Developing a Natural and Working Lands Emissions Reduction and Sequestration Proposal

Presentation to Oregon Global Warming Commission 1/29 2021, Cathy Macdonald, Danny Norlander and Judith Callens

Governor Brown's Executive Order 20-04

Directive to the Oregon Global Warming Commission on Natural and Working Lands:

> *"In coordination with ODA, ODF and OWEB, the OGWC is directed to submit a proposal to the Governor for consideration of adoption of state goals for carbon sequestration and storage by Oregon's natural and working landscapes, including forests, wetlands and agricultural lands, based on best available science. The proposal shall be submitted no later than June 30, 2021."*

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Steps to Developing a Recommendation

Stakeholder Engagement

1. Identify existing inventory data.
2. Identify priority improvements to the land sector inventory.
3. Establish the methods for tracking emissions and sequestration from the land sector.
4. Develop a baseline and a Business-as-Usual projection.
5. Identify potential policies, programs and practices that could be advanced to reduce emissions and increase sequestration on Natural and Working Lands.
6. Develop proposed goals and a process for including Natural and Working Lands in Oregon's climate mitigation plan.

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Commission Meeting Dates and N&WL Discussion Topics

January 29th	Preliminary work on the inventory and survey results
March 5th	Approve an outline for recommendations, discuss final survey report and key decisions and options regarding management of a Natural and Working Lands Goal
April 16th	Review draft baseline, hear expert input on goals and discuss new stakeholder input , choices for how to include and manage the land sector in our overall GHG inventory and policy and practice priorities
May 7th	Review draft report and recommendations, identify any necessary changes
June 4th	Finalize the report and recommendations

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National Greenhouse Gas Inventory

What is it? A report prepared and updated annually by the EPA in accordance with IPCC guidelines to comply with the United States' commitments under the UNFCCC.

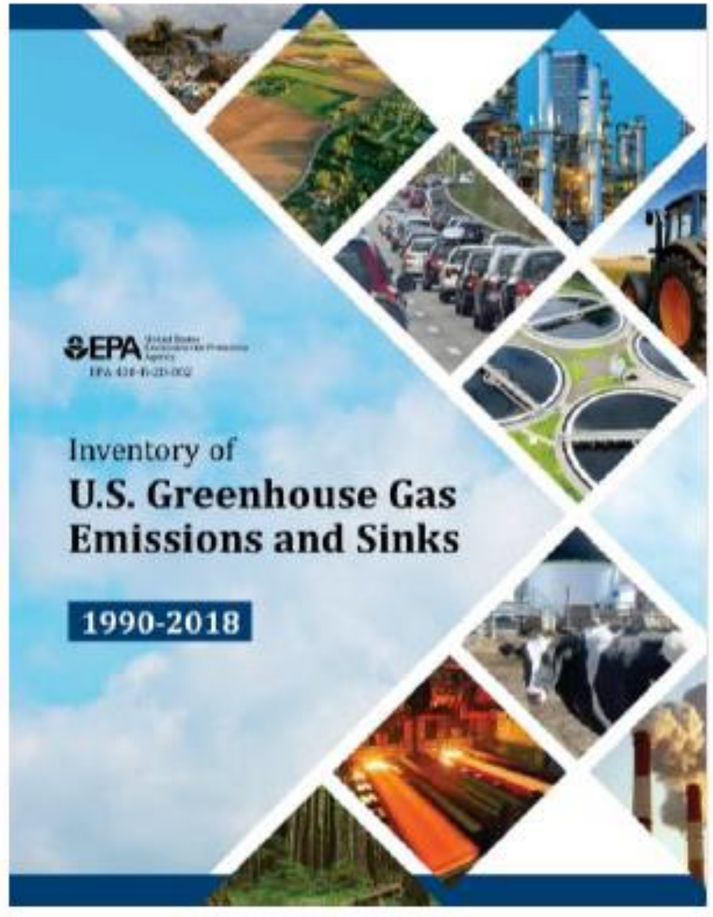
What does it do? Reports GHG emissions and removals (collectively, carbon fluxes) from each sector, starting in 1990.

