Mid-Atlantic Region

Forest Ecosystem Vulnerability Assessment and Synthesis

SUMMARY AND HIGHLIGHTS

The Mid-Atlantic region covers 60 million acres sweeping north from the Atlantic coastal plain to the Catskill Mountains and west to Pennsylvania. The 32 million acres of forests provide many benefits to residents of this region, including clear air and water, fish and wildlife, and places to spend time outdoors.

Evidence of climate change can already be observed in the Mid-Atlantic region. Understanding vulnerabilities is an important first step to sustaining healthy forests and ecosystems in the face of changing conditions.

As part of the Mid-Atlantic Climate Change Response Framework project, more than 40 scientists and forest managers collaborated to assess the vulnerability of forest ecosystems in this region to the range of projected climate change. Learn more about other project activities at: **www.forestadaptation.org/mid-atlantic**

The climate has changed

Across the Mid-Atlantic region, the annual average temperature has increased by 1.8 °F since 1901. Some places are warming faster than others, such as along the coast, where average temperature has warmed by more than 4 °F. Average winter temperatures have also warmed faster than any other season. Both minimum and maximum temperatures have increased in every season except fall, suggesting fewer opportunities to cool down from increasingly warm days.

Across the region, precipitation has increased primarily in fall by an average of 3.2 inches, or by 31 percent compared to the normal fall precipitation of 10.3 inches. Precipitation is falling in greater amounts during more frequent extreme events. Sea-levels on the Mid-Atlantic coast have risen by 12 inches since 1900. Land use change in the region has contributed to a higher rate of sea-level rise than the global average.

Minimum temperatures increased by 2.6 °F in winter and 2.3 °F in summer.
Maximum temperatures increased by 2.2 °F in winter and 1.0 °F in summer.

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Northern Institute of Applied Climate Science

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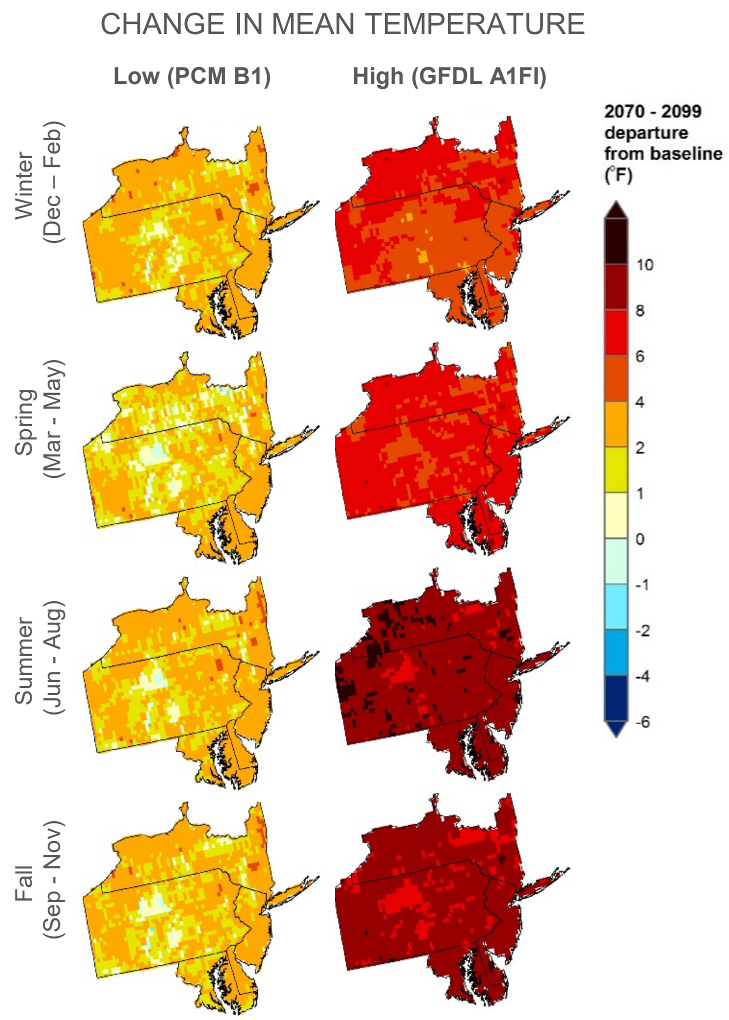
Temperatures will increase

