

Forest carbon removal

Forests are important natural resources and nature's own carbon removal machines – trees can remove and store vast amounts of CO₂ for decades to hundreds of years. We can increase the carbon removal potential of forests via afforestation, reforestation, restoration, and forest management practices that focus on maximizing tree growth.¹

Forests grow in rural and urban settings on public and private lands, bringing a suite of ecological benefits that include improved air and water quality as well as carbon storage. Roughly one-third of the US is forested, capturing nearly 12% of the country's carbon emissions.^{2,3} Trees also provide economic co-benefits and local job opportunities, making them a win-win for communities and for climate.

Land use and ownership considerations

Some forestry practices (afforestation, for example) require a lot of land and may compete with other community or economic priorities, like using land to grow food.⁴ Public forests in the US are managed for multiple uses including timber, water, recreation, wildlife habitat, and more. However, nearly two-thirds of American forests are privately owned and classified as private corporate, private non-corporate, or family owned. Family forest owners (FFOs) control 36% of the nation's forestland and have enormous potential to support carbon removal – but when FFOs are not intimately involved in managing their land, they are more likely to sell it, leading to land conversion and forest loss.⁵

KEY TERMS

Afforestation

Planting trees where there was never a forest.

Reforestation

Planting trees where there was once a forest.

Private corporate

Entities that are legally incorporated such as forestry companies and timber investment management organizations.

Private non-corporate

Entities that are owned and operated by individuals, families, trusts, estates, Native American Tribes, and/or conservation organizations and not legally incorporated.

Family owned

Property of individuals, families, trusts, estates, and family partnerships.

Forest carbon stock

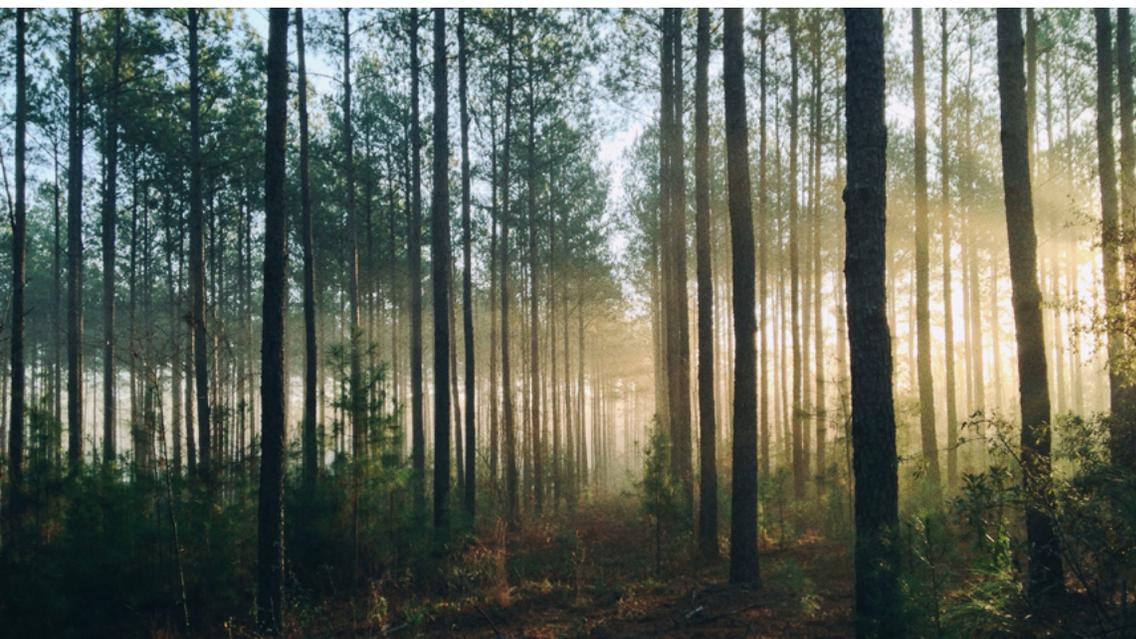
The amount of carbon that has been sequestered from the atmosphere and is now stored within the forest ecosystem.

Albedo

The measure of reflectivity of a surface – for Earth, this measures how much of the sun's energy is reflected back into the atmosphere.

Urban heat island

A city or metropolitan area that is significantly warmer than its surrounding rural areas due to human activities.



