phenologically Active Season
(1)	Mount Wanda (WAND)	<i>Aesculus californica</i> (3)	2012	Leaves: April-March Flowers: April-March Fruit: Sept-Dec
		<i>Baccharis pilularis</i> (3)	2012	Leaves: April-March, Oct-Dec Flowers: April-March Fruit: November
		<i>Quercus agrifolia</i> (3)	2012	Leaves: April-March Flowers: April Fruit: TBD
		<i>Quercus douglasii</i> (3)	2012	Leaves: April-March, October Flowers: April Fruit: October
		<i>Umbellularia californica</i> (1)	2012	Leaves: October Flowers: TBD Fruit: Sept-Nov
(2)	Strentzel Meadow (STME)	<i>Aesculus californica</i> (3)	2012	Leaves: March-Nov Flowers: April-August Fruit: June-August
		<i>Baccharis pilularis</i> (4)	2012	Leaves: March-August Flowers: June-November Fruit: Sept-Nov
		<i>Rosa californica</i> (3)	2012	Leaves: March-November Flowers: March-July Fruit: June-October
		<i>Sambucus nigra</i> (2)	2012	Leaves: March-November Flowers: April-July Fruit: May-August
		<i>Symphoricarpos albus</i> (3)	2012	Leaves: March-November Flowers: April-October Fruit: May-November

Note that the timing of phenophases may vary with interannual variation in temperature and precipitation (e.g., in years where spring temperatures are warmer than average, phenophases may appear earlier than average). As such, the USA-NPN and the CPP recommend that monitoring should continue during the phenologically inactive season, although monitoring may continue at a lower frequency. In the 2-4 weeks before the phenologically active season, monitoring frequency may increase to catch the onset of the early phenophases.

