Sudden Aspen Decline in Colorado

Forest Health Management
Rocky Mountain Region
USDA Forest Service

2008 March 19

What is happening to aspen?

Aspen forests in some areas of Colorado are experiencing widespread, severe, rapid dieback and mortality. This phenomenon, termed "sudden aspen decline," or SAD, affected 139,000 acres of Colorado aspen in 2006. In 2007 substantial new areas of mortality were seen and the affected area statewide more than doubled, reaching over 358,000 acres and affecting about 13% of the aspen acreage. The southwestern and northwestern Colorado mountains are experiencing the worst damage.

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

Aspen forests are dynamic, and have always changed in response to climate, frequency and intensity of disturbance, and succession to other forest types. However, the current 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 is evident on a landscape scale, as opposed to the individual stand-level changes we have typically seen in the past.

Rapidity of mortality. The current phenomenon has 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 mortality in old stands in Colorado.

What causes SAD?

Three interacting groups of factors appear to be involved:

Predisposing factors. Low elevations, south to west aspects, open stands, and mature trees are most impacted by the inciting factors.

Inciting factors. Hot, dry conditions of 2000-2005 and possibly earlier stress trees that are predisposed.

Contributing factors. Secondary insects and diseases are able to kill trees stressed by the other factors. These include Cytospora canker, poplar borer, bronze poplar borer, and two aspen bark beetle species.

How does tree age affect SAD?

Older, larger trees have the greatest demand for water, are most stressed during hot, dry conditions, and are least able to tolerate stress. The overall age structure of unmanaged aspen in Colorado is heavily skewed to older trees. Although our old aspen would have eventually died anyway, SAD has synchronized the mortality on a landscape scale and may be affecting the potential for regeneration of aspen.

Since aspen can sprout from the roots, won't forests recover quickly?

Because of heavy populations of ungulates in some areas, losses to diseases and insects, and plant competition, sprouting must be abundant and vigorous to ensure successful regeneration. Where sprouting is poor, other vegetation types may take over the site and the aspen clone may die. Surveys indicate that sprouting is weak and roots are in poor condition in some affected stands, although some stands with mortality have abundant sprouts.

When will it stop? If the warm drought was the inciting factor, shouldn't trees have recovered and stopped dying by now?

We cannot predict how long SAD will continue. A series of stresses often results in a downward spiral of tree health that may be irreversible and takes years to reach mortality. In addition, the populations of insects and pathogens that are contributing to mortality are high now and may further extend the event.

How has past forest management influenced SAD?

Where aspen has been regenerated through management in the past and SAD is present, healthy green regenerated patches can often be seen beside dying, unmanaged stands. It appears that the diversification of age structure through management has increased the resilience of the landscape to SAD (see photo).

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

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

There is nothing we can do to prevent continued dieback and mortality of affected stems. 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.

What is the USDA Forest Service doing to respond to this?

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

Analysis of landscape data. A paper published in the journal FOREST ECOLOGY AND MANAGEMENT documents much of what we know about SAD at this point.[a]

Aspen field study. Forest Health Management is conducting an intensive field survey of aspen in southwestern Colorado to better define the causal factors and to help predict the likelihood of recovery.

Cooperation. The USDA Forest Service is cooperating with other federal agencies, Colorado State Forest Service, legislators, and local governments to share information on SAD and its management implications, and to look for opportunities for partnerships, collaboration, and funding.

Management activities. National forests are actively developing strategies to address this issue. Test regenerative treatments are being planned to identify conditions under which clones may regenerate.

Why is aspen so important?

Beauty. Esthetically, the bright stems, leaves that tremble in the wind, and brilliant fall coloration of aspen contribute a major share of Colorado's scenic beauty.

Tourism. Tourism contributed $7.3 billion and 200,000 jobs to Colorado's economy in 2004 (Colorado Tourism Office). The scenic beauty of aspen-covered mountains undoubtedly are part of the attraction.

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

Biodiversity and wildlife habitat. Forest communities under aspen are exceedingly diverse. Soil and litter that develop under aspen are rich and hold moisture and nutrients well, serving as reservoirs during dry periods. Many species are specifically associated with aspen, and aspen provides unique wildlife habitat.

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[a] Worrall JJ, Egeland L, Eager T, Mask RA, Johnson EW, Kemp PA, Shepperd WD. 2008. Rapid mortality of *Populus tremuloides* in southwestern Colorado, USA. Forest Ecology and Management 255(3-4): 686-696. http://www.fs.fed.us/r2/fhm/reports/sad_2008.pdf

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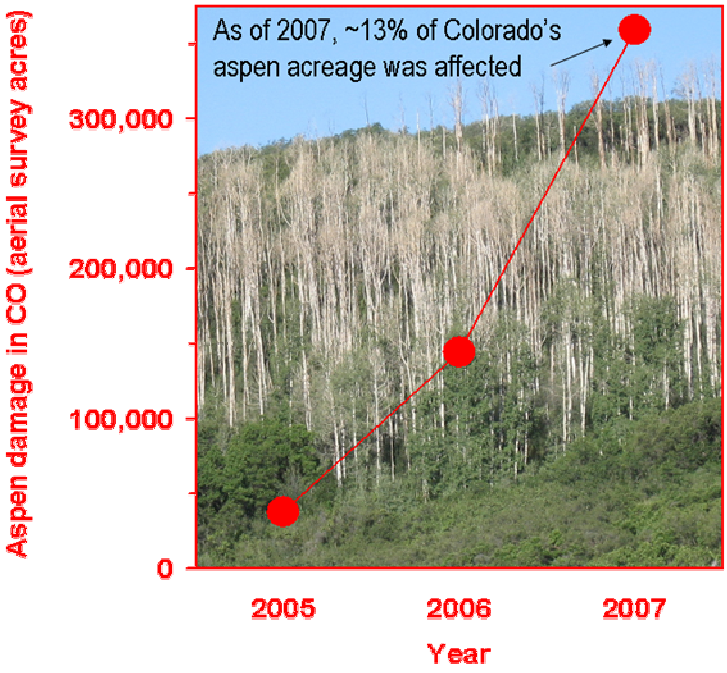


Area of aspen damage recorded on lands of all ownerships by aerial survey in Colorado, 2005-2007.

