TITLE: Bark Beetles and Southwestern Ponderosa Pine: Fuel Loading and Susceptibility Rating

LOCATION: Southwest US (Arizona, Utah, Colorado)

DATE: 25 August 2011

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

PROJECT LEADER: Matt Hansen, Rocky Mountain Research Station, 435-755-3575, matthansen@fs.fed.us

COOPERATORS: Barbara Bentz, RMRS; Jim Vandygriff, RMRS; Joel McMillin, R-3 FHP, Flagstaff

FHP SPONSOR/CONTACT: Steve Munson, R-4 FHP, Ogden, 801-476-9720, smunson@fs.fed.us

PROJECT OBJECTIVES: 1) Measure fuel loadings among southwestern ponderosa pine sites with diverse levels of bark beetle-caused mortality; 2) Evaluate factors affecting stand and landscape level bark beetle susceptibility in southwestern ponderosa pine; 3) Estimate snag fall rates.

JUSTIFICATION:

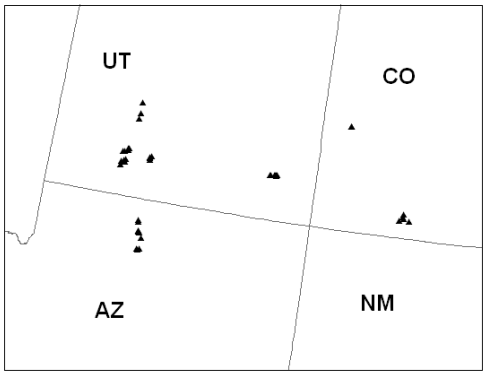
a. **Linkage** Plots are compatible with FIA data. Permanent plots were established from 1995-96 (see below) and were chosen based on FHP aerial detection surveys. These data are also used in analyses and for predicting risk.
b. **Significance** Results from this project can be applied to ponderosa pine type throughout the southwestern US.
c. **Biological impact** Mountain pine beetle and other bark beetle species outbreak periodically in ponderosa pine on the Colorado Plateau, affecting thousands of acres. Additional information is needed to help managers forecast and mitigate outbreaks as well as understand changes in fuel loading.
d. **Scientific Basis/Feasibility** This project will take advantage of permanent plots established in 1995-96. All tagged trees will be re-measured. One publication has already resulted from earlier work and further analyses (unpublished) have been conducted. Additional temporal data will aide risk/ susceptibility modeling and improve our understanding of this system. It will be relatively easy to add fuel loading measurements. RMRS has a strong reputation for completing projects and reporting results.
e. **Priority Issues** This project aims to describe bark beetle-related changes in fuel loading and produce a refined bark beetle risk model for southwestern ponderosa pine type (including climate change-related factors).

DESCRIPTION:

a. Background: Bark beetle activity has been increasing over the past decade in

many western conifer forests, including southwestern type ponderosa pine. Under a Special Technology Development Project (R3-95-01), permanent plots were established for the purpose of collecting data to develop a mountain pine beetle risk/susceptibility rating system specific for southwestern type ponderosa pine. Established in 1995 and 1996, the 45 sites in Utah, Arizona, and Colorado have two parallel transects of 10 circular plots for a total of 900 plots (0.1 acre each; ~19,000 stems). Using data from the initial project, two stand risk rating methods were compared and an individual tree attack probability model was developed (Chojnacky *et al.* 2000). However, many plots did not receive sufficient beetle attacks during the time period of the study to fully evaluate stand risk/susceptibility to bark beetle attacks. An important finding from the study was that mountain pine beetle is only one of several bark beetle species that attack and kill southwestern type ponderosa pine. This type of project can greatly benefit from long-term monitoring of the permanent plots because local beetle population size will widely very across spatially independent locations when considering a single time-frame. A re-visit of all plots in 2012 (16-17 years following plot initiation) will provide important information on long-term bark beetle dynamics in these forests. Additionally, the longer time frame enables consideration of weather-related factors on beetle population levels. In fact, inclusion of weather data is necessary to fully assess risk because bark beetle population success is tightly coupled to suitable temperatures.

Most plots were re-visited in 1999, 2001, and 2004 to check for subsequent attacks but none have been measured since 2004. We intend to re-measure all trees (DBH and height) and identify and record all trees that have been attacked by bark beetles (all species) subsequent to the last visit. We anticipate this information will substantially aid in our understanding of bark beetle activity in southwestern type ponderosa pine and development of a stand-level risk model. Additionally, re-visiting these plots presents an opportunity to measure bark beetle-related changes in fuel loading and estimate snag fall rates, issues that have become increasingly important.



b. Methods: All 900 plots at the original 45 sites will be re-located and all stems re-measured and inspected for bark beetle and woodboring insect activity subsequent to the last visit. Although plot establishment took two summers for a crew of three, we anticipate a crew of two can complete this task in a single summer as the trees are already identified and it will not be necessary to assess the full suite of measurements (*e.g.* tree ages, crown ratios and plot-level attributes). Additional modeling, such as classification and regression trees, will be applied to these data to develop a risk model. Climate data will also be incorporated into models. Fuel loading will be quantified through: 1) line transect sampling for downed woody materials; 2) forest floor depth measurements; and 3) trees with needles will be classified regarding proximity of ladder fuels. The Fire and Fuels Extension of FVS will be used to

summarize fuel loads and characterize potential fire behavior. Given that we have a record of year of death for many of these trees, snags fall rates can be estimated.

c. Products: Peer-reviewed journal articles describing: 1) factors important for assessing long-term bark beetle risk in southwestern ponderosa pine type; and 2) fuel loadings as a function of bark beetle-caused mortality levels.

d. Schedule of Activities:

Summer 2012: Field crew re-measures all plots.
Fall 2012: Data entry and analysis.
Spring 2013: Manuscript preparation and submission.

COSTS:

	Item	Requested FHM EM Funding	Other-Source Funding	Source
YEAR 2012				
Administration	Salary	32,200	15,000	RMRS
	Overhead	3,981		
	Travel	8,000		
Procurements	Contracting	7,000		
	Equipment	500		
	Supplies	4,000		
Total		55,681	15,000	

	Item	Requested FHM EM Funding	Other-Source Funding	Source
YEAR 2013				
Administration	Salary	7,100	24,500	RMRS
	Overhead	1,147		
	Travel	3,500		
Procurements	Contracting	3,500		
	Supplies	800		
Total		16,047	24,500	

Requested salary is for one GS-6 for 15 pay periods and one GS-5 for 13 pay periods, split over FY 2012 and FY2013. RMRS charges 7.7% overhead on intra-agency transfers. Contracting is for a leased truck. Travel is for field rate per diem for two technicians and RMRS entomologists. Equipment is for tree mensuration and camping trailer maintenance. Supplies are fuel for leased vehicle. Additional support is requested in FY 2013 to pay for journal publication charges and travel to the Bark Beetle Technical Working Group meeting to report results. Thus, the total request is $71,728.