BRITISH COLUMBIA
Ministry of Forests

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FOREST INVESTMENT PROGRAM

Whitebark Pine Planting Guidance

OVERVIEW

The Forest Investment Program (FIP) is helping to support the long-term survival of whitebark pine (*Pinus albicaulis*) by funding planting projects and related activities. This work supports FIP's goals to enhance forest resiliency and to restore ecosystems and wildlife habitat. This document is intended to provide guidance to FIP delivery partners looking to plant whitebark pine. Please refer to the references and supplemental resources provided for further information.

All FIP standards that typically apply to reforestation projects are also applicable to whitebark pine projects. This document is in addition to the FIP General Standards and the FIP Planting Standards.

New and ongoing whitebark pine planting projects must be discussed with the FIP whitebark pine lead each year prior to applying for funding through the FIP Annual Operating Plan.

Contents

For more information, scan the QR code or check out the FIP Website.

1 Definitions

"indehiscent cones" – Seed cones that do not open at maturity to release their seeds. Seed dispersal relies on animals, mechanical disturbance or decay. These are different from serotinous cones that open on their own following an environmental trigger such as a wildfire.

"plus tree" – A relatively healthy tree in a stand that has a high incidence of white pine blister rust. These trees are suspected of being rust resistant but that has not been confirmed through progeny rust resistance screening trials.

"putatively resistant seed" – Seed collected from plus trees. The seedlings grown from this seed are suspected to have some genetic resistance to white pine blister rust but not confirmed.

"rust resistant screening" – The systematic process by which putatively resistant seedlings are inoculated with *Cronartium ribicola* in a greenhouse setting to identify seedlots that demonstrate genetic resistance to developing the disease.

2 Background

Whitebark pine (*Pinus albicaulis*) is a high-elevation five-needle pine species found in the mountains of B.C. and Alberta, roughly south of the 56th parallel. It is an early-seral species in mixed-conifer subalpine forests but can form pure stands through all seral stages in the upper subalpine to treeline. Whitebark pine populations have been greatly reduced due to a combination of the exotic white pine blister rust (caused by the pathogen *Cronartium ribicola*), mountain pine beetle (*Dendroctonus ponderosa*), fire suppression, wildfires and climate change. The species is blue listed in B.C. and listed as endangered in Canada under the Species at Risk Act.

Whitebark pine is a keystone species in subalpine ecosystems. It provides shelter and nesting habitat for wildlife. Its seeds are a critical food source for species such as Clark's nutcrackers, grizzly bears, squirrels and black bears. Clark's nutcrackers are the primary seed disperser for whitebark pine. They have a specialized bill that allows them to extract the seeds from the indehiscent cones. The nutcrackers then cache seeds for future use. Lost or forgotten seed caches can germinate and grow

into trees. Whitebark pine is also a foundation species in subalpine ecosystems providing structure that facilitates plant community development, retains snowpack and reduces soil erosion.

3 Cone and seed collection

Inventory of whitebark pine seed is limited in B.C. Early confirmation of available seed and suitability is necessary during project planning. The limited availability is due to the low demand for the non-commercial species and the limited amount of expertise in collecting and processing the cones. Cone collection costs are very high compared to other conifers due to site access and the need to visit the site twice. Access to suitable collection sites is usually poor due to the nature of whitebark's habitat, which is typically outside forest road networks and therefore helicopters must be used to access the sites. Sites must be visited twice in a collection year: first to cage the cones, protecting them from forage by wildlife and then to harvest the cones.

Ideally all whitebark pine restoration projects use seed that is genetically resistant to white pine blister rust. However, while rust resistance screening is occurring on some collected seed in the province, it is not practical to have all seedlots screened due to the cost and the time required to conduct screenings. The use of putatively resistant seeds is best practice for restoration projects when insufficient rust resistant seedlots are available for a project. Seed should not be collected from trees exhibiting signs of white pine blister rust.

