

FORESTS

OVERVIEW

Forests provide critical economic, environmental, and health benefits to Vermonters. Climate-driven changes, combined with land use development, are reshaping Vermont’s forests. Climate impacts on our forests include changes in composition, from forest floor to canopy; increases in stress from invasive insects, pathogens, drought, and wildfires; a longer growing season; and reduced tree harvesting operating windows. Forests are both a key indicator of how climate change is impacting Vermont and a vital tool for capturing and storing carbon, thereby helping mitigate the effects of climate change. Careful monitoring and management of Vermont’s forests can help forests adapt to the changing climate, keep forests healthy and productive, and maintain the benefits that Vermonters depend on.



MORE MAPLE, LESS SPRUCE

A changing climate will change our familiar plant and wildlife species in Vermont forests. With warming winters, more extreme weather events, and hotter summers, Vermont forests will be better suited for trees with high seedling establishment rates, shade and drought tolerance, and resistance to invasive pests and pathogens. Oaks and maples are likely to fare well under future climate conditions, but other trees like red spruce and white cedar, found in the colder, boreal climate of northern Vermont, are predicted to fare poorly (Figure 1). Vermont’s warming winters are also creating favorable conditions for the spread of invasive plants from the south. Invasive insects and pathogens are likely to increase in abundance due to warmer temperatures. Species such as beech leaf disease, butternut canker, emerald ash borer, hemlock wooly adelgid, and spotted lanternfly pose the most immediate threat because they are already established in Vermont (or have the potential to rapidly emerge), can cause significant mortality in tree species, and are expected to worsen under projected climatic changes.

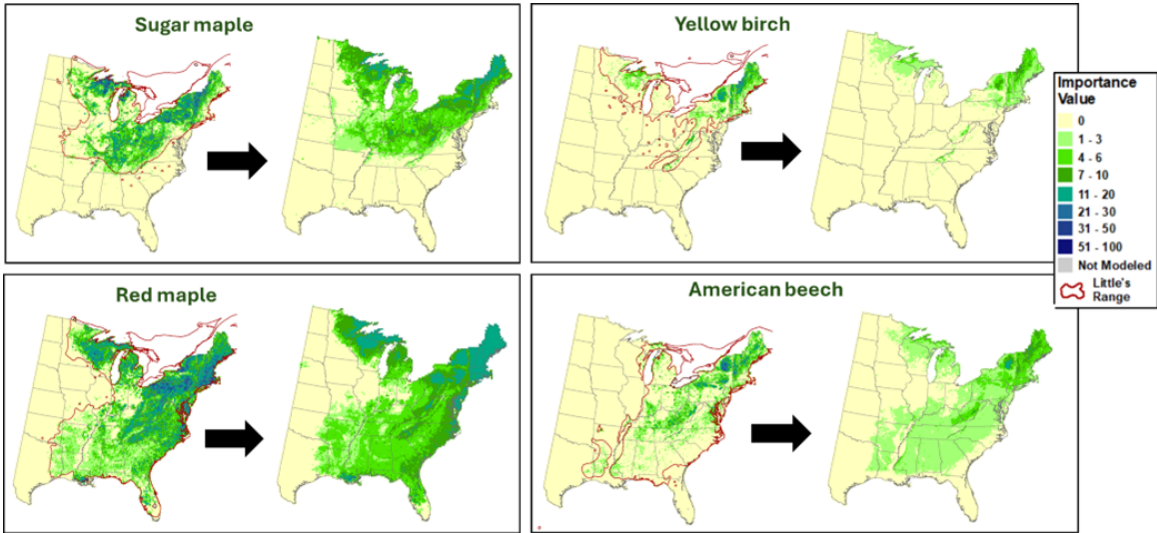


Figure 1 Projected species' suitable habitat shifts for common northern hardwood species from current estimated distributions to a future 2100 distribution for a high emissions climate scenario, using color-coded importance values to represent relative population density

Source: USDA Tree Climate Change Atlas (Iverson et al., 2012; Peters et al., 2020).

