Carbon Leadership Forum

Going beyond neutrality in embodied carbon accounting for forest products

…and why carbon-friendly forestry is not always climate-smart forestry

David Diaz

- Director of Forestry Technology & Analytics, Ecotrust
- Research Assistant, Center for Sustainable Forestry Pack Forest
  - Work at the intersection of ecosystem science, conservation finance, forest management planning, and computation/data science
- Credentials:
  - BA in Environmental History, Harvard University
  - MS in Soil Science, Oregon State University
  - PhD Candidate in Forestry, University of Washington
- Key experiences
  - 2009-2011 - Analyst covering domestic and international forest carbon science, policy, and markets. Lead author of State of the Forest Carbon Markets 2011.
  - 2011- 2013 – Senior Portfolio Associate at The Climate Trust, originating carbon offset contracts and contributing to offset accounting standards for forest and other land use projects
  - 2013 – present – Ecotrust, lead on forest modeling, geospatial analysis, and technology development

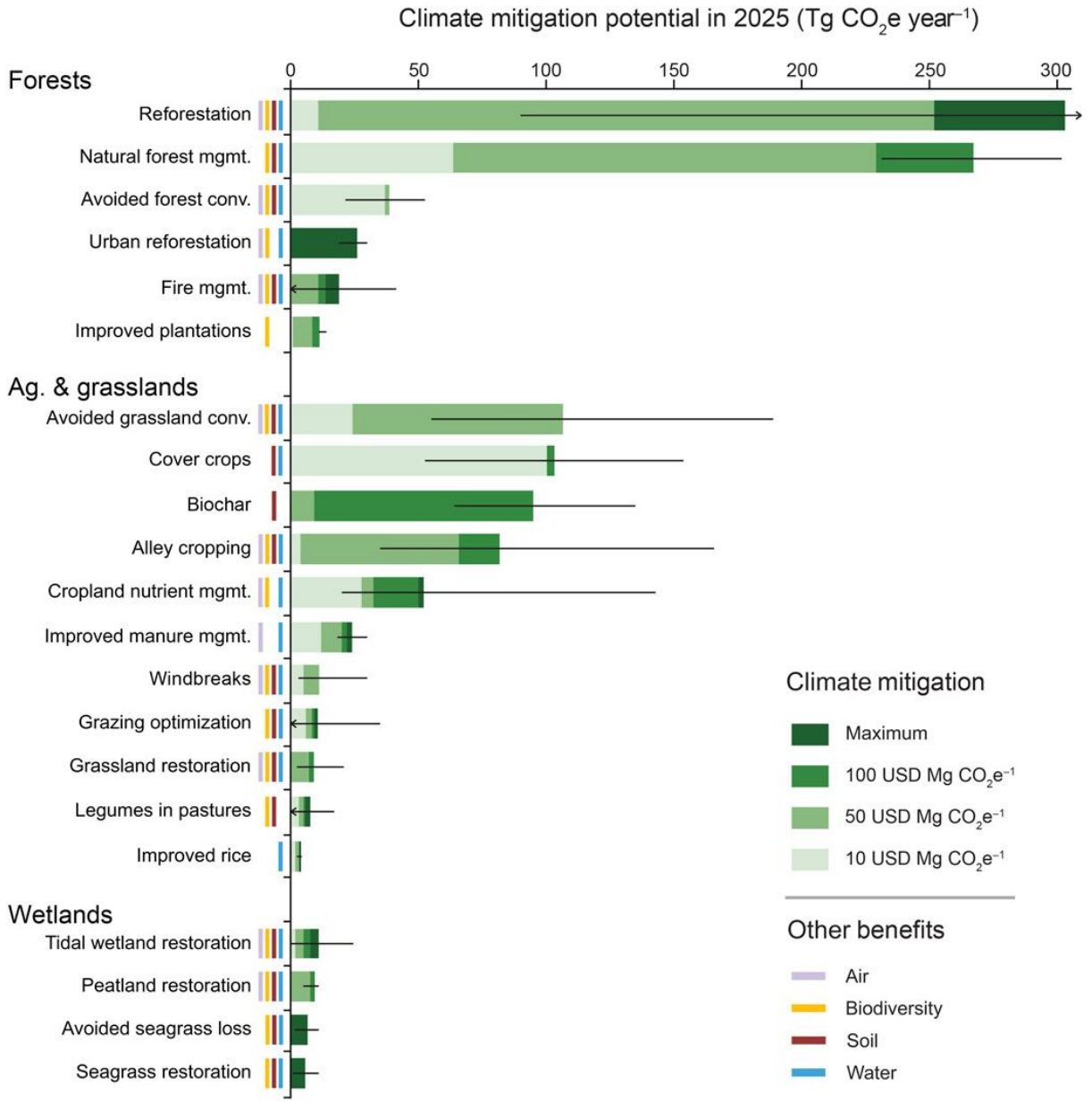
FORESTRY CHOICES MATTER

- Forest carbon balance exerts a significant influence on our global climate.
- Choices around how forests are treated and where we source wood products from are moving to forefront of business decisions amidst our climate crisis.
- Forests provide fundamental benefits including food, clean water, and shelter, in addition to economic development opportunities.

FORESTS DOMINATE NATURAL CLIMATE SOLUTIONS

- Reforestation, forest protection, conservation **and** "improved" management in both natural forests and plantations can be expanded to yield millions of tons of CO_2-equivalent mitigation.

- Not an accident that forests were the first type of carbon offsets introduced in the 1990s.



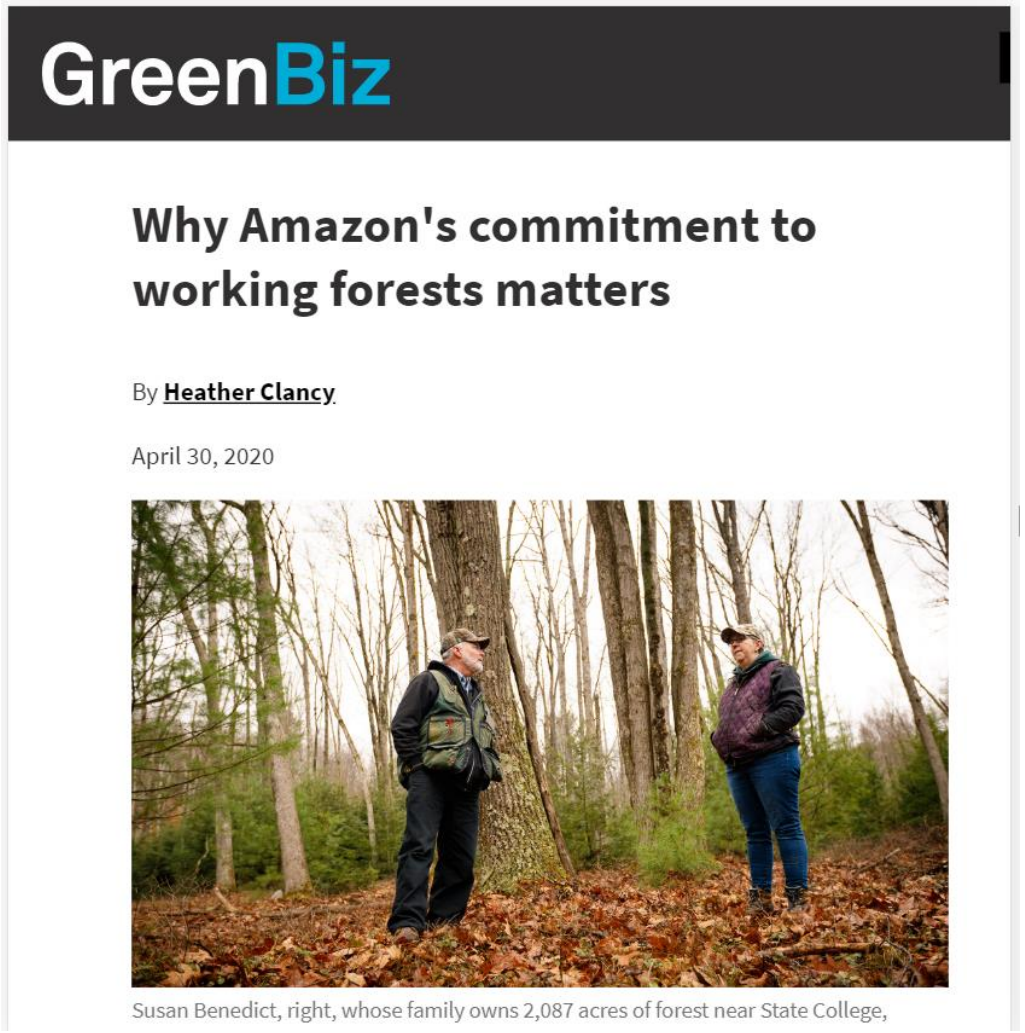
Fargione et al. (2018). Science Advances 4(11)

