Sudden Aspen Decline in Colorado

Forest Health Protection
Rocky Mountain Region
USDA Forest Service

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What happened to aspen in the southern Rockies?

Aspen forests in many areas of western Colorado and adjoining states experienced widespread, severe, rapid branch dieback and mortality (Fig. 2). This phenomenon, termed "sudden aspen decline" (SAD), was first noticed in 2004 and increased rapidly through 2008 (Fig. 3). There was no notable increase in size of the affected area after 2008.

Is this any different from change that has always happened to forests?

Aspen forests are dynamic, and have always changed in response to climate, disturbance, and succession. However, the recent event is different from the usual changes that have been seen during the last hundred years for a number of reasons:

Landscape scale. The change occurred on a landscape scale, as opposed to the individual stand-level changes we have typically seen in the past.

Rapidity of mortality. The damage increased dramatically over a few years, as opposed to the typical changes that we see over decades.

Mortality agents. The relative importance of pathogens and insects associated with SAD are different from those typically associated with aspen mortality in Colorado.

What causes SAD?

Three interacting groups of factors are involved:

Predisposing factors. Low elevations, upper slope positions, south to west aspects, and open stands are vulnerable to warm drought.

Inciting factors. Hot, dry conditions of 2000-2003 weakened vulnerable stands.

Contributing factors. Secondary insects and diseases can kill trees under stress. These include Cytospora canker, poplar borer, bronze poplar borer, and two aspen bark beetle species.

How do tree age and prior management affect SAD?

In southwestern Colorado, among overstory trees (> 12 cm DBH), there was no correlation between SAD and tree age or size. However, stems < 12 cm DBH were unaffected. Where aspen was cut in the past, healthy green regenerated patches remained beside dying, unmanaged stands (Fig. 1). Diversification of age structure through management increased the resilience of the landscape to SAD.

What happened to roots and vegetative regeneration?

Roots in many affected stands were in poor condition (Fig. 4) and, probably as a consequence, there was no significant regeneration response to overstory loss from SAD (Fig. 5). Future stands may be more open than the ones that existed prior to SAD. Where sprouting is poor and ungulate browsing or other factors suppress sprouts, other vegetation types may dominate the site and the aspen clone may die.

Is SAD related to climate change?

The impacts of SAD are consistent with projected effects of climate change on aspen. The inciting drought was called a "global-change-type drought" because it was both unusually hot and dry. SAD occurred mostly in areas projected to become climatically unsuitable for aspen early in the 21st century (Fig. 2), in areas with the most severe moisture deficits. In Colorado, 2/3 of the aspen-suitable area is projected to become unsuitable by 2060, and the lower elevation of suitable climate is projected to rise nearly 2,500 feet by 2090.

Is there anything we can do to stop it, or to help stands recover?

In stands with active mortality, SAD may continue, and practical methods to protect the overstory are not available. Where clones still retain some vigor and energy, but are deteriorating, regeneration may be stimulated by burning, cutting or other stand manipulation before root systems are too weak to respond. Work in Utah suggests that stands with less than 50% mortality may be vigorous enough to respond to such disturbance. Preliminary results of treatments in Colorado generally support this. In the long run, more young stands on the landscape will increase the likelihood of aspen presence following future warm droughts of this sort.

Figure 1. The healthy, fine-grained canopy in the center of the picture is aspen that sprouted after harvest in 1984. Surrounding, older aspen is dead or dying. (Terror Creek, Gunnison NF, 2007)

What is being done?

Aerial survey. Aerial survey of forested land is conducted annually in the Rocky Mountain Region by Forest Health Protection and cooperators. We continue to monitor aspen conditions annually.

Analysis of landscape and survey data. Papers published in the journal FOREST ECOLOGY AND MANAGEMENT document the state of knowledge in 2008 and 2010, based largely on southwestern Colorado. Colorado State University and the Forest Service are studying plots in the rest of Colorado, Wyoming, and South Dakota.

Cooperation. The USDA Forest Service cooperates with other federal agencies, Colorado State Forest Service, legislators, and local governments to share information on forest health issues like SAD and their management implications, and to look for opportunities for partnerships, collaboration, and funding.

