



# Seeing Embodied Carbon

*an emergent property of working forest landscapes*



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*Ecotrust*



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## 00 *Missing the forest*

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## Where are the trees and forests in your LCA?

(You probably won't find them!)

- LCAs usually forego “biogenic carbon” tracking, assuming all managed forests to be exactly “carbon neutral”
- Forestry practices that produce observable increases or decreases in forest carbon storage are left completely off the balance sheet

Oneil and Puettmann (2017).  
 “A Life-Cycle Assessment of Forest Resources of the Pacific Northwest, USA.”  
*Forest Products Journal* 67(5-6): 316-330.

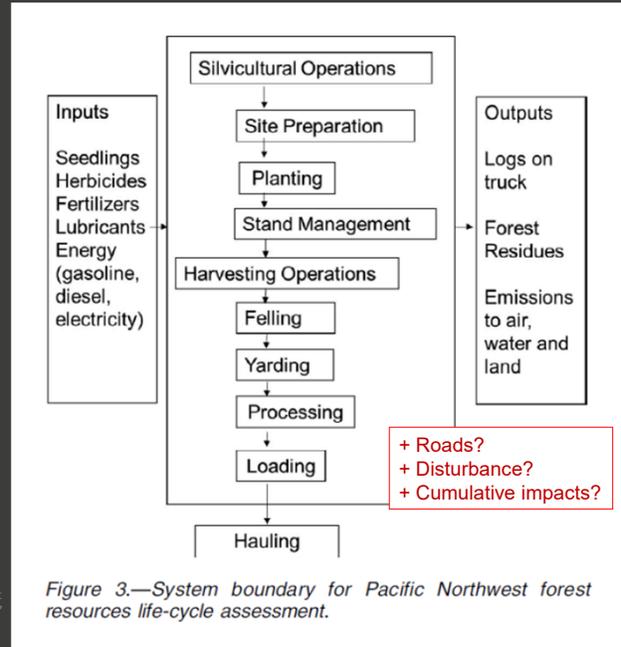


Figure 3.—System boundary for Pacific Northwest forest resources life-cycle assessment.

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## Where did we choose to ignore forests?

Product Category Rules governing LCA and EPDs for North American structural wood products allow (but don't require) a simplifying assumption of carbon neutrality.

“...biogenic carbon neutrality of wood is valid for North American wood products as national-level inventory reporting shows overall increasing and/or neutral forest carbon stocks in recent years.”

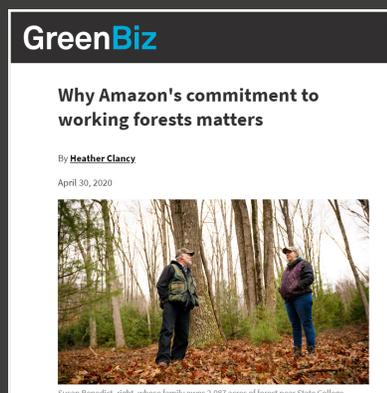


In a nutshell, because national-scale carbon stocks are non-declining, wood products from any and every forest in North America can be (but don't have to be) treated as if they were exactly carbon neutral.

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## We need to bring our values into our markets

Catalytic investments are ongoing to reduce GHG emissions and increase forest carbon sequestration.



Beyond offsets, globalized markets for forest products are blind to most forest values but have enormous untapped potential to shape forest management and conservation decisions.

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## We can do better than carbon neutral

*A simple formula for recognizing non-zero carbon balance in LCA*

### 1. Determine carbon stock change in the forest

Cumulative carbon gain or loss from an area of interest over a specific timeframe.

### 2. Determine timber (roundwood) output

Volume of logs entering market from same area and timeframe.

### 3. Calculate "upstream" embodied carbon

Divide #1 by #2 to calculate "upstream" embodied carbon for the area of interest for the specified timeframe.

➤ Johnson, Eric (2009). "Goodbye to Carbon Neutral: Getting Biomass Footprints Right." *Environmental Impact Assessment Review* 29(3): 165-68. <https://doi.org/10.1016/j.eiar.2008.11.002>.

