Why are aspen dying?

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(Phys.org) —If Utah's quaking aspen appear to be quaking more than usual this summer, the trees have reason to tremble, says a Brigham Young University biologist. In dappled forests across the West, aspen trees are battling deadly killers from heat stroke to bud-nipping

predators to tree "heart attacks."

In a July special aspen tree issue of *Forest Ecology and Management*, BYU biology professor Sam St. Clair and colleagues from across the west report that they are seeing troubling declines in aspen populations in Utah, Arizona, and Colorado. The die-offs are seen most dramatically at lower elevations where drought and hotter temperatures are killing older trees.

"Aspen trees, because of their sensitivity to drought, experience what I call 'plant heart attacks,'" says St. Clair, lead researcher on a multi-year study of aspen in Utah. "As you get hot dry conditions, taller aspen trees have to pull water up from the soil more strongly and it creates bubbles in the water and blocks the transport of water and nutrients up the tree. The tree will die from the top down."

The biology of aspen is complex because thousands of trees in one stand are all one organism, genetically identical clones tied to a mother root system. If the clone dies, thousands of trees can be lost.

In Fishlake National Forest, where aspen clones have been a part of the Utah landscape for thousands of years, St. Clair says the branches of many low-elevation aspen trees were bare last year even before the chill of fall. Researchers from Utah State University have made similar observations at nearby 107-acre "Pando," the largest documented genetic aspen clone.

Just as older aspen are dying from drought and hotter temperatures, younger trees are also dying, primarily from over-browsing by hungry deer, elk and livestock. Since aspen clones are all connected to a central root system, biologists worry that if there are no young trees to photosynthesize and to sustain the organism, it will eventually die.

"If drought occurs for long enough and is severe enough, it would even kill the younger aspen trees. Extended drought over long periods of time would in time affect the mother root system that supports the whole clone," says St. Clair.

In the face of this trend, St. Clair and his BYU students are working with the Division of Wildlife Resources to study the effects of over-browsing, species facilitation, drought impact, recovery after fire, and other factors that may be killing trees. The research will be used to help establish land use guidelines throughout the western states.

"We're studying the sustainability of forests especially aspen forests at lower elevations where we are susceptible to losing them. I want to understand how these systems work," he says. "Aspen set the stage for all of the other organisms so aspen is at the foundation of everything that goes on here biologically."

The filtered light of the aspen canopy creates a micro-ecosystem that nurtures plant and animal species. In addition to providing forage and shelter for wildlife, St. Clair says aspen also help human populations by accumulating more snowpack that increases water availability for human use. Aspen stands also help regenerate forests after fire.

Within the aspen canopy, St. Clair has shown how aspen facilitates other species. In one instance, conifer trees grow at the base of aspen but they outgrow the aspen and eventually kill the host tree. Nature has a way of restoring balance to the system; fire wipes out the less desirable conifers but the aspen root clones survives.

"These systems are fire dependent. Fire will come into the system and the aspen will regenerate and start this cycle over," he says.

On Utah's Monroe Mountain, an area charred last year by a June forest

fire, hundreds of aspen suckers quickly emerged from the mother root system. BYU and the DWR have fenced off small plots to see if protecting the seedlings from browsers will help them survive. Although they can't fence off every forest, St. Clair says solid research will help them to better understand what is killing aspen and how humans will be impacted if we lose these forests.

"It's a keystone species. All of the things we care about in our lives tie back to these systems functioning in a certain way. I want to understand the connection between the loss of aspen forests and what that means to society as a whole."

More information:
www.sciencedirect.com/science/journal/03781127/299

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