Management activities. National forests are actively addressing this issue. An Applied Silvicultural Assessment at Terror Creek, Paonia District, Gunnison National Forest, is being conducted in cooperation with Colorado State University and USFS Rocky Mountain Research Station.

Why is aspen so important?

Water. Aspen forests often yield more and higher-quality water than conifer forests. They favor riparian and aquatic habitats, reduce erosion, and moderate streamflows.

Biodiversity and wildlife habitat. Aspen forests are very diverse. Many species are specifically associated with aspen. Aspen provides unique wildlife habitat and good forage for elk and other ungulates.

Beauty and Tourism. Esthetically, aspen contribute a major share of Colorado's scenic beauty. Tourism contributed $7.3 billion and 200,000 jobs to Colorado's economy in 2004 (Colorado Tourism Office).

Wood products. Several communities have industries that depend on aspen wood, with products such as paneling and excelsior.

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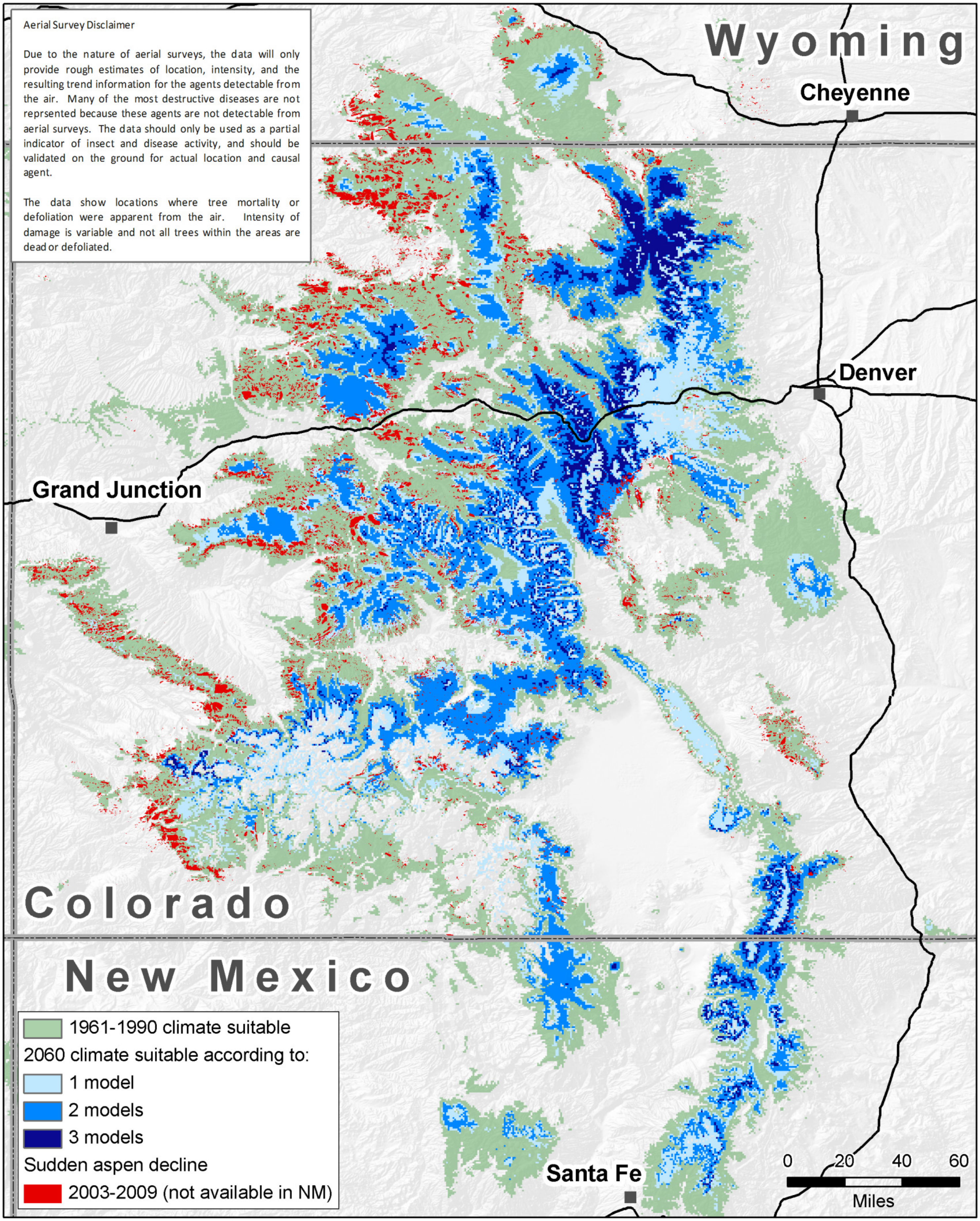

