

Greater Yellowstone Network

RESOURCE BRIEF

National Park Service
U.S. Department of the Interior

Inventory & Monitoring Division
Natural Resource Stewardship and Science



Whitebark Pine Monitoring in the Greater Yellowstone Ecosystem: 2023 Data Summary

Whitebark pine (*Pinus albicaulis*) is a keystone species in subalpine communities throughout the western United States. It provides high-energy food for birds and mammals. Its broad canopy provides shade that helps to prolong spring snowmelt. Once established, this slow growing conifer creates favorable habitat to support forest succession. However, over the last 2 decades, whitebark pine forests have been steadily declining in response to infection by white pine blister rust (*Cronartium ribicola*), periodic mountain pine beetle (*Dendroctonus ponderosae*) outbreaks, and the suppression of low severity fires that historically pass through these forests. As a result of these population decreases, the whitebark pine was listed as threatened under the Endangered Species Act by the U.S. Fish and Wildlife Service in January 2023.

Since 2004, the Greater Yellowstone Network has been monitoring whitebark pine in national parks and forests at 176 transects (divided across 4 panels) in the Greater Yellowstone Ecosystem as part of an interagency whitebark pine long-term monitoring program. The objectives are to document the current status and changes in

- Infection of whitebark pine by white pine blister rust
- Severity of white pine blister rust infection on whitebark pine
- Mortality of whitebark pine
- Recruitment into the reproducing population of whitebark pine

In 2013, the Wyoming Bureau of Land Management began monitoring whitebark pine and limber pine, providing more contiguous

information for evaluating the overall health of five-needle pine species in the region. Those results are reported separately in the NPS.gov article series, “[Five-Needle Pine Monitoring on Wyoming Bureau of Land Management Forests in the Greater Yellowstone Ecosystem.](#)”

This brief summarizes results from visiting Panel 4 transects on national park and forest lands in the Greater Yellowstone Ecosystem.

Key Findings—2023—Panel 4 Trees

- Of the 1003 live, tagged trees examined on transects, 285 (28%) showed signs of blister rust infection. Of these 285 infected trees, 172 (60%) had bole (trunk) infections.
- The majority of live trees (65%) had no evidence of blister rust infection between 2019 to 2023, although 11% transitioned from uninfected to infected.
- We observed 78 newly dead trees since 2019.
- Of the 44 Panel 4 transects, 4 visited in 2023 no longer had live, tagged trees since monitoring first began at the panel.
- 89 new trees were added to the tagged, >1.4 m tall population.
- We counted 2,575 five-needle pines ≤1.4 m tall in understory plots across all transects. (Whitebark pine cannot be distinguished from limber pine (*Pinus flexilis*) as seedlings.)

Detailed Findings for Panel 4 Trees

Infection Status

We examined 1003 live tagged trees in 44 Panel 4 transects for signs of blister rust infection in 2023. This number includes 89 new live trees added during the 2023 survey. Of the 1003 live trees, 285 (28%) showed signs of blister rust infection. Of these 285 infected trees, 172 (60%) had bole (trunk) infections (Figure 1).

Change in Infection Status

Comparing only trees surveyed in both 2019 and 2023 (912 trees), we found these changes in infection status:

- 590 (65%) remained free of blister rust infection evidence
- 181 (20%) had sign of infection in both years
- 99 (11%) developed evidence of infection over the 4 years
- 42 (5%) no longer showed evidence of infection by 2023 (this can result from observer error, a change in evidence criteria, or infected branches self-pruning)

Infection Severity

We chronicled if and when infection location changed in the canopy (branches) and bole of infected, tagged trees between time-steps. A bole infection is considered more consequential than a canopy canker. A bole infection compromises not only the overall longevity of the tree, but its functional capacity for reproductive output because blister rust can lead to the loss of the cone-bearing branches above the infected site.

