



The California Cone Hunter's Pocket Guide

First Edition

This pocket guide belongs to:

phone # or email address



Marisol Villareal

The California Cone Hunter's
Pocket Guide
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Acknowledgements

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Contents

Acknowledgements	ii
Introduction	3
Why Collect Cones? Why Now?	3
How do Conifers Produce Cones?	6
Cone Surveying, Monitoring & Sampling	9
Timeline	9
Materials and Equipment	9
Cone Surveying	13
Stand Selection for Cone Monitoring and Collection	14
Cone Crop Reporting	17
Cone Monitoring and Sampling	20
Monitoring Frequency	20
How to Evaluate the Exterior of the Cone	22
How to Evaluate the Interior of the Cone and the Seeds	26
Cone Cut Test	28
Table: Recommended minimum number of filled seeds exposed on one-half cone face	29
Cone Collection & Transportation	32
Timeline	32
Materials & Equipment	33
Who to Contact for a Cone Collection & Seed Bank Delivery	35
Methods of Cone Collection	37
Harvesting Cones	39
Cone Collection Guidelines for Tree Climbing	40
Bagging & Tagging Cones for Storage	42
Bagging Cones	42
Tagging Bushels of Cones	43
Bushel Storage Before Transportation to Seed Bank	47

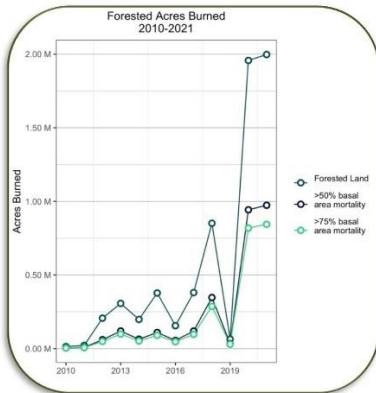
The California Cone Hunter's Pocket Guide

Transportation & drop-off Communications	48
Additional Resources	49
References	50
About the Reforestation Pipeline Partnership	52
Appendix A: Tree Identification Guide.....	53
Appendix B: Survey123 'CA Cone Observations' User Guide	160

Introduction

Why collect cones? Why now?

In California, the need for post-fire forest landscape restoration grows with each passing wildfire season. California is losing its forests to catastrophic fires (Wang 2022, Steel et al. 2022). The beneficial effects that fire often provides—improving forest health by promoting biodiversity and reducing fuels and tree density—are threatened as increasing fire frequency, extent, and severity are killing more mature trees (Steel et al. 2015, Westerling et al. 2016, Parks and Abatzoglou 2020, Dennison et al. 2014). Since 2010, more than 8.2 million acres of forested land have burned in California (CAL FIRE 2022).



California forested acres burned resulting in various levels of tree mortality, 2010-2021 (American Forests)

Recent high-severity wildfires, driven by fire exclusion, loss of cultural fire, and climate change, threaten natural forest recovery mechanisms and the ability of these systems to return to pre-fire conditions (Hessburg et al. 2021). Large continuous areas of high severity fire reduce the likelihood of natural tree regeneration (Coop 2020).

Post-fire regeneration failure is becoming increasingly common, especially in low elevation dry forests (Harris and Taylor 2020). As a result, many forested landscapes in California have not recovered and have transitioned to shrub and grass dominated vegetation types (Steel et al. 2020, Wang et al. 2022).

Where forests are deemed the desired condition on post-fire landscapes, active replanting of conifers to re-establish the basis of a forested ecosystem is becoming more frequently necessary. An enabling supply chain is needed to actively replant conifers on severely burned landscapes. That supply chain is commonly referred to as the reforestation pipeline.

The reforestation pipeline traces the process of reforestation from conifer seed collection, to processing and storage, nursery seedling production, site preparation and planting; and finally post-planting maintenance and monitoring.

reforestation pipeline



In California, the reforestation pipeline is presently undersized relative to the scale of replanting at hand across roughly 1.5 million acres across land ownership and management types identified by a working group of the CA Wildfire and Forest Resilience Task Force as being at risk of forest loss via vegetation type conversion after experiencing high-severity wildfire in recent years.

The most basic prerequisite for planting at such scale is access to native seed. Conifer seed must be carefully selected for its genetic suitability to current and future landscapes and climates, then cultivated into the seedlings that will become future forests. However, seed sources are being depleted by five simultaneous threats—wildfire, insect infestations, disease, drought, and workforce gaps—each one damaging or limiting collective seed supplies. Without seed collection, a robust response to the current tree mortality crisis is not possible—the genetic diversity of California’s forests will be reduced by the threats acting upon them. In the current business-as-usual scenario, cone crops too often go unseen and uncollected, and both public and private seed banks are running on short supply.

This, California cone hunters, is where you enter the picture.

Cone collections are a critical first step in successful reforestation projects. Understanding how to collect high-quality seeds is essential for supplying seed banks for nursery seedling production, as the quality of the seed directly affects the germination and survival of seedlings. Seed banks are responsible for the long-term storage of seed repositories from 85 distinct California tree seed zones, across 24 elevation bands of 500' each. Typically stocking approximately 16-20 of the most common conifer tree species native to the state, these factors mean that there are more than 125 unique seed sources in California for seed banks to source and store seed from. As wildfires burn through the state, it is vital to support California's seed banks to support current and future reforestation projects that protect our forests from permanent habitat loss and to preserve genetic diversity of native tree species.

How do Conifers Produce Cones?

Conifer trees are a type of gymnosperm, characterized by their cone-bearing reproductive structures. Male pollen cones generate pollen grains containing sperm cells that are dispersed by the wind. When pollen grains reach a receptive female seed cone, they adhere to a specialized structure known as the ovule. Once attached, the pollen grain germinates and forms a pollen tube, which grows towards the ovule. This tube delivers the sperm cells to an egg cell contained within the ovule, leading to fertilization.

The California Cone Hunter's Pocket Guide

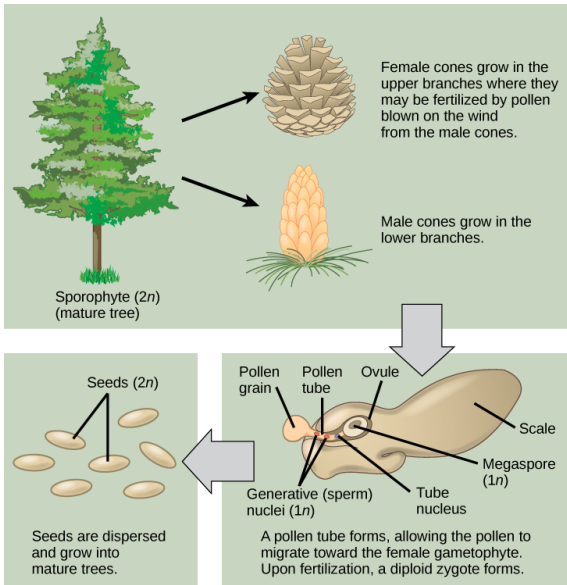


Image: OpenStax Biology

Unlike in angiosperms, gymnosperms do not rely on pollinators for this process. Following fertilization, the ovule develops into a seed, containing the embryo of the new plant. The seed is protected within the cone until it is mature enough to be dispersed. This maturation process can take anywhere from two to three years, depending on the species.

Conifers often exhibit cyclical patterns of cone production, with some years characterized by abundant cone production and others by fewer cones.

Good crops may occur roughly every 3 years, while exceptional bumper crops occur less frequently. In some cases, the interval between good crops, also known as periodicity, may be as long as 10 to 15 years.

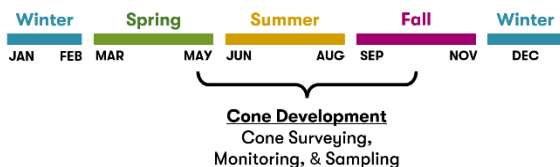
While estimates of cone crop intervals exist for some tree species, average periodicities are still being deduced for many. Several other factors can influence annual crop production and frequency including site characteristics, genetics, elevation, age, and various climatic conditions.

Cone Surveying, Monitoring, and Sampling

Timeline

Surveying, monitoring, and sampling stands for cones are essential duties to perform in order to successfully harvest high quality seed in financially feasible manner. Due to the cyclical nature and various environmental factors influencing annual cone production in conifers, stands must surveyed every year. In most cases, trees producing large crops the previous year will not produce a large crop the following year.

Once desirable cone crop is identified through surveying, periodic monitoring is then necessary to ensure that the cone crop remains viable over time and to determine when the cone crop is mature enough for collection. As part of the monitoring process, sampling cones will help determine the quality and viability of the cone crop.



Cone crop surveys can begin in late spring, and often continue into mid-fall depending on species, elevation, and regional weather.

The California Cone Hunter's Pocket Guide

After surveyed stands have been selected for continual observation, cone monitoring (regular sampling) occurs until the cones and seeds are developed enough for harvesting. Typically, this ripening occurs from early summer through fall but varies by species, elevation, and seasonal weather throughout California's eco-regions.

Materials & Equipment



4x4 vehicle: for varying road conditions



Alcohol wipes or hand sanitizer: to remove pitch/sap from skin and clothing



'Big Shot' Sling Shot or APTA (Air Powered Tree Access) with throwline and throw weight: for knocking or shaking cones out of trees



Binoculars: to visualize cones in trees from afar



Colored flagging: for marking specific seed trees or stands of interest for continual monitoring



Cone cutter: for evaluating the interior of the cone for seed maturity and quality; can be either purchased or made by fastening hand cutting tools (e.g., machetes, cleavers, knives) to a guided cutting board on a hinge; cone cutters should be routinely sharpened to bisect cones smoothly and symmetrically



Disposable gloves: recommended for handling sappy or 'pitchy' cones



GPS device: for recording latitude and longitude; e.g. smartphone, Garmin, etc.)

The California Cone Hunter's Pocket Guide



Hard hat: safety recommendation for walking under trees and sampling cones



Hiking boots: for potentially walking far distances in uneven or hazardous terrain



Leather gloves: recommended for handling sharp prickly cones



Notebook: to record information about location of cone monitoring



Razor blade or pocket knife: for longitudinally slicing open seeds to evaluate embryo development and seed maturity



Survey123 “CA Cone Observations” app: for reporting cone crop observations and location (Note: scan QR code on below for quick access, see also: Appendix B)



The California Cone Hunter's Pocket Guide



Example of a cone cutter. Photo: Paul Wade, USDA Forest Service

Cone Surveying

Cone surveying consists of finding and visually evaluating stands of trees for cone collection.

Individuals responsible for cone surveying in wild forest stands can spend many hours driving through forest roads searching for stands of trees or individual trees with significant cone crops.

Always check with regional or local authorities to determine specific guidelines to follow for cone surveying. If regional or local information is unavailable, then use the following information as a general guide to help you successfully survey for cone production.

To find out who the local authority is your survey area, download a land ownership map here:



Make sure to contact landowners ahead of site visits to obtain permission and to avoid road and forest hazards, ensure access is not obstructed or gated, and assist in defining the best locations to concentrate efforts (check CAL FIRE's 'Seed Bank Assessment of Needs' for additional information).

Stand Selection for Cone Monitoring and Collection

Number of stands

It is recommended to collect and combine (bulk) seed from up to 20 unrelated stands separated by 200 ft within a given seed zone and elevation band. Seed from stand collections can be bulked at seed extractories to meet agency specific seed lot diversity standards (USFS, 2016).

Number of seed trees

Typically, a single stand should contain cones from no less than 10 separate seed trees suitable for collection; 20 to 30 trees preferred (USFS, 2016). Fewer trees per stand are acceptable if more stands are included. Collect equally among selected trees to ensure any individual tree does not contribute more than 10% of the total collection (USFS, 2016). Check with local agencies to confirm minimum number of seed trees recommended to for your collection.

Tree spacing

To ensure unrelatedness and to optimize genetic diversity in a cone collection, it is important to ensure that the seed trees are adequately spaced apart; 100 ft or greater is recommended for most outcrossing woody plants (USFS, 2016). Consult your regional geneticist's recommendations for the appropriate distance between trees for collections in your area.

Stand type

Cones should only be collected from native conifer forest stands to ensure that the resulting seed source is representative of the 'local' forest genetics. Avoid collecting cones from plantations because the reforested seed source identity isn't typically known, and may not be planted with the appropriate local seed source. A plantation will typically consist of the same species and age of trees, and appear to be arranged in a uniform pattern. Avoid collecting from populations with unique site characteristics that may contain ecotypes, like unusual soils (e.g., serpentine), extreme or marginal environments, and isolated or small stands that may contain low genetic diversity.

Phenotypic traits & tree health

Collect cones from trees in stands with overall desirable phenotypic traits that appear to be generally healthy. These may be indicative of superior tree genetics. Also, note that there is no minimum tree height or diameter, however it is best to collect from dominant or co-dominant trees.

