

The background of the slide is a lush forest scene. The top and bottom sections show moss-covered tree trunks and dense green foliage. The middle section is a solid dark grey band containing the title and author information.

# Seeing Embodied Carbon

*an emergent property of working forest landscapes*

David Diaz

*Ecotrust*

Oct 27, 2021

## 00 *Missing the forest*

# 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.

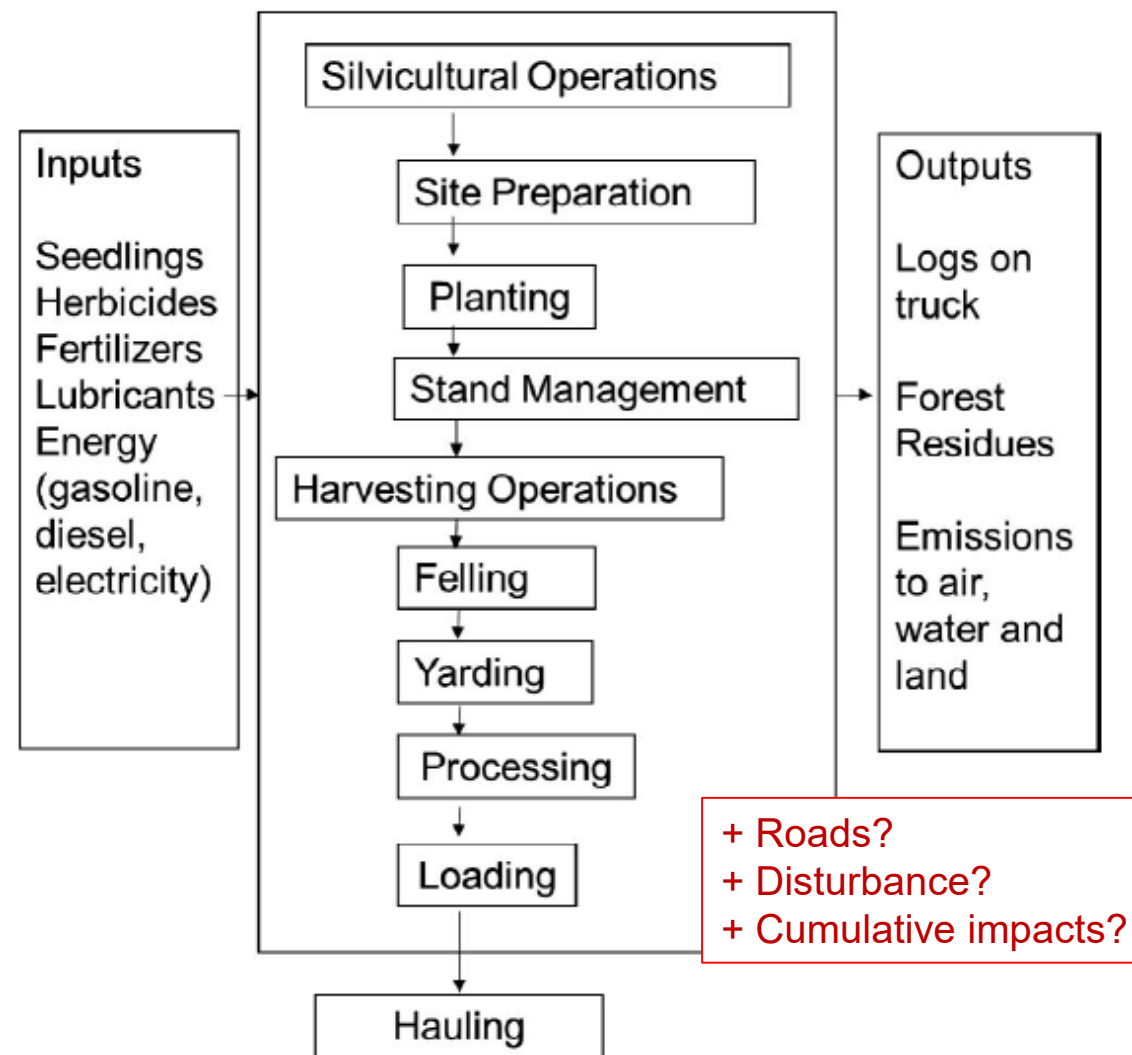


Figure 3.—System boundary for Pacific Northwest forest resources life-cycle assessment.

