WC-EM-04-01

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TITLE: An Assessment of White Pine Blister Rust on High Elevation White Pines in California

LOCATION: California

DURATION: Year 2 of 3-year project **FUNDING SOURCE:** Base Plan

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PROJECT OBJECTIVES:

1) To determine current levels of white pine blister rust associated with western white, whitebark, foxtail, limber and bristlecone pines in California.
2) To establish a system of permanent plots for long-term monitoring of rust incidence and severity, and its effects on the dynamics of the high elevation pine stands over time.

JUSTIFICATION:

a. Linkage: The distribution and severity of the introduced invasive pathogen *Cronartium ribicola* on sugar pine populations are well documented in California, and permanent plots are in place to measure trends. However, the presence and impacts of the pathogen on other, higher elevation, 5-needled pines (western white, whitebark, limber, foxtail, and bristlecone) in California are not well documented. There are no current surveys or system of permanent plots that assess the incidence and severity of blister rust on these species in the State. Reports of the rust on high-elevation white pines are sporadic and mostly anecdotal, resulting in observations that are not adequately recorded. The existing network of FHM plots in California is inadequate to determine the incidence of blister rust. For example, in 1992 only 5 of 55 forest health monitoring plots contained sugar pine and none had blister rust recorded. We know from other more intensive surveys that sugar pine makes up a greater component of the mixed conifer forest and that the level of rust in sugar pine averages about 40%. Intensification of the grid to adequately sample 5-needled pines was examined, but deemed cost prohibitive. Results from the Region 5 2002 aerial mortality survey indicate that about 53,000 acres of high elevation (>8,000 ft.) pine type have mortality. The cause for about 50% of the mortality is recorded as insects or as fire; the cause for the remaining 25,000 acres or so is unknown.

b. Significance: The high elevation mountain ranges of California contain some of the most diverse ecosystems in North America. Five species of white pines are keystone species of these ecosystems, playing a major role in maintaining ecosystem health and resilience. Bristlecone, foxtail, limber, and whitebark pines are among the few conifers adapted to arid, high elevation environments with harsh climatic conditions, sometimes being the only tree species present. They stabilize soils, provide wildlife forage and habitat, and are valued culturally. Bristlecone, foxtail, and limber pines have relatively small geographic ranges with isolated populations. Bristlecone pine has been dated as the oldest living trees, attaining 4600

years. These white pines are hosts, or potential hosts, to the exotic, invasive pathogen, *C*. *ribicola*.

c. Biological impact/political importance: Levels of blister rust in whitebark and limber pines of the Rocky Mountain and Intermountain regions are 80 to 90%; in some instances, ecosystems are being threatened. The incidence and effects of the rust in high elevation ecosystems in California are largely unknown. In the lower elevation sugar pine, the pathogen has not yet stabilized, and is continuing to spread and intensify. Anecdotal reports suggest that the rust may just be entering the higher elevations. The spread and impact of the introduced disease in these high elevation ecosystems needs to be documented in order to effectively formulate recommendations and policies to mitigate adverse impacts, and in order to respond to public concerns regarding the health of these highly visible and highly valued ecosystems.

d. Feasibility or probability that the project will be successfully completed: The rust resistance program and FHP in Region 5 are committed to obtaining the information. The ten National Forests of the Sierra Nevada are in the process of obtaining insect and disease information for forest plan revisions. Several private contractors with experience in high elevation blister rust surveys are interested and available to contribute to the project.

DESCRIPTION:

a. Background: The project will determine the current extent of *C*. *ribicola* on five species of white pines in high elevation ecosystems in California, and establish a system of permanent plots to allow for long term monitoring of health of these ecosystems. Reconnaissance surveys, using a contractor with rust experience, Wilderness Rangers, and Forest and FHP personnel, will be made to record the current presence and extent of the rust and tree mortality. A procedure for GPS/GIS documentation used in Sequoia-Kings Canyon National Parks will be used to document locations. Permanent plots will be established and examined for rust in representative areas with the 5-needled pine species. We anticipate working first with those species of limited distribution (Foxtail, bristlecone, limber) and having substantial data collection completed on those species in the first year. Similar work will be done for western white and whitebark pines with limited plot establishment and surveys in the first year, and more extensive work in the second year.

b. Methods:

Permanent Plots:

1. Compile, from existing vegetation type maps and other sources, a GIS database of the potential distribution of western white, whitebark, limber, foxtail and bristlecone pines, and reported incidences of rust, in California.
2. Divide the range of each of the hosts into units delineated by watershed boundaries.
3. Within each watershed unit, install at least one plot for each white pine species. The number of plot/unit will be governed by the areal extent of each species and the variability in rust expression observed). Potential plot locations will be determined by random points that “hit” the target population distribution. Random X,Y coordinates will be generated for each subpopulation of each species within a watershed unit.
4. Install plots at valid points (30 m wide and 50 m long; size adjustable according to stand density, topography, and other factors; extend transect until 50 white pines included).
5. Data collection in each plot will include location, slope, aspect, associated tree species, estimate of *Ribes* cover, white pine information (ht., dbh), and rust information (number of branch/stem cankers, age of cankers, presence of other mortality agents).

