Beleaguered forests are losing ground

March 29 2023, by Clay Bonnyman Evans

1875 City of Boulder Reservoir, photographer J.B. Sturtevant (“Rocky Mountain Joe”). Credit: Carnegie Library for Local History, Boulder Public Library

Criticizing the Biden administration's $3.5 trillion Inflation Reduction Act, a U.S. Senate candidate in Georgia singled out funding to plant and protect trees.

"They continue to try to fool you that they are helping you out. But they're not. Because a lot of money, it's going to trees," GOP candidate

Herschel Walker said while stumping at a fundraiser. "We got enough trees—don't we have enough trees around here?"

A 2015 study in *Nature* estimated there are 3 trillion trees on the planet. Whether or not that's "enough," the survey also found that "the global number of trees has fallen by approximately 46% since the start of human civilization."

And according to a University of Colorado Boulder scientist who has been monitoring the health and number of trees in the Colorado high country for more than four decades, climate-driven changes in temperature and drought have not only tripled tree mortality rates in the past two decades, but also significantly undermined tree regeneration rates.

And that matters.

"If we are losing forest cover, we are going to lose a variety of ecosystem services," says Tom Veblen, Distinguished Professor emeritus of geography, who has been tracking changes in thousands of trees on Niwot Ridge west of Boulder since 1982.

Tom Veblen, distinguished professor emeritus of geography, in approximately the same spot as the 1875 photo above. Credit: Glenn Asakawa.

Declining tree cover results in damage to watersheds as debris flow and flooding increase, and in the loss of habitat for certain species. Perhaps most destructive, the loss of "above-ground biomass" removes a vital source of carbon storage, which further fuels climate change.

"In most simulation models of ecosystem impacts of climate change . . . the trees grow back after fire. But we're not seeing that as documented for montane forests in Colorado," Veblen says. That results in "one of those nasty, somewhat unexpected positive-feedback loops that speeds

up climate change because there is more carbon dioxide in the atmosphere. Even a politician in Georgia will potentially be affected by that."

Veblen came to CU Boulder in 1981 after six years of research in Chile and New Zealand, which taught him the value of establishing plots where trees could be observed long-term.

"I knew from my research experience in the Southern Hemisphere that I wanted to put in permanent forest plots, which are essential for understanding long-term changes in tree populations," he says. "There is no substitute for that."

With money from a short-lived program funded by the state of Colorado, he and his students established 40 "long-term monitoring plots," marked 8,000 trees on Niwot Ridge and have been monitoring them ever since.

"The proposal . . . was to assess the influence of climate variability on tree demography and population changes, mortality, and the establishment of new seedling recruitment (new trees)," Veblen says. A second goal was to study the effects of 19th-century fires on lower elevation ponderosa pine and Douglas fir forests.

One of the key findings from Veblen's research: While tree mortality rates remained low and stable until 1994, they have tripled since then, even in higher elevation Englemann spruce and lodgepole pine forests.

"That's not at all surprising . . . given increasing temperatures and increasing drought," Veblen says, noting that researchers have reached the same conclusions at locations across the western United States.

Meanwhile, new trees are not filling in the gaps.

Former CU Boulder graduate student Robert Andrus, now a postdoctoral researcher at Washington State University, harvested about 1,000 juvenile trees to determine their establishment dates and found that new trees grew in "pulses of single years, cooler, moister years, based on late spring and summer weather conditions," Veblen says.

But the occurrence of such years has plummeted by two-thirds in the latter half of the seven-decade record Andrus examined.

"Without cool, moist years, we're not getting establishment" of new seedlings, including after fires, Veblen says. "That's an indicator of what is likely to continue with warming temperatures."

Even lodgepole pines, famous for colonizing burned areas—the tree's cones open after exposure to fire—are failing to regenerate in some places. In areas torched by severe fires in 2002 in the Routt and White River national forests that have been repeatedly sampled over a 15-year period, there are only sparse and patchy seedlings of this fire-adapted species, which usually take root within a year or two.

Those trends have convinced Veblen and other researchers and forest managers that Western forests need a helping hand from humanity, particularly after destructive wildfires.

"If we want to have forests after fires, we need to not rely on natural regeneration. We need to invest heavily in artificial regeneration," the cultivation and planting of seedlings in strategic areas, Veblen says.

Andrus agrees. "We have bark beetle outbreaks and wildfires that cause very obvious mortality of trees in Colorado. But we're showing that even in the areas that people go hiking in and where the forest looks healthy, mortality is increasing due to heat and dry conditions alone," adding:

"It's an early warning sign of climate change."

Veblen and the fire management community broadly agree that "living with fire" is increasingly challenging, as shown by modeling projections that say, "Exceptional fire seasons like 2020 will become more likely, and wildfire activity under future extremes is predicted to exceed anything yet witnessed."

In Wildland Urban Interface areas, so-called "red zones" that are abundant throughout the West, Veblen has recommendations: Property owners must still establish "defensible spaces." Building codes should be used to require less-flammable building materials. "Fuels reduction" through a combination of tree cutting and prescribed fires should be prioritized near settled areas to give firefighters a foothold.

However, Veblen says, in more remote areas, mechanical thinning alone is not effective and not practical. Instead, he says, managers are increasingly emphasizing the value of letting wildfires do the work of reducing fuels and buffering against future fire potential.

"Agencies previously tended to strongly emphasize mechanical thinning to reduce fuels, but under the kind of extreme weather conditions that promoted the 2020 East Troublesome fire, no practical amount of fuel management can fully protect homes and communities," he says.

Instead, he'd like to see resources currently dedicated to remote-area fuels reduction be redirected into seedling cultivation and planting in selected, suitable areas.

"We are not going to be able to prevent large, severe fires, so we need to be much more strategic in investing our resources to avoid or delay some of the worst outcomes of climate change," he says.

Provided by University of Colorado at Boulder