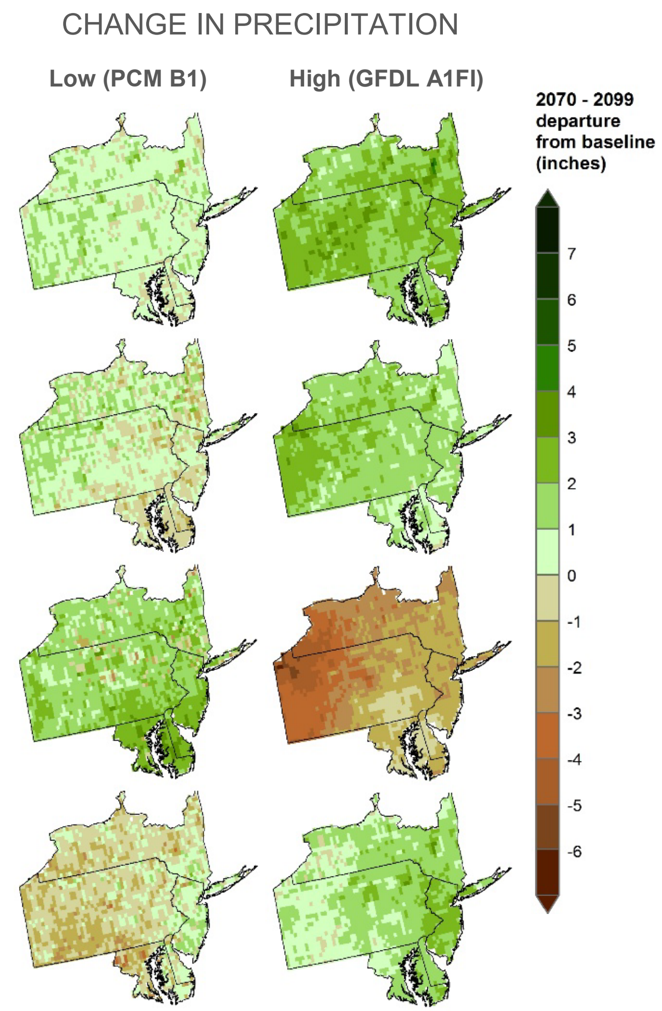
Models can help us understand how the climate may respond to future changes in greenhouse gas emissions. Here, we report climate projections for two downscaled climate models (GFDL and PCM) under two emissions scenarios (A1FI: high and B1: low) during the 21st century.

All climate models project that average temperatures will generally increase across the region. Under the low climate scenario, we can expect increases of 1 to 4 °F, with some hot or cool areas (see maps below). Under the high climate scenario, we can expect much warmer temperatures ranging from 4 to 10 °F or more. The number of hot days above 90 °F may increase by 20 to 30 days per year by the end of the century.

Precipitation will change

Precipitation projections are more challenging due to the variable timing and geographic pattern of rain and snow in the region. Both models project precipitation to generally increase in winter and spring, especially under the high climate scenario. Models disagree about the seasonal timing of increases or decreases in summer and fall. Even without changes in precipitation, higher temperatures may lead to increased water loss from evaporation and transpiration, suggesting that we can expect some moisture stress late during the growing season. Regional studies also project more frequent heavy (1-inch and 3-inch) rain events, and there is evidence that these extreme events will be interspersed among relatively longer dry periods.





These maps describe a range of projected changes. *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

Two downscaled climate models, three forest impact models, hundreds of scientific papers, and professional expertise were combined to assess the effects of climate change on Mid-Atlantic forest ecosystems. Based on this information, we can expect the following impacts will occur in the Mid-Atlantic Region.

Forest vegetation may face increased risk of physiological drought

Warmer temperatures can result in decreased soil moisture even without a decrease in precipitation, resulting in less available water for plants. Further, extremely hot days can increase drought-induced mortality by disrupting plant physiology. “Hot drought” can also interact with other forest stressors to cause tree death and forest die-off.

Wildfire risk will increase

The fire season in the Mid-Atlantic region is closely linked with increases in summer temperature. National and regional studies agree that wildfire risk will increase across the region due to changes in temperature and precipitation. Fire severity may also increase as a result of dry fuels from pest-induced mortality, invasive plants, or storm damage.

Tree regeneration and recruitment will be affected by changing conditions

Predicted changes in temperature, precipitation, growing season onset, and soil moisture may alter the duration or quality of germination conditions. After establishment, saplings may still be more sensitive than mature trees to disturbances such as drought, heat stress, frost, fire, and flooding.