Infection location changed for trees that were documented with blister rust in 2019 and again in 2023 (Figure 2). Fifteen trees (8%) with canopy-only infections in 2019 that remained infected in 2023 transitioned to a more severe state of infection in the bole by 2023. Overall, blister rust infection is most common in the 10 to ≤30 cm DBH class.

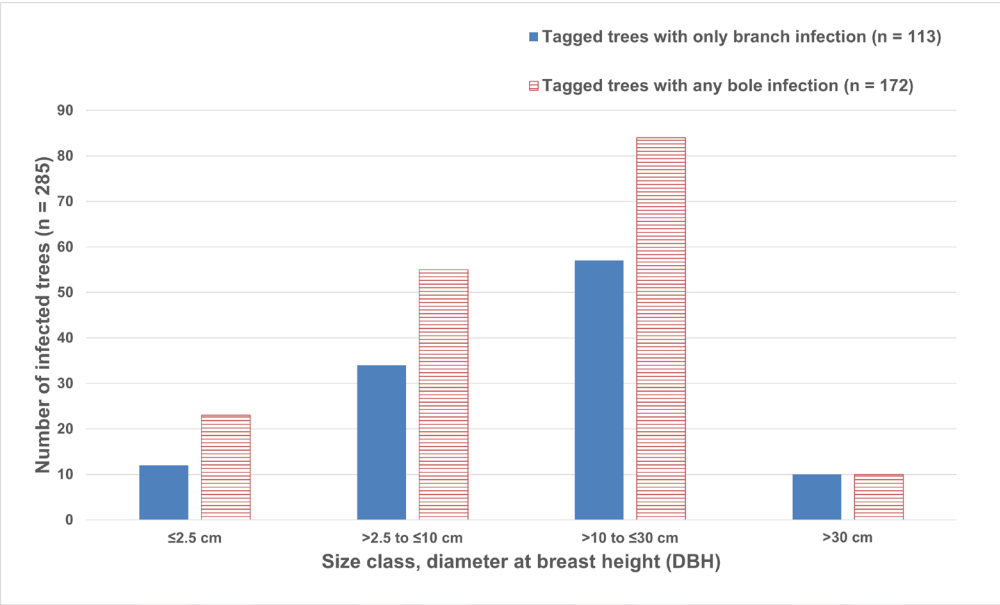


Figure 1. Blister rust infection was detected on 285 live whitebark pine trees during 2023 surveys of Panel 4 transects. Trees are grouped by size class and blister rust location (canopy only or bole infection).

