Carbon 101

Carbon and Forest Management Work Group

July 10, 2024

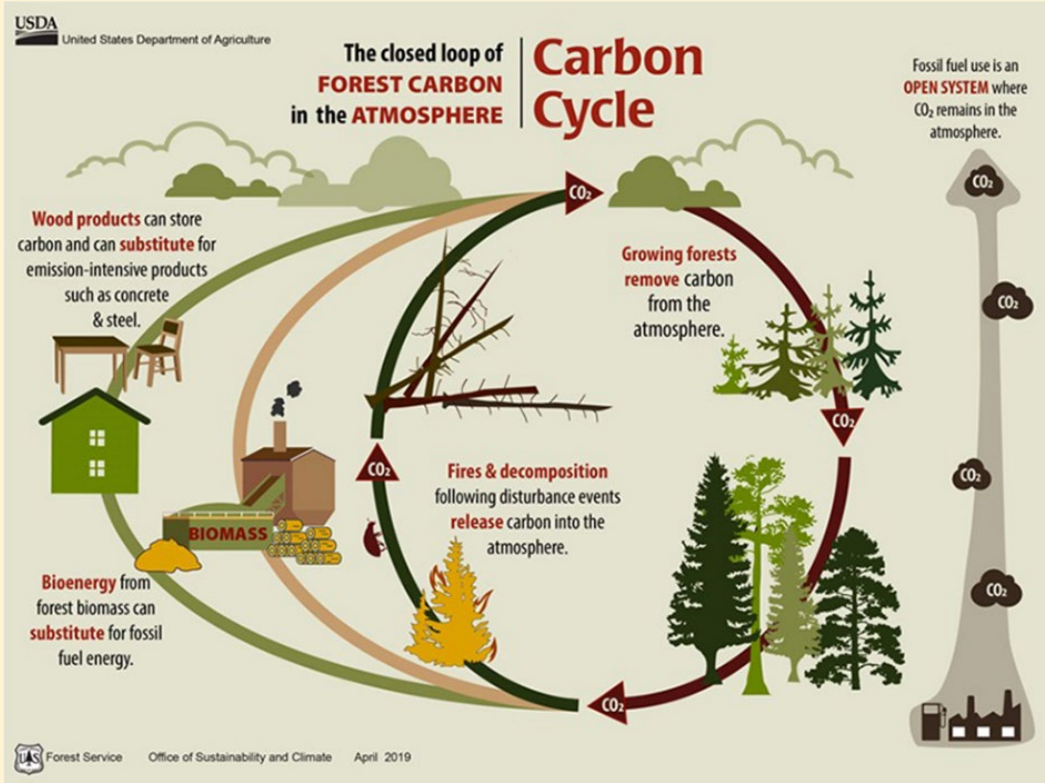
Evergreen Economics

www.evergreenecon.com

CARBON 101 TERMINOLOGY

Two Key Terms

1. **Carbon Stocks** – the amount of carbon in a pool (*or account*). The pictures in the figure to the right
2. **Carbon Flux** – or difference in carbon stocks over a specified time period (*or stock change*). The arrows in the figure to the right



Two Key Concepts

1. **Reliability** – the emissions reduction (*or sequestration*) must be additional and that includes onsite and offsite effects (*so leakage*)
2. **Durability** – they also need to stick around (*or we need to account for the project timeframe*) through reserve pools or discounting