Desirable phenotypic traits

- Single top (no forking)
- Straight
- High vigor (fast growth rate)
- Minimal defoliation
- No flagging (browning or wilting of branches)
- Blister-rust free
- Free from diseases and pests

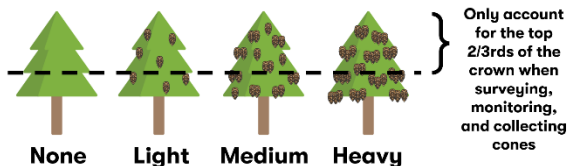
Accessibility

Select stands that are accessible for your collection method (different collection methods are described in the 'Cone Collection and Transportation' section).

Factors to take into consideration when evaluating accessibility:

- Vehicle access - Determine if you can easily transport equipment and collected cones to and from a vehicle.
- Climber safety - If a tree appears to be dying, consists of many dead branches, leaning, or is located close to a powerline, it may not be safe for climbers or ground crew to harvest cones. Try to select trees with large well-spaced branches that can support a climber.
- Plants and animals - Check for presence of poisonous plants or reptiles, beehives, or harmful insects
- Minimal slope - Is the ground easily walkable or navigable? Remember that there will need to be a ground crew assisting tree climbers if a collection is to occur.

Cone Crop Rating



To determine if a stand is ideal for collection, you will rate cone crops on individual trees (See Table 1), and report the average rating of the overall stand in

Survey123.

Only include the top 2/3 of the tree's crown as cones harvested from the same target area because the lower canopy may have more seed insects and have an increased probability of self-pollination. Dead cones remaining on trees are NOT taken into consideration for cone crop rating. See the following 'Cone Monitoring and Sampling' section to learn what constitutes a live versus dead cone.

Stands with medium to heavy cone crops will be ideal for continual monitoring and potential cone harvesting. Additionally, the larger the crop, the more financially feasible it is to harvest.

Table 1. How to rate cone crops on individual trees by percentage of cone density (adapted from Stewart, 2020).

Cone crop rating per tree	Definition
None	No cones present on tree
Light	Cones on 25% or less of tree canopy
Medium	Cones on 25-50% of tree canopy
Heavy	Cones on 50% or more of tree canopy

Cone Crop Reporting

Seed bank managers with oversight and funding to support cone collections need to know where cone crops are developing as early in the season as possible. When users report information on cone crop development in forested stands, the “CA Cone Observations” tool is how they will be able to receive, review, and work with that crucial information.

The tool was created with the goal of improving the coordination of limited statewide resources and capacity for cone collection, and to ensure that as many viable cone crops as possible are collected on a yearly basis. It has been improved for the 2024 field season based on user feedback from 2023.

When cone surveying, cooperators are strongly encouraged to download and utilize Survey123 ‘CA Cone Observations’ to report information on potentially collectable stands including GPS location, property type/land ownership, tree species, observation scale, photos, crop rating, and accessibility notes.

See ***Appendix B*** for a step-by-step user guide on filling out the “CA Cone Observations” form and answers to frequently asked questions (FAQ) about the tool.

**2024 CA Cone
Observation Survey
Access Information**

Scan to access cone observations reporting form when conducting conifer cone surveys in California.



Direct link: <https://arcg.is/1qSKra0>

Cone Monitoring & Sampling

Once you have identified stands with significant cone crops, it is extremely important to continually monitor sites to evaluate cone, seed health, and development. Monitoring consists of sampling cones over time to evaluate successive changes cone and seed characteristics. Sampling cones includes utilizing a variety of techniques to get individual cones down from the tree to cut open and observe. The samples will inform cone and seed maturity, which is essential for the successful collection of viable conifer seeds.

When sampling cones from trees within the stand, ensure collection is from the top 2/3 of the tree's canopy. The collected samples should be from the same selected seed trees from which cones would eventually be harvested if they prove to be of good quality.

To obtain cones you may need to use either a 'Big Shot' Sling Shot or APTA (Air Powered Tree Access) with a throwline and throw weight to knock cones from the tree. Trained and permitted marksmen utilizing rifles is an uncommon method for cone sampling due to legal and safety reasons, but may be a viable option on private property, and is subject to individual landowners' discretion.

Monitoring Frequency

Selected sites targeted for cone collection can be ideally monitored about every 2 - 4 weeks throughout the season. Once cones begin to exhibit changes in physical appearance, cone monitoring should occur weekly and more frequently when possible (e.g., 2-3 days).

The frequency of monitoring should increase as cones progressively mature. It is necessary to re-visit sites 1 - 2 days before collection to ensure seed dispersal has not already occurred, thus preventing the unfortunate waste of a trip for the climbing team and ground crew to a site where nothing is left in the trees to collect. It's important to track weather reports, as weather can change the timing of cone ripening. For example, extreme heat may increase the rate of maturation and seed dispersal.

How to Evaluate the Exterior of the Cone

Observe the exterior physical characteristics of the sampled cones to determine if the cones are ready and acceptable for collection.

Note: Determining cone maturity by the exterior of the cone can vary between individuals, populations, locations, and elevation; make sure to look up specific characteristics of your species of interest.



Photo: Bryan Jephson

Exterior characteristics descriptions

Color change	Ripening cones in general will begin turning from green to golden brown, yellow, gray, or purple depending on the species.
Shape	Cones should be relatively straight and smooth. Curved (sometimes referred to as 'J' shaped) or irregularly bumpy cones can be indicative of insect damage.
Flex	Ripening cones will be able to slightly bend when applying pressure.
Scale opening	Scales on ripening cones will start to open slightly. Cones with fully open scales are unacceptable for collection. Note: scales on some species may not open (e.g., serotinous species that require heat for opening). Look up specific characteristics of the species you are observing.
Insect activity	Look for entry and exit holes, frass (fine powdery brown debris produced by wood boring insects), and irregularly shaped cones, as these are indicators of infestation. These cones should not be collected.

Examples of insect damage



Frass (debris from insect boring) is visible on the outside (top image) and inside (middle image) of a Douglas fir cone. Curved Douglas fir cone also referred to as a 'J' shaped cone is a result of insect damage (bottom image) Photo credits top and bottom: Kelli Thorup, American Forests. Middle: B.C. Ministry of Forests

The California Cone Hunter's Pocket Guide

Example - Evaluating the Exterior of a Cone



Immature & Unopened

Green, Closed Scales, Stiff

No visible insect damage (no frass, no severe curve, no entry holes)

Do not collect, too early



Mature & Unopened

Golden brown, Slightly Opened

Scales, Retained Seed, Flex, Seed wings separate from the scale and slightly brittle

No visible insect damage

Ready to collect!



Mature & Opened

Brown, Fully Opened Scales,
Dispersed Seed

Do not collect, too late

Photo credit: Kelli Thorup, American Forests (top and middle) and National Park Service (bottom).

How to Evaluate the Interior of the Cone and Seeds

After making observations on the exterior of the cone, ***you will need to perform a cone cut test*** using a cone cutter to check several characteristics of the inside of the cone, including the seeds themselves.

Perform cut tests - Using a cone cutter, slice cones longitudinally down the center to monitor cone ripeness and check seed viability.

Evaluate cone and seed maturity - Check the different characteristics listed in the table below to evaluate the cone ripeness and seed viability. To evaluate individual seeds, you may need to use a razor blade or sharp small knife and tweezers to cut them longitudinally.



A variety of cone cutters.

Photo credit: Paul Wade, USDA Forest Service

The California Cone Hunter's Pocket Guide

Examples of Cone face cut tests



Longitudinal cut test performed on a Douglas-fir cone. One half of the cone shows the 'cone-face' where seed count can be observed. Additionally, cutting individual seeds to assess seed viability is often required and always recommended. Photo credit: Meredith Sierra, American Forests



Longitudinal cut test performed on a white fir cone. One half of the cone shows the 'cone-face' where seed count can be observed. Photo credit: Brian Lindstrand, Sierra Pacific Industries



A longitudinal cut-face test performed on a Whitebark pine cone where seeds can be counted and observed for their development. Photo credit: USDA Forest Service

Cone Cut Test - Determining Cone Maturity and Seed Viability

Seed Count

In general, one-half of the cone face should present over 50% of filled seed. Adequate number of viable seeds visible from the face of a cut will vary between species (see Table 2) and/or collection needs. Contact your regional geneticist to check for specific seed count standards.

Embryo length & Megagametophyte

The embryo must fill no less than 90% of the seed cavity in length. The inner seed tissue or megagametophyte should be white or yellow (depending on species), opaque, and have a firm texture.



Mature seed with 100%
filled embryo

Ready



Immature seed with <50%
filled embryo

Not Ready

Photo credit: Canadian Forestry Service

Oxidation

The fleshy part of the cone should stay the same color after cutting. If the cone begins to turn from white to brown after ~1 min, this indicates oxidation, which signifies that the cone is immature and is not ready for collection.

Immediately after cut



Photo credit: Mahalovich

Oxidation 1 minute after cut, cone is still immature



Photo credit: Mahalovich

Insect activity and abortion

Empty seeds or seeds filled with debris can indicate abortion or insect infestation; these seeds are not viable.

The California Cone Hunter's Pocket Guide

Table 2. Recommended minimum number of filled seeds exposed on one-half cone face for native California conifers. More information is still needed for many native California conifer species, as indicated by the blank spaces in the table (Portlock, 1998; Bonner & Karrfalt, 2008; USFS, 2016).

Species	Minimum number and/or percent of sound filled seed per half-cone face
Baker Cypress	
Big Cone Douglas-fir	50%
Black spruce	3 seeds
Brewer spruce	10 seeds
Bristlecone pine	
Coast redwood	
Colorado pinyon pine	3-4 seeds
Coulter pine	
Cuyamaca cypress	50%
Douglas-fir	
Englemann spruce	5-6 seeds
Foxtail pine	10 seeds
Giant Sequoia	
Grand fir	
Gray pine	12 seeds or 50%
Incense cedar	50%
Jeffery pine	2 seeds or 50%
Knobcone pine	50%
Limber pine	8 seeds or 50%
Lodgepole pine	
Macnab cypress	6 seeds
Monterey cypress	
Monterey pine	
Mountain hemlock	
Noble fir	6 seeds or 50%

The California Cone Hunter's Pocket Guide

Table 2. (Continued from previous page) Recommended minimum number of filled seeds exposed on one-half cone face for native California conifers.

Species	Minimum number and/or percent of sound filled seed per half-cone face
Pacific Silver fir	8 seeds
Parry pinyon pine	
Piute cypress	
Ponderosa pine	7-10 seeds or 75%
Port-Orford cedar	3 seeds
Pygmy cypress	
Red fir	50%
Redwood	50%
Santa Cruz cypress	
Santa Lucia fir	
Sargent cypress	
Shore pine	
Sierra juniper	
Singleleaf pinyon pine	
Sitka spruce	50%
Subalpine fir	5 seeds or 50%
Sugar pine	12-15 seeds or 66%
Torrey pine	
Utah juniper	
Western hemlock	3 seeds
Western juniper	
Western redcedar	2 seeds
Western white pine	10 seeds or 66%
White fir	50%
Whitebark pine	
Yellow cedar	2 seeds

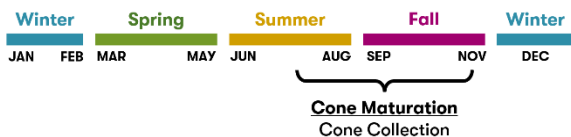
Cone Collection & Transportation

Cone collection supplies seed banks with high-quality seed to retain genetic diversity of California native tree species and for the production of high quality nursery seedlings used in reforestation projects. Cone collection is a crucial step in the larger goal of reforesting California's devastated forestlands.

Timeline

The timing of cone collection is crucial. Too early, and cones will not contain viable seeds. Too late, and seeds will already have shed from opened cones. Once cones show signs of maturation, the typical window for collection is 1-2 weeks before seed dispersal begins.

Monitor upcoming weather reports, as different weather conditions such as higher temperatures can narrow the window of the collection.



Cone collections typically take place towards the end of summer and early fall, but different elevations, species, aspect, slope, and weather conditions can change the timing of cone maturation and thus the appropriate timing of cone collection.

The California Cone Hunter's Pocket Guide

Always sample cones on the day of collection to ensure that cones are ready for collection and haven't fully opened their scales and released their seed.

Materials & Equipment

For cone collection, you will need the following for bagging and tagging bushels of cones. It is also recommended to bring materials and equipment mentioned in section 1.1.



Baby Powder: to remove pitch from skin and clothing



Binoculars: to visualize cones from afar



Bushel bags: mesh or burlap material, no plastic bags



Bushel buckets or large plastic buckets



Cone collection identification tags: either USFS tags or CAL FIRE tags, dependent on location of the cone collection



Cone cutter: to longitudinally cut open cones for sampling and evaluating crop viability



Gloves: both leather and disposable latex gloves are recommended for protecting hands from sharp cone prickles and pitch



GPS device: to record longitude and latitude of the collection site

The California Cone Hunter's Pocket Guide



Hand pruners: to remove debris and trimming peduncle



Hard hat: safety recommendation while walking under trees and remaining in the area during active cone collection by climbers or lift operators



Hiking boots: for potentially walking far distances in uneven or hazardous terrain



Notebook: to record number of bushels



Permanent markers: to fill out cone collection tags



Various colored flagging: to separate different bushel types



Walkie talkies: communication between ground crew and climbing crew



Zip ties: necessary for tying the end of the bushel bags to secure their closure

Who to Contact for Cone Collection & Seed Bank Delivery

To ensure that cones get collected and that appropriate seed banks are prepared to receive cones, it is key to contact the correct land managers and seed bank managers for your collection location. Make sure to contact recipient seed banks at least 1-2 days before cone delivery.

