

National climate change report: what's in store for Southern Appalachian forests?

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(Photo: Courtesy of Adam Warwick/The Nature Conservancy)

STORY HIGHLIGHTS

- "Increased fire will be the most observable and large-scale, dramatic change in forest"
- Most in WNC live in or within striking distance of a forest, which should cause concern for climate change.
- The No. 1 concern from clients and the public is the fear of wildfires burning their homes.
- Climate change will lead to more drought and fire as well as more rain and flooding in forests.



ASHEVILLE - Drought, fires, epic storms, flooding, even plagues of insects.

The recently released government report on climate change, the "[National Climate Assessment](#)," predicting drastic changes to the way our local forests will look and function in the next few decades reads like the worst of Bible tales.

But according to local scientists who worked on the 1,600-page report released on Black Friday, and those who work on climate change issues, the dire predictions laid out in the report are true and real, and shouldn't have taken anyone by surprise.

As the Earth warms due to climate change, mostly brought on by human-caused emissions of carbon dioxide and other greenhouse gases, drought will increase, leading to larger, more intense fires and outbreaks of tree-damaging insects. Climate change will also lead to more extreme storms and an increase in rain and flooding, leading to runoff and stream pollution and a decrease in water quality, just to name a few impacts.

Jim Vose, senior research ecologist with the U.S. Forest Service Southern Research Station in Asheville, said these plagues are already upon us, as evidenced by record rainfall in Western North Carolina over the Memorial Day weekend, and the historic fires in the fall of 2016 that burned some 30,000 acres of forest and killed 14 people in Gatlinburg, Tennessee, after an arson fire escaped from the Great Smoky Mountains National Park, an event that was mentioned in the report.



Jim Vose, senior research ecologist with the U.S. Forest Service's Southern Research Station in Asheville, was a co-lead author of the "Forest" chapter of the National Climate Assessment. *(Photo: Courtesy of U.S. Forest Service)*

"The very dry fall in 2016, back when Gatlinburg and most of WNC burned, was an example of how very dry conditions increase the likelihood of a larger area being burned than had been experienced in the recent past," said Vose, who was the co-lead author on the climate report's Forest chapter, which he worked on for two years.

“The increased frequency of very dry conditions is likely over the long run to increase the likelihood of those events happening again in the future. This will be the most observable and large-scale, dramatic change in forest,” he said.

This prediction doesn't bode well for Western North Carolina, an 18-county area of the Southern Appalachians that is awash in mountainous forests.

The landscape is covered in millions of acres of dense forest, including more than 1 million acres in the Pisgah and Nantahala national forests, a half-million acres in the Great Smoky Mountains National Park, and thousands more in state parks, state forests and state game lands. But publicly owned forests account for only 14 percent of forests in the state.

According to the North Carolina State University Extension Office, the state has about 17.9 million acres of forest. But most of the forests in North Carolina are actually privately owned - 10.9 million acres, 61 percent, are family owned, while 4.4 million acres, 24 percent, are in corporate or industry ownership.



That means most people in WNC live in or within striking distance of a forest. Vose said that should make everyone concerned about the future of our forests in the face of climate change.

Dire predictions

The National Climate Assessment is the second of two volumes from the U.S. Global Change Research Program, a team of 13 federal agencies. It begins ominously:

“Earth’s climate is now changing faster than at any point in the history of modern civilization, primarily as a result of human activities. The impacts of global climate change are already being felt in the United States and are projected to intensify in the future.

“The severity of future impacts will depend largely on actions taken to reduce greenhouse gas emissions and to adapt to the changes that will occur.”

The report looks at the possible impact of climate change by U.S. region, and the effects global warming will have on health, economy and infrastructure. Chapter 6 is dedicated to forests.

One of the key messages from this chapter is that more frequent extreme weather events (remember Hurricane Michael, Winter Storm Diego?) will “increase the frequency and magnitude of severe ecological disturbances ... and will alter forest productivity and health and the distribution and abundance of species.”

The report also asserts that climate change will decrease the ability of many forest ecosystem to provide important “services to society,” including tree growth and carbon storage and the ability to prevent flooding and provide clean water.

Vose said while fisheries were not included in the report, the cold water trout streams of the Southern Appalachians will most likely be negatively impacted as temperatures rise and sedimentation causes stream pollution.



