



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 pine beetle, 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 >1.4 m tall;
3. estimating the survival of whitebark pine trees, taking into account effects of white pine blister rust, mountain pine beetle, fire, and other agents; and
4. assessing and monitoring whitebark pine recruitment in the understory.

Methods

An interagency monitoring program developed methods to track whitebark pine survival in the GYE. The initial establishment of permanent transects took place between 2004 and 2007; during this period, 176 permanent transects in 151 whitebark pine stands were established and 4,774 individual 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. Transects are visited on a four-year rotation, although during the mountain pine beetle epidemic they are visited every two years to measure tree status.

Status of White Pine Blister Rust

The 2007 baseline estimate of the proportion of live whitebark pine trees infected with white pine blister rust in the GYE is 20%. White pine blister rust infection remains widespread throughout the ecosystem. We are in the pro-



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A stand of whitebark pine in the Greater Yellowstone Ecosystem.

cess of analysing the data from 2008-2011 and completing the first step-trend analysis. This will provide the new rate of infection as well as explain how this rate may be impacted by loss of trees from the mountain pine beetle epidemic, fire, or other causes.

Tree Survival

To determine whitebark pine mortality, all transects were resurveyed between 2008 and 2011 to reassess the status of permanently tagged trees >1.4 m tall. By the end of 2011, we observed a total of 977 dead tagged whitebark pine trees within the boundaries of the permanent monitoring transects; this equates to a loss of approximately 20% of the original live tagged tree sample. While transects are experiencing varying degrees of mortality, they are also experiencing varying degrees of recruitment. Once a whitebark pine tree within the transect boundary reaches a height greater than 1.4 m tall, it is permanently tagged and included in the live, tree sample. As of 2011, 3,767 (79%) of the originally marked trees remained alive, 30 trees were not relocated (1%), and an additional 301 new trees were added.

Presence of Mountain Pine Beetle

High elevation forests across the GYE are experiencing elevated mortality as a result of the current mountain pine beetle epidemic. Mountain pine beetle exhibit a propensity for attacking whitebark pine trees that are 10 cm diameter at breast height (DBH) and greater. Trees that are less than 10 cm DBH are not generally large enough to successfully support mountain pine beetle brood. By the end of 2011, we found that 33% of the trees >10 cm DBH had died, whereas only 8% of the trees ≤10 cm had died (Figure 1). Of the 176 established transects, 111 have recorded evidence of mountain pine beetle infestation while 65 have no observed evidence of mountain pine beetle infestation (Figure 2).

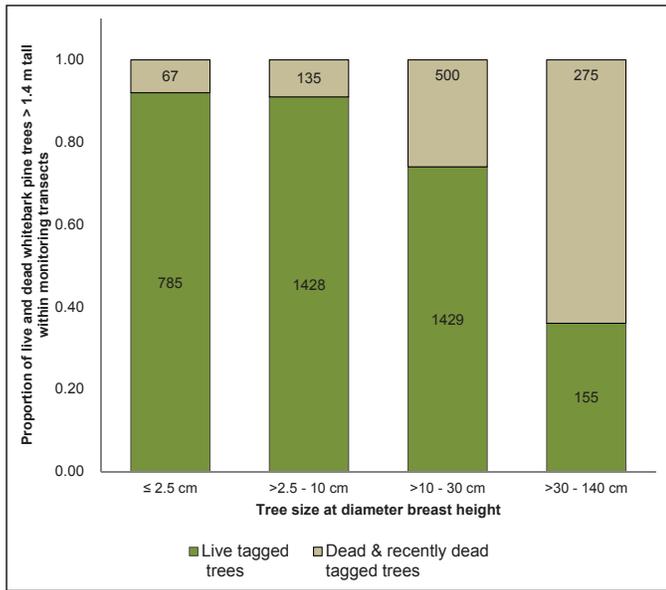


Figure 1. Proportion of live, dead, and recently dead tagged whitebark pine > 1.4 m tall within the monitoring transects by size class. A recently dead tree has persistent non-green needles, whereas a dead tree has shed all of its needles. These values are based on the original sample (4,774) and do not include the 301 trees that have been added since initial establishment. Dead and recently dead could be from any number of causes such as mountain pine beetle, fire, windthrow, or unknown.

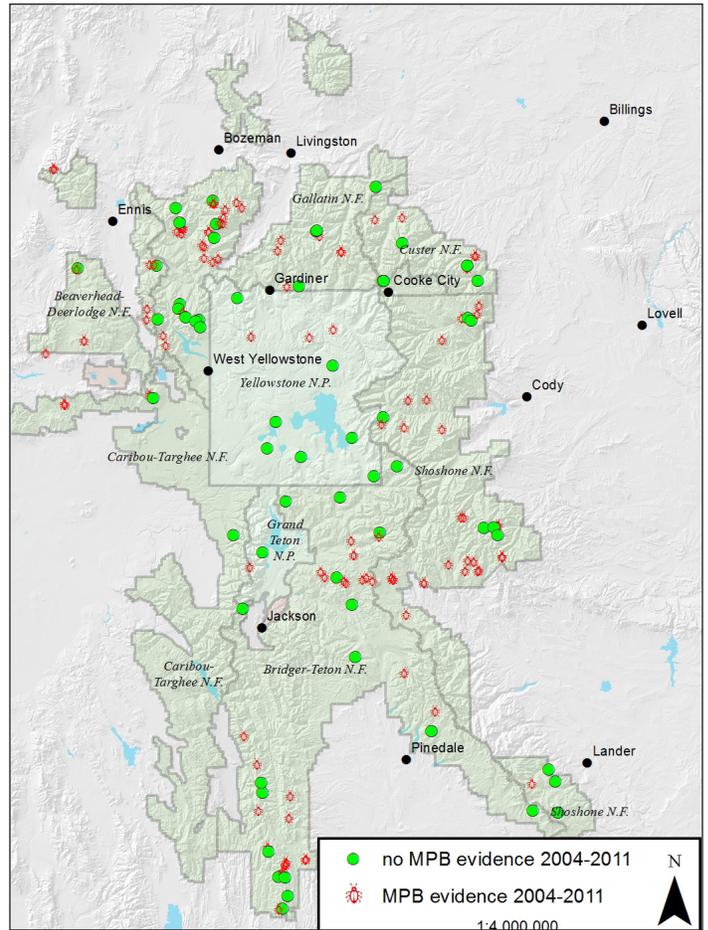


Figure 2. Location of transects throughout the GYE with and without evidence of mountain pine beetle infestation.

Future Direction

This long-term monitoring program provides critical information that will help determine the likelihood of whitebark pine persisting as a functional and vital part of the ecosystem. In addition, data from this program are currently being used to inform managers, guide management strategies and restoration planning, and substantiate conservation efforts throughout the GYE. The interagency protocol has also been a valuable resource for a variety of agencies embarking on five-needle pine monitoring.

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.



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Greater Yellowstone Whitebark Pine Monitoring Working Group. 2012. Monitoring Whitebark Pine in the Greater Yellowstone Ecosystem: 2011 Annual Report. Natural Resource Report NPS/GRYN/NRDS—2012/278. 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, USA.