

Whitebark Pine in British Columbia

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INTRODUCTION

Whitebark pine (*Pinus albicaulis*) is an uncommon five-needle pine growing at higher elevations in western North America from California to British Columbia. At its upper elevation limit it is generally considered to be a short, slow growing species, but at lower elevations it can attain commercial dimensions. Interest in the status, preservation, and restoration of this species has recently intensified due to the increasing mortality and low regeneration success as a result of the mountain pine beetle epidemic, white pine blister rust, and its replacement by more shade-tolerant species. The British Columbia Conservation Data Centre recently elevated the conservation status of whitebark pine from “Yellow” (not at risk) to “Blue.” Blue listed species are those which are not immediately threatened with extinction, but are of

Whitebark pine is considered to be a keystone or foundation species in subalpine ecosystems.

concern because of characteristics that make them particularly sensitive to human activities or natural events. Whitebark pine is considered to be a keystone or foundation species in subalpine ecosystems because a large number of other plant and wildlife depend upon its existence, and it plays an important role in retaining snow and water on site.

SPECIES CHARACTERISTICS

Needles

The needles occur in bunches of five, and range in length from 3 to 9 cm. They are stiff, slightly curved, usually bluish-green, and tend to be clumped towards the ends of the branches.

Cones

The male flowers or pollen are visible in mid-June to mid-July, raspberry red, and easily distinguished from

the yellow-orange pollen buds of western white pine, lodgepole pine, and limber pine.

The mature seed cones are dark purple maturing to brown, almost round, and very hard. They range from 5 to 10 cm in length, and 4 to 7 cm in width. The number of seeds per cone can be as low as 10, and up to over 100, depending on pollination success. The cone has been described appropriately as a pitch daubed hand grenade.

The cones are permanently closed, and seldom release their seed unaided. Wildlife, especially birds such as the Clark's nutcracker, other birds in the crow family, chipmunks and squirrels are the most common agents of seed dispersal. The literature suggests that cone production does not begin until the trees are at least 75 years old, although in 2008 cones were collected from trees as young as 42 years near Takla Lake.

Like all members of the *Pinus* genus, the cones mature about 15 months after pollination.

The cones are situated latterly on the outermost tips of the upswept branches, making them highly visible and attractive to the Clark's nutcracker.

Seeds

The large, light brown, wingless seeds average about 1 cm in length. Whitebark pine and limber pine are the only conifer species in British Columbia that have wingless seeds. For this reason they are not wind dispersed, and depend almost entirely on birds and mammals for regeneration.

Bark

The name speaks for itself: "white bark" or from the Latin *albicaulis* meaning "white stemmed".

The thin juvenile bark is particularly chalky-white and smooth. However as the trees mature, the bark becomes thicker, darker, and forms narrow brown-grey scaly plates.

Form and Wood

Near tree-line on severe, exposed, wind-swept sites, whitebark pine is often a stunted, slow growing shrub. The multiple stems can be the result of several germinants arising from a seed cache deposited by a Clark's nutcracker or a squirrel, or the result of poor apical dominance. At lower elevations stems can be quite straight, attain commercial dimensions, and occasionally be confused with western white pine, or at a distance lodgepole pine. Trees over 1.46 m in diameter, and 31 m tall have been recorded. The wood quality is inferior to most other conifers for construction, decorative, and commercial purposes due to its poor live load bending strength, spiral grain, and generally low volumes.



Whitebark pine cone.

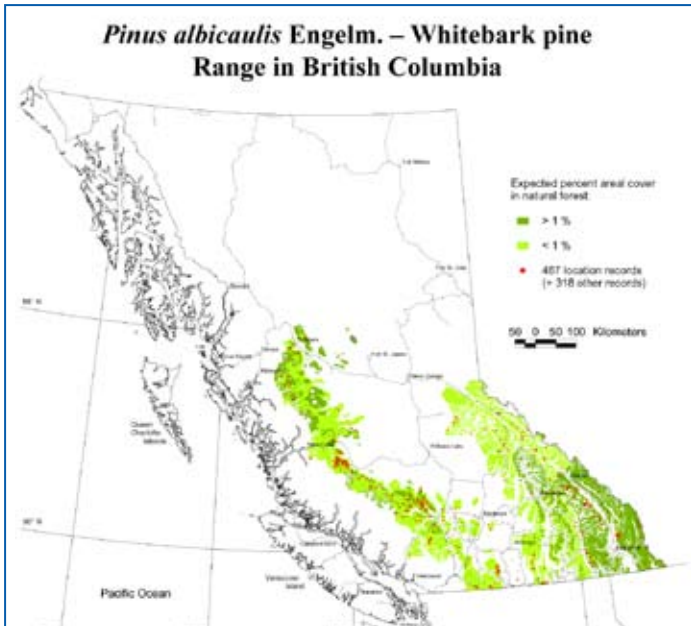


Cone scales broken with seeds exposed.

