
(Photo Credit: Wisconsin DNR)


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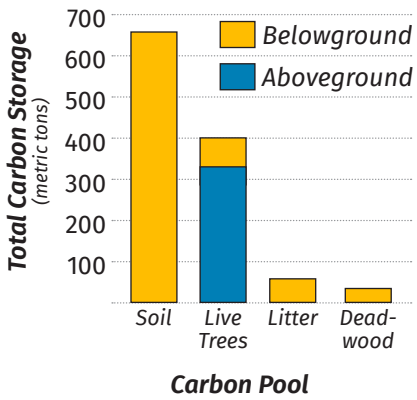
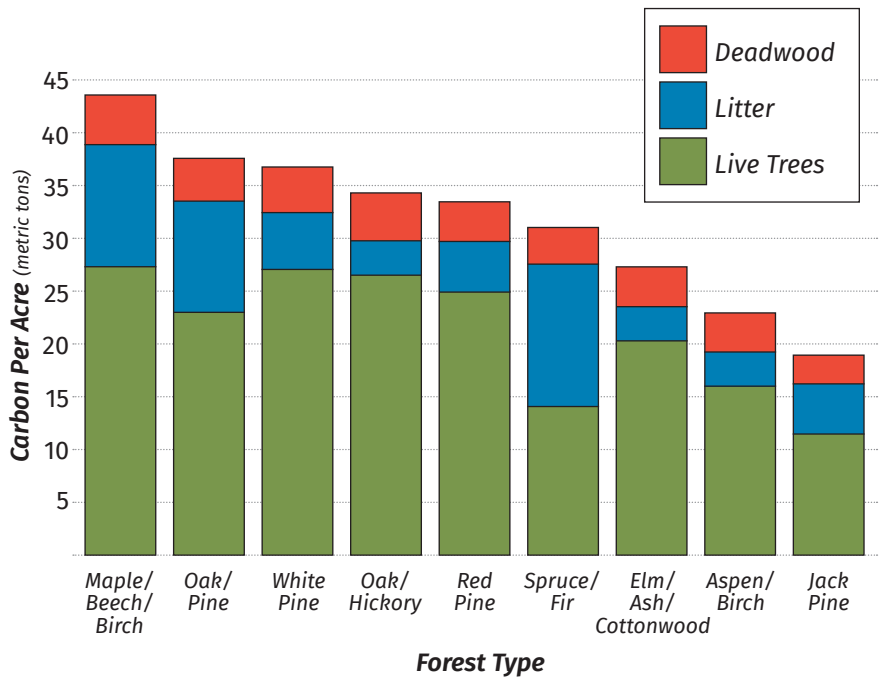
# CARBON IN WISCONSIN FORESTS

***As climate change continues to impact our environment, forests can act as sinks that take in carbon and reduce the amount of greenhouse gas in the atmosphere, helping to curb climate change. The Wisconsin Department of Natural Resources (DNR) prepared this document to introduce key terms related to forest carbon, as well as to provide a current and historical snapshot of carbon in Wisconsin's various forest types.***

## CARBON STORAGE

Wisconsin's forests hold about 1.162 billion metric tons of carbon. This equates to the annual carbon emissions from 491 million homes' energy use. More than half of forest carbon is stored in the soil, with the aboveground and belowground portions of live trees being the next largest pools. The live tree pools are where forest managers can most greatly influence carbon sequestration and storage through sound forest management techniques.




