

12 Steps for Climate Resilience:

Managing Your Forest with Climate Change in Mind



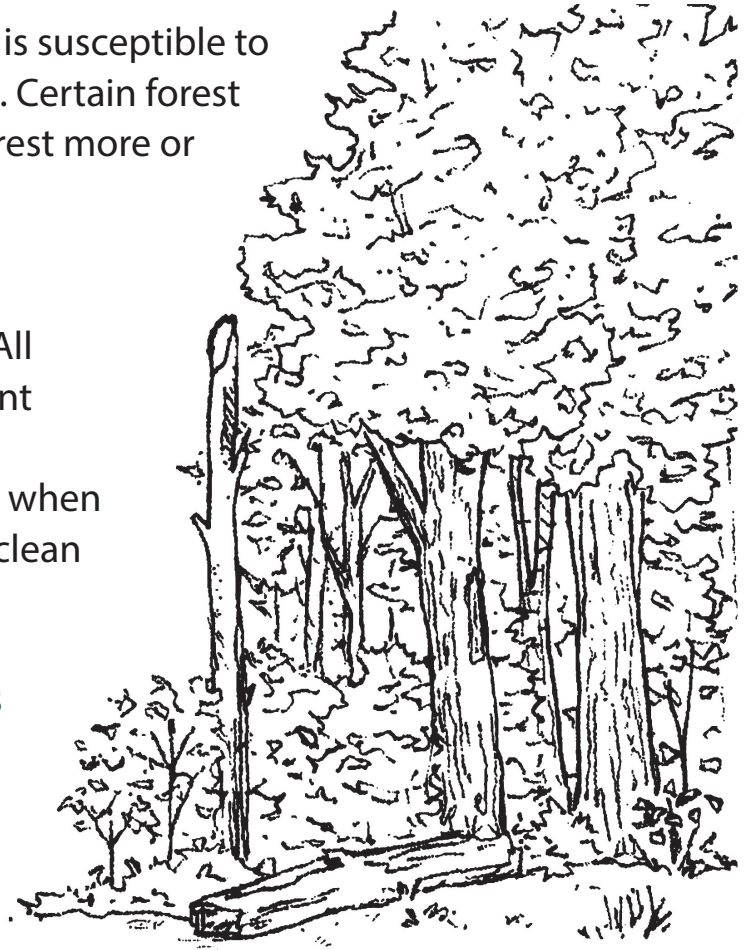
THE UNIVERSITY OF VERMONT
EXTENSION
FORESTRY

The climate is changing and bringing more uncertainty to the future conditions of forests. As a landowner, you can make decisions to reduce the vulnerabilities and advance the resilience of your woods.

Vulnerability is the degree to which a forest is susceptible to and unable to recover from climate change. Certain forest conditions and disturbances can make a forest more or less vulnerable to climate change impacts.

Resilience is the ability of a forest to recover or adapt following disturbance or change. All forests are different, but in general, a resilient forest is diverse with tree of different sizes, contains deadwood, regenerates new trees when disturbed, and water is absorbed and runs clean during storms.

All landowners should perform steps 1-3 and step 12; steps 4-11 might not apply to everyone or every parcel so feel free to choose the ones that make the most sense for you and your woods.



**FOR A LIST OF RESOURCES VISIT:
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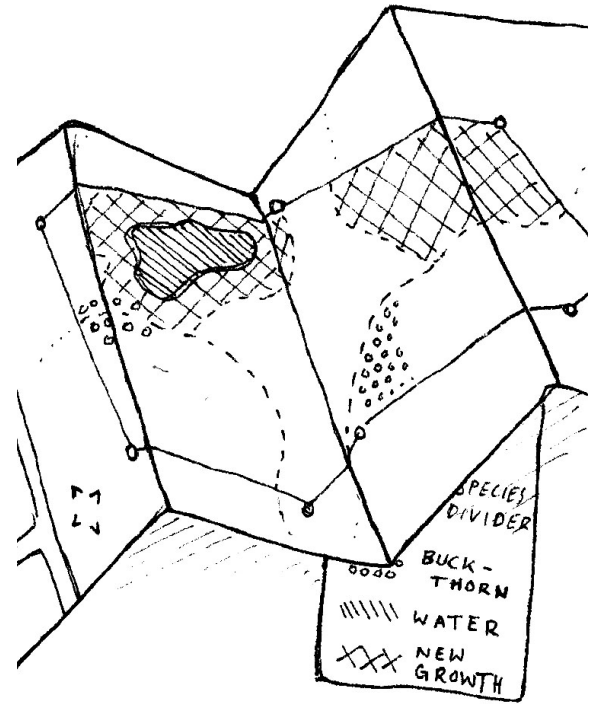
Author: Alexandra M. Kosiba (UVM Extension). Drawings: Kati Ripaldi. This project was a collaboration between Vermont Woodlands Association, UVM Extension, Vermont Tree Farm Program, and Vermont Forests, Parks and Recreation. The project was funded in part by the Open Space Institute (2022) and USDA Forest Service State and Private Forestry (2022) and Landscape Scale Restoration Program (2023). Updated 2023.

