Progress Report

Title: Bugs & Burns: Effects of Fire on Ponderosa Pine Bark Beetle **INT-F-07-02**

LOCATION: Northern Arizona and Eastern New Mexico

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

PROJECT LEADER: Tom DeGomez, University of Arizona, Forest Health Program, 928-523-8385, degomez@ag.arizona.edu

COOPERATORS: John Anhold, Region 3, FHP; Tom Kolb, Northern Arizona University; Chris Hayes, University of Arizona; Kelly Williams, University of Arizona, Mike Manthei, Coconino N.F.

PROJECT OBJECTIVES:

1. Quantify long-term effects of operational prescribed fire on bark beetle attacks in ponderosa pine-dominated stands of Arizona and New Mexico.
2. Identify the species of bark beetles in prescribed burned and unburned ponderosa-pine dominated stands in Arizona and New Mexico.
3. Assess the utility of using measures of pre-fire bark beetle populations as predictors of future bark beetle caused mortality at prescribed fire sites. Quantify species of beetles and stand conditions in ponderosa pine dominated stands prior to igniting control burns.

JUSTIFICATION:

Linkage to FHM Detection Monitoring: Aerial and ground detection surveys have determined that trees continue to die for several years after fire from a combination of direct damage from fire and bark beetle attacks (USFS 2004), yet long-term data on long-term effects of fire on tree mortality and beetle attacks is rare

Significance in terms of geographic scale: Although this project will be conducted in USFS Region 3, similar impacts from fire are experienced throughout the range of ponderosa pine.

Biological and political importance: Management practices in the past have left many forests and woodlands in the Southwest US with high tree density and more susceptible to bark beetle outbreaks and stand-replacing wildfires (Covington and Moore 1994a, 1994b; Kolb et al. 1994). Forest managers have been conducting understory burning in conjunction with overstory thinning to reduce stand density. Prescribed fires, however, have led to the eventual death of some residual trees due to acute or non-lethal tissue damage, leading to bark beetle attacks. Both wildfire and bark beetle threats are important issues facing communities within the wildland urban interface. It is important that work to reduce the threat of wildfire does not acerbate the bark beetle situation. Therefore, a better understanding of the relationship between fire and bark beetles is needed.

Feasibility or probability that the project will be successfully completed: Protocols for this work have been tested during other successful projects conducted by the PI's. We have qualified staff and infrastructure to conduct all aspects of the project. We have already collected three years of data in support of objectives 1 and 2.

DESCRIPTION:

a. Background: Available upon request. Also available in original proposal.

b. Methods: Part I study sites are part of the Birds and Burns Network (www.rmrs.nau.edu/lab/4251/birdsnburns) and are located in the Kaibab, Coconino and Apache-Sitgreaves National Forests of Arizona and Gila NF in New Mexico. These sites were treated and measured in 2004, 05' and 06' as follows.

Site characteristics - Stands range from ponderosa pine dominated to mixed conifer. Each 250-400 hectare site is paired with an unburned control site of similar size and stand structure. Burns were conducted in the fall of 2003 or spring of 2004. Each treatment and control site has a permanent sampling grid of 25-40 sampling stations.
Standard tree measurements - A total of 994 ponderosa pines on burned sites and 1097 on unburned control sites were sampled. Other non-dominant species such as Douglas-fir, Gambel oak, and alligator juniper were also sampled. At each sampling station a 10-meter radius circular permanent plot (0.03 ha) was established. Within each plot, all trees >13cm dbh were tagged and measured for tree species, diameter at breast height (dbh), tree height, length of live crown and live crown ratio.
Assessment of fire damage to trees - All trees at prescribed fire sites were measured for bole char severity; char height and direction; % of the bole circumference charred; % of crown scorched by fire; % of crown consumed by fire; length of the pre-fire live crown and the percent of the crown volume with green needles; and needles that were black or consumed by the fire (McHugh and Kolb 2003).
Bark beetle sampling - Each spring and fall of 2004-2006 each sample tree was examined for mortality and bark beetle activity. We assigned each tree an insect attack rating (IAR). If a tree had an IAR of 1 or 2 (partial or mass attack), and 75% or more of the crown was fading, a 30 x 30 cm section of the bark was cut out on the north side of the tree at heights of 1m, 3m, 5m, and 7m. Each bark sample was examined for bark beetles and galleries and, if possible, identified the species of bark beetle making the galleries.

