



Keep Your Woods Healthy for Tomorrow

A Tool to Assess Risk in a Changing Climate

Maintaining a healthy forest is getting harder and harder. In today's world, there are an increasing number of stresses that forests have not traditionally had to deal with. Despite this, you still depend on your woods for many benefits such as clean water, wildlife habitat, timber, and recreation.

Our climate is changing faster than at any time known in history. While forests are adaptable, the pace of change may overwhelm their ability to adjust to the new conditions. Climate change can intensify existing challenges, including both exotic and native species that become invasive. Woodland owners will need to consider how to prepare for these risks and respond appropriately.

Actions you take today can help your woods be more resilient, healthy, and productive in the face of future climate change. This publication can help you assess the resilience of your woods quickly and easily. It does not list every possible scenario or impact, but it can help you consider important risk factors and offer suggestions about ways to reduce risk. Work with a forester, or other natural resource professional, to help you identify strategies to keep your woods in good condition.

Forest Resilience: The capacity of a forest to withstand or recover from disturbance and stress.

Forest Resilience Principles

Climate change will alter the frequency and intensity of threats, such as pest outbreaks, invasive species, wildfires, and storms. A changing climate, combined with existing pressures, can further jeopardize the health of your woods. Here are some high-level principles to keep in mind as you consider how to prepare your woods to cope with the unpredictable conditions that lie ahead. A forester or other natural resource professional can help you determine the specific practices for the unique conditions on your land.

PRINCIPLES OF RESILIENT FOREST MANAGEMENT

1. **Keep Forests as Forests.**

Forests provide many benefits, such as clean water, wildlife habitat, and wood products. But forests can only provide these goods and services if they remain as forests. There are legal tools to continue your legacy and protect your forest from development and other land-use change. Talk to a forester about conservation easements and legacy planning. Your long-term planning will be fruitful only if the forest is there for the long term.

2. **Maintain Forest Health and Vigor.**

Maintaining a healthy, vigorous forest is one of the best protections against many risks. Actively managing a forest to promote growth rates, species diversity, and stand structure has many benefits, including reducing stress and vulnerability to pests. Climate change is expected to create more stress for Michigan forests, such as more frequent droughts which in turn can create attractive conditions for some invasive species, forest pests, and pathogens. A diverse forest with healthy trees may be in a better position to able to withstand these stressors.

3. **Address Vulnerabilities.**

Your woods may be vulnerable to climate change if there is a risk of declining health, productivity, or forest cover, or if there may be a substantial shift in identity (one forest type converting to another). The scorecards on the pages that follow are designed to help you identify potential risks for your property. These vulnerabilities can be addressed systematically through time with forest management. Certain risk factors, such as lower than expected species or structural diversity, may not be signs of an immediate crisis but rather may be a sign that you have too much emphasis on a particular species or age class in your "forest portfolio."

4. **Forest Management Can Help.**

Forest management is the purposeful intervention by humans in forests, using ecological principles, to optimize forest health, along with desired goods and services. We have the ability to anticipate changing climate conditions and the potential consequences of those changes, which might be beyond the ability of your woods to cope with naturally. If your woods are vulnerable to climate change or if they are challenged by current disturbances, management can help ensure that you have the best possible chance for a successful outcome.

Woods Health Scorecards and Actions

The remainder of this guide is structured into “Scorecards” and corresponding “Actions.” The scorecard elements are colored blue and the action elements are colored red.

Assess the Condition of Your Forest

Each Woods Health Scorecard (blue pages) can help you assess how resilient your forest may be to changing climate conditions. Consider the condition of your woods and check the appropriate boxes during a woods walk. This evaluation can help you identify potential risks and highlight management options that may increase the forest’s ability to cope with changing conditions. Discuss these topics with a forester or resource professional as you plan for the future of your woods.

