

Appendix D: Lassen Volcanic National Park CPP Monitoring Guide

Version 1

Revision History Log:

Version #	Revision Date	Author	Changes Made	Reason for Change
1.00				

Phenological monitoring guide: Lassen Volcanic National Park

A designated monitoring site of
The California Phenology Project



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I. Introduction to the California Phenology Project

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 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).

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*.

Products of the pilot period include the *CPP Plant Phenological Monitoring Protocol* (with step-by-step instructions for conducting monitoring) and *park-specific monitoring guides* for each of the seven pilot parks. The material in this monitoring guide is meant to serve as a reference for CPP participants who are observing plants at **Lassen Volcanic National Park (LAVO)**. It identifies and describes all of the CPP and USA-NPN resources that observers will need to start monitoring plants at LAVO (e.g., USA-NPN datasheets, LAVO monitoring sites and locations, and CPP species profiles). 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 *Plant Phenology Monitoring Protocol* for detailed monitoring instructions. 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) and USA-NPN websites (www.usanpn.org), where you can download newsletters, project briefs, presentations, and more (<http://www.usanpn.org/cpp/resources>).

II. Points of Contact

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For volunteer opportunities regarding phenology research, including data collection or individual projects, please visit <http://www.volunteer.gov/gov/results.cfm?ID=12477> and fill out the volunteer application available at the end of that web page.

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III. Species Monitored at LAVO

There are six species targeted for phenological monitoring at Lassen Volcanic National Park: aspen (*Populus tremuloides*), bluntlobe lupine (*Lupinus obtusilobus*), greenleaf manzanita (*Arctostaphylos patula*), lodgepole pine (*Pinus contorta*), mountain pride (*Penstemon newberryi*), and ponderosa pine (*Pinus ponderosa*).

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

Table 1. CPP species monitored at LAVO, with their USA-NPN protocol category and the other parks where they are monitored.

Common Name	Scientific Name	USA-NPN Protocol Category	Parks
aspen	<i>Populus tremuloides</i>	Deciduous Trees and Shrubs (with pollen)	LAVO
bluntlobe lupine	<i>Lupinus obtusilobus</i>	Forbs	LAVO
greenleaf manzanita	<i>Arctostaphylos patula</i>	Broadleaf Evergreen Trees and Shrubs	SEKI, LAVO
lodgepole pine	<i>Pinus contorta</i>	Conifers (needle bundles)	LAVO
mountain pride	<i>Penstemon newberryi</i>	Broadleaf Evergreen (no buds)	SEKI, LAVO
ponderosa pine	<i>Pinus ponderosa</i>	Conifers (needle bundles)	LAVO

Abbreviations used: SEKI= Sequoia and Kings Canyon National Park

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


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

3.1 Aspen (*Populus tremuloides*)


- CPP four letter code: POTR
- Download the USA-NPN datasheet and the CPP profile for POTR here:
<http://www.usanpn.org/cpp/POTR>
- This deciduous tree reaches 12-24 meters in height and often occurs in large clumps connected by underground roots.
- Aspen is the most widely distributed tree species in North America. One male clone in Utah occupies 17.2 acres and has more than 47,000 stems. A single clone can be >1,000 years old. A common tree at moderate elevations throughout the western U.S., aspen prefers elevations between 5,200 and 6,500 ft. at LAVO.
- This species is dioecious; individual trees are either male or female, producing either male or female flowers. Both male and female flowers are tiny and arrayed in elongated clusters (catkins), which look like long, soft caterpillars. The flowers are wind-pollinated.
- Aspen provide excellent forage for deer and elk, and many other native animals. Alder stands provide excellent habitat for a wide variety of plant, animal and insect species.
- With the capability to vigorously resprout after fire; aspen is perfectly adapted to periodic fire. With nearly a century of fire suppression however, many aspens stands are now in a state of gradual decline, throughout the western states. The decline is largely attributed to conifer encroachment, which outcompete the mature aspen for resources (in addition to suppressing aspen resprouting behaviour).

Aspen, *Populus tremuloides*, CPP species profile (Version 2; March 2012):

California Phenology Project:
species profile for
Quaking Aspen
(*Populus tremuloides*)



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CPP site(s) where this species is monitored: Lassen Volcanic National Park




Photo credit: Jerry Oldenettel (Flickr)

What does this species look like?

This deciduous tree reaches 12-24 meters in height and often occurs in large clumps connected by underground roots. This species is dioecious; individual trees are either male or female, producing either male or female flowers. Both male and female flowers are tiny and arrayed in elongated clusters (catkins), which look like long, soft caterpillars.

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

Species facts!

- The most widely distributed tree species in North America. One male clone in Utah occupies 17.2 acres and has more than 47,000 stems.
- A single clone can be thousands of years old.
- The flowers are wind-pollinated.
- Leaves can be used to treat burns, irritations, aches, and swollen joints.




Photo credit: Eli Sagor (Flickr)





Photo credit: Nelson Stauffer (Flickr)

Where is this species found?


- Occurs in dry and moist sites, but not under shade.
- Found along streamsides, slopes, valley bottoms, dry mountainsides, high plateaus and mesas, talus slopes, avalanche chutes, and openings and slopes in montane and subalpine forests and woodlands.
- Occurs with oaks and sagebrush at lower elevation and as a prostrate form above timberline.


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:
species profile for
Quaking Aspen
(*Populus tremuloides*)




UCSB





Breaking leaf buds


Matt Lavin




Leaves

Note the long stalks (petioles) at the base of each fully expanded leaf.

Matt Lavin




Increasing leaf size



Colored leaves

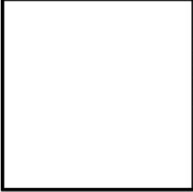
Walter Siegmund



Flowers or flower buds

Flowers in the photo to the left are male and only produce pollen, no fruit. 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.


Matt Lavin



Open flowers


Flowers are unisexual (producing only anthers or only stigmas and ovaries); only flowers with female parts will produce fruit! **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)! For big trees, estimate abundance for a few branches and extrapolate for the rest of the tree.

