



Generating a time series of forest change to enable supply chain monitoring and reporting for Climate Smart Commodities in the USA

David Diaz

Dec 9, 2024

+ Vibrant Planet:

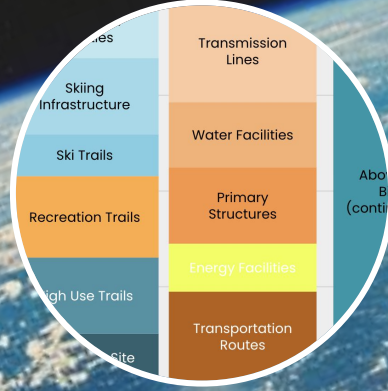
A common operating picture for climate resilience



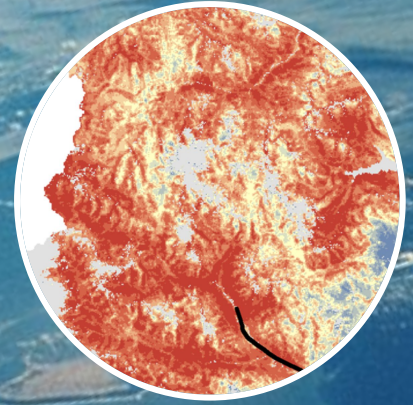
3D foundational vegetation base level



Synthetic canopy height modeling



Complex socio-ecological quantification



Leading hazard risk visualization



Building the Climate-Smart Wood Economy

Partnership for Climate-Smart Commodities Grant Team



**NORTHWEST
NATURAL
RESOURCE
GROUP**



Ecotrust



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Projects must...

Building Markets and Investing in America's Climate-Smart Farmers, Ranchers & Forest Owners to Strengthen U.S. Rural and Agricultural Communities

Fiscal Year (FY) 2022
Partnerships for Climate-Smart
Commodities
National Funding Opportunity (NFO)

No. USDA-NRCS-COMM-22-NOFO0001139



- Pilot implementation of climate-smart practices on a large-scale
- Include meaningful involvement of small or historically underserved producers
- Produce quantification, monitoring, reporting, and verification plans
- Develop markets and promote climate-smart commodities generated

Shift to focus on embodied carbon



Embodied Carbon

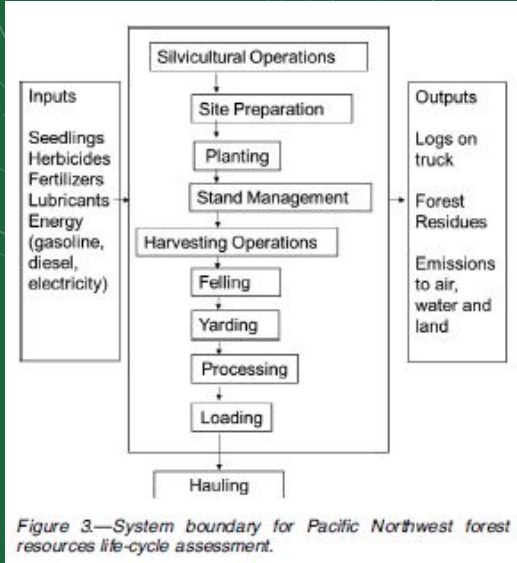
Manufacture, transport and installation of construction materials

Operational Carbon

Building energy consumption

Attributional Accounting

Attributional LCA, v1.0

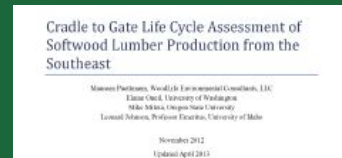
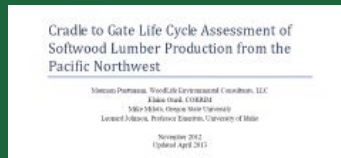


Oneil and Puettmann (2017). "A Life-Cycle Assessment of Forest Resources of the Pacific Northwest, USA." *Forest Products Journal* 67(5-6): 316-330.

