VERMONT FORESTS FOR CLIMATE
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The State of Vermont has the opportunity to develop a land management planning rule that will fully justify the original name of Vermont as the Green Mountain State. This commentary addresses the importance of Vermont forests in removing atmospheric carbon dioxide and storing the carbon in the wood and soils of Vermont's forests, while providing additional climate related benefits.

Vermont forests are still rebuilding following maximum deforestation by 1870 when 75% of forests had been cleared first for sheep, then by railroads for fuel and rail ties, and then finally for lumber production that peaked in 1889.

Today, replanting and forest regeneration of abandoned farmland has forested about 75% of Vermont's area as part of the great Northeastern temperate forest. This has been sufficient to justify the establishment of the 400,000-acre Green Mountain National Forest with eight designated wilderness areas.

The contiguous area of southern Vermont and New Hampshire with western Massachusetts forms the second largest high carbon density forested area in the Northeastern United States along with the separate constitutionally protected Adirondack Park in upper New York State.

However, **as the following map demonstrates**, the above ground carbon density of most of Vermont's forest is less than forests in western Massachusetts, and large portions of Vermont are devoted to high-intensity timber harvest, resulting in lower carbon densities. Maine has the largest forested area in the Northeast, but most of it is of very low carbon density because forests have been frequently harvested for pulp.

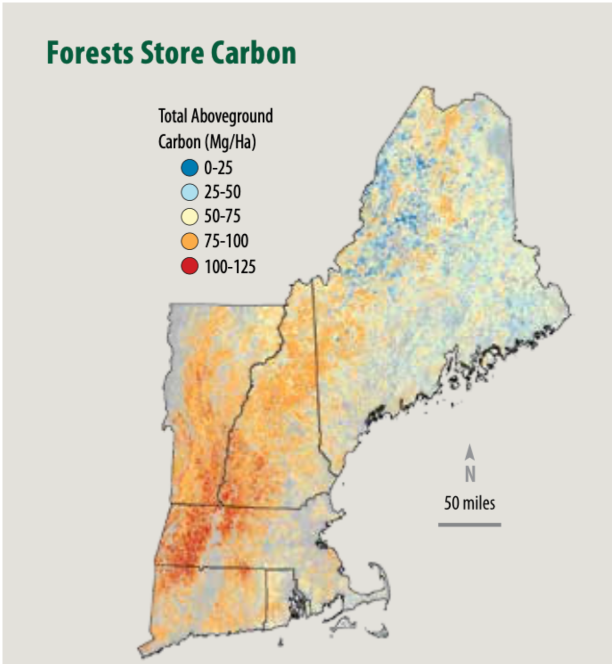


Figure 8. *New England's forests provide a vast storehouse of carbon that helps mitigate global climate change. Variation in the amounts of carbon, wood, and the size of trees across the region is largely due to the history of timber harvesting. Data are not represented for gray areas that are predominantly agricultural or densely populated.*[18]

Source: Foster et al 2017, "Wildlands and Woodlands, Farmlands and Communities." Available for download at https://www.wildlandsandwoodlands.org/sites/default/files/Wildlands%20and%20Woodlands%202017%20Report.pdf

Converting Megagrams/Hectare to imperial tons per acre

75 Mg/Ha = 33 tons per acre
100 Mg/Ha = 45 tons per acre
125 Mg/Ha = 56 tons per acre

High carbon density of 75-125 metric tonnes/hectare is 33-56 tons per acre.

The source is Report of the Climate Forestry Committee: Recommendations for Climate-Oriented Forest Management Guidelines 2024

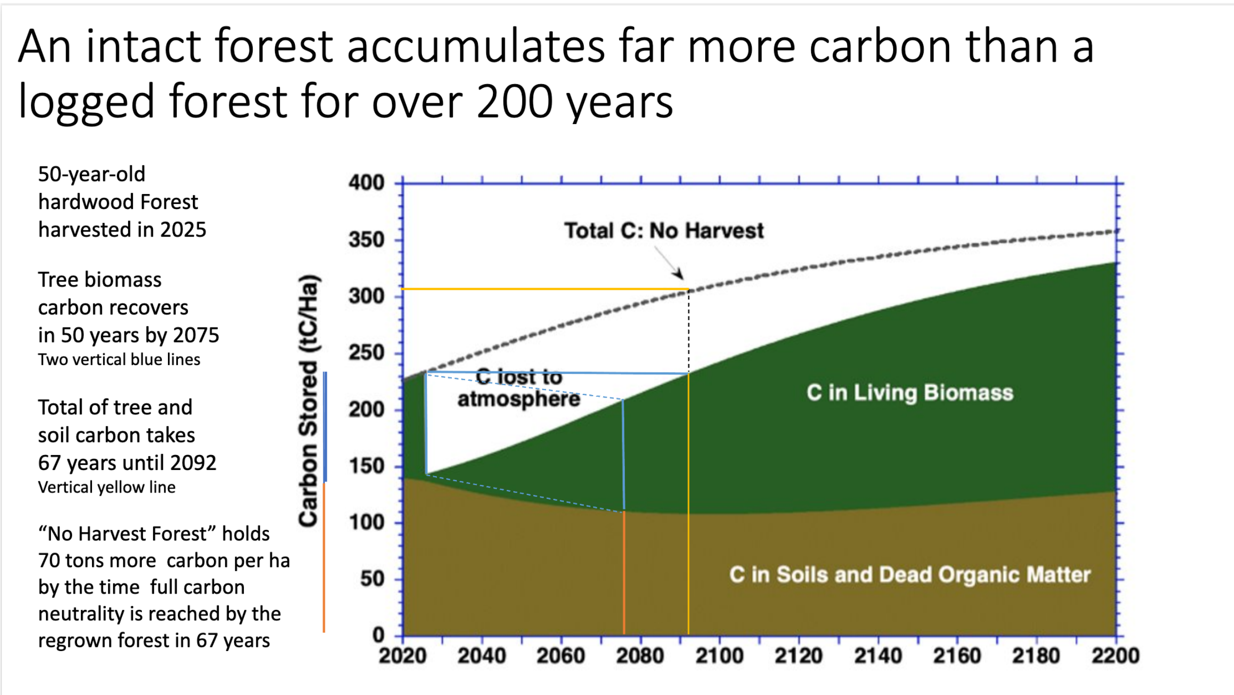
https://www.mass.gov/doc/forests-as-climate-solutions-climate-forestry-committee-report-final/download