For project proponents looking to conduct cone collections please refer to the following materials in the references section for more detailed guidance: Tamm 2022 and Moody and Pigott 2021.

4 Planting site selection and eligibility assessments

Planting site selection

Identifying the most suitable sites is a critical part of a whitebark pine restoration project. This section is intended to inform initial site selection screenings and eligibility assessment fieldwork. Information provided here does not supersede local knowledge about the species.

In B.C., whitebark pine primarily occurs south of the 56th parallel in the upper Engelman Spruce Subalpine Fir (ESSF) and, less frequently, in the upper submaritime Mountain Hemlock (MH) biogeoclimatic zones. It can also be found in the upper Interior Cedar Hemlock (ICH) and in the Alpine Tundra (AT). In moist mountain ranges, whitebark pine is most abundant on southern and western slopes, while in drier ranges it occurs more on northern and eastern aspects (Arno and Hoff 1990). As a pioneer species, whitebark pine regenerates best in recently disturbed areas, especially post-wildfire (Perkins 2015).

The species has a competitive advantage on dry, shallow-soiled, wind-exposed sites at high elevations. Sites that have a mesic or drier moisture regime have been found to have the highest survival rates (Izlar, 2007). However, sites that exhibit the extremes of these site conditions within the species' natural range should be prescribed with caution or simply avoided. For example, upper slopes of steep southern aspects with shallow rocky soils will be difficult to regenerate from seedlings and should be avoided. The pre-disturbance presence of whitebark pine does not guarantee successful planting establishment.

Whitebark pine does not establish well when competing vegetation is present on site. This includes other tree species as well as most brush species. An exception is grouse whortleberry (*Vaccinium scoparium*), which studies have shown has a positive association with whitebark pine (Forcella 1978, Perkins 2004). Studies have found that beargrass (*Xerophyllum tenax*) should especially be avoided due to the dense clonal mats it forms (Arno and Hoff 1990, Forcella 1978). Sites that had a major component of lodgepole pine (*Pinus contorta var. latifolia*) in the pre-fire stand should be avoided because whitebark pine will be outcompeted by the faster growing lodgepole pine.

Access is a critical component to any planting project. Most high elevation sites suitable for whitebark pine restoration do not have truck access. Sites that are accessible by truck or all-terrain vehicle (ATV) should be prioritized due to the significantly lower costs compared to helicopter access. When helicopters must be used, sites that are accessible by a short hike for future monitoring surveys are preferred and can significantly reduce overall costs. Sites that require helicopter access for monitoring activities may not be funded by FIP.

If a site can be accessed by ATV, it is necessary to consider the potential damage to these sensitive ecosystems. Damage may occur during the project or by public use of any trails developed. Where ATVs are being used off-road, a damage mitigation strategy should be included in the prescription or work plan. It may be determined that helicopter access is the best method to avoid environmental damage.

While ski resorts offer good access opportunities to whitebark pine habitat, experience has found that these high traffic areas are not well suited to tree planting projects. FIP will not fund planting of whitebark in ski resorts or similar high traffic areas.

Site conditions recommended to avoid

- Steep south/southwest aspect slopes
- Moderate or high brush hazard
- Lack of protected microsites (i.e., obstacles)
- Abundant natural conifer regeneration ingress
- Avalanche paths
- High traffic ski areas or other areas that may be

Recommended workflow for eligibility assessments

- Office review of recent high elevation wildfires
- Identify polygons of whitebark pine habitat that are good candidates for reforestation based on the site selection guidance
- Assess access requirements for each potential area considering:
    - How trees will get to every part of the treatment area?
    - If ATVs are used, what is the risk of environmental damage?
    - If helicopters are used, are landing spots available or is there preparatory work required?
- Focus on the most easily accessible sites to conduct eligibility assessment recces
- Conduct eligibility assessments on priority polygons focusing on:
    - Site series identification and delineation
    - Actual soil moisture regimes: moderately dry to fresh (slightly dry preferred)
    - Soil nutrient regimes: poor to rich (medium preferred)

