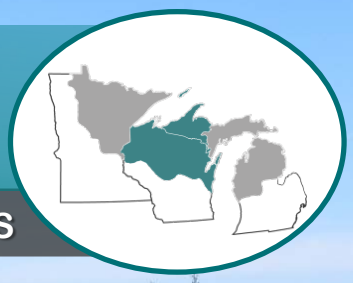
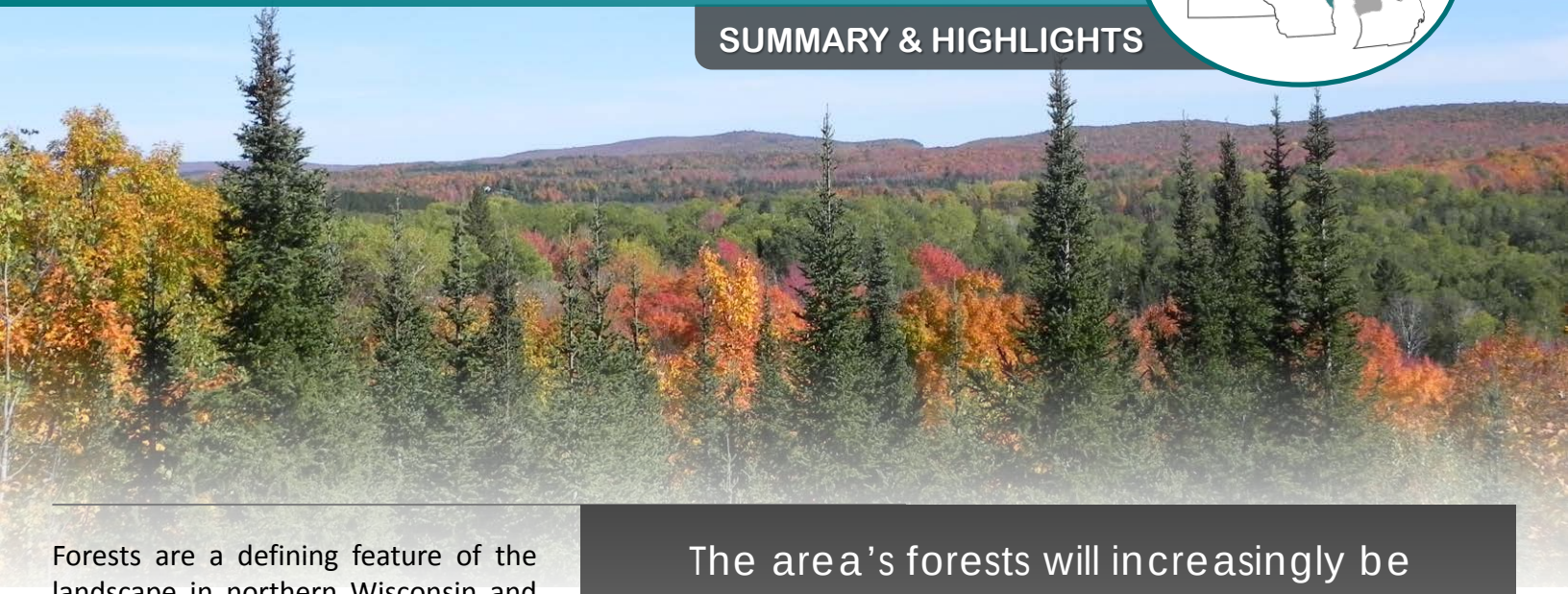
Northwoods: Wisconsin/Michigan

Forest Ecosystem Vulnerability Assessment and Synthesis

SUMMARY & HIGHLIGHTS





Forests are a defining feature of the landscape in northern Wisconsin and western Upper Michigan, including boreal forests of spruce and cedar and extensive northern hardwoods. These systems provide many environmental, economic, and social benefits to the region.

The area's forests 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 Northwoods Climate Change Response Framework project, more than 40 scientists and natural resource professionals collaborated to assess the vulnerability of forest ecosystems in northern Wisconsin and Michigan's western Upper Peninsula. Companion assessments address northern Minnesota and the remainder of northern Michigan. Learn more about other project activities at:

www.forestadaptation.org/northwoods

The climate has changed

The average annual temperature in the assessment area increased 1.4 °F between 1901 and 2011. Temperatures warmed in all seasons, with winter warming by more than 2 °F. Temperature records show that warming has accelerated in recent decades.

Winter temperatures increased by more than 2 °F since the turn of the last century, and heavy rainfall events have become more common.

