UtahStateUniversity
FORESTRY EXTENSION

Utah Forest News

USU Forestry Extension Volume 23, Number 1, 2018

Balsam Woolly Adelgid Confirmed in Utah

In 2017, Aerial Detection Surveyors with the USDA Forest Service's Forest Health Protection (FHP) group in Ogden detected and confirmed the presence of a (new to Utah) invasive forest pest called the balsam woolly adelgid (BWA) in Farmington Canyon (Davis County). Originating in Europe and Asia, this tiny, difficult to see insect made landfall on the East Coast in 1908, was detected in California in 1928, and eventually spread to Idaho in 1983. This pest primarily attacks subalpine fir (*Abies lasiocarpa*) often called balsam trees in Utah. It will also attack white fir *(Abies concolor)*, however this species is more resistant to the insect. Balsam woolly adelgid is of particular concern because until now, subalpine fir has been one of the few tree species that has resisted large scale insect infestations that have killed millions of acres of trees across the West over the past 20

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"Now it is likely that subalpine fir may be facing a significant decline, similar to those trees impacted by bark beetles across the West."

Dieback and decline of subalpine fir due to attack by balsam woolly adelgid. Photo by Darren McAvoy.

In This Issue

The Old Pine is Dead, Long Live the Old Pine

In the Winter 2008 edition[1] Utah Forest News reported on identification of the world's oldest-known living ponderosa pine. It was located by Dr. Stan Kitchen in Utah's Wah Wah Mountains during a fire history study[2] and was pith-dated (at stump height) to the year 1075. It is now a sad note to report that the tree died in 2016 at an age of 941 years, a victim of drought and attack by the mountain pine beetle, *Dendroctonus ponderosae*. Kitchen was again the initial observer.

"It is now a sad note to report that the tree died in 2016 at an age of 941 years, a victim of drought and attack by the mountain pine beetle..."

Drought and bark beetles killed the oldest-known ponderosa pine in 2016. Photo taken October 10, 2017, by Doug Page.

Bristlecone pine infested with ips. Cages will be left overwinter to catch emerging beetles, should there be any. Photo by Barbara Bentz.

However, a nearby ponderosa pine, estimated to be within five years in age of the original (and perhaps older), stands alive and as well as possible in a 15-inch annual precipitation zone, where in some years not even 10 inches of precipitation graces the site.

The surrounding forested areas are on lands managed by BLM and fall within both a Research Natural Area and a Wilderness Study Area. The general area is unmanaged other than for some livestock, wild horse and wildlife use and occasional fire suppression.

Both Kitchen and I noted an increase in bark beetle related tree mortality in the area over the past three to five years. But mortality has not been limited to ponderosa pine (*Pinus ponderosa*). Pine mortality related to bark beetle activity has been also observed in pinyon pine (*Pinus monophylla*) and Great Basin bristlecone pine (*Pinus longaeva*).

Dr. Barbara Bentz, research entomologist with the US Forest Service, Rocky Mountain Research Station in Logan, conducted field investigations in 2017 to determine which beetle species are attacking and killing pines in the area. Bentz confirmed that *D. ponderosae* killed the old ponderosa pine, but also found *D. brevicomis*, the western pine beetle, attacking ponderosa pines in the stand. Pinyon pine mortality was attributed to the pinyon ips beetle, *Ips confusus*. Interestingly, Great Basin bristlecone pine in the area were also being attacked by the pinyon ips beetle. Great Basin bristlecone pine is a new host record for the

The oldest-known ponderosa pine, now dead, stands in the background as Stan Kitchen surveys the nearby hills for additional beetle activity. Photo taken October 10, 2017, by Doug Page.

pinyon ips beetle, whose identity was confirmed by James R. LaBonte, an expert in bark beetle taxonomy with the Oregon Department of Agriculture[3].