“In addition to drought and fire, the other extreme suggests large precipitation events are likely to become more frequent, increased risk of flooding, landslides, potential damage to road systems and stream crossings,” Vose said. “So that double impact of drier and wetter at same time, the potential risks at both ends of spectrum can increase in probability.”

Perhaps the most in-your-face impending impact of climate change, however, is fire.

Andy Tait, a registered forester with the nonprofit EcoForesters, which works with private forest owners to manage their property for forest health and sustainability, said the No. 1 concern he hears from clients and the public is the fear of wildfires burning their homes and their forests.

In addition to the 2016 wildfires in WNC, the recent wildfires in California that killed at least 86 people and destroyed nearly 19,000 homes and other structures are grim realities.



“People are afraid. It’s a very natural, human instinct,” Tait said. “Although we do not have the high risk level they have in the West, it should be a consideration for people on where they’re building homes.”

Because global temperatures are rising, and the air gets drier the higher up in elevation, Tait said building on mountaintops surrounded by dry timber is not the best practice.

“If you build down in the bottom of a cove forest, it’s moister and better for building. Fires burn uphill. Those higher, drier forest are more likely to burn, especially on ridge tops,” he said.


Using [fire-wise practices](#) can also help mitigate the impact of climate change in forests, he said, including the types of building materials (hint: wood is not good), keeping a 30-foot buffer free from vegetation and flammable materials such as firewood, around your home, and employing the right landscaping.

“Some trees are more flammable than others. Rhododendron and mountain laurel have greatly increased their range and density, but they are not fire tolerant. They burn readily, and they’re used heavily in landscaping,” Tait said.

Better landscape choices are buckeye, serviceberry, fruit trees, dogwoods and paw paws, which have a low flammability rating, he said.

Vigilance is key, Tait said, since more than 90 percent of fires in the East are human-caused, either through arson, careless campfires or brush burning that gets out of control.

“With an increase in drought, wildfires are probably not going to be natural fires, they’re going to be human-caused,” he said.




Balsam Mountain Preserve, a luxury, low-density, 4,400-acre home development in Jackson County, is taking the threat of climate change seriously.



A home in **Balsam Mountain Preserve**, a planned community in Jackson County, is built to strict fire-prevention and steep slope codes to help reduce its carbon footprint and minimize impacts due to climate change. *(Photo: Courtesy of Balsam Mountain Preserve)*

The preserve, which partly borders the Nantahala National Forest, ranges in elevation from 2,644 feet to 5,482 at peak of Doubletop Mountain. There are 92 homes on the property, although there are 354 home sites, said Joe Dellinger, chief operating officer of the preserve. The community, which includes a golf course, equestrian center, pool, fitness center, hiking trails, a nature preserve and other amenities, has 3,400 acres in conservation easement.

The community was developed from its beginnings in 2000 with sustainability in mind, Dellinger said.



The preserve has no high density in heavily forested areas, strict guidelines for buffers and building that avoids typical steep slope issues. Each home is required to have a cistern with a minimum capacity of 2,000 gallons or larger. All homes have gutters, and the down spouts are piped into the cisterns to avoid runoff, he said.

While the 2016 wildfires that burned across Pisgah and Nantahala national forests did not enter Balsam Mountain, Dellinger said, residents experienced heavy smoke and a heightened awareness of the need for better fire protection, including steel mesh spark arrestors over fire pits. The community also has strict regulations for stormwater runoff to decrease downstream flooding.

Twisted forest history complicit in climate change?

The long, painful history of Western North Carolina's forests might play a role in some of the impending disasters due to climate change, ecologists say.

"We are already starting to see a shift in our forests, but that is largely due to fire suppression over the last century. When you couple fire suppression and historical logging that happened across the forest, they're already shifting in a different direction," said Megan Sutton, program director for Southern Blue Ridge Program of The Nature Conservancy. "Climate change is exacerbating that."

Fire was suppressed on the landscape for so long because it was seen as damaging to timber. That led to a buildup of fuel load and a denser forest, which can lead to a higher fire risk.

In addition to wanton logging in the early 20th century, which took the biggest, tallest trees – namely the oaks – through clear-cutting, the forest is much different than it was more than 100 years ago.

Oaks, which are fire and drought tolerant – a boon for climate change – have greatly decreased, along with American chestnuts, wiped in in a blight in the 1950s, while less fire tolerant species – meaning they burn more easily – such as red maple and yellow poplar, are dominating the landscape, Sutton said.