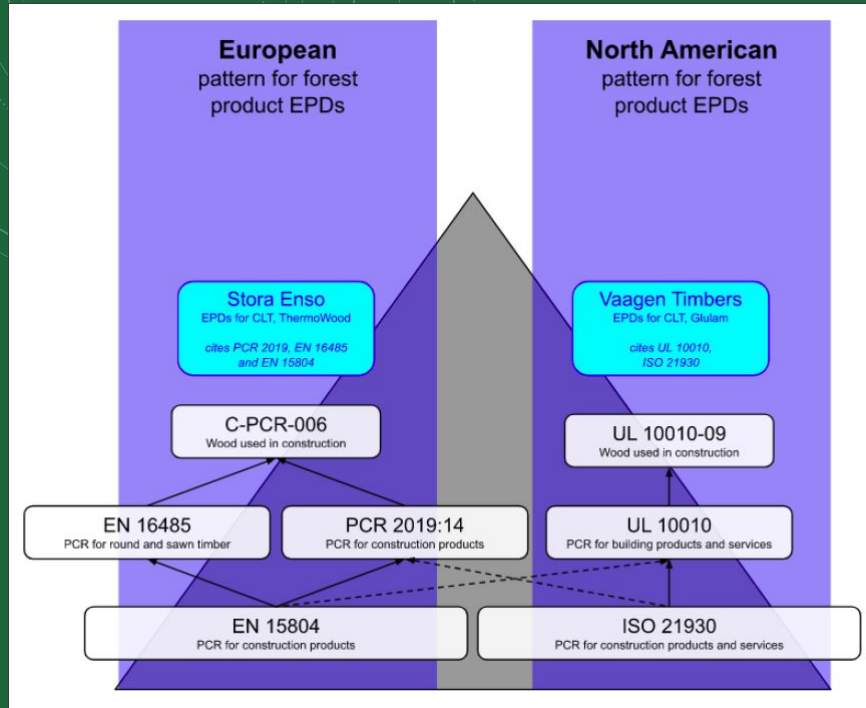
Average inputs and outputs from industrial forest practices evaluated at regional extents for PNW, SE, and Canada.

Does not track or report observed forest carbon stock changes at local or regional scales.

Used to generate Environmental Product Declarations that provide "cradle-to-gate" impact estimates per unit of product.



Environmental Product Declarations



Hierarchy of standards governing application of LCA for product specific declarations which report “cradle-to-gate” impact estimates per unit of product.

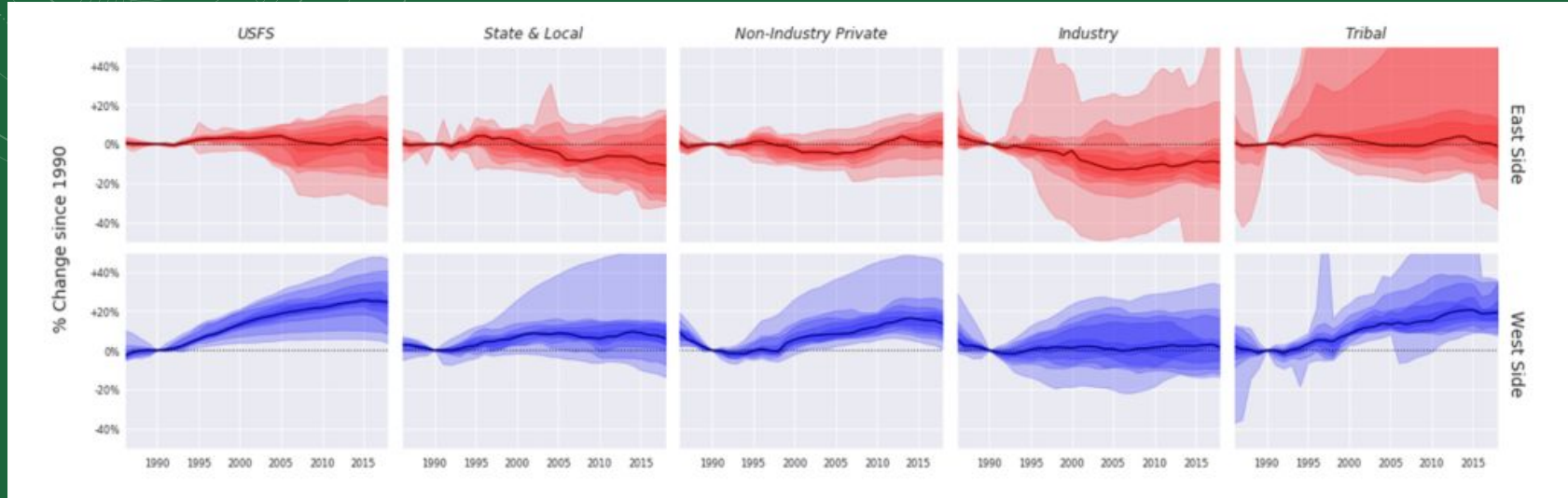
Two poorly integrated sets of standards operating in North America vs. Europe.

