Central Hardwoods

Ecosystem Vulnerability Assessment and Synthesis

TECHNICAL SUMMARY

The Central Hardwoods region contains a mosaic of forests, woodlands, savannas, and other ecosystems that are an essential part of the landscape. Many of these ecosystems are dominated by oaks, shortleaf pine, hickory, and various other tree species.

Ecosystems will increasingly be affected by a changing climate. Understanding these potential impacts is an important first step to sustaining healthy forests in the face of changing conditions.

As part of the Central Hardwoods Climate Change Response Framework project, more than 30 scientists and forest managers collaborated to assess the vulnerability of forest ecosystems in this region to the likely range of climate change. Learn more other project activities at:

www.forestadaptation.org/central-hardwoods

The climate has changed

Since the turn of the last century, daily low temperatures increased by 1 to 2 °F, and daily high temperatures decreased by a similar amount. The increase in daily lows was most pronounced during summer months, and the decrease in daily highs was most apparent in the fall.

Minimum temperatures increased by 1 to 2 °F, and maximum temperatures decreased by a similar amount since the turn of the last century

The region is receiving 12 to 17 percent more precipitation, particularly in the spring and fall since the turn of the last century. In fact, more rain has been falling as heavy precipitation events of 3 inches or greater over the past 30 years.

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Global climate models can help us understand how climate may change in the future given changes in greenhouse gas emissions. In this assessment, we report climate projections for two global climate models under two contrasting greenhouse gas emissions scenarios (high and low) over the next century compared to the average over the last 30 years of the 20th century.

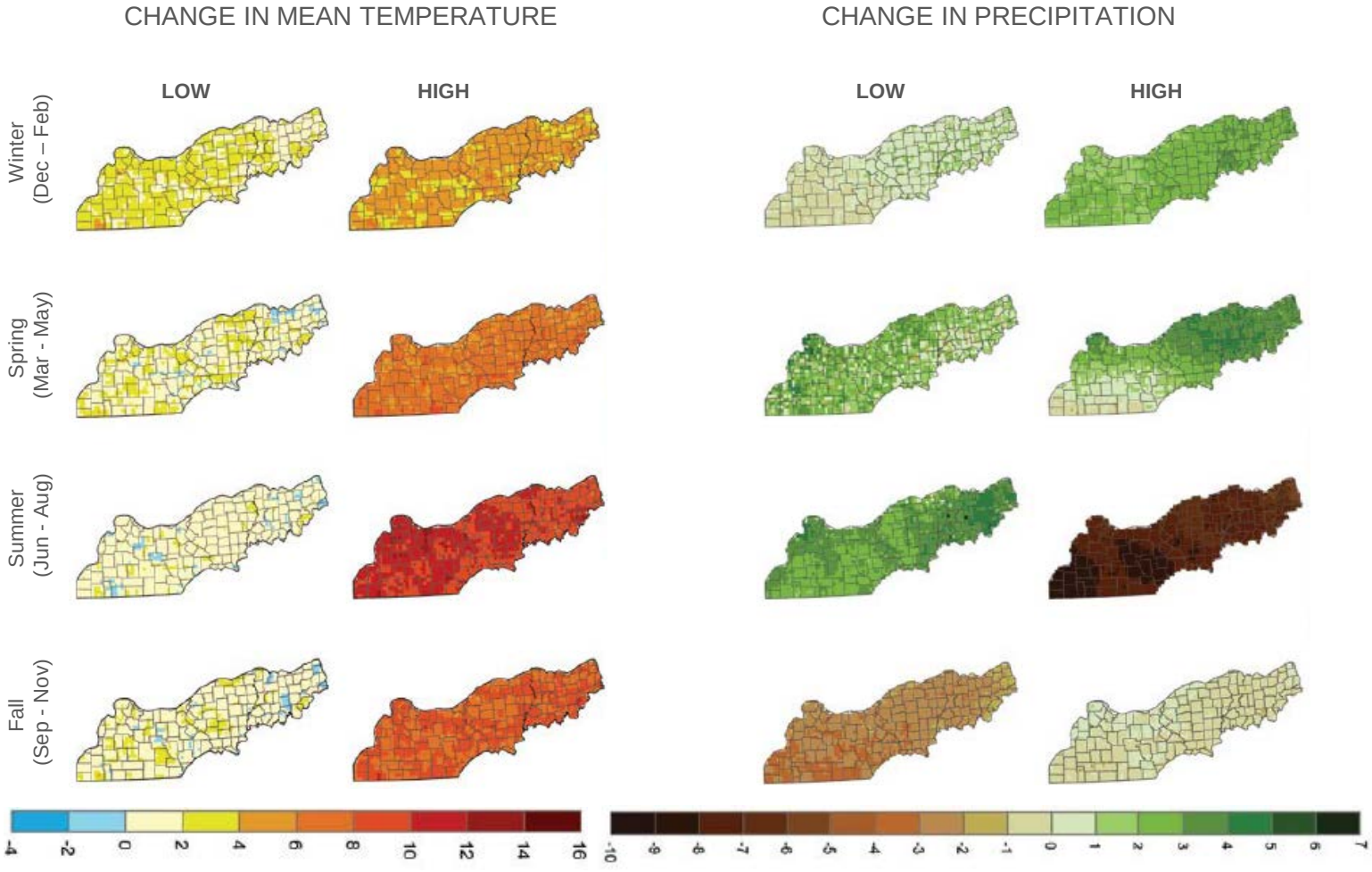
Temperatures will increase

All global climate models project that temperatures will increase in the Central Hardwoods Region. Model projections suggest an increase in temperature over the next century across all seasons by 2 to 7 °F. Growing seasons will continue to lengthen due to warmer temperatures.

