

Greater Yellowstone Network

RESOURCE BRIEF

National Park Service
U.S. Department of the Interior
Inventory & Monitoring Program



Whitebark Pine in the Greater Yellowstone Ecosystem

Whitebark pine (*Pinus albicaulis*) occurs at high elevations and in subalpine communities in the Pacific Northwest and northern Rocky Mountains. It is a key component in the upper ranges of these ecosystems where it provides a multitude of ecological functions, including regulating runoff by slowing the progress of snowmelt and providing high-energy food sources to birds and mammals. Whitebark pine often grows in locations that are inhospitable to other tree and vegetative species, though once it has populated an area, it creates favorable habitat that enables other species to colonize. By generating these beneficial microenvironments, whitebark pine plays a significant role in forest successional processes and promotes diversity.

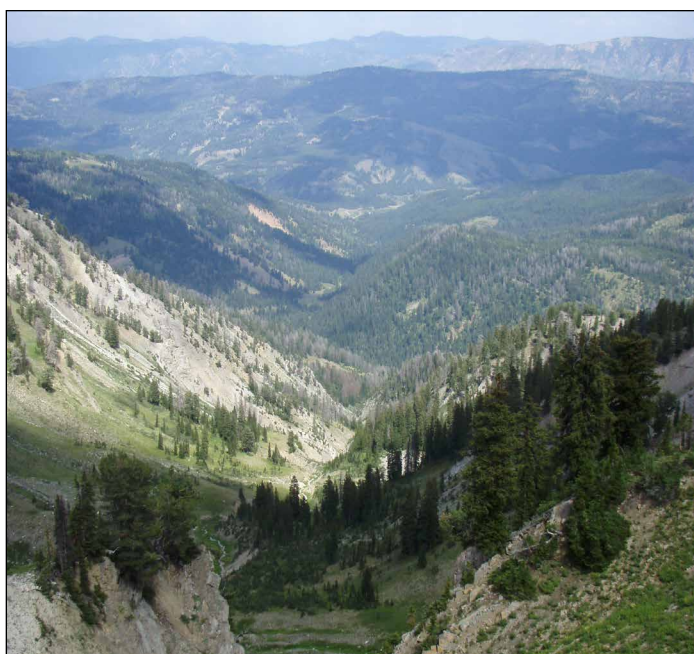
Purpose and Objectives

The purpose of the whitebark pine monitoring program is to detect changes in the health and status of whitebark pine populations across the Greater Yellowstone Ecosystem (GYE) due to infection by white pine blister rust, attack by mountain pinebeetle, and impacts by other environmental and anthropogenic agents. Objectives include:

1. estimating the proportion of live whitebark pine trees infected with white pine blister rust and the rate at which infection changes over time;
2. determining the relative severity of infection of white pine blister rust in whitebark pine trees;
3. estimating the survival of whitebark pine trees, taking into account effects of white pine blister rust, mountain pine beetle, and fire; and
4. assessing and monitoring whitebark pine recruitment in the understory.

Methods

Details of the sampling design and field methodology can be found in the Interagency Whitebark Pine Monitoring Protocol for the GYE. The basic approach is a two-stage cluster design with stands of whitebark pine being the primary units and 10x50 m transects being the secondary units. Initial establishment of permanent transects took place between 2004 and 2007; during this period, 176 permanent transects in 150 whitebark pine stands were established and all whitebark pine trees >1.4 m tall were permanently marked in order to estimate changes in white pine blister rust infection and survival rates over an extended period. In 2008, transects were randomly assigned to one of four panels; each panel consists of approximately 44 transects. Each panel is scheduled to be visited every four years. During revisits, new trees that grow to 1.4 m tall are tagged and monitored into the future. The sample of 176 transects is a probabilistic sample that provides statistical inference to the GYE.



NPS/RACHEL SIMONS

High country in the Greater Yellowstone Ecosystem.

Results

Status of White Pine Blister Rust

Approximately 885 live tagged trees in 43 transects were examined for blister rust infection in 2012. There was no significant evidence of a change in the percent of live trees infected.

Of the 807 trees that were surveyed both in 2008 and 2012, approximately 66% (531) had no evidence of blister rust infection, 19% (155) were infected in both years, 7% (59) transitioned from no evidence of infection to infected, and 8% (62) went from infected to uninfected. A transition from infected to uninfected could be the result of factors such as observer error, an earlier-documented infection based on indicators that upon resurvey no longer meets the established standards of three indicators in the same location, or infected branches that broke and fell off.