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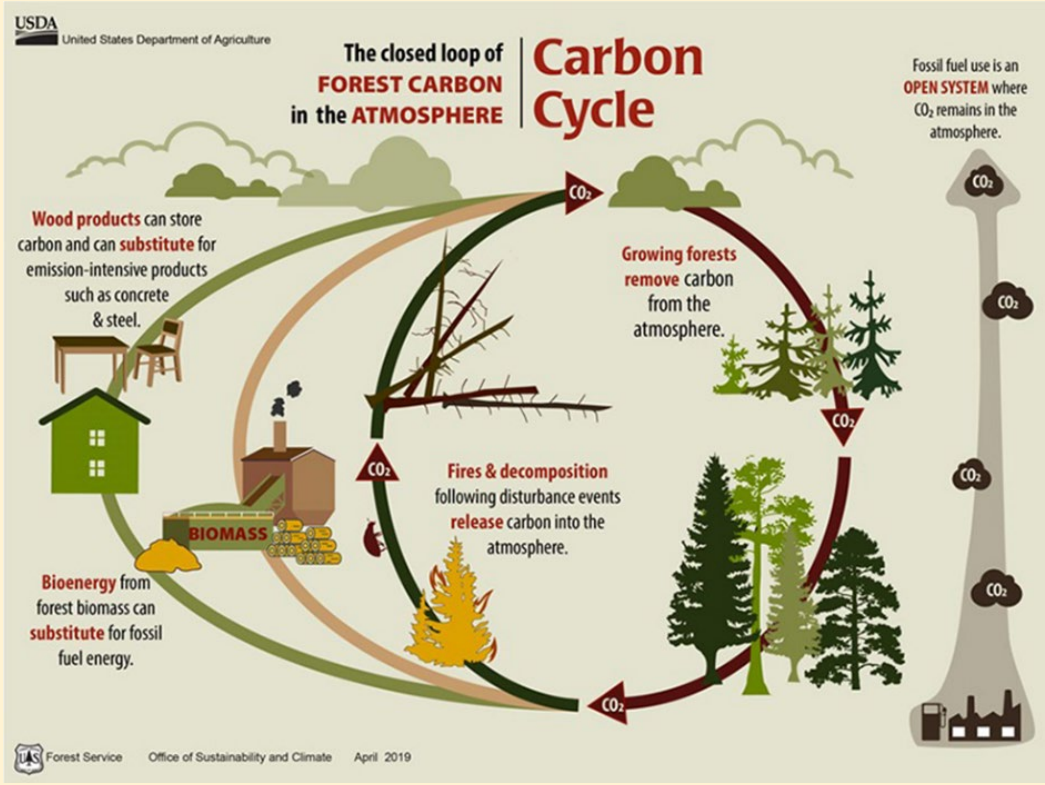

When talking Fluxes or stock changes (typically defined over a period of time)

1. **Emissions** – going from terrestrial pools to the atmospheric pool
2. **Sequestration** – going from the atmospheric pool into a terrestrial pool

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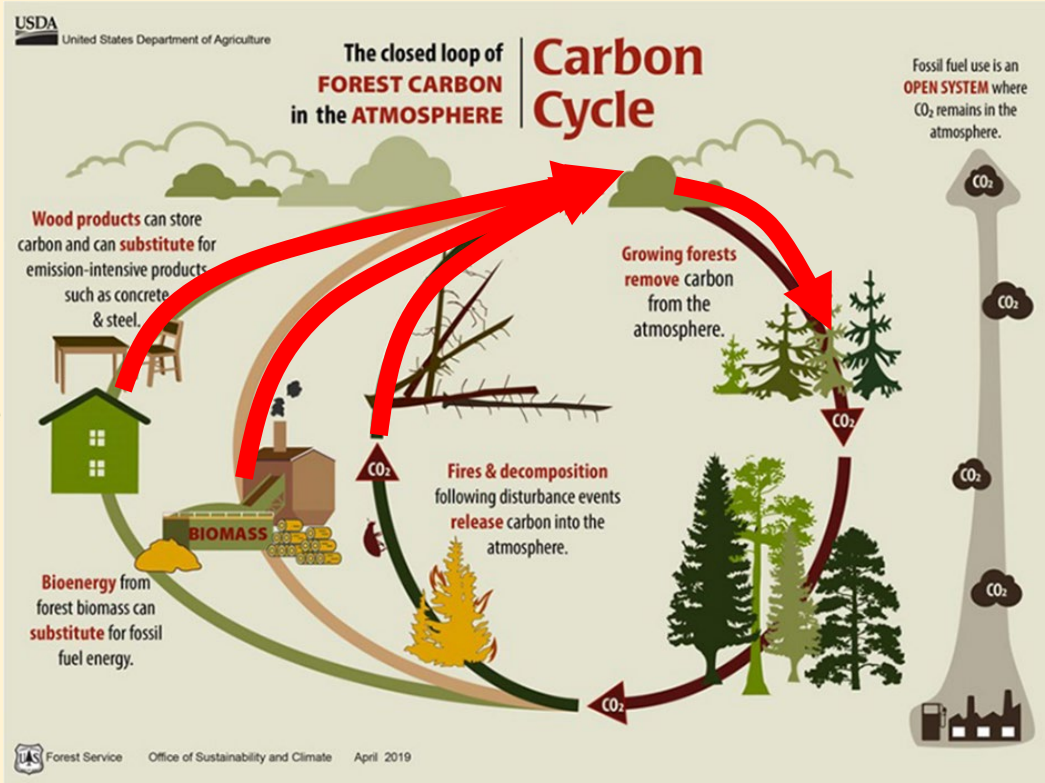
Stocks do not matter, only flux (particularly stock change between terrestrial pools and atmosphere)