Great Basin Bristlecone is thought to be immune to mountain pine beetle attack[4]. Bentz and colleagues have found only one Great Basin bristlecone pine with a successful mountain pine beetle attack and it was in the Wah Wah Mountains (this is the only instance of a successful mountain pine beetle attack on Great Basin bristlecone pine that she has seen in thousands of individual tree inspections throughout Utah and Nevada). Bentz and her student's research suggests that mountain pine beetle adults are not attracted to Great Basin bristlecone pine[5], and in lab studies they showed that when manually infested into Great Basin bristlecone pine very few offspring survive to adult[6]. It is not known whether or not the pinyon ips beetle can survive and mature in Great Basin bristlecone pine. Bentz will return to the Wah Wah Mountains this summer to check traps placed on infested trees to capture emerging beetles, should there be any. This will help determine if any live brood was produced.

-Doug Page, Society of American Foresters

[1]McAvoy, Darren. 2008. World's Oldest Ponderosa Pine Found in Utah Fire Study. Utah Forest News, volume 12 number 1, pages 1 -4. (https://forestry.usu.edu/files-ou/Winter08.pdf)

[2]Heyerdahl, Emily K.; Brown, Peter M.; Kitchen, Stanley G.; Weber, Marc H. 2011. Multicentury fire and forest histories at 19 sites in Utah and eastern Nevada. Gen. Tech. Rep. RMRS-GTR-261WWW. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 192 p. (https://www.fs.fed.us/rm/pubs/rmrs_gtr261.pdf)

[3]Bentz, Barbara, Personal communication, Oct. 30, 2017 and December 21, 2017

[4]Bentz, B. J., Hood, S. M., Hansen, E. M., Vandygriff, J. C. and Mock, K. E. (2017), Defense traits in the long-lived Great Basin bristlecone pine and resistance to the native herbivore mountain pine beetle. New Phytol, 213: 611–624. doi:10.1111/nph.14191. (first published in 2016, available online http://onlinelibrary.wiley.com/doi/10.1111/nph.14191/epdf)

[5]Eidson EL, Mock KE, Bentz BJ. 2017. Mountain pine beetle host selection behavior confirms high resistance in Great Basin bristlecone pine. Forest Ecology and Management 402:12-20. (pdf available at www.usu.edu/beetle).

[6]Eidson, E.L. 2017. Great Basin bristlecone pine resistance to mountain pine beetle: an evaluation of *Dendroctonus ponderosae* host selection behavior and reproductive success in Pinus longaeva. Utah State University, Master of Science thesis. (https://digitalcommons.usu.edu/etd/6324/)

'Gouting' of branches, the swelling and deformity caused by balsam wooly adelgid feeding. Photo by Darren McAvoy.

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years. Now it is likely that subalpine fir may be facing a significant decline, similar to those trees impacted by bark beetles across the West.

It can take 2-10 years for trees to die following BWA infestation. It is believed that separate invasions of subspecies or races of BWA may differentially impact tree host species. The scale of the dieback in some locations in Idaho is widespread. For example in the western Payette National Forest, an estimated 70% of subalpine fir trees are dead and falling down. Many interested parties in Utah are concerned that this level of devastation could be on the horizon for Utah.

Identification

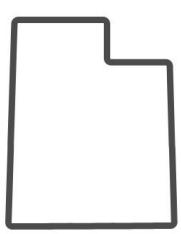
BWA attacks trees of all sizes and ages and its impacts are most visible in the fall. At first glance, a tree infested with BWA has needles that appear to be drought stressed, with a key difference being that the crown starts thinning/ browning from the inside out. It may take a well-tuned eye to notice that affected needles don't turn red like they do with bark beetle attacks, rather the needles turn brown in color. Upon further inspection, the branches reveal a swelling and twisting deformity known as gouting. When BWA attacks smaller trees, they take on a bonsai appearance; branch twisting and swelling has been locally observed in seedling-sized trees.

What can be done?

Sites with high-value trees such as near cabins, campgrounds, and ski areas can be treated with insecticides to suppress BWA. While many BWA insecticides, insecticidal soaps, and horticulture oils may be applied year-round, we recommend applying treatments during the summer and/or fall. The following insecticides are labeled for BWA control: Asana, Astro, Safari, Sniper, Talstar, Lorsban. Thorough coverage of the trunk and limbs is critical to penetrate the adelgid's waxy covering. Good coverage is more important than the choice of insecticide. If the infestation is not widespread when first detected, affected trees should be harvested and removed that season. This recommendation comes with a caveat, because it is possible to infect healthy trees when infected trees are removed and transported, therefore care must be taken if trees are removed.