Precipitation also increased by 2 inches during this period, particularly in the spring and fall. A greater percentage of precipitation is falling as heavy rainfall events of 3 inches or greater, particularly over the past 30 years.

Funded in part by the US Forest Service. The USDA is an equal opportunity provider and employer.

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

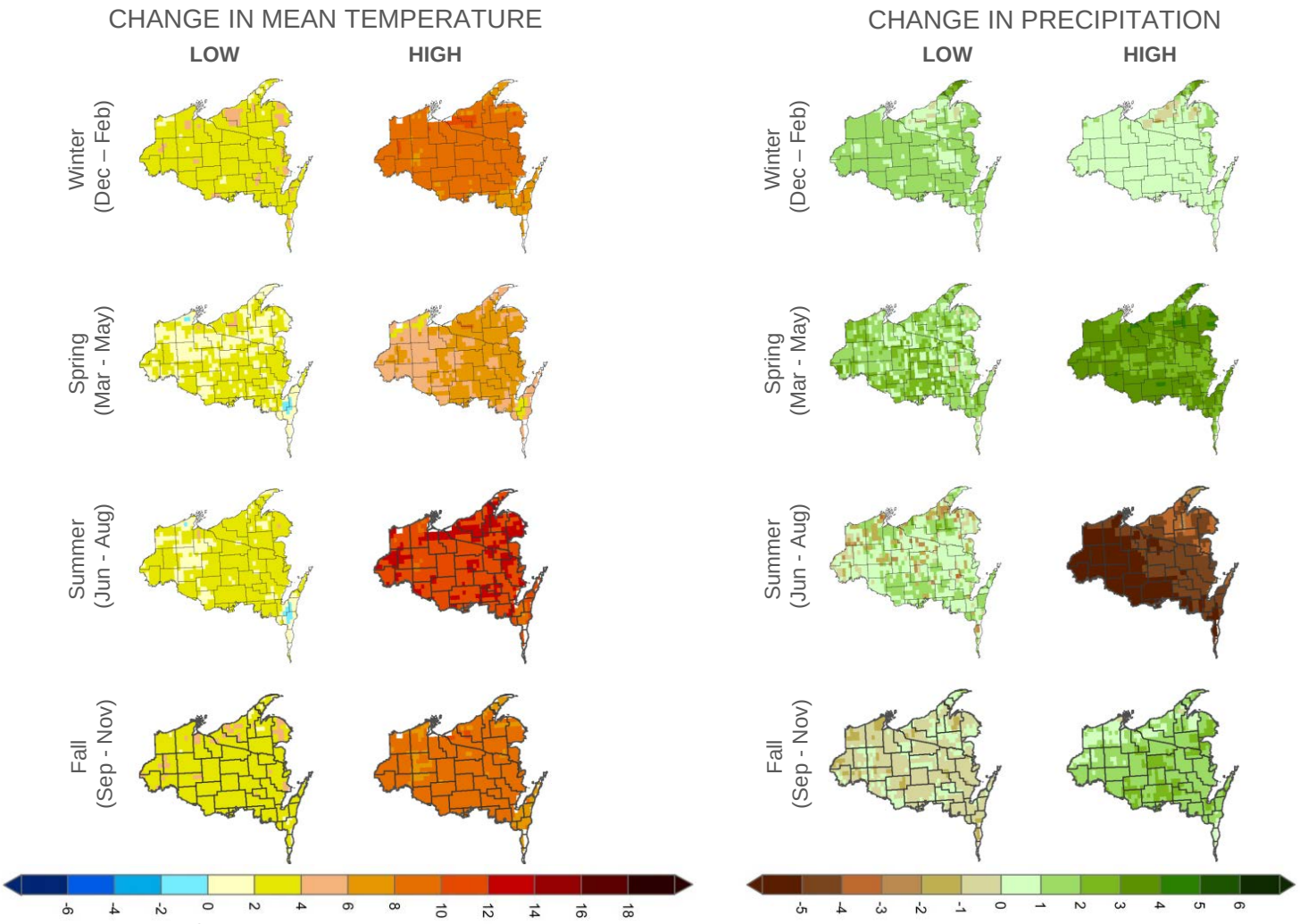
Temperatures will increase

Climate models agree that temperatures will increase across all seasons in the region over the next century. The projected change is on the order of 2 to 9 °F, with winters expected to continue warming faster than other seasons.