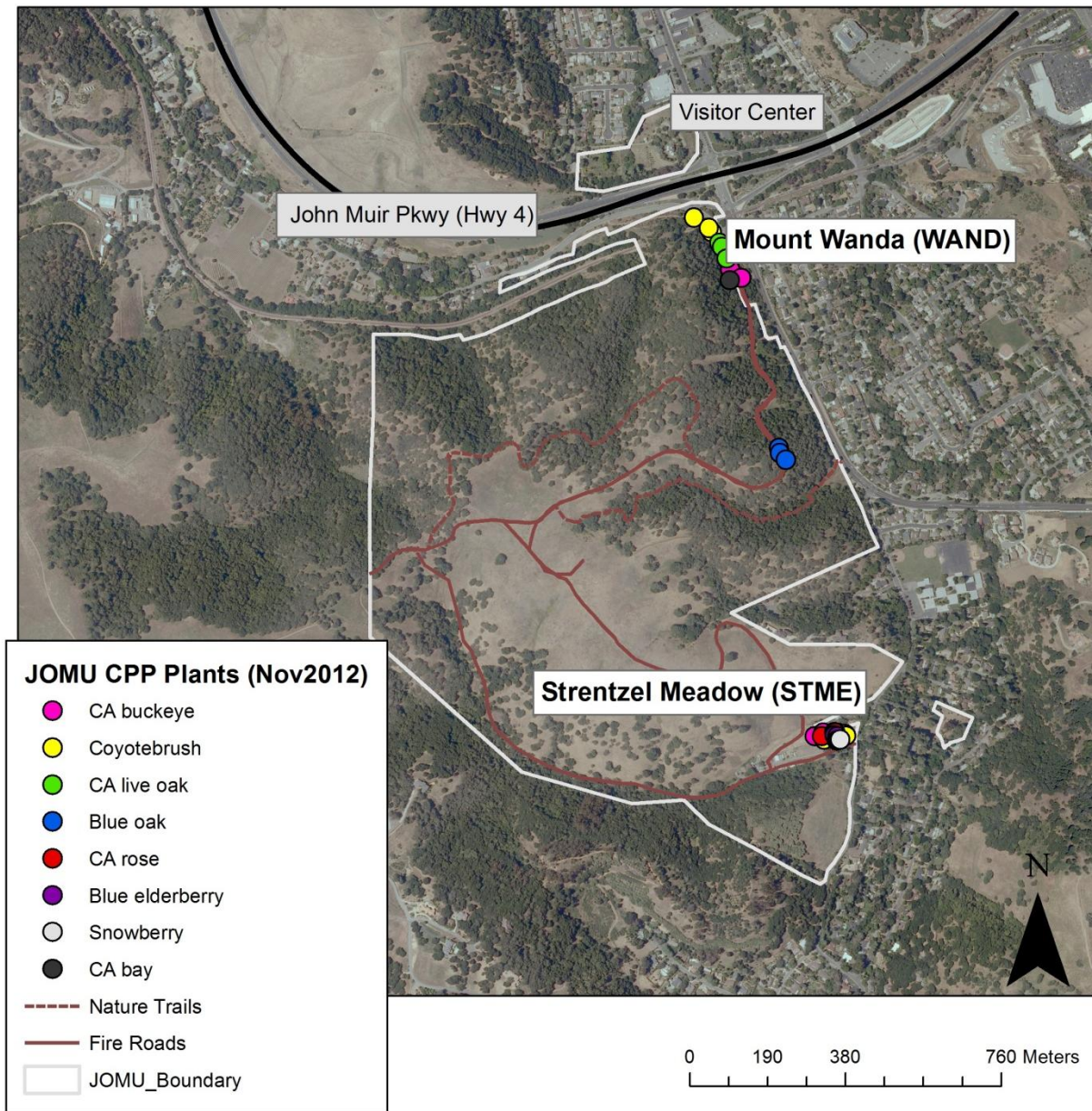


Figure 1. The two California Phenology Project monitoring locations at John Muir National Historic Site (JOMU).

Each plant that is targeted for monitoring has been marked with an aluminum tag that is labeled with an identifier code. The identifier code for each plant conforms to the following format:

CPP - PARK - LOCA# - GESP# ,

where LOCA# represents the location name in a four letter code (e.g., Strentzel Meadow= STME) and the site at each location (e.g., site 1 at Strentzel Meadow= STME1) and GESP# represents the four letter code for each genus species combination (e.g. *Aesculus sylvatica* = AECA) and the individual plant number at each site (e.g. the third *Aesculus sylvatica* = AECA3).

At *Strentzel Meadow (STME)*, there are 14 targeted individuals representing 5 species (Table 2; Figure 2). It takes roughly 20-30 minutes to monitor the plants at this location (not including travel, which varies for everyone). The terrain is level and plants are all very close in proximity. The site has been disturbed and reformed in order to address erosion and flooding issues. A seasonal creek runs through the meadow, but is dry most of the year. Most of the native plants currently at the site have been reintroduced after several years of efforts for promote soil stability. The current vegetative make up of this site is a mix of exotic annual grasses with native grasses, sedges, forbs and shrubs.