# 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."

## Doing Better than Carbon Neutrality for Forest Products

BY DAVID DIAZ

I'm a forest modeling, mapping, and number-crunching nerd. Seven years ago, I got pulled into an investigation of the social and ecological impacts



material extraction, manufacture, transport, and construction—dubbed “embodied” carbon—are now critical sustainability concerns for green builders. Life Cycle Assessment (LCA) has become the lingua franca in the world of embodied carbon, and Environmental Product Declarations (EPDs), which apply LCA to quantify the impacts of specific products are multiplying rapidly.

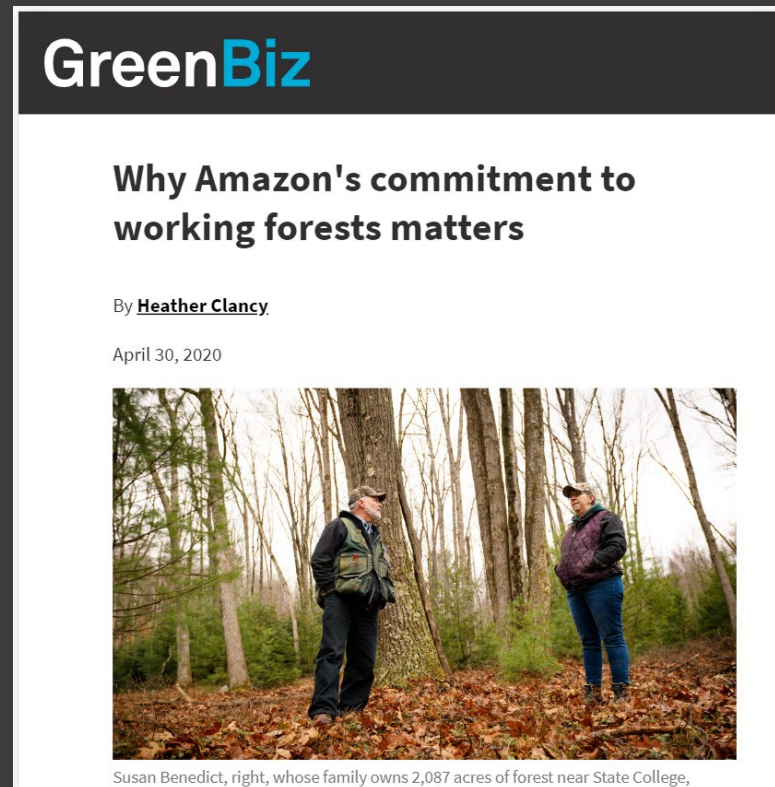


In a nutshell, because national-scale carbon stocks are non-declining, wood products from any and every forest in North America can be (but don't have to be) treated as if they were exactly carbon neutral.