Size comparison of whitebark pine seeds and green peas.



Bark on a 25 year old tree. Note the pitch tubes from mountain pine beetle attack.

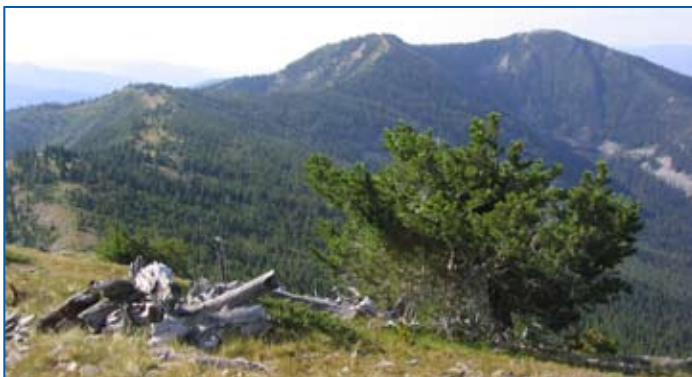


Tree forms –

Above: Mature tree at Darcy, BC.

Below: Stunted tree at tree line near Apex Mountain, BC.

Right: Large, mature tree at Heckman Pass, BC.



DISTRIBUTION

Whitebark pine in British Columbia grows from Tweedsmuir Park to the Smithers area at the 800 to 1000 m elevation range, and up to 2400 meters in the East Kootenays. Its latitudinal range in British Columbia is from the 49th parallel to 55° N in the north near Takla Lake.

It occurs in scattered stands mixed with other species, including Engelmann spruce, subalpine fir, alpine larch, and lodgepole pine, throughout much of it's range, but pure stands do occur in some areas.

HABITAT

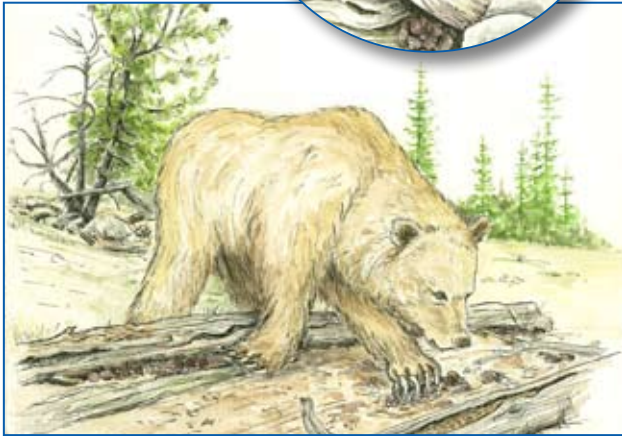
In general, whitebark pine is most abundant on drier, exposed south-facing slopes, near treeline. This is likely because these areas provide good seed caching sites for Clark's nutcracker, and have suitable growing conditions. It can also be found on fresh to moist sites at lower elevations, where it can grow quite large. After fires, it is commonly mixed with lodgepole pine, but through normal succession in the absence of disturbance both species of pine are gradually replaced by Engelmann spruce and subalpine fir. Whitebark pine are often seen at the top of ski hills, or where microwave and communication towers are located.



IMPORTANCE FOR WILDLIFE

The seeds of whitebark pine are the largest of all of the conifers of British Columbia. They are often as large as a green pea, and are an important source of food for several wildlife species, especially the Clark's nutcracker and red squirrels. Both start to harvest the seed in the middle of August and through September. Ground squirrels, chipmunks, and even black and grizzly bears also eat the seeds.

Whitebark pine seeds are a prime food source for grizzly bears and squirrels.



Whitebark pine seeds average about 5 seeds per gram compared to approximately 100 Douglas-fir seeds per gram, and as many as 380 lodgepole pine seeds per gram. By weight, whitebark pine seeds contain about 52% fat, 21% carbohydrates and 21% protein, comprising a very important wildlife food source.

Red squirrels eat some of the seeds from the cones as they remove them from the trees, but generally they take whole cones and cache them one by one, in middens for their winter food supply. These middens, or caches are usually located in or under old stumps, under logs, or in protected depressions, often obscured by brush. When cone crops are abundant, they seem less concerned about choosing sites that are difficult for their competitors to locate.