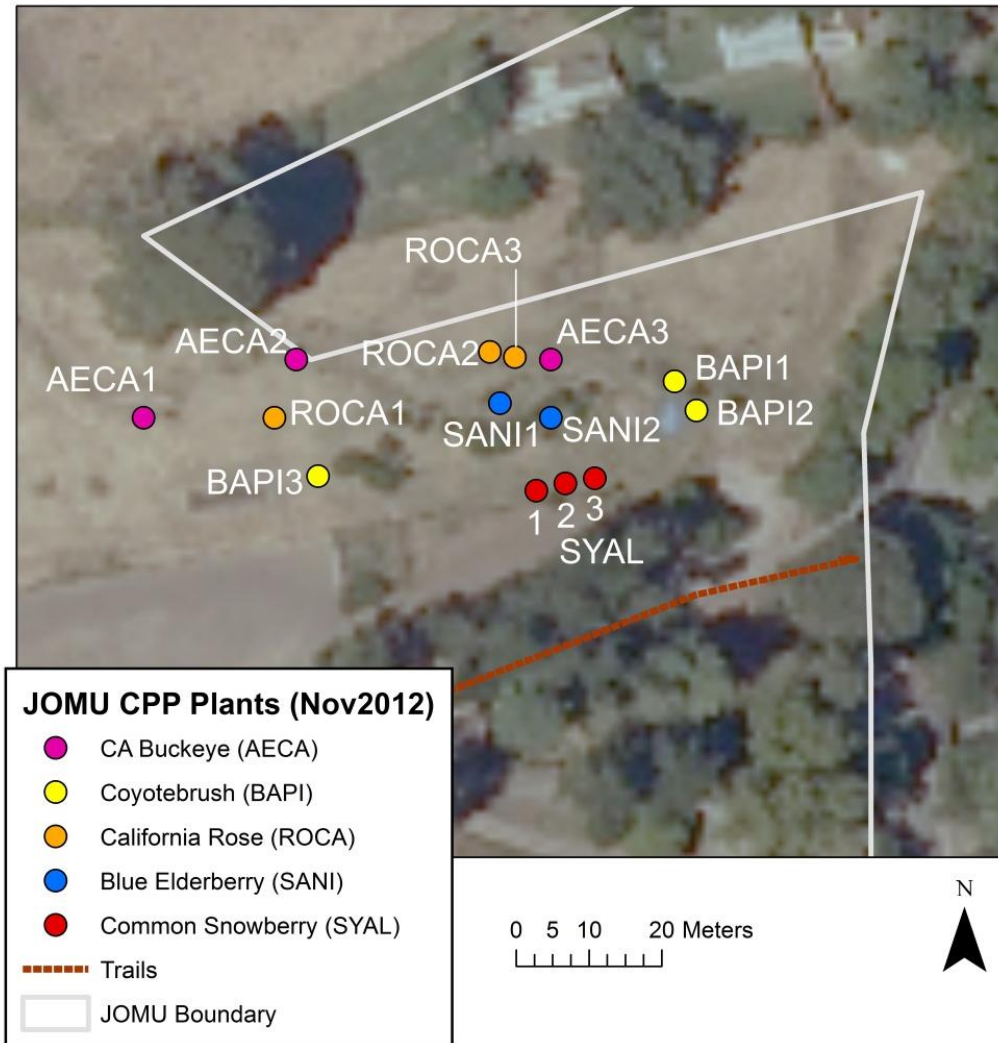


Figure 2. CPP plants at Strentzel Meadow (STME) monitoring location.

At *Mount Wanda (WAND)*, there are 13 targeted individuals, representing 5 species. It takes roughly 1 hour to monitor this site (about 1.5 hours from the visitor center and back for the students that are monitoring the site as of spring 2013). A round-trip monitoring session is roughly 0.75 miles, with a moderate incline to get to the southern-most plants (QUDO). Located in the northeastern portion of Mt Wanda, this site does have some steep terrain and care should be taken while hiking and monitoring plants. Poison oak is also present near several monitored plants, but contact can be easily avoided with good observation and mindfulness. During this session, phenology monitors will first experience a shrubland habitat, followed by a Coast Live Oak Forest and Blue Oak Woodland.