Evidence suggests that winter temperatures will increase, even under low emissions, leading to reduced snowpack and soil frost. Growing seasons will continue to lengthen by 1 or 2 months by the end of the century.

Precipitation will change

Precipitation is projected to increase up to 1 inch during winter and 1 to 3 inches in spring by the year 2100. The greatest uncertainty exists for summer precipitation, with slight increases or large decreases possible. Projections for fall precipitation are also mixed. There may be greater drought stress in summer or fall, because higher temperatures will lead to greater water loss from evaporation and transpiration.



This is 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 future climate scenarios. Low = PCM B1, High = GFDL A1FI.

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

Two global climate models, three forest impact models, hundreds of scientific papers, and professional expertise were combined to assess the effects of climate change on forest ecosystems in the assessment area. Based on this information, there is a large amount of evidence to suggest that the following impacts will occur in northern Wisconsin and western Upper Michigan.

Soil moisture patterns will change, with drier soil conditions later in the growing season.

Seasonal changes in precipitation are expected across the assessment area, and the trend toward more frequent heavy rainfall events is expected to continue. Warmer winters may lead to earlier snowmelt in the spring, and longer growing seasons combined with warmer temperatures may lead to more frequent moisture stress in summer and fall.

Boreal species will face increasing stress from climate change.

Forest impact models agree that boreal or northern tree species such as balsam fir, black spruce, white spruce, quaking aspen, and paper birch will have reduced suitable habitat and biomass across the assessment area. They may be less able to take advantage of longer growing seasons and warmer temperatures than temperate forest species.

Southern species will be favored by climate change.

Forest impact models also agree that temperate or southern tree species will generally have increased suitable habitat and biomass in this area. Several other minor species and species found further south of the assessment area are projected to increase, but fragmentation may limit natural migration of these species.

Species and forest types that are more tolerant of disturbance have less risk of declining across the landscape

Climate change is generally expected to increase disturbances across northern Michigan forests over the next century. As wildfires, floods, pest outbreaks, or other events become more frequent or damaging, tree species and forest types that are better able tolerate these disturbances may be favored. This idea holds true only to a point, because it still may be possible for disturbance-adapted systems to undergo too much disruption.

Low-diversity systems are at greater risk.

Studies have consistently shown that more-diverse systems are more resilient to disturbance, and low-diversity systems have fewer options to respond to change. There are many aspects to forest diversity – species, structural characteristics, and genetics – and each of these can generally help reduce risk and increase adaptability.

Download the full assessment:
www.nrs.fs.fed.us/pubs/46393

Download a copy of this summary:
www.forestadaptation.org/wi-wup

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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 different forest systems in the assessment area.

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 nine forest communities assessed, **lowland conifer and upland spruce-fir forests were rated the most vulnerable** to climate change because many important boreal species are expected to decline. **Oak and white pine forests were rated the least vulnerable** because of their ability to withstand drought and because oak species are generally expected to be favored under climate change.

These vulnerability determinations are general across the landscape, and they will be influenced by local conditions, forest management, and land use. The assessment doesn't consider future changes in management, land use, fire suppression, or other social and 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, assess risk, and ensure that the benefits forests provide are sustained into the future.

Forest managers and landowners will naturally have different goals and objectives, and different opportunities and constraints for how they might respond to climate change risk. These factors will help determine the most appropriate actions to prepare for climate change.

Managers can use scientific information from this assessment, in combination with site-specific knowledge, to better understand how particular forests may be more or less 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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Citation: Janowiak, M, L Iverson, D Mladenoff, E Peters, K Wythers, W Xi, L Brandt, P Butler, S Handler, PD Shannon, C Swanston, L Parker, A Amman, B Bogaczyk, C Handler, E Lesch, P Reich, S Matthews, M Peters, A Prasad, S Khanal, F Liu, T Bal, D Bronson, A Burton, J Ferris, J Fosgitt, S Hagan, E Johnston, E Kane, C Matula, R O'Connor, D Higgins, M St. Pierre, J Daley, M Davenport, M Emery, D Fehringer, C Hoving, G Johnson, D Neitzel, M Notaro, A Rissman, C Rittenhouse, R Ziel. 2014. Forest ecosystem vulnerability assessment and synthesis for northern Wisconsin and western Upper Michigan: a report from the Northwoods Climate Change Response Framework. . Gen. Tech. Rep. NRS-136. Newtown Square, PA: U.S. Dept. of Agriculture, Forest Service, Northern Research Station. www.nrs.fs.fed.us/pubs/46393

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