Table 3. Appropriate seed bank to contact based on land manager of cone collection area.

Land Owner or Manager Type	Action/Lead Contact
Federal—USDA Forest Service	Contact the USFS Placerville Nursery 2375 Fruitridge Road Camino, CA 95709 Ph: (530) 622-9600
Federal—Bureau of Land Management (BLM)	Secure BLM field office permissions. Cones processed at the USFS Placerville Nursery. 2375 Fruitridge Road Camino, CA 95709 Ph: (530) 622-9600
Federal — Other	Contact or visit nearest information/visitor center to inquire
State—Demonstration State Forest	CAL FIRE Reforestation Services 5800 Chiles Road Davis, CA 95618 Ph:(530) 753-2441 reforestation@fire.ca.gov
State—California State Parks	Cone collections not currently allowed within CA State Parks

The California Cone Hunter's Pocket Guide

Land Owner or Manager Type	Action/Lead Contact
Private property—non-industrial	Secure verbal landowner permission, then contact CAL FIRE Reforestation Services to facilitate written land access permission. Ph:(530) 753-2441 reforestation@fire.ca.gov
Private property—industrial timber	Contact nearest field office or area forester of the landowning entity
Tribal territories	Contact the administrative offices of the Tribal entity to inquire
Unknown	Vacate premises. <u>Never</u> attempt to conduct a cone collection without the explicit permission of the landowner or land managing entity.

Methods of Cone Collection

Several different methods can be used to harvest cones. Each method has different advantages and disadvantages. Important guidelines and considerations are noted for each method discussed below.

Tree Climbing

The most common and recommended method for wild stand collection. This method is typically hired through independent contractors.

- Do not use climbing spurs on valuable trees or species (ex. five-needle pines) with easily damaged stems. While climbing spurs are not typically utilized for cone collection, there are certain species and scenarios that their use may be advised.
- Ensure that branches on the trees are well-spaced and large enough to support a climber.

Hydraulic Lifts

Ideal for most orchards and plantations, but can be expensive and limit tree crown access depending on tree height.

Helicopter

An aerial cone rake can be practical in coastal regions with steep terrain or other limited access areas, but can be very high cost, require highly trained pilots, and pose a greater risk of damage to the trees.

Shooting

This can be a practical method for small collections, not a common method used by state or federal agencies, but still used by private landowners; special permits are required and may damage future cone crops.

Ladders

An uncommon method with major limitations to access of the upper crown of the tree.

Felled Trees

Can make cone collection easier, but the tree must've fallen when cones were ripe and collected soon after. There is a high risk of fungal contamination through ground contact. Destructive sampling of high-value seed trees should be avoided when possible.

Squirrel Cache

Not a recommended method, as it is difficult to determine which trees the cones originated from. There is a high probability of extreme fungal contamination from ground contact. Only use this collection method if you are highly experienced and qualified to do so.

Ground collection

Not a recommended or common method but occasionally useful for serotinous species such as giant sequoias. Giant sequoias are a species that may warrant such a collection or in areas of a homogenous growing stock. Only use this collection method if you are highly experienced and qualified to do so.

Harvesting Cones

When collecting cones from trees there are several guidelines that you should follow to ensure that quality seed is collected without damaging the tree.

- Only harvest unopened, mature cones.
- Only harvest cones from the top 2/3 of the crown, as the lower the lower canopy may have more seed insects and have an increased probability of self-pollination.
- If cones are not easily removed, cut the cones at the peduncle to avoid splitting and damaging the branch.
- Do not damage or cut off branches to access cones or to collect cones from, as this will damage the following years' cone crop which is produced on the ends of branches.

- When collecting cones, keep in mind the characteristics of quality ripe cones. Avoid harvesting cones that indicate insect activity or abortion as described in section 1.3.4 (entry/exit holes, frass, J shape, irregularly bumpy).

Cone Collection Guidelines for Tree Climbing

If using the climbing method for cone collection, the collection crew should consist of a climbing crew as well as a ground crew.

Climbers collect cones from the top 2/3 of the tree, while the ground crew supports communication and safety on the ground. A climber should never enter a tree with no individuals on the ground to support as it is extremely unsafe to do so.

The ground crew is responsible for checking for cone maturity and seed viability, bagging and tagging cones, counting bushels, and removing debris from bushels. The ground crew should consist of at least 2 individuals, in some cases one member is acceptable. Ground crew should wear a hard hat at all times during collection.

Ground crew should sample several cones and perform cone-cutting tests on the day of collection to ensure that cones still contain viable seed and observe the characteristics described in the 'How to Evaluate the Interior of the Cone and Seeds Using a Cone Cut Test' section to determine if the cones are ready for collection.

The failsafe way to prevent potential seed damage from dropping cones is to bag them in the tree. Depending on the species of tree collected and the collection contract, climbers will either bag cones in the tree or drop cones to the ground. It is the responsibility of the ground crew to collect dropped cones once safe to do so, bag/tag cones, and remove debris from bushels.

Note: falling cones are a safety hazard for those below; it is important to use clear communication between the climbing crew and ground crew.

Do not use climbing spurs on valuable trees or tree species (ex. five-needle pines) with easily damaged stems. While climbing spurs are not typically utilized for cone collection, there are certain species and scenarios that their use may be advised. In emergency situations the use of climbing spurs may be necessary on any tree to rescue a climber.

Bagging & Tagging Cones for Storage

Bagging and tagging cones are extremely important steps in cone collection to protect the quality of the cones and to identify the cones. Without proper storage and identification, receiving seed banks will not be able to process and utilize the cones, and the time and resources used for collection will have been ineffectual.

Bagging Cones

- Store cones in well-ventilated mesh or burlap bushel bags. Do not store cones in plastic bags as this will suffocate the cones and lead to the growth of mold.
- 1 US bushel of unopened cones = 37.2 fluid quarts = 32 dry quarts = 9.3 fluid gallons = 8 dry gallons. Check your contract with the climbing crew for bushel definition or call the recipient seed bank for their bushel definition
- Do not overfill the bushel bags. Each bag should only carry one bushel of cones. The bushel bags are larger than one bushel to allow room for expansion within the bags as the cones dry and open up.
- Remove as much debris from bushel bags as possible (needles, twigs, etc.)
- Do not tie off bushel bags lower than 3 inches from the top of the bag. This allows room for cone expansion and opening.

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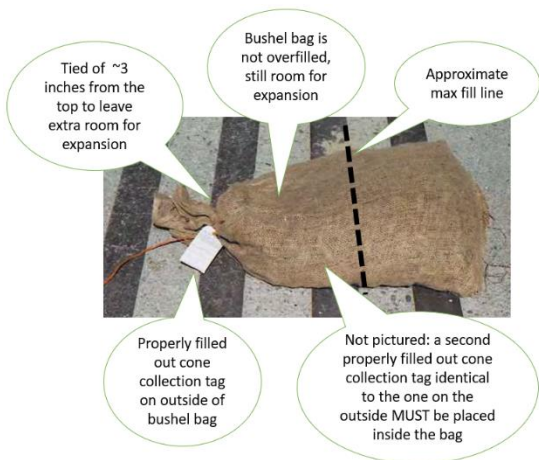


Photo Credit: adapted from Miller & Schaefer, 2015

Tagging Bushels of Cones

All bushels of cones must be properly labeled with seed lot identification tags. Seed lot identification is crucial to retain information on seed source for successful future plantings.

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All bushel bags require **TWO** identical seed lot identification tags, one inside the bag AND one on the outside of the bag.

The outer tag provides quick identification when handling, and the inner tag provides confirmation of the contents should the outer tag separate from the bushel. The types of tags required depend on the land managers of your location site.

USDA Forest Service Seed Lot Identification Tags

If delivering cones to the USFS Placerville Nursery, then you will need to acquire and properly fill out (1) USDA Forest Service seed lot identification tags, and; (2) the Seed Handler's Checklist.

USDA Forest Service Cone Collection Tag

CONE IDENTIFICATION TAG
FSH 2409.26

SPECIES CODE _____

SEED ZONE/ELEVATION _____

FOREST/DISTRICT CODE _____

LOCAL AREA _____

LATITUDE/LONGITUDE _____

TOWNSHIP	RANGE	SECTION
TYPE OF COLLECTION (CHECK ONE)		
1	SPECIAL	
2	SEED ORCHARD	
3	RUST RESISTANT TREES	
4	SELECTED STAND (SEED TREES)	

GENETIC BASE INFORMATION
REQUIRED ON CONE HANDLING CHECKLIST
USE SHARPIE PEN OR EQUIVALENT

Previous Edition **R5-2400-98 (Rev. 8/16)**
Obsolete

Callout Boxes:

- The three digit seed zone can be found on the map on page 1.2
- Use the three digit code designating the species found in Appendix B
- Elevation is rounded up to the nearest 500 feet (e.g. 5528 ft. in elevation becomes 60)
- The two digit forest code and associated two digit district codes are listed in Appendix B
- Use WGS 84
- Candidate & Test Trees
- Most collections
- Proven Major Gene Resistant Trees. i.e. RRSP or WWP

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Seed Handler's Checklist

Seed Lot ID: _____

PLACERVILLE NURSERY CONE HANDLING CHECKLIST									
<i>Inspectors of the cone collecting must complete all of Part A of the checklist and submit the form upon delivery. Please read the instructions on the back to ensure all information is accurately recorded.</i>									
<i>Parts B-E will be completed by Nursery staff after receiving cones.</i>									
PART A: TO BE COMPLETED BY COLLECTION INSPECTORS									
Species Code			Species Name						
Seed Zone - Elevation			Total Number of Trees						
Forest - District			Tree Number (if applicable)						
Type of Collection			Aspect:						
Location: T.		R.		Sec.		Collection Dates:			
Stand Name/Tag ID:			Delivery Dates:						
Local Area:			Total Number of Bushels						
Latitude/Longitude (degree decimal format in datum WGS 84):									
Remarks:									
PART B: CONE RECEIVING									
Received on:			by:		Seed Lot ID:				
Number of Bushels:			Remarks:						
Number of Sacks:									
PART C: CONE EVALUATION								Not evaluated	
Date evaluated:			by:		Remarks:				
Cone mold		Y		N					
Cone color and scales:									
Scales open		starting to open		closed					
Cut surface									
Cut face:		# of seeds		# of faces		average			
Insects		Y		N		Species:			
Wing color:		loose		medium		tight			
Seed coat color:									
Endosperm:									
Embryo:									
Seed maturity:									
PART D: SEED STORAGE									
Total weight (lbs):			Remarks:						
Purity %:									
Seeds per pound:									
Moisture content:									
PART E: FINAL REMARKS FOR FOREST FOLLOW UP									
Part A was incomplete or completed incorrectly									
Cone tags were incomplete or completed incorrectly									
Poor quality cones									
Immature cones									
Other:									

M. Partain
October 2021

The California Cone Hunter's Pocket Guide

CAL FIRE Seed Lot Identification Tags

If delivering cones to the CAL FIRE Seed Bank, then you will need to acquire and properly fill out CAL FIRE seed lot identification tags. See below to learn how to properly fill out the CAL FIRE tags.

CAL FIRE Cone Collection Tag

CAL FIRE
COLLECTION TAG

Company	
Species	
Lot Number	
Seed zone	Elevation
T ____ R ____	Sec. ____
Date	

Use waterproof ink.
Two tags per sack: one inside, one outside

Tree species or species code

Check the California Seed Zone Map and write the 3-digit code for the collection site

Write the GPS in D,D (6-digits) on the back of the tag

Land manager responsible for the collection, example: *Private landowner*

Write the exact elevation of the collection site

T: Township
R: Range
Sec: Section

Bushel Storage Before Transportation to Seed Bank

Proper storage of bushels is key to retaining the quality of the seed. Improper storage can damage the viability of the seed and cause contaminants such as mold to flourish.

Guidelines for Proper Storage:

- Store bushels in dry, shaded, well-ventilated areas off the ground. Lying flat makes it easy to see if they've been flipped recently or not.
- Do not leave bushels in direct sunlight
- Do not store bushels under tarps
- Do not store bushels in moist areas
- Do not drop bushels
- Do not stack bushels on top of each other
- If storing for longer than 2 days in proper storage conditions, flip the bushel bags over daily to allow for more ventilation



Photo credit: University of California, Berkeley

Transportation & Drop-off Communications

Make sure to contact the appropriate seed bank manager 1-2 days before cone delivery to allow preparation of delivery and plan for interim storage logistics should rapid transportation to a processing center not be available. See Table 3 - Who to Contact for Cone Collection.