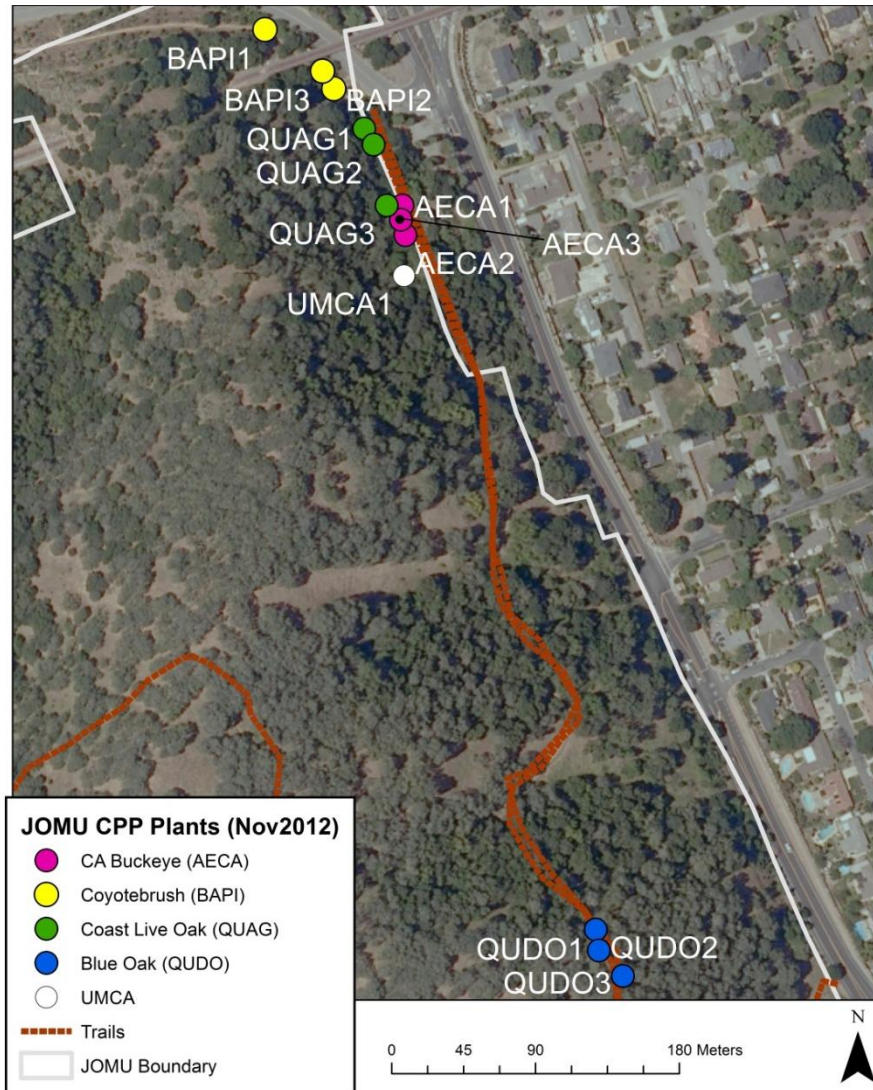


Figure 3. CPP plants at Mount Wanda (WAND) monitoring location.

## **V. Frequency of monitoring and estimated time investment**

As described in detail in the *CPP Plant Phenology Monitoring Protocol*, ideally plants should be monitored *at least* twice weekly to accurately detect changes in the onset and duration of phenophases. More frequent monitoring will maximize the ability to detect and to measure phenological change, although some CPP monitoring sites may be established primarily for interpretive purposes and monitored less frequently.

Although data entry is not time-sensitive, uploading observations to *Nature's Notebook* at least 4 times a year will minimize a back-log of data entry. Entering data more frequently (e.g., after each monitoring event or at the end of every week), however, is helpful in preventing confusion or correcting observation errors on the datasheets, since observers may remember the monitoring events well enough to correct errors during data-entry.

It is best to have only a small number of well-trained observers monitoring a site. Novices tend to interpret phenophase abundances or “quantities” differently, and if there are many observers with little experience recording abundance estimates, percentages and quantities may be estimated inconsistently on the data sheets.

## VI. Datasheets and Data Entry

Datasheets for all CPP species can be downloaded from the CPP website on the individual species pages (direct links to the datasheets are provided below) or from the USA-NPN website ([www.usanpn.org](http://www.usanpn.org)). See *Phenology Site and Trail Monitoring SOP #6* for additional instructions for downloading and using USA-NPN datasheets.

### Links to datasheets for all JOMU species:

[Blue Elderberry, \*Sambucus nigra\*](#)

[Blue Oak, \*Quercus douglasii\*](#)

[California Bay, \*Umbellularia californica\*](#)

[California Buckeye, \*Aesculus californica\*](#)

[California Live Oak, \*Quercus agrifolia\*](#)

[California Wild Rose, \*Rosa californica\*](#)

[Common Snowberry, \*Symphoricarpos albus\*](#)

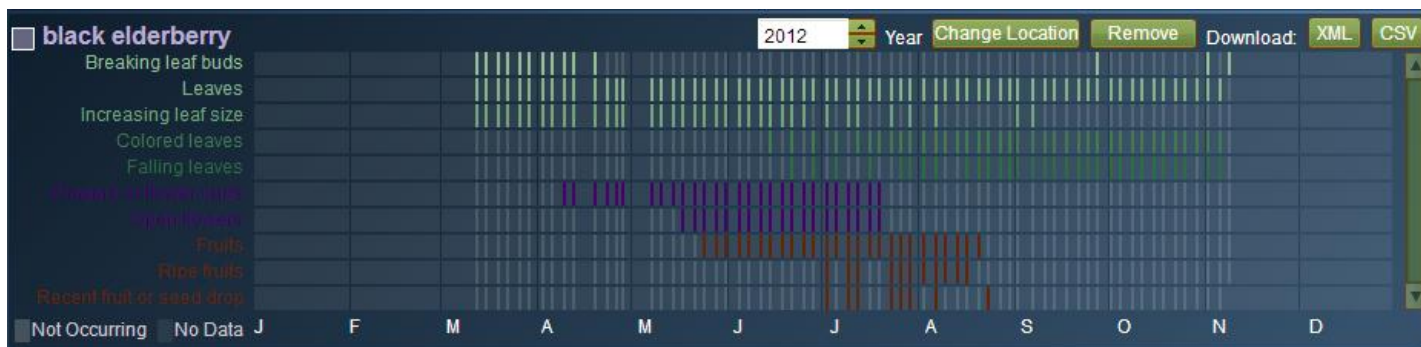
[Coyotebrush, \*Baccharis pilularis\*](#)