Wool-covered adelgid bodies are visible on the collar of a subalpine fir tree. Photo by Darren McAvoy.

Utah's Response



A Utah partnership has been formed to survey, research, and implement education and management efforts for BWA. Led by the Utah Department of Agriculture, members represent a wide variety of concerned organizations including USDA Forest Service, USU Extension, the Utah Division of Forestry, Fire and State Lands, USDA Animal Plant and Inspection Service, and ski resort representatives. This group is coordinating efforts to secure grant funding to study BWA's spread and impact in Utah, and to develop public educational products.

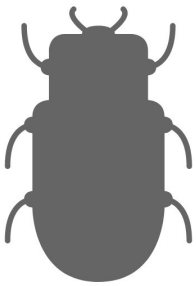
-Darren McAvoy, Extension Forestry Assistant Professor and Diane Alston, Extension Entomologist

Streamwater nitrogen and forest dynamics following a mountain pine beetle epidemic: Insights from three decades of research at the Fraser Experimental Forest, CO

A recently published study (https://goo.gl/qweK3j) by a team of Rocky Mountain Research Station (RMRS) scientists describes a 10-year investigation of streamwater nitrogen and forest dynamics following a mountain pine beetle epidemic.

Unlike the abrupt nutrient changes typical after a wildfire or timber harvesting, the outcomes of insect outbreaks are poorly understood. RMRS Scientists Chuck Rhoades, Rob Hubbard, and Kelly Elder capitalized on long-term, pre-outbreak monitoring at the Fraser Experimental Forest (https://goo.gl/Ly8Dqs) near Winter Park Colorado where the U.S. Forest Service has studied the forest and hydrologic processes responsible for regulating streamflow from high elevation watersheds since 1937. Contrary to expectations, watersheds with extensive MPB-caused forest mortality 'leak' very little stream nitrogen.

For example, the stream nitrogen response to the beetle infestation at Fraser differed between watersheds comprised primarily of large trees that are more susceptible to the bugs and watersheds with a mixture of large and small trees. Old-growth watersheds lost 85 percent of large lodgepole pine, representing nearly half of the entire forest basal area. In contrast, mixed-age watersheds lost only a quarter of total stand basal area. Stream nitrogen increased significantly in two old-growth watersheds during the decade after beetles arrived but remained unchanged in two mixed-age stands.



So where did the nitrogen go?

In addition to lower beetle-related mortality, mixed age watersheds support twice as many small trees as old-growth watersheds. Smaller conifers use more soil resources—including nitrogen—per unit leaf area than larger trees. Death of large trees reduces competition for sunlight, water, and nitrogen; young trees respond rapidly with increased

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Dramatic overstory mortality was caused by epidemic mountain pine beetle levels at Fraser Experimental Forest. Unlike logging or wildfire, forest mortality from bark beetles does not disturb the soil surface and the many remaining young trees take up nitrogen. Photo by Chuck Rhoades.

MANAGEMENT IMPLICATIONS

Wildfires, harvesting, and beetle outbreaks all have different effects on forest dynamics and biogeochemical responses.

Responses to beetle outbreaks vary with forest species composition, understory conditions, tree size and age, and other factors.

Larger trees are more susceptible to mountain pine beetle attack. Mixed-age stands at the Fraser Experimental Forest had lower overall tree mortality and greater recovery potential.

These findings provide support for maintaining age, species, and structural diversity within headwater forests.

Ongoing watershed research at Fraser and elsewhere will help land managers better predict the impacts of beetle outbreaks on delivery of clean, low nutrient water and assess management responses to beetle outbreaks or other forest disturbances.

