



Photo courtesy: Renee Williams

As the impacts of climate change continue to affect our planet, it is important for woodland owners and land managers to understand how these changes will affect trees and woodlands. Fortunately, a variety of web applications and tools are available to help woodland owners and land managers make informed decisions and manage their land in a way that is sustainable and climate-resilient. One of the significant impacts of climate change on woodland management is the predicted change in forest-species composition. Let's take a closer look at this impact and how web applications can help woodland owners manage this change.

### Change in Forest Tree Species Composition

Climate change is causing a shift in temperature and precipitation patterns across the planet. In Kentucky, these conditions are unlikely to substantially reduce the forest cover, but it will most likely influence changes in forest species composition. The climate shifts may lead to the migration of certain tree species to areas that are more suitable for their growth and survival. As temperatures rise, tree species that are adapted to cooler climates are expected to move northward or to higher elevations. Similarly, as rainfall patterns change, tree species that require more or less moisture are expected to migrate accordingly. The climate predictions for Kentucky include higher temperatures and increased annual precipitation as well as changes in periodic precipitation with reduced rainfall during the growing season.

The changes in temperature and precipitation that may lead to changes in forest-species composition will have significant implications for woodland management. Woodland owners and land managers will need to consider how these changes will affect the composition and struc-

# FORESTRY 101

by Laurie Taylor Thomas

## Kentucky Woodlands and Climate Change



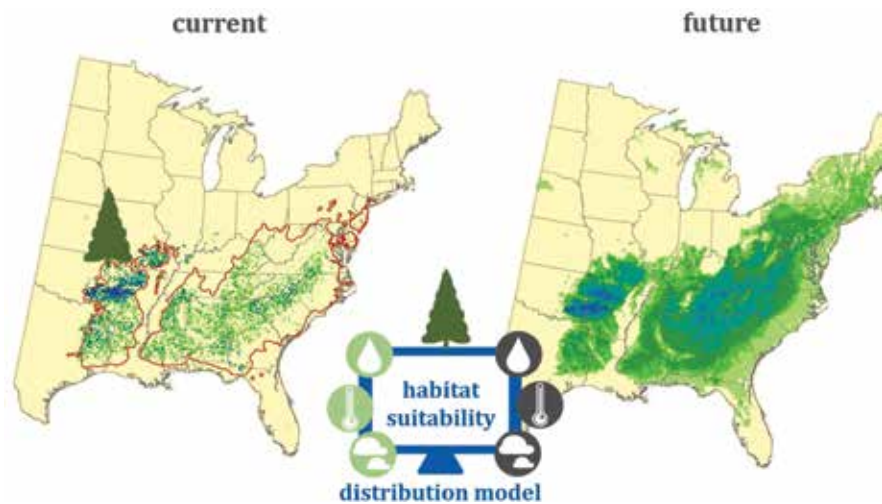
ture of their forests as well as the economic and ecological values of their land. For example, tree species that are currently being harvested for timber may no longer be suitable for growth in certain areas, while other species may become more abundant and valuable.

### Web Applications for Understanding and Managing Changes in Forest Species Composition

Fortunately, there are several web applications and tools available to help woodland owners understand and manage for these predicted changes in forest species composition. Here are some of the most useful:

**U.S. Forest Service Climate Change Resource Center**  
<https://www.fs.usda.gov/nrs/atlas/tree/>

The Climate Change Resource Center includes the Climate Change Tree Atlas. This interactive web application provides information on climate-change impacts across the United States. The Atlas can help answer a range of questions about the current and projected potential



The Climate Change Tree Atlas can be used to examine how tree species ranges may change in the future.

suitable habitat by the year 2100 for 125 tree species within eastern U.S. forests. The information the Atlas provides for each species includes species characteristics, life history and distribution and which factors such as temperature, elevation or soils that determine the species habitat. This type of information provides some guidance on species sensitivity to large-scale climate differences. The Atlas shows how each species' suitable habitat may change by the year 2100 under different climate models for both high and low emission scenarios. This information can help woodland owners identify potential risks to their land and make management decisions that support climate adaptation. The Atlas provides numerous tutorial videos including: An Introduction to the Climate Change Atlas: How Does It Work?; Adaptability Ratings: Understanding Biological and Disturbance Factors; and Regional Summaries. The following are two example tree species and their response to climate change as projected by the Tree Atlas:

### **Southern red oak (*Quercus falcata*)**

Southern red oak is a widely distributed, relatively densely populated species based on Forest Inventory Analysis data. It is a common species across the southern U.S. but of relatively low importance. The model suggests a large increase in habitat throughout the South, but also a northeastern extension of its range especially under the higher emissions scenario. However, the Atlas' migration model largely limits those northern locations from being naturally colonized within 100 years. Southern red oak is rated as having a "high" adaptability and a very good ability to cope with changing climate.



Southern red oak leaf and acorns.

Photo courtesy: Vern Wilkins, bugwood.org

### **Eastern White Pine (*Pinus strobus*)**

Eastern white pine is a widely distributed and relatively densely populated species based on Forest Inventory Analysis. It is an important northern pine species. The model projects little change in its suitable habitat by 2100. The Atlas points out that eastern white pine has some traits such as susceptibility to drought, fire and insects that reduce its adaptability rating to "low" to climate change. However, because of its high abundance, the model rates its capacity to cope with climate change as "fair."

## **Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers** <https://www.fs.usda.gov/research/treesearch/52760>

Forest Adaptation Resources is a comprehensive guide to climate-change adaptation strategies for forest managers. This web-based resource includes information on topics such as forest ecology, climate projections, and adaptive management strategies. It also includes case studies and resources for implementing climate-adaptation strategies on the ground. This tool can help woodland owners understand the science behind climate change and make informed decisions about how to adapt their management practices to support resilience.



## **Nature's Network**

<https://www.naturesnetwork.org>

Nature's Network is a web application that helps woodland owners identify areas of high ecological value and connectivity across the northeastern United States. By mapping ecological values such as habitat quality, water quality, and biodiversity, Nature's Network can help woodland owners identify areas that are particularly important for conservation and management. This tool can help woodland owners prioritize areas for conservation or restoration and make decisions that support ecological connectivity and resilience. Nature's Network is a collaborative effort facilitated by the U.S. Fish and Wildlife Service Science Applications program that brings together partners from 13 states, federal agencies, nongovernmental organizations, and universities to identify the best opportunities for conserving and connecting intact habitats and ecosystems and supporting imperiled species to help ensure the future of fish and wildlife across the Northeast region.

Climate change is one of the most pressing challenges facing woodland owners and land managers today. It is important to understand how species may respond to the impacts of climate change and to use that knowledge to make informed decisions to develop, adapt and carryout management practices to support forest resilience in the face of changing conditions.

About the author: **Laurie Taylor Thomas**, is an extension forester at the UK Department of Forestry and Natural Resources and is responsible for providing forestry and natural resource education programs for youth and adults across the state.

Cooperative Extension Service, Department of Forestry and Natural Resources, University of Kentucky, 217B Thomas Poe Cooper Building, Lexington, KY 40546-0073; Phone: 859.257.2703; Fax: 859.323.1031; E-mail: [laurie.thomas@uky.edu](mailto:laurie.thomas@uky.edu)