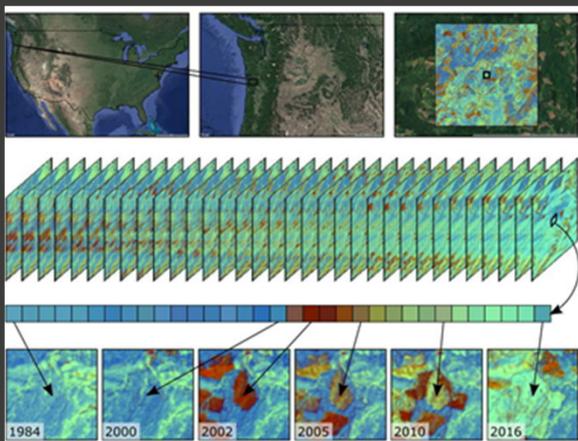
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## 01 Seeing the forest

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### Eyes on forests

*Nationwide time series of forest carbon stocks and timber outputs*



Publicly available data funded by the NASA Carbon Monitoring System offers annual wall-to-wall estimates at 30 x 30 m resolute of aboveground forest biomass across contiguous USA from 1990 to 2017.

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# Eyes on forests

Nationwide time series of forest carbon stocks and timber outputs

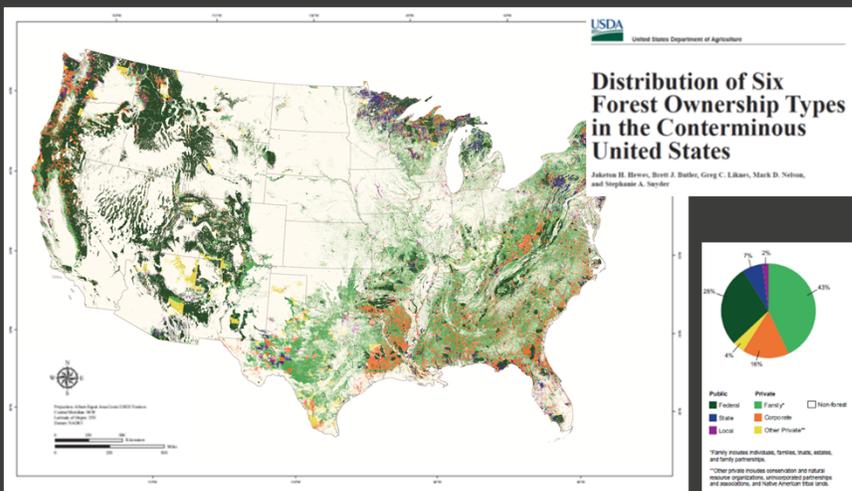


Annual timber output records exist at the county-level by owner group for many western states. Periodic reporting is available for entire USA.

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# Eyes on forests

Nationwide time series of forest carbon stocks and timber outputs



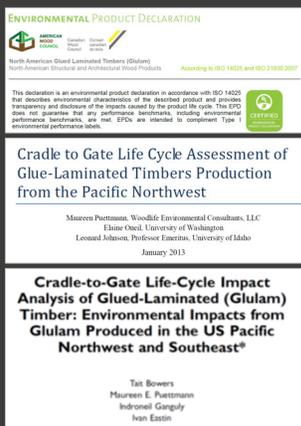
Forest ownership across the contiguous USA based on US Forest Service research.

Distinctions between private owner types aren't exact, but do permit us to see emergent trends at regional scales.

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# How does a forest product EPD stack up?