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CARBON IN WESTERN WASHINGTON

The focus was more of what is on forest land in WWA

Figure 16: Projected Forest Carbon Stored on Private Lands in Western Washington

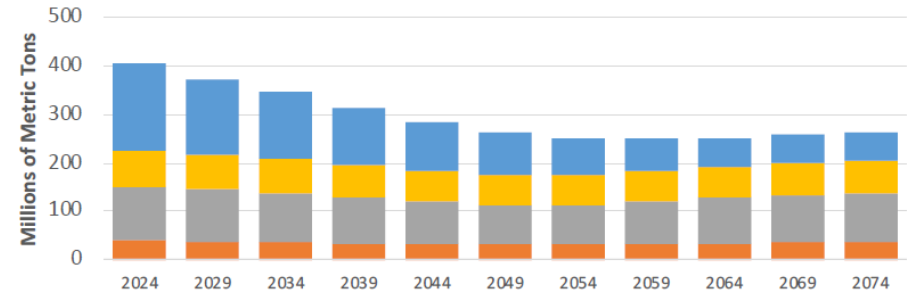


Figure 17: Projected Forest Carbon Stored on State Lands in Western Washington

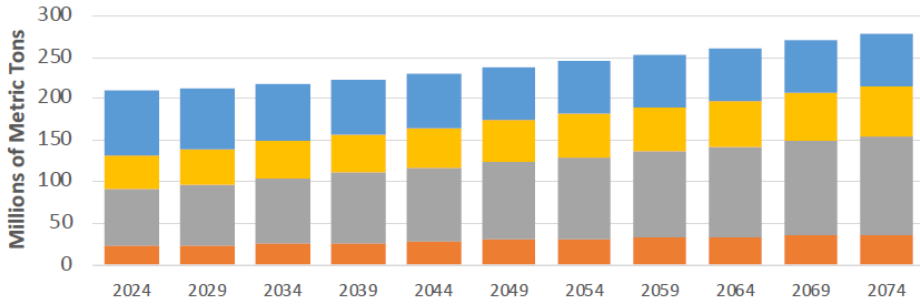
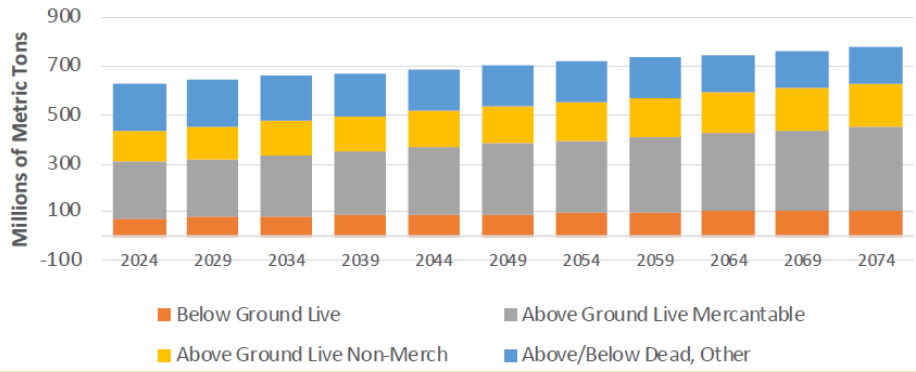