Step-by-step instructions for data entry into the National Phenology Database (NPDb) curated by the USA-NPN are provided in *Data Entry and Data Management SOP # 7*.

## VII. Preliminary phenological calendars for JOMU focal taxa: estimates of phenophase onset and duration

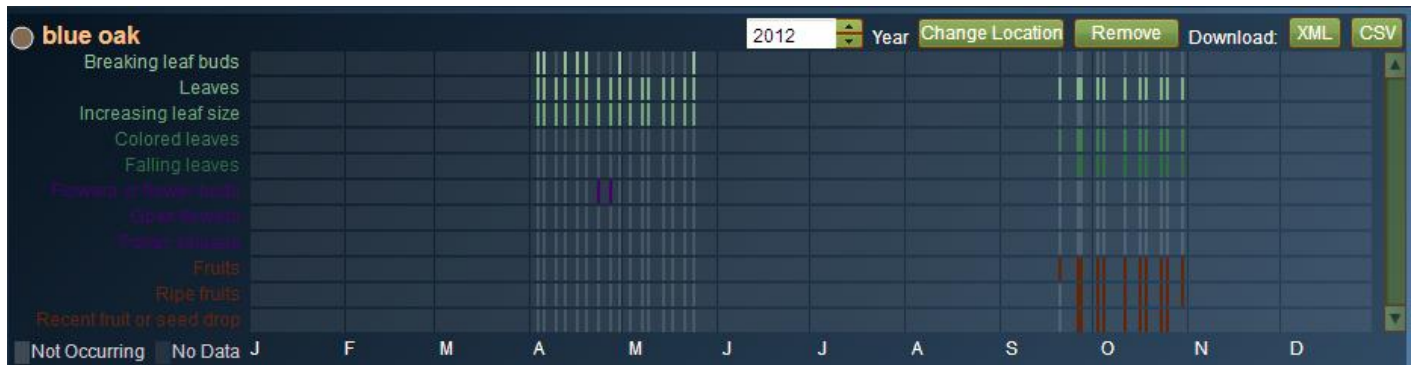
(1) **Blue elderberry**: 2012 observations at JOMU are summarized in the USA-NPN visualization tool below. Note absence of data collection January-February and November-December. Based on these preliminary summaries, estimates the phenologically active season (at JOMU) for black elderberry phenophases are:

- *breaking leaf buds*: March-April, October-November
- *leaves*: March-November
- *increasing leaf size*: March-September
- *colored leaves*: June-November
- *falling leaves*: June-November
- *flowers*: April-July
- *open flowers*: May-July
- *fruits*: May-August
- *ripe fruits*: July-August
- *recent fruit drop*: July-August



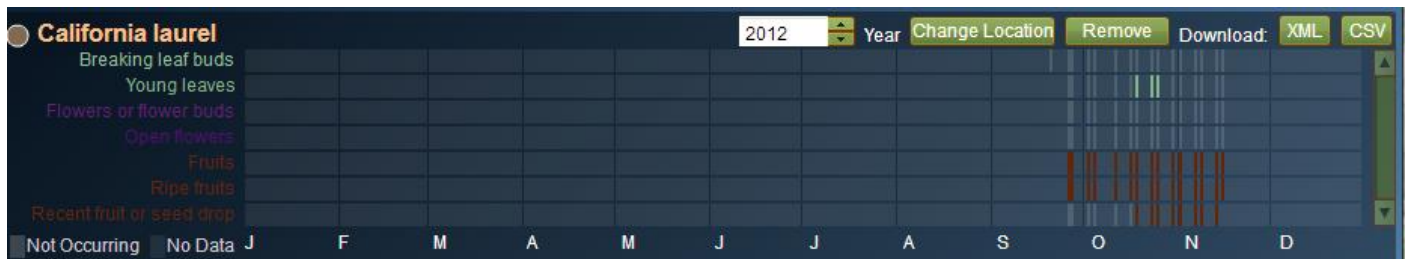
(2) **Blue oak**: 2012 observations at JOMU are summarized in the USA-NPN visualization tool below. Note absence of data collection January-March, June-mid September, and November-December. Based on these preliminary summaries, estimates the phenologically active season (at JOMU) for Blue oak phenophases are:

- *breaking leaf buds*: April-March
- *leaves*: April-March, Sept-October
- *increasing leaf size*: April-March
- *colored leaves*: September-October
- *falling leaves*: September-October
- *flowers*: April
- *open flowers*: TBD
- *pollen release*: TBD
- *fruits*: September-October
- *ripe fruits*: September-October
- *recent fruit drop*: September-October



(3) **California bay:** 2012 observations at JOMU are summarized in the USA-NPN visualization tool below. Note absence of data collection from January through late September and mid-November through December. Based on these preliminary summaries, estimates the phenologically active season (at JOMU) for California laurel phenophases are:

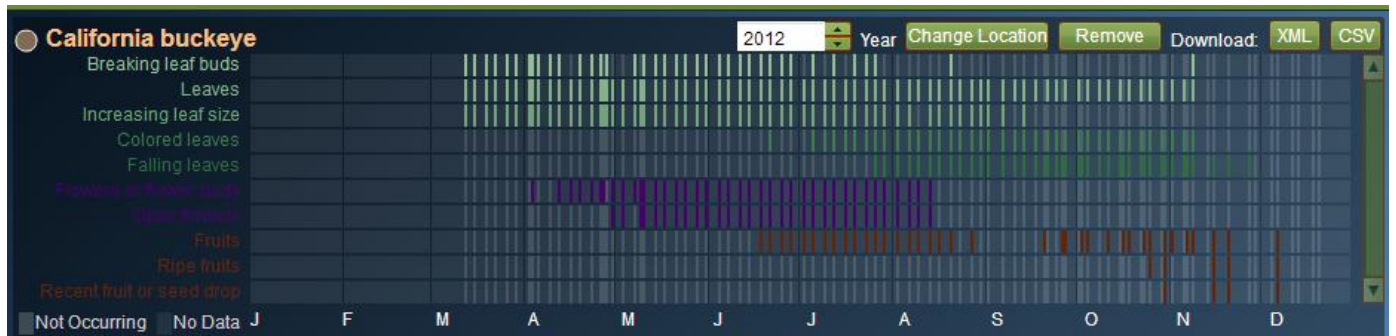
- *breaking leaf buds:* TBD
- *young leaves:* October
- *flowers:* TBD
- *open flowers:* TBD
- *fruits:* September-November
- *ripe fruits:* September-November
- *recent fruit drop:* October-November



(4) **California buckeye:** 2012 observations at JOMU are summarized in the USA-NPN visualization tool below. Note absence of data collection in January and February. Based on these preliminary summaries, estimates the phenologically active season (at JOMU) for buckeye phenophases are:

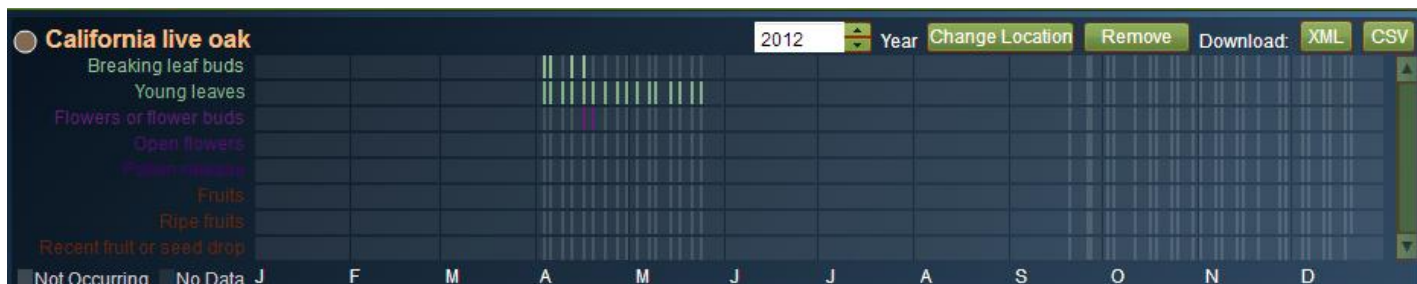
- *breaking leaf buds:* March-August (November)
- *leaves:* March-November
- *increasing leaf size:* March-September
- *colored leaves:* June-November
- *falling leaves:* July-November
- *flowers:* April-August
- *open flowers:* April-August
- *fruits:* June-December
- *ripe fruits:* October-December
- *recent fruit drop:* October-December