Unpacking glulam's embodied carbon from a sample of LCAs and EPDs



With 1 m<sup>3</sup> of roundwood, we can make ~0.42 m<sup>3</sup> of glulam  
(58% of the roundwood meets another short-lived fate)

For each cubic meter of industrial roundwood used for glulam, we get the following embodied carbon footprint:

- +5** Forest Operations
- +20** Lumber Production
- +20-40** Glulam Production
- 375-455** In Product  
(kgCO<sub>2</sub>e / m<sup>3</sup> roundwood)

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# How Oregon's roundwood stacks up

Non-reserved forests from 2002-2016

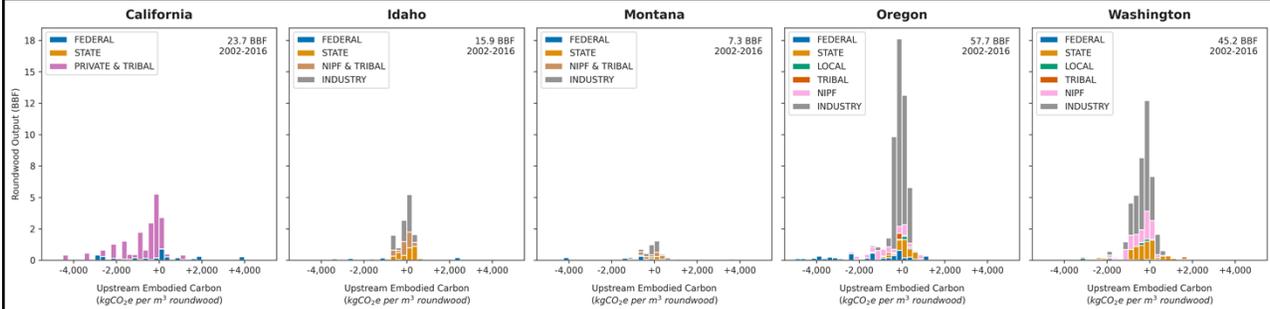
Owner Type	"Upstream" Embodied Carbon (kgCO <sub>2</sub> e/m <sup>3</sup> roundwood) by percentile from the distribution of a supplier's timber output									Timber Output 2002 - 2016	
	10 <sup>th</sup>	20 <sup>th</sup>	30 <sup>th</sup>	40 <sup>th</sup>	50 <sup>th</sup>	60 <sup>th</sup>	70 <sup>th</sup>	80 <sup>th</sup>	90 <sup>th</sup>	%	BBF
Federal	-6,871	-4,756	-3,757	-2,726	-1,706	-1,157	-363	+25	+520	11.2%	6.5
State	-676	-101	-85	+21	+128	+180	+228	+327	+520	6.9%	4.2
Local	-1,333	-827	-265	-57	+0	+84	+123	+240	+351	1.1%	0.6
Tribal	-598	-353	-167	-127	-119	-103	-61	+89	+680	1.6%	0.9
NIPF	-2,124	-1,319	-1,125	-936	-622	-365	-37	+110	+430	9.6%	5.6
Industry	-353	-257	-221	-159	-101	-42	+98	+183	+353	69.2%	40.0
<b>Overall</b>	<b>-1,277</b>	<b>-390</b>	<b>-257</b>	<b>-190</b>	<b>-123</b>	<b>-43</b>	<b>+94</b>	<b>+185</b>	<b>+365</b>	<b>100%</b>	<b>57.7</b>

Data sources:  
 Timber output: Oregon.gov Open Data Portal <https://data.oregon.gov/NaturalResources/Timber-Harvest-Data-1962-2019-3ag-af54>  
 Forest biomass: Kennedy et al. (eMapR web application) <https://empr.ceccat.oregonstate.edu/cmapes/land/forest-biomass/>  
 Land ownership: Sass et al. (2020). [https://www.fs.usda.gov/tech/archives/CAT/doi/026\\_2020-0044](https://www.fs.usda.gov/tech/archives/CAT/doi/026_2020-0044)

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# With opened eyes, we see huge variation

All of which was previously being treated as exactly zero



Timber from non-reserved western forests from 2002–2016.

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## 03 Now what?

