



Aspen Mortality in the Rocky Mountain Region: Extent, Severity, and Causal Factors (INT-EM-08-01 (Base EM))



(year 2 of a 3 year study)

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Fig. 1. (A) Mycelial fan of *Armillaria* on an aspen root, and (B) a *Ganoderma* conk on an aspen root collar.

MATERIALS & METHODS

A series of permanent plots were established systematically in aspen stands in National Forests (NFs) in 2008 and 2009 (Fig. 4). Three circular plots were established in each stand (1/50 acre for trees and 1/500 acre for regeneration). At each plot center, site information including coordinates, elevation, stand age, slope position, slope, and aspect were recorded. Root disease pathogens were assessed per plot. Variables recorded for aspen trees included tree diameter; host condition (living, recent dead, old dead); and crown health. Associated stress/mortality agents (diseases, insects, damage) were recorded for aspen trees and regeneration.



Fig. 3. Bronze poplar borer on an aspen stem.

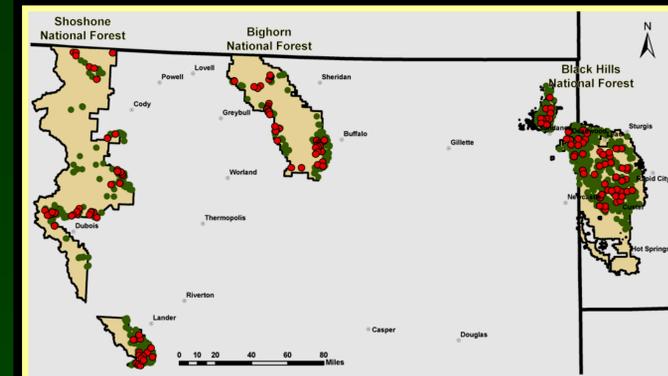


Fig. 4. Location of plots (●) and aspen cover type (green) in the three National Forests.

INTRODUCTION

Aspen is an important and widely distributed species in the Rocky Mountain Region. Aspen forests support diversity, wildlife, watersheds, aesthetics, and local economies.

Aspen decline and mortality has been reported from aerial detection surveys (ADS), forest health surveys, forest managers, and the public over the past years throughout the Region. Unfortunately, information obtained from aerial surveys can not tell us the extent and severity of decline and mortality, the condition of regeneration, or specific causal factors.

USDA Forest Service districts, local landowners, and politicians are requesting information about causes, management recommendations, and what the future holds for aspen. Knowing the distribution, severity, and frequency of causal agents is required before appropriate management recommendations can be made.

OBJECTIVES

The main objective of this study is to obtain a Region-wide perspective of the extent, severity, and causes of aspen mortality.

Specific objectives are to:

- ① evaluate tree and regeneration health;
- ② quantify frequencies of damage causal agents;
- ③ generate hazard maps and descriptions of the spatial distribution (extent and severity) of aspen mortality in the Region;
- ④ analyze hazard maps in relation to ADS results, climate, and other data (including drought).

RESULTS

In 2008 and 2009, 465 plots were established in the Bighorn (135 plots), Black Hills (180 plots), and Shoshone (150 plots) NFs (Fig. 4; Table 1). The average crown health of live trees was 87%, and a mortality rate was estimated to be 3.7% per year.

Armillaria spp. were found in all forests and were confirmed to be causing root disease (Fig. 1A; Table 1). *Ganoderma* root disease (*G. applanatum*) also was present in all forests (Fig. 1B; Table 1).

Twenty six different damage agents were recorded on aspen trees, although, only eight were observed on more than 2% of the trees (Fig. 2 and 3; Table 2). Twenty seven damage agents were recorded on aspen regeneration, although, only two were observed on more than 2% of the regeneration (Table 2).

In 2009, 144 plots and 190 roadside-surveys were completed in the Pike, San Isabel, White River, and Routt NFs. Results for these NFs are being summarized and are not included in this poster.



Fig. 2. Cytospora canker on an aspen stem.

Table 1. Tree, regeneration, and root pathogen means for the three forests

	Shoshone	Bighorn	Black Hills
Tree summary			
Age (yrs)	79	81	58
Radial growth, recent 10 yrs (mm)	8	10	12
Height (ft)	41	42	51
Live stems/acre	370	450	358
Live aspen stems/acre	341	438	313
Aspen DBH (in)	6.4	6.9	6.3
Aspen live crown (%)	88	84	89
Percentage of live aspen	87	89	90
Regeneration summary			
Live stems/acre	4,393	3,344	6,572
Live aspen stems/acre	4,077	3,215	2,978
Percentage of live aspen	80	85	82
Root pathogen summary			
<i>Armillaria</i> found (% of plots)	31	55	71
<i>Armillaria</i> found killing ^a (% of plots)	10	19	18
<i>Ganoderma</i> found (% of plots)	9	10	15

^a *Armillaria* was found killing the cambium at a root collar or on a major root.

Table 2. Percentage of stems with damage agents in the three forests

Damage agent	Shoshone (%)	Bighorn (%)	Black Hills (%)
Trees			
Cytospora canker	41	35	35
Sooty-bark canker	15	10	33
Aspen trunk rot	7	4	18
Animal debarking	4	26	0.4
Bronze poplar borer	9	2	14
Black canker	5	2	8
Cryptosphaeria canker	4	1	4
Poplar borer	5	1	3
All other agents ^a	16	10	8
Any damage agent ^b	61	56	69
Regeneration			
Animal browsing	16	33	17
All cankers ^c	9	5	4
All other agents ^a	3	6	4

^a Percentage of damage from all agents not listed. Individuality found on less than 2% of the stems.

^b Percentage of trees with at least one damage agent. The total is less than the columns sum since multiple agents can be found on a single stem.

^c Percentage of all cankers. Cytospora canker was the most common.

COOPERATORS

Bill Jacobi, Colorado State University; Jose Negron, USDA Forest Service, Rocky Mountain Research Station (RMRS); Wayne Shepperd, Retired-RMRS; Jim Worrall, Dan Long, Brian Howell, and Jennifer Ross, Region 2, Forest Health Management; Blaine Cook, Black Hills National Forest; Chris Thomas, Bighorn National Forest; Randy Spiering, Shoshone National Forest.

CONCLUSIONS and FUTURE PRODUCTS

- ① A few stands have significant mortality. However, most of the stands in the three NFs are healthy.
- ② Many causal agents were observed, but only eight agents were observed on more than 2% of the trees and regeneration.
- ③ Spatial distribution maps of the extent and severity of aspen mortality will be generated for the forests.
- ④ A thorough analysis of the data is planned including an analysis of the spatial distribution maps in relation to R2-ADS results, climate, and other data (including drought).
- ⑤ We are surveying the Medicine Bow and northern Colorado NFs in 2010.