

# Protect Your Woods for Tomorrow

## A Tool to Assess Risk in a Changing Climate

Whether you spend time outside in your woods or just enjoy the beauty of your trees and wildlife from the window, you likely love your woods and want to keep it healthy.

Forests are always changing and adapting to new conditions. Some changes, like the progression of green summer leaves to bright red and gold fall foliage, or the annual return of migratory songbirds, are expected.

Other shifts, such as earlier spring leaf-out or an increase in nuisance plants such as buckthorn, are only visible when comparing differences in woodlands across many years or decades.

Our climate is changing, resulting in altered weather patterns, rising temperatures and shifts in seasonal precipitation patterns. Actions you take today can help

your forest be resilient, healthy and productive in the face of future climate changes.

This publication can serve as a tool to help you assess the resilience of your woods in a quick and easy manner. It contains background information on the important characteristics of resilient and healthy forests and provides examples of potential adaptation strategies. The included scorecards can be used in the field to evaluate the resilience of your woods, which you can use on your own or to start a conversation with a forester.

**Forest Resilience:** The capacity of a forest to respond to a disturbance by resisting damage or stress and recovering quickly.

# Forest Health and Resilience Principles

Climate change will alter the frequency and intensity of threats, such as pest outbreaks, invasive species, wildfires and storms. Our Wisconsin woodlands already face threats from invasive bugs like the emerald ash borer. A changing climate, combined with increased existing pressures, can further jeopardize the recovery of your woods from extreme weather events and other forest stressors. There are several management actions that can help you prepare your woods to cope with the unpredictable conditions that lie ahead. A forester or other natural resource professional can help you determine the appropriate actions or the unique conditions on your land.

## PRINCIPLES OF RESILIENT FOREST MANAGEMENT

---

### 1. **Keep Forests as Forests.**

Larger and more connected forest blocks tend to be more resilient and less impacted by stressors such as invasive plants. Aim for the long-term protection of the plant, soil and water resources on your land by considering long-term protection tools like conservation easements and legacy planning that prevent the fragmentation of your woods. Consider updating your management plan. Ensure that rare or unique species and communities are managed and protected.

---

### 2. **Reduce Stressors.**

The changing climate is expected to create more attractive conditions for invasive species, forest pests and pathogens that often outcompete native tree species or even render them functionally extinct. A diverse forest with healthy trees may be able to withstand threats from pests and disease and provide a future seed source. Young tree seedlings are the future of the forest — and often the tastiest morsels for your local deer population. By promoting a diverse community of younger trees, your woodland will be more adaptable to changing stressors in the future.

---

### 3. **Address Vulnerabilities.**

As the climate changes, conditions for current tree species will change, too. Hedge your bets and have a variety of native tree species present in your woods so eventual “winners” will be ready to thrive. If your focus is on maintaining a single tree species, you run the risk of that species being unable to handle future conditions — and your whole forest loses out. A diverse forest structure is just as important as the individual species. A woodland with all the same size trees can also be at risk. Keeping a good population of young trees, middle-aged trees and old trees will not only provide diverse places for wildlife to live today, but it will also enable your woods to handle a variety of situations in the future.



## Assess the Condition of Your Forest

Each Woods Health scorecard 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 the pressure of changing conditions. Discuss these topics with a resource professional as you plan for the future of your woods.



## Take Action to Improve Forest Resilience

Once you complete a Woods Health scorecard, organize the outcomes by risk and address the high-risk performance areas first. This section presents concerns and potential strategies to address areas that need improvement. A forester can help fit goals, objectives and associated practices that improve resilience into a landowner's long-term plan. A forester can also help prioritize activities over time. It's important to remember that any activity to address at-risk areas moves a woodlot forward toward improved resilience.

# Scorecard → Actions

# FOREST DIVERSITY AND COMPOSITION



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 current local conditions and future climate conditions will be better able to tolerate changes in climate and other stressors.

## SPECIES DIVERSITY

### Higher Risk



One or a few tree species are dominant, either in the canopy or throughout the forest.

