TECHNICAL NOTE

Cone Collecting Techniques for Whitebark Pine

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ABSTRACT

Whitebark pine (*Pinus albicaulis Engelm.*), a common long-lived tree of high elevation and timberline forests in much of western North America, is declining because of insect infestation, fire exclusion, and the introduced white pine blister rust disease. Restoration treatments relying on nursery production of seedlings for artificial regeneration are quickly developing. Cone collecting techniques are a critical step in this process. The aim of this study was to describe common and emerging techniques for cone collection used at Crater Lake National Park in 2005. Recommendations are offered to guide managers and fieldworkers in efficient, safe, and effective cone collection.

Keywords: Restoration, climbing, ladder, tree-tong

Forest managers and scientists have intensified their focus on whitebark pine (*Pinus albicaulis* Engelm.) over the past 20 years. Although the tree's value as a keystone species at timberline is increasingly recognized, populations are in decline from fire exclusion, mountain pine beetle epidemics, and the disease white pine blister rust, which is caused by a nonnative fungi (*Cronartium ribicola* J.C. Fisch; Tomback et al. 2001). In many stands, up to 100% infection and mortality have been observed (Kendall 1998).

Tempering tree decline requires a long-term commitment to restoration. Nursery-based restoration programs benefit from extensive seed collections from a broad geographic area. Whitebark pine is common to high-elevation forests of southwestern Canada and the western United States where trees are exposed to cold, windy, snowy conditions typical of timberline environments (Arno and Hoff 1989). These habitats often are miles from the nearest road. Considerable environmental hazards combined with long rescue times present risk to forest workers. An additional challenge is preventing the harvest of cones by marauding birds. These impediments demand careful planning that incorporates the safest and most efficient techniques for collecting cones.

There is very little information available addressing whitebark pine cone collection. Burr et al. (2001) briefly mention cranelifts, ladders, pruners, riflery, and climbing. Although very effective, these techniques can be impractical or hazardous to trees, workers, and bystanders, in many scenarios. This article provides a description of common and emerging techniques for cone collection used at Crater Lake National Park in 2005 and offers a decision process to guide managers making similar collections.

Methods

Collection Techniques

During the summer of 2005, 29 whitebark pine trees were chosen for disease-resistance testing at Crater Lake National Park, Oregon (Table 1). Each tree was evaluated to determine the most appropriate collection method based on safety and efficiency. Tree remoteness and height of cone clusters were the primary factors used in choosing a technique. Collecting options were climbing with rope (CR), free climbing (CF), ground-based (G) orchard ladder (L), and tree-tong (T). Free climbing with rope (CR) involved the prusik system with a climbing harness (Davis 2005). Free climbing (CF) involved the same safety gear, harness, and lanyard except no rope was used to assist the climber. Ground-based collection (G) was performed simply where cones were within reach of a person standing on the ground. The orchard ladder (L) I used was a commonly available aluminum tripod model (14 ft tall). The tree-tong (T) was developed specifically at Crater Lake National Park for collecting whitebark pine cones in 2005. It consists of an 18-ft long telescoping aluminum pole with a prefabricated tong screwed on the end that is opened and closed from a dangling rope. A two-person crew was used for all collecting.

Cone Cages

Because Clark's nutcracker (*Nucifraga columbiana* Wilson) and rodents are ubiquitous collectors of whitebark pine seeds, I enclosed cones in protective mesh cages in early summer. During return visits in September–October I retrieved each cage and the enclosed ripened cones. I tested two types of steel mesh cages (13.5-in. wide by 18-in. long) for ease of installation and ability to stay affixed to tree branches. One type was made entirely of ⅛-in. mesh. The other was a combination of ⅛-in. mesh with a 4-in. extension band of coarser ¼-in. mesh forming the bottom opening. The coarser mesh was used to test its ability to retain a crimped grasp, thus potentially remaining on the branch longer. Each tree had two to five cages installed. Observations were recorded for each cage including height aboveground (ft), number of cones, animal harvesting, and cage type.

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Table 1. Characteristics of 29 whitebark pine trees chosen for cone collecting at Crater Lake National Park.

	Diameter at breast height (in.)	Height (ft)	Crown width (ft)	Verticle crown ratio (%)
Mean	18.8	26.3	14.2	94.5
SD	8.6	8.7	6.6	13.9

Elapsed Time Testing

Elapsed time was measured from the beginning of setup for each technique to the nearest 0.5 minutes. Specific timing starts for each technique were (CR) initiation of rope installation on tree, (CF) climber first contacts tree with foot or hand, (G) worker first touches cage to cone branch, (L) workers begin to position ladder, and (T) cage is grasped for installation or removal.

Results and Discussion

Cage Mesh

Of 101 cages installed, 13 fell off before cone retrieval. Nearly equal numbers of ⅛-in. mesh cages ($n = 5$) and combination mesh cages ($n = 8$) fell off. Therefore, the extra crimping ability of the combination cage did not increase the cage's longevity on the branch. Furthermore, I found no evidence of animals harvesting caged cones while uncaged cones were almost completely reaped.

