2019

Role of Disease & Insects in Aspen Ecology

John C. Guyon II

WAA BRIEFS

WESTERN ASPEN ALLIANCE

EXTENSION UtahStateUniversity

THE ROLE OF DISEASE & INSECTS IN ASPEN ECOLOGY

WAA Brief #5: April 2019

John C. Guyon II, Forest Pathologist, USDA Forest Service, Intermountain Region

Overview

Aspen is a keystone species in montane forests, and enhances a number of key resource values including wildlife habitat, water resources, and fire behavior. Recently, aspen forests have experienced episodes of dieback and decline across western North America (Worrall et al. 2010, Guyon and Hoffman 2011). A large proportion of the dieback and decline has been linked to drought stress or drought-prone locations (Hanna and Kulakowski 2012). However, insects and diseases are commonly found in declining aspen stands, leading to confusion about the role of insects and diseases in aspen ecology. Additionally, aspen has a reputation for being susceptible to many diseases and insects, but only a few cause significant damage in the western U.S. (Worrall et al. 2010, Guyon and Hoffman 2011).

Background: Roles of insects and diseases causing significant damage in aspen forests

1) **Stressors**: In addition to stress caused by drought or ungulate herbivory, outbreaks of defoliation by both insect and disease agents also stress aspen stands. Two of the more common defoliating agents are Marssonina leaf blight (*Marssonina brunnae*) and the large aspen tortrix (*Choristoneura conflictana*). However, multiple consecutive years of repeated defoliation in the same location is usually required before dieback or mortality is triggered.

Fig. 1 Defoliators: Marssonina leaf blight (L); leaves rolled by, large aspen tortrix (R)

2) **Thinning agents**: In young cohorts, particularly after disturbance, aspen is capable of producing up to 100,000 new stems/acre. This number is reduced to approximately 500-2000 stems/acre at cohort maturity. Insect and disease-caused damage, particularly canker diseases, are responsible for a great deal of this "self-thinning" of young cohorts.

In mature cohorts, sooty bark canker (*Encoelia pruinosa*) was one of the most common and virulent canker diseases found in surveys in both the Intermountain and Rocky Mountain states (Colorado, Idaho, Utah, Wyoming; Guyon and Hoffman 2011, Dudley et al. 2015). This tree disease has no known relationship with environmental stress but needs wounds, typically caused by browsing animals and insects (but human cutting/carving, too!), to become established. In addition, two root diseases are common in aspen stands. Ganoderma root disease (*Ganoderma applanatum*) is largely associated with wind thrown trees in older stands. Armillaria root disease (*Armillaria spp*) is found in pure aspen stands, but is more often associated with aspen stands containing conifers. Neither root disease appears to impact aspen stands after stand replacing disturbance; this may be due to the nearly complete turnover of host biomass post-disturbance.

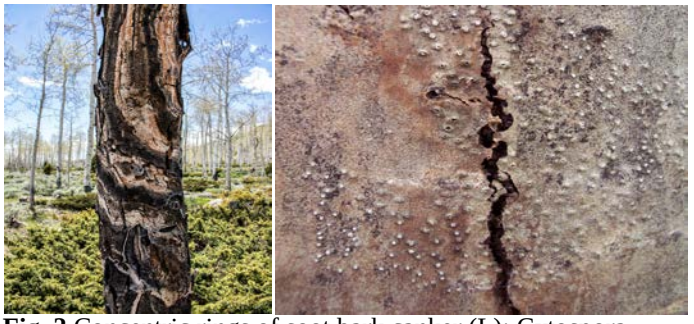

Fig. 2 Concentric rings of soot bark canker (L); Cytospora canker fruiting bodies (R).