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growth and demand for soil resources. Nitrogen liberated by the beetle-killed trees is taken up to support growth of live trees and understory plants as well as soil microbes. Despite the dramatic overstory mortality that occurred a decade ago, the forests at the Fraser Experimental Forest are thriving today. This research that utilized historic watershed studies, helps underscore how multiple-age stands may increase forest resilience to insect outbreaks. It also validates the sustainable forestry practice of retaining live understory trees that have potential to respond rapidly to death of mature overstory trees and mitigate potential water quality responses.

Questions about this study can be directed to Chuck Rhoades: crhoades@fs.fed.us.

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Rocky Mountain Research Station researchers work at the forefront of science to improve the health and use of our Nation's forests and grasslands. More information about Forest Service research in the Rocky Mountain Region can be found here: https://www.fs.fed.us/rmrs/

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Why do stream nitrogen levels matter?

Nitrogen is essential for plants and increased soil nitrogen fertility is associated with higher plant growth in ecosystems around the world.

However, excess nitrogen can leach from soils and degrade water quality. High concentrations of nitrogen or phosphorus promote algal blooms that can severely deplete oxygen in the water and harm fish and other stream organisms. At high levels, stream nitrate-nitrogen is a human health hazard and a regulated water quality constituent. Excess stream nutrients affects about 1/3 of streams in the continental United States.

Stream nitrogen monitoring helps scientists study forest and watershed change

Headwater forests typically produce low nutrient water that maintains healthy stream ecosystems and delivers clean water to downstream users. When a large number of trees are harvested or die, that lack of plant uptake and site disturbance often increases nitrogen in soils and streams. Unlike logging or wildfire, forest mortality from bark beetles does not disturb the soil surface and dying trees add pine needles that can conserve nitrogen within impacted forests.

Increased nitrogen deposited with rain or snow has been shown to aggravate nitrogen losses from forest dieback in some areas. Researchers working throughout the U.S. Forest Service

Experimental Forest Network measure nitrogen entering and exiting watersheds effected by forest change.

Optimism for Aspen Restoration Project in Carbon County, Utah

Photo by Natalie Conlin.

The West Fork Willow Creek Aspen Restoration Project was funded by Utah's Watershed Restoration Initiative (WRI). The project is located on private land near Soldier Summit, where aspen stands are dying out and in the process of conversion to sagebrush rangelands. The objectives of this project are to encourage regeneration of declining aspen forests, prevent complete loss of the aspen resource, and improve wildlife habitat by increasing aspen acreage and understory forage productivity. Removal of the aspen was completed by a private contractor who used a trackhoe mounted rotating cutting head to cut the aspen. A Utah Conservation Corps crew put up 8 ft tall polypro mesh fencing to protect the aspen resprouts from cattle, elk, and deer. This photo was taken 3 months after fencing, and despite the dry summer of 2017, the aspen is already a few feet tall, and all the resprouts outside of the fenced area have been eaten by browsing animals.

-Natalie Conlin, Southeast Area Forester, Division of Forestry, Fire, & State Lands

Biochar Kiln Demonstration

Meeting Location • Dirt road turnoff of HIWY 191, (County road 264), north of Recapture Reservoir in San Juan County

Wednesday
March 28, 2018
10am - 12pm

RSVP by March 26 to:
megan.dettenmaier@usu.edu

PARTNERS:
Division of Forestry, Fire, & State Lands; USU Extension, San Juan County Extension, Intermountain Society of American Foresters

Join us for a biochar kiln demonstration in San Juan County, Utah. Tour attendees will observe biochar being made using simple, metal kilns and learn how to safely make biochar at home or on the farm or ranch. This low-tech, low-budget technique can be a useful way to reduce hazardous fuels in forests and create a valuable soil amendment that is a form of direct carbon sequestration. Anyone with an interest in biochar or anyone that has woody biomass to dispose of will find this demonstration useful. Biochar experts will be on hand to answer questions and provide resources. All are welcome to observe and learn about this technique!

Meet by 10:00 am at the dirt road turn off of Highway 191 directly north of Recapture Reservoir, north of Blanding, Utah, locally known as County Road 264. 4wd vehicle recommended, but not necessary, carpools will be available.

Contact Us

Do you have a story idea for the next edition of Utah Forest News? Have feedback about any story in this issue? Get in touch with us.

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