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## Learning to see forests

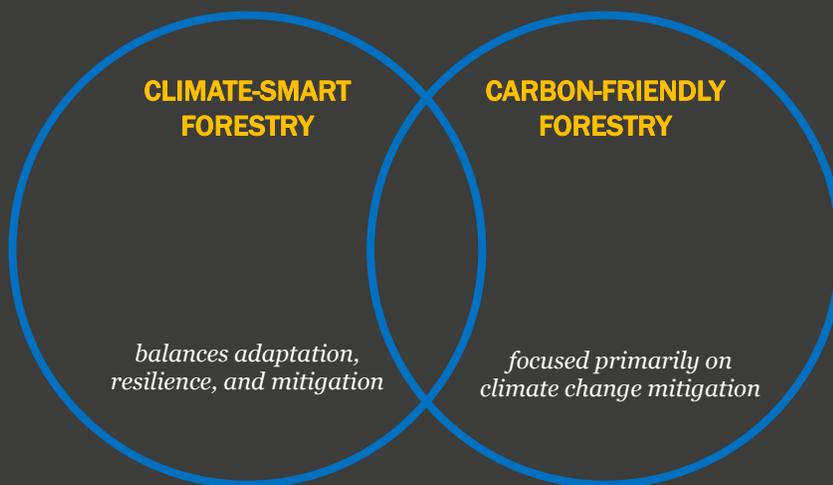
*increasing actionable information flow from forests to builders*

- **Forest practices matter. Place matters.**  
*Keep asking questions and articulating what matters to you about forests.*
- **Every major timberland owner knows their inventory and output (it's their business to know)**  
*... but sawmills and product manufacturers usually won't know many "upstream" impact details.*
- **We need actionable (place-based) EPDs for products and LCI data on forests**  
*Forest Carbon Disclosure could become a prerequisite for forest product suppliers to compete for market share among green builders.*
- **Clients are asking carbon-specific questions about wood**  
*We need a better answer about how much forestry choices matter than "Um... zero."  
And continent-wide averages just won't cut it anymore.*
- **Carbon is the tail, not the dog**  
*Reducing forest carbon stocks isn't always a bad thing. Find out more what climate-smart forestry looks like.  
And what bringing an equity lens to your decisions might look like.*

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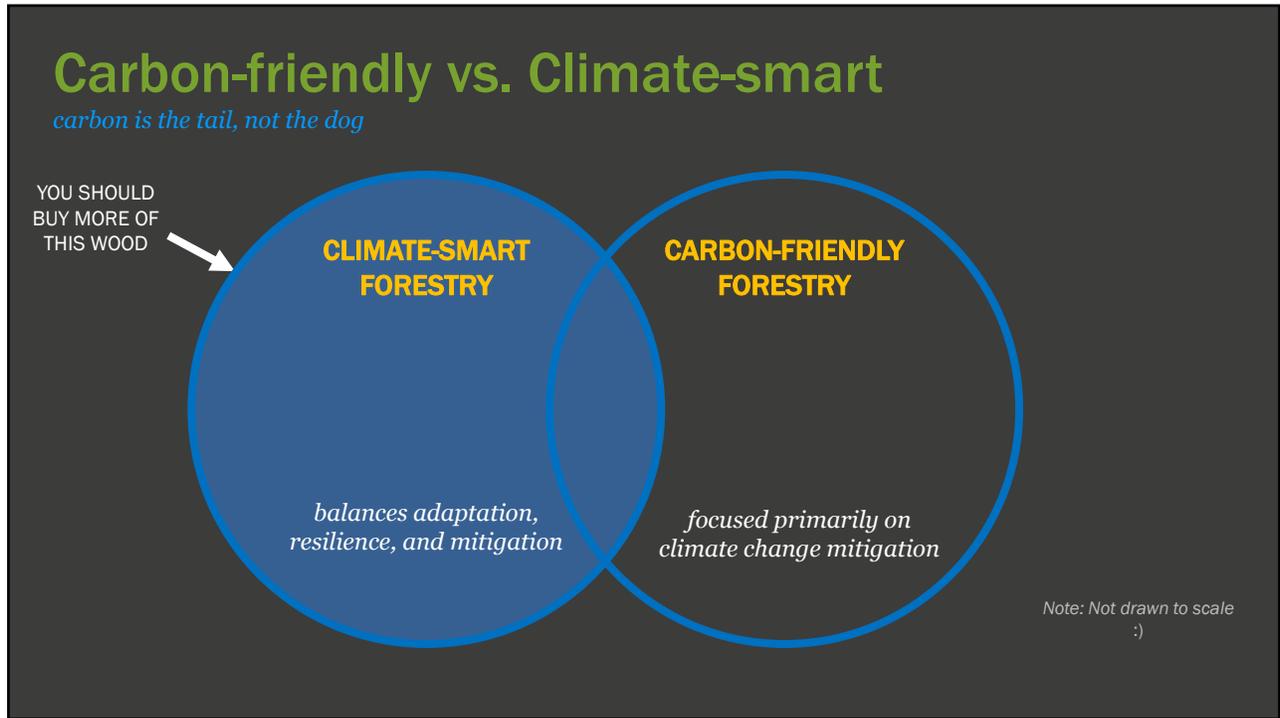
## Carbon-friendly vs. Climate-smart

