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### **WHITEBARK PINE SEEDS AT RISK, HARVARD STUDY SHOWS**

New research by Harvard University suggests more trouble ahead for the whitebark pine, a prominent mountain tree species integral to wildlife and water resources in the Western U.S. and Canada.

Over the past decade, some populations of whitebark pine have declined by more than 90 percent. Infestations of mountain pine beetle and outbreaks of white pine blister rust are being exacerbated by a warming climate. But these declines may be just the beginning.

The Harvard study, supported by the National Science Foundation and published today in the *Journal of Ecology*, suggests that as pine stands are increasingly fragmented by widespread tree death, surviving trees may be hindered in their ability to produce their usually abundant seeds.

“With fewer seeds, you get less regeneration,” says Joshua Rapp from the Harvard Forest, lead author of the study.

Whitebark pine populations vary between producing a high number of seed cones some years, and a low number of seed cones other years. This variation depends on four factors: male pollen cones, female seed cones, wind, and proximity. Each year, pollen from male cones is carried on the air to fertilize female seed cones perched atop nearby trees.

Elizabeth Crone, senior ecologist at the Harvard Forest and co-author of the study, explains, “In low-cone years, less pollen is released, reaching extremely few female cones. But as more and more whitebark pines die, every year becomes a low-cone year.” In isolated pockets of trees, the gene pool is also diminished, meaning the seeds produced may be less viable over time.

To reach this conclusion, the researchers had to look back in time. They inspected branches from seven whitebark pine sites in western Montana, counting the scars left by pollen cones and seed cones, which are easily traceable by year. “All the years with a high number of seed cones had one thing in common: a high number of pollen cones,” says Rapp. “The success of the seeds seems to depend on the amount of pollen produced.”

Whitebark pine seeds are an essential food source for many animals in mountain habitats. A Clark’s Nutcracker, a type of mountain bird, can store up to 100,000 seeds in underground caches each year. Squirrels also store thousands of seeds underground.

A diminished number of seed cones has a marked impact on grizzly bears, who regularly raid squirrel seed caches to prepare for winter hibernation. Crone notes, “In the past, low years for

whitebark pine cones have led to six times more conflicts between grizzlies and humans, as hungry bears look for food in campgrounds. Now, concerns about viability of whitebark pine populations are one of the main reasons grizzly bears in Yellowstone National Park are still listed as threatened under the Endangered Species Act.”

Birds, squirrels, and bears are not the only species that depend on whitebark pine. Vast stands of whitebark pine help to maintain the mountain snowpacks that provide water to more than 30 million people in sixteen U.S. states each year. Whitebark pines are often the only trees at the highest elevations. Their branches retain snow as it blows across gusty mountaintops. Their shade moderates snow-melt in the spring, keeping flows down the mountain in check.

A small percentage of whitebark pine trees have outlived the ongoing destruction by pests and disease. These trees are the next area of focus for Crone’s team. “We want to find out whether the surviving trees are still producing cones,” Crone says. “They represent how the population will endure.”

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The Harvard Forest, founded in 1907 and located in Petersham, Mass., is Harvard University's outdoor laboratory and classroom for ecology and conservation, and a Long-Term Ecological Research (LTER) site funded by the National Science Foundation. Its 3,500 acre property is one of the oldest and most intensively studied research forests in the U.S. Open to the public year-round, the site includes educational and research facilities, a museum, and recreational trails. More information can be found at <http://harvardforest.fas.harvard.edu/>.

The full *Journal of Ecology* paper, “Sex allocation, pollen limitation and masting in whitebark pine” is available upon request. Photos are available at <http://harvardforest.fas.harvard.edu/press-resources-whitebark-pine-seeds-story-610>.

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