### Lower Risk

Many tree species are present, without a single species being overly dominant.

## SPECIES SUITABILITY

### Higher Risk



The dominant tree species are near the southern extent of their species range or are adapted to cold conditions.

Explore current and future range maps at:  
[www.fs.fed.us/nrs/atlas](http://www.fs.fed.us/nrs/atlas)

### Lower Risk

The dominant tree species can tolerate warmer, drier or more variable conditions and are generally found farther south.

## GENERAL TREE HEALTH

### Higher Risk



Trees have poor growth form or have been damaged by insect pests or forest diseases.

### Lower Risk

Trees are healthy, free of disease and have generally straight trunks with no scars.

## INSECTS AND DISEASES

### Higher Risk



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

To learn more about current insects and diseases at:  
[dnr.wi.gov/topic/foresthealth](http://dnr.wi.gov/topic/foresthealth)

### Lower Risk

There are no current or looming forest insect or disease issues, and there is a diversity of non-host tree and shrub species.

---

## FOREST DIVERSITY AND COMPOSITION



WOODS HEALTH  
ACTIONS

### CONCERNS

#### Species Diversity

Forest has low species diversity. One or a few tree species are dominant.

### STRATEGIES

- Use management to promote a greater diversity of tree species. Multi-species stands are generally more resilient than single-species stands.
- Promote regeneration through harvesting, or plant a variety of native species expected to do well under future conditions.

---

#### Species Suitability

The current tree species are near the southern extent of their species range or are adapted to cold conditions.

- 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.

---

#### General Tree Health

Trees have poor growth form reflecting more challenging site conditions or have damage from insect pests or forest diseases.

- When appropriate, thin forest stands to remove crowded, damaged or stressed trees to reduce competition for light, nutrients and water.

Find potential "winner" tree species for your part of the state at [www.forestadaptation.org/northwoods\\_treehandouts](http://www.forestadaptation.org/northwoods_treehandouts)

# FOREST STRUCTURE



When it comes to forest structure, more complexity is often better. Forest structure includes having a diversity of tree sizes and species, varying the number of trees per acre and ensuring the presence of dead wood — both standing and down. These conditions make your woods more likely to recover quickly from disturbance, with the added benefit of quality wildlife habitat.

## STRUCTURAL DIVERSITY

### Higher Risk



The forest contains trees that are primarily a single age or size, creating a simple canopy (see illustration below).

### Lower Risk

The forest includes trees of different sizes as well as multiple vertical layers (overstory, understory, etc.).

## STANDING DEAD TREES

### Higher Risk



No or few large standing dead trees are present.

### Lower Risk

There are noticeable numbers of standing dead trees (several per acre), and some are large.

## DOWN DEAD WOOD

### Higher Risk



Woody material, especially large pieces, is rare or absent from the forest floor.

### Lower Risk

There are noticeable amounts of dead wood, especially large pieces, on the forest floor.

## TREE CROWNS AND SPACING

### Higher Risk



Trees are too crowded and competing for growing space, or less commonly, trees are inadequately stocked and too widely spaced.

See "Estimating stocking conditions" at [woodlandinfo.org/publications](http://woodlandinfo.org/publications)

### Lower Risk

Trees have adequate growing space that enables them to have large, healthy crowns.



Even-aged woods



Uneven-aged woods

---

## FOREST STRUCTURE



WOODS HEALTH  
ACTIONS

### CONCERNS

### STRATEGIES

#### Structural Diversity

The forest contains trees that are primarily a single age or size, creating a simple canopy.

- Use forest management to mimic aspects of natural disturbance to support the establishment of different age classes. Stands containing trees of different ages and sizes may be more resilient than even-aged stands.

---

#### Standing Dead Trees

No or few standing 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.

---

#### Down Dead Wood

Woody material, especially large pieces, are rare or absent.

- Leave large pieces of woody material on the ground after disturbances and forest management activities.

---

#### Tree Crowns and Spacing

Trees are inadequately stocked and too widely spaced, or trees are too crowded and competing for growing space.