Millions are being invested into forests that go beyond carbon neutrality

The Seattle Times

Microsoft buys carbon credits in forest near Rainier to offset pollution

Originally published November 25, 2015 at 7:12 pm | *Updated November 25, 2015 at 9:09 pm*



GreenBiz

Why Amazon's commitment to working forests matters

By **Heather Clancy**

April 30, 2020

Susan Benedict, right, whose family owns 2,087 acres of forest near State College,

FOCUSING ON EMBODIED CARBON

Embodied Carbon

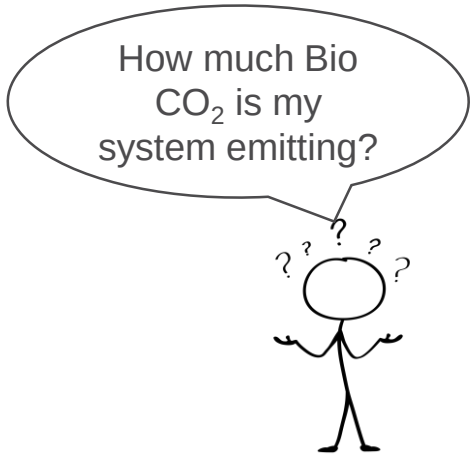
Manufacture, transport and installation of construction materials

Operational Carbon

Building energy consumption

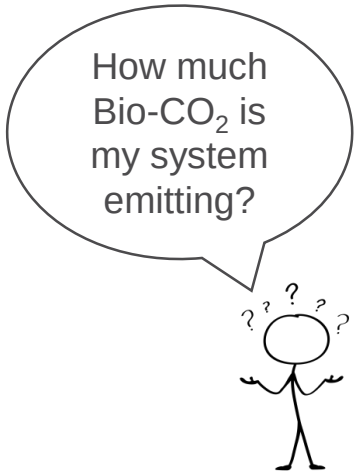
SKANSKA

4 General Approaches to Forest Product LCA Calculations



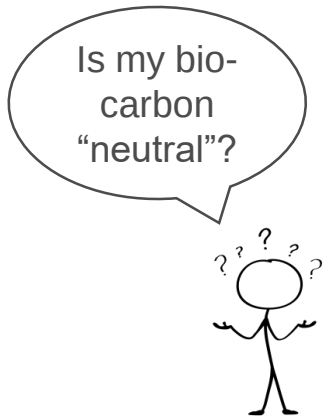
1. CO_2 is removed from the atmosphere before harvesting while the tree is growing
2. CO_2 is removed from the atmosphere after harvest by the trees that replace the tree that was harvested
3. CO_2 is removed from the atmosphere in the year of harvest by non-harvested trees growing across the landscape
4. Any of the previous approaches adjusted to account for foregone sequestration

So the answer to the question is…… it depends



The traditional LCA approach (Approach 1) results in biogenic carbon being "neutral" in most circumstances

- It can miss deforestation unless constraints are added
- It can miss forests that gain carbon over time



The landscape or supply area approach (Approach 3) is best aligned with wood procurement practices

- Where supply area carbon stocks are ~~stable~~ non-declining over time, biogenic carbon ~~is~~ can be conservatively simplified as "neutral".
- It can include effects of ~~deforestation~~ carbon gains and losses, although the impact depends on the scale used to define the supply area
- It may be difficult to isolate the C uptake due to our product

MOVING BEYOND NEUTRALITY

A basic formula for adding non-zero forest carbon balance to existing LCAs

Environmental Impact Assessment Review 29 (2009) 165–168

Contents lists available at ScienceDirect

Environmental Impact Assessment Review

journal homepage: www.elsevier.com/locate/eiar

Goodbye to carbon neutral: Getting biomass footprints right

Eric Johnson *

Atlantic Consulting, Obstgartenstrasse 14, CH-8136 Gattikon, Switzerland

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Keywords:
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Sequestration credits
Carbon footprinting
LCA

ABSTRACT

Most guidance for carbon footprinting, and most published carbon footprints or LCAs, presume that biomass heating fuels are carbon neutral. However, it is recognised increasingly that this is incorrect: biomass fuels are not always carbon neutral. Indeed, they can in some cases be far more carbon positive than fossil fuels. This flaw in carbon footprinting guidance and practice can be remedied. In carbon footprints (not just of biomass or heating fuels, but all carbon footprints), rather than applying sequestration credits and combustion debits, a 'carbon-stock change' line item could be applied instead. Not only would this make carbon footprints more accurate, it would make them consistent with UNFCCC reporting requirements and national reporting practice.

There is a strong precedent for this change. This same flaw has already been recognised and partly remedied in standards for and studies of liquid biofuels (e.g. biodiesel and bioethanol), which now account for land-use change, i.e. deforestation. But it is partially or completely missing from other studies and from standards for footprinting and LCA of solid fuels.

Carbon-stock changes can be estimated from currently available data. Accuracy of estimates will increase as Kyoto compliant countries report more land use, land use change and forestry (LULUCF) data.

1. **Calculate carbon stock change in the forest**
   Account for carbon gains and losses from an area of interest over a specific timeframe.