The importance of whitebark pine seeds for grizzly and black bears is particularly well documented in Montana

and Wyoming, where in years of heavy cone crops, the seeds constitute a major source of their energy intake. The relative abundance of cones can have a significant influence on the health, and well being of bear populations in that region. Black bears are far more proficient than grizzly bears at climbing trees, and have been observed feeding on cones in trees. However the vast majority of the seeds they eat are obtained by raiding squirrel caches.

Although the seeds are an important food source for many animals, the most important and fascinating mutualistic relationship is between whitebark pine and the Clark's nutcracker (*Nucifraga columbiana*). Whitebark pine seeds are one of the preferred foods for the nutcracker. The seeds of whitebark pine are wingless, and adequate dispersal is dependent upon the bird to perpetuate the species across the landscape.

Birds in the crow family *Corvidae* are considered to be the most intelligent of all birds, and the Clark's nutcracker is considered to be the genius of all crows. They are equipped with a long, sturdy bill which enables them to peck the cones apart. They are able to break off the outer portion of the cone scales at a thin natural fracture point which exposes the seeds for easy removal. The nutcracker then removes the seeds from the cones and stores them in its sublingual pouch, a sac-like structure on the floor of the mouth. This pouch is capable of holding over 100 seeds. Before the nutcracker deposits the seeds into the pouch however, it rattles each one individually in its beak to ensure that the seed is filled, and sound. The Clark's nutcracker then carries the seeds to a caching site where the seeds are buried 1-5 cm deep for a fall and winter food supply. The preferred caching sites are usually on south facing, exposed meadow-like sites, with minimal snow pack to facilitate easy retrieval. The substrate is often sandy soils, gravel litter, or in rock crevasses. Nutcrackers cache between 1 and 25 seeds in each location. A single nutcracker is estimated to cache between 22,000 and 98,000 seeds in up to 7,500 different places, and appears to be able to capitalise on at least half of them. They use rocks and woody debris to create a memory map to help relocate the seeds when needed.

FIRST NATIONS USE

The Thompson and Ts'ilhqot'in people ate the seeds of the whitebark pine both raw and roasted; they collected the cones in the fall and dried them to open the scales. They extracted the seeds and ate them fresh or sometimes preserved them for winter

by cooking and crushing them, and then mixing them with dried berries, or pounding them to make a fine flour. The fibrous roots were used to sew bark together and to weave watertight containers and canoes.

HEALTH AND THREATS

In recent years there has been a rapid decline in whitebark pine due to several factors.

White Pine Blister Rust

White pine blister rust is a serious disease, which affects all five-needle pines with severe consequences. It is caused by the fungus *Cronartium ribicola* which also infects an alternate host, the members of the *Ribes* (currant and gooseberry family). This disease was introduced to British Columbia in 1910 from infected eastern white pine nursery stock imported from Europe. Within 25 years the disease swept across most of the range of the three native, five-needle pine species in British Columbia; western white pine (*Pinus monticola*), whitebark pine (*Pinus albicaulis*), and limber pine (*Pinus flexilis*). The disease has also expanded into the western United States, and throughout eastern North America due to a previous introduction on the east coast.

The spores are released from the leaves of the *Ribes* plants in the spring and land on the needles of the pine trees, where they enter through tiny pores (stomata) in the needles. The fungus then travels from the needles down the branch to the main stem, where it eventually can girdle and kill the tree. The orange fruiting body of the fungus is rich in sugars and highly prized by rodents such as red squirrels and porcupines. By eating the fruiting body, and bark they may accelerate the ultimate death of the tree, or in some cases destroy the fungus, and prolong the tree's survival.

Right:
White pine blister rust on whitebark pine.

Below:
Mature whitebark pine killed by mountain pine beetle.



Mountain Pine Beetle

The spread of the current mountain pine beetle (*Dendroctonus ponderosae*) infestation in British Columbia over the last decade is an epidemic of a scale not seen before. Over 17.5 million hectares have been affected to some degree. Although most residents of the province are familiar with the unprecedented mortality in lodgepole pine stands, few realize that ponderosa pine and whitebark pine can also be affected. Whitebark pine stands have been attacked in some areas such as the Chilcotin during previous outbreaks. Older stands, and trees already infected by white pine blister rust seem to be more susceptible to attack.

Natural Succession and Fire Suppression

The increasing effectiveness of fire suppression and elimination of this moderately frequent natural disturbance has allowed more shade-tolerant species such as subalpine fir and Engelmann spruce to colonize traditional whitebark pine habitats.