Download the full assessment:
https://www.nrs.fs.fed.us/pubs/57325
Download a copy of this summary:
www.forestadaptation.org/MEVAS

Suitability for southern species will increase

Forest impact models project increases in suitable habitat and biomass for tree species with ranges largely south of the region, including blackgum and shagbark hickory. Some species, however, may be limited in their ability to move into new habitats by their need for specific soil or site conditions. Habitat fragmentation or natural barriers may also hinder the northward movement of southern tree species, despite increases in habitat suitability.

Suitability for northern species will decline

Forest impact models project decreases in habitat suitability for northern and remnant boreal species such as black spruce, red spruce, and northern white-cedar. These species are generally limited to specific landscape positions where conditions are cool and moist. Near the southern edge of their range, sugar maple, northern red oak, and other northern species may be able to persist, but are expected to face competition from southern species and suffer more stress than trees in cooler northern locations.

Invasive plants, pests, and pathogens will increase or become more damaging

A warming climate has been linked to increased susceptibility of trees to native and nonnative pests and pathogens. Populations of these agents may also benefit from changes such as warmer, wetter springs, to increase in number and extent. Longer growing seasons, warmer winters, and increased disturbance may also benefit the growth or migration of invasive plants, such as kudzu, bush honeysuckles, and privet.

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Vulnerability of Forest Communities

Climate change will not affect all forest species, communities, and 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 forest ecosystems 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 of a fundamental change in identity, or if the system is anticipated to suffer substantial declines in health or productivity.

Of eleven forest ecosystems assessed, three forest systems – coastal maritime forest, lowland conifer, and montane spruce-fir - were considered highly vulnerable due to negative impacts on dominant species and a limited capacity to adapt to disturbances such as drought and fire. Oak and pine dominated forests were rated with low vulnerability because they are composed of more drought- and heat-adapted species and are better able to withstand large-scale disturbances.

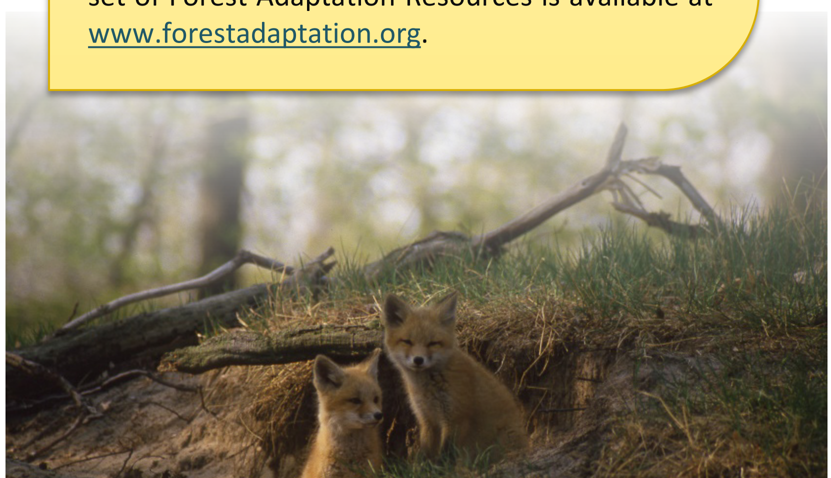
These determinations of vulnerability are general across the region, and will be influenced by local conditions, forest management, and land use. The high diversity in landforms, microclimates, hydrology, and species assemblages across the region greatly complicates assessment of vulnerability. It is essential to consider local characteristics when interpreting vulnerabilities at local scales. The assessment does not consider adaptive management actions, changes in land use, or other social or 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.

Forest managers will naturally have different goals and objectives, and different opportunities and challenges for how they might respond to climate-related risk. Managers can use scientific information from the assessment in combination with site-specific knowledge to determine which places may be most vulnerable.

Resources are available to help natural resource managers and planners to 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.

Citation

Butler-Leopold, Patricia R.; Iverson, Louis R.; Thompson, Frank R., III; Brandt, Leslie A.; Handler, Stephen D.; Janowiak, Maria K.; Shannon, P. Danielle; Swanston, Christopher W.; et al. 2018. **Mid-Atlantic forest ecosystem vulnerability assessment and synthesis: a report from the Mid-Atlantic Climate Change Response Framework project.** Gen. Tech. Rep. NRS-181. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 294 p. https://doi.org/10.2737/NRS-GTR-181.