Greater Yellowstone Network
RESOURCE BRIEF

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

Whitebark Pine in the Greater Yellowstone Ecosystem
2014 Annual Report

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 serves a multitude of ecological functions, including regulating runoff by slowing spring snowmelt and providing high-energy food sources to birds and mammals. Whitebark pine often grow 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. Recent population declines of whitebark pine in the Greater Yellowstone Ecosystem (GYE), largely attributed to the mountain pine beetle outbreak, are a significant concern to land managers.

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 GYE. Objectives include:

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


NPS

Monitoring whitebark pine in the Greater Yellowstone Ecosystem.

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. Stands of whitebark pine are the primary units and 10 × 50 m transects are the secondary units. From 2004 to 2007, 176 permanent transects were established in 150 whitebark pine stands. Within each transect, all whitebark pine trees >1.4 m tall were tagged in order to evaluate changes in blister rust infection and monitor survival rates over time. In 2008, transects were randomly assigned to one of four panels; a panel consists of approximately 44 transects. Each panel is scheduled to be visited every four years. To closely document changes in tree survival during the recent mountain pine beetle epidemic, we temporarily increased the frequency of panel monitoring to every other year between 2008 and 2013. We returned to the four year revisit schedule in 2014. The probabilistic sample of 176 transects supports statistical inference to the GYE whitebark pine population.

Results

Results for 2014 are based on data collected from Panel 3 transects.

Status of White Pine Blister Rust

Approximately 1,055 live, tagged trees in 43 transects were examined for blister rust infection in 2014. This includes newly tagged trees added during the surveys.

Greater Yellowstone Whitebark Pine Monitoring Working Group. 2015. Monitoring whitebark pine in the Greater Yellowstone Ecosystem: 2014 annual report. Natural Resource Data Series NPS/GRYN/NRDS—2015/796. National Park Service, Fort Collins, Colorado. https://irma.nps.gov/App/Reference/Profile/2222132

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. https://irma.nps.gov/App/Reference/Profile/660369

Of the 923 trees that were surveyed in 2010 and 2014, approximately 70% (647) had no evidence of blister rust infection, 17% (155) were infected in both years, 7% (65) transitioned from no evidence of infection to infected, and 6% (56) went from infected to uninfected. A tree may transition from infected to uninfected due to observer variability, pruning or complete death of formerly infected branches, or as a result of indicator-based infections that upon subsequent revisits no longer meet established infection criteria.

Presence of Mountain Pine Beetle

Similar to blister rust infection, the mountain pine beetle infestation is widespread and varies in severity throughout the GYE. Of the 176 established transects across all four panels, 126 had recorded evidence of mountain pine beetle infestation, while 50 had no observed evidence of mountain pine beetle infestation by the end of 2014.

Mountain pine beetle primarily attack whitebark pine trees that are >10 cm in diameter at breast height (DBH). Of the 33 newly dead tagged trees recorded in 2014, 14 (42%) occurred in the >10 cm size class. Four of these trees were documented with evidence of mountain pine beetle infestation only; that is, there were no signs of other probable influences on mortality, such as fire or blister rust.

Tree Survival

To determine whitebark pine survival and mortality, we resurvey all transects to record the status of permanently tagged trees. As of 2014, approximately 1,440 tagged trees have died across all four panels in the sample frame, primarily from the >10 cm DBH size class. Figure 1 shows the 33 newly dead tagged trees from 2014 surveys (recorded by DBH size class) that exhibited evidence of fire, mountain pine beetle infestation, blister rust, a combination of the three, or other factors.

New and Reproducing Trees

Trees are tagged and added to the sample frame once they reach a height above 1.4 m. In 2014, 31 new trees were tagged and over 2,166 understory trees (≤1.4 m tall) were documented. Currently, there are 623 reproducing tagged trees across the 176 transects; a few of these trees are ≤2.5 cm DBH.

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 conclusions about the health and status of whitebark pine in the GYE based solely on this brief.

Based on all 176 transects, blister rust infection remains widespread and variable across the ecosystem. Our proportional estimate of a 20–30% infection rate for the GYE reflects the geographical differences that exist throughout the study area. Our preliminary analysis of data from Panel 3 transects this year suggests no change in blister rust infection between 2010 and 2014. Wildland fire is playing an increasing role in whitebark pine mortality, having affected 250 trees on 15 transects throughout the study area since 2008.

In 2014, we also established 4 permanent whitebark pine/limber pine monitoring plots and evaluated 86 rapid assessment plots on Bureau of Land Management lands in Wyoming. 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.

See the newly published NPS Natural Resources Technical Report documenting our first step-trend analysis of whitebark pine monitoring in the GYE at https://irma.nps.gov/App/Reference/Profile/2216554.

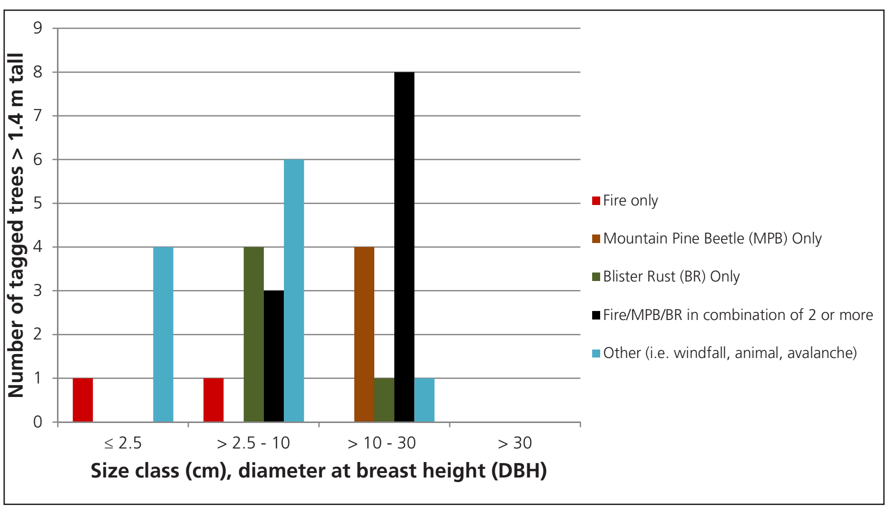

Figure 1. Size class and mortality influencing agents observed for 33 dead tagged whitebark pine trees in Panel 3 transects, 2014.

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.