LONG-TERM MONITORING OF HIGH-ELEVATION WHITE PINE COMMUNITIES IN PACIFIC WEST REGION NATIONAL PARKS (1C)

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National Park Service Inventory and Monitoring (I&M) networks conduct long-term monitoring to provide park managers information on the status and trends in key biological and environmental attributes (vital signs). Three Pacific West Region I&M networks identified white pine communities as vital signs in their monitoring plans and are collaborating on protocol development, project implementation, and data analyses. Here we present an overview of our approach to long-term monitoring of high-elevation white pine forest dynamics in the Klamath (KLMN), Sierra Nevada (SIEN), and Upper Columbia Basin (UCBN) networks. Whitebark pine (Pinus albicaulis) is monitored in five national parks; : Lassen Volcanic and Crater Lake in the KLMN, and Yosemite, Sequoia, and Kings Canyon in the SIEN. Foxtail pine (P. balfouriana) is monitored in Sequoia and Kings Canyon, and limber pine (Pinus flexilis) is monitored in Craters of the Moon in the UCBN. Previous but limited sampling efforts report low levels of blister rust infection and tree mortality, especially compared to other parts of western North America where severe declines are occurring. In KLMN, 30% of whitebark pine trees were infected within plots, while less than 5% of whitebark pine trees were infected within plots in SIEN. Rust infection was not found on foxtail pine and limber pine within plots in our parks. However, one infected foxtail pine tree was identified in SIEN (Sequoia) in 1995, and several infected limber pine trees were found in UCBN (Craters of the Moon) in 2006. Within respective parks, permanent plots are allocated to random locations using an equal-probability spatially-balanced approach using the Generalized Random Tessellation Stratified (GRTS) algorithm. A serially alternating panel design is used with a three-year rotation for re-surveying permanent plots; each plot is surveyed once per 3-year rotation. Tree- and plot-level data are collected to determine the status and trends in forest structure, species composition, demographic rates, cone production, incidence and severity of white pine blister rust (Cronartium ribicola), occurrence of mountain pine beetle (Dendroctonus ponderosae), and dwarf mistletoe (Arceuthobium spp) infection. Despite previously reported low levels of rust infection, the occurrence of blister rust and mountain pine beetle within several of the network parks, coupled with projections of increased temperature and decreased precipitation in the region portends future declines in white pine communities. This underscores the need for broad-scale collaborative monitoring. Our joint efforts will provide comparable data on rust infection rates and tree damage, pine beetle outbreaks, and tree mortality across a large region with diverse forest types. In addition, monitoring white pine status and trends in these Pacific West Region parks will afford opportunities to share information to better understand the effects of modern stressors on the dynamics of forest ecosystems, and add to a growing body of information on blister rust spread and epidemiology within white pine forest communities. This information can help management adapt to anticipated short- and long-term changes in ecosystem structure and function.

Key words: Whitebark pine, Foxtail pine, Limber pine, GRTS