Relevance for NWL inventories: The National GHG Inventory is the data source of record for GHG fluxes in NWL in the United States. It includes most carbon fluxes in NWL according to IPCC land use categories (e.g., "Forest Land Remaining Forest Land" or "Land Converted to Cropland") and quantifies the uncertainty in these carbon flux estimates with 95% confidence intervals. Many (though not all) of the estimates are based on state-level data, which can be found in annexes or other publications.

Limitations:

- Does not include GHG flux estimates for some minor NWL carbon pools, such as trees in agroforestry systems, some terrestrial wetlands, flooded lands, and coastal seagrass beds. Some of these pools are covered by IPCC guidelines, while others are not.
- Not all data are timely or temporally explicit (i.e., specific to the year in which they are reported) due to limitations in underlying data sources.
- Not spatially explicit, and not all data are available at the state level.

Resources: National GHG Inventory 1990-2018; Annex 3: Methodological Descriptions for Additional Source or Sink Categories; GHG Emissions and Removals from Forest Land, Woodlands, and Urban Trees in the US, 1990-2018



Source: WRI

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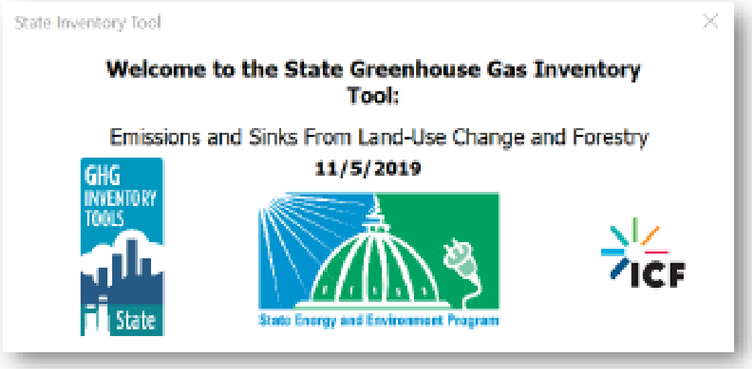
EPA's State Inventory Tool



What is it? An interactive spreadsheet model with sector-specific modules updated annually by EPA to help states develop or update a GHG inventory, with similar methods and sectoral coverage to the National GHG Inventory.

What does it do? Estimates GHG fluxes at the state level based on pre-loaded default federal data and/or custom data entered by state users. Data relevant to the NWL inventory is reported within the Land Use, Land Use Change and Forestry (LULUCF) module.

Relevance for NWL inventories: Because SIT is free and easy to use-off-the-shelf, it is considered the default method for states compiling GHG inventories. SIT provides default NWL data for any state in the lower 48 and is customizable with state-specific data.

Limitations:

- Default data are not timely, and many NWL data inputs are not refreshed year-to-year
- Some NWL data sources and estimation methods are less sophisticated than those used in the National GHG Inventory
- Does not report estimates according to IPCC land use categories, making comparisons with the National GHG Inventory difficult
- Excludes wetlands (both tidal and terrestrial)
- Does not quantify uncertainty around GHG flux estimates
- Limited default data available for Alaska and Hawai'i
- Perpetuates other limitations of the National GHG Inventory (e.g., estimates are not temporally or spatially explicit)

Resources: EPA State Inventory and Projection Tool

Source: WRI

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FIA Current Sampling Design

- All forested lands
  - All states, territories, and U.S. affiliated islands
  - All ownerships – public, private, National Forests, National Parks, wilderness areas, military installations, etc.
- Sampling intensity – Annualized design
  - 10% of all plots measured every year in the western states, 10-year remeasurement cycle
  - Field measured plots permanently located on a base grid of 1 plot per 6,000 acres
  - Starting with 2020 field season, ODF forest lands now measured on intensified sampling grid, same as National Forests and BLM forest lands

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OREGON FOREST CARBON ACCOUNTING FRAMEWORK

Based on Monitoring of Historical and Current Processes

Forest Ecosystem Carbon Stocks and Flux

- Live and dead trees
- Live and dead roots
- Understory vegetation
- Fallen logs & branches
- Forest Floor
- Soil