Guidelines for Transportation:

- If possible, limit stacking of bushels on top of each other during transport
- Transport bushels in a properly ventilated trailer or truck. Avoid transporting bushels in an enclosed vehicle, as this can promote molding.
- Take caution to properly secure the load of bushels before driving. You may need to use cargo netting or tie downs. Consider evaluating any shifting of load periodically along the route.
- If possible, schedule the bulk of travel time during cooler periods of the day when less direct sunlight exists.
- Confirm with the appropriate Seed Bank Manager upon arrival of proper drop-off location and bushel information (number of bushels per collection location and species, etc.)

Additional Resources

Cone Collection, USDA Forest Service

<https://www.fs.usda.gov/t-d/seedlings/conecoll/index.htm>

Cone Scouting Guide, Silvaseed by Mast

<https://23185209.fs1.hubspotusercontent-na1.net/hubfs/23185209/Silvaseed/Cone-Scouting-Guide.pdf>

Reforestation Pipeline Partnership, American Forests

<https://www.americanforests.org/coalition/reforestation-pipeline-partnership/>

Reforestation Services Program, CAL FIRE

<https://www.fire.ca.gov/what-we-do/natural-resource-management/wildfire-resilience/reforestation-services-program>

Seed zone and elevation searchable map, CAL FIRE

<https://experience.arcgis.com/experience/ee7c8259e92a40d7b617da59ed60801f/page/Page/?org=CALFIRE-Forestry>

Silvics of North America. Volume 1. Conifers, USDA Forest Service

https://www.srs.fs.usda.gov/pubs/misc/ag_654_vol1.pdf

The California Cone Hunter's Pocket Guide

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The California Cone Hunter's Pocket Guide

[doi.org/10.1029/2021AV000654].

Westerling, A. L. 2016. Increasing western US forest wildfire activity: sensitivity to changes in the timing of spring. *Philosophical Transactions of the Royal Society* 371.[doi.org/10.1098/rstb.2016.0373].

About the California Reforestation Pipeline Partnership

The California Reforestation Pipeline Partnership is a strategic collaboration between the United States Forest Service Region 5, the California Department of Forestry and Fire Protection (CAL FIRE) and American Forests that was created in 2022 to address challenges to post-burn reforestation activities on public and private lands and help rebuild California's reforestation pipeline.

The California Reforestation Pipeline Cooperative invites interested collaborators to assemble quarterly and join in project-based work groups to address specific challenges hindering the pace and efficacy of post-fire reforestation efforts. The stated mission of the Cooperative is *to provide a platform upon which diverse stakeholders can accelerate timely, effective, climate-informed reforestation practices across all lands.*

The Cone Corps, a workforce development program, is building capacity by providing and entry-level pathway into critical roles all along the reforestation pipeline.

Learn more and sign up to receive regular updates from the partnership by scanning the QR code and filling out the form at the bottom of the web page.



Appendix A: Tree Identification Guide

Common conifer species naturally occurring in California are listed alphabetically by common name.

Baker Cypress

Hesperocyparis bakeri

Height: 10 - 25 meters

Distribution: The Sierra Nevada, the Cascade Ranges, and the Siskiyou Mountains.

Elevation range: 900 - 2000 meters

Bark: Partially exfoliating on the main trunk, smooth at first, later building up in layers

Leaves: Leaves are scale-like, 2-5 mm long, and produced on rounded shoots.

Flowering period: Non-flowering

Cone Maturity: Maturing gray or gray-brown about 20-24 months after pollination.

Cones: Seed cones are globose to oblong, 10-25 mm long, with 6 or 8 scales, green to brown at first.

Seed: Seeds 3-4 mm, light tan to medium brown, not glaucous to slightly glaucous.

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Blowe (bottom left and bottom right), Elbert Little (map).

Big Cone Douglas Fir

Pseudotsuga macrocarpa

Height: 15 – 30 meters

Distribution: Occurs from the San Rafael Mountains in central Santa Barbara County and the Tehachapi Mountains of southwestern Kern County, south through the Transverse Ranges, to the Cuyamaca Mountains in San Diego County.

Elevation range: 300 – 2700 meters

Leaves: Needle-like, 2.5–4.5 cm long, and are shed when about five years old.

Bark: Deeply ridged, composed of thin, wood like plates separating heavy layers of cork.

Seed: Large and heavy, 10 mm long and 8 mm broad, with a short-rounded wing 13 mm long.

Flowering period: March - April

Cone Maturity: 2 years

Cones: From 11–17 cm long, larger and with thicker scales than those of other douglas-firs, and with exerted tridentine bracts.

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Photos by: Huy Ho (top left), Herve Rey (top right), MPF (bottom left), and Elbert Little (map).

Bishop Pine

Pinus muricata

Height: < 51 meters

Distribution: Mendocino County, Sonoma County, San Luis Obispo County, northern Baja California, Cedros Island.

Elevation range: < 300 meters

Leaves: 2 per bundle, generally 5 – 15 cm, twisted or not, generally green or blue-green, sheath persistent.

Bark: Brown, rough ridges.

Seed: Coat hard, woody, large.

Flowering period: April - May

Cone Maturity: 2 years

Cones: Generally whorled, 5 – 9.7 cm, ovoid, brown, weathering gray, generally closed, persistent many years, either spreading, symmetric, with scale tip knobs < 3 mm, prickled, or reflexed, asymmetric, with proximal, middle scale tip knobs < 15 mm, angled, stalk 0 – 2 cm, serotinous.

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Photos by: PictureThis (top left), Marisol Villareal (top middle, top right, bottom left, and bottom right), and William Critchfield and Elbert Little (map).

Black Spruce

Picea mariana

Height: 5 – 30 meters

Distribution: In a broad band from northern Massachusetts to northern Labrador on the Atlantic coast, west across Canada to the west coast of Alaska.

Elevation range: 300 - 1220 meters

Leaves: leaves are needle-like, 6–15 mm long, stiff, four-sided, dark bluish green on the upper sides, paler glaucous green below.

Bark: Bark is thin, scaly, and greyish brown.

Seed: Disperses after fire, winged.

Flowering period: May - June

Cone Maturity: 2 years

Cones: Smallest of all of the spruces, 1.5–4 cm long and 1–2 cm broad, spindle-shaped to nearly round, dark purple ripening red-brown, produced in dense clusters in the upper crown, opening at maturity but persisting for several years.

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Photos by: USFWS Alaska (top left), Arthur Chapman (top right and bottom left), PictureThis (middle left), and Elbert Little (map).

Brewers Spruce

Picea breweriana

Height: 10 - 40 meters

Distribution: Mountains of northwestern California and southwestern Oregon near the Pacific coast.

Elevation range: 700 to 2100 meters in the western Siskiyou Mountains and from 1370 to 2286 meters in the eastern Klamath region.

Leaves: 5-3 cm long, spirally inserted on twig, flattened or broadly triangular in cross section.

Bark: Grey to brown.

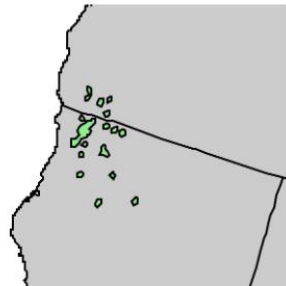
Seed: The seeds are 3 to 5 mm long; the wing is four times as long as the seed.

Flowering period: September-October

Cone Maturity: Maturing in 2 years, sometimes 1.

Cones: Seed cones dark red-purple ripening red-brown, cylindrical, 6.5-12 cm, scales fan-shaped, rigid, margin at apex entire to slightly erose.

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Photos by: Tom Hilton (top left), Meneerke Bloem (top right), David Hocken (bottom left), Agnieszka Kwiecien (middle right), and Elbert Little (map).

Bristlecone Pine

Pinus longaeva

Height: 5 – 15 meters

Distribution: In California, it is restricted to the White Mountains, the Inyo Mountains, and the Panamint Range, in Mono and Inyo counties.

Elevation range: 2900 – 3100 meters

Leaves: Needles are in fascicles of five, stout, 2.5 to 4 cm long, deep green to blue-green on the outer face, with stomata confined to a bright white band on the inner surfaces.

Bark: Bright orange-yellow, thin, and scaly at the base of the trunk.

Seed: 5 mm long, with a 12 to 22 mm wing; they are mostly dispersed by the wind, but some are also dispersed by Clark's nutcrackers.

Flowering period: June - July

Cone Maturity: 2 years

Cones: Ovoid-cylindrical, 5 to 10 cm long and 3 to 4 cm broad when closed, green or purple at first, ripening orange-buff when 16 months old, with numerous thin, fragile scales, each scale with a bristle-like spine 2 to 5 mm long.

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Photos by: Jim Morefield (top left), riosam_87 (top right), Nickolas Turnland (bottom left and bottom right), and Elbert Little (map).

Colorado Pinyon Pine

Pinus edulis

Height: 3 – 6 meters

Distribution: Southeastern California, and the Guadalupe Mountains in far western Texas, as well as northern Mexico.

Elevation range: 1400 – 3000 meters

Leaves: In pairs, moderately stout, 3–5.5 cm long, and green, with stomata on both inner and outer surfaces but distinctly more on the inner surface forming a whitish band.

Bark: Irregularly furrowed and scaly.

Seed: 10–14 mm long, with a thin shell, a white endosperm, and a vestigial 1–2 mm wing.

Flowering period: Non-flowering

Cone Maturity: 3 years

Cones: Globose, 3–5 cm long and broad when closed, green at first, ripening yellow-buff when 18–20 months old, with only a small number of thick scales, with typically 5–10 fertile scales. The cones open to 4–6 cm broad when mature, holding the seeds on the scales after opening.

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Photos by: Famartin (top left), Bryant Olson (top right and middle left), Grand Canyon National Park (bottom right), and Elbert Little (map).

Coulter Pine

Pinus coulteri

Height: 10–24 meters

Distribution: From Contra Costa County, California, south through the Coastal, Transverse, and Peninsular ranges to the Mexican border.

Elevation Range: 200–2300 meters

Leaves: Needle-like, in bundles of three, glaucous gray-green, 15–30 cm.

Bark: Thick and roughly furrowed at maturity.

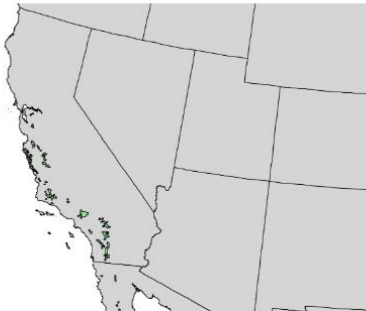
Seed: Seeds obovoid, body 15–22 mm, dark brown, wing to 25 mm.

Flowering period: ~June

Cone Maturity: 2 years

Cones: Spiny cones which are 20–40 cm long, occurring in whorls of four.

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Photos: American Forests and Elbert Little (map).

Cuyamaca Cypress

Hesperocyparis stephensonii

Height: 10 – 16 meters

Distribution: Only in the headwaters area of King Creek in the Cuyamaca Mountains, south of Cuyamaca Peak within San Diego County in extreme Southern California, most individuals occur within the Pacific Southwest Research Station's King Creek Research Natural Area

Elevation range: 910 – 1800 meters

Leaves: Of 1 kind, gray-green, glands generally inactive,

Bark: Smooth, thin, peeling in thin strips or plates, red-brown to cherry-red

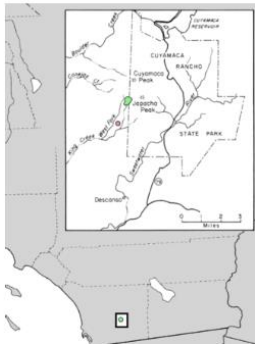
Seed: 3.6 – 6 mm, glaucous or not, dark to red-brown, attachment scar conspicuous

Flowering period: March - May

Cone Maturity: 2 years

Cones: 10 mm diameter, cone scales 6 – 8 mm, that are high and conical, dull gray to brown, 100 – 125 seeds per cone.

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Photos by: Joey Santore and C. B Wolf (map).

Douglas Fir

Pseudotsuga menziesii

Height: < 100 meters

Distribution: West-central British Columbia southward to central California, along the Coast Range to Santa Barbara County and in the Sierra Nevada south to Yosemite.

Elevation Range:< 2200 meters

Leaves: 2-4 cm needles, flat and flexible, grow in all directions around the branch and can vary in different shades of green to blue-gray on a tree.

Bark: Gray and smooth becoming dark and scaly with age, thick and corky.

Seed: Brown, yellow-brown seed wing, 6-9 mm long.

Flowering period: April – May

Cone Maturity: Maturing in 2 years

Cones: 7-10 cm long, green when immature, red-brown, between two and four inches long, with three pointed bracts extending from beneath the cone scales.

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Photos by: Born1945 (top left and middle right), Ava Joseph (top right), American Forests (middle left), Redwood State Park (bottom right), and Elbert Little (map).

Engelmann Spruce

Picea engelmannii

Height: < 60 meters

Distribution: Klamath and High Cascades Range.

Elevation range: 900-1800 meters

Leaves: 1.6-3 cm long, 4-angled in cross section, rigid, blue-green, bearing stomates on all surfaces, apex sharp-pointed.

Bark: Gray to reddish brown.

Seed: Seeds are black, 2–3 mm long, with a slender, 5–8 mm long light brown wing.

Flowering period: August – September

Cone Maturity: New cones mature in one season.