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 a capsule that turns from green to brown and dry; it then splits open to reveal seeds surrounded by white fluff.



Ripe fruits

The 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"

Matt Lavin

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

Version 2, March 2012

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3.2 Bluntlobe lupine (*Lupinus obtusilobus*)

- CPP four letter code: LUOB
- Download the USA-NPN datasheet and the CPP profile for LUOB here:
<http://www.usanpn.org/cpp/LUOB>
- Bluntlobe or satin lupine is an easily identified perennial forb that is common in dry soils of open ridges and sandy meadow flats. The palmate leaves are comprised of 5-7 leaflets that emerge from a single point. The leaflets are silvery in color, up to 5 cm long, and covered with silky hairs. The small flowers are clustered in whorls and are blue to lilac with a yellow patch. The fruit is a silky legume pod with mottled brown seeds inside.
- LUOB occurs in northern California and Nevada. In LAVO, it is found 6,300 to about 9,000 ft.
- Most lupines are fire followers; their seeds can remain viable in the soil for many decades, then to become dominant for several years following fire. Its roots form nodules that host bacteria that can fix inert nitrogen from the air, and make it available to lupine, and after some years, the next successional cohort.

Bluntlobe lupine, *Lupinus obtusilobus*, CPP species profile (Version 2; March 2012):

California Phenology Project:
species profile for
Bluntlobe Lupine
(*Lupinus obtusilobus*)



UCSB



CPP site(s) where this species is monitored: Lassen Volcanic National Park



Photo credit: Elaine with Grey Cats (Flickr)

What does this species look like?
This perennial herbaceous species reaches 15-30 centimeters in height. The palmate leaves are comprised of 5-7 leaflets that emerge from a single point. The leaflets are silvery in color, up to 5 cm long, and covered with silky hairs. The small flowers are clustered in whorls and are blue to lilac with a yellow patch. The fruit is a silky legume pod with mottled brown seeds inside.

When monitoring this species, use the USA-NPN forbs datasheet.

Species facts!



Photo credit: Jean Pawek

Where is this species found?

- Found on gravelly summits, in mixed conifer forests, and in disturbed habitat such as roadsides.
- Between 2500 and 3000 meters in elevation.
- Northwestern California; in the Cascade Range and the Northern High Sierra Nevada



Photo credit: Jean Pawek


Where is this species found?

- Found on gravelly summits, in mixed conifer forests, and in disturbed habitat such as roadsides.
- Between 2500 and 3000 meters in elevation.
- Northwestern California; in the Cascade Range and the Northern High Sierra Nevada


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)


Version 2, March 2012

California Phenology Project:
species profile for
Bluntlobe Lupine
(*Lupinus obtusilobus*)




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Brian Haggerty

Initial growth
Only consider new shoots emerging from the ground!




Brian Haggerty

Leaves
Each leaf is divided into a fan of leaflets.



Brian Haggerty

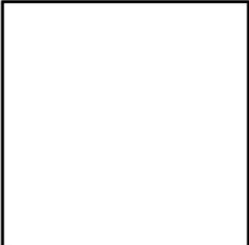
Flowers or flower buds
When monitoring flower or flower bud abundance for this species, count each inflorescence as a single flowering structure! For example, if there are two inflorescences with many flowers or buds each, then abundance should be recorded as <3.



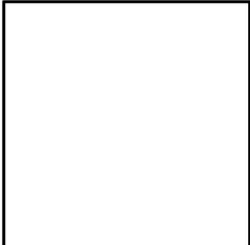
Brian Haggerty

Open flowers
Each flower has both male and female parts. 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"



Brian Haggerty



Brian Haggerty

Fruits
The fruit is a silky pod that changes from green to tan or light brown, and splits open to expose the seeds when dry and ripe. Do not include empty pods that have already exposed all of their seeds.

Ripe fruits
A fruit is ripe when it has turned tan or light brown and has split open to expose the seeds. Do not include empty pods that have already dropped all of their seeds.
Note: fruit phenophases are nested; if you record Y for "ripe fruits" you should also record Y to "fruits"

Phenophases not pictured: Recent fruit or seed drop


Version 2, March 2012

3.3 Greenleaf manzanita (*Arctostaphylos patula*)


- CPP four letter code: ARPA
- Download the USA-NPN datasheet and the CPP profile for ARPA here:
<http://www.usanpn.org/cpp/ARPA>
- Greenleaf manzanita is an easily identified, evergreen shrub that is often found in relatively accessible locations. It forms circular clones that are 1 to 2 meters tall and up to 3 meters in diameter. Clones form when the lower branches produce roots that penetrate the soil, promoting clonal growth. The smooth bright green leaves are 2.5 to 6 centimeters long and 1.5 to 4 centimeters wide. The glabrous pink or white, pendant, urn-shaped flowers form drooping clusters. Fruits are dark brown and 1 centimeter in diameter, each containing five hard seeds.
- ARPA occurs in the coniferous forests of the western U.S. at moderate to high elevations. In the Sierra Nevada, it can be found in oak woodlands, chaparral, and forests generally above 2,450 ft. in elevation and as high as 11,000 ft. (750-3350 m).
- ARPA's showy flowers are bee-pollinated and hang in bunches. The many-flowered inflorescence of greenleaf manzanita is formed the year before the flowers mature, opening the following spring. The fruits contain hard-coated seeds that provide important forage for many species of wildlife. Seeds are dispersed by seed-caching small mammals and fruits are eaten by larger animals such as bears, coyotes, and foxes.
- Greenleaf manzanita is well-adapted to periodic fires. The leaves are highly flammable. Its seeds require fire (or other scarification) followed by cold weather in order to germinate.

Greenleaf manzanita, *Arctostaphylos patula*, species profile (Version 3; August 2012):

California Phenology Project:
species profile for
Greenleaf Manzanita
(Arctostaphylos patula)



UCSB



CPP site(s) where this species is monitored: Lassen Volcanic National Park, Sequoia National Park



Photo credit: Bryant Olsen (Flickr)

What does this species look like?