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1 Get to know your woods

Climate change will not affect all forests and locations in the same way. Each forest has unique conditions based on the species, soil, elevation, slope, landscape position, past land use, and disturbance history that may make it more or less vulnerable to changing conditions. Before making management decisions, it is important to get to know your woods.

- A great way to start is by making a map of your woods. If you have a forest management plan already, there may be a map included.
- Start with the basics like your boundary lines and compass directions so you can observe weather patterns.
- Make notes of locations of features like streams, wet areas, steep slopes, rocky areas, and roads and trails.
- Look out for old roads or trails on your property that you don't need.
- Once you have developed your map, note where different species grow, locations of old or young forests, large standing dead trees that may provide habitat for wildlife, invasive plants, or areas with signs of animal browsing that can lead to forest degradation.



2 Connect with a licensed forester

Foresters are trained professionals that have expertise in a variety of forest-related topics. In Vermont, foresters must be licensed whether they work for Vermont Forests, Parks and Recreation or as a private consulting forester. Regardless of your parcel size or whether you plan to harvest timber, a forester can help you set goals and plan for the future.

- Walk through your woods with a forester to identify ecological features and possible forest health concerns.
- Ask a forester to help you establish goals for your woods and management actions you could use to help increase resilience to climate change.
- Inquire about other experts the forester can recommend, as well as landowner programs for which you may be eligible.
- If you hire a consulting forester, the relationship should be based on mutual respect, so make sure you find someone that suits your needs.
- Not sure who to talk to? Start with your FPR county forester for free assistance regardless of the size of your parcel.



3 Identify vulnerabilities

Once you've gotten to know your land and its features, you can begin to assess the possible vulnerabilities it might have to climate change and other stressors, as well as what steps you can take to address those vulnerabilities. A forest's vulnerability to climate change is a function of its exposure, its sensitivity, and its ability to adapt. Identifying vulnerable locations or conditions on your land is a critical step in long-term planning.

Here are some things to look out for in your woods:

- *Look at the forest understory. Are there invasive plants? Evidence of intensive animal browsing? A lack of species diversity? These are conditions that can affect the future of your forest*
- *Look at the forest canopy. Do the trees look unhealthy? Are they growing close together, of similar size or species? These are conditions that can increase the forest's vulnerability extreme events and disturbances.*
- *Look at the forest floor. Is there exposed or eroded soil? Is there a lack of dead logs? Do water sources lack vegetation buffers? These are conditions that can affect soils and water quality.*
- *Explore the rest of the steps for specific strategies that you can use to improve the resilience of your forest, but keep in mind that they might not be applicable to every parcel.*

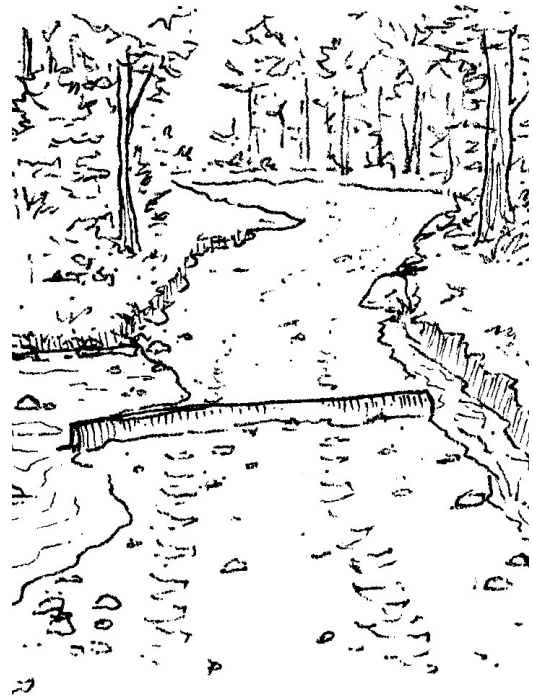


4 Slow, spread, and sink water

Vermont is getting more rain, sometimes in stronger storm events. Heavy rain can wash away leaf litter, cause soil erosion, and result in nutrient losses. These impacts negatively affect streams, lakes, and ponds as well as the forest.

Certain management actions can help lessen the impact of these heavy rains and keep water in the woods where it can be absorbed.