Neither system meaningfully addresses observable carbon stock changes due to forest land use or land-use change.

Blanket use of “biogenic carbon neutrality”.

Forest Management Matters

Landowners shape forest carbon balance



Benchmarking Washington forest owner types by county against their 1990 carbon stocks.

Not Neutral

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

1. Calculate carbon stock change in the forest

Account for carbon gains and losses from a specific area 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 timber supply area.



Calculating a Land Carbon Accounting Factor in the United States: an Example and Implications [Get access >](#)

Stephen P Prisley, Edie Sonne Hall

Journal of Forestry, Volume 122, Issue 1, January 2024, Pages 1-12, <https://doi.org/10.1093/jofore/fvad037>

[10.1093/jofore/fvad037](https://doi.org/10.1093/jofore/fvad037)

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Monitoring & Reporting Framework

Our work follows from global and national standards, advice from industry experts, a proof-of-concept study, and user-centered design

ENVIRONMENTAL PRODUCT DECLARATION NORTH AMERICAN GLUED LAMINATED TIMBER



The American Green Council (AGC) and the Canadian GreenWood (CGW) are pleased to present the Environmental Product Declaration (EPD) for North American Green Laminated Timber (GLT). This EPD provides the carbon footprint for the entire life cycle of the product, from the raw materials to the manufacturing process. The underlying data is based on the average of the manufacturing with 10, 14, 20, 25, and 30% moisture content. The underlying data is based on the average of the manufacturing with 10, 14, 20, 25, and 30% moisture content. The underlying data is based on the average of the manufacturing with 10, 14, 20, 25, and 30% moisture content.



Intergovernmental Panel on Climate Change Good Practice Guidance for Land Use, Land-Use Change and Forestry

Edited by
Jon Pearson, Michael Oromsky, Taha Elshakibi, Thomas Krug, Dana Krugler,
Fátima Ruyter, Leticia Quintanilla, Scotty Adams, Tihao Yin, and
Elyse Tanshe and Fabian Wagner



IPCC National Greenhouse Gas Inventories Programme



Land Sector and Removals Guidance Part 2: Calculation Guidance

Supplement to the GHG Protocol Corporate Standard
and Scope 3 Standard

DRAFT FOR PILOT TESTING AND REVIEW
(SEPTEMBER 2022)



Exploring the landscape of embodied carbon

FORESTS & ECOSYSTEM SERVICES

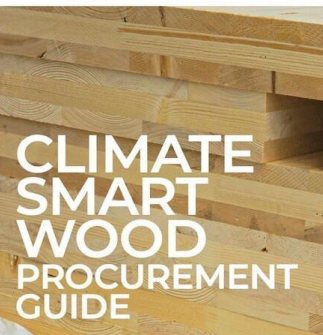
A new look at the relationship
between forest land ownership,
timber production, and climate in
the Pacific Northwest.

We are in the midst of an unprecedented explosion in the volume of data flowing from satellites that now offer imagery of Earth's surface on an almost-daily basis. The raw imagery alone allows us to quickly see how the Earth changes over time. It's hard not to marvel at how ingeniously these images reveal the complexity and beauty of our planet's diverse places and their dynamic nature.

Ecotrust

The real power to learn about what's happening on our planet, and particularly to our forests, emerges more clearly when we figure out how to systematically translate the raw data to each of these pixels (including wavelengths of light not visible to the human eye) to information we can readily understand and interpret, such as the amount of canopy cover, abundance of different species, the size or volume of trees, and types of disturbances. For those of us working at the intersection of equity, economy, and the environment, we are just beginning to scratch the surface of a treasure trove of imagery blanketing our planet that reaches back nearly 50 years.

The image: The mouth of the Columbia River on June 1, 2019. The Sentinel-2 satellite on September 2, 2019.