Figure 18: Projected Forest Inventory on Federal Lands in Western Washington by Species



These are stocks

They represent the tree lists from the FIA run through FVS

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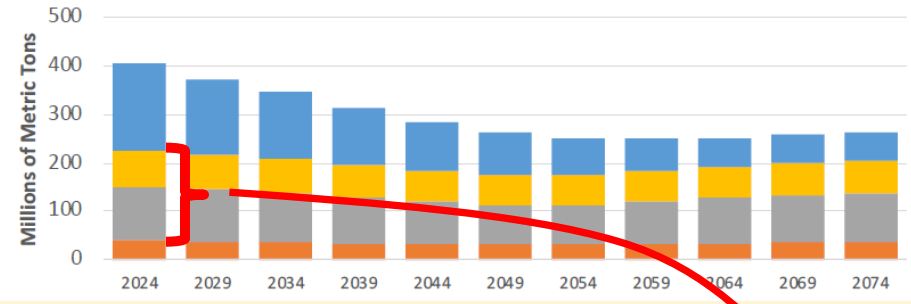

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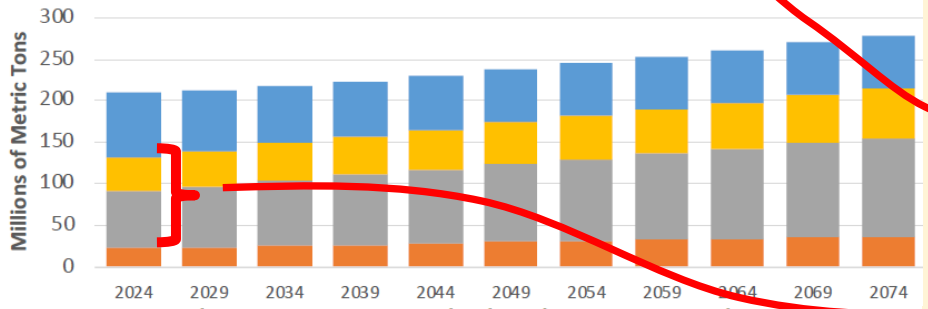

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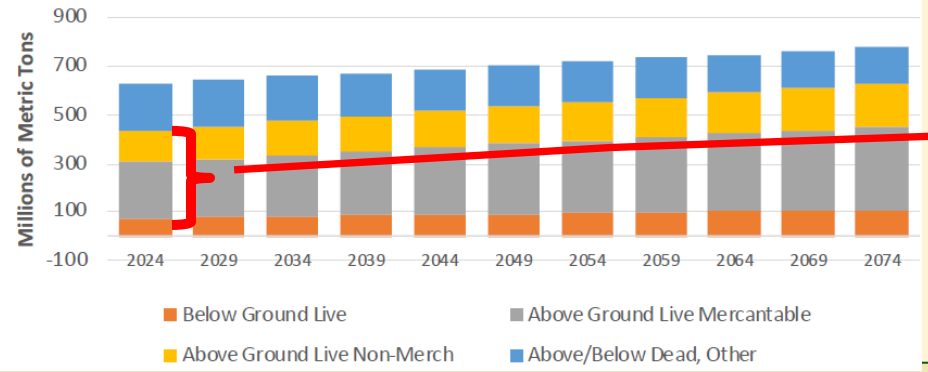

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Let's focus on aboveground live tree carbon

