Rooted in Research

The Climate Change Tree Atlas: Managing Tree Species in the Face of Climate Change

Two Decades of Research and Development Help Manage Forests for the Future

For 20 years, the Climate Change Tree Atlas has given foresters insight into tree species trends and how possible future climate scenarios may affect eastern tree species' habitat suitability. Found at www.fs.fed.us/nrs/atlas/tree, the Climate Change Tree Atlas recently underwent a major overhaul. Now even more resources are available to land managers looking for detailed data sets and maps on species traits, habitat quality, land cover, and dispersal potential for most tree species in the eastern United States. Tables and maps on the website are intended to inform

The Climate Change Tree Atlas includes a database of 125 species, species summaries based on various spatial levels, and other climate change data resources. Licensed photo by Katja Schultz/flickr. Map source: http://www.fs.fed.us/nrs/atlas/tree.

KEY MANAGEMENT CONSIDERATIONS

- The Climate Change Tree Atlas helps land managers understand current species characteristics and to predict and plan for climate change impacts to these species throughout the eastern United States.

- Information about the 125 tree species included in the Tree Atlas can be used to answer questions about where these species are located, what predictor variables contribute to them being there, and what might happen to suitable habitat and migration potential under different climate scenarios.

- The Atlas, recently updated to version 4, features a range of updates including parsing and summarizing for all species by various sub-units, including states, ecoregions, federal land management areas, metropolitan areas, and hydrologic units.

- The Climate Change Tree Atlas and tutorial links can be found at www.fs.fed.us/nrs/atlas/tree.

land managers and landowners about their forests and enable more forward-looking management of tree species under various climate change scenarios.
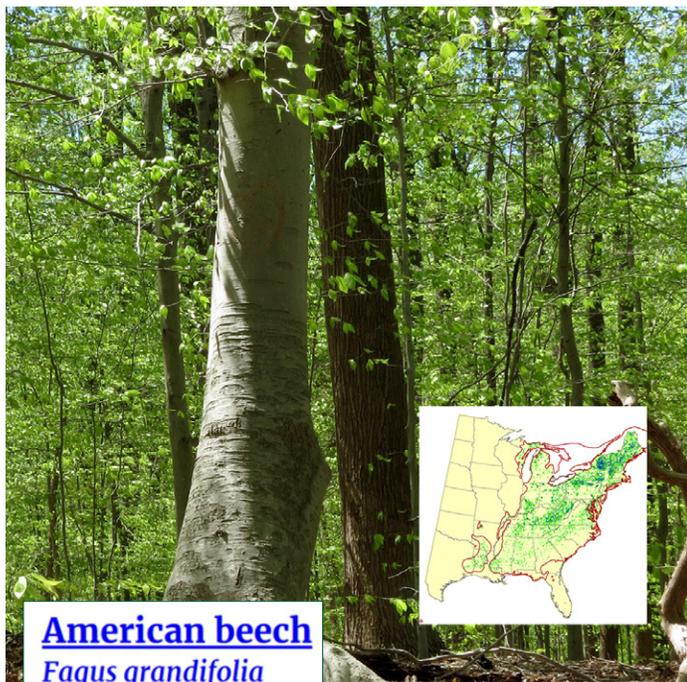
The Climate Change Tree Atlas development team is made up of Northern Research Station (NRS) ecologists Louis Iverson, Matthew Peters, Anantha Prasad, and NRS/Ohio State University ecologist Stephen Matthews. Additional support comes from the Northern Institute of Applied Climate Science, and web development is provided by NRS natural resource specialist Jim Lootens-White.

New and Improved

In late 2020, the Climate Change Tree Atlas underwent a major upgrade. New predictor variables, an updated modeling framework, updated data, and information on potential species migration have been incorporated.

Specifically, more than 84,000 Forest Inventory and Analysis data plots have been cross-referenced with 45 predictor variables. The predictor variables are factors such as climate, elevation, soil characteristics, and land use that influence where certain species can grow. This new dataset allows users to understand current and future habitat suitability for 125 different tree species. Four new tutorial videos are available on the website to help users navigate the Atlas.

"With the latest update to version 4, we've used the varying density of inventory plots to enhance the maps' spatial resolution to increase flexibility and accuracy," Peters says. "We've also added a migration component, which makes the outputs more realistic," according to Prasad. Iverson notes that the latest version is more management focused. "It's an applied tool for managers at many levels, from forests to regions," he says, adding, "It provides information not only for each individual tree species, but it provides outputs for all species summarized within a particular area or region."

The Climate Change Tree Atlas is helping land managers plan for and adjust to changing habitat in the Mississippi National River and Recreation Area. U.S. National Park Service photo by Gordon Dietzman.

Applications along the Mississippi

A key use of the Atlas is to determine what tree species might be the best to consider in climate change adaptation strategies, such as assisted migration, or what the team calls habitat suitability and colonization potential modeling. The Atlas also provides migration simulation modeling, which describes current tree species conditions as well as potential natural changes to species ranges during a 100-year period, in addition to assessing biological and disturbance factors not included in the modeling framework. These outcomes are based on quantitative results, but the team notes that on-the-ground knowledge of land managers should always be applied.

One example of how the Atlas has been used is a project in Saint Paul, Minnesota, by the Northern Institute of Applied Climate Science and the Northern Research Station. Faced with the rising threat of emerald ash borer (*Agrilus planipennis*) insects, scientists with these groups are working to address the expected loss of green ash (*Fraxinus pennsylvanica*) trees in and around the Mississippi National River and Recreation Area.

According to Leslie Brandt, a Northern Research Station climate change specialist associated with this project, "We used the Climate Change Tree Atlas to identify what species might be gaining suitable habitat in our study site and use that to select which species to plant in our research plots." This example is being replicated by land managers across the eastern United States, including in several national forests such as the Superior National Forest in Minnesota. Land managers are using the Climate Change Tree Atlas in a variety of ways, including trying different approaches and mixes of trees to see what plant and tree configurations are likely to work best in an increasingly variable and warming climate.

FURTHER READING

Iverson, Louis R.; Prasad, Anantha M.; Peters, Matthew P.; Matthews, Stephen N. 2019. Facilitating adaptive forest management under climate change: a spatially specific synthesis of 125 species for habitat changes and assisted migration over the eastern United States. Forests. 10(11): 989. https://doi.org/10.3390/f10110989.

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Iverson, Louis R.; Peters, Matthew P; Prasad, Anantha M.; Matthews, Stephen N. 2019. Analysis of climate change impacts on tree species of the eastern US: Results of DISTRIB-II modeling. Forests. 10(4): 302. https://doi.org/10.3390/f10040302.