***Carbon Storage Per Acre By Forest Type in Live Tree Carbon Pools:*** *Carbon per acre is a way to normalize and compare the carbon stored by forest type. Maple/beech/birch stores the most carbon of any forest type on average when excluding soil carbon. Soil carbon (not included in this figure) remains relatively stable over time when undisturbed. This figure is representative of average stand conditions in each cover type in Wisconsin (i.e., stocking, age, etc.).*

*"An important factor in maintaining and increasing carbon stocks is maintaining current forests as forests, and maintaining a balanced distribution of forest types, ages and size classes. Older forest systems with large trees generally store more carbon than younger forests and should be well-represented on the landscape."*

*(Wisconsin 2020 Statewide Forest Action Plan)*

*(Photo Credit: Wisconsin DNR)*

## KEY DEFINITIONS

***Carbon Pool*** **-** A reservoir of carbon which has the capacity to both emit and remove carbon from the atmosphere. Forests contain five carbon pools: soils, aboveground portion of live trees, belowground portion of live trees, litter and deadwood (standing and lying on the ground).

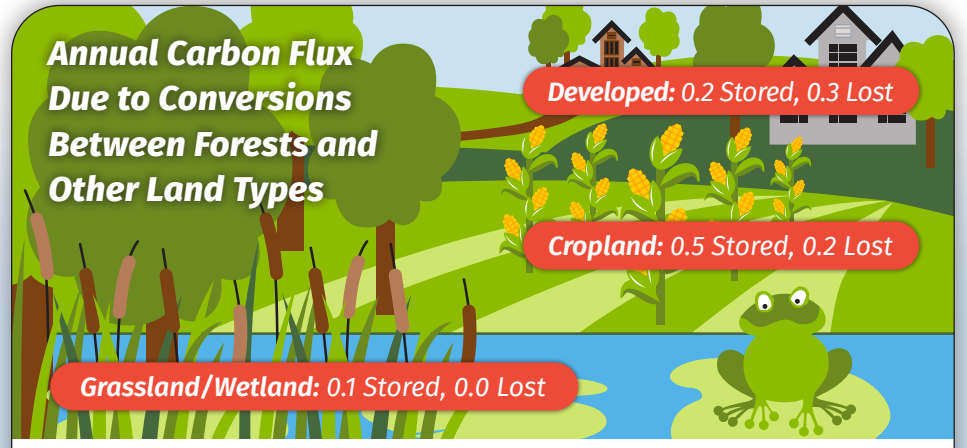
***Carbon Storage*** **-** The amount of carbon that is retained in a carbon pool within the forest. This is often also referred to as carbon stocks.

***Carbon Flux*** **-** The transfer of carbon from one overall pool (i.e., forest, atmosphere, etc.) to another. Typically expressed as a gain to or loss from forests.

***Carbon Sequestration*** **-** The process of removing carbon from the atmosphere for use in photosynthesis, resulting in the maintenance and growth of plants and trees.

# CARBON FLUX

Carbon flux is greatest in land converted to forests from cropland, and conversion to forestland from other land types is an important potential avenue to increase carbon storage in forests.