Climbing with Rope

This technique was used when cones were high in tree canopies and no branches were near the ground (Table 2) and may be feasible for virtually any sound whitebark pine tree with branches able to support human weight. This technique demands the highest skill level and is potentially the most hazardous of all techniques. Climbing more than two trees in a day was not possible given the time needed. Production rates may be higher with greater climbing skills; however, even the most skilled climbers would be hard-pressed to outpace results for any of the other techniques. Agencies such as the US Forest Service require formal training certification before any climbing. Two climbers (one to provide assistance from the ground) are required at each tree (Davis 2005). Rupturing the characteristically thin bark of branches with lightweight boots was a very common impact despite efforts to the contrary. The cost of technical climbing gear for two people was about $1,200. An additional cost of premium hazard pay was incurred also. Carrying heavy and bulky gear over lengthy distances proved to be challenging.

Free Climbing

Free climbing was performed where climbable branches occurred along the entire stem. Because no roping, throwline, or prusik setup was required, this technique was faster than climbing with ropes. Less gear resulted in greater portability. Free climbing could occur at greater heights than I sampled (Table 2); however, the tallest whitebark pine trees tended to have no branches near the ground. Damage to branch tissue from boots was very pronounced.

Figure 1. Worker uses tree-tong to install cage and pluck a cone (inset) at Crater Lake National Park.

Ground Based

I found this technique to be the simplest and quickest, and it was used where cones occurred close to the ground. A single person was able to do this without any special gear.

Orchard Ladder

A ladder was used when trees supported cones below 18 ft in height and were near roads. Two people were needed to carry the ladder because of its weight and length. This was difficult on rough or uneven terrain and tiring when distances exceeded 0.2 mi. Ladder setup and cage handling were quick and effective. No other equipment was necessary. The ladder cost $176.

Table 2. A comparison of whitebark pine cone collecting techniques used at Crater Lake National Park.

Technique	No. of cages installed	Height to cage (ft)	No. of cages that fell off	Elapsed time per cage installation/retrieval (min)	No. workers required Installation/Retrieval	Equipment cost	Portability	Impacts to tree
Climbing with rope (CR)	11	13–45	1	22.0/6.0	2/2	High	Low	Moderate-high
Free climbing (CF)	22	6.5–30	1	5.0/3.0	2/2	Moderate	Moderate	Moderate-high
Ground-based (G)	23	2.0–9.0	0	2.0/1.0	1/1	None	High	None
Orchard ladder (L)	22	10–18	1	2.5/2.0	2/2	Moderate	Low	None
Tree-tong (T)	23	10–21	10	4.5/3.5	1/2	Low	High	Low-none

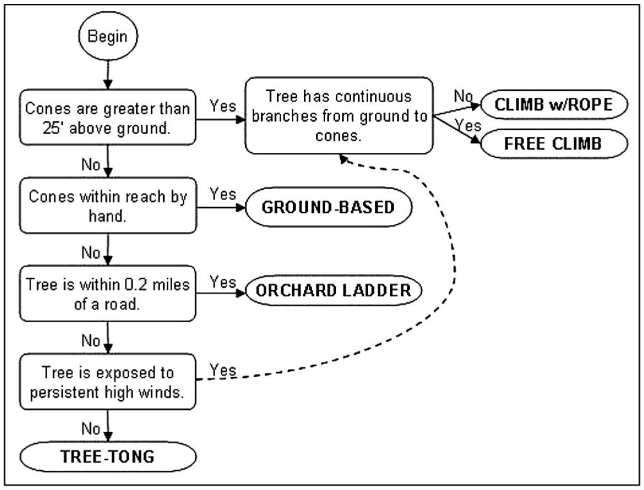

Figure 2. Decision flow chart for choosing a collection technique for whitebark pine cones.

Tree-Tong

The tree-tong was a viable and safe tool when cones were between 6.5 and 21 ft in height. The lightweight telescoping pole was easy to transport to the most remote trees in this study. It reached all but the highest cones sampled. It could be operated by a single person. The pole and tong cost $92. The tong end was effective in plucking cones (Figure 1) but was less effective in closing the bottom of each cage around the branches. Many cages fell before cone retrieval (Table 2), probably in response to strong winds. Improving the cage design to better adhere to branches may increase this technique's applicability. Overall, the tree-tong was the favorite tool because of its easy and safe operation, portability, and low cost.

Recommendations

The best time to select a collecting technique is during the initial tree survey. During the work reported here, the constraints of a particular technique were based on cone height in the tree canopy, the availability of branches for climbing, the distance from a road to the tree, and the exposure of the canopy to strong winds. These factors were instrumental in developing a decision flow chart to aid in selecting the most appropriate technique (Figure 2). Once a technique is selected, corresponding field gear can be prepared for a return trip to install cages. In remote locations requiring long travel, the initial survey can be combined with cage installation, necessitating the transport of all cages and installation equipment. In these instances, a tree-tong plus climbing gear with ropes is recommended. An additional aid for all techniques except the tree-tong is an extended hook for pulling cone branches in close to the worker. This can be made by screwing a hooked bicycle hanger on the end of a broomstick.

I found strengths and weaknesses of each collection technique. Overall, climbing is the least desirable option because of impacts on trees and the risk of climbers falling. Attaching cages with a tree-tong may be inadequate on extremely windy sites. It was difficult to maneuver the pole-mounted tree-tong into position to access cones at heights greater than 25 ft. During retrieval, it is recommended that a second person track the whereabouts of cones that occasionally fall out of the cage or tong to the ground.

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