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

David Diaz

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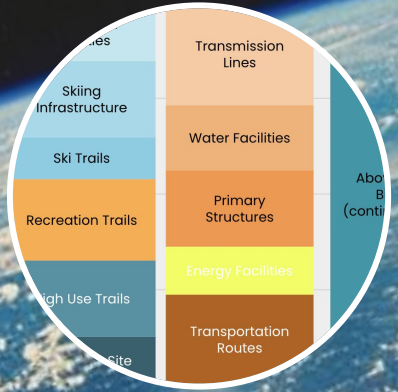
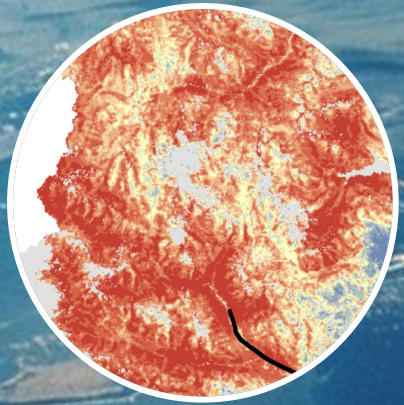
+ Vibrant Planet:
A common operating picture for climate resilience

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

This work is supported by a $25M award from USDA under grant agreement number NR233A75000G042.

Projects must…

- ➔ 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

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Shift to focus on embodied carbon

Skanska

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Attributional Accounting

Attributional LCA, v1.0

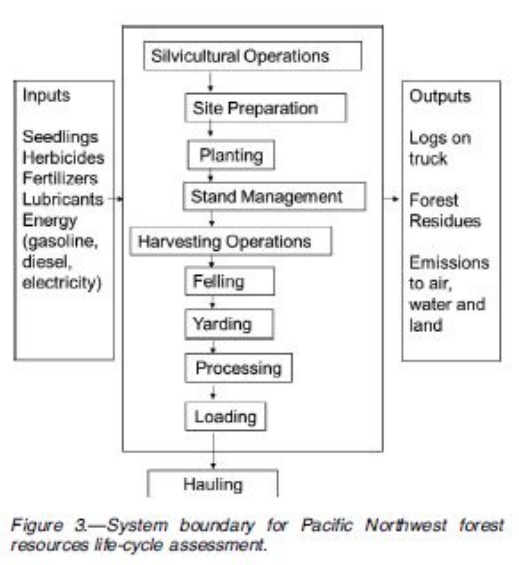


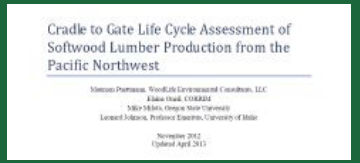
Figure 3.—System boundary for Pacific Northwest forest resources life-cycle assessment.

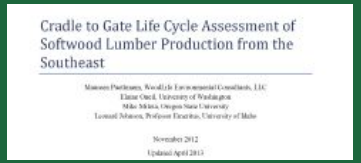
Oneil and Puettmann (2017). "A Life-Cycle Assessment of Forest Resources of the Pacific Northwest, USA." Forest Products Journal 67(5-6): 316-330.

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.


Cradle to Gate Life Cycle Assessment of Softwood Lumber Production from the Pacific Northwest


Cradle to Gate Life Cycle Assessment of Softwood Lumber Production from the Southeast


A Cradle-to-Gate Life Cycle Assessment of Canadian Surfaced Dry Softwood Lumber

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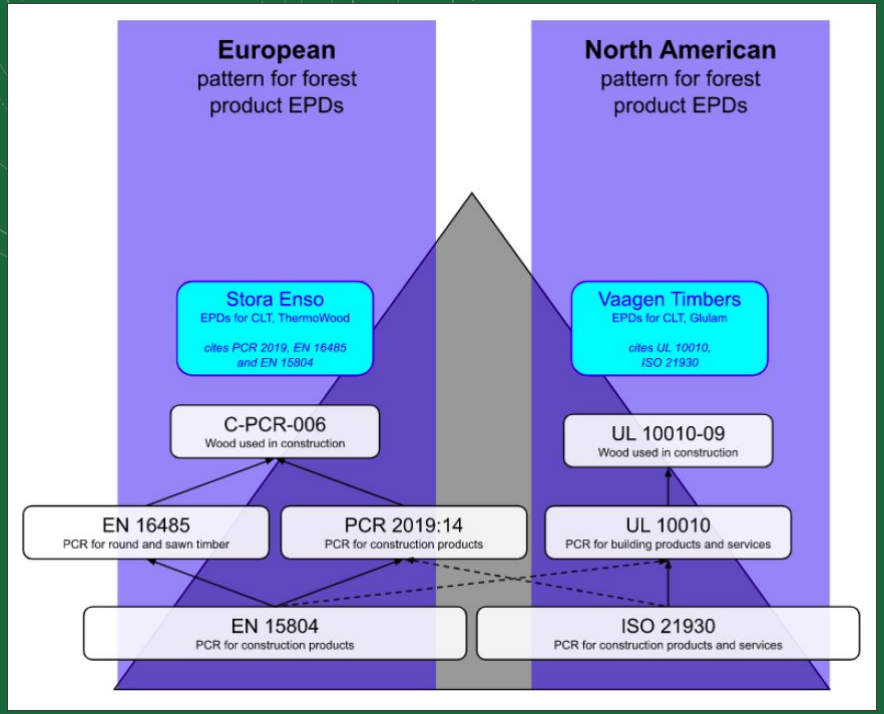
Attributional Accounting

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.