- Competition from brush and other tree species
- Signs of white pine blister rust in adjacent stands (useful information for monitoring)
- Plantable spots per hectare based on the presence of obstacles and soil conditions
- Number of potential danger trees per hectare (if any)
- Any other safety hazards

5 Planting prescription considerations

Planting prescriptions should aim to mimic natural distributions which are typically small groupings of trees with gaps between groupings. Groupings are found where microsite conditions favour establishment and growth on sites that typically have harsh growing conditions. Microsite selection by planters is therefore key to seedling establishment. Inter-tree spacing should be dictated by the location of suitable microsites described in the prescription or work plan. Microsite and spacing specifics must be clearly communicated in the pre-work to planting contractors since many specs will be different than most typical planting projects.

Whitebark pine planting projects often have low survival. It should be determined at the prescription stage whether a re-plant/fill plant is recommended if high mortality is observed during monitoring surveys. Considerations should include access and site conditions. Sites that are prescribed with a single-entry only planting recommendation will require a professional rationale and should be discussed with a FIP representative.

The following are some other recommended specifications to include in planting prescriptions. These are not hard rules, but suggestions to be adapted based on site conditions, local knowledge and project objectives:

- Sow seedlings in large plugs. The minimum recommended size is PSB 412A. Both 1+0 and 2+0 aged stock has been used for projects in B.C.
- The fall planting season is typically the preferred timing for planting due to the high elevation of whitebark pine sites
- Do not plant with other conifer species or where natural regeneration of other species is expected to be moderate to high. Other associated conifer species typically grow faster and will outcompete whitebark pine
- Cluster planting is a commonly used technique for whitebark pine where seedlings are planted in small tightly spaced groupings of 3-6 trees with gaps in between. This distribution mimics how nutcrackers cache seeds and allows planters to plant only optimal microsites[1]
- Planting density: 400 to 1000 stems/ha, depending on site characteristics, density of suitable microsites and expected mortality

[1] Some guidelines suggest planting at even spacing (e.g., 4.5 m x 4.5 m) to reduce future inter-tree competition and promote large crowns which produce the most cones (McCaughey et al., 2009). However, silvicultural experience in B.C. has found that focusing on optimal microsites, rather than even spacing distributions, is most effective for seedling establishment and thus cone production.

- Avoid planting in grassy areas. Including a screefing requirement is an option, but if a variable distribution pattern is allowed then it is best to have planters simply avoid grass mat
- Target obstacles (just like Clark's nutcrackers[2]) to protect from snow creep and wind, and for soil moisture. The choice of acceptable obstacles and the aspect to be planted will depend on location and site characteristics. The following are some general guidelines:
    - Large non-living stationary obstacles are preferred (e.g., rocks, stumps, snags)
    - Shrubs can be effective obstacles, but seedlings should be planted outside the dripline
    - On steep sites target the downhill side of large stable obstacles for protection from snow creep and soil pooling
    - On solar aspects target the northeast to north aspect of obstacles on subdued terrain to take advantage of the moister microsite and potentially reduce damage from sunscald
    - In the northern part of its range, the south aspect of obstacles may be preferred
    - Consider targeting the leeward aspect of large obstacles on wind prone sites

6 Monitoring and reporting

FIP Whitebark pine planting projects are subject to the same monitoring and reporting standards as all other FIP planting projects. For the purposes of forward planning monitoring surveys, whitebark pine sites should default to a high-risk area as used in the standard linked below. Please review the FIP Reforestation Monitoring Forward Planning Standard and the RESULTS Information Submission Specifications (RISS) for more information.

7 References and supplemental resources

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[2] Clark's nutcrackers relocate caches through pattern recognition. Large objects on the ground create patterns for the birds which results in the seeds being placed in protected microsites (Kamil and Balda 1985)

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