Cones: Seed cone violet or deep purple, ripening buff-brown, 3-7 cm long; scales diamond-shaped to elliptic, widest above middle, flexible, margin at apex irregularly toothed to erose, apex extending 3-8 mm beyond seed-wing impression.

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Photos by: Matt Lavin (top left), Natalie Kim (top right), National Parks Gallery (middle left), Tony Frates (middle right), and Elbert Little (map).

Foxtail Pine

Pinus balfouriana

Height: 10 – 20 meters

Distribution: Occurs in the subalpine forest in the Klamath Mountains, and in the Sierra Nevada. In the Sierra Nevada, Foxtail pines are limited to the area around Sequoia and Kings Canyon National Parks.

Elevation range: 1950 – 3500 meters

Leaves: Needle-like, in bundles of five, with a semi-persistent basal sheath, and 2–4 cm long, deep glossy green on the outer face, and white on the inner faces.

Bark: Gray to salmon or cinnamon, irregularly deep-fissured or with irregular blocky plates.

Seed: Ellipsoid to narrowly obovoid; body to 10 mm, pale brown, mottled with deep red; wing 10-12 mm.

Flowering period: April - May

Cone Maturity: 2 years

Cones: 6–11 cm long, dark purple ripening red-brown, with soft, flexible scales each with a 1-millimeter central prickle.

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Photos by: Miguel Viera (top left), Jim Morefield (top right and middle left), DCRJSR (bottom right), and Elbert Little (map).

Giant Sequoia

Sequoiadendron giganteum

Height: 50-85 meters

Distribution: Restricted to a limited area of the western Sierra Nevada, California.

Elevation range: 825-2700 meters

Leaves: Alternate, green, awl like needles, arranged spirally on shoots, <15 mm.

Bark: Fibrous, ridged, red-brown.

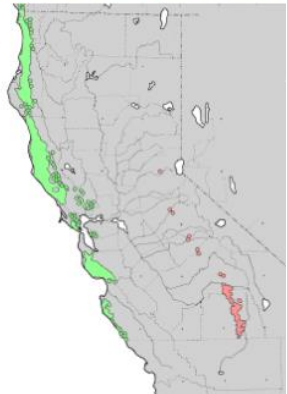
Seed: 3-9 per scale, 2 wings, yellow-brown wings, unequal, lateral, 3-6 mm.

Flowering period: April – May

Cone Maturity: 2 years

Cones: Serotinous, egg-shaped mature cones, woody, 30-50 spirally arranged scales, fused to bracts, 40-90 mm.

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Photos by: Kai Best (top left), Steven Severinghaus (top right),
Matthew Dillion (bottom left), S. Rae (middle right), and James R.
Griffin & William B. Critchfield (map).

Gowen Cypress

Hesperocyparis goveniana

Height: 10 – 50 meters

Distribution: Endemic to the Monterey Peninsula in coastal Monterey County, located on the Central Coast of California, in the Western United States.

Elevation range: 30 – 300 meters

Leaves: Scale-like, 2–5 mm long, and produced on rounded (not flattened) shoots.

Bark: Smooth or rough, fibrous.

Seed: 3-5 mm, dark brown to jet black, sometimes slightly glaucous.

Flowering period: March – May

Cone Maturity: 2 years

Cones: Seed cones are globose to oblong, 11–22 mm long, with 6 to 10 scales, green at first, maturing brown or gray-brown about 20–24 months after pollination.

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Photos by: Trap Hers (top left), PictureThis (top right and bottom right), James R. Griffin & William B. Critchfield (map).

Grand Fir

Abies grandis

Height: < 73 meters

Distribution: Along the Pacific coast from southwest British Columbia to Northern California, with the inland variety growing in montane conifer forests of eastern Washington, the Idaho Panhandle, and far western Montana.

Elevation range: < 700 meters

Leaves: Needles, 2-ranked, < 5 cm, on each side, shorter toward twig tip, adaxially flat, white bands, tip notched or blunt, glossy dark green.

Bark: White-gray in youth, red-brown, thin in age, slender plates.

Seed: Winged

Flowering period: May - June

Cone Maturity: 1 – 2 years

Cones: Green-to-reddish, 100 – 150 scales, 8 – 15 cm, stalk < 5 mm, bracts are short and handed in the closed cone, 6-month maturity.

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Photos by: Bryant Olson (top left), Walter Siegmund (top right), Peter Schmitz (middle left), Dave Powell (middle right), and Elbert Little (map).

Gray Pine

Pinus sabiniana

Height: 11–14 meters

Distribution: Siskiyou County south through the foothills of the Klamath, Cascade, and Coast Ranges and the Sierra Nevada to Ventura County.

Elevation Range: Sea level and 1200 meters

Leaves: 3 per bundle, needle like, 9-38 cm, gray-green, sheath persistent.

Bark: Dark gray, furrows irregular, forming yellow plates in age.

Seed: The hard-coated, heavy seeds are from 15-25 mm long and have short-winged seeds.

Flowering period: February – March

Cone Maturity: Open slowly second year.

Cones: Pendent, 10-28 cm, ovate-oblong, brown, scale tip recurved, clawlike.

The California Cone Hunter's Pocket Guide



Photos by: Natalie Kim (top left), S. Rae (top right), David Sawyer (middle), kqedquest (bottom right), and NordNordWest (map).

Incense Cedar

Calocedrus decurrens

Height: 30-40 meters

Distribution: Oregon south through California to northern Baja California, Mexico and east to western Nevada.

Elevation range: 50-2900 meters

Leaves: Scale-like leaves 2–15 mm, small, oblong ovate, in whorls of four, decurrent, and closely adnate on the branchlets and aromatic when crushed.

Bark: Light or reddish-brown, thick, fibrous, deeply, and irregularly furrowed into shreddy ridges.

Seed: The winged seeds are about 2.5 cm long and nearly one-third as wide.

Flowering period: May - June

Cone Maturity: Mature in one season.

Cones: Red-brown to golden brown, 14-25 mm long, oblong-ovate when closed, pendant at end of slender, leafy stalk, proximal scales often reflexed at cone maturity.

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Photos by: Erutuon (top left), Fabrice Rubio (top right and bottom left)
American Forests (middle left), John Rusk (middle right), Toter Alter
Mann (map).

Jeffrey Pine

Pinus jeffreyi

Height: 24 - 39 meters

Distribution: North through the Klamath Mountains, across the Sierra Nevada into western Nevada, and south in the Transverse and Peninsular Ranges into northern Baja California.

Elevation range: 450-3100 meters

Leaves: 3 needles per bundle, 12-27 cm, thick, gray-blue-green, glaucous; sheath persistent.

Bark: Mature bark generally red-brown, furrows close-spaced, deep, outer scales with pink inner surfaces, crevices with definite odor of vanilla/banana.

Seed: Seeds ellipsoid-obovoid, 1 cm, brown or gray-brown, mottled darker; wing to 2.5 cm.

Flowering period: May - June

Cone Maturity: 2 years

Cones: Spreading or recurved, generally 13-25 cm, ovate to oblong, brown, when immature light green to red-purple.

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Photos by: Cruiser (top left), Tristen Schmurr (top right), Marisol Villareal (middle left), Matt Lavin (bottom right), Elbert Little (map).

Knobcone Pine

Pinus attenuata

Height: 8 – 24 meters

Distribution: Southwestern Oregon south through the Klamath, Cascade, and Coast ranges and the Sierra Nevada.

Elevation Range: 300 and 750 meters

Leaves: 3 per bundle, 6-16 cm, yellow-green; sheath persistent.

Bark: Thin and smooth, flaky, and gray-brown when young, becoming dark gray-red-brown and shallowly furrowed into flat scaly ridges in age.

Seed: Seeds compressed-oblique-obovoid, body 6-7 mm, nearly black, wing narrow, to 20 mm.

Flowering period: March - May

Cone Maturity: 2 years

Cones: Resin-sealed and irregularly shaped, 8–16 cm long and clustered in whorls of three to six on the branches.

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Photos by: 4jonny5 (top), Marisol Villareal (middle left), Kelly the Deluded (middle right), Elbert Little (map).

Limber Pine

Pinus flexilis

Height: 5 – 25 meters

Distribution: Occurs in the mountains of the Western United States, Mexico, and Canada.

Elevation range: 850 – 3800 meters

Leaves: About 8 cm long and a dark, blueish green.

Bark: Heavily creased and dark grey.

Seed: Large, wingless.

Flowering period: May - June

Cone Maturity: 2 years

Cones: 6–15 cm long where the species overlap, green when immature, and open to release the seeds; the scales are not fragile.

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Photos by: Matt Lavin (top left and top right), PictureThis (bottom left), Famartin (middle right), Elbert Little (map).

Lodgepole Pine

Pinus contorta
Subsp. murrayana

Height: 10-35 meters

Distribution: Primarily in the Sierras, with scattered populations in other mountain ranges.

Elevation range: 450-3600 meters

Leaves: 2 needles per fascicle (or rarely, 3) are 4-8 cm long, moderately wide needles, yellow-green.

Bark: Thin, scaly, grayish brown.

Seed: Tiny with little, papery wings that aid in dispersal.

Flowering period: May – July

Cone Maturity: 1- 3 years

Cones: The cones are 3–7 cm long, with prickles on the scales, ovoid, and slightly lopsided, projecting from branches hard and heavy, may be reflexed, semi-erect on branches.

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Photos by: Arthur Chapman (top right), Walter Seigmund (middle right), Famartin(middle left), Docentjoyce (top left), and Jason Hollinger (middle left), Elbert Little (map).

MacNab Cypress

Hesperocyparis macnabiana

Height: 3-10 meters

Distribution: Inner northern California Coast Ranges and the foothills of the northern Sierra Nevada, one of the most widely distributed of all native CA cypresses.

Elevation range: 300 – 1460 meters

Leaves: Dense, short flat sprays, bright glaucous gray-green, strong spicy-resinous scent.

Bark: Fibrous, gray-brown

Seed: 3 – 5 mm, can be glaucous, dull brown.

Flowering period: Non-flowering

Cone Maturity: 1 – 1.5 years

Cones: Oblong-ovoid to cuboid, 15 – 25 mm long, 13 – 20 mm broad, 6 scales, prominent umbo, strongly serotinous.

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Photos by: Diego Alex (top left), Joe Blowe (top right), John Rusk (middle left), Joey Malone (middle right), Elbert Little (map).

Monterey Cypress

Hesperocyparis macrocarpa

Height: 18 – 25 meters

Distribution: Native to the Central Coast of California in the Monterey Peninsula with two relict populations at Pebble Beach and Point Lobos. It is widely planted and naturalized outside of the native range.

Elevation range: < 50 meters native range, widely planted outside of native range.

Leaves: Needles, overlapping scales, rounder than incense cedar, bright to dark green, deep lemony aroma when crushed.

Bark: Fibrous, rich brown aging ash-gray.

Seed: 2.5 – 5 mm, dull red-brown to black

Flowering period: April – June

Cone Maturity: 2 years

Cones: 20 – 32 mm, spherical to oblong, green while immature, brown at maturity, 8 – 12 scales, two-year cone production cycle, moderately serotinous.

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Photos by: Kqedquest (top left), Pereira Jorge (bottom left),
Marisol Villareal (top right), David Eickhoff (bottom right).

Monterey Pine

Pinus radiata

Height: < 38 meters

Distribution: Native to the Central Coast of California (Santa Cruz, Monterey, San Luis Obispo) and Mexico (on Guadalupe Island and Cedros island).

Elevation range: < 1300 meters

Leaves: Needles, bright green, clusters of 3, slender, 8 -15 cm long, blunt tip, minute-prickled.

Bark: Fissured and dark grey to brown.

Seed: < wing

Flowering period: January - February

Cone Maturity: 2 years

Cones: 7 – 17 cm long, brown, ovoid, set asymmetrically on branch, serotinous.

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Photos by: Marisol Villareal and William B. Critchfield & Elbert L. Little (map)

Mountain Hemlock

Tsuga mertensiana

Height: 20 – 40 meters

Distribution: Native to the west coast of North America, found between South central Alaska and south-central California.

Elevation range: 1600 – 2300 meters

Leaves: Needle-like, 7 to 25 mm long and 1 to 1.5 mm broad, soft, blunt-tipped, only slightly flattened in cross-section, pale glaucous blue-green above.

Bark: About 3 cm thick and square-cracked or furrowed, and purplish-brown to gray in color.

Seed: Red-brown, 2 to 3 mm long, with a slender, 7 to 12 mm -long pale pink-brown wing.

Flowering period: March - April

Cone Maturity: 3 years

Cones: Small (but much longer than those of any other species of hemlock), pendulous, cylindrical, 3 to 8 cm long and 8 to 10 mm broad when closed, opening to 12 to 35 mm broad.

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Photos by: Marisol Villareal and Herring, E.M., D.G. Gavin, S.Z.
Dobrowski, M. Fernandez, and F.S. Hu (map).

Noble Fir *Abies procera*

Height: < 75 meters

Distribution: Native to the Cascade Range and Pacific Coast Ranges of western Washington and Oregon, as well as the extreme northwest of California.

