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Climate Change Killing America's Trees at Ever Faster Rates

By Michael Wall | January 22, 2009 | 2:06:27 PM

Trees in western North America are dying at faster and faster rates, and climate change is likely to blame.

The mounting deaths could fundamentally transform Western forests because tree reproduction hasn't increased to offset losses, according to a new study published Thursday in Science. And new seedlings aren't rising quickly enough to fill the gaps.

If current trends continue, forests will become sparser over time, co-author Philip van Mantgem, an ecologist with the U.S. Geological Survey, said in a press conference call. This would be a setback in the fight against global warming because thinner forests with small, young trees store less carbon, so more heat-trapping carbon dioxide would cycle into the atmosphere.

A large-scale transition to such threadbare woods would have other negative effects as well, van Mantgem said. Species that depend on big stands of old growth, such as marbled murrelets and spotted owls, would have much less room to roam. And the risk of catastrophic fires would go up with more dead, dry wood lying around to fuel it.

The evidence is mounting that warming and drought are changing ecosystems across western North America. Other studies have documented major tree die-offs and surging wildfires. Plant species have climbed uphill, and bark beetles are laying waste to ever-increasing tracts of woodland.

The new study adds to the list, said Michael Goulden, an ecologist at the University of California, Irvine who was not involved in the research. Something large and important is happening to Western ecosystems, in correlation with climatic shifts.

The research revealed that tree mortality rates in old-growth forests from southern British Columbia to Arizona have doubled every few decades over the past 50 years.

This is likely because region has warmed considerably during this period too, the scientists say. Since the 1970s, temperatures across the West have risen by 0.3-0.5 degrees Celsius every ten years. Such warming has led to reduced snowfall, a smaller winter snowpack, and earlier spring melts.

Trees are under more drought stress, said USGS ecologist Nathan Stephenson, a co-author on the study.

Higher temperatures could also be killing trees by jump-starting their enemies, he said. The warmer the weather, the faster the insects and pathogens that feed on trees can grow and reproduce.

And the two factors could be acting in concert, as drought-stressed trees are less able to

fight off disease and predators.

The scientists looked at 76 forest plots across western North America. All were old-growth stands, undisturbed for at least 200 years and censused multiple times from 1955 to 2007. The researchers found that tree death rates increased in 87 percent of plots during this time. This strong pattern held no matter how they parsed the data — across all regions, elevations, tree sizes, and tree species.

Altered burning regimes aren't the answer, they argue, because tree deaths have gone up even in forests where fire has never played a major role. Pollution or forest fragmentation cannot be responsible, either, because the mortality rate has risen even in pristine habitats. That leaves climate change as the most likely culprit.

Even in the most resilient old-growth stands, there still is a coherent signal of increased mortality related to warming, said co-author Thomas Veblen of the University of Colorado.

The use of long-term data makes the study stand out, Goulden said. The data are as high-quality as anyone could realistically hope for. The conclusions are based on repeat surveys of permanent plots over long periods.

However, Goulden thinks the authors should have hedged a bit more on their claim that warming is responsible for the increase in tree deaths.

The authors' argument is based on rejecting the alternatives and showing that warming was correlated with increased mortality, he said. The direct evidence that warming caused the change, or even that the observed warming was sufficiently large to have caused the mortality change, is not there.

Still, the paper makes a valuable contribution, further documenting a worrisome trend the world should be watching, Goulden said. I'm convinced the authors are describing a large, widespread, real, and important phenomenon, he said.

Citation: Widespread Increase of Tree Mortality Rates in the Western United States. By Phillip J. van Mantgem, Nathan L. Stephenson, John C. Byrne, Lori D. Daniels, Jerry F. Franklin, Peter Z. Ful, Mark E. Harmon, Andrew J. Larson, Jeremy M. Smith, Alan H. Taylor, Thomas T. Veblen. Science Vol. 323, 23 January 2009.