This perennial evergreen shrub forms circular clones that are 1 to 2 meters tall and up to 3 meters in diameter. Clones form when the lower branches produce roots that penetrate the soil, promoting clonal growth. The smooth bright green leaves are 2.5 to 6 centimeters long and 1.5 to 4 centimeters wide. The glabrous pink or white, pendant, urn-shaped flowers form drooping clusters. Fruits are dark brown and 1 centimeter in diameter, each containing five hard seeds.

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

Species facts!

- The CPP four letter code for this species is ARPA.
- The fruits of Greenleaf manzanita are eaten by bears and other animals.
- The seeds can stay dormant in the soil for many years, and require both fire and cold conditions to germinate.
- Pollinated by bees.
- Has a relationship with mycorrhizal fungi.




Photo credit: Brian Haggerty

Where is this species found?

- *Arctostaphylos patula* is found in coniferous forests between 750 and 3350 meters in elevation.
- Adapted to hot, dry climates and to extreme temperatures.
- Found on well drained soils, from sandy to silky loam.

The photo at left shows the **immature** inflorescence structure (a panicle) that will develop into mature flower buds the following year (do not record these structures as "flowers or flower buds" during the first year they appear on the plant)




Photo credit: Ann Huber (SEKI/NPS)

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)

Version 3, August 2012

CPP species profile for Greenleaf Manzanita (*Arctostaphylos patula*)




Brian Haggerty

Breaking leaf buds

Leaf buds originate at the nodes of existing leaves, in the leaf "axils".


Note: The photo shows leaf buds right before they have broken to reveal the tips of young leaves.



Brian Haggerty

Young leaves

Young leaves tend to be thinner and brighter than mature leaves.



Brian Haggerty

Flowers or flower buds

When monitoring ARPA flower or flower bud abundance, count each inflorescence as a single flowering structure! For example, if there are 2 inflorescences with many flowers or buds each, then abundance should be recorded as < 3.

There are no flower buds in the photo above.




Bryant Olsen

Open flowers

Each flower has both male and female parts contained within the urn-shaped floral tube; this makes it difficult to see the anthers and the 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!)

Note: USA-NPN flower and fruit phenophases are nested! If you record **Yes** for "open flowers" you should also record **Yes** for "flowers or flower buds" and if you record **Yes** for "ripe fruits" you should also record **Yes** for "fruits"




Brian Haggerty

Fruits

The fruit is berry-like and changes from green to red, reddish-brown, purplish-brown, or chestnut brown; it drops from the plant when ripe.

There are no flower buds in the photo above.



Bryant Olsen

Ripe fruits

The fruit is considered ripe when it has changed color from green to red, reddish-brown or chestnut-brown. A ripe ARPA fruit will have very little green color on the surface (i.e., <10% will be green).

Important note regarding sequence of ARPA phenophases: The phenological progression of ARPA can be confusing as its phenophases do not appear in the sequence presented on USA-NPN datasheets. Observers should look for the following progression: Inflorescence structures (i.e. panicles) begin to develop early in the growing season and are mostly, if not exclusively, terminal; the buds on these inflorescences do not open into flowers until the following spring (flower buds form one year prior to maturity). See a photo of this inflorescence structure on the front page. Flowering of last year's inflorescence begins after the flower buds for next year have developed. Following flowering, leaf buds break. Following leaf bud break, fruits set and ripen. Leaves are often fully developed before the fruits become ripe.

Phenophases not pictured: Recent fruit or seed drop

Version 3, August 2012

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3.4 Lodgepole pine (*Pinus contorta*)

- CPP four letter code: PICO
- Download the USA-NPN datasheet and the CPP profile for PICO here:
<http://www.usanpn.org/cpp/PICO>
- Lodgepole pine is one of the most widespread pine species in the west, ranging from Alaska to California. In Lassen Volcanic National Park, it is found from 5,200-7,000 ft. in elevation.
- Lassen's only native two-needle pine, lodgepole is known for its ability to tolerate a wider range of edaphic conditions than many other coniferous species. For example, periods of soil inundation kill most conifer species, but lodgepole thrives in these conditions. Its ability to survive such periodic inundation may partially explain why it is so abundant around many of the mountain lakes in LAVO.

Lodgepole pine, *Pinus contorta*, species profile (Version 2; March 2012):

California Phenology Project:
species profile for
Lodgepole Pine
(*Pinus contorta*)

USA **nnpn**
National Phenology Network

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CPP site(s) where this species is monitored: Lassen Volcanic National Park



What does this species look like?
This evergreen pine can be either a tall upright tree, or a shrub. The trunk has scaly bark and reaches 2-34 meters in height at maturity. There are two needles per bundle, and needles are 2.5-6.8 centimeters long, with a persistent sheath at the base of the bundle. The seed cone is less than 6 centimeters long and is angled, with knobs at the tip of the scales.

When monitoring this species, use the USA-NPN conifers (needle bundles) datasheet.

Photo credit: Iwona Erskine-Kellie (Flickr)

Species facts!

- The CPP four letter code for this species is **PICO**.
- Adapted to fire; populations self-thin as they regenerate after a fire. Fire is required for the cones to release their seeds.
- Attacked by blue stain fungus, which is transferred by the mountain pine beetle.
- Used by Native Americans for building lodges and teepees
- Used for railroad cross ties and building lumber.



Photo credit: Bryant Olsen (Flickr)

Where is this species found?

- *Pinus contorta* is found in many habitats from coastal to subalpine forests throughout the Western United States.
- It is found at elevations less than 3500 meters.
- Grows on moist, medium-textured soils derived from granitic, shale, or coarse-grained materials.



