



Limber Pine Conservation

Limber pine (*Pinus flexilis*), a type of five-needle pine, is ecologically important to Rocky Mountain National Park (RMNP) — it supports biodiversity, is a food source to wildlife, and provides erosion mediation by capturing and retaining snow. RMNP has designated limber pine as a species of management concern. Severe drought conditions and bark beetle infestations, such as those caused by the mountain pine beetle (MPB; *Dendroctonus ponderosae*), have resulted in a declining population within the park. White pine blister rust (WPBR; *Cronartium ribicola*) infections pose further risk to the species. Research on the ecological role and historical relevance of limber pine started in the 1970s. Much of the research and management activities today focus on how best to conserve this species.

Background

Limber pine is distributed throughout western North America. In the central Rocky Mountains, patches of limber pine grow from about 1,600 to over 3,300 meters in elevation (or 5,200 to over 10,800 feet).¹ Limber pine is often one of the first tree species to colonize an area after a fire. Clark's Nutcrackers can disperse seeds many kilometers away from the parent tree, which enhances colonization of new areas. Limber pine forests thrive in dry, rocky, exposed windswept slopes where other species cannot. All native five-needle pines are highly susceptible to WPBR, including limber pine. WPBR has now begun to invade RMNP. WPBR, MPB, and climate change are the most eminent threats to these populations.



L: Photo courtesy ASchoettle; R: NPS

Top: RMNP Forest staff attach a verbenone packet to a limber pine. Verbenone mimics the pheromone pine beetles exude, which wards off other pine beetles. **Bottom:** WPBR is caused by *C. ribicola*, a non-native fungus that has a two-host lifecycle. Cankers, seen on the tree stems are a recognizable sign of infection. Cankers eventually erupt and release spores (right photo) which infects the second host, usually *Ribes* spp. such as current or gooseberry shrubs.

Key Messages for Communicating to our Public

- Limber pines are ecologically significant and a keystone species in RMNP — they maintain ecosystem structure and function, and support biodiversity.
- Limber pine is a species of management concern; the species is declining in the park and is threatened by mountain pine beetles, white pine blister rust, and climate change.

Desired Action from the Public

- Appreciate limber pines and their ecological role.
- Understand threats to limber pine.

Cultural Significance

Limber pines have been used by Native American peoples for nutritional, medicinal, and ceremonial purposes.² Limber pine also has historical and contemporary uses—the resin of the trees can be used for turpentine, and lumber has been used for rough construction, mine timbers, railroad ties, and poles.

Research

Limber pine studies in RMNP started in the late-1970s, when tree damage by pine beetles was gaining attention. Sturgeon and Mitton found that pine beetles using limber pine as their host plant tended to be smaller and more cold hearty, likely a necessary adaptation since limber pine have thinner bark than other pine species.³ In the late 1980s, studies were conducted on tree health in reaction to the Lawn Lake flood of 1982; trees were found to have abnormally high amounts of iron.⁴ Wildlife related studies have evaluated the importance of limber pine seeds to black bears and Clark's Nutcrackers.^{5,6,7}

Ecological research continued with emphasis on distributional shifts and fire effects following the 1978 Ouzel Fire.^{8,9} The recent MPB outbreak began in the park in 2002, in lodgepole pine stands (B. Verhulst, pers. comm). Extensive bark beetle mortality in lodgepole and limber pines was observed on the East side of the park in 2007; impacts at higher elevations were noted beginning in 2009. Warmer winters and drier summers have supported higher overwinter survival of MPB which in turn led to 19% mortality of RMNP's limber pine between 1996 and 2014.² Fire suppression has likely inhibited limber pine expansion in recent decades.

In anticipation of the spread of WPBR into the park, efforts began in 2008 to understand how to conserve limber pine in the presence of WPBR.^{2,10,11,12} WPBR was later confirmed in RMNP in 2010.¹³ On a positive note, genetic resistance to WPBR was found in approximately 20% of limber pine.² This is a relatively high rate of resistance compared to other areas studied. In addition to better understanding blister rust effects, research has also gone into trying to model or predict how limber pine populations will change in the future.^{14,15,16,17}

Management

Dr. Anna Schoettle, a US Forest Service (USFS) research plant ecophysioecologist at the Rocky Mountain Research Station, has been conducting limber pine research in RMNP for decades. Dr. Schoettle's work, in partnership with USFS plant pathologist Kelly Burns, led to the initiation of a long-term monitoring program and the development of the *Limber Pine Conservation Strategy* (2015²) for the park. The Limber Pine Conservation Strategy, initiated in 2008, employs on-site and off-site approaches to management to promote conservation. It aims to increase the limber pine population, sustain genetic diversity in limber pine stands, identify WPBR resistant trees, and monitor limber pine communities for rust. RMNP's Forestry team, with the support of volunteers, is actively implementing the strategy.

To combat pine beetle infestations, Verbenone packets are placed on 15 trees within 17 monitoring plots each year (255 total). To proactively assess WPBR, surveys are done within each of the monitoring plots and six wetland early detection monitoring plots. Wetland sites were selected for the early detection plots because they provide the high humidity and cool temperatures necessary for fungal spore release and germination. WPBR has been found in the Beaver Ponds area and below Hidden Valley. RMNP has taken a proactive stance to reduce blister rust pressure by having a monitoring and sanitizing program. As soon as a tree is confirmed to have blister rust, the infected part is cut off so that the fungal spores cannot spread to the surrounding area.

Seed collections and seed/seedling outplantings are another conservation measure. Some seeds are archived in a freezer for later use if needed and for genetic research. Trees identified as resistant to WPBR are monitored periodically.

Overall, the park has seen a decline in the limber pine population, primarily due to MPB. It is hard to say what the future holds – whether a continually shrinking population or its stabilization – but RMNP is committed to conserving these ecologically important trees and will continue to work toward their protection and conservation.



Limber pine monitoring and conservation activities could not be done without the help of dedicated volunteers. Data is recorded on a variety of factors including tree health status, percent canopy kill, percent of branches with fresh cones, other notable damages to the trunk and branches, and signs and symptoms of WPBR and MPB.



NPS/VIP Vpelton

Limber pine seeds are an important food source for the Clark's Nutcracker, who support limber pine seed dispersal by caching ripe seeds in the late summer and fall. When left unclaimed, the seeds may sprout and establish in new areas.

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*These and other resources can be found at <https://irma.nps.gov/DataStore/Collection/Profile/4399>

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