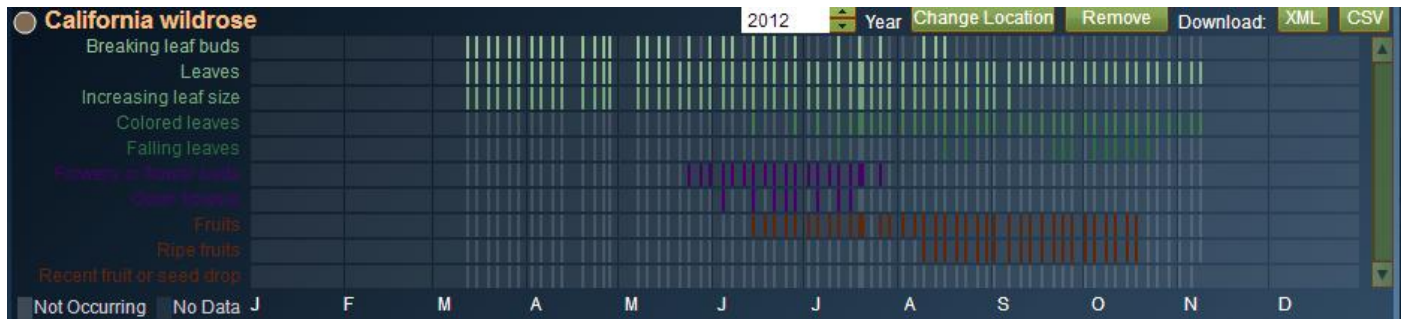
(5) **California live oak:** 2012 observations at JOMU are summarized in the USA-NPN visualization tool below. Note absence of data collection January-March and June-mid September. Based on these preliminary summaries, estimates the phenologically active season (at JOMU) for California live oak phenophases are:

- *breaking leaf buds:* April
- *young leaves:* April-May
- *flowers:* April
- *open flowers:* TBD
- *pollen release:* TBD
- *fruits:* TBD
- *ripe fruits:* TBD
- *recent fruit drop:* TBD



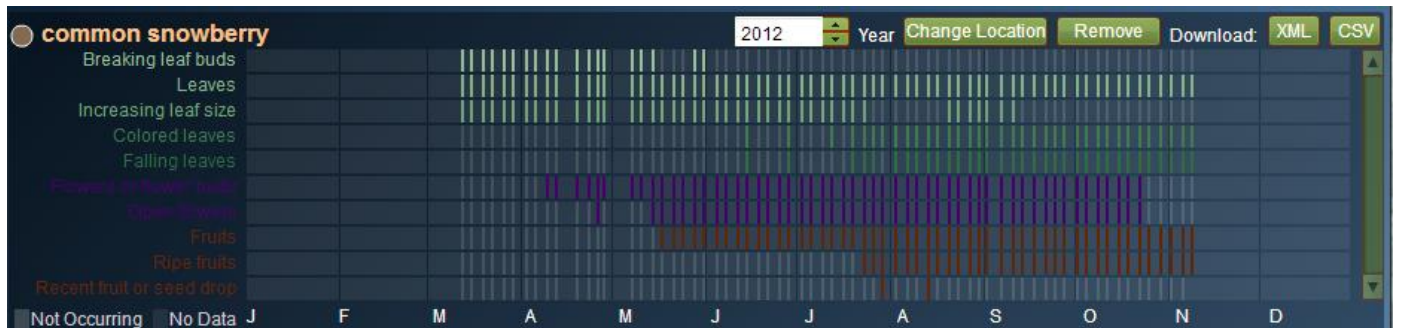
(6) **California wild rose:** 2012 observations at JOMU are summarized in the USA-NPN visualization tool below. Note absence of data collection January-February and November-December. Based on these preliminary summaries, estimates the phenologically active season (at JOMU) for California wild rose phenophases are:

- *breaking leaf buds:* March-August
- *leaves:* March-November
- *increasing leaf size:* March-September
- *colored leaves:* June-November
- *falling leaves:* July-October
- *flowers:* May-July
- *open flowers:* June-July
- *fruits:* June-October
- *ripe fruits:* August-October
- *recent fruit drop:* TBD



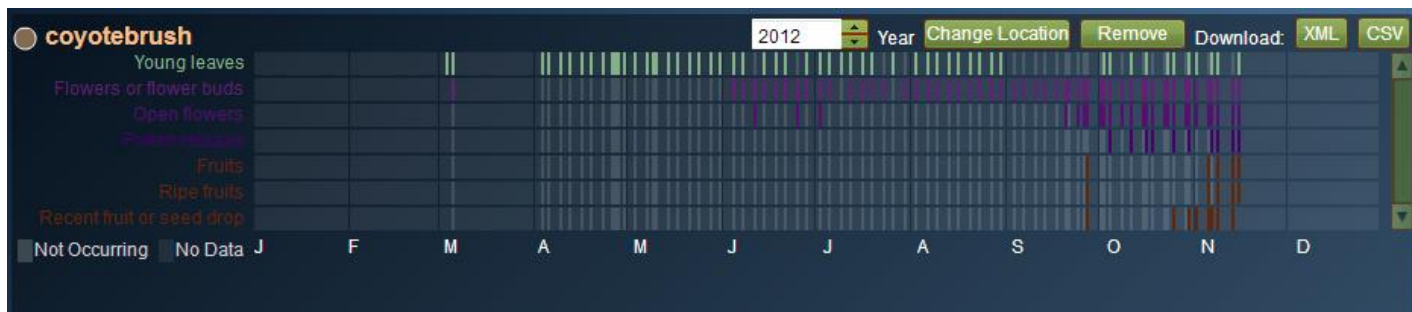
(7) **Common snowberry:** 2012 observations at JOMU are summarized in the USA-NPN visualization tool below. Note absence of data collection January-February and November-December. Based on these preliminary summaries, estimates the phenologically active season (at JOMU) for common snowberry phenophases are:

- *breaking leaf buds*: March-May
- *leaves*: March-November
- *increasing leaf size*: March-September
- *colored leaves*: June-November
- *falling leaves*: June-November
- *flowers*: April-October
- *open flowers*: April-October
- *fruits*: May-November
- *ripe fruits*: July-November
- *recent fruit drop*: July-August



(8) **Coyotebrush:** 2012 observations at JOMU are summarized in the USA-NPN visualization tool below. Note absence of data collection in January, February, late November, and December. Based on these preliminary summaries, estimates the phenologically active season (at JOMU) for coyotebrush phenophases are:

- *young leaves:* March-November
- *flowers:* (March) June-November
- *open flowers:* June-November
- *fruits:* September-November
- *ripe fruits:* September-November
- *recent fruit drop:* September-November



## VIII. Suggestions for Interpretative Programs for the Public

The CPP has developed a variety of educational and interpretive programs that can be downloaded from the *Education* page on the CPP website (<http://www.usanpn.org/cpp/education>). Whether you're looking for a simple hands-on activity for the backyard or schoolyard, or you're in need of a guide to plan, install, and use a phenology garden for year-round scientific and educational activities, you'll find over 25 phenology-focused resources on the *Education* page. These resources are designed by CPP scientists and educators for a variety of ages and scientific abilities.

The CPP Interpretive Guide is also available for download on the website on the *Resources* page (<http://www.usanpn.org/cpp/resources>). We expect this guide will help park interpreters and educators to introduce the CPP to park visitors. This guide also provides suggestions for ways in which — through hands-on activities — park staff can help visitors to learn how park scientists and volunteers are detecting the effects of environmental variation and climate change on the seasonal cycles of plants and animals.

Program support components that JOMU hopes to develop include:

- training a docent who would interact with the public and focus on climate change and phenology-related topics
- training a CPP participant at JOMU to act as the outreach arm of the project, engaging new segments of the local community and new organizations