Part II – Four new study sites will be identified by the Coconino N.F. as areas scheduled to be burned along with paired sites that will not be burned. We will look for sites that have similar site characteristics as those used in Part I. The “standard tree measurements”, as described above, will be recorded prior to burning. In addition, an array of three Lindgren funnel traps will be placed at four locations within the four sites. Each trap will be baited with a different combination of lures targeting *Ips pini, Ips lecontei* and *Dendroctonus brevicomis.* We have found that this array of traps is an effective monitoring system for 11 species of bark beetles in Arizona ponderosa forests (Barton et al. 2005). Trap catches will be collected weekly (mid April – early Sept.) each of the years. After burning we will conduct “assessment of fire damage to trees” and “bark beetle sampling” as described above.

c. Products: Evaluation monitoring and technical reports will be sent to Northern Arizona forest managers and planners on the extent and severity ponderosa morality following burning. This information will also be useful for agencies outside the Forest Service, i.e. State Land, Fish and Game, Bureau of Indian Affairs, National Park Service, Bureau of Land Management, as well as the numerous mountain communities that are concerned with the effects of burning on forests within the urban wildland interface.

d. Schedule of Activities:
Year 1 (2007). Sample Part I sites for bark beetle activity and mortality. Establish Part II sites, monitor bark beetle populations with Lindgren funnel traps, assess damage to scorched trees, and sample bark beetle activity. (Manthei will locate study sites in Coconino N.F. Hayes and Williams will conduct field and bark beetle lab work. Kolb, DeGomez and Anhold will produce the proposal and field design.)
Year 2 (2008). Revisit all plots in Part I and II and collect information on bark beetle activity and mortality. Prepare annual progress report. Monitor bark beetle populations with Lindgren funnel traps on all plots. Prepare and present poster at the annual FHM conference. (Hayes and Williams will conduct field and bark beetle lab work. Kolb, DeGomez and Anhold will conduct

data analysis and produce the annual progress report. DeGomez will produce poster and attend annual FHM Conference)
Year 3 (2009). Revisit all plots in Part I and II and collect information on bark beetle activity and mortality. Complete final analysis and report. Prepare and present poster at the annual FHM conference. (Hayes and Williams will conduct field and bark beetle lab work. Kolb, DeGomez and Anhold will conduct data analysis, produce the final report and publication. DeGomez will produce poster and attend annual FHM Conference)

e. Progress/Accomplishments:

Part I
2007 - One of the four existing study sites was revisited in September and the remaining three are scheduled to be visited in October.
2008 – The three sites that were not visited prior to October 2007 were visited in October. We have the field visits for 2008 scheduled for late September and early October. In general very little tree mortality was seen in the burn or the control plots. Data collected is available upon request. This part of the project is on schedule and going very well.
Part II
2007 - Four new study sites were located & the plots in the burn and control areas were established. Two of the four burn sites have been burned by USFS. Bark beetle traps were put up to monitor populations prior to burning. Data collected & maps of the sites are available upon request. This project is right on schedule and going very well.
2008 – Field data (scorch) was taken on the two burned sites in the spring of 2008. Bark beetle traps were put up to monitor bark beetle populations after burning (two sites) and prior to burning (two sites). The two unburned sites are scheduled to be burned by the USFS this fall. As soon as possible after they are burned we will take scorch measurements. The two burned sites were monitored for bark beetle mortality in October of 2007 and are scheduled to be revisited in October of 2008. Not having two of the sites burned has set us back one year for half the project. USFS has promised us that they will try very hard to get these sites burned this fall. As of September 17, 2008 the Flagstaff-Williams area is experiencing a wetter than normal late summer. Data collected & maps of the sites are available upon request.

COSTS:

	Item	**Requested FHM EM Funding**			**University funding**
		Year 1 (2007)	**Year 2 (2008)**	**Year 3 (2009)**	
Administration	Salary	$26,555.	$25,473.	$22,800	(Yr. 1) $3,455 (Yr. 2) 3,347 (Yr. 3) 3,425
	Contract for Services with NAU	2,165	4,510	4,650	
	Overhead	0	0	0	(Yr. 1) $9,883 (Yr. 2) 9,620 (Yr. 3) 9,737
	Travel	4,000.	4,000.	4,000.	
Procurements	Supplies	4,000.	4,000.	4,000.	
Totals		**$38,010.**	**$37,000.**	**$37,450.**	(Yr. 1) **$13,338** (Yr. 2) **$12,967** (Yr. 3) **$13,162**

Progress Report