# 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.

# 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

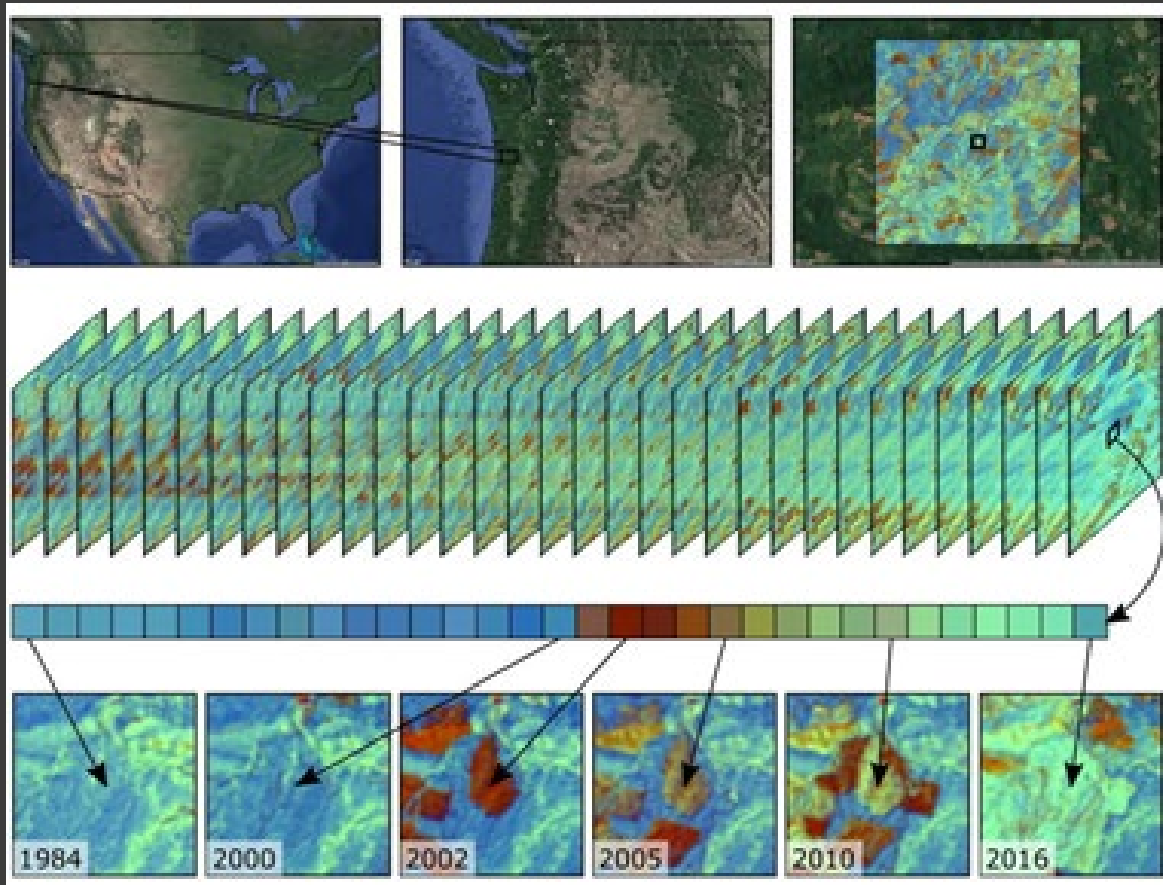
Divide #1 by #2 to calculate “upstream” embodied carbon for the area of interest for the specified timeframe.

- 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>.