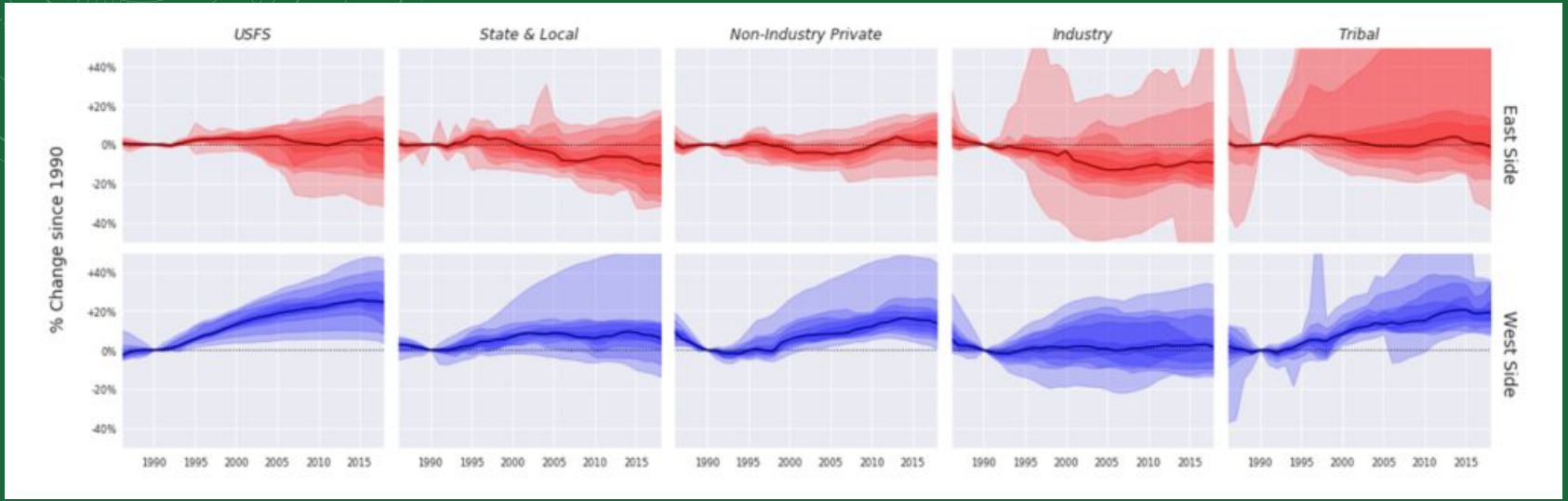
Two poorly integrated sets of standards operating in North America vs. Europe.

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.

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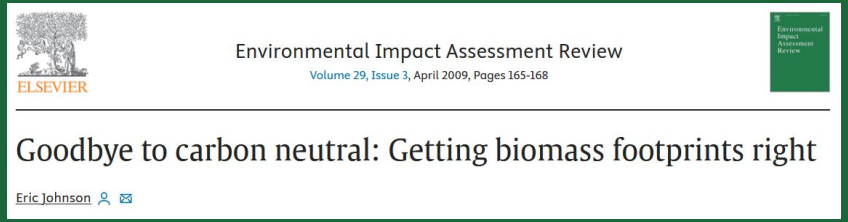
Not Neutral

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.

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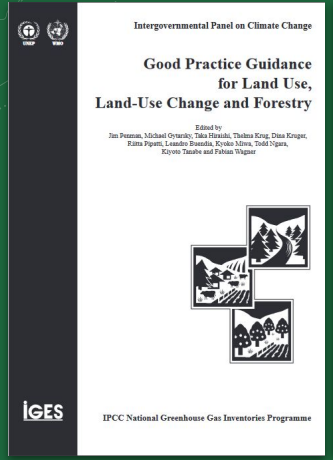
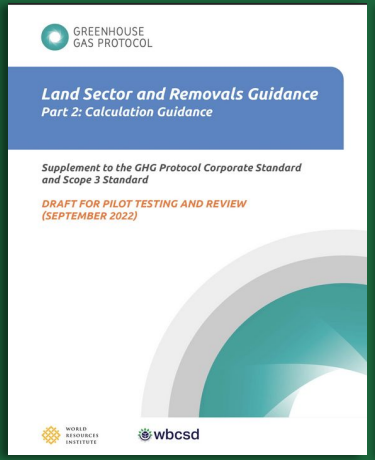
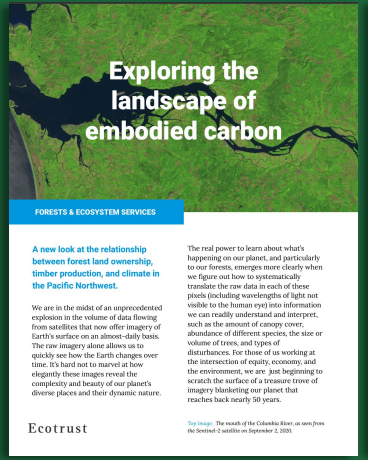
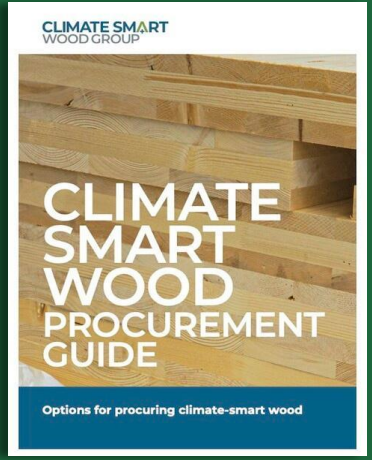
Monitoring & Reporting Framework