Take Action to Improve Forest Resilience

Once you complete a Woods Health Scorecard, the accompanying Woods Health Actions (red pages) can help you decide how to take action. Review each scorecard and address the high-risk areas first. Any topics you answer with “Don’t Know” can be ideas to discuss with a forester. Actions page presents potential strategies to address areas that need improvement. A forester can help fit goals, objectives, and associated practices that improve resilience into your long-term management plan. A forester can also help prioritize activities over time. The suggested actions are general and won’t include all the possible options, and every site location is at least a little bit different. However, the suggestions might help spark your imagination.

Helpful Resources:

Climate Change Response Framework
www.forestadaptation.org

U.S. Forest Service Climate Change Atlas
www.nrs.fs.fed.us/atlas

Michigan Forests Forever
mff.forest.mtu.edu/TreeBasics/TreeBasics.htm

Michigan Forest Types
<https://forestadaptation.org/learn/resource-finder/michigan-forest-type-summaries>

Michigan Climate Change Summaries
<http://glisa.umich.edu/resources/great-lakes-climate-divisions>

USDA Web Soil Survey
<https://websoilsurvey.sc.egov.usda.gov/>

Michigan Invasive Species
www.misin.msu.edu/states/michigan/

The Scorecards and Actions are organized into four categories:



PROPERTY-LEVEL
CONSIDERATIONS



FOREST STRUCTURE



FOREST DIVERSITY
AND COMPOSITION



TREE REGENERATION



PROPERTY-LEVEL CONSIDERATIONS

Scorecard

Woodlands will be affected differently by climate change depending on their location on the landscape. For example, woods along waterways may be more vulnerable to extreme rain events or flooding. Different areas of the landscape may be exposed to higher or lower pressure from deer browse. Getting a sense for these overall considerations can help set some expectations for how you might cope with future change. Talk with a forester about these factors for your woods.

DROUGHT STRESS

Higher Risk

Soils and landscape position may make the property more prone to drought stress, or forest types may be mismatched to the soils on the property.



Don't Know/Not Sure

Lower Risk

Soils and landscape position are expected to retain water, and forest types are well-matched to soil conditions.

EXTREME RAINFALL

Higher Risk

Property contains areas that would be heavily affected by extreme rainfall, such as a floodplain or steep, highly-erodible slope. Early and rapid snowmelt can also cause flood conditions.



Don't Know/Not Sure

Lower Risk

Extreme rainfall would not cause problems at this location.

ACCESS FOR MANAGEMENT

Higher Risk

Warmer winter conditions create challenges to management. For example, if you have wet soil types that need frozen ground for a timber sale.



Don't Know/Not Sure

Lower Risk

Warmer winter conditions may increase opportunities for management. For example, you may find that some areas of your property are accessible during different seasons.

DEER BROWSE

Higher Risk

Your woods are in an area of high deer populations and are exposed to moderate to high browse pressure.



Don't Know/Not Sure

Lower Risk

Your woods are in an area with relatively lower deer numbers.

PROPERTY-LEVEL CONSIDERATIONS

Explanations



An individual woodland owner can't do much to change these property-level considerations. Nevertheless, these topics are still useful to recognize and discuss with your forester. These considerations may help determine different risks from climate change, as well as the range of options that are available to adapt and prepare. Rather than concrete "actions," this page will present a little more explanation about the topic.

EXPLANATIONS

Drought Stress

- Drought may become more frequent under climate change as growing seasons become longer and warmer, snowmelt comes earlier, heavy rain events occur more often, and there are longer stretches between rain events.
- Drought stress won't be uniform across the landscape so it's important to consider whether factors such as soils, topography, and forest types might make your property more vulnerable.
- An example "mismatch" might be a sugar maple forest growing on sandy soils that would historically not have supported this forest type.

Extreme Rainfalls

- Michigan has already experienced dramatic increases in the frequency of extreme rainfall over the past several decades, and this trend is expected to continue under climate change.
- Low-lying forests may be exposed to larger floods in the future, and upland forests or steep slopes may experience more erosion from large rain events.
- Early and rapid snowmelt and rain-on-snow events are also expected to become more common under climate change, and these can also lead to flooding.