Fig. 3 Fruiting bodies: *Armillaria spp* (L); *Ganoderma applanatum* (R)

3) **Stress indicators**: Several damage agents rarely kill unless they are first facilitated by some form of stress on the host tree. For example, Cytospora canker (*Cytospora chrysosperma*, Fig. 2) has a well-established relationship with drought stress, and rarely causes serious damage of unstressed trees. Cytospora is also commonly found around the edges of other cankers, on trees wounded by insects or animals, and on shaded branches. Conditions where Cytospora canker moves out of its facultative role and kills trees without the presence of other agents may be indicative of clones experiencing serious drought stress.

Fig. 4 Wood borers: bronze poplar borer galleries (L); Poplar borer frass (R)

In cases of aspen dieback, two stress-facilitated insect borers are the most damaging to aspen in the western U.S. Bronze poplar borer (*Agrilus liragus*) and poplar borer (*Saperda calcarata*) both damage aspen stems from saplings to mature trees. These insects may also cause the wounds necessary for canker disease establishment.

4) **Normal ecosystem functioning**: All insects and diseases mentioned above are native species commonly associated with aspen ecosystems. As such, they play several beneficial roles in healthy fully functional aspen forests

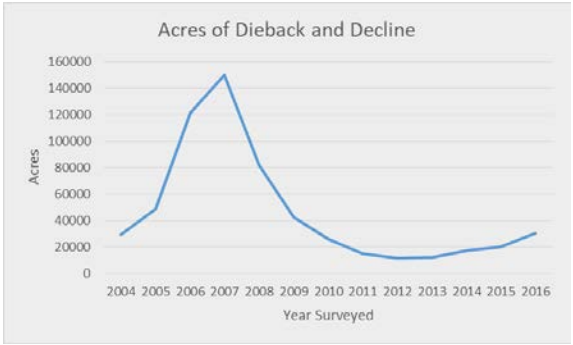

Fig. 5 Pulse of dieback and decline, Utah and Nevada Aerial Detection Survey, U.S. Forest Service

including recycling biomass, facilitating wildlife habitat, and creating space for regeneration. In many aspen forests in the Rocky Mountain West pulses of overstory dieback due to insect and disease activity are a normal part of ecosystem functioning, but if they occur in conjunction with drought stress or heavy grazing/browsing pressure the death of clones may occur.

Management implications

Aspen are commonly affected by a diverse array of pathogens and invertebrates. Forest insects and diseases can drain an aspen clone's carbohydrate reserves, reducing its ability to resist damage or perform other vital functions like growth and regeneration. The first key to managing insects and diseases in aspen forests is recognition of when levels of insect and disease induced dieback diverge from normal background levels. The second key is to avoid regeneration treatments until the impacted aspen forests have recovered.

Key Findings:

1. Aspen forests host a large complex of native insects and diseases which are a normal part of ecosystem functioning.
2. Dieback pulses due to this complex commonly occur in aspen systems ranging from single clones to entire regions.
3. Diebacks may lead to decline and death of clones when paired with factors such as chronic herbivory or drought.
4. Recognition of the ecological roles insects and diseases play in aspen forests, particularly when serious damage results, is a key to management in western North America.

Sources

Dudley, M.M., Burns, K.S. and Jacobi, W.R., 2015. Aspen mortality in the Colorado and southern Wyoming Rocky Mountains: extent, severity, and causal factors. Forest Ecology and Management, 353:240-259.

Guyon, J.C., Hoffman, J.T. 2011. Survey of aspen dieback in the Intermountain Region. USDA Forest Service Rep. INT 2011-1.

Hanna, P., Kulakowski, D., 2012. The influences of climate on aspen dieback. Forest Ecology and Management, 274:91-98.

Worrall, J.J., Marchetti, S.B., Egeland, L., Mask, R.A., Eager, T., Howell, B., 2010. Effects and etiology of sudden aspen decline in southwestern Colorado, USA. Forest Ecology and Management, 260(5):638-648.

Hogg, E.H., Brandt, J.P., Michaelian, M., 2008. Impacts of a regional drought on the productivity, dieback, and biomass of western Canadian aspen forests. Canadian Journal of Forest Research, 38(6):1373-1384.