# **01** *Seeing the forest*

# Eyes on forests

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

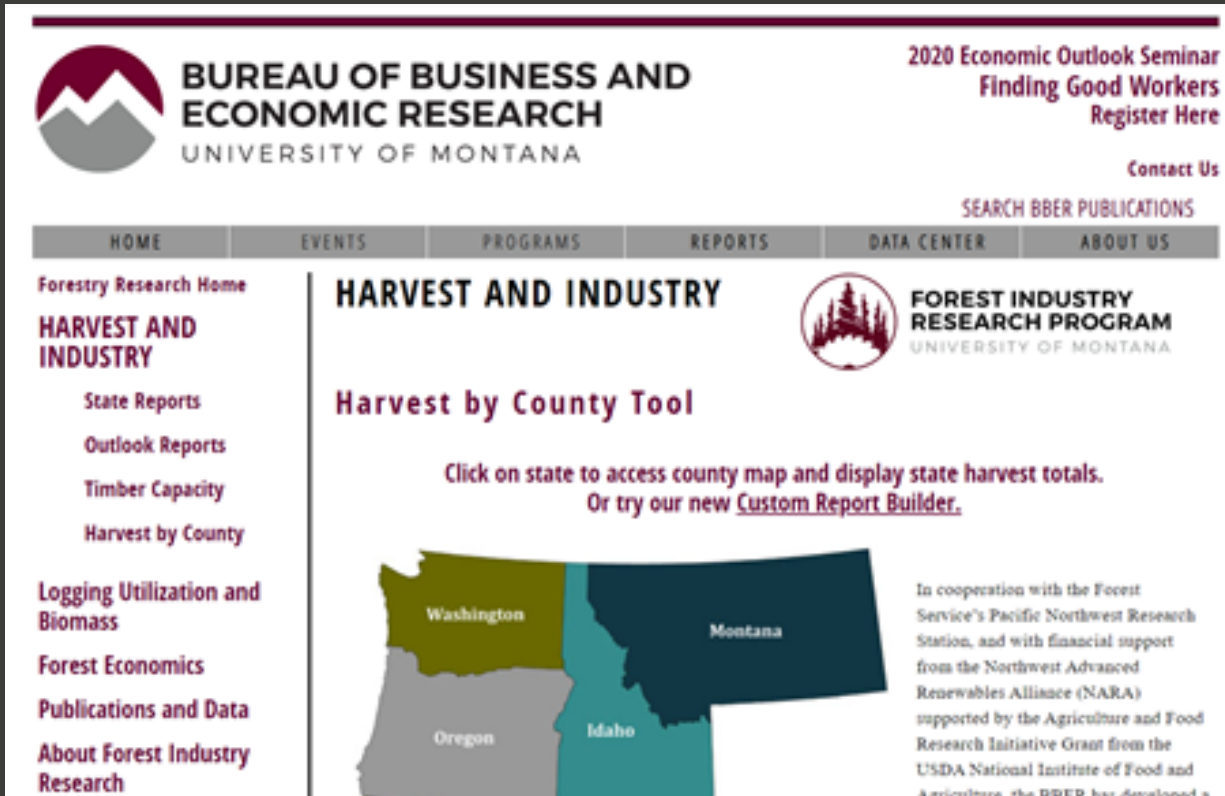


Publicly available data funded by the NASA Carbon Monitoring System offers annual wall-to-wall estimates at 30 x 30 m resolute of aboveground forest biomass across contiguous USA from 1990 to 2017.



# Eyes on forests

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



The screenshot shows the BBER website with a navigation bar at the top containing links for HOME, EVENTS, PROGRAMS, REPORTS, DATA CENTER, and ABOUT US. The main header includes the BBER logo and text: "BUREAU OF BUSINESS AND ECONOMIC RESEARCH UNIVERSITY OF MONTANA". A sidebar on the left lists various resources under "Forestry Research Home", including "HARVEST AND INDUSTRY", "State Reports", "Outlook Reports", "Timber Capacity", "Harvest by County", "Logging Utilization and Biomass", "Forest Economics", "Publications and Data", and "About Forest Industry Research". The main content area is titled "HARVEST AND INDUSTRY" and features a "Harvest by County Tool" section. This section includes a map of the Pacific Northwest states (Washington, Oregon, Idaho, and Montana) and text instructing users to "Click on state to access county map and display state harvest totals. Or try our new Custom Report Builder." The "Forest Industry Research Program" logo and name are also visible in the main content area.

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**HARVEST AND INDUSTRY**

**FOREST INDUSTRY RESEARCH PROGRAM**  
UNIVERSITY OF MONTANA

**Harvest by County Tool**

Click on state to access county map and display state harvest totals.  
Or try our new [Custom Report Builder](#).