188.0 MtC on Private Forest Land

108.7 MtC on State Forest Land

361.8 MtC on Federal Forest Land

658.5 MtC total

CARBON IN WESTERN WASHINGTON

The focus was more of what is on forest land in WWA

658.5 MtC total aboveground live tree carbon

These are stocks

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Let's focus on aboveground live tree carbon

State	Carbon Pools	2018	2019	2020	2021	2022
Washington	Total Forest Ecosystem	2,590	2,594	2,599	2,603	2,608
Washington	Aboveground Biomass	901	904	907	910	912
Washington	Belowground Biomass	188	189	189	190	190
Washington	Dead Wood	262	264	265	267	268
Washington	Litter	154	154	154	154	154
Washington	Soil (Mineral)	1,083	1,083	1,083	1,082	1,082
Washington	Soil (Organic)	1	1	1	1	1

Compare with this (for all WA)

Domke, Grant M.; Walters, Brian F.; Giebink, Courtney L.; Greenfield, Eric J.; Smith, James E.; Nichols, Michael C.; Knott, Jon A.; Ogle, Stephen M.; Coulston, John W.; Steller, John. 2023. Greenhouse gas emissions and removals from forest land, woodlands, urban trees, and harvested wood products in the United States, 1990-2021. Resource Bulletin. WO-101. Washington, DC: U.S. Department of Agriculture, Forest Service, Washington Office. 10 p. https://doi.org/10.2737/WO-RB-101

CARBON HARVESTED WOOD PRODUCTS

The typical approach

1. Start with harvest level in carbon
   - This would be the merchantable component of the trees harvested

CARBON HARVESTED WOOD PRODUCTS

The typical approach

1. Start with harvest level in carbon
2. Apply mill efficiency rate (how much of the harvested carbon makes its way into the product)

Region	States	Hardwood		Softwood	
		Saw Log	Pulpwood	Saw Log	Pulpwood
Pacific Coast: Pacific Northwest, West (PWW)	Washington	0.531	0.531	0.740	0.500
	Oregon				

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The typical approach

1. Start with harvest level in carbon
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3. Apportion to a set proportion of wood products

Wood Products Generated							
Supersections	Softwood Lumber	Hardwood Lumber	Plywood	Oriented Strand Board	Non-structural Panels	Miscellaneous	Paper
Oregon and Washington Coast	73%	5%	12%	0%	1%	2%	8%

CARBON HARVESTED WOOD PRODUCTS

The typical approach

1. Start with harvest level in carbon
2. Apply mill efficiency rate (how much of the harvested carbon makes its way into the product)
3. Apportion to a set proportion of wood products
4. Apply half life to account for when those products come out of use
5. And account for the out of use part that remains stored in landfills

Table 1.6.[1] - Average disposition patterns of carbon as fractions in roundwood by region and roundwood category; factors

Year after production	Pacific Northwest; Westside					
	Softwood				Hardwood	
	Saw log		Pulpwood		All	
	In use	Landfill	In use	Landfill	In use	Landfill
0	0.740	0.000	0.500	0.000	0.531	0.000
10	0.489	0.125	0.075	0.122	0.231	0.122
25	0.340	0.195	0.001	0.110	0.122	0.157
50	0.228	0.240	0.000	0.085	0.069	0.167
75	0.168	0.263	0.000	0.078	0.044	0.173
100	0.130	0.279	0.000	0.076	0.030	0.177

[1] from the Forestry Appendix of the Technical Guidelines of the U.S. Department of Energy's Voluntary Reporting of Greenhouse

CARBON ODDS AND ENDS

Other items to consider:

- Afforestation and Avoided Emissions
  - We did not consider forest management at the extensive margin (adding trees on land that was not forest before)
  - Nor do we consider avoided emissions (payments for stocks as opposed to flux) as it is fraught with issues like additionality and leakage and the voluntary market has shied away from it in favor of removals (payments for flux)
- The final issue relates to substitution
  - This can be done through post processing if need be.
  - For wood used in single family housing it has been argued that assuming concrete and steel substitution may not be warranted