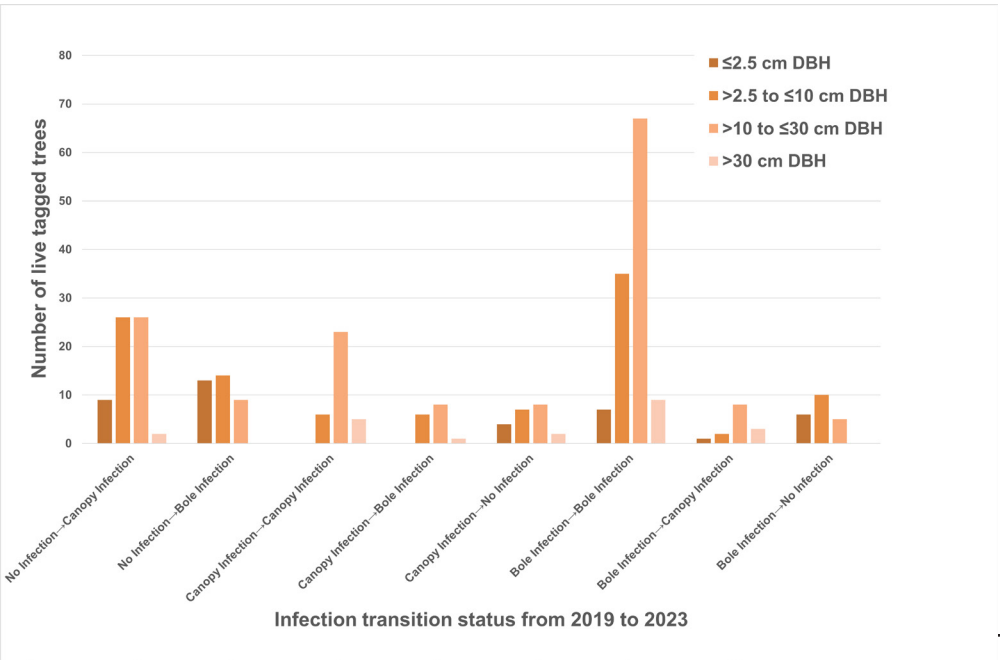


Figure 2. Infection transition status by diameter at breast height (DBH) category for live, tagged whitebark pine trees on Panel 4 transects surveyed in 2019 and again in 2023. The total count of live tagged trees surveyed in both years was 912.

Mortality

In 2023, we observed 78 newly dead tagged trees on Panel 4 transects (Figure 3). Of these, 22 (28%) were ≤2.5 cm DBH, 28 (36%) were >2.5 to ≤10 cm DBH, and 28 (36%) were >10 cm DBH. Thirty-nine (50%) of the dead trees had evidence of blister rust infection from one or more previous surveys but no evidence of mountain pine beetle or fire effects. Six dead trees (8%; 1 in the >2.5 to ≤10 cm DBH category; 3 in the >10 to <30 cm DBH category; and 2 in the >30 cm DBH category) had signs of a combination of blister rust, mountain pine beetle, and/or fire. Two trees (3%) died of unknown causes. Twenty (26%) of the dead trees had previously been recorded with evidence of cone production. Four Panel 4 transects no longer had live, tagged trees, but 2 of these were documented with five-needle pine regeneration (trees ≤1.4 m tall). Three of these transects experienced stand replacing burns: one burned in the 2012 Dewdrop Fire in Yellowstone National park, and two burned in the 2012 Millie Fire on the Custer-Gallatin National Forest. The fourth transect with no live trees was located in an avalanche chute that uprooted live, tagged trees over several years until none remained.

Recruitment

We assessed recruitment for whitebark pines by the presence of cone-bearing trees (reproduction), seedlings and saplings in the understory (regeneration), and newly tagged trees surpassing 1.4 m in height.

In 2023, 106 live tagged whitebark pine trees on Panel 4 had cone production evidence (current year cones or previous year cone scars) and the majority of these reproducing trees (95) had a DBH

>10 cm (Figure 4). Of the trees with cone evidence, 48 (45%) had signs of blister rust infection, with 19 (40%) noted as bole infected.

We counted 2,575 understory five-needle pines (≤1.4 m tall) on 43 transects. This equates to a density of approximately 60 small trees per transect. Of the small trees, we observed 31 (1%) to be infected with blister rust.

We tagged 89 new trees across 23 transects that had surpassed 1.4 m tall since the last survey. Five (6%) of the newly tagged trees had evidence of blister rust infection.

Whitebark Pine Protection and Restoration

Results from 2023 monitoring add to the growing dataset compiled by the Greater Yellowstone Ecosystem Interagency Whitebark Pine Monitoring Program. The program is a collaboration among national parks, national forests, and Bureau of Land Management lands in the Greater Yellowstone Ecosystem. This multiyear, landscape-wide whitebark pine dataset is available to inform management decisions across the region, including the recent US Fish and Wildlife listing of the whitebark pine as threatened under the Endangered Species Act in January 2023.