Ecosystem impacts

Forests provide many ecosystem services. They help control soil erosion, support biodiversity, and mitigate floods and droughts.⁶ Forests also help filter water and may improve access to safe and clean drinking water for local communities.⁷ In many cases, managing forests for ecological and climate outcomes can increase biodiversity and make forests more resilient.⁸

The site, scale, and tree species mix of any forestry project must be carefully assessed to protect the important ecosystem services that forests provide and their carbon stocks. Planting monocultures (or the same tree species) can threaten biodiversity, reduce soil productivity, disrupt water cycles, and leave forests more vulnerable to threats like disease and storms, which damage or kill trees and subsequently release stored carbon back into the atmosphere.⁹ Forestation efforts are best focused on geographies that were previously forested to restore ecological systems and because historically unforested land areas that are replaced with forest absorb more heat and exacerbate climate change via albedo feedback.¹⁰

Health impacts

Forests can improve human health conditions. Trees can reduce air pollution by absorbing CO₂ and other pollutants.¹¹ Trees also provide shade, reduce the urban heat island effect, decrease heat-related illnesses, and reduce utility costs.¹² There is also a growing recognition that forests and green spaces promote both physical and mental health by reducing stress and providing a stronger sense of community and connection to nature.^{13,14} Despite enormous ecological, economic, and health benefits, forests are not equitably distributed across America. Low-income neighborhoods and communities of color have significantly less tree coverage and experience higher levels of pollution than wealthier and white neighborhoods.^{15,16}

Job creation and economic impacts

Forests can bring economic opportunities to both urban and rural settings. Every \$1 million invested in ecological restoration creates 10–40 jobs, matching or exceeding jobs created by the same investment in oil and gas.¹⁷ Over the next 10 years, over 100,000 new jobs are projected to be created in urban forestry for planting trees, forest maintenance, and landscaping.¹⁸ As reforestation efforts expand, demand for seeds, sapling production, tree planting and maintenance, and broader technical assistance will all increase. However, planting and managing trees is not the only way forestry can mitigate climate change. Carbon can also be stored in harvested wood products for a long time. Opportunities for engineered wood products like cross-laminated timber are expanding. These products can both store carbon and substitute carbon-intensive construction materials like steel and concrete.¹⁹

Costs

The cost of carbon removal in forests can vary regionally and should be considered on a project- and ecosystem-specific basis.²⁰ Some natural restoration and reforestation may occur on its own, requiring no direct cost.²¹ However, some studies estimate costs ranging from \$5 to \$50 per ton of CO₂ sequestered.^{22,23,24} Opportunity cost is also critical to consider, such as if a landowner has to forego an immediate economic opportunity (like harvesting timber) in order to maintain or increase the current carbon stocks within a forest.²⁵ This opportunity cost becomes increasingly expensive as competing priorities and alternative uses for land arise.²⁶



Deployment

Most forest management approaches are well known and ready to be deployed today.²⁷ Sustainable reforestation efforts must take into account 1) competition for land between food and fiber production, 2) optimal geographies (that is, areas that are suitable for certain tree species, have little to no albedo concerns, and do not result in significant land use changes), 3) the need for robust monitoring of carbon outcomes, and 4) economic, social, and environmental benefits for foresters and local communities.^{28,29}