Elevation range: 300 – 1500 meters

Leaves: Needle-like, 1–3.5 cm long, glaucous blue-green above and below with strong stomal bands, and a blunt to notched tip. They are arranged spirally on the shoot, but twisted slightly S-shaped to be upcurved above the shoot.

Bark: Smooth and gray with resin blisters, becoming red-brown, rough, and fissured on old trees.

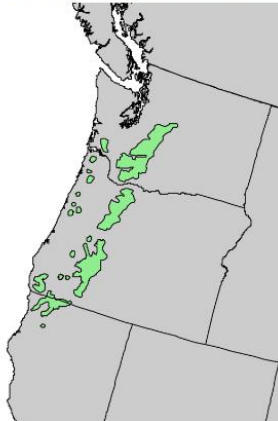
Seed: Winged

Flowering period: April - May

Cone Maturity: 2 years

Cones: Erect, 11–22 cm long and 6 cm thick, with the purple scales almost completely hidden by the long exserted yellow-green bract scales.

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Photos by: Jsayre64 (top left), S. Rae (top right and middle right), Cruiser (bottom left), Elbert Little (map).

Pacific Silver Fir

Abies amabilis

Height: 30 – 45 meters

Distribution: Pacific Coast Ranges and the Cascade Range from the extreme southeast of Alaska, Washington and Oregon, to the extreme northwest of California.

Elevation range: Sea level – 2000 meters

Leaves: Needle-like, flattened, 2–4.5 cm long and 2 mm wide by 0.5 mm thick, matte dark green above, and with two white bands of stomata below, and slightly notched at the tip.

Bark: Light grey, thin and covered with resin blisters, on older trees, it darkens and develops scales and furrows.

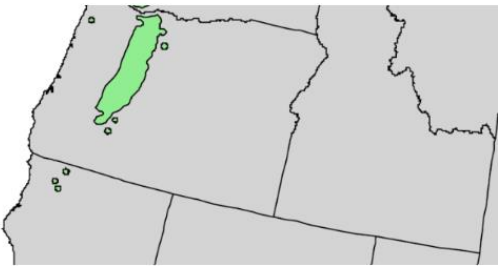
Seed: Winged, released 6-7 months after pollination, tan body.

Flowering period: May - June

Cone Maturity: 2 years

Cones: 9–17 cm long and 4–6 cm broad, dark purple before maturity, the scale bracts are short, and hidden in the closed cone.

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Photos by: Micheal Koffmann (top left), Walter Siegmund (top right, bottom right and bottom left), Elbert Little (map).

Parry Pinyon Pine

Pinus quadrifolia

Height: 8 – 15 meters

Distribution: Native to southern most California in the United States and northern Baja California in Mexico.

Elevation range: 1200 – 2500 meters

Leaves: Needles are in fascicles of 4–5, moderately stout, 2.5–5.5 cm long; glossy dark green with no stomata on the outer face, and a dense bright white band of stomata on the inner surfaces.

Bark: Thick, rough, and scaly.

Seed: 10–14 mm long, with a thin shell, a white endosperm, and a vestigial 1–2 mm wing.

Flowering period: March - May

Cone Maturity: 2 years

Cones: Globose, 4–5.5 cm long and broad when closed, green at first, ripening yellow to orange-buff when 18–20 months old, with only a small number of thick scales, with typically 5–10 fertile scales.

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Photos by: Stickpen (top left), Loidi Javier (top right and middle), and Elbert Little (map).

Piute Cypress

Hesperocyparis nevadensis

Height: 10 – 25 meters

Distribution: Grows in a small area of the Southern Sierra Nevada, within Kern and Tulare Counties.

Elevation range: 910- 1830 meters

Leaves: Scale-like, highly glandular, resinous, and aromatic, 2–5 mm long, and produced on rounded (not flattened) shoots.

Bark: Red-brown when young, sometimes exfoliating, with age becoming gray-brown, fibrous, 1-2 cm thick.

Seed: Light tan, to 5 mm long with a 0.5 × 2 mm hilum, echinate or slightly glaucous.

Flowering period: March - April

Cone Maturity: 2 years

Cones: Seed cones are globose to oblong, 25–55 mm long, with 6 or 8 (rarely 4 or 10) scales, green to brown at first, maturing gray or gray-brown about 20–24 months after pollination. Male cones are 3–5 mm long.

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Photos by: Paula Ley Valero (top left), Thermococypress (top right), Joey Santore (bottom right), and Elbert Little (map).

Ponderosa Pine

Pinus ponderosa

Height: < 72 meters

Distribution: from northwestern Oregon south to southern California.

Elevation range: < 3050 meters

Leaves: Bundles of three needles, and 13-25 cm long. They are clustered in tufts at branch tips.

Bark: Platy, rough, and scaly.

Seed: Seeds are winged, brown, 9mm

Flowering period: April - May

Cone Maturity: 2 years

Cones: Cones are oval and 8-13 cm long—about the size of a fist—and armed with prickles.

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Photos by: Matt Lavin (middle), Peter Stevens (top left), Moosicorn Ranch (middle right), S. Rae (middle left), Madison Daniels (top right), and Randy Nonenmacher (map).

Port Orford Cedar

Chamaecyparis lawsoniana

Height: < 61 meters

Distribution: Northwestern California and Southwestern Oregon.

Elevation range: < 1500 meters

Leaves: Leaves are evergreen, small 2-3 mm long, scale-like and overlapping on flat branchlets.

Bark: 15-25 cm thick, red-brown to tan, fibrous, fire-resistant.

Seed: Seeds 2-4 per scale, 2-5 mm, wing equal to or broader than body.

Flowering period: August – September

Cone Maturity: 1 year

Cones: Seed cones are round, 5 to 14 mm in diameter, have 5 to 12 scales, and are not resinous.

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Photos by: American Forests (top left and top right), S. Rae (bottom left), Kenpei (middle right), Elbert Little (map).

Pygmy Cypress

Hesperocyparis pygmaea

Height: 1 – 2 m on sterile soil, 10 – 20 m on rich soil.

Distribution: Endemic to certain coastal terraces and coastal mountain ranges of Mendocino and Sonoma Counties in northwestern California, associated with bishop pine and Mendocino shore pine.

Elevation range: 50 – 200 m

Leaves: Dull dark to light green color, scale-like leaves, 1 – 1.5 mm long, not spreading.

Bark: Fibrous, gray-brown, smooth, or fibrous.

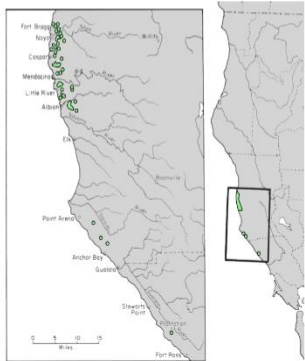
Seed: 2.5 – 4.7 mm, not glaucous, dark red-brown to black, shiny or not.

Flowering period: Non-flowering

Cone Maturity: 2 years

Cones: Small, 11 – 24 mm long, almost spherical, with 6 – 8 scales arranged in opposite decussate pairs, serotinous.

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Photos by: Suzi Rosenberg (top left), John Rusk (top right), Thermodocypress (bottom left), James R. Griffin & William B. Critchfield (map).

Red Fir

Abies magnifica

Height: 40-60 meters

Distribution: Sierra Nevada's from Kern County, California, north to the southern Cascade Range of Oregon and in the Coast Ranges from Lake County, California, north to the Klamath Ranges.

Elevation range: 1400-2700 meters

Leaves: leaves are needle-like, 2–3.5 cm long, glaucous blue-green above and below with strong stomatal bands, and an acute tip.

Bark: The bark of young trees is thin but becomes thick and roughly fissured with age. Color is gray, with resin blisters in youth.

Seed: Seeds 6-15 mm, body dark reddish brown; wing about as long as body, pale reddish-tan.

Flowering period: June – July

Cone Maturity: 1-4 years

Cones: Cones are erect, 9–21 cm long, yellow-green (occasionally purple), ripening brown.

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Photos by: David Hocken (top left), American Forests (top right),
Matt Lavin (middle left), Orjen (middle right), Elbert Little (map).

Redwood

Sequoia sempervirens

Height: 60-110 meters

Distribution: Coast redwoods occupy a narrow strip of land along the Pacific coast of North America; the most southerly grove is in Monterey County, California, and the most northerly groves are in extreme southwestern Oregon.

Elevation range: < 1390 meters

Leaves: Alternate, green, Awl-like needles, linear, generally flat, 5-25mm long.

Bark: Extremely tough and fibrous, red-brown.

Seed: 2-7 per scale, wings 2, narrow, lateral, 3-6mm long.

Flowering period: September – November

Cone Maturity: 1 years

Cones: Spheric, woody, reddish brown, scales peltate, fused to bracts, 13-25mm long.

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Photos by: Brian Hoffman (middle left), Carol M Highsmith (middle right), Cruiser (top right), Natalie Kim (top left), and James R. Griffin & William B. Critchfield (map).

Santa Cruz Cypress

Hesperocyparis abramsiana

Height: 10 – 25 meters

Distribution: Endemic to the Santa Cruz Mountains within the Santa Cruz and San Mateo counties of west-central California.

Elevation range: 490 – 760 meters

Leaves: Light green and scale-like and can grow up to 15mm in length, persisting on branches for many years.

Bark: Fibrous with thin grey vertical stripes

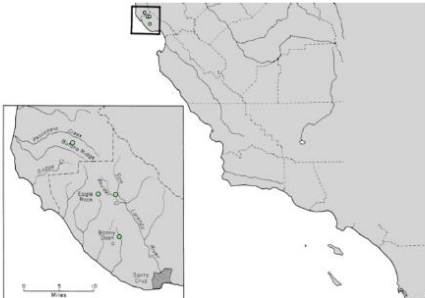
Seed: 3-4 mm, brown, often glaucous.

Flowering period: March - May

Cone Maturity: 2 years

Cones: Pollen cones can grow up to 4mm long and produce large amounts of pollen that spread in the wind. Female seed cones are produced annually on the tree and grow up to 20 to 30mm in diameter.

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Photos by: John Rusk (top left), USFWS (top right), J. Maughn (middle left), S. Rae (middle right), James R. Griffin & William B. Critchfield (map).

Santa Lucia Fir

Abies bracteata

Height: 20 – 35 meters

Distribution: Santa Lucia Mountains, in the Big Sur region on the central coast of California.

Elevation range: 610 – 1520 meters

Leaves: Needle-like, arranged spirally on the shoot, but twisted at the base to spread either side of the shoot in two moderately forward-pointing ranks with a 'v' gap above the shoot, hard and stiff with a sharply pointed tip, 3.5–6 cm long and 2.5–3 mm broad, with two bright white stomatal bands on the underside.

Bark: Reddish-brown with wrinkles, lines, and resin vesicles, thin.

Seed: Winged

Flowering period: May

Cone Maturity: 2 years

Cones: Differ from other firs in that the bracts end in very long, spreading, yellow-brown bristles 3–5 cm long. The male cones are 2 cm long.

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Photos by: John Rusk (top left), James Gaither (top right), S. Rae (bottom left), Silversyrpher (middle right), Elbert Little (map).

Sargent Cypress

Hesperocyparis sargentii

Height: 6 – 20 meters

Distribution: Endemic to California, where it is known from Mendocino County southwards to Santa Barbara County, limited to the Coast Range mountains

Elevation range: 60 – 1370 meters

Leaves: Dull, glaucous or not, dusty to gray-green

Bark: Fibrous, thick, gray, or dark brown

Seed: 3 – 5 mm, can be glaucous, dark brown, attachment scar generally conspicuous.

Flowering period: Non-flowering

Cone Maturity: 1 – 1.5 years

Cones: 15 – 25 mm, spheric, rough-surfaced, dull brown to gray, scales 6 – 10.

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Photos by: Marisol Villareal and James R. Griffin & William B. Critchfield (map).

Shore Pine

Pinus contorta
Subsp. contorta

Height: < 10 meters

Distribution: Pacific Coast, southern Alaska to northwest California.

Elevation range: < 150 meters

Leaves: Dark and mostly shiny needles are pointed and 4 to 8 cm long and 0.9 to 2 mm wide. The needle edge is weakly to strongly serrated. The needles are in pairs on short shoots and rotated about the shoots' longitudinal axes.

Bark: Thicker than in the other subspecies, irregularly furrowed, cross-checked into small, square or rectangular, orange-brown to purple-brown scaly plates.

Seed: Tiny with little, papery wings that aid in dispersal.

Flowering period: April - June

Cone Maturity: 2 years

Cones: 3–7 cm long, with prickles on the scales.

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Photos by: Walter Siegmund (top left, top right, middle right), Geographer (bottom right), and Elbert Little (map).

Sierra Juniper

Juniperus grandis

Height: 12 – 26 meters

Distribution: Native to the Sierra Nevada in eastern California and western Nevada; and the White and Inyo Mountains, San Gabriel and San Bernardino Mountains, and higher elevations of Mojave Desert mountains, in Southern California.

Elevation range: 100 – 3100 meters

Leaves: Whorled leaves are scale-like and closely appressed.

Bark: Red-brown.