Options for procuring climate-smart wood



vibrant planet

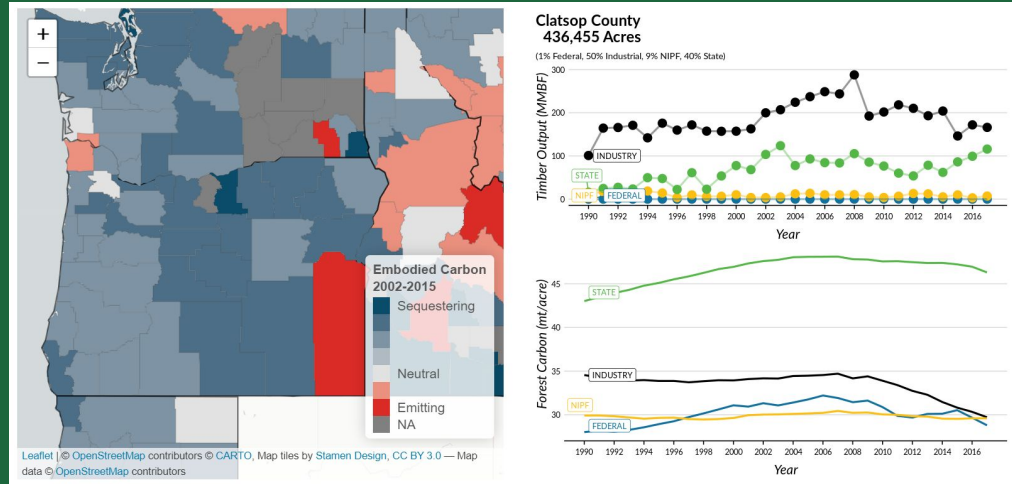
What we're reporting

Time series of carbon, timber output, and embodied carbon factors from 2000-present, summarized for different owner types and geographic scales:

- Individual forest owners
- Woodsheds for sawmills
- Jurisdictions (county to multi-state)

Additional land use tracking metrics

- Carbon stocking vs. unmanaged reference
- Land use intensity (timber output per area)
- Forest loss and other land-use changes
- Natural disturbance extent and severity



Example of an interactive map and data visualization highlighting carbon stocking and timber output of owner types and regions across the Pacific Northwest. Developed by Ecotrust for [Exploring the landscape of embodied carbon](#).

<https://ecotrust.org/mapping-the-northwests-working-forests>

Cooperating on Platform Development

1. Develop Methodology Ecotrust + Vibrant Planet

- Define impact assessment methods and reporting framework
- Prototype impact assessment with public datasets

3. Modeling & Inference Vibrant Planet

- Data updated ≤ annually and subjected to QA/QC.
- Impact estimates modeled to ensure reporting is accurate, consistent, and reproducible.

1. Develop Methodology

2. Prepare Novel Data

3. Data Processing

4. Ingest Data into Tool for
Visualization & Reporting

2. Hone Data Pipeline Vibrant Planet + Ecotrust

- Develop data pipelines and analytical processes
- Bring estimates of forest carbon stocking, disturbance, and timber removals up to the present and into the future.

4. Reporting & Visualization VP Data Commons + Ecotrust

- Impact data translated into a user-centered online reporting system
- Web app highlights forest impacts associated with timber production

Forest Modeling & Inference

Generating consistent and actionable forest trends.

1. Start with Small Area Estimation.

Use geospatial data on annual forest biomass, ownership, reserved status, and timber output.

- Condition remote sensing estimates on annual FIA inventory and Timber Product Output (TPO) surveys.
- Package independent datasets with plot- and stand-based measurements for benchmarking quality of RS-derived layers at stand- and property-scales.

2. Progress to State-Space Modeling

Generate time-series of forest growth, mortality, and removals, employing process-based growth model and infer disturbance impact factors.

- Ensure time-series of forest change is coherent (simple process model) and changes with detected disturbances
- Condition on annualized FIA and TPO at plot-, county-, and survey-unit scales.
- Validate on independent plot- and stand-based inventory datasets.
- Separate natural disturbance fluxes from timber impact reporting following Canadian approach.

Forest Modeling & Inference

Generating consistent and actionable forest trends.

1. Start with Small Area Estimation.

Use geospatial data on annual forest biomass, ownership, reserved status, and timber output.

- Spatial data: eMapR (2000–2018) + new VibrantBio (2018–present), USFS LCMS disturbance, PAD-US, sawmill database.
- Condition RS estimates against annualized FIA (via rFIA) and TPO at county- and survey-unit scales.
- Package independent benchmarking datasets with plot- and stand-based inventory for evaluating RS-derived layers at stand- and property-scales

2. Progress to State-Space Modeling

Generate time-series of forest growth, mortality, and removals, employing 3-PG Spatial for NPP, infer various disturbance impact factors.

- Spatial data: HLS, TerraClimate, USFS LCMS, SMAP/OpenET
- Condition on annualized FIA and TPO at county- and survey-unit scales.
- Validate on independent plot- and stand-based inventory datasets.
- Separate natural disturbance fluxes from timber impact reporting following Canadian approach.



Thank you.

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