Harvested Wood Products Carbon Stocks and Flux

- IPCC Production Accounting
- Harvests from 1906 to 2017
- Ownership from 1962-2017
- Products in Use, Landfills
- Emissions from fuelwood & decay
- Total Forest and HWP Carbon

Forest Industry Emissions & Energy Production

- Accounted for in industrial sector-DEQ
- Oregon Sawmill Energy Report
- Non-road diesel
- Transportation
- Life Cycle Analysis

Based on Simulations of Future Conditions

Forest Management Scenarios for Carbon Mitigation

- Forest growth and management simulation
- Collaborating with American Forests
- Carbon Budget Model
- Stakeholder process
- Collaborating with MOU partners & PNW RS

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Croplands and Grasslands

Cropland and grassland soils serve as both a carbon sink and a source of GHG emissions. Including accurate estimates of annual greenhouse gas (GHG) fluxes in cropland and grassland soils in GHG inventories allows states to track progress in enhancing carbon sequestration in these systems and monitor the impacts of Healthy Soils programs or other policies that incentivize climate-friendly land management activities. Currently, however, the United States does not have a monitoring system that directly measures GHG fluxes in croplands and grasslands. Instead, estimates are derived by modeling the GHG fluxes associated with various soil management activities, which are tracked through the National Resources Inventory (NRI). The national data are downscaled and provided to states through the EPA State Inventory Tool (SIT). This approach has several limitations:

- **Margins of error are large.** The uncertainty reported in the National GHG Inventory for carbon flux in croplands and grasslands is many times larger than the estimate itself, making it uncertain whether U.S. agricultural lands are a net sink or source of CO_2 (not including other GHG emissions like N_2O).
- **Activity data on soil management are not timely.** The NRI is only updated every three years and is subject to an additional three-year time lag before data are released. As states encourage growth in climate-friendly agricultural practices, out-of-date activity data in their GHG inventories will become increasingly problematic.
- **Land area coverage is incomplete.** NRI excludes federal lands and lands enrolled in the Conservation Reserve Program after 2012, meaning some states will not be able to monitor all their agricultural lands using this dataset.
- **Land use categories are not disaggregated in SIT.** SIT does not report GHG fluxes according to standardized IPCC land use categories and instead aggregates carbon flux estimates for croplands and grasslands, obscuring different GHG dynamics between those systems.

Source: WRI

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Croplands and Grasslands

- NRCS, ODA and OSU have been working together to collect soil carbon data
- The goal of the project is to develop a soil health scoring system that can help guide management decisions.
- The information is managed in a database that can be queried by portion of the state, soil texture, and past management practices.
- Currently there is information on over 300 soil samples in the database
- ODA have Policy Option Packages in the Governor's budget to expand this project.
- We are also exploring what information is available through existing NRCS soil samples and NRCS and American Farmland Trust modeling.

Source: WRI

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Wetlands

Wetlands greenhouse gas (GHG) fluxes are somewhat small nationally but may be important to consider for coastal states or states with sizable inland wetlands or peatlands. Both terrestrial (freshwater) wetlands and tidal (saltwater) wetlands accumulate carbon-rich organic matter in their submerged soils or in the form of peat mosses, and they support the growth of vegetation that captures additional carbon and holds soils in place. Due to seasonal or environmental variations in water level and plant decomposition, wetlands can also act as sources of greenhouse gases, particularly methane. Draining wetlands exposes soils to oxygen, which accelerates the decomposition of organic matter and the release of carbon and methane. GHG inventories can help states to obtain a more accurate estimate of fluxes in wetlands and prioritize protection and management of critical wetlands sites. Currently, there are serious limitations in federal datasets and scientific literature that make it difficult to accurately quantify GHG fluxes in wetlands at the state level. These limitations include:

- **Wetlands are missing from the EPA State Inventory Tool (SIT).** Because SIT does not include terrestrial or tidal wetlands data, states relying on SIT to develop their inventories would not be able to include GHG fluxes from wetlands.
- **The National GHG Inventory does not include data for some types of wetland.** The National GHG Inventory includes peatlands but does not include other terrestrial wetlands due to a lack of available data. While the Inventory includes estuaries, it also does not include carbon fluxes in seagrass beds. The information that is included in the National GHG Inventory is not disaggregated at the state level, making its value limited for informing state inventories.
- **Margins of error are large.** Margins of error tend to be large for national GHG flux estimates for wetlands. In the National GHG Inventory, error margins are as high as 38% for tidal wetlands and higher for peatlands. There are many sources of uncertainty in wetlands flux estimates, including imprecise mapping of wetlands extent and varying GHG emissions and sequestration dynamics in different types of wetlands. Such high levels of uncertainty make it difficult to make policy decisions based on these wetlands data.
- **Existing spatial data are updated infrequently and are of varied resolutions.** The US Fish & Wildlife Service's National Wetlands Inventory (NWI) compiles federal-level wetlands spatial data, of which only 2% is updated each year. NWI data do not have sufficient resolution to be useful for tracking change in wetlands size or quality. For example, NWI does not reliably differentiate between forest and forested wetlands, leading to a potential underestimation of terrestrial wetlands extent. The National Land Cover Database (NLCD) has more timely and higher-resolution spatial data that are updated every five years, but data are only available for private land and do not provide as much detailed information on wetland type and management.
- **Data on wetland GHG fluxes are not place-specific.** Wetlands flux estimates obtained from field sampling may not be applicable to all wetlands since wetlands fluxes can vary greatly with region and wetland type.

Source: WRI

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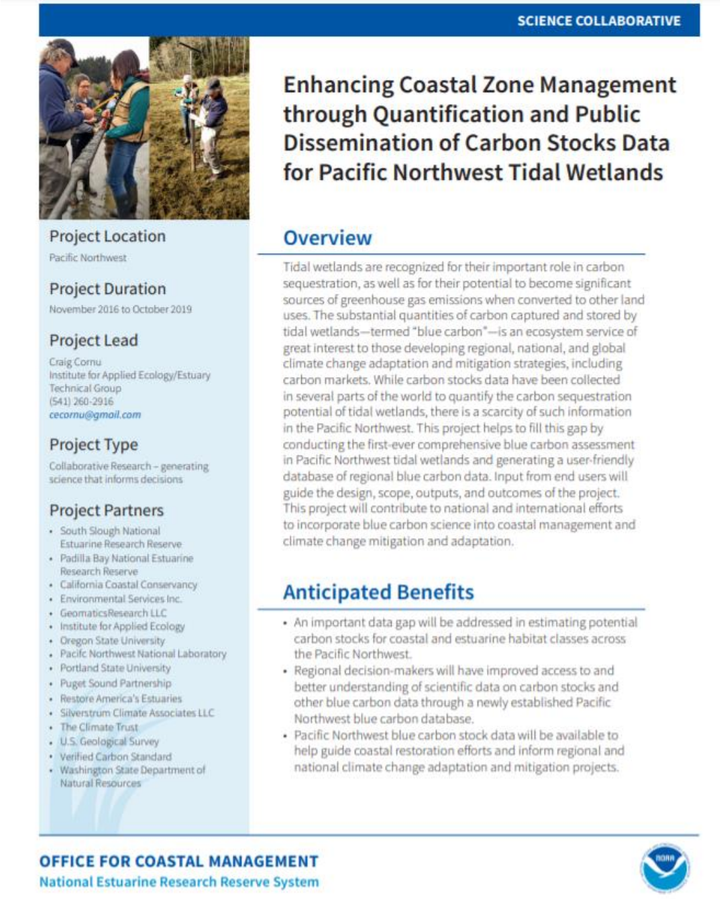
Blue Carbon



SCIENCE COLLABORATIVE

Enhancing Coastal Zone Management through Quantification and Public Dissemination of Carbon Stocks Data for Pacific Northwest Tidal Wetlands

Project Location
Pacific Northwest

Project Duration
November 2016 to October 2019

Project Lead
Craig Cornu
Institute for Applied Ecology/Estuary Technical Group
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Project Type
Collaborative Research – generating science that informs decisions

Project Partners
- South Slough National Estuarine Research Reserve
- Padilla Bay National Estuarine Research Reserve
- California Coastal Conservancy
- Environmental Services Inc.
- GeomaticsResearch LLC
- Institute for Applied Ecology
- Oregon State University
- Pacific Northwest National Laboratory
- Portland State University
- Puget Sound Partnership
- Restore America's Estuaries
- Silverstrum Climate Associates LLC
- The Climate Trust
- U.S. Geological Survey
- Verified Carbon Standard
- Washington State Department of Natural Resources