- Thin stands by identifying crop trees, creating room for desirable species of good form to grow.

## TREE REGENERATION



Regeneration refers to the young trees that will grow into the future forest, and these small trees are important because they will influence how the forest changes over time. The species and health of these trees matter, and it is important to protect them from challenges like deer browse and competition from less desirable or invasive species.

### DESIRABLE REGENERATION

#### Higher Risk



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

#### Lower Risk

Tree seedlings or saplings are present in the understory; the species mix is desirable for achieving management goals.

### SPECIES SUITABILITY

#### Higher Risk



Regeneration includes species that are near the southern extent of their species range or are adapted to cold conditions.

Explore current and future modeled range maps at [www.fs.fed.us/nrs/atlas](http://www.fs.fed.us/nrs/atlas)

#### Lower Risk

Regeneration includes tree species that can tolerate warmer, drier or more variable conditions, and they are generally present farther south.

### INVASIVE PLANTS

#### Higher Risk



Plants such as buckthorn, multiflora rose, autumn olive and garlic mustard are common and may impede natural regeneration.

Click the "learn" button to explore plants of concern at [dnr.wi.gov/topic/invasives](http://dnr.wi.gov/topic/invasives)

#### Lower Risk

Invasive plants are absent on the property or are deliberately confined to small areas.

### DEER BROWSE

#### Higher Risk



The occurrence of moderate to severe deer browse creates substantial challenges for tree regeneration and recruitment.



A heavily deer-browsed woods lacking a new generation of small trees.

#### Lower Risk

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

Photo: Wisconsin Department of Natural Resources



---

## TREE REGENERATION



WOODS HEALTH  
ACTIONS

### 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.
- Control competition from undesirable tree species to enhance regeneration of desired tree species.
- Restrict recreation or management activities that may damage desirable regeneration. For example, prevent off-trail ATV use or minimize damage from harvesting operations to protect regeneration.

---

#### Species Suitability

Regeneration includes species that are near the southern extent of their species range or are adapted to cold conditions.  
(See "winner" species web link on page 5.)

- 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 Plants

Plants such as buckthorn, multiflora rose, autumn olive and garlic mustard are common in the forest.

- 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.
- Prevent and remove invasive plants to reduce competition for resources and enhance regeneration of desired tree species.

---

#### Deer Browse

The occurrence of moderate to severe deer browse may create substantial challenges for tree regeneration and recruitment.

- Install fences, bud caps and other physical barriers to prevent browsing damage.
- Promote abundant regeneration of multiple species to supply more browse than herbivores are expected to consume.
- 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.
- Monitor long-term survival and growth of seedlings.

## SITE-LEVEL RISKS



Woodlands will be affected differently by climate change depending on their location. For example, woods along waterways may be more vulnerable to extreme rain events or flooding, while an exposed ridgetop may be more susceptible to wind storms. Consider the unique ways that a site may be affected to develop actions tailored to that place.

### MOISTURE STRESS OR DROUGHT

#### Higher Risk



Areas of the property are susceptible to drought because the trees are not tolerant or because the soils are sandy or drought-prone.

To understand more about your soil type, see "Forest Soils of Wisconsin" at [woodlandinfo.org/publications](http://woodlandinfo.org/publications)

#### Lower Risk

Too much or too little water would not cause problems at this location.

### EXTREME RAINFALL

#### Higher Risk



Property contains areas that would be heavily affected by extreme rainfall, such as a floodplain or steep, highly-erodible slope.

#### Lower Risk

Extreme rainfall would not cause problems at this location.

### OTHER EXTREME WEATHER

#### Higher Risk



Property may be susceptible to extreme weather events, such as a ridgetop that has a higher risk of damage from high winds.

#### Lower Risk

This location is not at an elevated risk of damage from extreme weather events.

### SHORTER AND MILDER WINTERS

#### Higher Risk



Warmer winter conditions could negatively affect the property or create challenges to management or timber harvests. For example, wet soil types that need frozen ground for a timber sale.

