

TREES IN TRANSITION

by Stephanie Worley Firley

In forests as in life, the only constant is change. Forest species are ever adjusting to changing conditions resulting from seasonal fluctuations in temperature and precipitation, disturbances such as storms and wildfire, and interactions with other species. But typical temperature and precipitation

patterns are now also changing; in some areas, climatic changes are occurring rather rapidly, which could pose a severe threat to forest trees. Whether tree populations adapt onsite to changing habitat conditions, shift their ranges to new suitable locations, or simply die out, the forests we know today—and

the genetic makeup of the species within them—could be very different by the middle of the 21st century.

Now researchers from the **Eastern Forest Environmental Threat Assessment Center** (EFETAC) are asking the question: In a future with a different climate, where might the trees be?

With support from the Forest Service **Forest Health Monitoring Program**, EFETAC ecologist **Bill Hargrove** and **North Carolina State University** cooperating scientists **Kevin Potter** and **Frank Koch** are collaborating to develop **Forecasts of Climate-Associated Shifts in Tree Species** (ForeCASTS). Using projections of future climate in combination with the concept of fine-scale ecoregions—land areas that share similar environmental characteristics such as soils, topography, and climate variables—the researchers are developing maps depicting future suitable habitat ranges for tree species within the United States as well as across the globe.

ForeCASTS maps can help scientists, land managers, and policymakers target tree species for monitoring and management activities by pinpointing locations where climate change pressures are likely to be most intense.

“The Forest Service has a long history of understanding that the seed source makes a huge difference in tree growth and performance,” says Hargrove. “ForeCASTS maps can ultimately be used to assess the risk to genetic integrity of North American forest tree populations.”



Kevin Potter collects cones from a Fraser fir tree on Mount Rogers in Virginia. As a high-elevation species, Fraser fir may be at particular risk from climate change. (photo courtesy of Kevin Potter, North Carolina State University)



Parts of the current range of longleaf pine may become less suitable for the species as climate changes. (photo courtesy of Kevin Potter, North Carolina State University)

Potter adds, “The ForeCASTS project can help guide decisions about how and where to invest time and funds for conservation efforts.” Conserving genetic variation is particularly important because it confers the evolutionary potential to adapt to change, reducing susceptibility to stressors like insects and pathogens in addition to climate change.

So far, the researchers have developed maps for 213 tree species under varying climate models and scenarios for the years 2050 and 2100, including “minimum required movement” maps that quantify the distances between existing habitat that may become unsuitable in the future and the nearest future suitable habitat. “The general trend, as we would expect, is for tree ranges to expand at least a little bit to the north, and to drop off at least a little

bit at their southern edges,” says Potter. “Looking at species with ranges that include the Southern Appalachians, the ForeCASTS maps show nearly all species decreasing their overall suitable habitat area.”

The ForeCASTS maps are still provisional. As the project unfolds, the researchers are refining the available map products and adding additional species to the queue. They plan to identify closest “lifeboat” areas for tree species that may migrate from multiple locations as well as add measures of performance to determine where species may thrive in future projected habitat ranges. Later, the methods used in ForeCASTS could be employed to explore future distributions of invasive species to aid in proactive management of vulnerable forest ecosystems. 🌲

ForeCASTS:

www.forestthreats.org/tools/ForeCASTS

For more information:

Bill Hargrove at 828-257-4846
or whargrove@fs.fed.us

Kevin Potter at 919-549-4071
or kevinpotter@fs.fed.us

Recommended reading:

Potter, K.M.; Hargrove, W.W.; Koch, F.H. 2010. **Predicting climate change extirpation risk for central and Southern Appalachian forest tree species.** In: Rentch, J.S.; Schuler, T.M., eds. Proceedings from the conference on ecology and management of high-elevation forests of the central and Southern Appalachian Mountains. Gen. Tech. Rep. NRS-P-64. Newtown Square, PA: U.S. Department of Agriculture Forest Service, Northern Research Station: 179-189.

Stephanie Worley Firley is a biological science information specialist with EFETAC in Asheville, NC.