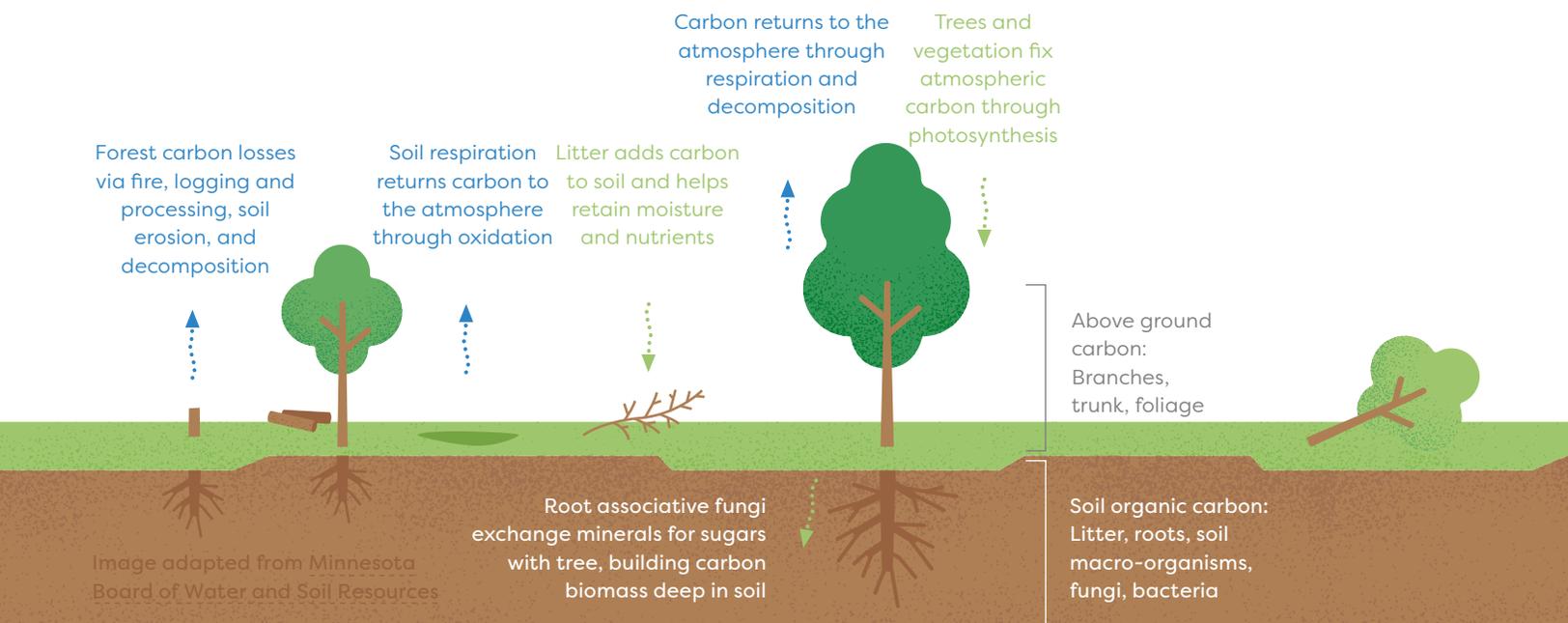
There are many forestry projects and initiatives across the United States focused on carbon removal and storage. Many reforestation projects are launched in response to disturbances such as wildfires or disease outbreaks and may include carbon removal as a goal.³⁰ Robust monitoring, reporting, and verification (MRV) will be critical to accurately measure how much carbon is stored in forests across geographies, species, and management approaches. Monitoring is incredibly important given the growing interest in monetizing forest carbon.

Government engagement

The Department of Agriculture (USDA)'s Forest Service is a global leader in developing tools to measure and manage forest carbon. It produces regional carbon assessment reports to help foresters and communities understand how carbon is stored in forests and harvested wood products, as well as the potential co-benefits of forestry practices.³¹ Through the Farm Bill, USDA also administers conservation programs (such as the Forest Legacy Program and Environmental Quality Incentives Program) and provides technical assistance to support the implementation of different forestry practices.

While federal funding for forestry has increased in recent years, most of these funds are directed to wildfire suppression, leaving other critical research and implementation programs severely underfunded.³² In 2022, however, Congress increased forestry funding across the board, bolstering programs like Forest Inventory and Analysis, Urban and Community Forestry, and Forest Health Management. Congress has also supported forestry as a tool to address climate change through bills like the ambitious Repairing Existing Public Land by Adding Necessary Trees (REPLANT) Act.

Continued government support and partnerships are necessary to increase forest carbon practices across the US. Government engagement at the local, regional, national, and international level will be crucial for ensuring inclusive, equitable, and transparent scale-up.



Endnotes

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- 2 [Forest Inventory and Analysis: Fiscal Year 2016 Business Report](#), United States Department of Agriculture
- 3 [US Forest Carbon Data: In Brief](#), Congressional Research Service
- 4 [Building a New Carbon Economy: An Innovation Plan](#), Carbon180
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- 8 [Carbon sequestration and biodiversity co-benefits of preserving forests in the western United States](#), Polly C. Buotte et al.
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- 31 [Carbon](#), United States Forest Service
- 32 [Soil carbon sequestration](#), CDR Primer, Jennifer Wilcox et al.

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