Sudden aspen decline in southwest Colorado

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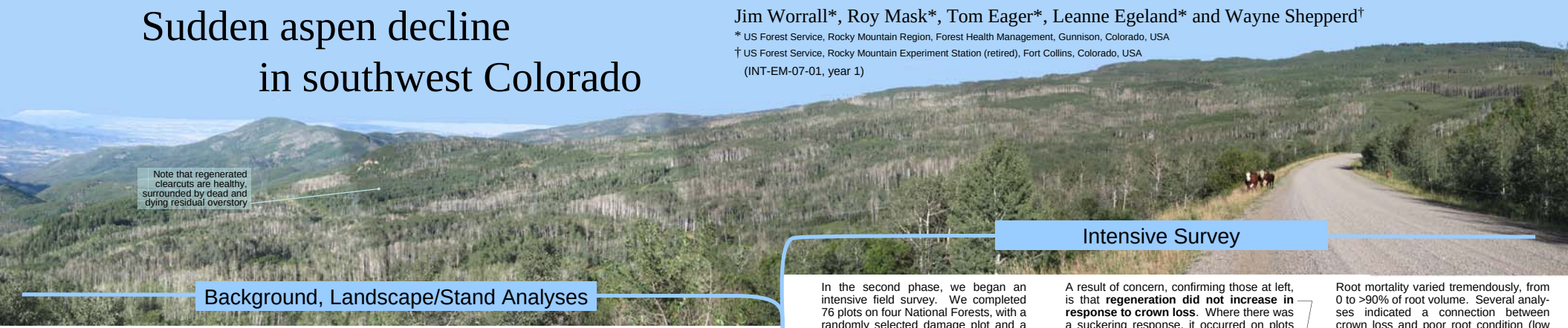
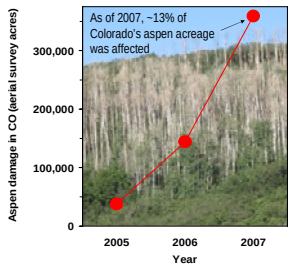


Background, Landscape/Stand Analyses

Background and Objectives. In 2004, foresters in southwest Colorado began to report unusual dieback and mortality of aspen. **Mortality has increased rapidly in Colorado** and has attracted intense media interest and concern from wildlife officials, forest managers, forest products industry, environmentalists, and others.

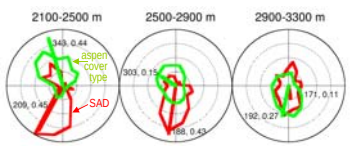
We initiated a project in FY07 with the objectives of determining the severity, site/stand factors and causes of the recent, rapid mortality of aspen in Colorado.

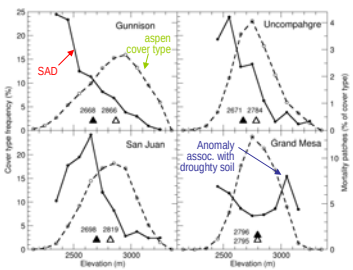
Work in the first year was in two phases. The results of the first phase, reported in this section, are in press[§]:



Landscape Analyses. We used GIS-DEM to analyze aerial survey and cover-type data. We found:

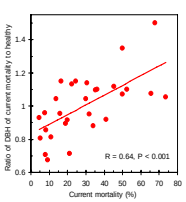
- Damage generally increases as elevation decreases (see also gradient in photo above)
- Damage tends to be on flat slopes
- Damage is focused on south and southwest aspects

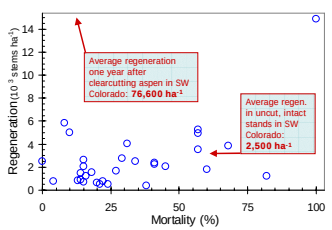




Stand Analyses. We analyzed stand exam data from 31 stands in two areas of the San Juan NF and found:

- Regeneration is poor in damaged stands
- Relative size of mortality is strongly correlated with amount of mortality
- Five biotic agents occurred in some combination in all examined SAD locations:
  - •Cytospora canker,
  - •poplar borer,
  - •bronze poplar borer,
  - •two aspen bark beetle species





We propose 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.

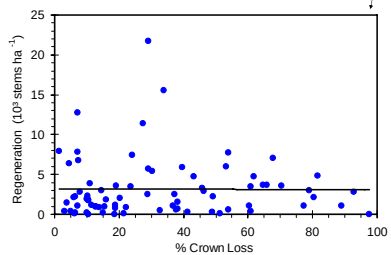
Inciting factors: Warm, dry conditions 2000-2005 and possibly earlier.

Contributing factors: Secondary, biotic agents mentioned above.

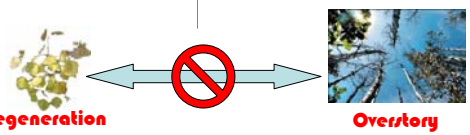
Intensive Survey

In the second phase, we began an intensive field survey. We completed 76 plots on four National Forests, with a randomly selected damage plot and a neighboring, paired healthy plot.

A result of concern, confirming those at left, is that **regeneration did not increase in response to crown loss**. Where there was a suckering response, it occurred on plots with a large volume of healthy roots and/or on mollic and especially pachic mollic soils.

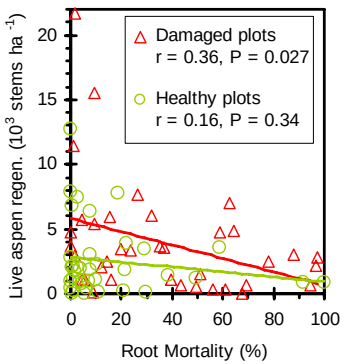


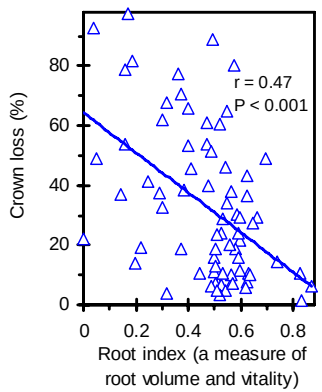
Root mortality varied tremendously, from 0 to >90% of root volume. Several analyses indicated a connection between crown loss and poor root condition (low volume/ high mortality). Healthy plots generally had low root mortality. However, damaged plots had root mortality from <10% to >90%.



Root condition is correlated with overstory crown loss and (in damaged plots only) regeneration, but the latter two are not correlated with one another

Roots





Preliminary Conclusions

1. Sudden aspen decline continues to increase rapidly in Colorado.
2. Two sources of data indicate that damaged stands are not responding to crown loss and mortality with regeneration.
3. Poor regeneration in damaged stands is associated with dying root systems.
4. Warm, dry conditions appear to drive SAD as inciting factor, but predisposing and contributing factors also play important roles.

[§]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. http://dx.doi.org/10.1016/j.foreco.2007.09.071