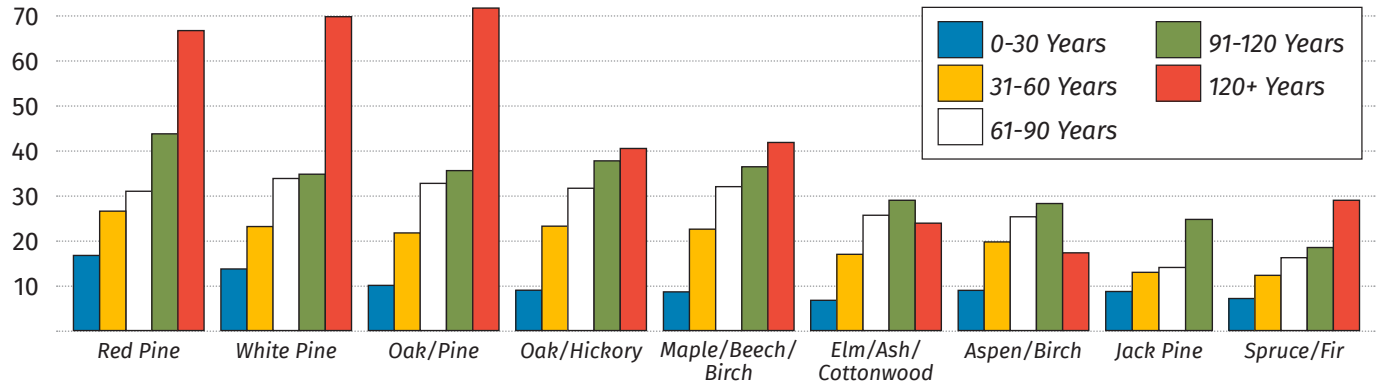



***Annual Carbon Flux (million metric tons):*** *Carbon is lost to the atmosphere if forests are converted to other land types. Carbon is stored if land is converted to forest.*

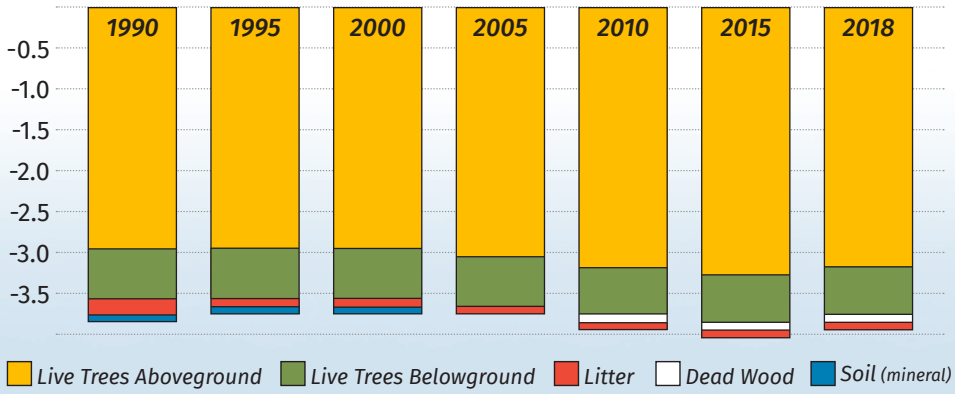
*"Forest land, harvested wood products and urban trees ... collectively represent the largest net carbon sink in the United States."* (U. S. Forest Service)

# CARBON SEQUESTRATION

Trees convert atmospheric carbon dioxide into carbon, which makes up about one-half of the dry weight of trees. Though a standard biological process, carbon sequestration rates vary across species and age; young trees tend to have high rates of sequestration, but old and large trees store more carbon overall. Due to the life cycles of some species, they may not ever reach periods of high storage capacity (e.g., jack pine).




***Carbon Per Acre (in metric tons) in Aboveground and Belowground Biomass by Forest Type and 30-year Age Classes:*** *Displaying carbon per acre by age class (mean age of trees in a stand of trees) shows the different rates at which various forest types sequester carbon. The steeper the increase in carbon as a forest ages, the more quickly carbon is sequestered and stored. This also shows how old a forest type can be before its rate decreases or reverses.*