Figure 2. Of the area with climate suitable for aspen, ⅔ is projected to be lost by 2060. SAD occurred largely in those areas. Suitable climate areas based on model data of Rehfeldt et al. 2009.

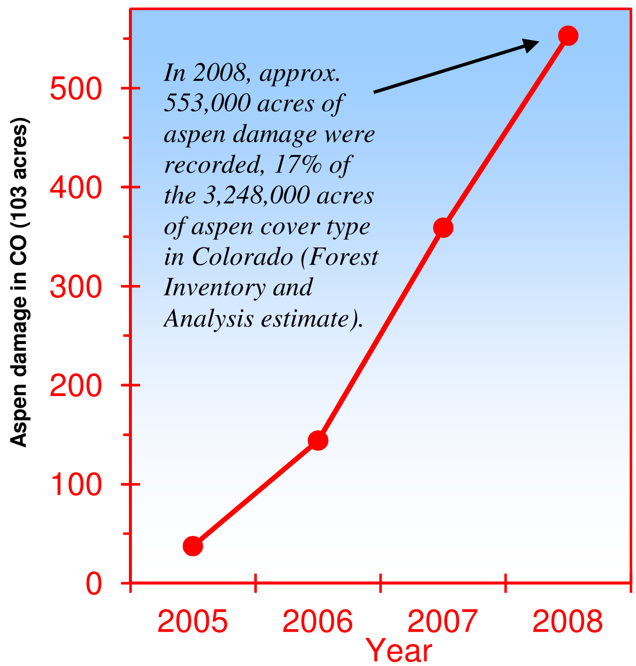

Figure 3. Aspen damage increased rapidly in Colorado from 2004-2008.

The 2008 aerial survey used different procedures to record aspen damage, so trends including 2008 should be interpreted cautiously. Due to the nature of aerial surveys, the data provide only rough estimates of intensity and the resulting trend information. Not all aspen acreage was surveyed every year, so the figures are underestimates.

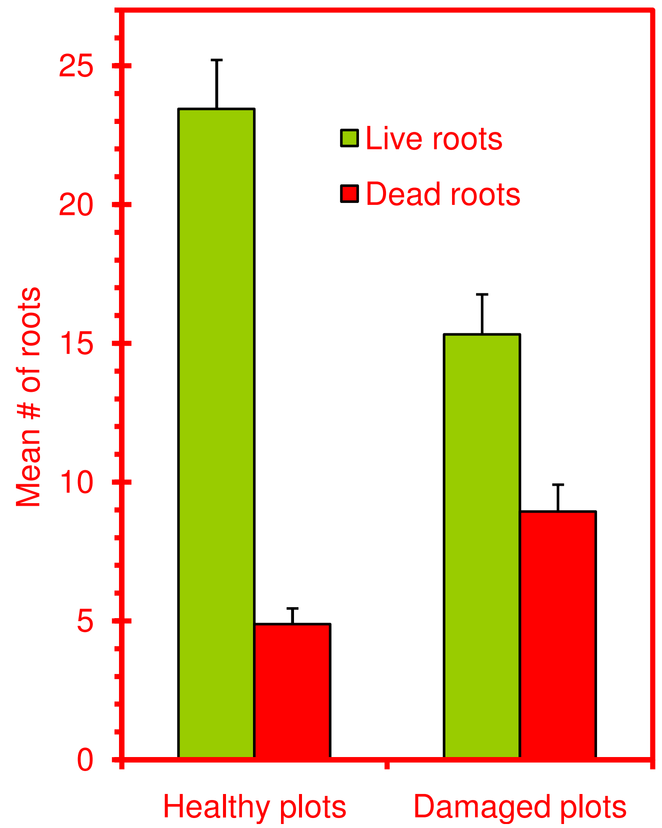

Figure 4. Compared to healthy plots, damaged plots had significantly fewer live roots and significantly more dead roots.