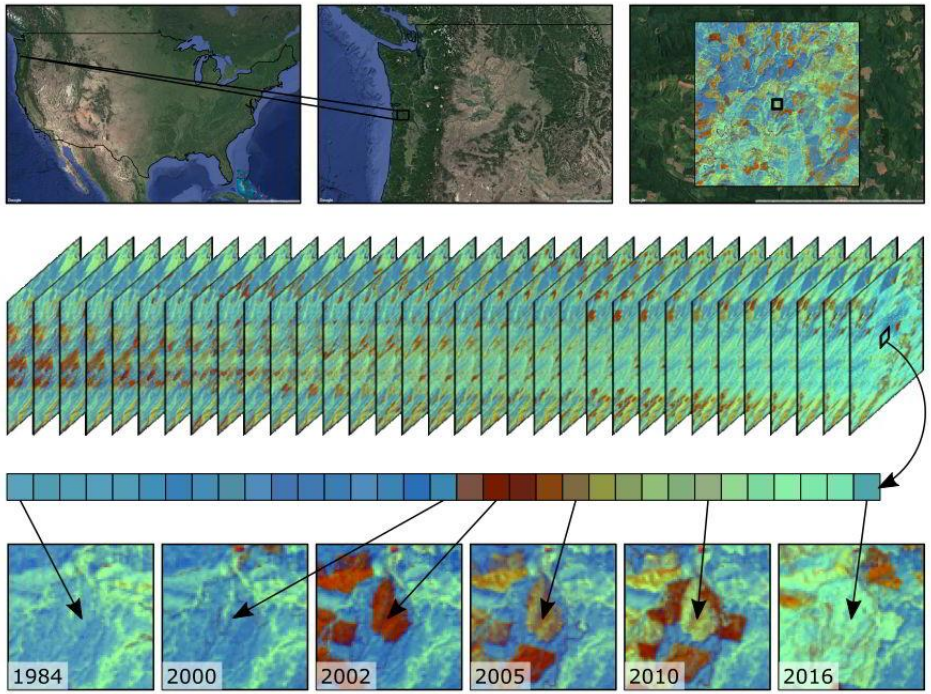
2. **Calculate timber output**
   Total output of industrial roundwood from same area and timeframe.

3. **Calculate “upstream” embodied carbon**
   Divide #1 by #2 to calculate “upstream” embodied carbon for the area of interest over a specific timeframe.

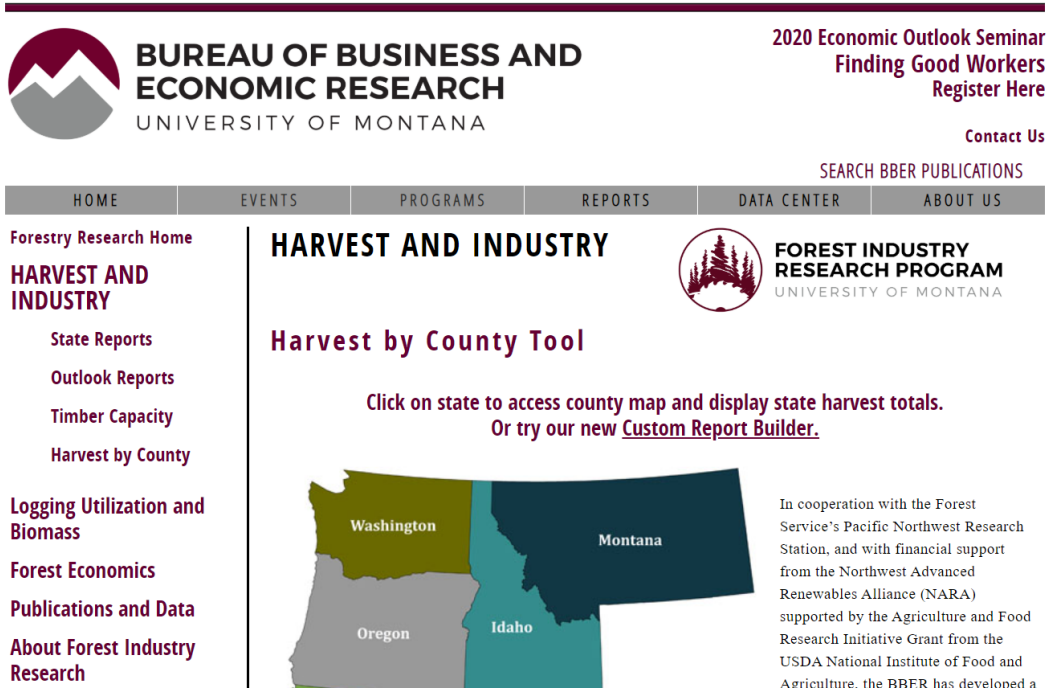
   - This “upstream” embodied carbon is cleanly separated from “downstream” stocks and fluxes which are comparatively well-reflected in existing LCIs, LCAs, and EPDs for forest products.

UTILIZE OBSERVATIONAL DATA

Time series of forest conditions and timber outputs



The Landtrendr approach is applied in a project funded by NASA Carbon Monitoring System to provides wall-to-wall (30x30m) biomass estimates from 1986-2018.



Coincident annual timber harvest records exist at the county-level by owner group
(Industry, NIPF + Tribal, State, USFS, BLM)

- Periodic reporting available by broader owner groups across every state.

1. Calculate carbon stock change in the forest

Using NASA CMS data, convert biomass (Mg) to carbon ($kgCO_2e$) and subtract total carbon stock in at the end of the period from carbon stock at the beginning.

2. Calculate timber output

Using independent timber output reports, calculate total timber produced over specified timeframe, convert Scribner boardfeet to cubic meters of industrial roundwood (assuming 0.1395 MBF per m^3).

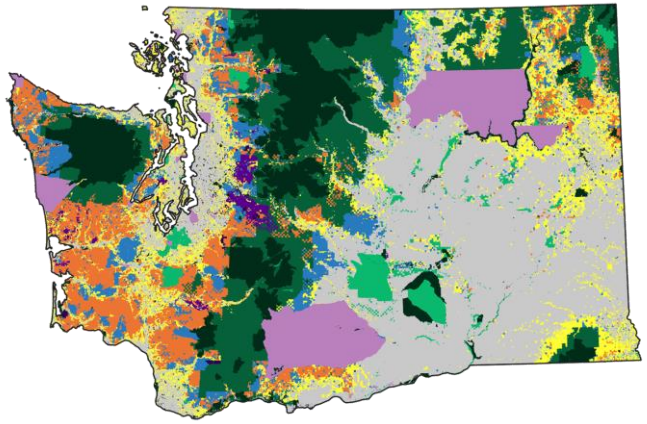
3. Calculate "upstream" embodied carbon

Divide #1 by #2 to calculate "upstream" embodied carbon ($kgCO_2e$ /m^3) for that area of interest over the specified timeframe.

- The following example covers non-reserved forests of Washington State from 1990-2016.