*carbon is the tail, not the dog*

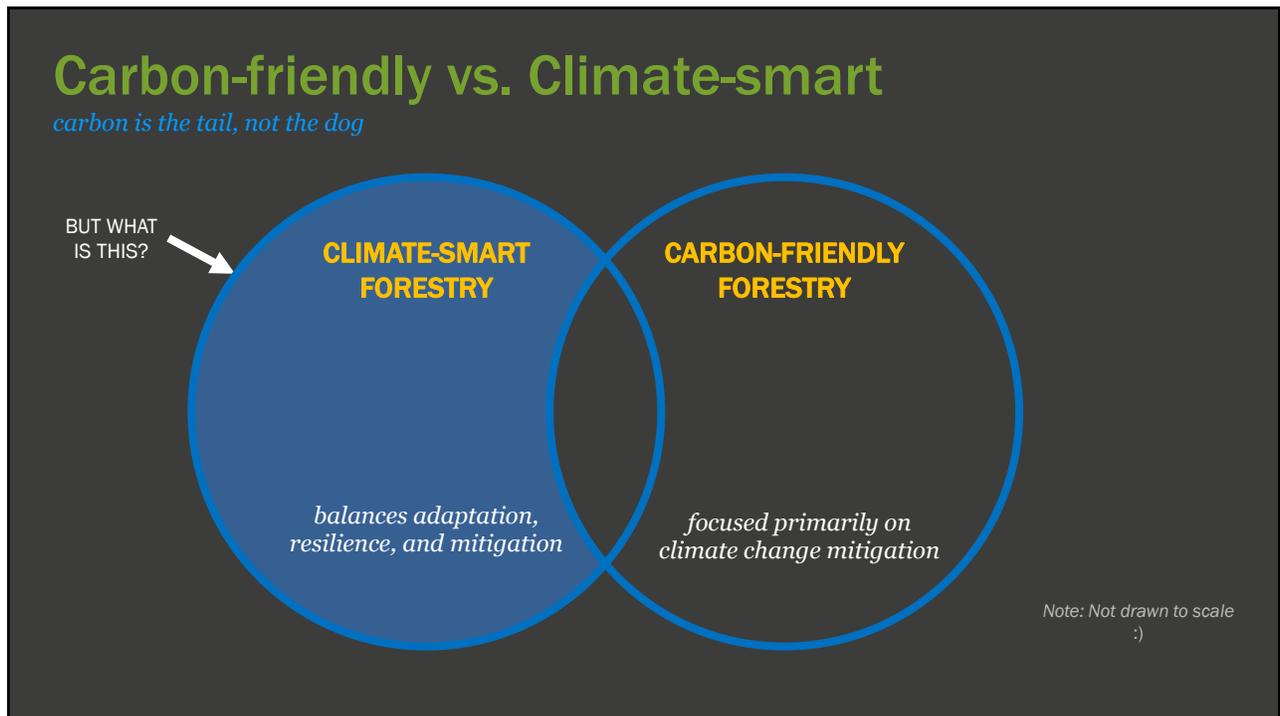


*Note: Not drawn to scale  
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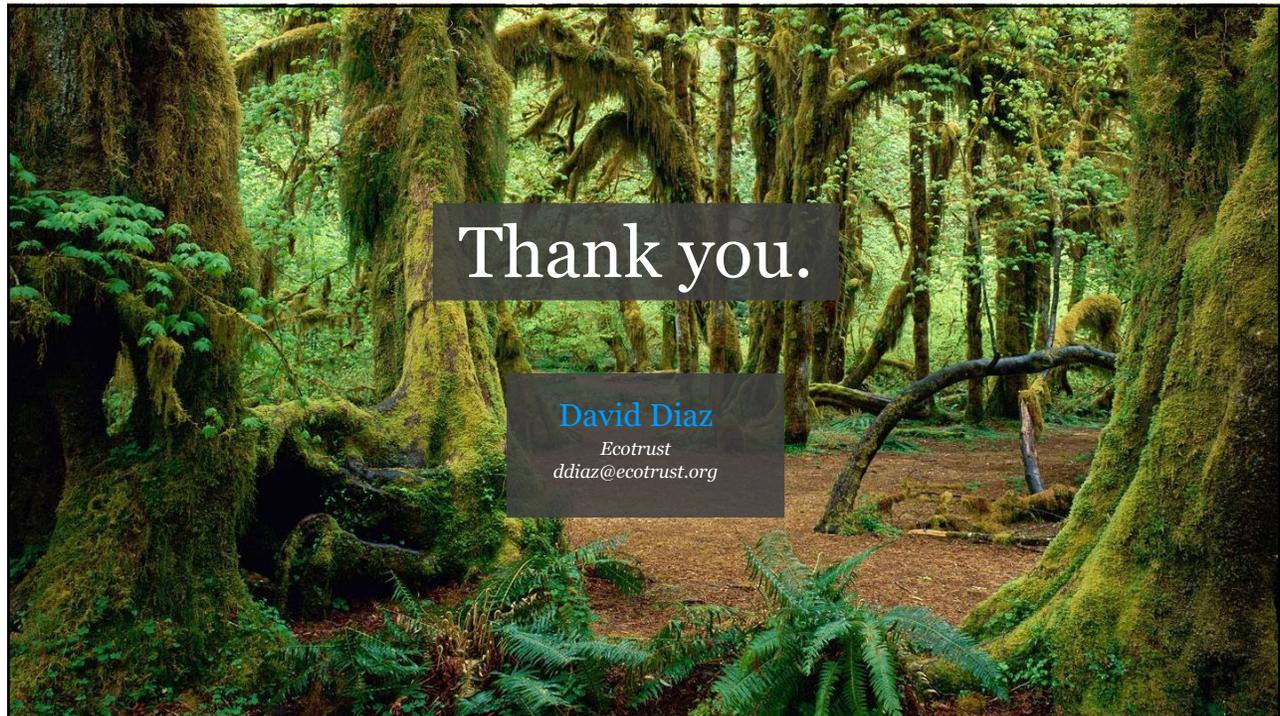
## Keep going

*“You take the red pill. You stay in wonderland,  
and I show you how deep the rabbit hole goes.”*

- Morpheus (The Matrix)

- Diaz, David (2020). “Going Beyond Neutrality” Presentation to the Carbon Leadership Forum, Wood Carbon Seminar Series. 22 min. <https://www.youtube.com/watch?v=XtcbsY9BXT0>
- Diaz, David (2020). “Doing better than neutrality for forest products.” Western Forester 65(4): 7-9. <http://www.alaska.forestry.org/sites/default/files/westernforester/WFOctNovDec2020color.pdf#page=7>
- Diaz, David (2018). “Tradeoffs in timber, carbon, and cash...” Forests 9(8)447. <https://www.mdpi.com/1999-4907/9/8/447>

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