

TITLE: Rapid aspen decline on the southwestern edge of its range

LOCATION: Northern Arizona - Kaibab National Forest (South Zone)

DATE: September 30, 2009

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

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PROJECT OBJECTIVES: We propose to examine the relationships among stand conditions, site factors, and causal agents associated with the accelerated decline, dieback, and mortality of aspen on the southwestern edge of its range. The Kaibab National Forest-South Zone (KNF-SZ) has a mixture of aspen stands ranging from high elevation, large stands to low-elevation, small pockets of aspen. Specific objectives of the project are to: 1) determine the biophysical setting of these aspen stands (i.e., elevation, slope, aspect, parent material, soil texture, etc.); 2) determine the current aspen stand structure (density, diameter, age), dieback and mortality on a subset of conditions across the Forest (approximately 100 stands); 3) reconstruct aspen stand history on this subset of stands. The stand reconstruction would include the short-term (past 5-15 yrs) and long-term (past 100-150 yrs) aspen stand structure to determine how variation in climate, drought, fire occurrence, domestic and wild ungulate populations, and insect or disease may have affected aspen regeneration (ramets) and stand structure.

JUSTIFICATION:

Linkage to FHM Detection Monitoring - Aspen dieback and mortality have increased rapidly over the past 10 years throughout the Southwest and on the KNF-SZ, and have been reported by aerial detection surveys (ADS), Forest Health Protection, and KNF-SZ forest managers. Aspen damage in the southwestern region was detected on about 176,000 acres in 2008, which is an increase from ~85,000 and 143,000 acres reported in 2006 and 2007, respectively. Arizona suffered the majority of this damage (123,130 acres) (USDA, 2008). Significant mortality has occurred in northern and central Arizona, particularly in aspen stands located below 8,500 feet elevation. Fairweather (INT-EM-03-02) initiated an EM project on aspen decline on the Coconino National Forest in 2003, followed by the Apache-Sitgreaves NFs in 2004. Aspen on low-elevation xeric sites (<7500 ft) sustained 95% mortality since 2000 while mid-elevation sites (7500–8500 ft) lost 61% of aspen stems during the same time period.

Significance in terms of the geographic scale – ADS has reported rapid aspen dieback and mortality across many National Forests in the West, and southwestern region (R3) is no exception. This project will complement previous studies on aspen decline in the USFS R3, and contribute to a broader perspective on aspen decline and dieback in R3 and throughout the Rocky Mountains. In addition, this project will offer a unique perspective because the study area occurs within the southwestern edge of aspen's range, and therefore, these aspen stands may have the most rapid and most severe responses to climate change, periods of drought, etc.

Biological impact and/or political importance of the issue - Aspen stands provide critical (and disproportionately high) amounts of plant and animal habitat and aesthetics in the Southwest. A loss of aspen results in a loss of biodiversity, aesthetics, and loss to local rural economies.

Scientific Basis/Feasibility – The project leaders have experience with inventory, monitoring, and analysis of aspen; and experience in reconstructing stand dynamics and history. We also have experience in completing large projects such as this one. Lastly, there is a good working relationship among USFS FHP, USFS RMRS, KNF-SZ and Northern Arizona University.

Priority Issues – This project will address the following priority issues: the effects of climate change forests, drought impacts, and accessing tree mortality.

DESCRIPTION:

Background – The long-term persistence of aspen on the landscape is a concern across much of the western U.S. The extent of aspen decline is controversial. In the past 5-15 years, many western forests experienced rapid mortality of aspen. Decline disease includes predisposing factors, such as long-term climate change, rate of plant succession, site, and stand characteristics. Specific predisposing site factors for aspen include low elevation and southerly aspects, while stand factors include large stem size and low stand density. Severe drought, high temperatures during the growing season, and defoliation (insects, diseases, or late frost) are important inciting factors. Chronic ungulate browsing exacerbates the problem since aspen regeneration is already low.—In Arizona, Fairweather et al. (2008) noted an accelerated rate of decline following a severe frost event in June, 1999, and severe drought in 2000 and 2002. Although aerial detection survey results report on the change in defoliation of aspen at a broad level, the extent and severity of the decline and mortality at the local stand level is unknown.