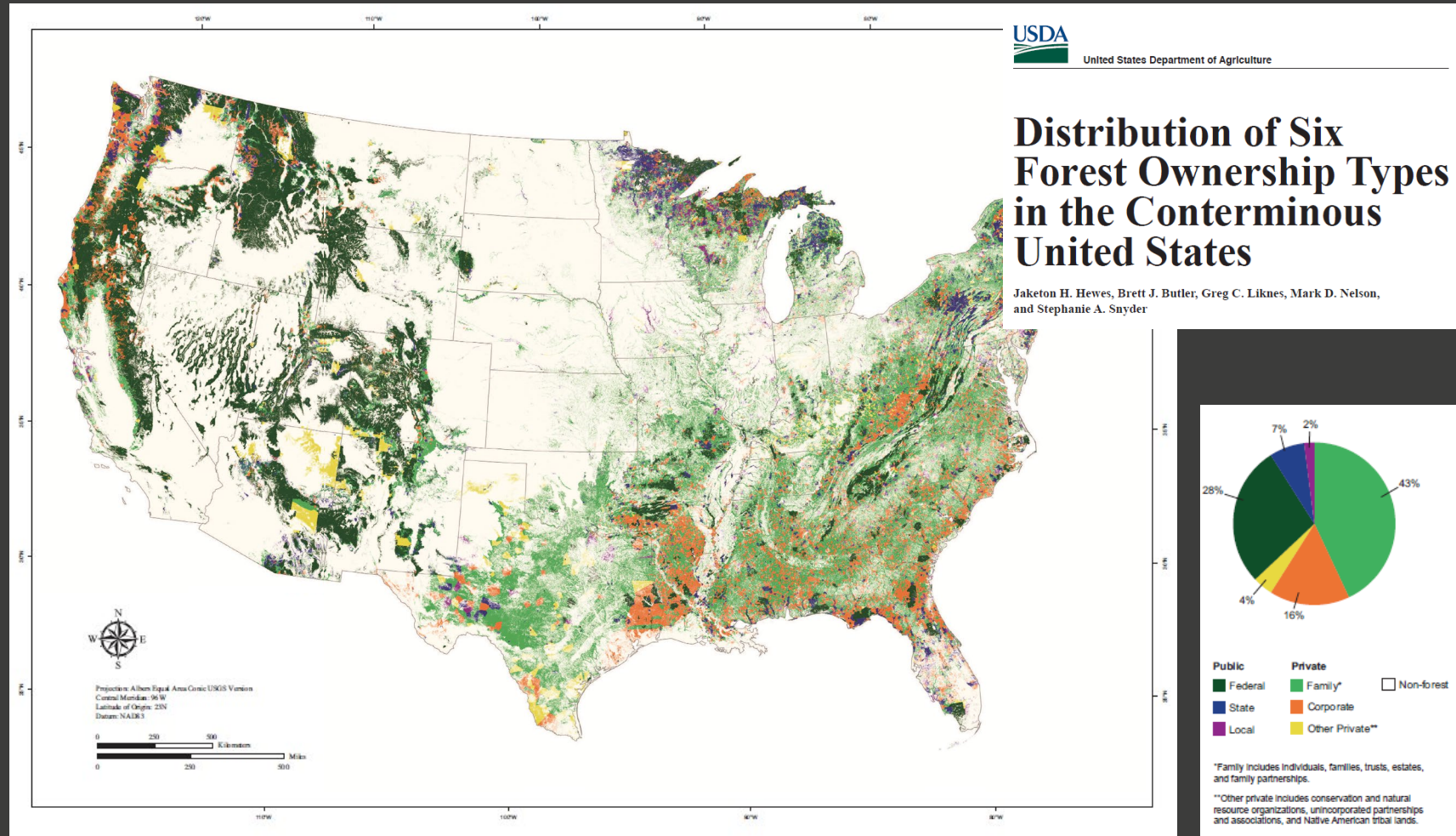
Washington Oregon Idaho Montana

In cooperation with the Forest Service's Pacific Northwest Research Station, and with financial support from the Northwest Advanced Renewables Alliance (NARA) supported by the Agriculture and Food Research Initiative Grant from the USDA National Institute of Food and Agriculture, the BBER has developed a

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

# Eyes on forests

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

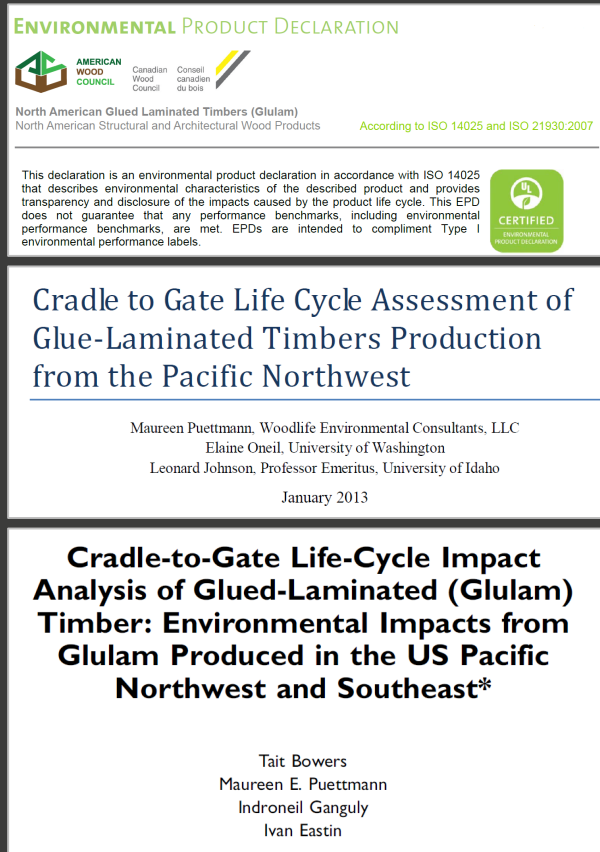


Forest ownership across the contiguous USA based on US Forest Service research.