Photo credit: enhan (Flickr)


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)

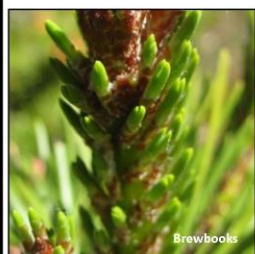
Version 2, March 2012

California Phenology Project:
species profile for
Lodgepole Pine
(*Pinus contorta*)


USA **nnpn**
National Phenology Network

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Emerging needles
Brewbooks




Young needles
Brian Haggerty




Pollen cones
Jason Hollinger



Open pollen cones
Young needles are also seen in this picture. Pollen is released when cones are tapped. This phenophase is nested; if you say Y to "open pollen cones", you should also say Y to "pollen cones".
Brian Haggerty



Unripe seed cones
An unripe seed cone is green or brown with scales closed together.
Brian Haggerty



Ripe seed cones
A seed cone is ripe when it has turned brown and the scales have begun to spread apart to release the seeds. Do not include open cones that have already dropped all of their seeds but remain on the plant.
silversyrpher

Phenophases not pictured: pollen release, recent cone or seed drop.
For this species, look for seed drop rather than cone drop (cones stay on tree at maturity).

Version 2, March 2012

3.5 Ponderosa pine (*Pinus ponderosa*)


- CPP four letter code: PIPO
- Download the USA-NPN datasheet and the CPP profile for PIPO here:
<http://www.usanpn.org/cpp/PIPO>
- There are two species called ‘yellow pine’ at Lassen: ponderosa pine and Jeffrey pine. Whereas ponderosa pine is generally found below 6,000 ft. in elevation, Jeffrey pine generally grows at higher elevations (5300 to 9200 ft.). The elevation ranges of the two species overlap at the lowest elevations in LAVO, but the two species can be distinguished based upon the smell of the bark and the color of young needles and pollen cones.

3.6 Mountain pride (*Penstemon newberryi*)


- CPP four letter code: PENE
- Download the USA-NPN datasheet and the CPP profile for PENE here:
<http://www.usanpn.org/cpp/PENE>
- Mountain pride is a lovely perennial with showy magenta flowers that give bright color to the granite and other rocky places in the montane coniferous forests of the west. This species is found from southwest Oregon to the southern Sierra Nevada and western Nevada. In the Sierra Nevada, it is generally found from 5,000 to 9,000 ft. in elevation.
- This species is cultivated in rock gardens. It does not tolerate very hot summers or cold winter temperatures without snow cover, and can lose its leaves when stressed.

Mountain pride, *Penstemon newberryi*, CPP species profile (Version 2; March 2012):

California Phenology Project:
species profile for
Pride of the Mountains
(*Penstemon newberryi*)



UCSB



CPP site(s) where this species is monitored: Lassen Volcanic National Park, Sequoia National Park




Photo credit: Dan Allison (Flickr)

What does this species look like?
This bushy perennial subshrub reaches a height of 12-30 centimeters. The leaves are covered with short hairs and are generally densely clustered at the base of plants. The leaf blades are 1 to 4 centimeters long and produce finely-toothed leaf margins. The glandular magenta flowers are 2-3 centimeters long, and the flowers are tubular or funnel shaped.

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

Species facts!

- The CPP four letter code for this species is **PENE**.
- *Penstemon newberryi* spends the winter underneath snow.
- The showy flowers are pollinated by both hummingbirds and insects.




Photo credit: Mr.Stobbe (Flickr)

Where is this species found?

- *Penstemon newberryi* grows in high elevation in rocky habitat such as outcrops and talus.
- It is found at elevations between 700 and 3500 meters.
- Found in California, Nevada, and Oregon
- Occurs in the Siskiyou, Coast Range, Sierra Nevada Mtns and Mt. Lassen.





Photo credit: Gravitywave (Flickr)


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)


Version 2, March 2012

California Phenology Project:
species profile for
Pride of the Mountains
(*Penstemon newberryi*)




UCSB

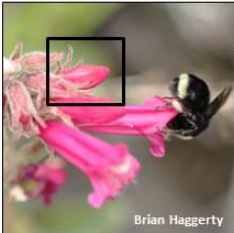




Young leaves are generally thinner than mature leaves and may be a different color (note the red young leaves in the photo).




CPP *Penstemon newberryi* at Lassen Volcanic National Park.




Brian Haggerty

Flowers or flower buds
A flower bud can be seen in the black box in the photo to the right.




Brian Haggerty

Open flowers
Can you see the anthers and stigma?
Note: flower phenophases are nested; if you say Y to "open flowers" you should also have said Y to "flowers or flower buds"



Brian Haggerty

Fruits
The fruit is a capsule that changes from green to tan, and then splits open when dry and ripe.



Sylvia Haightain

Ripe fruits
The fruit is considered ripe when it splits open. The picture shows dried capsules that have split open and the ripe seeds found within.

Note: fruit phenophases are nested; if you say Y to "ripe fruits" you should also have said Y to "fruits"

Phenophases not pictured: Recent fruit or seed drop

Version 2, March 2012

IV. LAVO Monitoring Locations and Maps

The CPP has established five monitoring locations within Lassen Volcanic National Park: Nobles Emigrant Trail (EMIG), Sunflower Flats (SNFL), Manzanita Lake (MANZ), Hot Rock (HORO), and at the Devastated Area (DEVA). Detailed maps for each monitoring site are available for download at: <http://www.usanpn.org/cpp/node/35>

