TITLE: Whitebark Pine Stand Conditions after Mountain Pine Beetle Outbreaks in Idaho, Wyoming and Montana

LOCATION: Intermountain West and Northern Regions (R1-R4)

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Continuing Project: INT-EM-B-12-03

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

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PROJECT OBJECTIVES: The primary goal is to obtain information that will be used to make recommendations and set priorities regarding restoration of whitebark pine in Central Idaho (Salmon River, Lost River, Pioneer, Lemhi, Beaverhead Mountains) and adjacent areas in Wyoming and Montana. Specific objectives to meet this goal include:

1. to determine the extent and severity of mountain pine beetle (MPB) impacts in whitebark pine stands following MPB outbreaks identified by aerial detection and other surveys - quantify both dead and remaining live mature whitebark pine
2. to determine blister rust status of remaining mature live whitebark pine
3. to determine health of whitebark pine regeneration in these stands
4. to determine probable stand trajectory by recording health and abundance of other species in mixed stands

JUSTIFICATION: Although whitebark pine has a very large range, populations are small and relatively isolated, so they are not well represented in FIA plots. This project will greatly augment the limited information available from FIA plots.

Aerial detection surveys (ADS) provide estimates of current dead trees, but are unable to provide information about remaining live trees or regeneration which is crucial to understanding future stand trends and determining restoration needs. This project will provide a valuable link between mortality estimates from aerial detection surveys and live trees remaining following MPB outbreaks.

This project will also document levels of blister rust in remaining mature whitebark pine and regeneration which are not recorded by ADS but are also critical elements in determining future stand trajectory and restoration priorities.

This project will use and build on previously successful EM project INT-EM-08-02 by evaluating new stands more recently affected by MPB in Central Idaho, Wyoming, and Montana using similar methods.

Significance in terms of geographic scale:

Whitebark pine has a very large natural range but is in serious jeopardy especially in the Intermountain West. Recent aerial detection surveys have documented increasing whitebark pine mortality throughout central Idaho. Ground observations estimate up to 90 percent of the whitebark pine overstory has been killed in some areas.

Biological impact and/or political importance of the issue:

Whitebark pine is a crucial high-elevation tree species. Not only does it help in watershed stabilization, It plays a key role in the survival and distribution of many wildlife species (Tomback et al. 2001). Its highly nutritious seeds were once prized by Native Americans and currently provide a primary food source for nearly 20 species of birds and animals such as the endangered grizzly bear. The loss of this important species has led to steps to classify it as an endangered species in Canada, a species of concern in the state of Washington, and a sensitive species in the Northern Region. The U.S. Fish and Wildlife Service recently concluded that listing the species as threatened and endangered is warranted, but precluded by higher priority actions.

Feasibility or probability that the project will be successfully completed

The survey procedures for collecting data (FINDITS) have been used for many years to assess bark beetle losses, and will also show residual live trees. Typical regeneration surveys will also be used to determine levels of regeneration of various species and potential stand trajectory. There are enough accessible sites to allow a 2-person crew to complete the ground surveys within two field seasons.

DESCRIPTION:

a. Background: Whitebark pine is a keystone species of high elevation ecosystems throughout western North America. It is often the only tree species capable of surviving in harsh subalpine areas, and is crucial in watershed stabilization and creating habitats that support a wide diversity of plants and animals. The old gnarled relics in remote timberline areas provide important aesthetic values by creating high elevation vistas and providing much of the character of the alpine experience (Schwandt 2006, Tomback et al. 2001).

Whitebark pine is currently at risk in much of its natural range due to a combination of white pine blister rust, forest succession, and recent outbreaks of MPB (Gibson et al. 2008, Keane et al. 2002). Although MPB outbreaks have occurred historically in whitebark pine, the additional impacts of white pine blister rust have caused deviations far exceeding expected mortality resulting in local extirpation of some populations and threatened extinction of others (Schwandt 2006).

