

PROGRESS REPORT

TITLE: Stand level impacts of *Ips* and *Dendroctonus* bark beetles in pine forest types of Northern Arizona.

LOCATION Arizona

DURATION: Year 1 of 3 year project **FUNDING SOURCE:** Base, Requesting funds for year 2 of this 3 year project.

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PROJECT OBJECTIVES:

1. Quantify the impact, extent and severity of bark beetles on ponderosa and pinyon pine at the stand level through an extensive plot network on a portion of Arizona's northern National Forests.
2. Describe the forest conditions in areas that have experienced moderate to high levels of mortality induced by recent drought and bark beetles.
3. Look for correlations between stand and site conditions and pine mortality.

BACKGROUND: Beetle related pine mortality in Arizona has continued for the second year at epidemic levels. Precipitation levels have increased over the last year, however much of the state continues to report below average levels of moisture for the year. There are several bark beetles that are working in concert to kill the ponderosa pine, *Ips* spp. and western pine beetle. The pinyon pine is being attacked primarily by pinyon ips. The current drought-related mortality has possibly exceeded the extent and severity of the 1950's drought. To date, considerable pine mortality has been detected in scattered pockets across most pine forests in Arizona. It appears that many of the pockets continue to be associated with poor site quality, shallow soils, cinder hills, south facing aspects and along transitional zones such as the Mogollon rim. However, pine mortality is being reported in more favorable habitats. Compounding the effect of the drought is the high densities of the pine forest. Trees are already competing for a limited amount of ground water, nutrients and sunlight.

Revised Methods: Working in conjunction with Northern Arizona University and the Rocky Mountain Research Station the following sampling protocol were developed for measuring pine bark beetle impacts to ponderosa and pinyon pine forests. Similar protocols are now being adapted by other FS Regions.

Distribution of plots:

1. GIS maps showing the distribution of ponderosa and pinyon pine, Forest boundaries and FS road system for each National Forest (or area of interest) were generated. These maps were then populated with sampling points for each forest type. Points were populated using a 3-mile grid laid over the forest; however, each point must be within ¼ mile of a road. Plots were then stratified according to levels of tree mortality (low, mod. or high) using current aerial detection survey data. The number of sample points is determined by the amount of area per forest type per Forest. Crews used handheld GPS units to navigate to each sample point.
2. For measuring extent of the tree mortality, only 1 plot will be installed at each sampling point.

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3. For measuring the severity and stand/site correlations, crews installed a cluster of three plots organized in a triangle and 10 chains (200 meters) apart, starting from the predetermined point.

Plot installation and measurements:

1. Plots are 1/20th acre fixed radius (26.33 feet radius). Plot center is marked with a piece of painted rebar and recorded with a GPS unit. Individual trees are not tagged. Logger tapes are used to determine “in” trees greater than 4 inches dbh for ponderosa pine or 3 inches at root collar for pinyon pine. Mensurational information is recorded on all trees, including: tree species, diameter at breast height (ponderosa pine) or root collar (pinyon pine), crown class, tree condition and damaging agent. Multiple stemmed juniper and pinyon are measured as a single stem if possible.
2. Tree condition is recorded as green uninfested, currently infested, dead with most needles still present, dead without needles present. Presences of boring dust, pitch tubes, galleries, life stages, etc., are used to determine if bark beetles are/will attack trees.
3. Site characteristics are recorded for each plot, including: aspect, slope, elevation, and soil type.
4. The species, number and type of regeneration, including saplings, is collected on a sub-plot of 1/100th of an acre located at plot center. For ponderosa plots, all individuals that are currently smaller than 4.0 inches dbh are classified as either saplings or seedlings. For pinyon plots, all individuals currently smaller than 3.0 inches DRC are classified as either saplings or seedlings.
5. For each Forest and forest type, bark beetles are collected from a minimum of 10 sampling points. Beetles are placed in vials filled with ethanol. This is being done because of the lack of detailed bark beetle records throughout the state.

Infested tree tally:

1. Crews are tallying the number of dead or infested trees by species between each plot at the clustered plots. The tally is done in a 1-chain wide swath between plot centers (10 chains or 660 feet long) for the number of dead trees by conifer species. The tally area is 1-acre in size between plots and 3 acres for each sampling point.

Based on this methodology, the work will represent an intensification of the permanent plots being measured in the Forest Health Monitoring program by providing finer resolution into specific forest types and how its growth and structure has been impacted by the drought/beetle related mortality.

Progress Statement:

As of this report 327 permanent plots have been established on the Prescott and Kaibab National Forests, see table below.

	Ponderosa Pine Plots		Pinyon Pine Plots	
	Cluster/Plots	Single	Cluster/Plots	Single
Prescott NF	20/60	28	6/18	9
Kaibab NF	35/105	42	17/51	14

Plot establishment on the Coconino NF will start in October. Data entry and analysis of all plots will occur this winter and will be presented at this years Forest Health Monitoring Working Group meeting in Sedona, AZ.

In addition, to this “on the ground” work, we have collaborated with FHTET, RSAC and Kodak to analyze different remote sensing applications for the extent and severity of pinyon pine mortality across the Southwest. Satellite and multispectral imagery were collected from the same areas where we have

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installed our ground plots. Although not funded from our FHM grant, we believe this offshoot will provide valuable contributions to monitoring techniques in Forest Health.

Schedule of Activities:

Year 1. Locate, establish and collect plot and transect measurements on three National Forests in northern Arizona (Coconino, Kaibab, and Prescott). Complete progress report and have initial findings summarized in a poster at the FHM Working Group meeting.

Year 2. Locate, establish and collect plot and transect measurements on two additional National Forests in Northern Arizona (Tonto and Apache-Sitgreaves). Collect additional impact data on year 1 plots and transects. Complete progress report with initial findings and any trend information.

Year 3. Revisit all plots and transects to collect subsequent impact data. Complete final report.

COSTS:

	Item	Requested FHM EM Funding	Other-Source Funding	Source
YEAR 2				
Administration	Salary	32,000	50,000	*FHP,NAU,RMRS
	Overhead			
	Travel	7,000	1,500	FHP Base
Procurements	Contracting			
	Equipment	1,000		
	Supplies	2,000		
Total, Year 2		42,000	51,500	

COSTS:

	Item	Requested FHM EM Funding	Other-Source Funding	Source
YEAR 3				
Administration	Salary	25,000	20,000	*FHP,NAU,RMRS
	Overhead			
	Travel	6,000	1,500	FHP Base
Procurements	Contracting			
	Equipment	500		
	Supplies	500		
Total, Year 3		31,000	21,500	

* NAU – Northern Arizona University, RMRS – Rocky Mountain Research Station