Seed: Wingless

Flowering period: May - June

Cone Maturity: 2 years

Cones: Fleshy and berry-like cones are 5–9 mm in diameter.

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Photos by: Marisol Villareal and Elbert Little (map).

Singleleaf Pinyon Pine

Pinus monophylla

Height: < 15 meters

Distribution: Eastern and central California to northern Baja California.

Elevation range: < 2800 meters

Leaves: Generally, 1 per bundle, 2-7 cm, often curved, gray or blue-green; sheath deciduous.

Bark: Smooth and thin on young trees, forming deep, irregular fissures and ridges with thin scales, and is up to an inch thick with age.

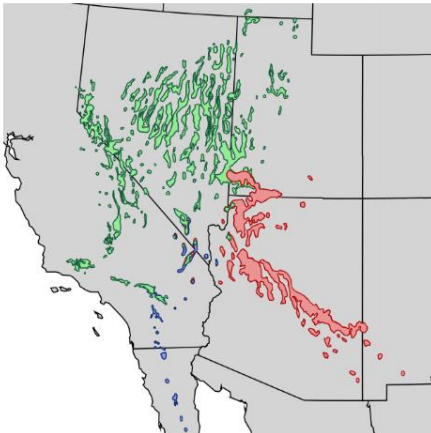
Seed: Wing persistent on scale

Flowering period: April – May

Cone Maturity: 2 years

Cones: Spreading, 3-12 cm, spheric-ovoid, light- or red-brown, angled, truncate.

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Photos by: Bryant Olson (top left), Baker Bryant (top right), NPGallery (middle left), Bryant Pine (middle right), and Kenneth L. Cole (map).

Sitka Spruce

Picea sitchensis

Height: < 100 meters

Distribution: Along the northern Pacific coast from south-central Alaska to northern California.

Elevation range: > 450 meters

Leaves: 1-3 cm, rigid; adaxially flat, with 2 faint, white bands, abaxially rounded, darker green, with 2 faint, white bands or not; tip acute, sharp to touch.

Bark: Gray, smooth, thin, becoming dark purplish-brown with scaly plates.

Seed: The seeds are black, 3 mm long, with a slender, 7–9 mm long pale brown wing.

Flowering period: April – June

Cone Maturity: Cones ripen the year they were pollinated.

Cones: < 10 cm, oblong; scale papery, margin jagged; bract > 1/2 scale.

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Photos by: anna_485 (bottom right), Brew Books (middle left), The Bureau of Land Management (bottom left), Anne Burgess (top right), and David Glass (top left).

Subalpine Fir

Abies lasiocarpa

Height: < 50 meters

Distribution: Native to the Trinity Alps of the Klamath Mountains in northwestern California in the Western United States.

Elevation range: 1200 – 3650 meters

Leaves: Flat and needle-like, 1.5–3 cm long, glaucous green above with a broad stripe of stomata, and two blue-white stomatal bands below; the fresh leaf scars are reddish.

Bark: Smooth, gray, and with resin blisters, becoming rough and fissured or scaly on old trees.

Seed: Winged

Flowering period: June - July

Cone Maturity: 1 years

Cones: Erect, 6–12 cm long, dark purple with fine yellow-brown pubescence, ripening brown.

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Photos by: Bryant Olson (top left), Malcolm Manner (top right), Walter Siegmund (middle right), Jay Sturner (middle right), Erin (middle left), and Elbert Little (map).

Sugar Pine

Pinus lambertiana

Height: 40-60 meters

Distribution: Distribution is almost continuous through the Klamath and Siskiyou Mountains and on west slopes of the Cascade Range and Sierra Nevada.

Elevation range: 500-1500 meters

Leaves: Dark green, needle leaves 3 inches long and in clusters of 5.

Bark: Mature bark thick, dark purple-brown, irregularly furrowed into plate-like ridges.

Seed: Seeds are 1–2 cm long, with a 2–3-centimeter-long wing that aids their dispersal by wind.

Flowering period: July – August

Cone Maturity: 1 year (heavy crops usually every 3-5 years).

Cones: Cones are large, 10-50 cm long, cylindrical, yellow-brown.

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Photos by: Dimi Talen (top left), CWBarrows (top right), William Coville (bottom left), S. Rae (middle right), Elbert Little (map).

Tecate Cypress

Hesperocyparis forbesii

Height: < 10 meters

Distribution: Only in the Santa Ana Mountains of Orange County and in San Diego County within Southern California, and in northern Baja California state of Mexico.

Elevation range: 450 – 1500 meters

Leaves: Light green to dull green.

Bark: Peeling in thin plates, smooth, polished, cherry-red or mahogany-brown.

Seed: 3 – 6 mm, dark to dull red-brown, generally with many wart-like pitch pockets.

Flowering period: Non-flowering

Cone Maturity: 2 years

Cones: 20 – 32 mm, generally spheric, dull brown or gray, 6 – 10 scales.

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Photos by: Stan Shelbs (top left, middle right, and middle left),
Joey Santore (top right), Elbert Little (map).

Torrey Pine

Pinus torreyana

Height: < 23 meters

Distribution: Coastal San Diego County, and on Santa Rosa Island, offshore from Santa Barbara in Santa Barbara County.

Elevation range: < 200 meters

Leaves: Gray-yellow-green, 5 needles per fascicle.

Bark: Red-brown to purple-red, deeply furrowed with irregular, elongate, flat, scaly ridges.

Seed: < 11 mm wide, light to dark brown, edible pine nuts.

Flowering period: January – February

Cone Maturity: 3 years

Cones: Width < 13.5 cm, scale tip knobs < 6 mm.

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Photos by: Marisol Villareal (top left, middle left, middle right), Geographer (top right), and Elbert Little (map).

Utah Juniper

Juniperus osteosperma

Height: 3 – 6 meters

Distribution: Native to the southwestern United States, in Utah, Nevada, Arizona, western New Mexico, western Colorado, Wyoming, southern Montana, southern Idaho and eastern California.

Elevation range: 1300 – 2600 meters

Leaves: Arranged in opposite decussate pairs or whorls of three; the adult leaves are scale-like, 1–2 mm long (to 5 mm on lead shoots) and 1–1.5 mm broad.

Bark: Gray or light brown and often hangs in loose, fibrous strips.

Seed: 1 or 2 per cone, sub globose, 4-10 mm diameter, shallowly grooved, light brown.

Flowering period: April - May

Cone Maturity: 2 years

Cones: Berry-like, 8–13 mm in diameter, blue-brown with a whitish waxy bloom, and contain a single seed. Male cones are 2–4 mm long.

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Photos by: Marisol Villareal (top left, middle left, and middle right), fcb981 (top right), and Elbert Little (map).

Western Hemlock

Tsuga heterophylla

Height: 50 – 70 meters

Distribution: Native in northwestern California. In California, western it occurs near the coast in scattered localities from Del Norte County southward to the vicinity of Elk Creek, Mendocino County.

Elevation range: < 700 meters

Leaves: 5 – 20 mm, needles, tip blunt to rounded, unequal lengths, flat, glossy, and soft, yellow to dark green on upper surface, and whitish underneath.

Bark: Thin at maturity, red-brown, narrow grooves, wide ridges.

Seed: 2 – 3 mm, brown, pale-brown wing.

Flowering period: April - May

Cone Maturity: 1 – 1.5 years

Cones: 14 – 30 mm long, 7 – 8 mm wide when closed, ovoid, short-stalked, papery scales, stalkless, hanging down at the end, green to reddish-purple when immature, brown at maturity.

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Photos by: MPF (top left), Cody Hinchliff (top right), Walter Siegmund (middle left), M J Richardson (middle right), Elbert Little (map).

Western Juniper

Juniperus occidentalis

Height: 5 – 15 meters

Distribution: Western United States, specifically southeast Washington, eastern and central Oregon, southwest Idaho, northeastern California, and extreme northwest Nevada, east of the Cascade Range.

Elevation range: 700 – 2300 meters

Leaves: Opposite decussate pairs, scale-like, 4 ranked or whorled in 3s, 6 ranked.

Bark: Dark brown.

Seed: Cotyledons generally 3.

Flowering period: May - June

Cone Maturity: 1 year

Cones: 5 – 10 mm, blue-green maturing blue black, resinous, 1 – 3 seeds, half monoecious, half dioecious.

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Photos by: Marisol Villareal and Elbert Little (map).

Western Red Cedar

Thuja plicata

Height: 30 – 70 meters

Distribution: From the Cascade Range and Coast Mountains westward to the Pacific Ocean, from central South East Alaska (near the village of Kake) to northern California (growing closer to the coast at the northern and southern extremes).

Elevation range: < 1800 meters

Leaves: Scale-like leaves, opposite, green above, green marked with whitish stomatal bands, strong pineapple aroma when crushed, 1 – 4 mm long, foliar sprays < 12 mm long.

Bark: Cinnamon-red, fibrous.

Seed: 4 – 6 mm, narrow, elliptic, light brown.

Flowering period: April - May

Cone Maturity: 1 – 2 years

Cones: 10 – 19 mm, light brown, overlapping scales.

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Photos by: Eric Hunt (top left), Roy Luck (top right), Gabe Schip (middle left), Elbert Little (map).

Western White Pine

Pinus monticola

Height: 30-50 meters

Distribution: Found in the California Sierra Nevada mountains.

Elevation range: 1800-3100 meters

Leaves: Soft, thin needles of 5, 5-13 cm long.

Bark: Mature bark dark gray to red-brown, in square blocks.

Seed: Seeds are small, 4–7 mm long, and have a long slender wing 15–22 mm long.

Flowering period: Late June - Mid July

Cone Maturity: 2 years

Cones: Woody, but softer than hard pine cones. Usually dotted with white resin spots. Also have thin scales.

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Photos by: Chris Schnepf (top left), Natalie Kim (top right), S. Rae (bottom left), Axel Kristinsson (middle right), Elbert Little (map).

White Fir

Abies concolor

Height: 25-60 meters

Distribution: Sierra Nevada, Klamath, and Siskiyou Mountains.

Elevation Range: 900-3400 meters

Leaves: Leaves are needle-like, flattened, 2.5–8 cm long and 2 millimeters wide by 0.5–1 mm thick, green to glaucous blue-green above, and with two glaucous blue-white bands below, and slightly notched to bluntly pointed at the tip.

Bark: In young trees, thin, gray, smooth. With age, it darkens and thickens with ridges.

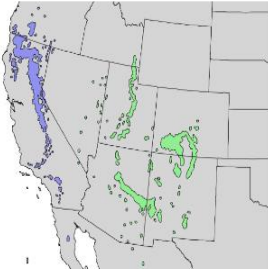
Seed: Seeds 8-12 mm, body tan or dull brown; wing about twice as long as body, tan or brown with rosy tinge.

Flowering period: May - June

Cone Maturity: 2 years

Cones: Yellow-green cones grow on upper branches, 6-12 cm.

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Photos by: Brew Brooks (top left), S. Rae (middle left), Famartin (top right), N. D. Herman (bottom right), Elbert Little (map).

Whitebark Pine

Pinus albicaulis

Height: 29 meters

Distribution: Kern River of the Sierras, subalpine zone of northeastern mountains.

Elevation range: 2000-2400 meters

Leaves: Needles usually shorter, 3–7 cm in bundles of 5.

Bark: Thin, gray scales.

Seed: Wingless seeds are large and heavy, 7 to 10 mm in length.

Flowering period: June – July

Cone Maturity: 2 years

Cones: The cones are 6–12 cm long, green when immature, and open to release the seeds; the scales are not fragile.

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Photos by: Okanogan National Forest (top left), Dcrjsr (top right), Bryant Olson (middle left), PictureThis (middle right), Elbert Little (map).

Yellow Cedar

Callitropsis nootkatensis

Height: < 40 meters

Distribution: Grows in moist areas of coastal mountains of the Pacific Northwest, including those of the Cascades, from the Kenai Peninsula in Alaska to the Klamath Mountains in northernmost California.

Elevation range: 750 – 2000 meters

Leaves: Flat sprays and dark green scale-leaves measuring 3–5 mm.

Bark: Thin, smooth, and purplish when young, turning flaky and gray.

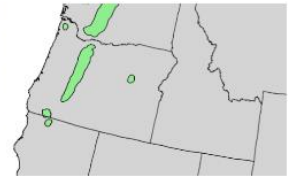
Seed: Small and winged.

Flowering period: April - June

Cone Maturity: 2 years

Cones: Have 4 (occasionally 6) scales, and resemble the cones of *Cupressus lusitanica* (another species which can show foliage in flat sprays), except being somewhat smaller, typically 8–14 mm in diameter; each scale has a pointed triangular bract about 1.5–2 mm long.

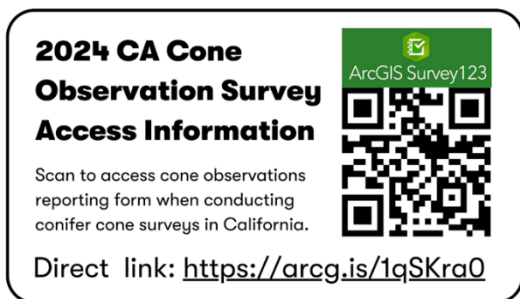
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Photos by: Walter Siegmund (top left, top right, middle right),
Brew Brooks (bottom left), Elbert Little (map).