Harvesting

At lower elevations, and on good sites, whitebark pine trees are often harvested with the primary species, if they are of merchantable size. As the

stem form and wood quality are generally less than desirable, the logs usually end up as low grade lumber, chips, or in many cases are left in the landing. In July 2008, a whitebark pine bulletin was produced by the Ministry of Forests and Range and the Forest Genetics Council advocating amending harvesting plans to help conserve the species. (Whitebark Pine-Conserving A Species At Risk)

ADDRESSING CONSERVATION ISSUES AND CONCERNS

Despite the bleak outlook for the future of whitebark pine in British Columbia, government agencies, local groups, and dedicated individuals have undertaken many initiatives which will have a positive impact on the survival of the species.

Since 1996 the amount of protected areas in British Columbia more than doubled from 6% to almost 14%, thereby increasing the area of better protection. Many of these new additions included whitebark pine habitat.

In 1996, Research Branch of the Ministry of Forests published a research note titled "A Survey of the Protected Status of Conifers in British Columbia: *In Situ* Gene Conservation".

Since that time a cataloguing project was undertaken to re-examine the conservation status of forest tree resources by the Centre for Forest Conservation Genetics at UBC, and to identify gaps in species representation within protected areas. Whitebark pine has been identified as a priority and several



Installation of protective cone cages.

projects have been completed or are underway that will help to increase the effectiveness of conservation measures.

It is important to protect and preserve representative whitebark pine ecosystems throughout their natural range, and the full range of species which depend upon it for their own survival. Protecting species in their natural habitat is called *in situ* conservation. It is equally important to maintain collections of individuals (trees, seed, tissue) in a location outside of their natural range in the event of the demise of the species or its habitat due to both natural, and unnatural causes (e.g. white pine blister rust,



Sowing seed.

mountain pine beetle, fire, natural succession, or logging). This is called *ex situ* conservation. Currently, there are several projects within the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) and the Ministry of Environment, to collect seed for both restoration work, and *ex situ* conservation. In order to collect cones, and seed from whitebark pine, it is necessary to install cages over the immature cones on the trees to prevent predation by the Clark's nutcracker and red squirrels which normally harvest over 95% of the cone crop.

The MFLNRO has surveyed whitebark pine stands across its range in BC to quantify levels of white pine blister rust infection, and possibly identify resistant trees.

Seed collections have been made for genetic conservation projects and for long term provenance testing. A provenance test compares trees grown from seed collected in many parts of a species range. It can be used to demonstrate where different sources of seed can be used.

Both the Ministry of Environment and the Whistler Naturalists in cooperation with Intrawest, a company



Volunteer planters at Whistler Mountain.

that owns and operates ski and resort properties, have initiated projects to re-establish whitebark pine by field sowing seed, and by planting seedlings into traditional or suitable habitats.

Local naturalist groups in other communities such as Lillooet and Smithers have also been instrumental in assisting with restoration projects. The Columbia Basin Trust has funded restoration projects in both the East and West Kootenay.

Acknowledgements

Original funding for this publication was provided by the Forest Genetics Council of BC through the provincial Forest Investment Account.

A special thanks to Carmen Wong for allowing us to use the outstanding photo on the cover.

The following people must also be recognized for their contributions and suggestions in reviewing the document; Joanne Vinnedge, Elizabeth Campbell, Carmen Wong, Jodie Krakowski, Randy Moody, Sybille Haeussler, Diane Douglas, and Jack Woods. Randy should also be recognized for his leadership in the establishment of a Canadian chapter of the Whitebark Pine Ecosystem Foundation.

Second-edition edits and printing were supported by Columbia Basin Trust, which delivers economic, social and environmental benefits to the residents of the Columbia Basin.



Contact Information

You can learn more about Whitebark pine or how you can help or assist in its restoration, by contacting the Canadian Chapter of the Whitebark Pine Ecosystem Foundation.

www.whitebarkpine.ca

Reports & Other Resources

A Survey of the Protected Status of Conifers in BC: In Situ Gene Conservation

<http://www.for.gov.bc.ca/hfd/pubs/Docs/rr/rr04.pdf>

UBC Centre for Forest Conservation Genetics – Whitebark pine.

<http://www.genetics.forestry.ubc.ca/cfcg/projects.html#whitebark>

Whitebark Pine Workshop 2007, Whistler, BC

<http://www.genetics.forestry.ubc.ca/cfcg/pa-workshop.html>

Whitebark Pine-Conserving a Species at Risk

http://www.for.gov.bc.ca/hti/whitebark/WhitebarkPine_Bulletin-July08.pdf

Whitebark Pine Ecosystem Foundation

<http://www.whitebarkfound.org/>

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Image Credits

Front Cover – Carmen Wong

Whitebark pine cone sketch – T. C. Brayshaw

Whitebark pine range map – Andreas Hamann, edited by Jodie Krakowski

White pine blister rust on whitebark pine - Richard Snieszko

Other photos and drawings – Don Pigott