Aspen Dieback in Northern Arizona

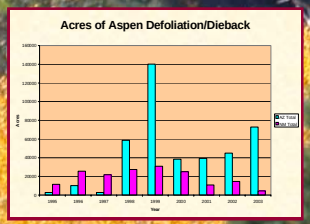
Mary Lou Fairweather[1], Kelly Barton[1], Brian Geils[2], and Mike Manthei[3]
[1]Arizona Zone, Forestry and Forest Health; [2]Rocky Mountain Research Station; [3]Coconino National Forest, Region 3.

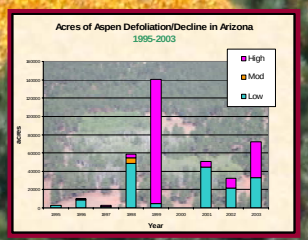
Introduction

For decades forest managers in the Southwest considered a decline in aspen communities the result of two factors: change in fire regimes since European settlement and heavy browsing by large ungulates. However, a recent accelerated dieback of aspen communities has occurred across northern Arizona, following two defoliation events and several years of drought. The Southwestern Region's 1998 aerial detection survey showed a doubling of defoliated aspen acres (>85,000), compared to previous years, followed by another doubling in 1999 (>170,000). Although 1998 defoliation was caused by foliar insects and pathogens, the 1999 defoliation was due to frost damage following a severe June snowstorm, which occurred across most of Northern Arizona. Since 2000, aerial surveyors have switched from reporting acres defoliated, from which trees recovered, to acres of dieback, marked by thinning crowns and mortality.

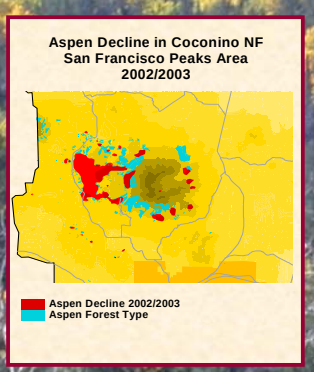
One of the most severe drought events on record occurred in 2002 and dieback and mortality of aspen was observed during the growing season.

We began evaluation and monitoring of affected aspen at the stand level on the Coconino National Forest (NF) in 2003, followed by the Apache-Sitgreaves NF in 2004. This monitoring project describes mortality levels, regeneration condition, and stand and site variables that are influencing decline.





During the extreme drought of 2002, mortality occurred during the growing season.

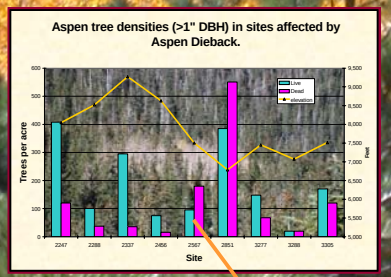


Methods

Plots were established on the Apache-Sitgreaves National Forest in 2004 and remeasured on the Coconino National Forest. Areas with aspen decline were randomly selected from off-plot aerial detection survey data, and a series of 1/20th acre permanent plots established. Plot data includes slope, aspect, and elevation. Large tree data information includes species, status, dbh, height, crown fullness, and severity of any damaging agent. Regeneration on 1/100th acre subplots were sampled for species and number.

Estimated year of death was determined by presence of leaves, buds, fine branches. Categories included current year, 1 year, and more than 2 years.

All live aspen trees greater than 5 inches dbh were tagged and tree height measured on the first two live aspen in each plot. The species, number and type of regeneration were collected on a 1/100th acre sub-plot.



Heavy mortality in an aspen clone at Dry Lake Park near Flagstaff, Arizona

Preliminary Results and Discussion

Eighty permanent plots were established in 9 randomly located sites on the Coconino National Forest in 2003. These were revisited in 2004 and over sixty more plots were established in 9 randomly located sites on Apache-Sitgreaves National Forest. Well over 2,000 aspen trees are now part of the data set for this project. A diversity of aspen communities is represented. Plots are laid out on a grid dispersed throughout an affected area.

A preliminary analysis of data from the Coconino plots follows. Elevation varied from 6,800 to 9,300 feet and was a key factor in both tree species composition and severity of decline. Lower elevation sites (<7,500 feet) were on northerly aspects, dominated by aspen, and had a ponderosa pine and oak component. In general, these sites have a higher ratio of dead aspen to live aspen, and in sites 2567, 2851, and 3288 more than half the overstory aspen died in the past 3 years. Death is gradual and mortality is expected to increase as many live trees currently have only 10 to 30 percent of the original crown left. Higher elevation sites were on various aspects, had a mix of conifer species and a higher ratio of live to dead aspen.

Secondary pathogens and insects included canker fungi, wood borers, and clear wing moths.

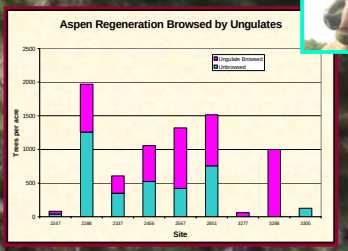
There is little aspen regeneration, especially at lower elevations where most of the overstory is dead. Ungulate browse is heavy at all sites, especially to aspen regeneration. On seven of the nine sites surveyed more than 50 percent of the regeneration was browsed (Figure 9), and two sites had 100 percent browse damage. Drought stressed overstory trees are expected to sprout suckers only within a year or two of tree death. The large die-off of mature aspen trees in many lower elevation sites coupled with browsing by ungulates is expected to result in type conversion of many ecologically unique and important sites across the state.

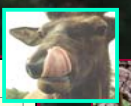
In 2005 all plots will be revisited. In addition, new plots will be established on the North Kaibab Ranger District to observe differences in an area absent of elk.

Gallery from Bronze poplar borer.

Clearwing moth hole and fungal canker.

Fresh bark stripping by elk.





Defoliators of Aspen in Arizona.

Large Aspen Tortrix

Marsonina Leaf Spot

Melampsora rust

Acknowledgements: We wish to thank Brian Howell, Steve McKelvey, Allison Honahni, Joleen Atencio, and Kevin Johnson. Funding was provided by Forest Health Monitoring, Evaluation and Monitoring Funds.