Access for Management

- Winters have warmed more rapidly than other seasons in Michigan over the past several decades, and winter is expected to continue warming across the state.
- In some regions, forest management and trucking depends on frozen ground conditions or deep snowpack during the winter. These rules are in place to protect wetlands and sensitive soils.
- Warmer winters will mean a shorter window of opportunity with reliable conditions for forest management, particularly for properties with low areas or wetlands. Timing of harvest operations is important to minimize risks to forest soils.

Deer Browse

- In some areas of Michigan, forest regeneration is severely limited by deer browse.
- Landowners in areas with high deer populations may be limited in terms of what species you are able to plant, or you may be required to invest extra time and resources into installing tree fences, bud caps, or other deterrents to protect vulnerable seedlings.



FOREST DIVERSITY AND COMPOSITION

Scorecard

Composition refers to the variety of species, communities, and ecosystems in an area. Every property is different and will contain a different mix of tree and plant species due to the conditions unique to that place and the history of the land. In general, a forest that contains a variety of tree species that are well-suited to local conditions as well as future climate conditions will be more resilient. You may also consider forest diversity across the landscape and how your woods might contribute important variety to the surrounding area.

SPECIES DIVERSITY

Higher Risk

Missing tree species and understory plants that would be expected for that forest type.



Don't Know/Not Sure

Lower Risk

Contains a mix of tree species and understory plants appropriate for that forest type.

SPECIES SUITABILITY

Higher Risk

Many species not expected to do well over the next 50 years, or many species not well-suited for the soils on the property.



Don't Know/Not Sure

Lower Risk

A mix of species that are expected to fare well under a changing climate, and species that are well-suited for the soils on the property.

GENERAL TREE HEALTH

Higher Risk

Trees appear sickly and have weak crowns, rotting trunks, with too many dead or dying limbs.



Don't Know/Not Sure

Lower Risk

Trees have fully green crowns typical for their species. Trees tend to be healthy and growing well.

INSECTS AND DISEASES

Higher Risk

The forest is currently affected by insects or diseases. There are looming threats such as nearby outbreaks.



Don't Know/Not Sure

Lower Risk

There are no current or looming forest insect or disease issues. No evidence of major insect or disease problems.

LANDSCAPE DIVERSITY

Higher Risk

The landscape around my property has uniform topography and a similar forest type. The surrounding forest types are not expected to thrive under climate change.



Don't Know/Not Sure

Lower Risk

The landscape around my property has diverse topography and a variety of forest types. Many surrounding forest types are expected to fare well under climate change.

FOREST DIVERSITY AND COMPOSITION

Actions



Strategies to increase or maintain diversity and composition will vary from region to region and among different sites. These strategies are general suggestions, and they may not be suitable for all situations. Talk with a forester about what makes sense for you and your woods.

CONCERNS

STRATEGIES

Species Diversity

Species diversity, among trees and in the understory, is lower than what is expected for my forest types.

- During timber harvest, select against over-represented species in the overstory and understory, where appropriate for the site and soil types.
- Promote regeneration of a variety of species through harvesting, or plant a variety of native species expected to do well under future conditions.
- Consider deer browse levels in your area before deciding what to plant and what kind of protection may be required.

Species Suitability

Many tree species are not expected to do well under continued climate change.

- Promote species with a wide range of moisture and temperature tolerances if they are present, or plant if needed.
- Promote a variety of native species expected to do well under future conditions if they are present, or plant if needed.
- Consider deer browse levels in your area before deciding what to plant and what kind of protection may be required.

General Tree Health

My forests are growing poorly and/or have high amounts of damage from insects, diseases, or weather events.

- When appropriate, thin forest stands to remove crowded, damaged or stressed trees to reduce competition for light, nutrients, and water.
- For stands with too few trees, consider regeneration strategies for tree species appropriate for the soil types and expected climate change conditions.

Insects and Diseases

The forest is currently affected by insects or diseases. There are looming threats such as nearby outbreaks.