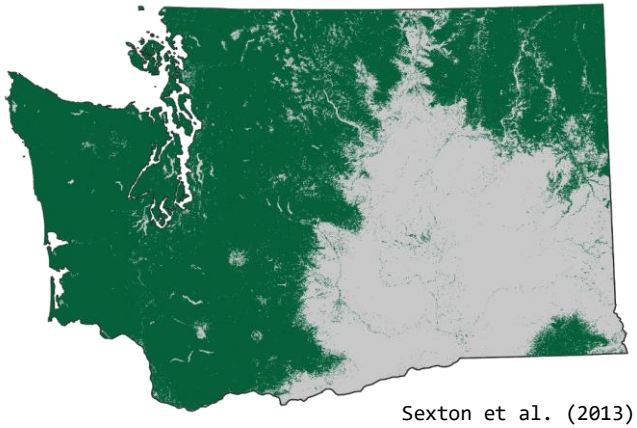
OWNERSHIP

from RTI, PADUS, and US Census data



FOREST COVER

in 2000, 2005, 2010, or 2015



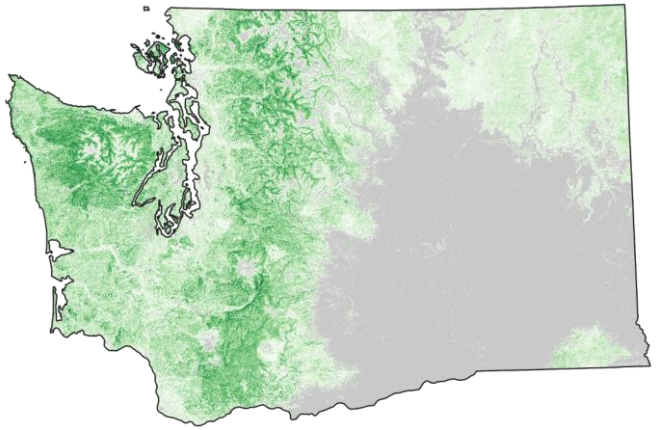
Sexton et al. (2013).
"GFCC30TC" https://cmr.earthdata.nasa.gov

COUNTIES

to indicate "woodsheds"

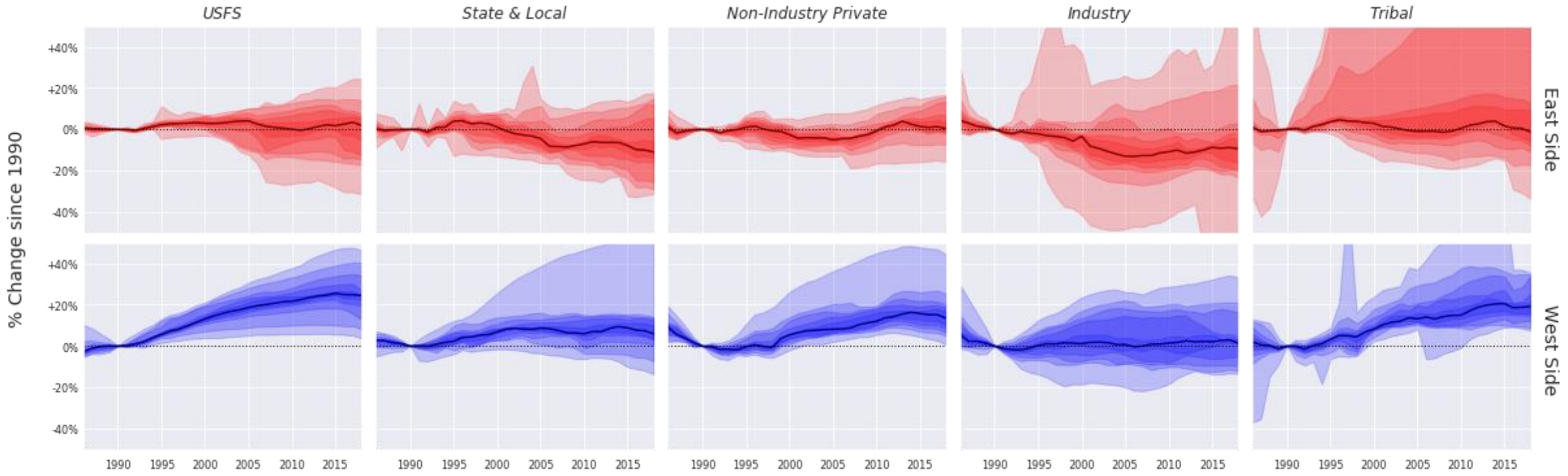
BIOMASS

from Landtrendr 1986-2018



WASHINGTON OWNERS SHAPE CARBON BALANCE

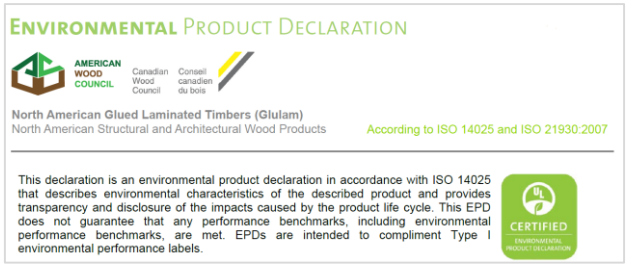
Benchmarking carbon stock change against 1990 levels



Note: These graphs illustrate the distribution of proportional carbon stock change among counties. The dark line represents the median county for that owner type in that region. Moving away from the median, shaded areas correspond to the 40-60th percentiles, 30-70th, etc.

UNPACKING GLULAM'S EMBODIED CARBON

Contextualizing the magnitude of emissions and sequestration from a smattering of EPDs and LCAs


ENVIRONMENTAL PRODUCT DECLARATION

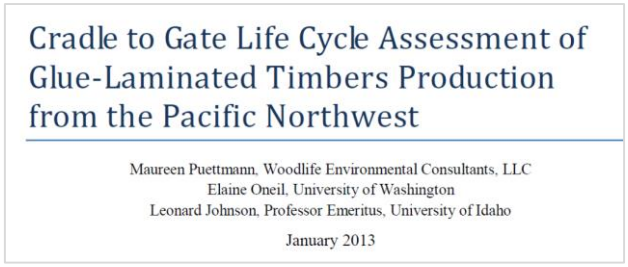
AMERICAN WOOD COUNCIL — Canadian Wood Council — Conseil canadien du bois

North American Glued Laminated Timbers (Glulam)
North American Structural and Architectural Wood Products

According to ISO 14025 and ISO 21930:2007

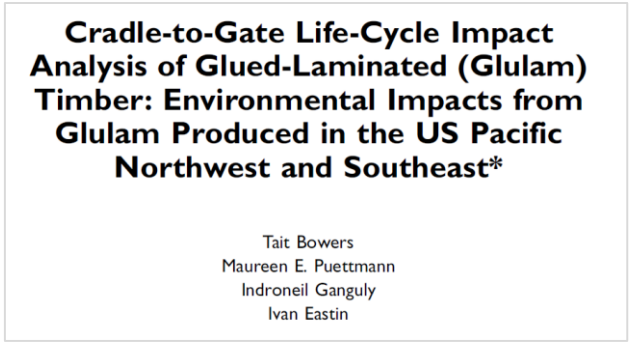
This declaration is an environmental product declaration in accordance with ISO 14025 that describes environmental characteristics of the described product and provides transparency and disclosure of the impacts caused by the product life cycle. This EPD does not guarantee that any performance benchmarks, including environmental performance benchmarks, are met. EPDs are intended to compliment Type I environmental performance labels.

