MINNESOTA WOODLANDS AND CLIMATE CHANGE

ADDITIONAL INFORMATION

HOW MINNESOTA’S WOODLANDS DEVELOPED:

Woodlands are continually changing—there's no such thing as a static forest. Every year individual trees germinate, grow, and die. Across decades, one group of species may almost completely replace another. Across centuries, tree species move in response to changing conditions, seed dispersal patterns, and other factors.

About 10,000 years ago, as the glaciers receded from Minnesota, the landscape was a barren, cold, rocky landscape. Over millennia, the combined actions of a warming climate, seasonal freeze/thaw cycles, chemical weathering, and invading vegetation led to development of the characteristic soils we see today in Minnesota.

These soils, along with variation in precipitation levels throughout the state, support four different ecological provinces, or biomes.

HUMAN INFLUENCES ON TODAY’S WOODLANDS

People are part of every natural ecosystem, and have actively managed Minnesota’s forests for centuries. Forest Stearns describes American Indian impacts as follows (2):

\[\text{It is clear that Native Americans influenced the Lake States forests long before European settlement began. Their influence was greatest on fire-susceptible communities such as savanna, grassland, and pine forests. These were intentionally burned for ease in travel or to aid hunting. Sometimes considerable areas were cleared for cultivation or around settlements for fuel wood and to build stockades. In some locations, long “fences” of brush were constructed to funnel game to the hunters, whence names like “Fence Lake.” The Indians also transported native plants for food, medicinal, and ritual purposes.}\]

Following settlement by European Americans, Minnesota’s seemingly inexhaustible white and red pine resource was harvested to build (or rebuild) the great cities of the Midwest, like Chicago and Minneapolis. This timber harvest period occurred primarily between 1850 and 1920. Far different
from modern forest management, during this period little attention was paid to managing the forest resource—the focus was on getting the wood to market. Harvested woodlands were left in a severely degraded condition, prone to catastrophic wildfire.

The Hinckley and Cloquet fires, of 1894 and 1918 respectively, led to massive loss of property and life. In marked contrast to the initial massive timber harvest, Minnesota's woodlands are managed very differently now. Minnesota's woodlands are resilient and have returned to a highly productive, diverse state. On both public and private lands, sustainable management of a renewable natural resource is the primary concern.

**IMPACTS OF MINNESOTA’S CHANGING CLIMATE**

Data collected at Minnesota’s weather stations over the past 125 years or so indicate a clear trend in Minnesota’s climate. Annual average temperatures are rising, with the most pronounced increases during the winter months.

Looking to the future, the clear trend among climate models is that most of Minnesota’s tree and plant ranges will shift northward and eastward. According to the Union of Concerned Scientists, by the end of this century Minnesota’s summer climate will resemble the current climate of Kansas, and the winter climate that of southern Wisconsin.

As already noted, Minnesota lies at the juncture of four major ecological provinces, or biomes. Ecological boundaries depend heavily on temperature and rainfall patterns, and changes in temperature and rainfall are likely to have relatively major effects near the boundaries.

**How will these changes affect Minnesota woodlands?**

**Stress:** Warming temperatures are likely to stress trees that are adapted to cooler conditions. This stress may predispose trees to secondary insect or disease agents, making them more vulnerable. This would be exacerbated by longer and/or more frequent drought events.

**Insects & disease:** Healthy trees can defend themselves against most native insect and disease threats. However, stressed trees are more vulnerable. As a consequence, native pests like the two-lined chestnut borer and bronze birch borer can have more damaging outbreaks when trees are stressed. Both of these insects have had recent outbreaks due in part to drought events. These outbreaks, and associated losses, are likely to become more common.

**Invasive plants:** Many invasive species, like buckthorn, can thrive under a wide variety of conditions. Some native tree species can only thrive under a relatively narrow range of conditions. Changing climate may displace some natives, creating growing space that will be filled by invasives.
New forest health threats: Emerald ash borer was found for the first time in Minnesota in 2009. That year also marked a dramatic uptick in the number of gypsy moths trapped in northern Minnesota. Both of these insects will have major impacts on the Minnesota woods. Additionally, some native insects like jack pine budworm and two-lined chestnut borer have had big outbreaks in recent years. Different bugs have different impacts, but overall, new insect invaders will further stress and weaken forests, compounding stress from a changing climate.