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

# 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)

# 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
Overall	-1,277	-390	-257	-190	-123	-43	+94	+185	+365	100%	57.7

Data sources:

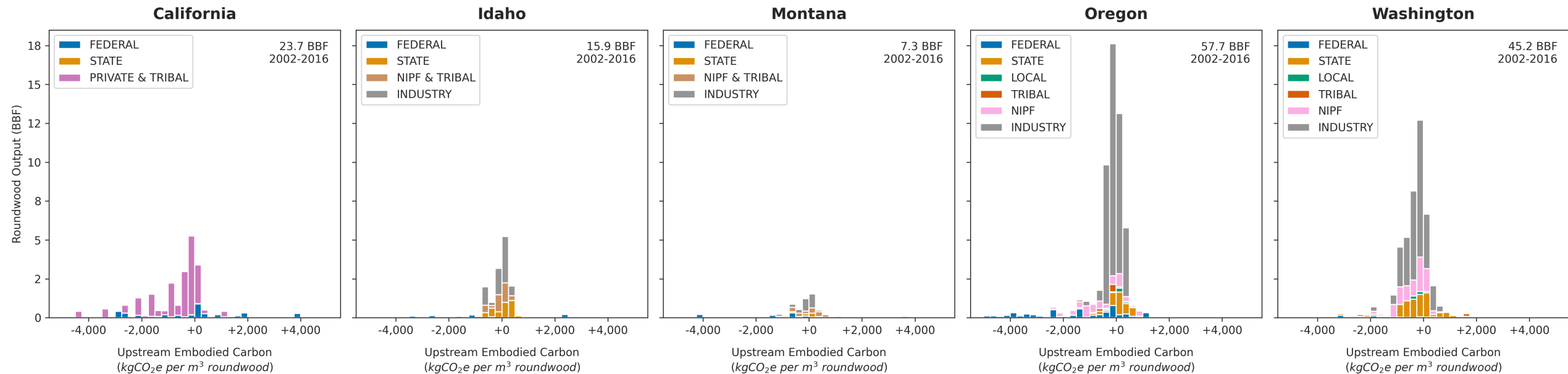
Timber output: Oregon.gov Open Data Portal <https://data.oregon.gov/Natural-Resources/Timber-Harvest-Data-1962-2019/c3sg-dl24>

Forest biomass: Kennedy et al. (eMapR web application) <http://emapr.ceoas.oregonstate.edu/pages/data/viz/index.html>

Land ownership: Sass et al. (2020). <https://www.fs.usda.gov/rds/archive/Catalog/RDS-2020-0044>