- Consult a local forest health professional for detailed recommendations.
- Conduct a salvage harvest of affected tree species, when feasible.

Landscape Diversity

The landscape around my property has uniform topography and a similar forest type, not expected to thrive under climate change.

- Consult a forester to discuss how your woods could contribute to boost diversity in the area.
- Consider if management could add diversity to the overall landscape, such as a patch cut in the middle of a uniform canopy.
- Talk with your neighbors about shared forest interests and discuss management options.



FOREST STRUCTURE Scorecard

Many forests in Michigan currently have simplified forest structure. Forest structure includes having a diversity of tree sizes and ages, varying the number of trees per acre, and ensuring the presence of dead wood — both standing and down. A complex forest structure can help provide a variety of conditions (light, moisture, and competition) that create opportunities for many species to find suitable opportunities for growth and regeneration. This can help a forest tolerate and respond to stress and disturbance. Different forest types are expected to have different amounts of structural complexity at different ages, and a forester can help you determine what kind of structural characteristics are suitable for your woods.

STRUCTURAL DIVERSITY

<p>Higher Risk</p> <p>Size classes and forest layers that should be there for my forest types are missing.</p>	  <p>Don't Know/Not Sure</p>	<p>Lower Risk</p> <p>My forests have properly developed size classes for the forest types present. Forest types that should have multiple size classes, do have multiple size classes.</p>
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STANDING AND DOWN DEAD TREES

<p>Higher Risk</p> <p>No or few large standing or down dead trees are present.</p>	  <p>Don't Know/Not Sure</p>	<p>Lower Risk</p> <p>There is an appropriate amount of standing and down dead trees (several per acre), and some are large. Note – if there are excessive dead and down trees, this could indicate a forest health issue. For example, if there are many dead trees all of the same species.</p>
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TREE CROWNS AND SPACING

<p>Higher Risk</p> <p>Trees are too crowded and competition for resources is slowing growth, or less commonly, trees are inadequately stocked and too widely spaced.</p>	  <p>Don't Know/Not Sure</p>	<p>Lower Risk</p> <p>Trees have adequate growing space that enables them to have healthy crowns and develop healthy forest canopies.</p>
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LANDSCAPE STRUCTURE

<p>Higher Risk</p> <p>The landscape around my woods is primarily a similar age and structure.</p>	  <p>Don't Know/Not Sure</p>	<p>Lower Risk</p> <p>There are a variety of forest ages and structures on the landscape around my property.</p>
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FOREST STRUCTURE

Actions



Strategies to increase or maintain structural diversity will vary from region to region and among different sites. Different forest types are expected to have different amounts of structural complexity at different ages. Talk to a forester about these general suggestions.

CONCERNS

STRATEGIES

Structural Diversity

The forest contains trees that are primarily a single age or size, creating a simple canopy, when a more complex structure can be expected.

- In certain forest types, use forest management to mimic aspects of natural disturbance to support the establishment of different age classes.
- Retain individual trees or groups of trees during harvest actions to allow some portions of your woods to reach an older age.

Standing and Down Dead Trees

No or few large standing or down dead trees are present.

- Leave or create standing dead trees during forest management activities where they do not create a hazard.
- Allow some trees to grow to larger sizes so that they can provide value to wildlife and serve as future dead wood.
- Leave large pieces of woody material on the ground after disturbances and forest management activities.

Tree Crowns and Spacing

Trees are too crowded and competition is slowing growth, or less commonly, trees are inadequately stocked and too widely spaced.

- In overstocked stands, identify desirable crop trees and thin to create room for these individuals to grow.
- In understocked stands, plant (and protect) a variety of native species expected to do well under future conditions.
- In understocked stands, introduce natural or mechanical disturbance to mimic conditions for regeneration.

Landscape Structure

The landscape around my woods is primarily a similar age and structure.

- Consult a forester to discuss how your woods contribute to structural diversity in the surrounding area, and how their characteristics could be managed to boost landscape structure.
- Talk with your neighbors about shared forest interests and discuss management options.