Table 2. LAVO monitoring locations, target plant species at each location (with # of targeted individuals), and the approximate phenologically active season for each phenophase category at each location. Estimates of the phenologically active season are based on observations recorded in 2011 and 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)	Nobles Emigrant Trail (EMIG)	<i>Arctostaphylos patula</i> (5)	2011	Leaves: TBD Flowers: TBD Fruit: TBD
		<i>Penstemon newberryi</i> (10)	2011	Leaves: TBD Flowers: TBD Fruit: TBD- July
		<i>Pinus ponderosa</i> (4)	2011	Leaves: TBD Pollen Cones: TBD Seed Cones: TBD
		<i>Populus tremuloides</i> (6)	2011	Leaves: TBD Flowers: TBD Fruit: TBD
(2)	Manzanita Lake (MANZ)	<i>Arctostaphylos patula</i> (12)	2011	Leaves: May-September Flowers: TBD Fruit: June - TBD
		<i>Pinus ponderosa</i> (5)	2011	Leaves: TBD Pollen Cones: TBD Seed Cones: TBD
		<i>Pinus contorta</i> (4)	2011	Leaves: TBD Pollen Cones: TBD Seed Cones: TBD
(3)	Hot Rock (HORO)	<i>Lupinus obtusilobus</i> (10)	2011	Leaves: TBD Flowers: June-August Fruit: June-October
		<i>Pinus contorta</i> (7)	2011	Leaves: TBD Pollen Cones: TBD Seed Cones: June-November
(4)	Sunflower Flats (SNFL)	<i>Arctostaphylos patula</i> (10)	2011	Leaves: TBD Flowers: TBD Fruit: TBD
		<i>Penstemon newberryi</i> (10)	2011	Leaves: TBD Flowers: TBD-September Fruit: July-TBD
(5)	Devastated Area (DEVA)	<i>Populus tremuloides</i> (6)	2011	Leaves: TBD Flowers: TBD Fruit: TBD

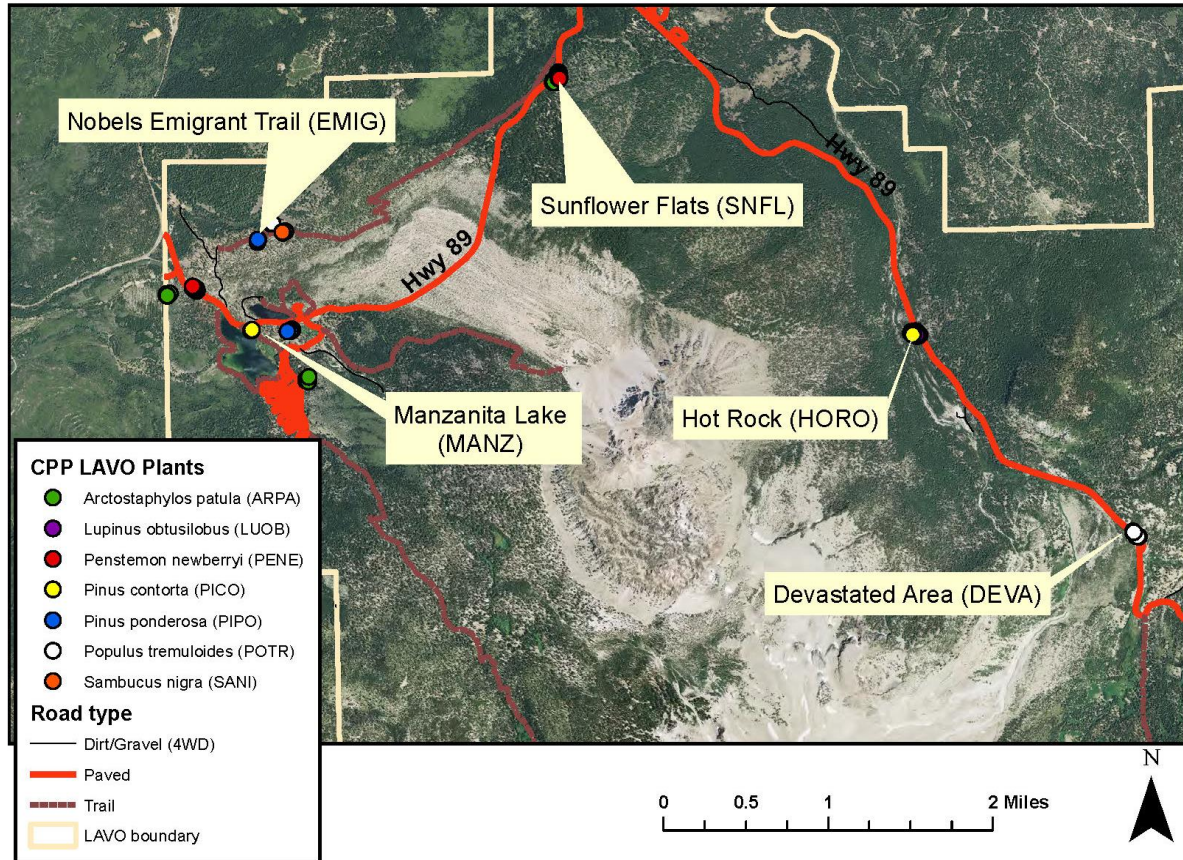


Figure 1. CPP monitoring locations at LAVO (as of April 2013).

The identifier code for each tagged plant follows the same format: CPP-PARK-LOCA#-GESP#.

LOCA# represents the location name in a four letter code (e.g., Manzanita Lake= MANZ) and the site at each location (e.g., site 2 at Manzanita Lake= MANZ2), whereas GESP# represents the four letter code for each genus species combination (e.g., *Penstemon newberryi*= PENE) and the individual plant number at each site (e.g., the third *Penstemon newberryi*= PENE3).

The CPP plants at LAVO are marked with two metal tags. The first tag includes the 4-part code described above. The second tag includes a unique number identifier; this number is unique to the individual plant. It is used in the tables below and in *Nature's Notebook*. See *Establishing Monitoring Sites SOP#5* for additional information about the tags used to mark CPP plants.

V. Frequency of monitoring and estimated time investment

As described in detail in the *CPP Plant Phenology Monitoring Protocol*, 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). See the *Phenology Site and Trail Monitoring SOP #6* for additional instructions for downloading and using USA-NPN datasheets.