In addition to forest carbon stocks that are measured as carbon density, there is the rate of carbon accumulation that depends upon tree species mix, forest age, soil, nutrients, water availability and climate.

Decisions that older forests need to be replaced with younger ones to increase removal rates, would lead to very large increases in atmospheric carbon dioxide. It is large older trees and forests that hold the most carbon in above ground wood, below ground wood roots, fungal networks and organic and inorganic soil carbon, and the replacement time of the regrowing forest, never is as great as if the forest had been allowed to continue growing.

The following research paper illustrates the dynamics of the forest following harvest. In this case, the forest was harvested for bioenergy so that all wood carbon was emitted to the atmosphere soon after time of harvest. Had it been harvested for wood products, about one-quarter of the harvested carbon would be in that product from 10-50 years before being released to the atmosphere.

- *Does wood bioenergy help or harm the climate?* 2022, John Sterman, William Moomaw, Juliette N. Rooney-Varna, Lori Siegel, https://doi.org/10.1080/00963402.2022.2062933



First, it is clear that when wood carbon is replaced by a newly grown replacement forest, this does not achieve "Net Zero Carbon", because more growth is required to remove the additional carbon lost from soils during the harvest.

Second, the replacement forest that grows never accumulates as much carbon by the year 2200 as would the uncut forest.

Here is a summary of forest carbon storage and potential future storage in a 2023 paper on Eastern forests.

Middle-aged forests in the Eastern U.S. have significant climate mitigation potential, 2023, Richard Birdsey, Andrea Costanho, Richard Houghton, Kathleen Savage,
https://www.sciencedirect.com/science/article/pii/S0378112723006072

- From the abstract: "We found that middle-aged Eastern U.S. forests could continue to accumulate carbon for many decades or several centuries in the absence of harvesting, with relatively low risk of natural disturbances. Compared with a recent study that estimated a potential increase in biomass of only 22%, and some analyses that anticipate significant increases in risks from natural disturbances, our results indicate a potential increase of about 100% over current biomass stocks by 2100. Temperate Continental forests have greater potential to increase carbon stock over longer time periods than Subtropical Humid forests. Results from scenario analyses showed that in the near term of 20–40 years, reducing harvest will yield the greatest reduction in net greenhouse gas emissions compared with business as usual."
- Most Eastern U.S. forests could continue to accumulate carbon for many decades or several centuries in the absence of harvesting, with relatively low risk of natural disturbances.
- In the near term of 20–40 years, reducing harvest will yield the greatest reduction in greenhouse gases compared with business as usual.
- How middle-aged forests in the Eastern U.S. are managed can clearly affect their contribution to achieving net-zero GHG emissions by 2050 and beyond.
- Our estimated emission reduction from stopping harvest over the 73 million ha studied amounts to 117 Mg CO_2 per year in 2050, equivalent to about 7% of the emissions from using fossil energy in the two ecozones. Increasing harvest would have the opposite effect of increasing emissions by a similar magnitude.
- In the longer term of 80 or so years, scenarios converge towards business-as-usual effects on greenhouse gases, but with differences between and within biomes.
- The contrast between short- and long-term impacts of different harvest levels is an important consideration for designing land management policies."

It is clear that forests in Vermont and the Northeast have the potential to double their presently accumulated carbon and add additional carbon to soils between now and 2100 if allowed to continue growing.

According to the United Nations Food and Agricultural Organization, the global forest area was 6 billion hectares covering about 57% of habitable land at the start of the neolithic or agricultural revolution. About one-third of the world's forests have now been lost and that loss accounts for about one-third of the increase in atmospheric carbon dioxide. Fossil fuels and industrial emissions account for the remaining two-thirds.

Had global forests not been removing about 30% of annual emissions current atmospheric concentrations would have been achieved around 1960, and current levels that exceeded preindustrial concentrations by 50% in 2021 would be nearly double preindustrial levels in 2026.

Vermont forests are at a stage where they are capable of doubling their stocks by 2100. If Vermont were to cut older trees and replace them with younger trees, there would be a large increase in carbon dioxide emissions to the atmosphere.

Protected Forests optimize present carbon stocks and future carbon accumulation for addressing climate change, regional cooling by evapotranspiration, flood reduction, and maintaining the rich plant, animal and micro-biodiversity that maintains the resilience of these forests.

In its Environmental Impacts Analysis, the Vermont Agency of Natural Resources should compare and contrast anticipated emissions from its proposed rule (which is modeled on ANR's status quo forest management) to various alternatives, including an alternative that would eliminate or dramatically reduce timber harvest on state lands. Such an assessment should compare the impacts of anticipated future management scenarios on the carbon emissions reduction requirements of the Global Warming Solutions Act. Only by completing such an assessment of alternatives can ANR accurately weigh future considerations related to the state's climate change and carbon mandates, and make informed decisions about how to manage Vermont state lands. Such an alternatives analysis is both reasonable and essential for ANR to conduct and to make available to the public.