

Western Ecological Research Center

Publication Brief for Resource Managers

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Fungi, Fire Exclusion, and the Fate of Sugar Pine in the Sierra Nevada

An exotic pathogen, white pine blister rust (*Cronartium ribicola*), has caused declines in five-needled pines throughout North America. Simultaneously, fire exclusion has resulted in dense forest stands that may cause additional stress for these generally shade-intolerant pines. Fire exclusion also allows fuels to accumulate, and it is unclear how affected populations will respond to the reintroduction of fire. Although white pine blister rust and fire exclusion are widely recognized threats, long-term demographic data that document the effects of these stressors are rare. In a study recently published in *Ecological Applications*, USGS scientists Drs. Phil van Mantgem, Nate Stephenson, and Jon Keeley and National Park Service fire ecologist MaryBeth Keifer addressed these issues using a unique long-term data set for sugar pine (*Pinus lambertiana*) in the Sierra Nevada of California.

The researchers presented sugar pine population trends from 2,168 individuals over 5–15 years at several burned and unburned sites. Population models indicate that most unburned populations have slightly negative growth rates, implying that if populations are indeed declining, the progression of any such declines is slow. They also found significant differences in the rate of decline among populations, primarily due to variation in recruitment rates. Deaths associated with blister rust and resource competition were common, indicating significant roles for both blister rust and fire exclusion in determining population trajectories. Presumably, both stressors are also affecting recruitment by causing deaths in seedlings (trees <1.37 m tall). Data from 15 prescribed fires showed the immediate effect of burning was the death of many small trees, with the frequency of mortality returning to pre-fire levels within five

Management Implications:

- White pine blister rust and fire exclusion appear to be having significant negative effects on sugar pine populations in the Sierra Nevada of California. All populations had high frequencies of infected trees, and infections were linked to considerable numbers of tree mortalities.
- The population-level effect of white pine blister rust was not uniform, and only one population was clearly declining. Most populations appeared to be buffered against significant declines due to relatively high survivorship of large individuals. However, the increasing scarcity of smaller individuals, often due to blister rust-induced mortalities, and low recruitment rates point to future problems.
- The slow rate of population declines suggests that managers have time to apply and refine recovery strategies (e.g., blister rust resistant genotypes, prescription fire to encourage recruitment and growth) to protect this species.

years. In spite of a poor prognosis for sugar pine, the results suggested that there is still time to apply and refine recovery strategies to protect this species.

van Mantgem, P. J., N. L. Stephenson, M. B. Keifer, and J. E. Keeley. 2004. Effects of an introduced pathogen and fire exclusion on the demography of sugar pine. *Ecological Applications* 14:1590–1602.