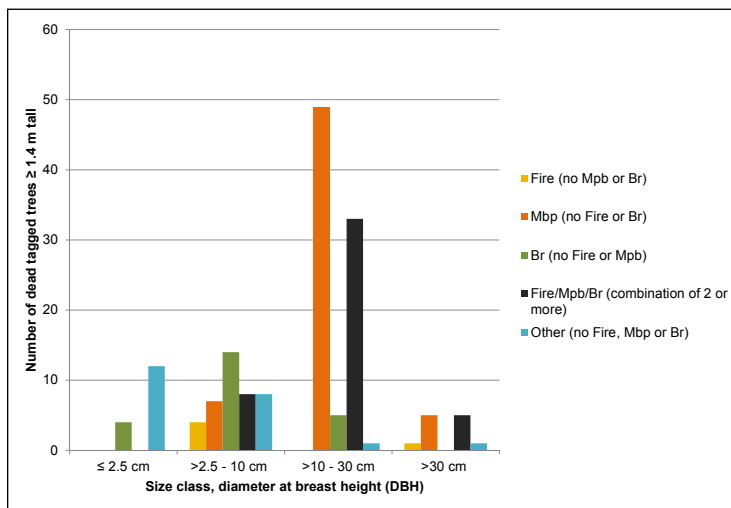
Presence of Mountain Pine Beetle

Trees in high-elevation forests across the GYE are experiencing elevated mortality as a result of the current mountain pine beetle epidemic. Mountain pine beetle primarily attack whitebark pine trees that are ≥ 10 cm DBH. Of the 156 dead trees recorded in 2012, 108 trees (69%) occurred in the >10 -30 cm DBH size class, with approximately 56% of those having evidence only of mountain pine beetle infestation.

Similar to white pine blister rust infection, the mountain pine beetle infestation is widespread and varies in severity throughout the GYE. Of the 176 established transects, 123 have recorded evidence of mountain pine beetle infestation while 53 have no observed evidence of mountain pine beetle infestation by the end of 2012.

Tree Survival

To determine whitebark pine mortality, we resurvey all transects to record the status of permanently tagged trees >1.4 m tall. The majority of trees that have been added to the sample frame fall within the ≤ 2.5 cm DBH size class; this cohort has experienced a net increase of roughly 25%. Based on monitoring observations, trees ≤ 2.5 cm DBH can reproduce; it will be informative to track how this metric changes as more data are collected in future years, particularly as the mountain pine beetle outbreak wanes.



As of 2012, approximately 1,134 tagged trees have died, primarily from DBH size classes >10 cm. Figure 1 presents evidence of fire, mountain pine beetle, white pine blister rust, a combination of the three, or other that were recorded for each dead tagged tree and the DBH size class (<2.5 cm, >2.5 -10 cm, >10 -30 cm, and >30 cm).

Discussion

Status and trend assessments are more meaningful after many years of monitoring as comparable data accumulate over time. Comparisons of whitebark pine monitoring data from year to year is misleading due to different transects being monitored each year. The reader is cautioned not to draw conclusion about the health and status of whitebark pine in the GYE based solely on this summary report.

Based on 2012 data, white pine blister rust infection remains widespread and variable across the ecosystem. Our proportional estimate of a 20% to 30% infection rate for the GYE reflects the geographical differences that exist throughout the sample frame. Our data suggest that the rate of mortality of tagged trees has decreased compared to mortality levels from previous years. These findings lend support to a waning mountain pine beetle outbreak as articulated by other federal agencies and private entities. We will establish whitebark pine monitoring transects on BLM lands in Wyoming following the Interagency Whitebark Pine Monitoring Protocol, and we will continue to collaborate with other research endeavors that are taking place in the ecosystem as well as participate on the Greater Yellowstone Coordinating Committee Whitebark Pine Subcommittee.

Figure 1. Mortality of tagged trees from 2012 surveys with associated health status indicators. Indicators (fire, mountain pine beetle, white pine blister rust, a combination of the three, or other) were recorded for each dead tagged tree by DBH size class (≤ 2.5 cm, >2.5 -10 cm, >10 -30 cm, and >30 cm).

Greater Yellowstone Whitebark Pine Monitoring Working Group

The Greater Yellowstone Whitebark Pine Monitoring Working Group is a collaboration of the National Park Service, U.S. Forest Service, U.S. Fish and Wildlife Service, U.S. Geological Survey, and Montana State University, organized under the auspices of the Greater Yellowstone Coordinating Committee.



Greater Yellowstone Whitebark Pine Monitoring Working Group. 2013. Monitoring whitebark pine in the Greater Yellowstone Ecosystem: 2012 annual report. Natural Resource Data Series NPS/GRYN/NRDS—2013/498. National Park Service, Fort Collins, Colorado.

Greater Yellowstone Whitebark Pine Monitoring Working Group. 2011. Interagency whitebark pine monitoring protocol for the Greater Yellowstone Ecosystem, version 1.1. Greater Yellowstone Coordinating Committee, Bozeman, Montana.