Aspen was not a priority in surveys before 2006 except on the Mancos-Dolores Ranger District and may be underrepresented.

The 2007 aspen damage affects roughly 13% of the aspen cover type in the State.

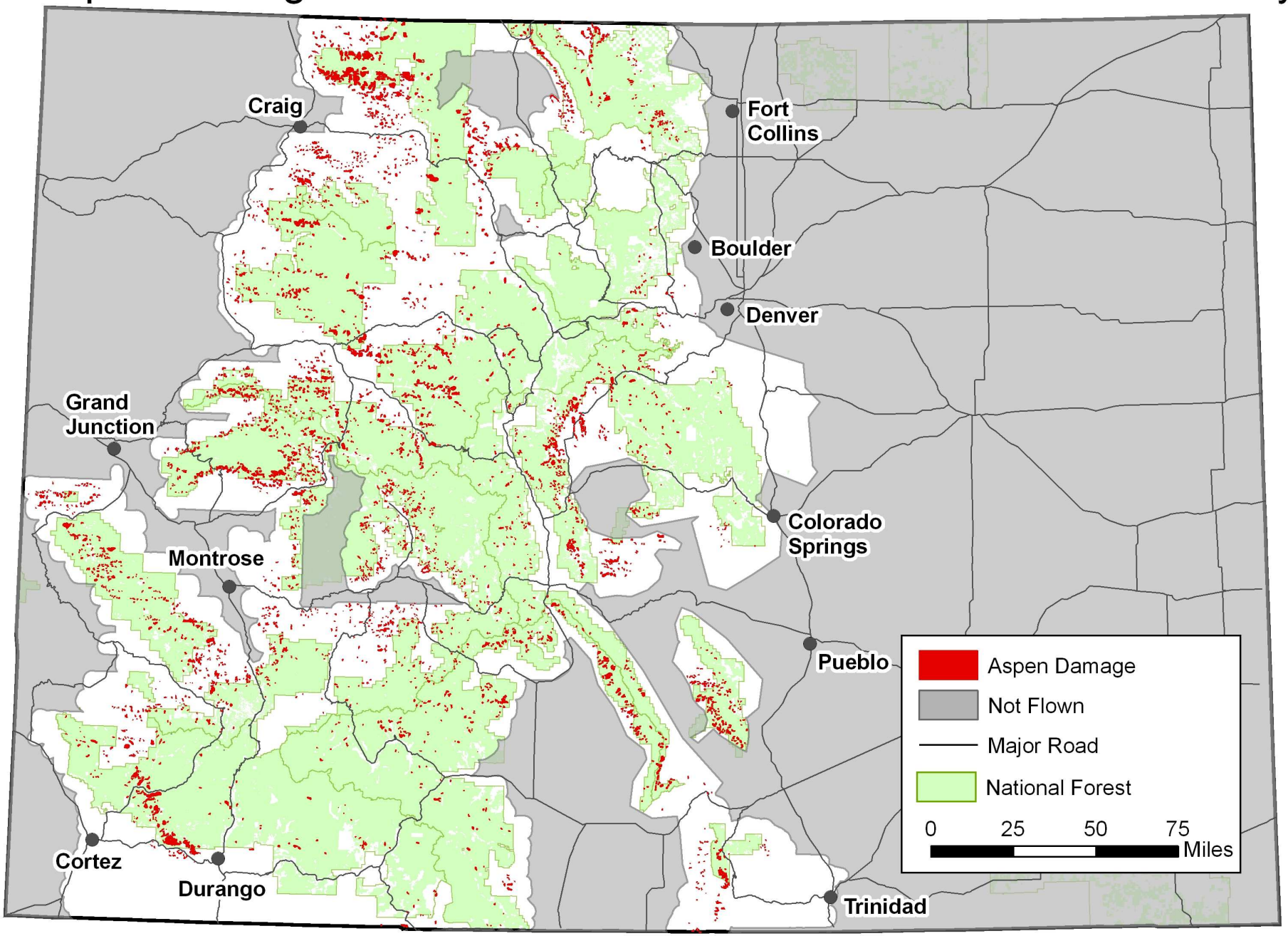
Rapid increase in mortality detected in stands is consistent with information from the aerial survey on a landscape scale. Comparison of aspen mortality in 2002/2003 vs. 2006 for four stands in the Turkey Knolls area, Mancos-Dolores Ranger District, San Juan National Forest.

Unit	2002/2003 Mortality (%)	2006 Mortality (%)
6	8	31
7	9	41
8	7	34
13	9	60

Next page: 2007 aerial survey map of sudden aspen decline in Colorado.

Source: 2007 aerial survey results AND Worrall, JJ, L Egeland, T Eager, RA Mask, EW Johnson, PA Kemp and WD Shepperd. 2008. Rapid mortality of *Populus tremuloides* in southwestern Colorado, USA. Forest Ecology and Management 255(3-4): 686-696.

Aspen Damage in Colorado from the 2007 Aerial Detection Survey



Due to the nature of aerial surveys, the data on this map will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented on this map because these agents are not detectable from aerial surveys. The data presented on this map should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and casual agent.
Shaded areas show locations where tree mortality or defoliation were apparent from the air. Intensity of damage is variable and not all trees in shaded areas are dead or defoliated.