CERTIFIED


Cradle to Gate Life Cycle Assessment of Glue-Laminated Timbers Production from the Pacific Northwest

Maureen Puettmann, Woodlife Environmental Consultants, LLC
Elaine Oneil, University of Washington
Leonard Johnson, Professor Emeritus, University of Idaho

January 2013


Cradle-to-Gate Life-Cycle Impact Analysis of Glued-Laminated (Glulam) Timber: Environmental Impacts from Glulam Produced in the US Pacific Northwest and Southeast*

Tait Bowers
Maureen E. Puettmann
Indroneil Ganguly
Ivan Eastin

With 1 m^3 of industrial roundwood, we can produce ~0.42 m^3 of glulam (58% of roundwood meets another fate).

Per 1 m^3 of industrial roundwood used for glulam, we get the following embodied carbon footprint:

+5 $kgCO_2e$ / m^3 roundwood - Forest Operations

+20 $kgCO_2e$ / m^3 roundwood - Lumber Production

+20–40 $kgCO_2e$ / m^3 roundwood - Glulam Production

-375–455 $kgCO_2e$ / m^3 roundwood - Retained in Product

OWNERS SHAPE EMBODIED CARBON

Looking back on Washington's non-reserved forests from 1990-2016

EAST SIDE

"upstream" embodied carbon ($kgCO_2e/m^3$ roundwood)

county percentiles	0 (min)	5	25	50 (median)	75	95	100 (max)
USFS	-1,567	-1,524	-744	-234	+1,861	+6,417	+9,028
State & Local	-457	-448	-271	+137	+335	+1,070	+1,473
Non-Industry Private	-1,058	-677	-105	-20	+18	+644	+1,069
Industry	-700	-624	0	+138	+298	+424	+485

WEST SIDE

"upstream" embodied carbon ($kgCO_2e/m^3$ roundwood)

county percentiles	0 (min)	5	25	50 (median)	75	95	100 (max)
USFS	-27,565	-18,036	-8,360	-7,751	-4,634	-2,256	-616
State & Local	-3,859	-1,652	-504	-131	-61	+157	+200
Non-Industry Private	-910	-694	-143	-111	-88	-63	-47
Industry	-250	-223	-119	-40	+86	+153	+178

Note: Percentiles indicate distribution among counties, not adjusted/normalized by timber output.

OWNERS SHAPE EMBODIED CARBON

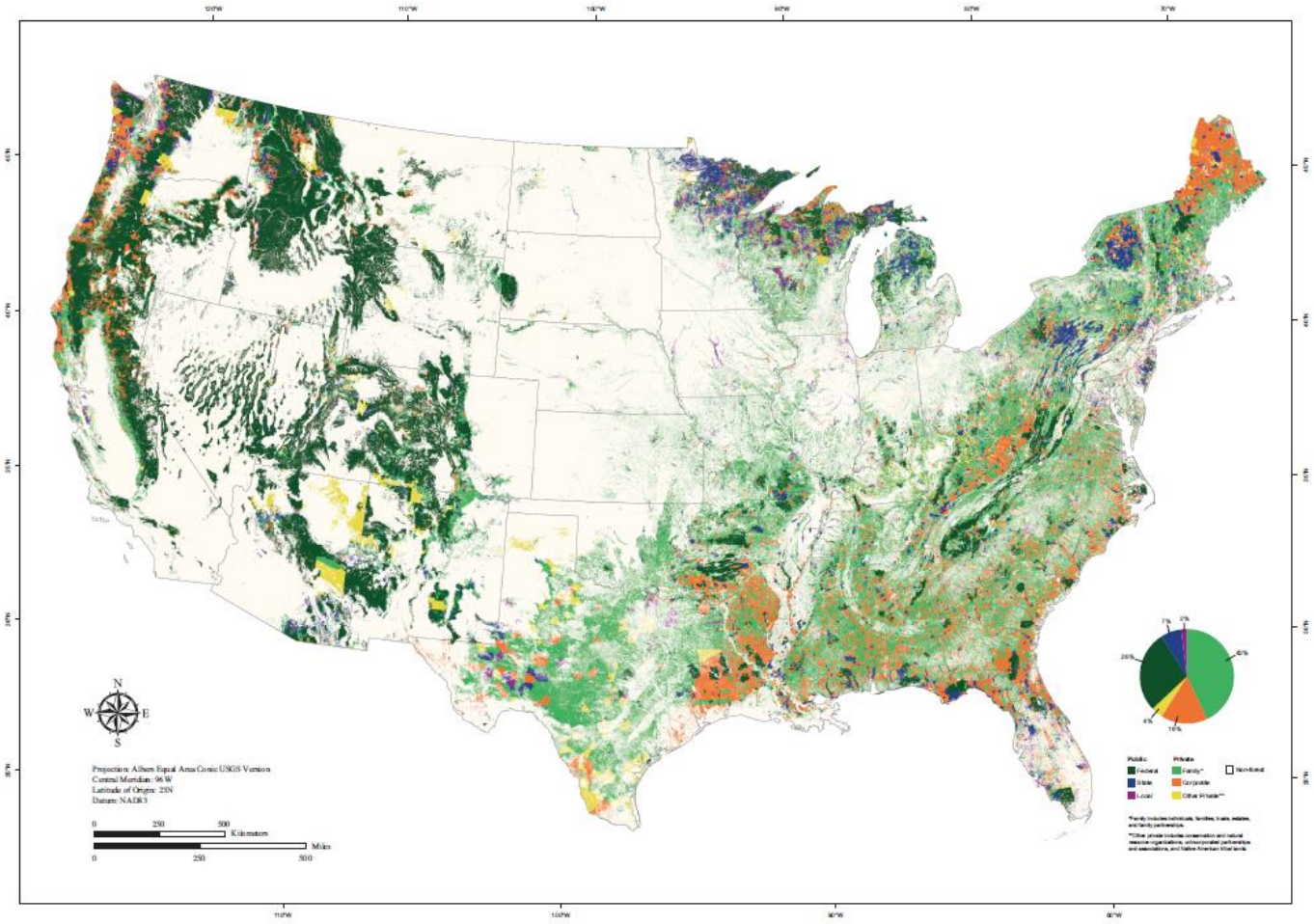
Looking back on Washington's non-reserved forests from 1990-2016

	"upstream" embodied carbon ($kgCO_2e/m^3$ roundwood)									Average Annual Timber Output (2012 - 2017)	
timber supply percentiles	10	20	30	40	50	60	70	80	90	%	MMBF
Industry	-238	-208	-149	-54	-24	-1	+73	+159	+181	40%	1,665
Non-Industry Private	-162	-134	-114	-101	-94	-86	-68	-51	+5	29%	1,203
State & Local	-364	-195	-178	-116	-89	-81	-64	+48	+150	24%	988
USFS	-7,163	-5,021	-4,725	-3,521	-1,190	-896	-221	+1,974	+3,390	3%	133
Other Federal	-1,100	-916	-916	-71	-71	-71	-71	+699	+4,111	1%	43

Note: Percentiles indicate distribution across counties weighted by timber output.

GOING NATIONAL

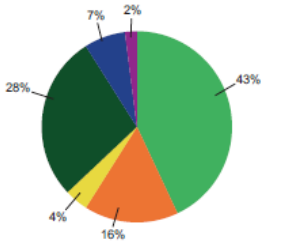
Embodied carbon disclosure will be coming to US forests soon



USDA United States Department of Agriculture

Distribution of Six Forest Ownership Types in the Conterminous United States

Jaketon H. Hewes, Brett J. Butler, Greg C. Liknes, Mark D. Nelson, and Stephanie A. Snyder



*Family includes individuals, families, trusts, estates, and family partnerships.