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









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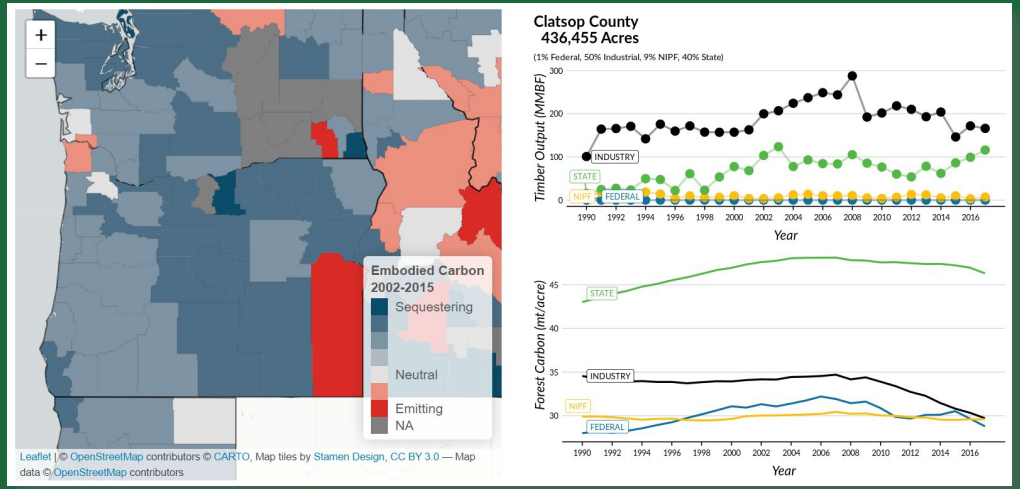
What we're reporting

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

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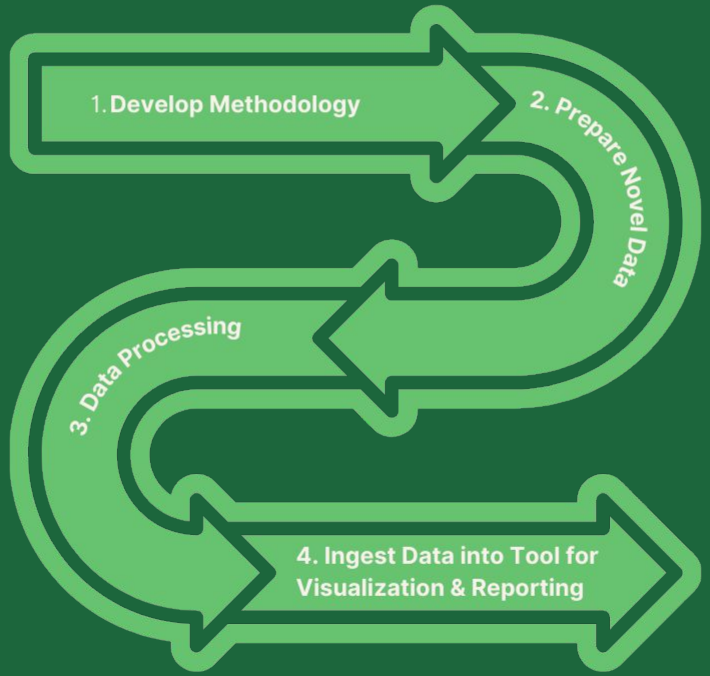
Cooperating on Platform Development

1. Develop Methodology
   Ecotrust + Vibrant Planet
   - ➔ Define impact assessment methods and reporting framework
   - ➔ Prototype impact assessment with public datasets



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.

3. Modeling & Inference
   Vibrant Planet
   - ➔ Data updated ≤annually and subjected to QA/QC.
   - ➔ Impact estimates modeled to ensure reporting is accurate, consistent, and reproducible.

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.

find me

ddiaz@vibrantplanet.net