FORESTRY INDUSTRY IN A WARMING CLIMATE

Climate change is extending Vermont's growing season, which has increased by almost 24 days since 1900. A longer growing season requires more nutrients and water to sustain prolonged photosynthesis. Therefore, a longer growing season does not necessarily mean increased forest productivity if other resources are limited. Hazards, such as heat, drought, and invasive insect and pathogen outbreaks associated with longer growing seasons, can cause an overall decline in tree growth rates. Warmer winter temperatures and increased rain-on-snow events also cause issues for timber harvest and forest management (Figure 2). Forest management operations depend on firm, frozen ground and snowpack to operate heavy machinery. Climate change has shortened the window for effective forest management operations with warmer and wetter soil in the winter and spring. Finally, long-term monitoring of Vermont maple trees shows important shifts in phenology including later fall peak leaf color and leaf drop, and earlier spring budbreak and leaf emergence, which have consequences for tourism and the maple sugar industry.

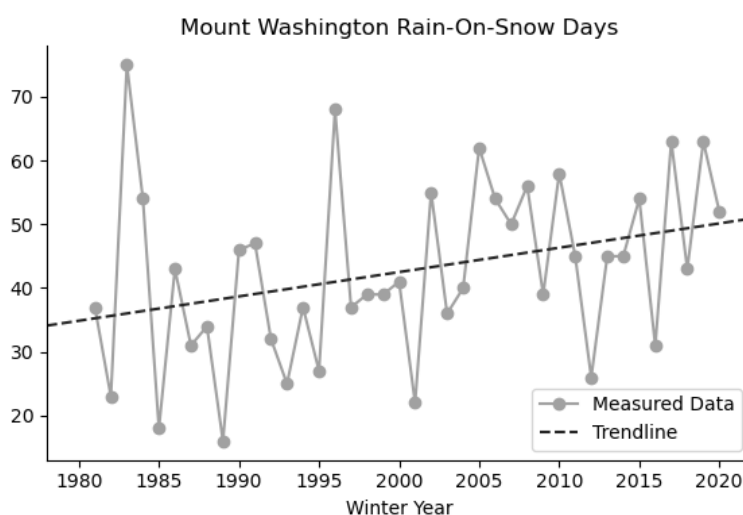


Figure 2 Rising occurrences of rain-on-snow events measured in total days, observed at the Mount Washington Observatory, NH from 1980-2020

Source: Data derived from Peachey (2023); figure adapted from Aldrich (2025)

MANAGING FORESTS FOR CLIMATE ADAPTATION AND MITIGATION

Forest managers can help forests be more resilient to climate change impacts. Climate-adaptive management practices fall under three main categories: resistance, resilience, and transition (Figure 3). Each category has its own goal for the forest under management, with different costs and benefits. Deciding the best category for a given tree stand requires local expertise and judgement and will depend on the site's location, composition, and vulnerability to climate-induced stress. Forest management can also be directed towards reducing climate impacts like planting heat-tolerant shade trees to cool urban neighborhoods, and encouraging old growth tree stands for greater carbon storage.

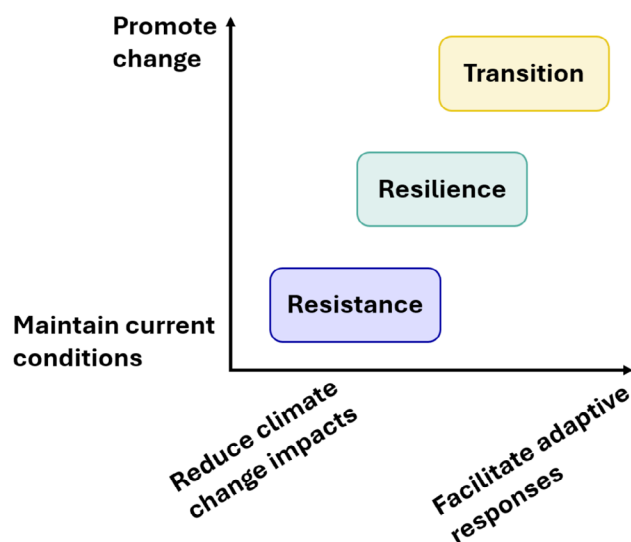


Figure 3 Resistance-Resilience-Transition model, with response to climate change (x-axis) and desired future forest state (y-axis)

Source: Adapted from Nagel et al. (2017)

See the full report at vtclimate.org

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VERMONT
CLIMATE
ASSESSMENT