- *On roads and trails, use water diversion structures, such as waterbars or dips, to direct water off the traveled surface to prevent erosion and rutting.*
- *Make sure culverts or bridges can accommodate extreme flows and are clear of debris.*
- *Try to minimize the channelization of water which leads to faster flows and more runoff and erosion. Instead, divert water into depressions or flat areas where it can be absorbed more slowly.*
- *Logs, branches, and other deadwood left on the forest floor can help to slow down and retain water, especially when they are positioned perpendicular to the slope.*
- *A good way to identify problem areas is to walk your woods during or immediately after a heavy rainfall event and observe where the water travels.*
- *Controlling runoff and erosion is also important to consider around your home and driveway.*



5 Protect soils and water quality

Protecting soils and water quality are key to forest health and resilience. Plus, most of the carbon in a forest is stored in the soil. Walking or traveling on wet roads can lead to soil rutting and compaction, leading to erosion and runoff into water bodies. Soil compaction also reduces air and water movement in the soil, which is necessary for roots and other living organisms. Once soils are damaged, they can take decades or longer to recover.

- Identify and protect water sources and sensitive soils, such as areas that are wet, clayey, or mucky.
- When using equipment in the woods, whether for logging, trail building, or recreation, minimize impacts by using equipment designed to reduce damage, waiting until the ground is dry or frozen, or using bridges, logs, or tree branches on the trail to reduce soil compaction on traveled routes.
- Pay particular attention to minimizing impacts of soil near waterbodies.
- It is important to close out any old, unused roads or trails as these can channelize water and be a significant source of erosion.
- Another good strategy is to maintain plants and trees along waterways, wetlands, and vernal pools to protect and cool water, as well as on steep slopes to stabilize soils.



6 Ensure successful regeneration

Key to forest resilience is ensuring that the forest perseveres in the future. This means there are multiple generations of trees in the woods. An old forest needs young trees, and vice versa. But many of our forests lack sufficient regeneration due to land use history, deer browsing, and other factors.

- Retain a diversity of large, healthy trees as a source of seed for the next generation.
- Promote tree regeneration by creating canopy gaps and other conditions necessary for successful establishment.
- Select a gap's size based on the forest type, site characteristics, and desired species, as different tree species have specific requirements for success. For example, red oak, white ash, and white pine need larger canopy gaps.
- You may need to provide certain ground conditions to promote the establishment of some species. For example, hemlock, red spruce, and yellow birch, benefit from stumps and dead logs on the forest floor.
- For established understory trees, thoughtful stand thinning can reduce competition for light, water, and nutrients.
- If young tree survival is low, you may need to control competition from other plants, like invasives or beech suckers, or by using branches, fencing, or other deterrents as protection from animal browsing.
- Where natural regeneration is lacking, consider planting trees. If so, talk to a forester about what species would grow well and where you can purchase or acquire them.



7 Create complexity

Forests that have more species and greater structural complexity – that is, trees of many sizes, ages, and conditions, including dead standing and downed trees, with irregular gaps in the canopy here and there – are more resilient to climate change. This is because if there is a disturbance, weather event, or insect outbreak, not all trees will be affected to the same degree. Forests that are more complex are also better at capturing and storing carbon to help mitigate climate change.

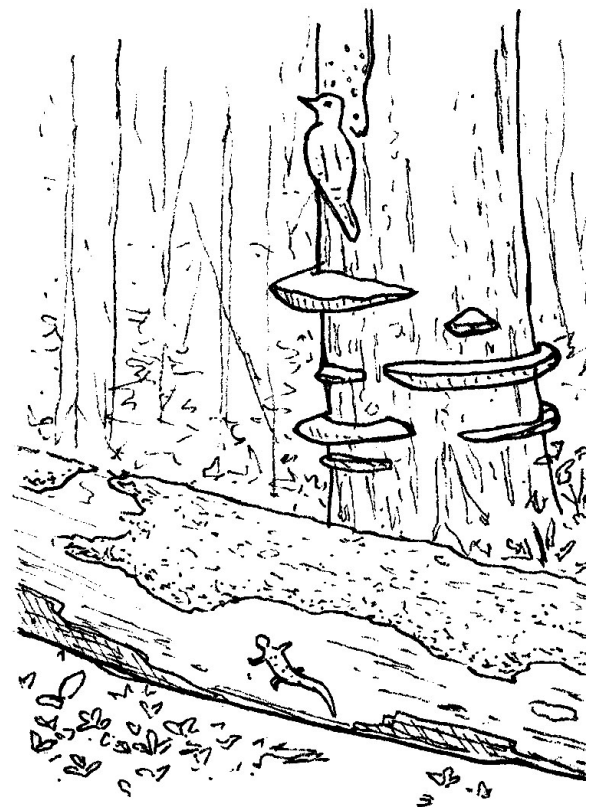
- *Talk to a forester about using management to increase the number of species present in the woods or to create more variation in the forest's structure.*
- *Retain old, large trees and dead logs, or create some during a timber harvest.*
- *When considering forest complexity, analyze the larger landscape: are there similar or different conditions in adjacent areas to your property? For example, if the surrounding area is mostly mature forest, creating a few canopy gaps can help create landscape diversity and act as stepping stones for certain wildlife species. A forester can help you think about the larger context your land plays.*