Direct links to USA-NPN datasheets:

Populus tremuloides (aspen):

https://www.usanpn.org/files/shared/observationsheets/species_27.pdf

Lupinus obtusilobus (bluntlobe lupine):

https://www.usanpn.org/files/shared/observationsheets/species_772.pdf

Arctostaphylos patula (greenleaf manzanita):

http://www.usanpn.org/files/shared/observationsheets/species_761.pdf

Pinus contorta (lodgepole pine):

https://www.usanpn.org/files/shared/observationsheets/species_762.pdf

Penstemon newberryi (mountain pride):

http://www.usanpn.org/files/shared/observationsheets/species_760.pdf

Pinus ponderosa (ponderosa pine):

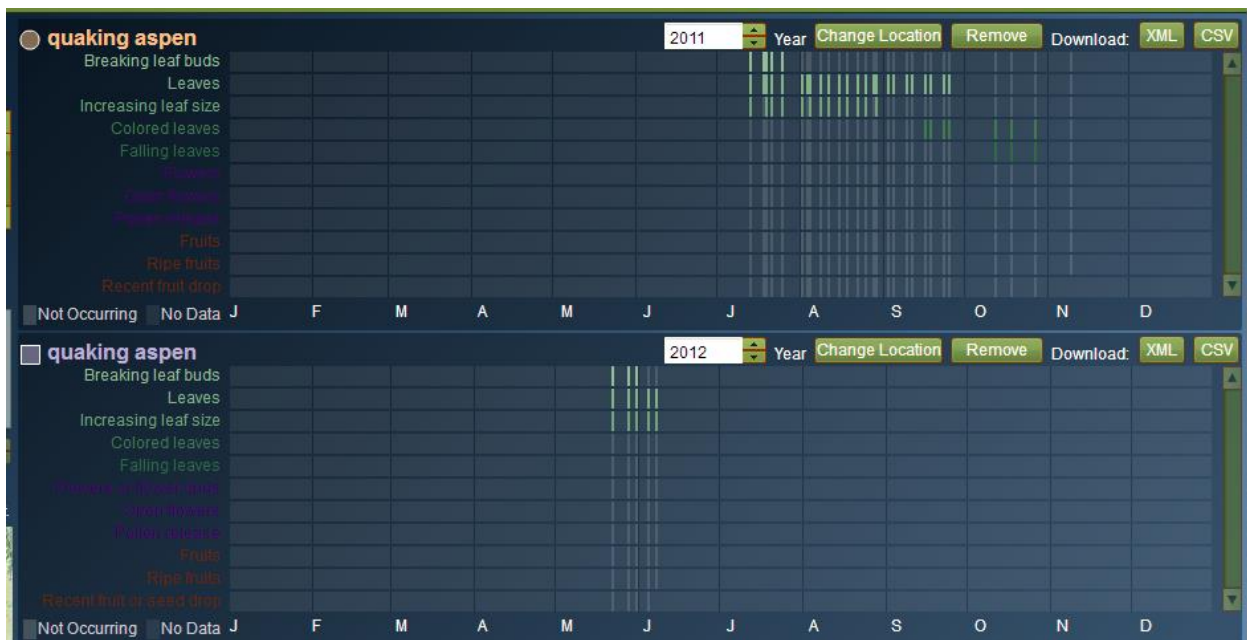
https://www.usanpn.org/files/shared/observationsheets/species_25.pdf

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 Lassen Volcanic NP focal taxa: dates and durations of phenophases at monitoring locations

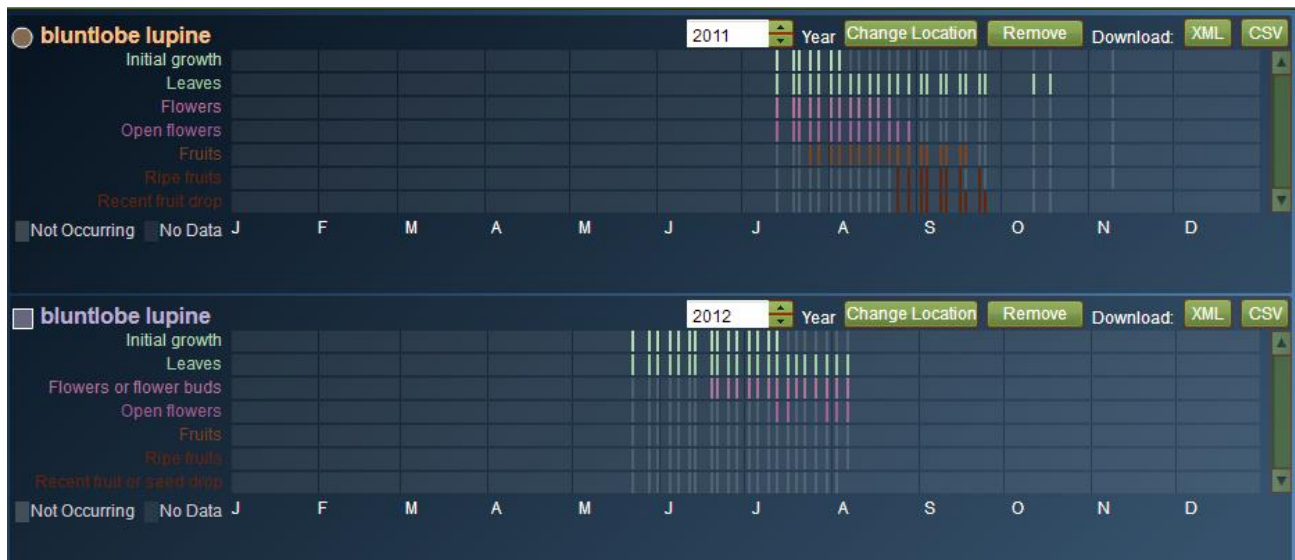
7.1 Aspen: 2011 and 2012 data are summarized in the visualization below. Based on these preliminary data summaries, the estimated the phenologically active season for aspen phenophases (at LAVO) is:

- *breaking leaf buds:* TBD-July
- *leaves:* TBD-September
- *increasing leaf size:* TBD-August
- *colored leaves:* September-October
- *falling leaves:* October
- *flowers or flower buds:* TBD
- *open flowers:* TBD
- *pollen release:* TBD
- *fruits:* TBD
- *ripe fruits:* TBD
- *recent fruit or seed drop:* TBD