Tulip and red maples suck up four times as much water as an oak species, which means they're moving more water up into the tree and making less water available to other trees, she said.

Warming temperatures will allow for invasive species, such as the tree of heaven, and the hemlock wooly adelgid to increase in numbers and expand their range of destruction to native species.

One of the Nature Conservancy's main focuses is trying to restore healthy and climate resilient forests by increasing diversity, mainly by increasing oak species on a landscape scale.

More than 200 species of organisms depend on oaks at some point in the life cycles, for food, shelter and shade, Sutton said.

One of the ways the Nature Conservancy, along with the U.S. Forest Service and National Park Service is working to increase oak regeneration, as well as reduce fuel load to prevent massive fires, is through controlled burns to reduce forest density and open up the canopy to allow for oak regeneration and other species.

"The state of North Carolina has one of the highest number of homes in the wildland-urban interface in the nation, meaning homes that are built directly adjacent to a forest. With that increase, it makes it much more challenging to safely put fire on the ground and manage it," Sutton said.

"What people can do is have a greater appreciation to tolerate controlled burning. And be thoughtful about where you do build your house," she said.

Climate change mitigation efforts underway

Local scientists have been on the climate change watch for decades. The Nantahala Pisgah National Forest Plan Revision, which will guide the management of the two massive forests for the next 15-20 years, is required to incorporate considerations for climate change.

"This has not caught anybody by surprise. This is something that has been increasingly addressed by the national forests, especially," Jim Vose said, "and has been implemented and part of their planning and action on the ground."

The next largest publicly owned forest land mass is Great Smoky Mountains National Park, which has a half-million acres spread over some of the highest mountains in WNC and Tennessee.

Paul Super, science coordinator for the Appalachian Highlands Science Learning Center at Purchase Knob in the Smokies, said research in mitigating the effects of climate change has been underway for decades.

In particular, the Smokies are concerned about the possible loss of high-elevation spruce-fir forests, and species that depend on that ecosystem, such as the Carolina northern flying squirrel.

"A lot less clear is what climate change might mean for bear and elk. There's not a whole lot of research related to large animals, but we sweat the small stuff," Super said.



"If streams warm up, it's bad news for native brook trout and endemic insects in the streams. Researchers have found insects' range has shifted upslope, such as the stonefly (an insect that needs clean water and is a main food source for trout).

"We don't have data on temperature changes that's been going on these habitats, but it's awfully suspicious that these things might be moving upslope," he said.

Another concern in the Smokies is the prospect of more severe weather events in the mountains. These have already been occurring, including the flash floods that took out the Cherokee fish hatchery, landslides that took out trails and U.S. 441/Newfound Gap Road, tornadoes and extreme drought that contributed to the Chimney Tops 2 Fire in 2016, Super said.

"Having a large protected, contiguous area with national forest land makes the Smokies a bit more resilient. Animals have places to move, north and south. There might be benefits to the local economy. We will be a cooler place than much of the American population is, so we might have more tourism," Super said.

"We need to be doing what we can to prepare for the challenges, both good and bad."

Vose, one of the climate report's authors, said a key takeaway is the need for forest resiliency. That will enable forests to provide the services for people, wildlife and the economy - for wildlife habitat, clean water, carbon sinks, flooding buffers, food sources, timber, tourism, recreation.

“One of the most important components to adaptation in being able to deal with climate change is maintaining forest cover and keeping as much of the landscape forested as possible,” Vose said.

“Trying to avoid those large, significant disturbances in the short and long term that reduce forest cover is a good landscape condition that has some resiliency.”

Vose, who has worked for the Southern Research Station for 32 years, said working on the climate report was “exhilarating.”

“We used the best science. This was unbiased assessment based on the published literature. It was written by a team of esteemed scientists, experts from the Forest Service and university sector who were very careful, very meticulous in the way the report was written, based on scientific evidence and not our opinions or potential biases,” Vose said.

“What also made it enjoyable was we focused a lot on how this science can be used to help society adapt to climate change. We didn't just focus on the negative effects, but what what are some management activities that we can implement today to mitigate impacts in the future?”

Learn more

Read the full National Climate Assessment report at <https://nca2018.globalchange.gov/>.