8 Increase deadwood

Standing dead trees and downed logs protect soils, retain water, and return nutrients to the soil. Plus, deadwood provides food and shelter for many organisms. In most Vermont forests, there is a lack of deadwood because of past land use.

- *Try to keep dead trees and logs where they are.*
- *To create more deadwood, trees can be felled and left in place, pushed over with equipment to create tip-ups, or girdled* and left standing where it does not pose a hazard.*
- *Think about ways to increase deadwood across a range of sizes and conditions. The best deadwood comes from trees that die of natural causes.*
- *Talk to a forester about identifying old trees that could be a future source of deadwood.*

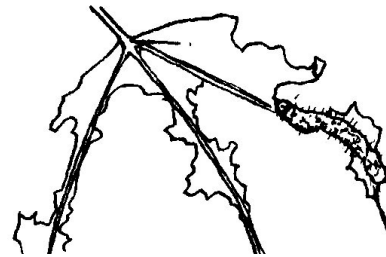


**girdling is achieved by cutting through the bark around the tree and allowing it to die slowly. This practice should not be done near trails, roads or other locations that could create a hazard.*

9 Manage other stressors

Forests face many stressors, such as competition from invasive plants and damage caused by insects, diseases, animal browsing, wind, ice storms, or fire. Climate change is expected to make these stressors more impactful. While we cannot fully eliminate these risks, we can provide the forest with opportunities for resilience.

- Control or eliminate invasives. For large populations, focus on preventing expansion or spread to new areas.
- Use dead tree branches or fences to protect young trees from animal browsing.
- Increase deer hunting to reduce browsing impacts.
- Promote a diversity of tree species and range of ages for greater forest resilience to insects and diseases.
- Talk to a forester about management for specific issues in your woods.



10 Favor future-adapted species

In general, the future climate of Vermont will be more stressful to trees adapted to cold climates, like balsam fir, black spruce, and northern white-cedar. Species that are adapted to warmer climates, like oaks, hickories, and pines, may expand where they can grow in the future. Cold-adapted species will still persist into the future, but where they grow might be limited to north-facing slopes and locations that stay cool. Luckily, we have a range of species that do or can grow here in Vermont.

- On warm, dry sites, favor species adapted to warmer conditions, like oaks, hickories, and pines.
- Retain healthy, vigorous trees already adapted to your site and its vulnerabilities.
- If planting trees, consider including species that might be better adapted to the future conditions of your woods.
- Overall, promote a diversity of healthy trees that can best withstand stressors and provide a source of pollen or seed for the next generation.
- A forester can help you evaluate your woods and which species may be best suited for the conditions now and in the future.



11 Protect the rare, unique, and important

In addition to climate change, we are also facing a biodiversity crisis due to habitat degradation and loss. Every year we are losing forestland to development and agriculture.

- You can help to protect biodiversity by keeping your forest as forest beyond your ownership through estate planning, conservation easements, or other strategies.
- Talk to a lawyer or land planning specialist about ways to legally protect your forest.
- Help to promote biodiversity by protecting rare species, natural communities, or landscape features that you have in your woods.
- You can also use forest management techniques to improve wildlife habitat.



12 Monitor and reevaluate

Climate change will continue to bring more unexpected and extreme events. While we can't prepare for everything, keeping track of changes in your woods can help you plan for the future.

- Find a way that works for you to keep track of events that occur, seasonal observations, stressors, and management tactics and outcomes. This can be as simple or detailed as you want.
- Taking photos of certain locations in your woods can be a helpful way to monitor change.
- Take advantage of resources and technical assistance available to you.
- Talk to a forester about what to do if there is a disturbance or pests that affect your forest.
- Keep your forest management plan updated, and if you don't have a management plan, consider making one. A forester can help you.
- React to unexpected changes by reevaluating and adjusting your plans as needed.
- If you are interested in incorporating these 12 steps into your forest management plan, we have a checklist you can use.
- Keep learning about your woods so that you can enjoy them long into the future.

