

Leveraging State Trust Lands: Acceleration of Improved Forest Management to increase carbon storage in the U.S.

Definitions and FAQs

Definitions

Additionality

Greenhouse gas removals or reductions that are additional to what would otherwise occur in 'baseline', business-as-usual (BAU), or a 'non-project' scenario. For example, this would refer to the past or common management practices for that forest.¹ Additionality is what can become a marketable forest carbon credit.

Carbon Accumulation²

The rate of change by which carbon is put into a reservoir or pool of carbon.

Carbon Sequestration

The process of drawing carbon out of the atmosphere and placing it into a reservoir, or pool, that is protected from being re-emitted to the atmosphere.

Forest Carbon

The International Panel on Climate Change (IPCC)³ separates carbon stored in forest ecosystems into 5 pools, with an additional two pools to account for forest-derived products. The five ecosystem pools are:

- **Aboveground biomass (Pool 1):** All living biomass above the soil such as stem, stump, branches, bark, seeds, and foliage. This includes the live understory.
- **Belowground biomass (Pool 2):** All living biomass below the soil surface, such as coarse living roots >2 mm in diameter.
- **Dead wood (Pool 3):** All non-living woody biomass such as standing and lying dead wood, does not include litter or deadwood found in the soil.
- **Litter (Pool 4):** This category contains all litter, fomic, and humic layers, as well as non-living biomass with a diameter less than 7.5 cm at transect intersection laying on the ground.
- **Soil Organic C (Pool 5):** All organic material down to 1 m below the surface, excluding the belowground pool.

¹ Forest Carbon Short Course, Michigan State University Forest Carbon and Climate Program (FCCP) - many of the above definitions were adopted from FCCP resources. Additional resources can be accessed here: <https://www.canr.msu.edu/fccp/>.

² Moura-Costa, Pedro. "CARBON SEQUESTRATION" *Dipterocarp forest ecosystems: towards sustainable management* (1996): 308.

³ IPCC, 2019. *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*. In press.

The additional pools that account for non-ecosystem forest carbon are:

- **Harvested wood products in use:** This accounts for all currently utilized wood products, such as furniture, lumber, paper, mass timber beams, etc. Wood harvested for energy purposes such as pellets, wood chips and firewood, also fall into this pool.
- **Harvested wood products in waste disposal sites:** This pool accounts for wood products currently in solid waste disposal sites such as landfills, where their residency time will vary until they decay.

Improved Forest Management⁴

Improved Forest Management acknowledges the importance of active forest management and includes practices such as multi-age management, mixed wood management, increased stocking, extended rotation, and thinning. These practices increase the amount of biomass in a forest by enabling longer growth, greater diversity, and/or greater resilience—with the added benefit of helping increase the amount of carbon stored in harvested forest products. In particular, older trees and the inclusion of multiple age cohorts within a single stand can store more carbon per acre. Moreover, by introducing greater age and species diversity, forests develop greater resilience and reduced susceptibility to disturbances. This resiliency enables better carbon management over the long term due to improved overall health—as well as by enabling greater tree density due to differential tree size.

Natural Climate Solutions (NCS)⁵

Natural Climate Solutions (NCS) are conservation, restoration, and improved land management practices that increase carbon storage or avoid greenhouse gas emissions in landscapes and wetlands across the globe. NCS have the potential to sequester ~30% of atmospheric carbon dioxide, the amount needed above and beyond fully implementing clean energy measures and decarbonizing the global economy in order to keep warming to <2 degrees Celsius.

Working lands/working forests

Working lands are lands used for farming, grazing, or the production of forests and related products and services.

*Working forests*⁶ are defined as forests that are actively managed to generate revenue from multiple sources, including sustainably produced timber and other ecosystem services, and thus are not converted to other land uses such as residential development.

⁴ Ahlring, M.; Blann, K.; Cornett, M.; Graber, S.; Lenhart, C.; and White, M. 2021. *Nature and Climate Solutions for Minnesota*. The Nature Conservancy. https://www.nature.org/content/dam/tnc/nature/en/documents/NCSinMinnesotaReport_01.11.2021.pdf?rc=s_two.ch_mn.x.x&sf136284002=1.

⁵ Griscom, W.; et al. 2017. Natural Climate Solutions. *Proceedings of the National Academy of Sciences of the United States of America*. 114 (44) 11645-11650. <https://doi.org/10.1073/pnas.1710465114>.

⁶ Talberth, J. and Yonavjak, L. 2011. *Forests at Work: A New Model for Local Land Protection*. World Resources Institute. <https://www.wri.org/publication/forests-work#:~:text=%E2%80%9CWWorking%20forests%E2%80%9D%20are%20defined%20as.working%20forest%20in%20two%20ways>.

Frequently Asked Questions

What carbon pools are being modeled in this project?