**Other private includes conservation and natural resource organizations, unincorporated partnerships and associations, and Native American tribal lands.

"All models are wrong but some are useful." -- George E.P. Box

If you're trying to guide a decision about an individual action you should take or not take (e.g., what materials to use in a building project), then attributional LCA may be "good enough" *(if you're comfortable with your simplifying assumptions)*…

… but if you're trying to make sweeping (policy) decisions that will impact broader social, economic, and ecological systems, attributional LCA is <u>probably not</u> "good enough."

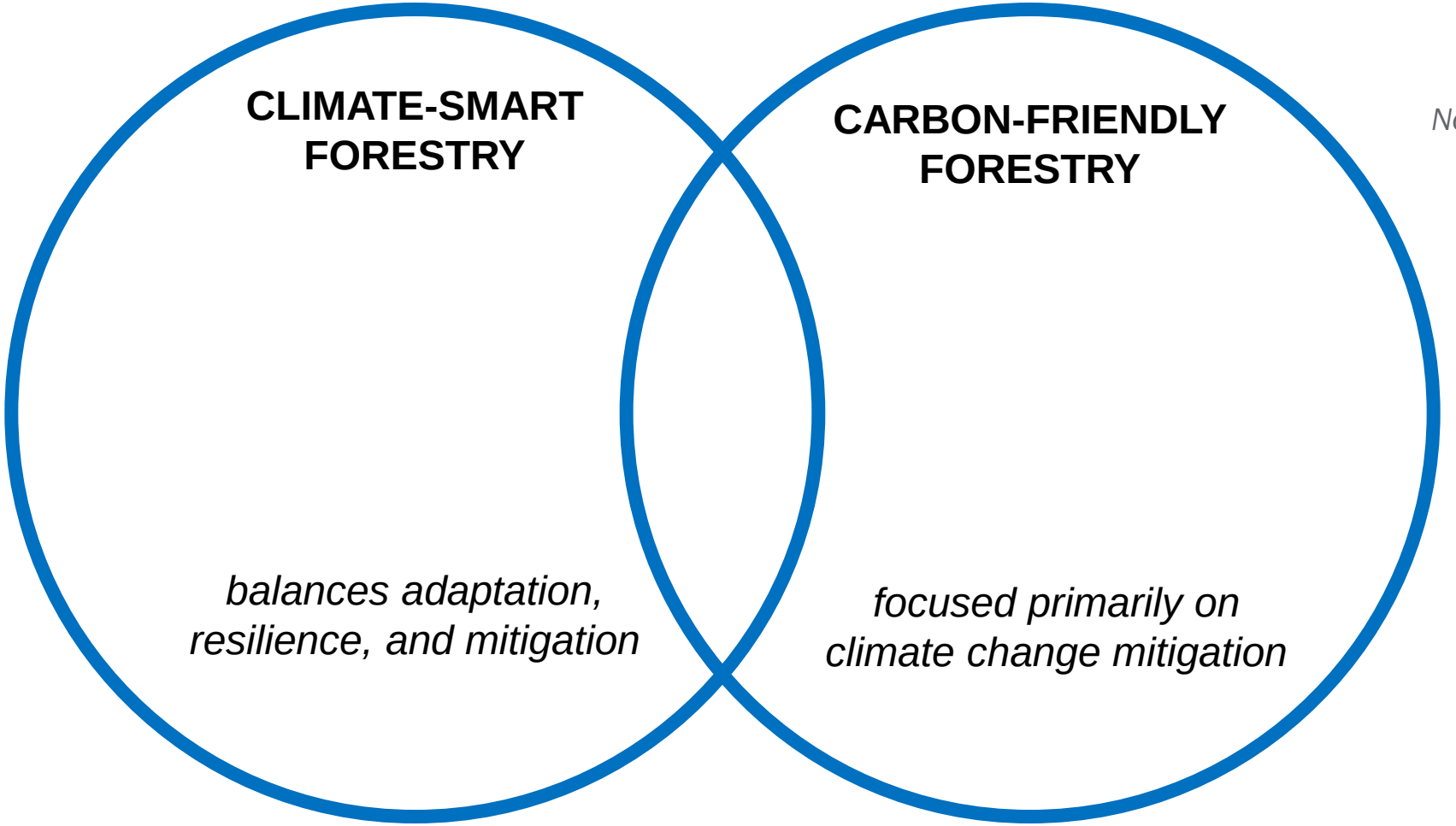
- To identify and address relevant (policy) questions and tradeoffs, you need to enter the realm of counter-factual (or "what if…") scenario modeling to, however crudely, interrogate how market, policy, and social and environmental interactions and impacts would occur with and without certain interventions.

