

TITLE: Status and trends of whitebark pine distribution and health in California, Oregon and Washington.

LOCATION: California, Oregon and Washington

DATE: Sept. 30, 2011

DURATION: Year 1 of 2 year project **FUNDING SOURCE:** Base

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PROJECT OBJECTIVES: The primary objective is to provide statistically based estimates of population dynamics of whitebark pine for the species' western range, with particular emphasis on the extent, severity, and causes of changes in forest health. Specifically, we seek to:

1. Describe the current health status of whitebark pine stands using Forest Inventory and Analysis (FIA) data, including off-grid, intensification plots.
2. Develop methods to estimate rates of change from plots measured at multiple occasions, but with different time intervals and plot designs.
3. Estimate rates of mortality and regeneration, change in health status, and change in the species distribution for the last 15 years.
4. Compile a comprehensive database of whitebark pine regional inventory data (Current Vegetation Survey (CVS), USFS Region 5 (R5) and FIA) for developing species distribution models and studying the impact of climate change and health threats.

JUSTIFICATION:

- a. **Linkage to FHM Detection Monitoring:** Aerial detection surveys show a dramatic increase of the area affected by mountain pine beetle between 2000 and 2010, including increased mortality of whitebark pine. The most recent Forest Health Highlight reports have raised the level of concern for the species, because of its limited distribution in the Pacific coast states. Whitebark pine mortality is associated with other health threats such as limber pine dwarf mistletoe and white pine blister rust. The symptoms of those agents are difficult to distinguish from those of mountain pine beetle from the air, but their presence and severity may be detected from field plot data.
Preliminary results from the base FIA inventory indicate that the difference in the mean latitude of plots with seedlings minus that of plots with mature trees was 0.83 degrees (95% confidence interval from 0.09 to 1.56), equivalent to 92 km north. This result suggests a significant northward shift in the range of the species.
The project is closely related to the FHP Monitoring on the Margins effort, initially focused on the high elevation, fine needle pines. This study will contribute data and analytical techniques for the monitoring of whitebark pine and other at risk tree species.
- b. **Significance in terms of the geographic scale:** The proposed study area includes the entire western range of the species in the US.
- c. **Biological impact and/or political importance:** Whitebark pine is considered a foundation and keystone species (Tomback et al., 2001). Multiple studies have

documented a range-wide decline, attributed to a combination of white pine blister rust, mountain pine beetle outbreaks, altered fire regimes, and climate change. The threats to the species are such that, on July 19, 2011, the US Fish and Wildlife Service determined that listing whitebark pine as threatened or endangered under the Endangered Species Act of 1973 was warranted.

- d. **Scientific Basis/Feasibility:** FIA, R5 and CVS provide a probabilistic sample of whitebark pine communities across the study area. The design allows for statistically sound inference to the entire population of whitebark pine in the Pacific coast. This type of data would complement studies based on a relatively small number of stands, subjectively selected and intensively measured. The team has extensive experience analyzing regional inventory data and a strong background in statistics and ecology.
- e. **Priority Issues addressed. Climate change** is considered one of the main drivers of the whitebark pine decline, and would directly affect changes in the species distribution. The study will provide estimates of **tree mortality** trends across the western range of the species, including estimates of uncertainty. The study will also allow estimation of **crown condition** and **down woody materials** status and trends.

DESCRIPTION:

a. Background: There is a general consensus that whitebark pine is declining throughout its range. However, it is difficult to estimate the rate and severity of the decline because, although whitebark pine populations are small and isolated, the species is distributed through a very large geographic area. Most of the available data are based on separate studies from selected stands and geographic locations, rather than a range-wide inventory. The annual FIA inventory covers the entire range of the species in the Pacific coast. It measures a number of relevant variables for assessing whitebark pine health status, including bark beetle, blister rust, and dwarf mistletoe presence and severity, crown condition, and down woody material abundance. A preliminary analysis of FIA data comparing the distribution of seedlings to that of mature trees suggests a significant northward shift in the range of the species, a result typically attributed to climate change (Lenoir et al., 2009). However, the lack of remeasurement data leaves the results tentative and, in general, limits the ability to estimate trends in the species' range and status. Combining the current data with earlier inventories will allow estimating changes in whitebark pine population parameters and exploring the causes of the decline throughout the species' western range.

b. Methods: The study will use CVS, R5 and FIA annual plots to estimate change in the variables of interest during the last 15 years. Approximately 97% of the whitebark pine range in the CA, OR and WA is in federal land, and approximately 85% is managed by the Forest Service. Starting in the early 1990s, CVS and R5 inventoried all NFS lands, at intensity greater than 3 times that of the current base FIA grid in non-wilderness areas and approximately the same as FIA in wilderness. Those plots were remeasured using the same protocols. Most of them were later incorporated into the current FIA grid, albeit with a different plot footprint and some changes in measurement protocols. Lands under other federal ownership, mostly National Park Service, have only been measured as part of the current FIA inventory. Therefore, there is a relatively large set of plots that cover the entire range of the species, but with a very complex measurement history. Plots may have been visited between 1 and 5 times since the early 1990s, largely depending on ownership. The first step of the project will be to compile a comprehensive and consistent whitebark pine dataset that includes the historic CVS, R5 and FIA plots, current FIA plots, and current measurements of intensified CVS plots in NFS lands. This dataset will substantially increase the sample size available for analysis. The

second step will be to develop sound statistical models to estimate trends in the variables of interest from plots measured multiple times, at different intervals and with different layouts.

c. Products: Reports, presentations, posters and papers in scientific journals describing the analysis methods and results, estimates of population dynamics of whitebark pine populations, and its implications for conservation will be produced. A comprehensive database with CVS and FIA plots with whitebark pine will be available for future studies.

d. Schedule of Activities:

Year 1: Collect data, create and validate database. Start developing statistical models.

Year 2: Develop statistical models, produce and present papers and reports

Lenoir, J., Gégout, J.C., Pierrat, J.C., Bontemps, J.D., Dhôte, J.F. 2009. Differences between tree species seedling and adult altitudinal distribution in mountain forests during the recent warm period (1986-2006). *Ecography* 32: 765-777

Tomback, D.F., Arno, S.F., Keane, R.E. 2001. The compelling case for management intervention. In: Tomback, D.F., Arno, S.F., Keane, R.E. (Eds.). *Whitebark pine communities*. Island Press. Washington, DC. pp. 3-25.

COSTS:

	Item	Requested FHM EM Funding	Other-Source Funding	Source
YEAR 1				
Administration	Salary	17,000	20,000	PNW RS
	Overhead	0		
	Travel	3,000		
Procurements	Contracting	0		
	Equipment	0		
	Supplies	0		
Total		20,000		

	Item	Requested FHM EM Funding	Other-Source Funding	Source
YEAR 2				
Administration	Salary	12,000	20,000 3,500	PNW RS OSU
	Overhead	0		
	Travel	3,000		
Procurements	Contracting	0		
	Equipment	0		
	Supplies	0		
Total		15,000		

Salary consists of 0.15 FTE of an OSU Research Associate (Bianca Eskelson) and, during year 1, data cleaning and database preparation. Travel expenses include field visits to verify data and results, and travel to meetings to present results (including FHM Working Group meeting). Matching funds include partial salary of PL and cooperators.