# 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.*



## **02** *Now what?*

# 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**

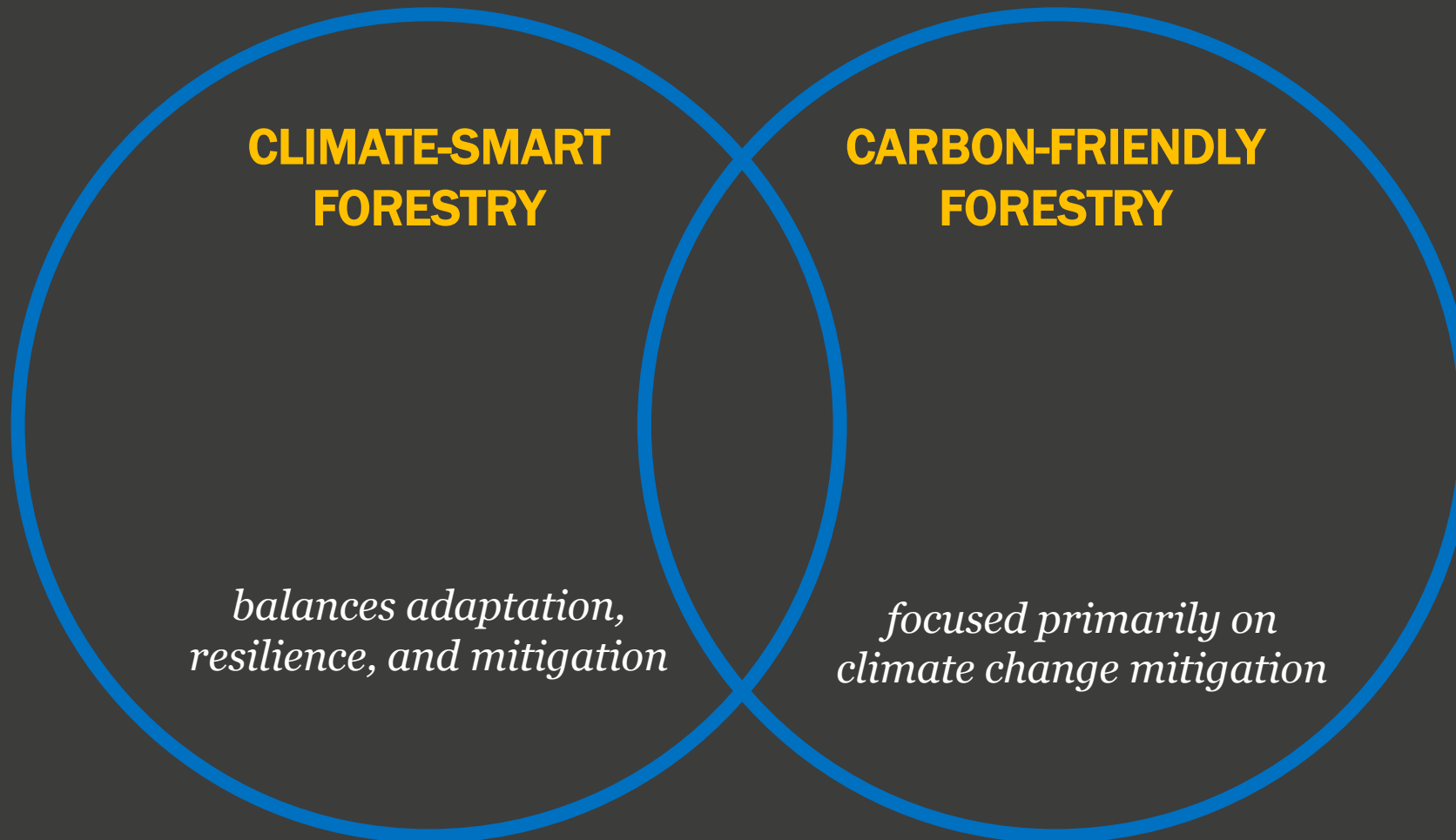
*We need a better answer about how much forestry choices matter than “Um... zero.”  
And continent-wide averages just won't cut it anymore.*

- **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.*

# Carbon-friendly vs. Climate-smart

*carbon is the tail, not the dog*



*Note: Not drawn to scale  
:)*

# Carbon-friendly vs. Climate-smart

*carbon is the tail, not the dog*

YOU SHOULD  
BUY MORE OF  
THIS WOOD



**CLIMATE-SMART  
FORESTRY**

*balances adaptation,  
resilience, and mitigation*

**CARBON-FRIENDLY  
FORESTRY**

*focused primarily on  
climate change mitigation*

*Note: Not drawn to scale  
:)*

# Carbon-friendly vs. Climate-smart

*carbon is the tail, not the dog*

BUT WHAT  
IS THIS?



**CLIMATE-SMART  
FORESTRY**

*balances adaptation,  
resilience, and mitigation*

**CARBON-FRIENDLY  
FORESTRY**

*focused primarily on  
climate change mitigation*

*Note: Not drawn to scale  
:)*



# 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=XtcbsY9BXTo>
- 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>



A photograph of a dense forest floor. Large tree trunks are covered in thick, vibrant green moss. The ground is covered in brown pine needles and ferns. The background is filled with more trees and foliage, creating a sense of depth and a lush, green environment.

# Thank you.

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