This project is specifically focused on IPCC Carbon Pools 1 and 2. Data between State and Federal forest inventories is consistent to make comparisons of methods when using these two field data types. The project focuses on live above and belowground biomass carbon pools because these are the most dynamic across a landscape as well as the most susceptible to management and policy decisions and implications. Both factors require more frequent monitoring (Fahey et al., 2010). Pools 3 and 4 may also be impacted by management and disturbance, but in the absence of major disturbance events such as wildfire or anthropogenic disturbances like land clearing for agriculture, these pools are less dynamic than Pools 1 and 2. Pool 5, while being the largest single pool of forest ecosystem carbon and often making up >50% of the ecosystem forest carbon, is also the least susceptible to changes in forest management (Gaudinski et al., 2000⁷) and typically more stable long term.

Why isn't the project also modeling the pools for non-ecosystem forest carbon?

Although we recognize the importance of these additional pools as part of the life cycle (Harvested wood products in use & Harvested wood products in waste disposal sites), we are focused on the carbon pools that are most responsive to the effects of active forest management. This project is funded by the [Natural Climate Solutions Accelerator](#) grant program, which emphasizes land management practices that lead to greater carbon storage in living biomass and soils.

What is the difference between carbon accumulation and carbon sequestration?

The terms carbon sequestration and accumulation are often used interchangeably. While the two concepts are linked, sequestration and accumulation are slightly different concepts in terms of how they relate to forest carbon. The distinction is important, as accumulated carbon is not necessarily sequestered.

Sequestering carbon refers to the removal of carbon from the atmosphere and adding it into a pool, while accumulation measures the quantity, as well as rate of change within that pool. Carbon within a pool, however, is not fully sequestered until the accumulated carbon within that pool is secured from being emitted back into the atmosphere.

How does implementation of carbon projects impact forest sector jobs?

A variety of studies and on-going initiatives are intended to address consideration of the economic impacts of a transition to a green economy, including the following examples of resulting reports.

⁷ Gaudinski, Julia B., Susan E. Trumbore, Eric A. Davidson, and Shuhui Zheng. "Soil carbon cycling in a temperate forest: radiocarbon-based estimates of residence times, sequestration rates and partitioning of fluxes." *Biogeochemistry* 51, no. 1 (2000): 33-69.

*Green Jobs in the Forest Sector*⁸ (Chapter 6, Section 6.2, pp. 45-47) addresses forest sector jobs related to climate change: https://unece.org/fileadmin/DAM/timber/publications/DP71_WEB.pdf

*Creating forestry jobs to boost the economy and build a green future*⁹:
<http://www.fao.org/3/i1025e/i1025e02.htm>

How do you define carbon storage achieved through wood products?

A variety of studies and policies have recognized the potential for carbon storage in the built environment and through the use of wood products, including potential substitution benefits derived from reducing the reliance on higher-emitting and fossil-based materials. Examples of the approaches to recognizing carbon storage in wood products are described in the following reports and resources.

Dovetail report, *Recognition Of Carbon Storage In Harvested Wood Products*¹⁰:
<https://dovetailinc.org/portfoliodetail.php?id=5e454dacebc0f>

Dovetail report, *Recognition Of Carbon Storage In Harvested Wood Products: A Post-Copenhagen Update*¹¹: <https://dovetailinc.org/portfoliodetail.php?id=5e480b6d7f2de>

The 2006 IPCC guidelines¹² provide guidance on how to estimate and report the contribution of harvested wood products (HWP) to annual CO₂ emissions/ removals.

⁸ UN-FAO-UNECE. 2018. *Green Jobs in the Forest Sector*.
https://unece.org/fileadmin/DAM/timber/publications/DP71_WEB.pdf.

⁹ Nair, C.T.S. and Rutt, Rebecca. 2009. *Creating forestry jobs to boost the economy and build a green future*.
<http://www.fao.org/3/i1025e/i1025e02.htm>.

¹⁰ Dovetail Report. 2010. *Recognition of Carbon Storage in Harvested Wood Products*.
<https://dovetailinc.org/portfoliodetail.php?id=5e454dacebc0f>.

¹¹ Dovetail Report. 2010. *Recognition Of Carbon Storage In Harvested Wood Products: A Post-Copenhagen Update*. <https://dovetailinc.org/portfoliodetail.php?id=5e480b6d7f2de>.

¹² IPCC, 2006. Chapter 12, Harvested Wood Products.
https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_12_Ch12_HWP.pdf.

Additional References

Fahey, T. J., Woodbury, P. B., Battles, J. J., Goodale, C. L., Hamburg, S. P., Ollinger, S. V., & Woodall, C. W. (2010). Forest carbon storage: ecology, management, and policy. *Frontiers in Ecology and the Environment*, 8(5), 245-252.

Carbon Neutral, <https://www.carbonneutral.com/the-carbonneutral-protocol/glossary-of-terms>, accessed Jan 22, 2021.