Methods - We will inventory the aspen stands on the Kaibab National Forest – South Zone (KNF-S), determine the current stand size and age structure, and investigate the severity, site factors and causes associated with aspen dieback. We will also reconstruct the stand history of the site both recent past (past 5-15 yrs) and long-term (past 100-150 yrs) to determine how variation in climate, drought, fire occurrence, domestic and wild ungulate populations, and insect or disease may have affected aspen regeneration (ramets) and stand structure.

Aspen stands on KNF-SZ will be stratified by elevation, aspect and slope and a stratified random sampling strategy will be used to select field sites proportional to the occurrence of these strata within aspen's current distribution. A nested plot design will be used to collect data at each site. A 20-m radius circular plot will be established with the random sample point at site/plot center. The 20-m radius plot will be the unit of analysis and data from the subplots will be averaged prior to the analysis. Four 8-m radius subplots will be located 20-m from site center in each of the cardinal directions. The plot center of the large 20 m plot and the four 8 m subplots will be permanently marked with rebar and the location recorded with a GPS. For each 8 m subplot, elevation, aspect and slope will be recorded. In addition, tree species, diameter, crown class/strata, crown dieback, tree condition (mortality), age, incidence of damaging agents (insect, disease, browse, etc.) will be recorded on all mature aspen trees (> 10 cm dbh). Species, diameter, crown class/strata, tree condition, and age will be collected on all non-aspen species. Seedlings/suckers (< 2.0 cm DBH) will be stratified into two height classes, with 1.37 m serving as the boundary between seedling height classes, as height is a better indicator of the likelihood of seedling/sucker canopy recruitment than age. Variables that will be recorded for seedlings/suckers include: species and percent incidence of damage agents.

Destructive sampling will occur off the plot to determine an age/height relationship. Variables that will be recorded for saplings (> 2.0 but < 10 cm DBH) include everything recorded for mature trees. Saplings will not be tagged. Species and stand-level (plot/site level) statistics will be determined such as density, basal area, average age and growth rates. A 2-4 ha area will be searched for fire scar evidence. This area will be surveyed along multiple transects and trees with the longest and most complete fire records will be targeted for sampling. Aspen with inner ring dates \leq 5 years after conifer evidence of fire (from fire-killed conifer outer ring dates or fire scars) will be considered post-fire recruitment cohort.

Products – Anticipated products include poster or oral presentations at meetings such as Forest Health Monitoring Working Group Meeting and Western International Forest Disease Work Conference. Results will also be published in a refereed journal. The information will be disseminated to forest managers in R3, state foresters in AZ and NM, and others interested in the results.

Schedule of Activities –

Summer 2010: Field survey and fire scar sampling on KNF - SZ

Fall 2010-Spring 2011: Tree core /fire scar preparation, data entry, data analysis

Summer 2011: Final data analysis and report and manuscript writing

Progress/Accomplishments: We tested the proposed method during summer 2009.

COSTS: Budget estimates for FY10.

	Item	Requested FHM EM Funding	Other- Source Funding	Source
YEAR 2010^a				
Administration	Salary ^b	\$13,637		
	Indirect costs ^c	\$ 2,032	\$7,824	NAU
	Travel	\$ 3,284		
Procurements	Contracting	0	0	
	Equipment	0	0	
	Supplies	\$3,400		
Total		\$22,353	\$7,824	

^a A similar budget is expected for FY11.

^b Most of the requested funds will be used to support one undergraduate for summer 2010 and academic year (half time) and their travel and a graduate student salary and travel.

^c For Northern Arizona University indirect costs.