TITLE: Recent, Rapid, Severe Aspen Mortality in the Rocky Mountain Region INT-EM-07-01

LOCATION: Southern Colorado, expanding to Northern Colorado and Eastern Wyoming

DURATION: Year 2 of 3 **FUNDING SOURCE**: Base EM

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PROJECT OBJECTIVES: We are investigating severity, site factors and causal complex associated with recent, rapid mortality of aspen in Colorado, now generally referred to as sudden aspen decline (SAD). It continues to attract intense media attention. We will also perform similar monitoring techniques throughout Northern Colorado and Eastern Wyoming.

JUSTIFICATION: This project addresses many emphases of the Base EM program:

Drought: We suspect that recent, rapid and heavy mortality was incited by the warm drought from about 2000-2005. We will measure site factors that are associated with drought stress, including soil texture, soil type, elevation, aspect, etc.

Tree mortality: Sudden aspen decline is a new syndrome of aspen mortality, much different from the west-wide, long-term "decline" due to succession and lack of disturbance. Mortality is very recent, rapid, and generally is clumped.

Poor crown condition: Mortality is often preceded by several years of branch dieback and crown deterioration.

Insects and diseases: A variety of usually secondary diseases and insects is associated with the mortality, though their incidence varies greatly among affected stands. These include Cytospora canker, poplar borer, bronze poplar borer, and aspen bark beetle (*Procryphalus* sp.).

Soil conditions: We will determine whether mortality is associated in part with well-drained, coarse-textured (i.e., droughty) soils and soil types that are generally less favorable for aspen.

In addition, it addresses evaluation criteria as follows:

Biological impact and/or political importance of the issue: Rapid deterioration of aspen stands has attracted intense media attention, legislative tours, and has raised concern in areas that are economically dependent on aspen, both for fiber and for tourism.

Feasibility of successful project completion: We demonstrated our ability to manage and produce products from similar projects in the past and have a good record of reporting/publication. We already have a manuscript in press from the first year.

Significance in terms of geographic scale: A similar phenomenon is occurring in northern Arizona and New Mexico and perhaps in parts of Utah and Montana. Findings from this EM project may relate to these other areas.

Linkage to FHM detection monitoring: Data from FHM/FIA plots on long-term loss of aspen acreage was analyzed recently (Rogers P. 2002. Using Forest Health Monitoring to assess aspen forest cover change in the southern Rockies ecoregion. Forest Ecology and Management 155: 223-236). Aerial Surveys conducted from 2005 - 2007 show vast acreages of Colorado aspen stands in decline.

DESCRIPTION

a. Background: Beginning in 2004, sharply elevated levels of aspen mortality became apparent on the western San Juan National Forest. This increased in 2005 and became a focus for the Dolores District managers. Of 300,000 acres of aspen, they reported that 8.6% is dead and that mortality in some measured stands increased from 9% to 60% in less than three years. Similar mortality was seen on the Grand Mesa, Uncompahgre and Gunnison (GMUG) National Forests in 2005 and expanded in 2006. Reports have also indicated heavy, concentrated mortality in other parts of Region 2. This may be related to the high levels of aspen mortality seen earlier in northern Arizona and northern New Mexico. We have received numerous requests from the media, forest managers, and from the Washington Office for assessments of the situation. In 2005, we intensified aerial survey of these areas and began to phase in a prioritization of aspen decline for recording that was complete in 2006. We now need to conduct detailed field assessments and analyze aerial survey and ground data to quantify the severity of the problem, assess potential causal factors, and determine the regeneration potential of affected stands. We suspect that the recent drought was a trigger for this event, and therefore predict that dying stands tend to occur on marginal aspen sites as characterized by elevation, aspect, soil type, etc.

b. Progress: We analyzed aerial survey and stand exam data from 2006 and prepared a manuscript that has been accepted for publication:

Worrall JJ, Egeland L, Eager T, Mask RA, Johnson EW, Kemp PA, and Shepperd WD. *In press.* Rapid mortality of *Populus tremuloides* in southwestern Colorado, USA. Forest Ecology and Management.

This paper reports site factors (based on GIS-DEM analyses of aerial survey and cover-type data) and stand factors (based on stand exams in two areas of the San Juan NF) associated with SAD. Generally there is a strong inverse relationship between elevation and damage (damage more frequent at lower elevations), damage tends to occur on south and southwest aspects more than does healthy aspen, damage is most severe in open stands with large trees, and regeneration is poor in damaged stands. However, the stand data is based on a very limited area and must be repeated over the larger study area. We observed five biotic agents most frequently associated with mortality: Cytospora canker, poplar borer, bronze poplar borer, and two aspen bark beetle species. Some combination of these stress-related agents occurred in all examined SAD locations. We concluded with a hypothesis on causal factors in a decline context:

Predisposing factors: Low elevations, south to west aspects, low density, mature age distribution on the landscape.

Inciting factors: Warm drought conditions 2000-2005 and possibly earlier.

Contributing factors: Secondary, biotic agents mentioned above.

(Put this in ISM proposal - We then began an intensive field survey during the summer of 2007 across the Grand Mesa, Uncompahgre and Gunnison and western San Juan NFs. We completed 38 plot pairs consisting of a randomly selected damage plot and a neighboring, paired healthy plot. We sampled trees in a prism plot, estimated % crown loss, identified agents, and took increment cores from a subsample. We excavated a trench to quantify live/dead aspen roots, and a soil pit to characterize soils. We identified dominant shrubs and herbs, and quantified aspen regeneration in a fixed-radius plot. The root and regeneration data will be critical in predicting the ability of affected clones to recover.

Because the plots are so time-consuming, it will be necessary to accumulate several years of data to properly analyze the results.)

c. Products: Early results are already in press in FOREST ECOLOGY AND MANAGEMENT, and the rest will eventually be published also. Results have been used to answer numerous inquiries from media, forest managers, and others. Accurate understanding of SAD will be an important determinant of policy direction for aspen management.

d. Schedule of Activities: In winter 2007/2008, we are analyzing increment cores, entering data, and summarizing preliminary results of the field survey. We will then select plot locations throughout Colorado and Eastern Wyoming for sampling in 2008.

COSTS:

(Put this information in ISM proposal and stick to the original budget request provided in the first proposal - Salary expenses include 5 seasonals for 13 weeks and one to work on increment cores and enter and analyze data after the field season through December 2007 (2008 planning rate). Travel funds are requested for all involved personnel and the project vehicle. *See previous paragraph for justification for the increased budget over last year.)*

	Item	Requested FHM EM Funding	Other-Source Funding	Source
YEAR 1				
Administration	Salary	17,366	35,000	SPFH, SPS4, NFTM
	Overhead (16%)	5,579	6,000	SPFH
	Travel	14,500	2,000	SPFH, NFTM
Procurement	Contracting			
	Equipment			
	Supplies	3,000	2,000	SPFH, NFTM
TOTAL		**40,445**	**45,000**	

Similar budget request ($40K) and "other source funding" are anticipated in year 3 for EM proposal. The above budget info will be in the ISM proposal.)