Overview

Tidal wetlands are recognized for their important role in carbon sequestration, as well as for their potential to become significant sources of greenhouse gas emissions when converted to other land uses. The substantial quantities of carbon captured and stored by tidal wetlands—termed "blue carbon"—is an ecosystem service of great interest to those developing regional, national, and global climate change adaptation and mitigation strategies, including carbon markets. While carbon stocks data have been collected in several parts of the world to quantify the carbon sequestration potential of tidal wetlands, there is a scarcity of such information in the Pacific Northwest. This project helps to fill this gap by conducting the first-ever comprehensive blue carbon assessment in Pacific Northwest tidal wetlands and generating a user-friendly database of regional blue carbon data. Input from end users will guide the design, scope, outputs, and outcomes of the project. This project will contribute to national and international efforts to incorporate blue carbon science into coastal management and climate change mitigation and adaptation.

Anticipated Benefits

- An important data gap will be addressed in estimating potential carbon stocks for coastal and estuarine habitat classes across the Pacific Northwest.
- Regional decision-makers will have improved access to and better understanding of scientific data on carbon stocks and other blue carbon data through a newly established Pacific Northwest blue carbon database.
- Pacific Northwest blue carbon stock data will be available to help guide coastal restoration efforts and inform regional and national climate change adaptation and mitigation projects.

OFFICE FOR COASTAL MANAGEMENT
National Estuarine Research Reserve System

- PNW Blue Carbon Working Group's created a database of new and existing Blue Carbon data
- It includes blue carbon data from tide flats, seagrasses, emergent marshes, scrub-shrub and forested tidal wetlands.
- Land uses include least disturbed tidal wetlands, tidal wetlands converted to ag lands, and restored wetlands
- Data gaps include woody wetlands including Sitka spruce swamps.
- More data is needed on accretion rates especially from woody wetlands, restoration sites, pastures and smaller estuaries
- Database is being expanded with the Working Group's Phase 2 Blue Carbon project (2020-2023)
- Database is accessible through Coastal Carbon Atlas and NERRS Centralized Database Management Office

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Potential Inventory Improvements

States that choose to go beyond basic inventory improvements may consider a range of additional improvement options, detailed in subsequent chapters of this Guide. These improvements address different limitations of the default inventory methods, listed here as objectives for inventory improvement. States may pursue one or more improvements depending on which inventory categories they prioritize and which objectives they hope to meet. *Improvements in italics require federal action.*

LEGEND

Improvement Objectives Met:

- Reduce uncertainty in GHG flux estimates
- Improve timeliness of data sources
- Enhance spatial and/or temporal data resolution
- Expand inventory scope to additional land uses, carbon pools or functionalities
- Attribute GHG fluxes to specific causes or activities

NWL Inventory Category	Inventory Improvement Option	Objectives Met
Trees & Forests	Integrate optical imagery with FIA	
	Integrate LIDAR/ phodar with FIA data	
	Increase statistical power of FIA plot network	
	Create field-based inventory for urban trees	
	Refine accounting for wood products	
	Develop a national remote sensing-based inventory	
Croplands & Grasslands	Integrate remote sensing for croplands	
	Expand transect surveys	
	Institute farm-level reporting	
	Create a plot network for soil carbon monitoring	
	Monitor soil carbon through national field networks	
Land Use Change	Incorporate info from available federal/ state databases, e.g. NLCD	
	Implement LIDAR/phodar-based monitoring system	
Wetlands	Integrate updated remote sensing data with federal spatial data	
	Refine state-specific stock and flux estimates	
	Develop national spatial inventory of GHG fluxes	
Baselines	Create a custom projected baseline	
	Back-cast updated historical baseline	