While aerial detection surveys can document recent increases in MPB activity, coverage is not always complete or consistent, and surveys only record current mortality, so cumulative mortality is not always known if areas are not flown annually. However, even where annual mortality levels have been reported, a major concern has been determining the amount of live

whitebark pine remaining to provide regeneration potential. Since whitebark pine depends almost exclusively on the Clark's nutcracker for natural regeneration (Tomback 2001), the loss of most mature whitebark pines in a stand may result in no regeneration if the residual live trees cannot support a nutcracker population.

The report from INT-EM-08-02 (Kegley et al. 2010) helped address this information gap by documenting what is left in various stand types following MPB outbreaks in 42 select stands throughout Idaho, Montana, and Wyoming. This project will fill in a large geographic area that was not covered in INT-EM-08-02. The information from this project will help managers understand losses and prioritize restoration efforts.

b. Methods: Areas in Central Idaho and adjacent areas in Wyoming and Montana where recent MPB outbreaks have occurred will be identified from past ADS, local specialists, or other surveys. These areas will be sampled using modified FINDITS protocols that use variable radius plots for large trees and fixed radius plots for regeneration. Plots will be taken at a frequency that adequately covers selected stands.

Data collected will include: tree species, size (DBH), condition (mortality causes for whitebark pine, and blister rust levels (for live trees).

c. Products: A report summarizing results for each area sampled that will describe current whitebark pine condition following MPB outbreaks as well as condition of other species sampled. It may also be possible to compare results to ADS information if available. Data will be entered into the WLIS database and compared with prior survey data to document trends over time. Results will be used to make recommendations regarding relevant restoration activities and priorities for restoration. Data will also be used to develop loss prediction models for whitebark pine.

d. Schedule of Activities:

- Winter 2011/2012 – identify areas to be sampled; develop field protocols; hire field crew
- Summer 2012 – sample areas selected
- Fall/winter 2012/2013 – analyze data and identify areas to be sampled 2013; hire field crew
- Presentation (poster or oral) will be given at the Western Forest Insect Work Conference (Coeur d'Alene, ID) in March, 2013
- A poster providing an update for Year 1 of the project will be brought to the Forest Health Monitoring annual meeting, Spring 2013
- Summer 2013 – 20-30 additional sites will be sampled in Idaho, Montana, Wyoming and Nevada
- Fall/winter 2013/2014 – data analysis will be conducted during the winter and placed into a final report

e. Progress/Accomplishments:

There have been no modifications to the objectives or schedule. However, due to US Forest Service travel caps and seasonal hiring issues, an agreement between the USFS and the University of Idaho was developed to conduct the field work, analyses and write-up. This resulted in a slight modification to the Year 2 budget from the original project proposal and adding UI participation as project leader.

A graduate student (Kendra Schotzko) was hired and began work in July 2012. She is primarily responsible for data collection and analysis (under the direction of Dr. Cook) and will be using some of the data in her Ph.D. dissertation.

We developed a comprehensive list of sites to be included in the project during the winter of 2011/2012 that included locations in Idaho, western Montana, western Wyoming and northern Nevada. Twenty-two sites were sampled during 2012 (we had planned to sample four additional sites but fire and smoke conditions prevented access to some areas). The sample area/sites were located on multiple National Forests and a breakdown of the sites by National Forest is presented in the following table:

National Forest & State	Number of Sites
Caribou-Targhee National Forest, ID	4
Caribou-Targhee National Forest, WY (Jedediah Smith Wilderness)	2
Helena National Forest, MT	2
Idaho Panhandle National Forest, ID (Kaniksu National Forest)	2
Salmon-Challis National Forest, ID	5
Sawtooth National Forest, ID	1
Sawtooth National Recreation Area, ID	6
Total	**22**

During the summer of 2013, 20-30 additional sites will be sampled in Idaho, Montana, Wyoming and Nevada.