Carbon Leadership Forum

…and why carbon-friendly forestry is not always climate-smart forestry

CARBON-FRIENDLY vs. CLIMATE-SMART

Carbon is the tail, not the dog

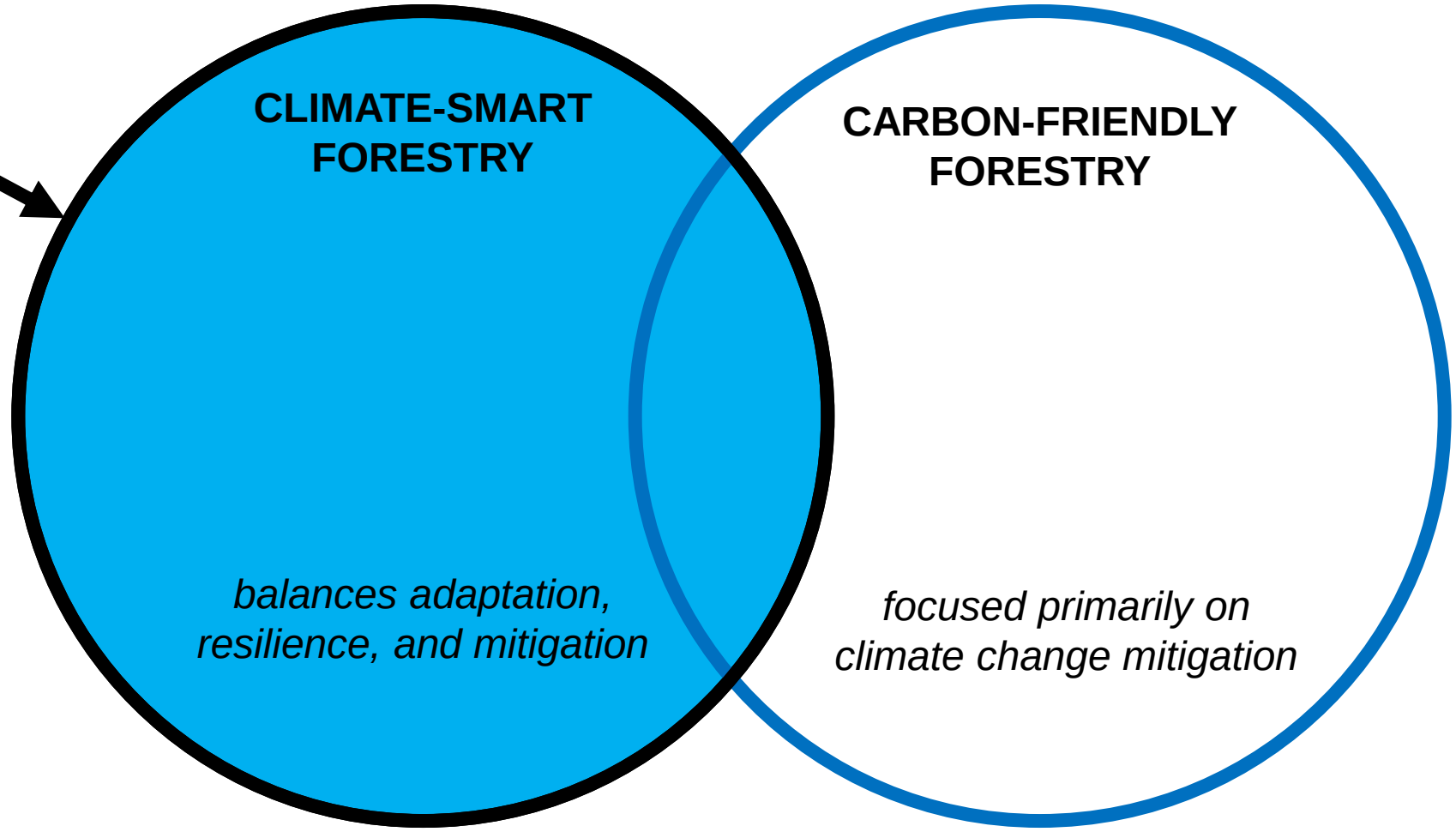


Note: Not drawn to scale :)