Appendix B: Survey123 'CA Cone Observations' User Guide

First, download the Survey123 application and open the CA Cone Observations form:



Open the survey form on a browser or within the application itself.

Tip: if the survey doesn't come up when you scan the QR above, try searching 'CA Cone Observations' within the Survey 123 webpage or application to locate and select the correct survey.

Filling the survey: Step-by-Step

1- Surveyor Information

Identify yourself and your affiliation. This will determine which ArcGIS group your submissions will be visible to.

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Surveyor Information

1- Name (First and Last Name, RPF#, etc)*

1- Surveyor Affiliation*

Select appropriate affiliation. Surveys collected under Federal, State, Partner/External Cone Specialist affiliations will only be viewable by agency staff and necessary partners such as American Forests. **Any surveys collected under Public will be publicly viewable.**

<input type="radio"/> Federal (i.e. USFS, NPS, BLM)
<input type="radio"/> State (i.e. CALFIRE)
<input type="radio"/> CALFIRE Collaborators
<input type="radio"/> Partner Cone Specialist (e.g. Cone Corps)
<input type="radio"/> External Cone Specialist (e.g. cone/collection climbers)
<input type="radio"/> Public (e.g. Community Scientist)

2- Site Information

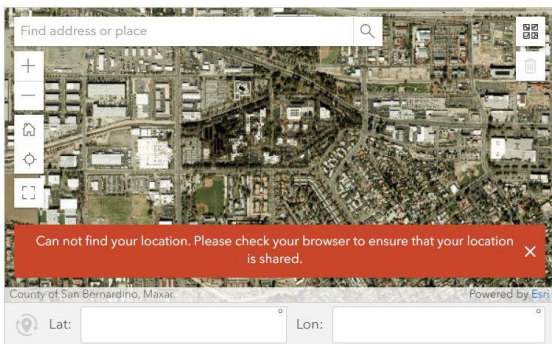
Verify that the location information and timestamp collected is accurate.

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Site Information

2- Observation Point*

Survey tool automatically collects your location. If it is inaccurate, please move the cursor to the location of the cone crop.



Determine the property type. For private property, you will be asked for the owner's name and contact information, but this will not be publicly visible. Only the seed bank managers will see private lands data.

2- Property Type*

Public Land

Private Land

Unknown

Share any accessibility concerns or hazards identified that might make cone collection difficult.

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2- Access

Locked Gate

Adjacent to Paved Road (~1000')

4WD Required

ATV/UTV Required

Backcountry (No Vehicle Access)

Other

2- Collection Hazards

Dense Understory

Active Avian Nest

Yellowjacket Nest

Guard Dogs

Steep, Rocky Terrain

Other

3- Tree Observation

Determine the observation scale: are you observing a stand or reporting on an individual tree?

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Tree Observation

This can be useful even if no cones are observed.

3- Observation Scale*

Assessment should be performed at a Stand Level (all trees close enough to the surveyor to see cones) except under special circumstances (i.e. rust resistant species, rare seed, etc).

<input type="radio"/> Stand
<input type="radio"/> Individual Tree

Identify the tree species you are observing.

Tree Species Filter*

Used to filter the full species list.

<input type="checkbox"/> Cypress Family (Sequoia, Redwood, Cedar)
<input type="checkbox"/> Fir (True or Douglas)
<input checked="" type="checkbox"/> Pine
<input type="checkbox"/> Other

Use the tree species filter to narrow down the list, then select which species are present. You may select more than one species, and can include trees without cones. Only species with verified seed need are listed, but the “Other” option is available for additional species. Some tree species will ask for information on disease resistance.

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For help with tree identification, see *Appendix A*.

3- Tree Species in Stand*

Select all tree species observed in the stand. Choices only include species with verified seed need, so any others will need to be listed under 'Other'.

Coulter Pine (PICO3)

Ghost or Foothill Pine (PISA2)

Jeffrey Pine (PIJE)

Knobcone Pine (PIA1)

Limber Pine (PIHL2)

Lodgepole Pine (PICO)

Ponderosa Pine (PIPO)

Sugar Pine (PILA)

Washoe Pine (PIWA)

Western White Pine (PIMO3)

Whitebark Pine (PIAL)

4- Cone Observation

From the list of tree species, you chose in step 3, select which species are producing cones. Identify the approximate number of trees with cones.

Cone Observation

4- Cones Observed on the Individual*

 Yes No


4- Cones Observed in the Stand

Image*

(Required) Take at least one photo of the crown from a cone producing tree.

(Recommended) Take a stand photo to indicate the overall condition of the cone crop.

Limit of 3 photos.

1 Drop image here or select image (maximum number of files allowed: 3) 

Image

(Optional) Photo(s) that may be of interest (i.e., rust-resistant trees, access issues, landmarks).

Limit of 3 photos.

Choose whether the cones are in their first or second year, or both. Rate the average cone crop of all trees in the stand. For individual tree observations: rate the volume of cones found on that tree.

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4- Cones Observed in the Stand

Jeffery Pine (PIJE)

Jeffery Pine (PIJE) trees in the Stand with Cones*

1-4

5-9

10-19

20+

Jeffery Pine (PIJE) Cone Year

First Year

Second Year

Jeffery Pine (PIJE) Cone Crop Volume*

Light ————— Medium ————— Heavy

Take at least one photo of a cone producing tree.

Image*

(Required) Take at least one photo of the crown from a cone producing tree.

(Recommended) Take a stand photo to indicate the overall condition of the cone crop.

Limit of 3 photos.

1 Drop image here or select image (maximum number of files allowed: 3)



Image

(Optional) Photo(s) that may be of interest (i.e., rust-resistant trees, access issues, landmarks).

Limit of 3 photos.

Other information

Upload any other photos and add any additional notes.

Submit

Click the check mark when you are finished. If you are in an area with no cell or internet service, your survey will save as a draft. You'll need to go back into the application and finish submitting your survey once you regain service.

'CA Cone Observations' FAQ

What is it?

A cloud-based tool that allows anyone to report sightings of developing cone crops into a centralized database to support cooperative conifer seed banking efforts as postfire reforestation ramps up in California.

Information submitted via the survey form called "CA Cone Observations" is viewable in a mapped format according to permissions-based access groups via ArcGIS and is hosted on the Survey 123 application by ESRI.

Who should use it?

- State and Federal Agency staff
 - USDA Forest Service (USFS)
 - CA Dept. of Forestry and Fire (CAL FIRE)

- Bureau of Land Management (BLM)
- National Park Service
- Department of Fish and Wildlife (DFW)
- Agency partners and cone specialists (e.g., contractors working with an agency on cone collections)
- CA Cone Corps
- Students (e.g., Forestry, conservation biology, etc.)
- Private owners of forested land
- People who recreate in the forests (e.g., mountain biking, hiking, bird watching, camping, etc.)

What is it used for?

Seed bank managers with oversight and funding to support cone collections need to know where cone crops are developing as early in the season as possible. When users report information on cone development in forested stands, the “CA Cone Observations” tool is how seed bank managers will be able to receive, review, and work with that crucial information.

The tool was created with the goal of improving the coordination of limited statewide resources and capacity for cone collection, and to ensure that as many viable cone crops as possible are collected on a yearly basis.

Who made it?

This reporting tool was created by a working group with participation by the University of California Cooperative Extension, CAL FIRE, USDA Forest Service (Pacific Southwest Region) and American Forests organized by the CA Reforestation Pipeline Cooperative, an all-comers platform with a mission *to serve as a platform for diverse stakeholders to accelerate timely, effective, climate-informed reforestation practices across all lands.*

The tool has been improved for the 2024 field season based on user feedback from 2023.

Funding for this program comes from the USDA Forest Service and the California Department of Forestry and Fire (CAL FIRE) Wildfire Resilience program.

When is the right time to use it?

Whenever conducting cone surveys in California's forests. Users are encouraged to report information on cone crop development in forested stands as early in the season as possible or as soon as cones are visible, roughly May-August.

What information should be reported?

The survey form is set up to seamlessly capture all the information seed bank and cone collection managers need to both identify trends and track individual potential cone crops. Data fields include the GPS

coordinates/location of either a stand and/or an individual cone bearing tree, property type/land ownership, tree species, photos, crop rating, and accessibility/hazard notes.

Who will see the information I submit?/ Data Sharing

Information submitted via the “CA Cone Observations” form will be viewable by the seedbank managers of California’s only two publicly-managed seedbanks, as operated by the USDA Forest Service Pacific Southwest Region and CAL FIRE (Reforestation Services Program). These two agencies’ seed banks are collaborating closely out of a recognition that everyone doing reforestation work needs seed, and these days, it is safe to assume that if the landowner or land managing organization doesn’t need the seed from a particular cone crop, it’s very likely that another organization, landowner or land manager does need it. Therefore, to enable timely postfire reforestation across all lands, seed bank managers are willingly cooperating to enable access and coordinated collections of surplus cone crops across jurisdictions and boundaries.

Information submitted via the Survey 123 cone observation form is always viewable by, at minimum, the submitter and the seed bank managers of the USDA Forest Service and CAL FIRE, who use the information to coordinate and weigh decisions about who, what, where and when to collect cones, and work with field crews, contract managers, and tree climbers

to do so. Thereafter, data viewing is limited to permissions-based groups according to the affiliation of the user, and the according land ownership and/or land management jurisdiction of the land where cone observations occur.

User groupings include:

- USDA Forest Service agency personnel
- CAL FIRE Reforestation Services affiliated personnel
- Cone partner specialists and contractors (this category includes several sub groups depending on their assigned territories)
- Public (viewable to all)

Data Privacy

Data viewing groups have been established to provide for data privacy as deemed necessary by agency protocols.

Data submitted about cones on privately owned forest lands is viewable only to the seed bank managers responsible for assisting the collection of cones in support of private-lands reforestation efforts. This is to protect private landowners privacy and prevent a scenario in which an eager cone collector uses location data submitted by a private landowner to attempt unsolicited or unwanted cone crop monitoring or collection.

Similarly, a member of the general public using the tool cannot view the data submitted by agency-affiliated personnel responsible for cone collection on their assigned National Forest or other agency-managed district lands. Members of the public CAN help the cause by using the tool to submit data when visiting forested public lands, at which point the seed bank manager and the personnel overseeing cone collection in that district may view the data submitted and consider whether it constitutes as a cone collection opportunity and act accordingly.

Access/How do I view the data I submit (and that of my close colleagues/collaborators)?

Anyone using the tool can access their own submitted data at any time via an ArcGIS Online account after they have requested and been granted access to the appropriate group depending on their affiliation.

ArcGIS Online (AGOL) is a browser-based mapping, analysis, collaborative web platform that allows users to use, create, and share maps, apps, layers, analytics, and data.

Group access requests can be made by using the following links and/or QR codes to navigate to ArcGIS pro.

But first, remember to login to your AGOL account!

If you do not have an AGOL account, no problem. You may still submit cone observations through the Survey

123 application, but you will only have access to the 'Public' group data on ArcGIS, which can be found using the 'search' function and entering the phrase 'CA Cone Observations'.

User Groups ArcGIS Access Information

ArcGIS 'CA Cone Observations' Data Viewing Groups Used for: access/viewing/navigation of cone observation data submitted by fellow group members throughout the monitoring and collection season)	
Group Title on ArcGIS	Group Description
Federal	USFS, BLM, NPS employees
CALFIRE Collaborators	
Grantees	Cone specialists who are CAL FIRE grant/award recipients
Mast Reforestation	Mast staff and affiliates
Mendocino RCD	MRCD staff and affiliates
SEGI	SEGI Consulting & affiliates

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Federal Agency Employees

Scan to visit group page.
Once access is requested and approved, use this page to view all group members' submitted cone observations.



Federal

Direct link: <https://arcg.is/1am9GG>

CAL FIRE Grantees

Scan to visit group page.
Once access is requested and approved, use this page to view all group members' submitted cone observations.



CAL FIRE Grantees

Direct link: <https://arcg.is/1am9GG>

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Mendocino RCD

Scan to visit group page.
Once access is requested and approved, use this page to view all group members' submitted cone observations.



Direct link: <https://arcg.is/1qSKra0>

Mast Reforestation

Scan to visit group page.
Once access is requested and approved, use this page to view all group members' submitted cone observations.



Direct link: <https://arcg.is/9PKH90>

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SEGI Consulting

Scan to visit group page.
Once access is requested and approved, use this page to view all group members' submitted cone observations.



Direct link: <https://arcg.is/SfCvC>

Troubleshooting

CA Cone Observations: Troubleshooting

Let us know what's going on.
You'll receive a written response or phone call (depending on the preference you express in the form) within 3 business days and sooner if possible.



The California Cone Hunter's Pocket Guide (First Edition)

is brought to you by the



CA REFORESTATION PIPELINE PARTNERSHIP



Whether for work or play, people involved with forest seed collection will find

***The California Cone Hunter's
Pocket Guide (First Edition)***

a useful source for concise in-the-field reference material when scouting for, monitoring, and collecting conifer cones in California's forests.



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