Several changes were made to the original sampling protocols to make the sampling scheme more repeatable and statistically valid. Changes were made to the original protocols in how both the measurements of mature trees and regeneration trees were made.

The protocols for the mature tree (Variable Radius Plots) plots follows:

Variable Radius Plots

Within each stand up to ten variable radius plots will be measured.

- Plots were two or more chains apart (minimum of 132ft) along one of two transect bearings (determined to keep plots within the whitebark pine zone). The same number of chains were used between all plots on a site.
    - Bearings were perpendicular and determined at or before the first plot. Bearing selection was based on the shape of the area in which the whitebark pine occur, and with the intention of staying within the whitebark pine area, characterizing as much of that area as possible, and minimizing changes in slope, aspect, and elevation.
    - Within all plots, a 2.5m prism was used to determine which trees were measured**.**
    - For trees that are not clearly within or outside of the plot, distance was measured from plot center to the face of the stem.

There were also changes to the protocols for measuring tree regeneration on the sites. The changes allow for analyses to be conducted on an area basis and included measurements of non-whitebark pine trees so that a trajectory of stand community composition can be made. The protocols for the assessment of regeneration (two plot types) follows:

<u>Regeneration Assessment</u>

- **Fixed Plot Regeneration Assessment**
    - Plot center was the same as for the corresponding variable radius plot.
    - A fixed area was used (1/300 ac = 6.8 ft radius).
- **Between Plot Regeneration Assessment**
    - Distance to be measured was two chains minus 13.6 ft (i.e. the distance between plot centers minus the fixed plot radius). All regeneration trees (of all species) that occur within 1 m of the center line were counted and measured (in addition to the rust status of the whitebark pine regeneration trees present).
    - A constant fixed area was measured (776.9 ft^2).
- **Qualifying Regeneration**
    - Diameter of regeneration trees was set at less than 5 inches (13 cm rounded to the nearest cm).
    - Codes were used to describe rust status of regeneration whitebark pine within the area.
    - Total assessment will be based on the combined fixed- and between-plot measurements.

f. Relevant Citations:

Gibson, K.; Skov, K; Kegley, S; Jorgensen, C; Smith, S; and Witcosky, W. 2008. Mountain pine beetle impacts in high-elevation five-needle pines: current trends and challenges. USDA Forest Service, Forest Health Protection Report R1-08-020.

Keane, R.E., Ryan, K.C., Veblen, T.T., Allen, C.D., Logan, J.A., and Hawkes, B. 2002. Cascading effects of fire exclusion in Rocky Mountain ecosystems. In: Baron, J.S. (Ed.), Rocky Mountain Futures: An Ecological Perspective. Island Press, Washington, D.C., U.S.A., pp. 133-152.

Kegley, S, Schwandt, J.W., Gibson, K., Perkins, D. 2010. Health of whitebark pine forests after mountain pine beetle outbreaks. USDA Forest Service, Northern Region Forest Health Protection, FHP Report 11-03, 11 p.

Schwandt, J.W. 2006. Whitebark Pine in Peril: A case for restoration. USDA Forest Service, Report R1-06-28, Missoula, Montana.

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: Ecology and Restoration. Island Press, Washington, D.C., U.S.A., pp. 3-25.

COSTS: Budget estimates for year 2 of the project:

	Item	**Requested FHM EM Funding**	**Other-Source Funding**	**Source**
YEAR 2-FY2013				
Administration	Salary – Grad student plus 2 weeks for Dr. Cook	$ 21,169	$ 8,400	6 weeks – FHP and BLM personnel to participate in field work and agreement administration
	Overhead (26%)[1]	$ 6,809		
	Travel	$ 3,522	$ 4,400	FHP travel from base funds plus FHP vehicle for personnel
Procurements	Contracting			
	Equipment			
	Supplies	$ 1,500		
Total		$ 33,000	$12,800	

1/ 26% is the standard UI overhead costs for off-campus projects.