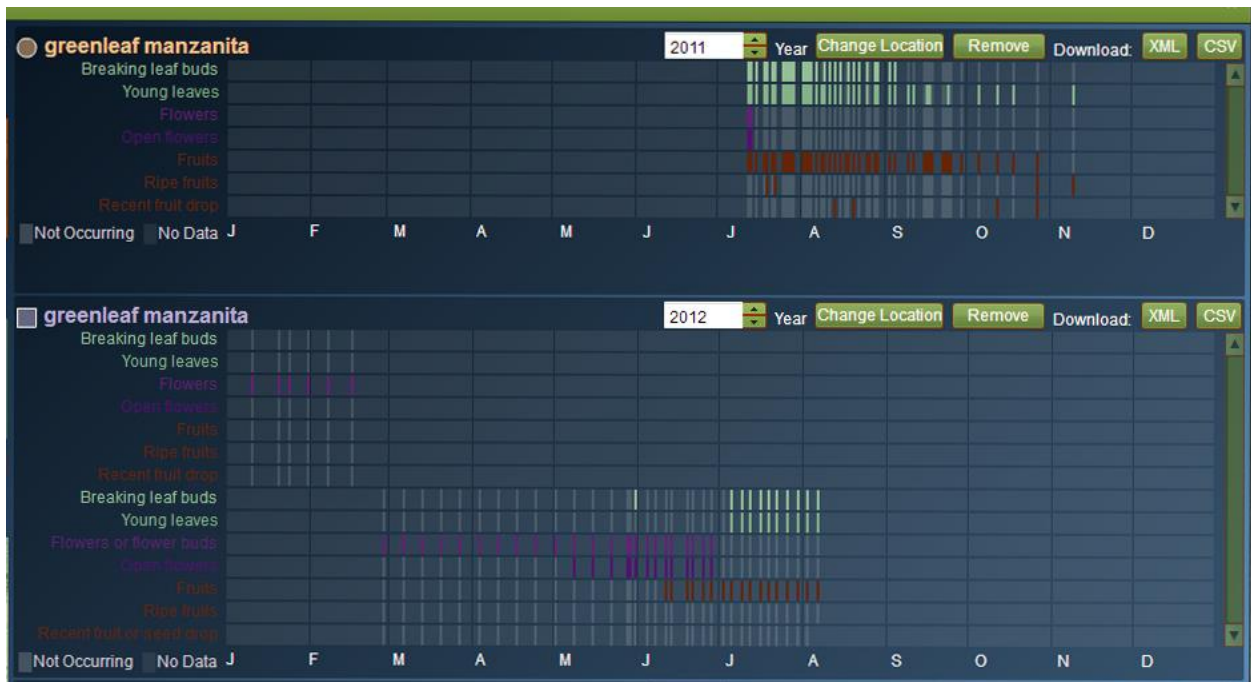
7.2 Bluntlobe lupine: 2011 and 2012 data are summarized in the visualization below. Based on these preliminary data summaries, the estimated the phenologically active season for lupine phenophases (at LAVO) is:

- *initial growth:* TBD
- *leaves:* TBD
- *flowers or flower buds:* June-September
- *open flowers:* July-September
- *fruits:* July-October
- *ripe fruits:* August-October
- *recent fruit or seed drop:* August-October



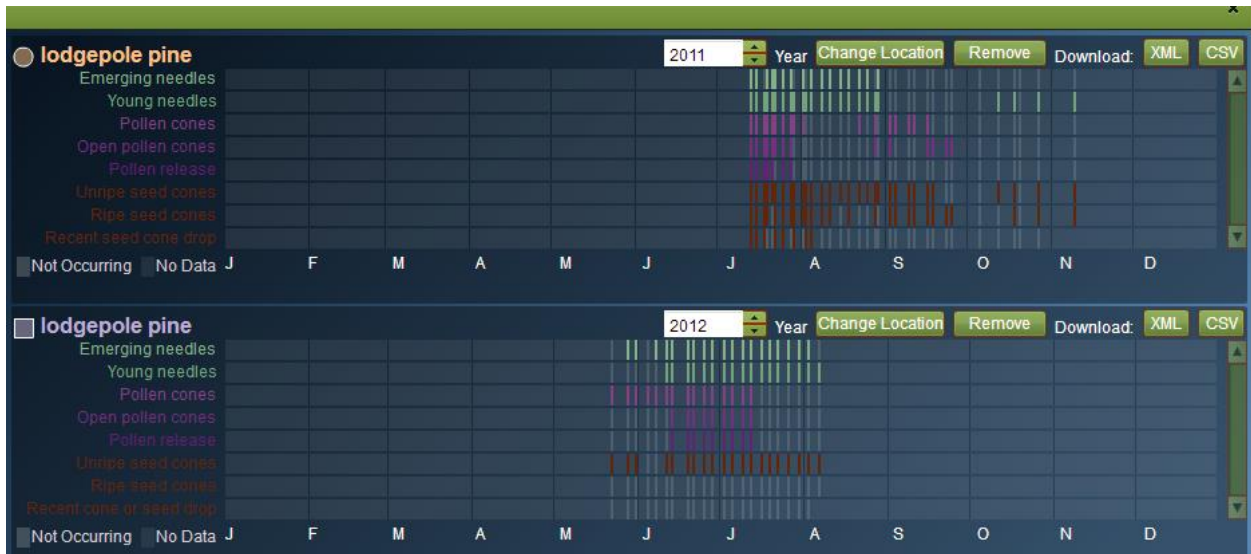
7.3 Greenleaf manzanita: 2011 and 2012 data are summarized in the visualization below. Based on these preliminary data summaries, the estimated the phenologically active season for greenleaf manzanita phenophases (at LAVO) is:

- *breaking leaf buds:* TBD-September
- *young leaves:* TBD
- *flowers or flower buds:* January-July
- *open flowers:* May-July
- *fruits:* June-October
- *ripe fruits:* June-TBD
- *recent fruit or seed drop:* August-TBD