TREE REGENERATION Scorecard

“Regeneration” refers to seedlings, usually under two feet tall. “Recruitment” consists of larger saplings that will likely become the new forest. In many situations, regeneration is not a problem but recruitment is a serious problem. Many factors contribute to a healthy, or unhealthy, forest understory. In Michigan, deer browsing may be the most important barrier to tree recruitment and understory diversity. Climate change will modify the microclimate conditions under which seeds germinate and seedlings survive.

DESIRABLE REGENERATION

Higher Risk

Tree seedlings and saplings are absent in the understory or are outcompeted by undesirable species.



Don't Know/Not Sure

Lower Risk

Tree seedlings and a sufficient number of saplings are present in the understory; the species mix is desirable for achieving management goals.

SPECIES SUITABILITY

Higher Risk

Regeneration is mostly tree species that are not expected to do well under continued climate change.



Don't Know/Not Sure

Lower Risk

Regeneration includes a variety of tree species expected to do well under climate change.

INVASIVE SPECIES

Higher Risk

Invasive plants such as buckthorn, autumn olive, and garlic mustard, or invasive animals such as earthworms are impeding natural tree regeneration. Native invasives may also be a concern.



Don't Know/Not Sure

Lower Risk

Invasive plants and animals are absent on the property or are confined to limited areas.

DEER BROWSE

Higher Risk

Moderate to severe deer browse creates substantial challenges for tree regeneration and recruitment.



Don't Know/Not Sure

Lower Risk

Deer browse does not pose a substantial challenge to tree regeneration.

TREE REGENERATION

Actions



Strategies to manage tree regeneration will vary from region to region and among different sites. These strategies are general suggestions, and they may not be suitable for all situations. Talk with a forester about what makes sense for you and your woods.

CONCERNS

STRATEGIES

Desirable Regeneration

Tree seedlings and saplings are absent in the understory or are dominated by undesirable species.

- Retain desirable tree species in the overstory so that they may provide a future seed source.
- Remove undesirable tree species to enhance regeneration of desired tree species. Consider manual removal for small areas, or explore mechanical removal, prescribed burning, or chemical control.
- Provide soil surface conditions appropriate to desired tree species. This may entail exposing mineral soil.
- Assess whether deer browse is limiting desirable regeneration.

Species Suitability

Regeneration is mostly tree species that are not expected to do well under continued climate change.

- Favor species currently present that can persist under a wide variety of climate and site conditions.
- Identify and promote species that currently occupy a variety of site conditions and landscape positions.

Invasive Species

Invasive plants such as buckthorn, autumn olive, and garlic mustard, or invasive animals such as earthworms are impeding natural tree regeneration. Native invasives may also be a concern.

- Thin stands by identifying crop trees, creating room for desirable species of good form to grow.
- Prevent new invasive species from establishing and manage existing populations or seed sources of invasive plants through physical or chemical treatments.
- Monitor regularly for the presence of new invasive plants or animals in your woods.

Deer Browse

Moderate to severe deer browse may create substantial challenges for tree regeneration and recruitment.

- Install fences, bud caps, or other physical barriers to prevent browsing damage.
 - Use tree tops from forest harvest or plantings of non-palatable tree species as locations for “hiding” desirable species from herbivores to reduce browse pressure.
 - Increase hunting pressure and/or hunter effectiveness.
 - Identify areas of your woods that may be naturally protected from deer due to steep slopes or other factors, and emphasize regeneration in these areas.
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This Publication Was Developed with Contributions From:

Bill Cook, Julie Crick, and Georgia Peterson
MSU Extension

Stephen Handler¹, Maria Janowiak¹, and Kailey Marcinkowski²
Northern Institute of Applied Climate Science, ¹USDA Forest Service, ²Michigan Tech University

Christine Cadigan
American Forest Foundation

Kristina Ferrare
Cornell Cooperative Extension

Lisa Hayden
New England Forestry Foundation

Gregg Sargis
The Nature Conservancy, Central and Western New York Chapter

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