Source: WRI

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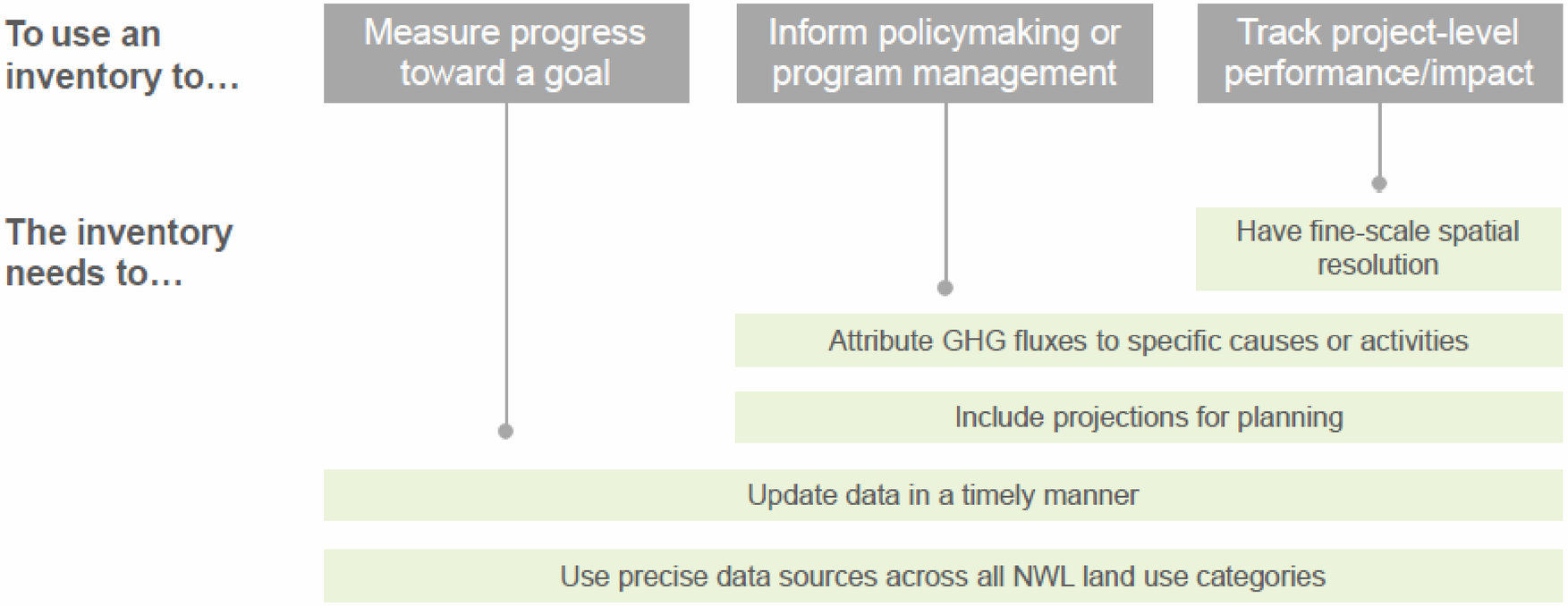
Considerations for Inventory Improvements

A state inventory based on default data from SIT is better than no inventory, but many of the inventory functions that states may wish to have require more sophisticated methods than what SIT currently offers. States can use their desired inventory function(s) to determine key **objectives for inventory improvement**.



Source: WRI

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Technical Assistance Support

Blue Carbon
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- Laura Brophy, Institute for Applied Ecology
- Steve Crooks, Silvestrum Climate Associates
- Pew Charitable Trust

Agriculture
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- Diana Walker, Oregon Department of Agriculture
- Markus Kleber, Oregon State University
- Corey Owens, Natural Resources Conservation Service
- Jennifer Moore, American Farmland Trust
- Mike Mertens, EcoTrust

Forest Inventory
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- Andrew Yost, Oregon Department of Forestry
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- Chad Davis, U.S. Forest Service
- Glenn Christensen, US Forest Service - PNW
- Taylor Lucey, US Forest Service - PNW
- Andrew Gray, US Forest Service - PNW
- Olaf Kuegler, US Forest Service - PNW

All Teams
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- Alexander Rudee, World Resources Institute
- Jimmy Kagan, OSU Institute for Natural Resources
- Catherine Macdonald, Chair, OGWC
- Elizabeth Elbel, Department of Environmental Quality