WHAT MINNESOTA WOODLAND OWNERS CAN DO
As the owners of a third of Minnesota's 17 million acres of woodlands, families and individuals have an important opportunity and responsibility. Careful forest health monitoring and prompt action to deal with emerging forest health threats will help landowners become part of the solution rather than a source of forest health problems for their neighbors. Based on research from the University of Minnesota, we describe three broad strategies by which landowners can help their woods adapt to a changing climate: Resistance, resilience, and facilitation.

RESISTANCE STRATEGIES include things like watering trees, prescribed burning, and other strategies designed to slow or resist the impacts of a changing climate. Some of these strategies will have limited impact, mainly because they're impractical across large scales—watering your yard tree may help; watering your woods is impossible. On the other hand, proactive management of emerging forest health threats, particularly insect outbreaks and new species invasions, will be an important resistance strategy.

What you can do: Monitor your woods carefully for new forest health or invasive species threats. When you see them, take prompt action to control them. Insect and disease outbreaks may travel through stands more quickly due to tree stress. The more quickly you can identify and act to control outbreaks, the more damage you can prevent. Your neighbors will thank you!

RESILIENCE STRATEGIES are designed to improve the woodland’s capacity to thrive under changing conditions. Maintaining species- and age-class diversity will increase woodland stands’ ability to remain healthy. Equally important is maintaining plenty of growing space for the trees you have so that they have the energy they need to naturally resist the effects of insect and disease threats.

What you can do: Talk to a local forester about opportunities to increase the diversity of your woods. Trees with large, full crowns receive more energy from the sun and are more resilient than crowded, spindly trees. Thinnings and woodland stand improvement treatments (see http://z.umn.edu/IST) may help to improve the diversity and vigor of your woodlands, increasing their natural capacity to adapt to change.

Figure 3: A partial harvest designed to increase diversity and regenerate oak at the St. John's University Arboretum, Collegeville.
FACILITATION STRATEGIES include more active interventions designed to help woodlands adapt to new conditions. According to Lee Frelich in the University of Minnesota’s Department of Forest Resources, the pace of range shifts will exceed trees’ ability to naturally disperse into new suitable ranges. This is particularly true of heavy-seeded species whose seed can not be naturally dispersed across large distances. Facilitation strategies include moving tree species from, generally, more southern and western areas in order to establish them in places in which changing climate may now favor them.

What you can do: Facilitation strategies are risky. Moving species large distances across the landscape may be illegal in some situations in Minnesota, and can lead to serious unintended problems—after all, species like buckthorn and garlic mustard were moved here with the best of intentions. Check local laws and work closely with a natural resource professional before moving species. And remember, before they can grow to maturity, whatever species you plant this year will first need to survive next winter!

ADDITIONAL LINKS AND INFORMATION:
Minnesota's native plant communities:  http://www.dnr.state.mn.us/ecs/

Minnesota's forest industry:
  • Minnesota Forest Industries:  http://www.minnesotaforests.com/

US Forest Service's Climate Change Atlas for Forest Tree Species in the Northeastern US: http://www.nrs.fs.fed.us/atlas

Choosing the right tree species to plant:
  • http://www.extension.umn.edu/distribution/naturalresources/DD7502.html
  • http://www.dnr.state.mn.us/forestry/nurseries/choosing.html

Invasive Species: Minnesota Dept. of Agriculture (search for gypsy moth, emerald ash borer, buckthorn, and others). http://www.mda.state.mn.us/plants.aspx

Minnesota landscape-level forest plans based on citizen input: http://www.frc.state.mn.us/initiatives_llm_landscapes.html


Minnesota Conservation Volunteer: Climate change article: http://www.dnr.state.mn.us/volunteer/janfeb01/warming.html

QUESTIONS OR COMMENTS?
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Add questions and comments to http://z.umn.edu/MWCC