More Information

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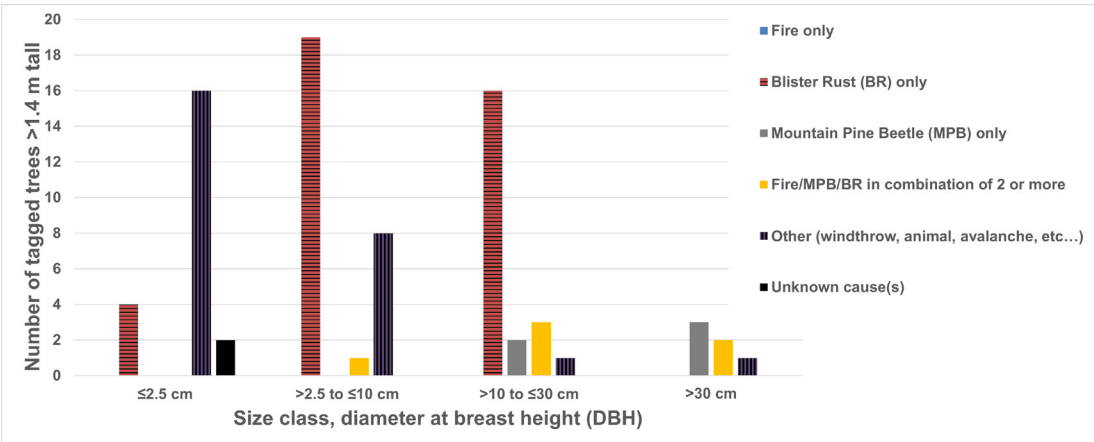


Figure 3. Seventy-eight tagged whitebark pine trees were recorded as newly dead on Panel 4 transects in 2023. These trees are categorized by DBH size class and mortality influencing agent.

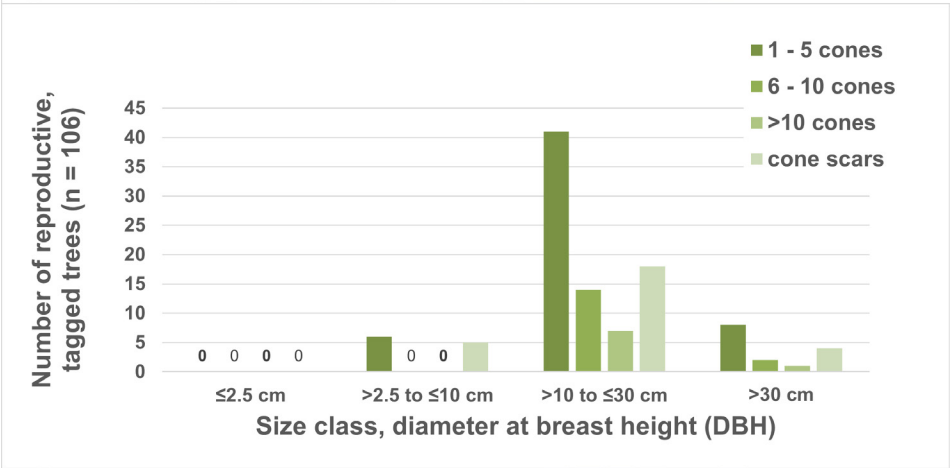


Figure 4. Reproducing whitebark pine trees grouped by the number of cones (cone bin) and DBH category on Panel 4 transects in 2023.