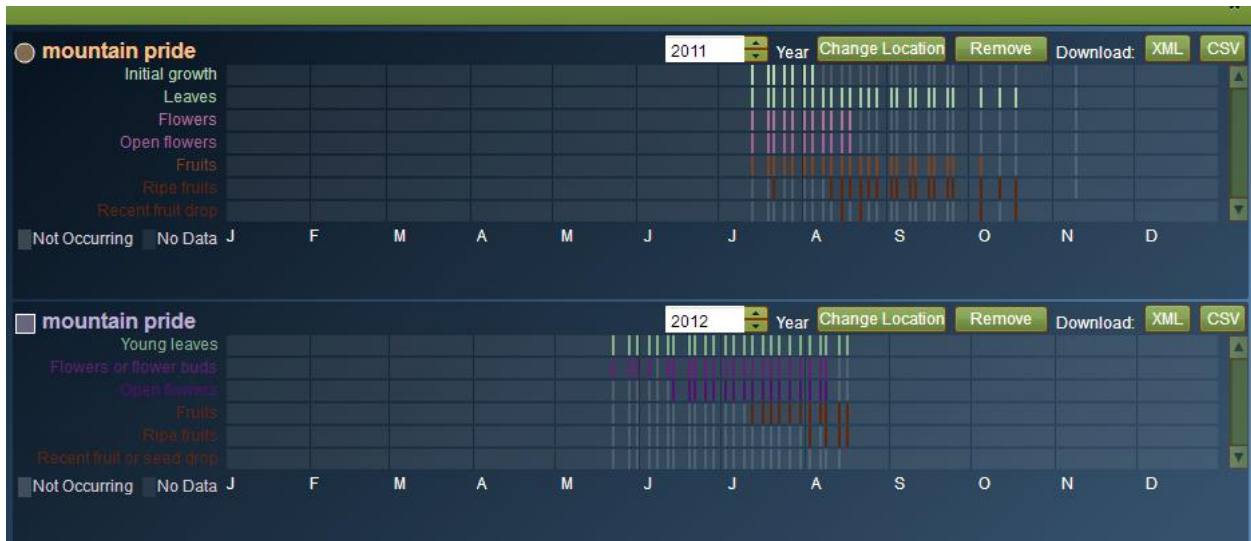
7.4 Lodgepole pine: 2011 and 2012 data are summarized in the visualization below. Based on these preliminary data summaries, the estimated the phenologically active season for lodgepole pine phenophases (at LAVO) is:

- *emerging needles:* May-August
- *young needles:* June-TBD
- *pollen cones:* TBD-September
- *open pollen cones:* June-September
- *pollen release:* June-July
- *unripe seed cones:* TBD
- *ripe seed cones:* TBD
- *recent cone or seed drop:* TBD-August (?)



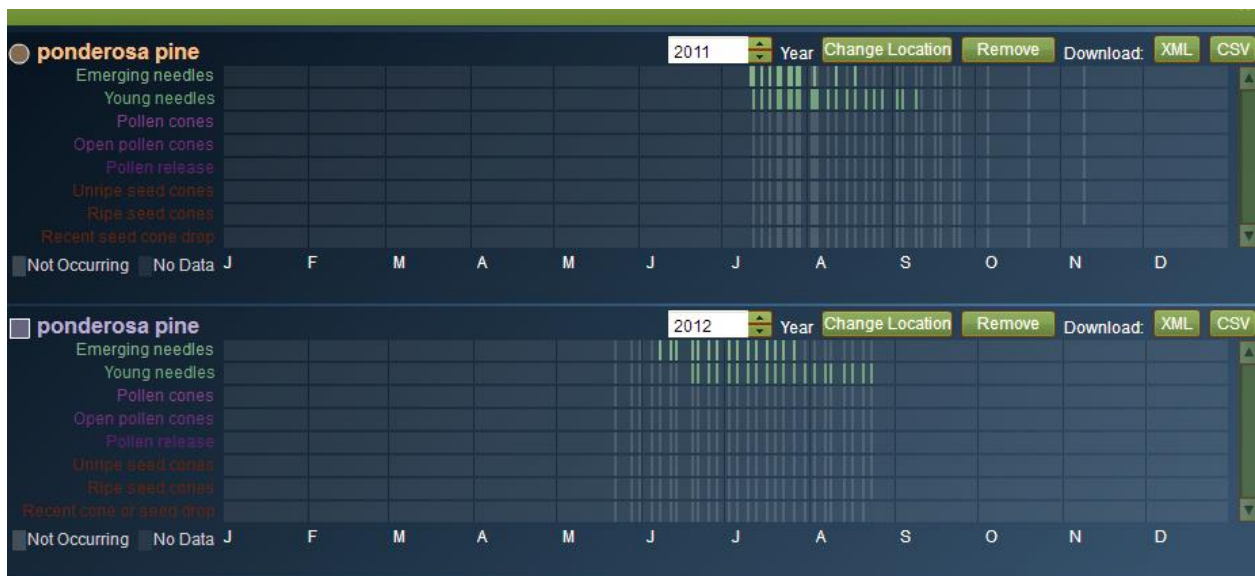
7.5 Mountain pride: 2011 and 2012 data are summarized in the visualization below. Based on these preliminary data summaries, the estimated the phenologically active season for greenleaf mountain pride phenophases (at LAVO) is:

- *young leaves*: May-August, TBD
- *flowers or flower buds*: (May)-August, potentially earlier
- *open flowers*: June-August
- *fruits*: July-October
- *ripe fruits*: July-TBD
- *recent fruit or seed drop*: August-TBD



7.6 Ponderosa pine: 2011 and 2012 data are summarized in the visualization below. Based on these preliminary data summaries, the estimated the phenologically active season for ponderosa pine phenophases (at LAVO) is:

- *emerging needles:* June-August
- *young needles:* June-September
- *pollen cones:* TBD
- *open pollen cones:* TBD
- *pollen release:* TBD
- *unripe seed cones:* TBD
- *ripe seed cones:* TBD
- *recent cone or seed drop:* TBD



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.