#### Lower Risk

Warmer winter conditions may be beneficial to the property or may increase opportunities for management or timber harvests.

---

## SITE-LEVEL RISKS



WOODS HEALTH  
ACTIONS

### CONCERNS

### STRATEGIES

#### Moisture Stress or Drought

The forest can be negatively affected by drought because the trees are susceptible or because the soils are drought-prone.

- Seed or plant drought-resistant varieties of commercial species.
- Plant oaks, pines and other drought-tolerant native species in locations that are expected to become drier.

#### Extreme Rainfall

Forest is in an area that will be heavily affected by extreme rainfall, such as a floodplain or steep, highly-erodible slope.

- Plant species that can cope with periodic inundation and flooding, such as swamp white oak and silver maple, on sites that are in low landscape positions or prone to flooding.
- Ensure the forest soils are covered by leaf litter, vegetation and downed wood to reduce the potential for soil erosion and sedimentation into nearby streams.

#### Other Extreme Weather

The forest is at risk from other extreme weather events, such as windstorms or tornadoes.

- Thin stands to increase space for tree growth and enhance sturdiness of the residual stand, favoring the healthiest trees.
- Encourage diversity of tree species to promote resilience of your woods in the face of storms (this also helps control invasives, which take advantage of disturbance).
- Design canopy gaps and harvest edges with an orientation and shape informed by the prevailing winds to reduce the risk of windthrow.

#### Shorter and Milder Winters

Warmer winter conditions will negatively affect the forest or create challenges to forest management or timber harvest.

- Promote long-lived conifers with wide ecological tolerances, such as eastern white pine.
- Time the season of harvest operations to match site conditions and minimize risk to stands.
- Limit harvest or management-related disturbance in areas that may be buffered from climate change (e.g., spring-fed stands sheltered in swales or valleys).

---

## This Publication Was Developed with Contributions From:

Maria Janowiak | Northern Institute of Applied Climate Science | USDA Forest Service

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

Kris Tiles | University of Wisconsin–Madison Division of Extension

---

## Related Resources

Climate Change Response Framework

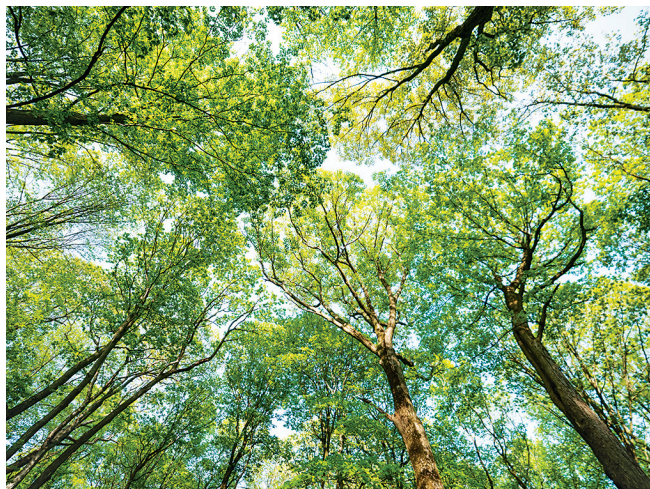
[www.forestadaptation.org](http://www.forestadaptation.org)

Increasing Forest Resiliency for an Uncertain Future

[www.masswoods.net/caring-your-land/forest-resiliency](http://www.masswoods.net/caring-your-land/forest-resiliency)

U.S. Forest Service Climate Change Atlas

[www.nrs.fs.fed.us/atlas](http://www.nrs.fs.fed.us/atlas)



This publication was adapted with permission from  
The Nature Conservancy® and Cornell Cooperative Extension

University of Wisconsin, U.S. Department of Agriculture and Wisconsin counties cooperating. An EEO/AA employer, University of Wisconsin–Madison Division of Extension provides equal opportunities in employment and programming, including Title VI, Title IX and American with Disabilities (ADA) requirements. Hearing Impaired Relay: 711

This work is supported by the Renewable Resources Extension Act Program from the USDA National Institute of Food and Agriculture.