Reconnaissance Surveys:

1. Select a sample of natural stands where these host species have ecological or other significance and stands in which the hosts are not part of the permanent plot system.
2. Record rust presence or absence.

c. Products:

1. A GIS database containing locations of high elevation white pines and locations of blister rust in California.
2. A system of permanent plots allowing for periodic re-measurement of trends and impacts.
3. A report of conditions and health of 5-needled white pines in high elevation ecosystems of California.

d. Schedule of Activities:

Year 1: Compile existing information on host range and reports of rust incidence; determine number and location of areas to survey; begin surveying.
Year 2: Continue surveys; compile information into database.
Year 3: Produce reports on incidence/severity of rust in the five high elevation white pines of CA.

e. Progress/Accomplishments —Year One:

Whitebark pine assessment — Seventeen plots have been established on the Inyo (4), Stanislaus (5), Humboldt-Toiyabe (4), and Lake Tahoe Basin Management Unit (4). In Fall 2004 additional permanent plots are planned to be established on the Tahoe and Eldorado National Forests. The projected total number of plots for 2004 are 30 to 35. A second year of funding for 2005 would add another 30 to 40 plots on the Modoc and Sierra NF[1]s, the Shasta and Lassen areas, as well as in the high country of Yosemite and Sequoia-Kings NP.

White pine blister rust has been found in 6 of the 17 plots presently established. The most southern location of blister rust has been found in the area of Disaster Peak on the Stanislaus NF (northwest of Sonora Pass). Three of the 5 plots on the Stanislaus NF are infested with blister rust, with an average incidence of 26%. Three of the 4 plots on the Lake Tahoe Basin Management Unit are infected with blister rust with an average incidence of 52%. Fifteen of the 17 plots established show signs of present and past mountain pine beetle activity as well. Percent cover of Ribes species averages 4.5% per plot. Two of the 6 blister rust infested plots have no Ribes within the plot, and 5 of the 11 blister rust free plots have no Ribes present in the plots as well. To date, no blister rust infection has been observed on Ribes in plots or observed in the areas where plots have been established.

Bristlecone, limber, and foxtail assessment — Seventeen plots have been established on the following Public Land areas: Inyo NF (12), Toiyabe NF (1), Klamath NF (2), and Death Valley NP (2). Of the 17 total plots established, eight (8) were in limber pine, five (5) in bristlecone pine, three (3) in foxtail pine, and one (1) in whitebark pine. The eight limber pine plots may be considered to adequately describe the range of this species in California. However, limber pine occurs in isolated stands west of the Sierra crest in the southern end of the range, in an area of higher rust hazard. One plot already exists in Sequoia National Park,

and should be re-evaluated next year and/or another several plots established there. Several other plots whould be established in the Sweetwater Mountains and in southern California with second year funding. Five bristlecone pine plots should be adequate, considering the limited geographic range of the species in California. A second year of funding would allow further plot establishment in foxtail pines, both in the northern (Klamath) and southern Sierra populations, in order to adequately describe the expression of blister rust on these species. At least two more stands in the Klamath mountain area should be visited and plots established there. The eastern Sierra canyons with foxtail pine and the Kern plateau should be sampled further as well. As many existing plots in Sequoia National Park should be evaluated as resources allow, bringing the total to 20 or so.

White pine blister rust has been found in 2 of the 17 plots presently established. These two plots were in the Klamath Mountains area of the northern foxtail pine population. The incidence of rust was 30% at Box Camp Mountain and 18% at Boulder Lakes. No rust was found on white pines in any of the other 15 plots. However, at Crooked Creek in the White Mountains, symptoms of branch flagging were observed on several limber pines that should be investigated further. Our decision in the field was that these branches had no rust cankers present, even though bark discoloration and some slight swelling was observed. Certainly there were no *active* cankers.

White pines in wilderness areas — Observations of western white and whitebark pines were reported by rangers in Desolation and Mokelumne Wilderness areas. Rust spores and/or other characteristic rust symptoms were observed on both species in various areas.

Database/GIS development — A contractor has been hired to research information and to develop a GIS-based database on the distribution of white pines and blister rust in California. Currently, the contractor is communicating with a variety of professionals to collate information and to discuss linking this California database with an inter-regional database being developed by FHP and the NPS.

White pines in southern California — Because white pine blister rust continues to extend its geographic distribution, a white pine – rust survey will be conducted in September 2004 in the southern California mountains where it has not yet been reported. A general survey will be done in areas where rust would likely occur, and up to a total of 15 permanent plots will be established in sugar pine and limber pine stands.

f. Summary:

The project is progressing as planned, and is on track. The additional $10,000 received for the first year work has been used to expand plot establishment. We request $45,000 second year funding to continue the project.

The budget, as included with the original proposal, follows below:

COSTS:

	Item	Requested FHM EM Funding	Other-Source Funding	Source
YEAR ONE				
Administration	Salary		$18,000	R5
	Overhead @ 15%		$2,700	R5
	Travel		$4,300	R5
Procurements	1 GS 11 @ $1,200/week for 12 wks.	$14,400		
	2 person crew, GS 5-7 level, 10 wks.	$18,000		
	Travel ($500/week X 12 weeks)	$6,000		
	Vehicle ($300/week X 12 weeks)	$3,600	$2,500	R5
	Contracting: rangers/others	$5,000		
	Equipment/Supplies	$3,000	$1,000	
TOTAL		$50,000	$28,500	
YEAR TWO				
Administration	Salary		$18,000	R5
	Overhead @ 15%		$2,700	R5
	Travel		$4,300	R5
Procurements	1 GS 11 @ $1,200/week for 12 wks.	$14,400		
	2 person crew; GS 5-7 level, 10 wks.	$18,000		
	Travel ($500/week X 12 weeks)	$6,000		
	Vehicle ($300/week X 12 weeks)	$3,600	$2,500	R5
	Equipment/Supplies	$3,000	$1,000	
TOTAL		$45,000	$28,500	
YEAR THREE				
	1 GS 11 @ $1,500/week for 4 weeks	$6,000		
	Supplies		$2,000	
TOTAL		$6,000	$2,000	