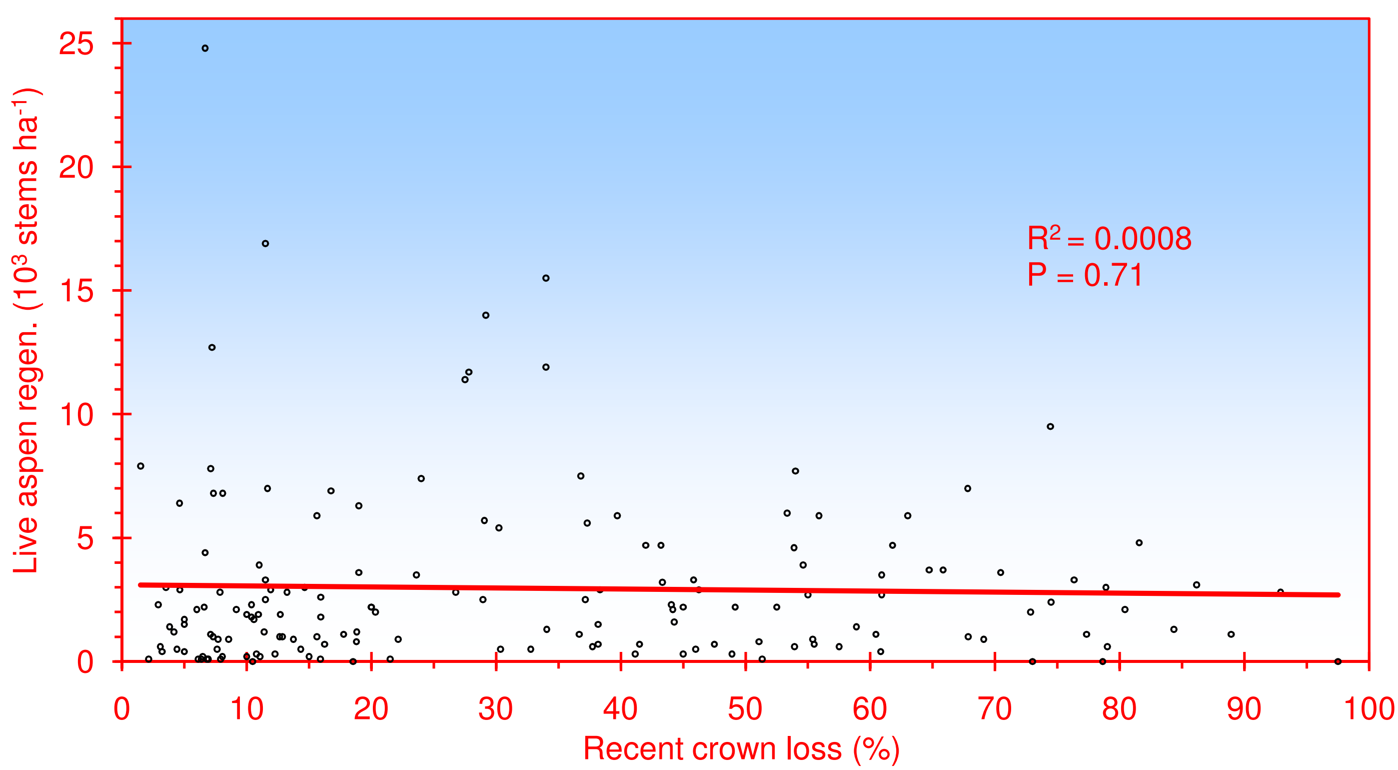

Figure 5. No significant regeneration response to crown loss (including mortality) associated with SAD in 160 plots.