Evidence suggests that winter temperatures will increase in the area, even under low emissions, leading to changes in snow and soil frost.

Precipitation will change

Precipitation is projected to increase in winter and spring by 2 to 5 inches for the two seasons combined. There is a difference in model projections for later in the growing season, but evidence seems to indicate there may be a decrease in precipitation in either summer or fall, depending on scenario. Even if the total annual amount of precipitation does not change substantially, some evidence suggests it may occur as heavier rain events interspersed among relatively drier periods



Projected difference in mean daily temperature and total seasonal precipitation at the end of the century (2070 through 2099) compared to 1971 through 2000 for two climate model-emissions scenario combinations.

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Forests will experience both direct and indirect impacts from a changing climate

Three forest impact models, hundreds of scientific papers, and forest manager's expertise were combined to assess the effects of climate change on regional forest ecosystems. Based on this information, there is a large amount of evidence to suggest that the following impacts will occur in the Central Hardwoods region.

Climate conditions will increase fire risks by the end of the century.

National and global studies agree that wildfire risk will increase in in the area. Relatively few studies have looked specifically at this region, but the majority of models project an increase in wildfire probability in the central US by the end of the century.

Many invasive species, insect pests, and pathogens will increase or become more severe.

A warming climate is allowing some invasive plant species, insect pests, and pathogens to survive further north than they had previously. Threats such as the southern pine beetle, oak decline, and some invasive species may increase in the future.

Suitable habitat for northern species will decline.

All three impact models project a decrease in suitability for northern species such as sugar maple, beech, and basswood. These northern species may persist, however, likely with declining vigor, in some southern portions of their range if competitors from farther south are unable to colonize these areas.

Habitat will become more suitable for southern species.

Model results suggest an increase in suitable habitat for many species at or near the northern extent of their range, including shortleaf pine, post oak, and blackjack oak. Habitat may also become favorable to species not currently found in the assessment area, such as loblolly pine. Most species can be expected to migrate more slowly than their habitats will shift, however, because of habitat fragmentation and the limited dispersal ability of seeds.

A major transition in forest composition is not likely in the coming decades.

Although major changes in forest composition are expected over the next century, these changes are likely to occur gradually in the absence of major disturbances.

Additional details on these changes and more are described in the assessment:
http://treesearch.fs.fed.us/pubs/45430

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Vulnerability of Forest Communities

Climate change will not affect all parts of the landscape in the same way. A panel of experts from a wide range of organizations worked together to assess the vulnerability of different natural communities in the Central Hardwoods Region to climate change.

Vulnerability is the susceptibility of a system to the adverse effects of climate change. It is a function of potential climate change impacts and the adaptive capacity of the system. A system is vulnerable if it is at risk for no longer being recognizable as that community type, or if the system is anticipated to suffer substantial declines in health or productivity.

Of nine community types assessed, mesic upland forests were considered to be the most vulnerable due to negative impacts on dominant species and a limited capacity to adapt to disturbances such as fire and drought. Fire-adapted communities such as woodlands, savannas, and glades were considered less vulnerable because they have more drought and heat-adapted species and are better able to withstand large-scale disturbances. Bottomland forests had slightly higher vulnerability due to the possibility of shifts in flood dynamics.

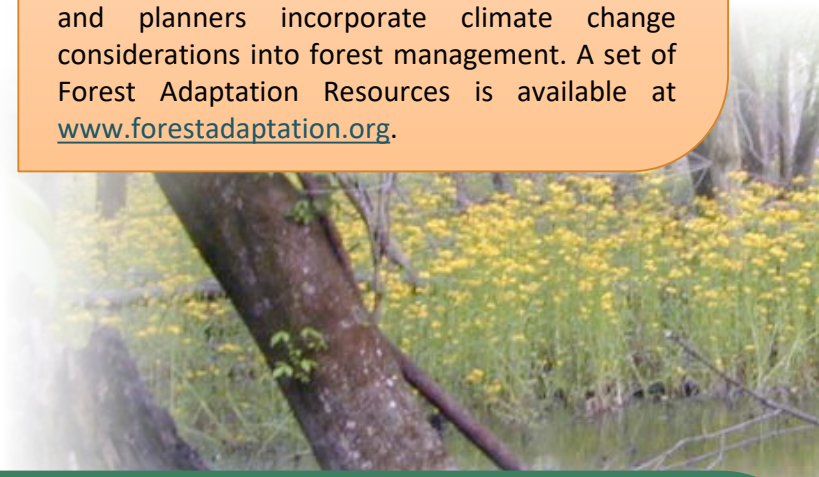
These determinations of vulnerability are general across the region, and will be influenced by local conditions, forest management, and land use. The assessment doesn't consider future changes in management, land use, or other social economic factors that could affect forest health or productivity.

What can managers do?

Confronting the challenge of climate change presents opportunities for land managers to plan ahead, foster resilient landscapes, and ensure that the benefits that forests provide are sustained into the future.

Climate change impacts will vary across the landscape. Examples of characteristics that make systems more adaptable include high species diversity, landscape connectivity, and the ability to bounce back following a disturbance, such as a drought, flood, or fire. Managers can use scientific information from the assessment and other sources to better understand which places may be most vulnerable.

Resources are available to help forest managers and planners incorporate climate change considerations into forest management. A set of Forest Adaptation Resources is available at www.forestadaptation.org.



More information

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The Climate Change Response Framework is a core forest adaptation effort of the USDA Midwest and Northeast Climate Hubs