



White Pine Monitoring



Great Basin bristlecone pine on a talus slope in Great Basin National Park overlooking the sagebrush steppe. NPS Photo / Nicole Hupp.

Background

White pines are the suite of pine tree species whose needles grow in bundles of five and, in the western US, include eight species. Several of these species are high-elevation, long-lived specialists that grow in environments too harsh for other tree species and are considered foundation species.

Foundation species create locally stable environments upon which other species depend, and they regulate important ecosystem processes. As foundation species, white pines influence snowmelt and stream flow, thus moderating local environments and allowing for establishment of shade-tolerant species. They also provide habitat and food for birds and mammals. If foundation species are lost, a cascade of impacts can occur, including shifts in biological diversity and in the function and stability of the community.

What are the Threats to White Pines?

Western coniferous forests are facing growing threats, including outbreaks of native pests and pathogens,

invasive species, and altered disturbance regimes. Increased atmospheric warming, carbon dioxide concentration, and nitrogen deposition, as well as changes in precipitation (timing, amount, and type) and decades of fire suppression pose short- and long-term threats. Of particular concern is the exotic fungal pathogen *Cronartium ribicola*, which causes white pine blister rust in five-needle pines. Blister rust eventually kills the host tree, altering forest stand succession and thus ecosystem structure and function. At this time, blister rust has not been observed in Great Basin National Park (GRBA) white pines, and initiating monitoring while stands are healthy will facilitate early detection of this pathogen, as well as the impacts of other threats.

Monitoring White Pines

The Mojave Desert Inventory and Monitoring Network (MOJN) monitors the two white pine species found in GRBA, limber pine (*Pinus flexilis*) and Great Basin bristlecone pine (*P. longaeva*). Great Basin bristlecone pine grows at high elevations and is very long-lived.



Measuring diameter at breast height (DBH) of a bristlecone pine in Great Basin National Park. NPS Photo / Nicole Hupp.

With individuals known to be more than 5,000 years old, it is among the oldest living species on earth! It has been identified by GRBA as a species of management concern for the park. While these two species have different ecological requirements, both are at risk to blister rust as well as the native mountain pine beetle (*Dendroctonus ponderosae*) and dwarf mistletoe (genus *Arceuthobium*).

Objectives

The goal of this monitoring protocol is to detect and interpret changes in community dynamics in forests containing limber and Great Basin bristlecone pine. Our primary monitoring questions are:

- 1) Are white pine forests changing in structure and species composition?
- 2) Are rates of tree mortality increasing, are rates of recruitment from seedlings to trees decreasing, and is seedling regeneration decreasing?

- 3) Are the key disturbance species—the invasive *Cronartium ribicola* and native mountain pine beetle and dwarf mistletoe—increasing in incidence and severity?

Sample Design

Target populations addressed in this protocol include white pine forest and woodland communities. The sample frame is implemented in the three vegetation alliances where white pines are found: Great Basin Bristlecone Pine Subalpine Woodland, Great Basin Bristlecone Pine Montane Woodland, and Great Basin Limber Pine Woodland.

The sampling design allocates permanent plots to random locations and is flexible and efficient; it allows inclusion of new or replacement sampling sites as needed. Plots are sampled using a 3-year rotating panel design, with a third of the total sample allocated to each panel. One panel of plots is monitored each year.

Management Applications

White Pine Monitoring will provide Park managers with information that has multiple applications:

- Monitoring these iconic and foundational tree species will enable early detection of disease, damage, or decline related to the numerous threats white pines face. Early detection provides managers with the information needed to inform appropriate responses.
- It will assist park resource managers in targeting limited financial resources and personnel time toward addressing the highest priority concerns.
- Sharing information about the importance and condition of these long-lived, sensitive tree species with the public will enhance visitor experiences and contribute to protecting the ecosystems where they are found.
- Combining white pine data from GRBA with data from other parks in the western US allows park managers to problem-solve together and collaborate on solutions instead of working alone.

More Information:

The protocol [narrative](#) and [standard operating procedures](#) for GRBA white pine monitoring were published in 2018.

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To learn more about the Mojave Desert Network Inventory and Monitoring Program, please visit our website at: <https://www.nps.gov/im/mojn/index.htm>