CARBON-FRIENDLY vs. CLIMATE-SMART

Carbon is the tail, not the dog

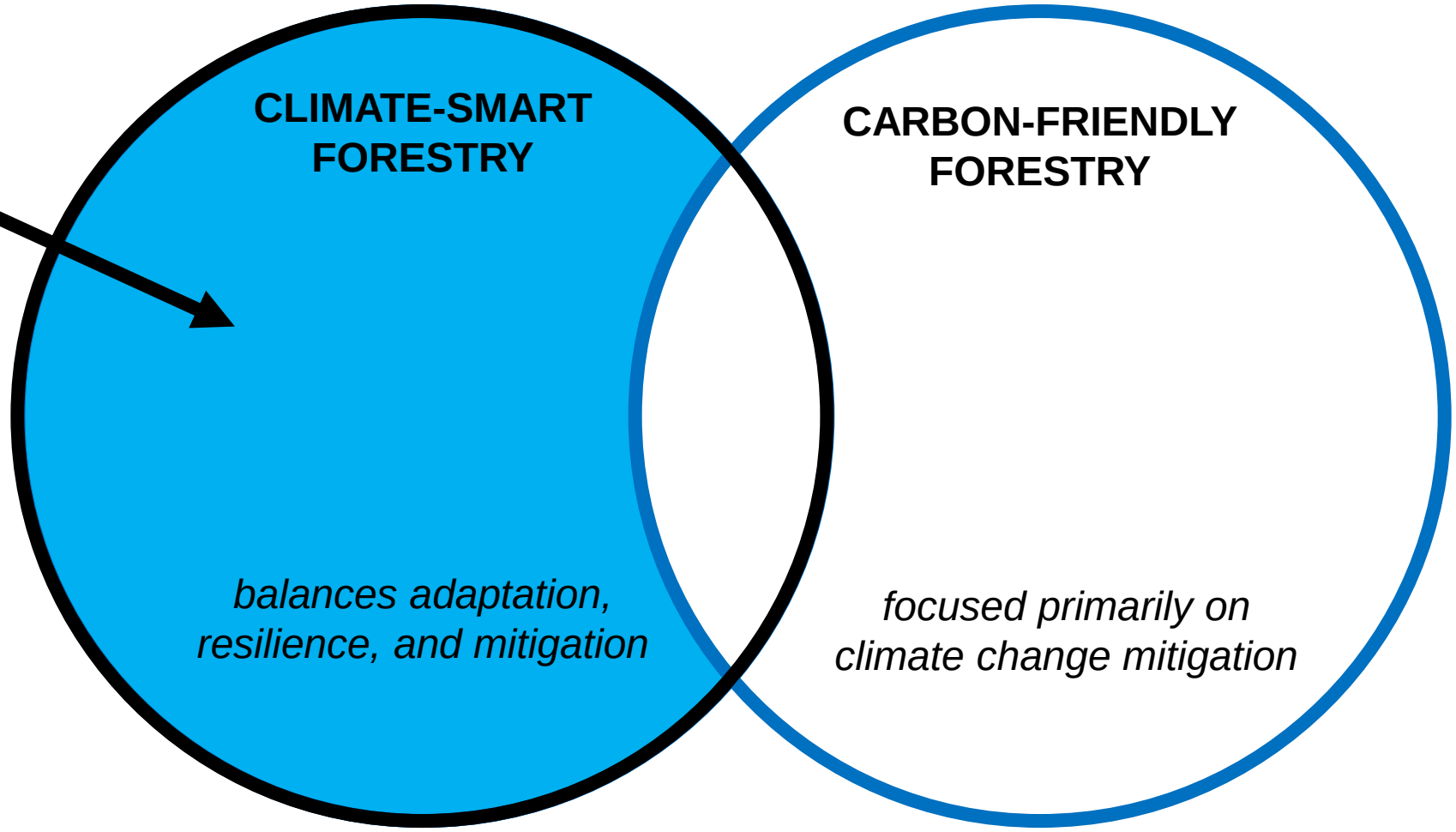
YOU SHOULD BUY MORE (OF THIS) WOOD



CARBON-FRIENDLY vs. CLIMATE-SMART

Carbon is the tail, not the dog

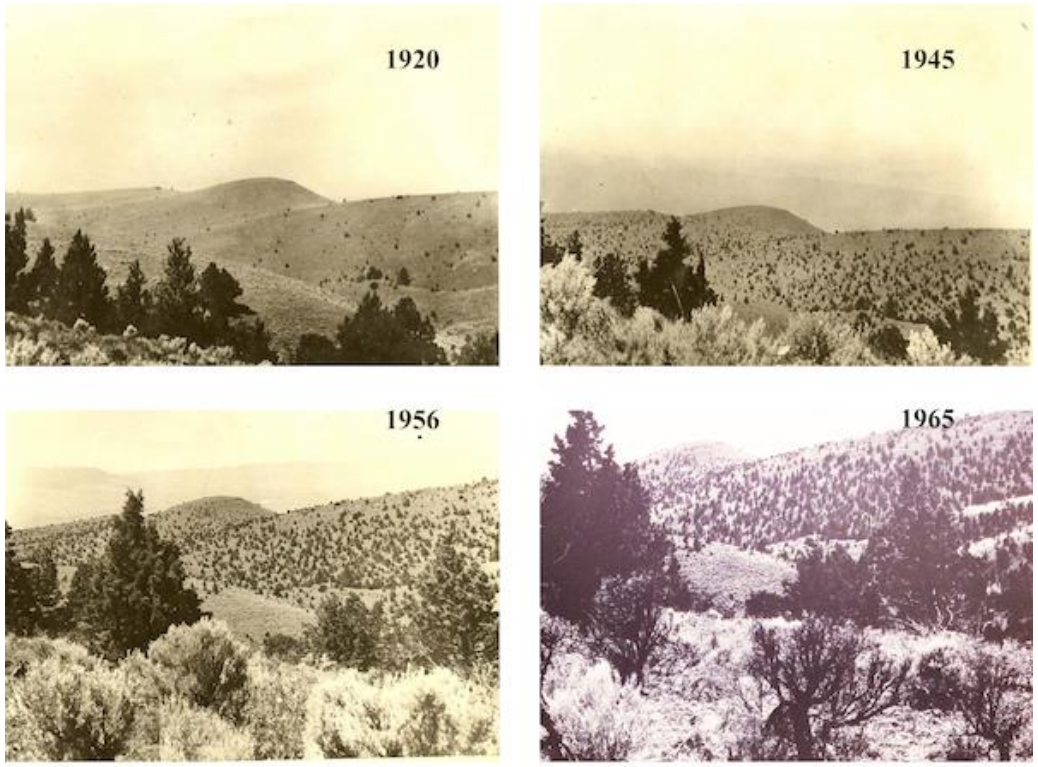
BUT WHAT IS ALL THIS ABOUT?



CARBON-FRIENDLY vs. CLIMATE-SMART

Carbon is the tail, not the dog

These photos, taken over a 45-year period, document the spread of western juniper in the mainstream John Day River valley near Dayville.



Credit: Sustainable Northwest.
https://greatnorthwestwine.com/2016/05/11/a-to-z-wineworks-puts-western-juniper-use-vineyards/

ELSEVIER

Rangeland Ecology & Management

Volume 70, Issue 1, January 2017, Pages 87-94

Bird Responses to Removal of Western Juniper in Sagebrush-Steppe ☆

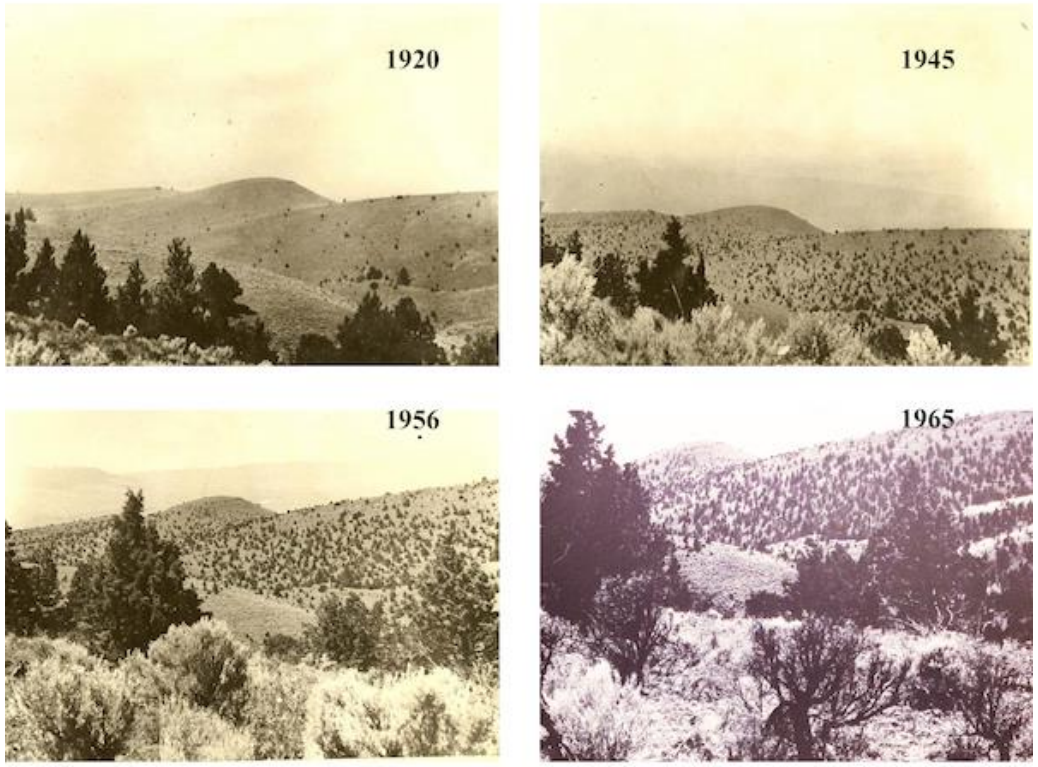
Aaron L. Holmes [a, b] ✉, Jeremy D. Maestas [c], David E. Naugle [d]

"This study demonstrates that conifer removal projects designed to retain shrub cover and structure can have benefits to multiple species of ground and shrub nesting birds, including several species of conservation concern."

CARBON-FRIENDLY vs. CLIMATE-SMART

Carbon is the tail, not the dog

These photos, taken over a 45-year period, document the spread of western juniper in the mainstream John Day River valley near Dayville.



Credit: Sustainable Northwest.
https://greatnorthwestwine.com/2016/05/11/a-to-z-wineworks-puts-western-juniper-use-vineyards/

ELSEVIER

Rangeland Ecology & Management
Volume 70, Issue 1, January 2017, Pages 116-128

Ecosystem Water Availability in Juniper versus Sagebrush Snow-Dominated Rangelands ☆

Patrick R. Kormos [a] ✉, Danny Marks [a], Frederick B. Pierson [a], C. Jason Williams [a], Stuart P. Hardegree [a], Scott Havens [a], Andrew Hedrick [a], Jonathan D. Bates [b], Tony J. Svejcar [b]

"…juniper-dominated catchments have… earlier snow melt, and less streamflow relative to sagebrush-dominated catchments….

The delayed water input… has wide-ranging implications for available surface water, soil water, and vegetation dynamics associated with wildlife habitat..."

CARBON-FRIENDLY vs. CLIMATE-SMART

Carbon is the tail, not the dog

Credit: Marcus Yam/Los Angeles Times.
https://www.sandiegouniontribune.com/news/watchdog/story/2019-12-22/how-new-utility-law-shifts-13-5-billion-of-future-wildfire-damages-to-consumers

Credit: USDA Forest Service.
https://www.fs.usda.gov/Internet/FSE_MEDIA/stelprdb5424132.jpg

CARBON-FRIENDLY vs. CLIMATE-SMART

Carbon is the tail, not the dog

https://dw.maps.arcgis.com/apps/Cascade/index.html?appid=5fadefb8803d44a3b3ef128528e38eac

CARBON-FRIENDLY vs. CLIMATE-SMART

Carbon is the tail, not the dog

Credit: The Nature Conservancy
https://www.nature.org/en-us/newsroom/forest-restoration-in-the-upper-south-platte-watershed-colorado/

THANK YOU.

David Diaz

ddiaz@ecotrust.org

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School of Environmental and Forest Sciences
Center for Sustainable Forestry
at Pack Forest