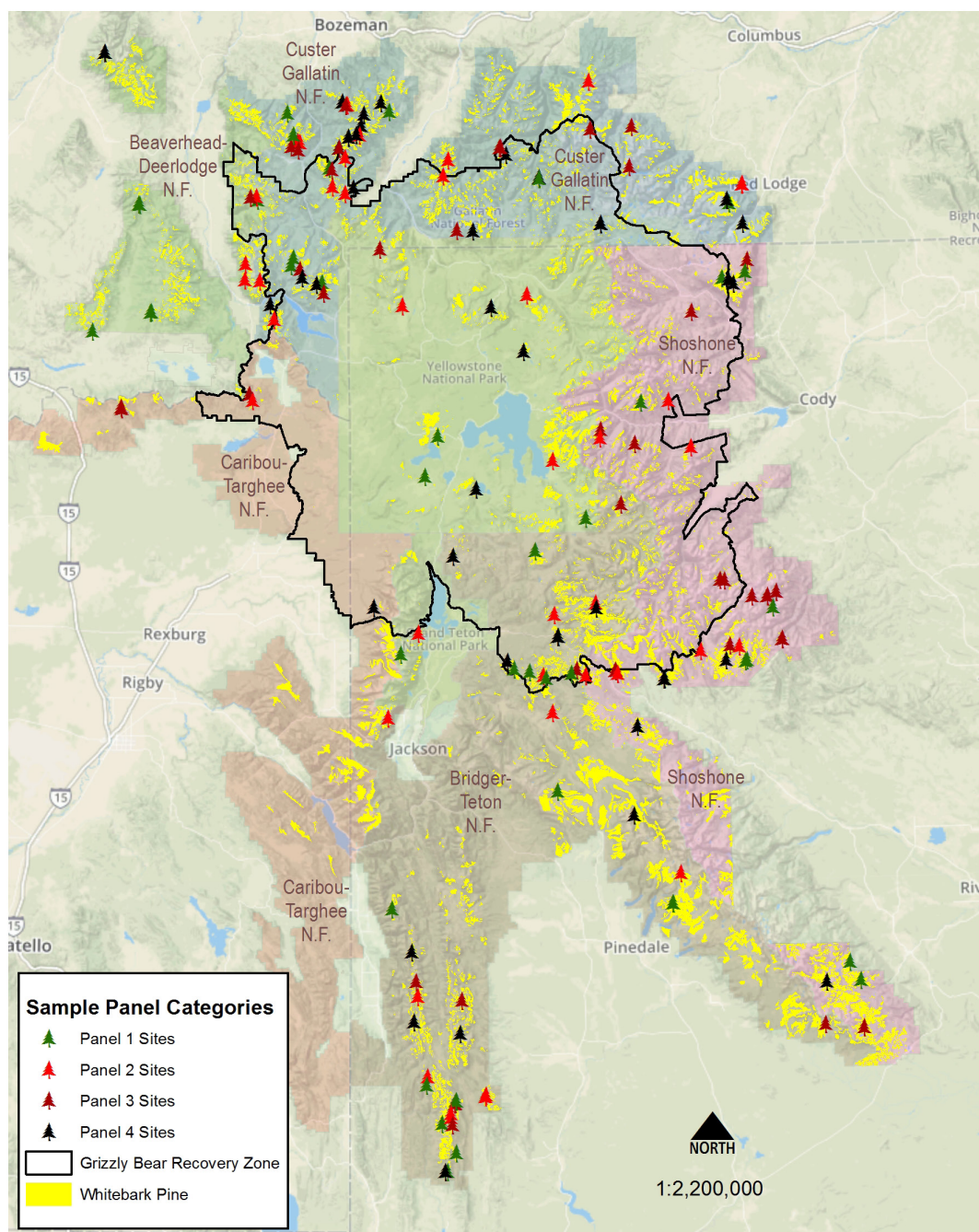
Methods and Study Area

The study area (see map) contains 176 transects, divided into 4 panels of approximately 43 transects each. We sample a panel of transects a year. Panel 4 transects were last surveyed in 2019.

Details of the sampling design and field methodology can be found in the [Interagency Whitebark Pine Monitoring Protocol for the Greater Yellowstone Ecosystem](#), as well as in a web article series on NPS.gov titled, “[Whitebark Pine Monitoring in the Greater Yellowstone Ecosystem](#).”

Past monitoring reports are available on the Greater Yellowstone Network website: <https://www.nps.gov/im/gryn/whitebark-pine.htm>.

Monitoring data are available from the NPS Integrated Resource Management Applications portal at <https://irma.nps.gov/DataStore/Reference/Profile/2209186>.



Whitebark pine survey transects within the Greater Yellowstone Ecosystem.