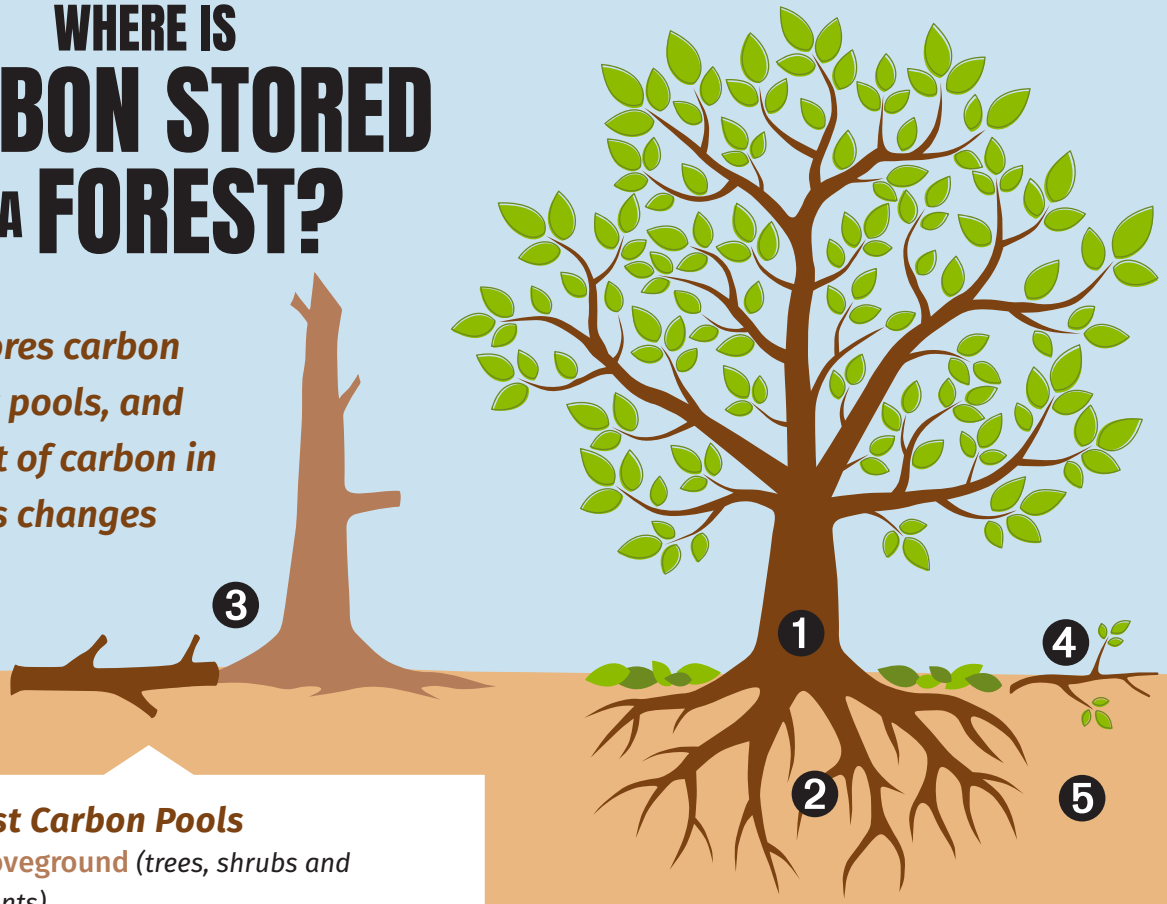



***Annual Carbon Sequestration by Carbon Pool Over Time (in million metric tons):*** *The carbon sequestration rate has increased slightly in the live tree pool, while remaining relatively stable in all other pools since 1990. An average of 3.7 million net metric tons is sequestered by forests in Wisconsin annually, meaning that total tree carbon in forestland has increased steadily, even factoring in the amounts removed due to harvests and mortality.*


***Total Carbon in Live Trees Over Time (in million metric tons):*** *Total carbon in live trees has increased steadily in Wisconsin since 1990 by about 1.2% per year.*

# WHERE IS CARBON STORED IN A FOREST?

***A forest stores carbon in different pools, and the amount of carbon in these pools changes over time.***




### *Five Forest Carbon Pools*

1. **Live Aboveground** *(trees, shrubs and other plants)*
2. **Live Belowground** *(roots)*
3. **Deadwood** *(standing dead trees [snags] and downed logs)*
4. **Litter** *(leaves, needles and small branches)*
5. **Soil Organic Matter** *(organic material in the soil such as dead and decayed biomass [e.g., plant material and insects])*

### *Factors that influence the amount and proportion of carbon in each of these pools:*

- the age of the forest
- the species of trees making up the forest
- natural and human disturbances
- soil characteristics *(e.g., texture and drainage)*
- past agricultural land-use history

***Graphic adapted from the UMASS Forest Carbon document: masswoods.org/sites/masswoods.org/files/Forest-Carbon-web_2.pdf (page 3).***

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