Oregon Forest Ecosystems Carbon Report

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ODF Stakeholder Meeting – October 18, 2018

USDA U.S. FOREST SERVICE
Caring for the land and serving people
United States Department of Agriculture

Pacific Northwest Research Station

Overview

- FIA: Historical context and relevant research
- Oregon forest ecosystems carbon report outline
- Preliminary Oregon forest land C flux estimates

What is FIA?

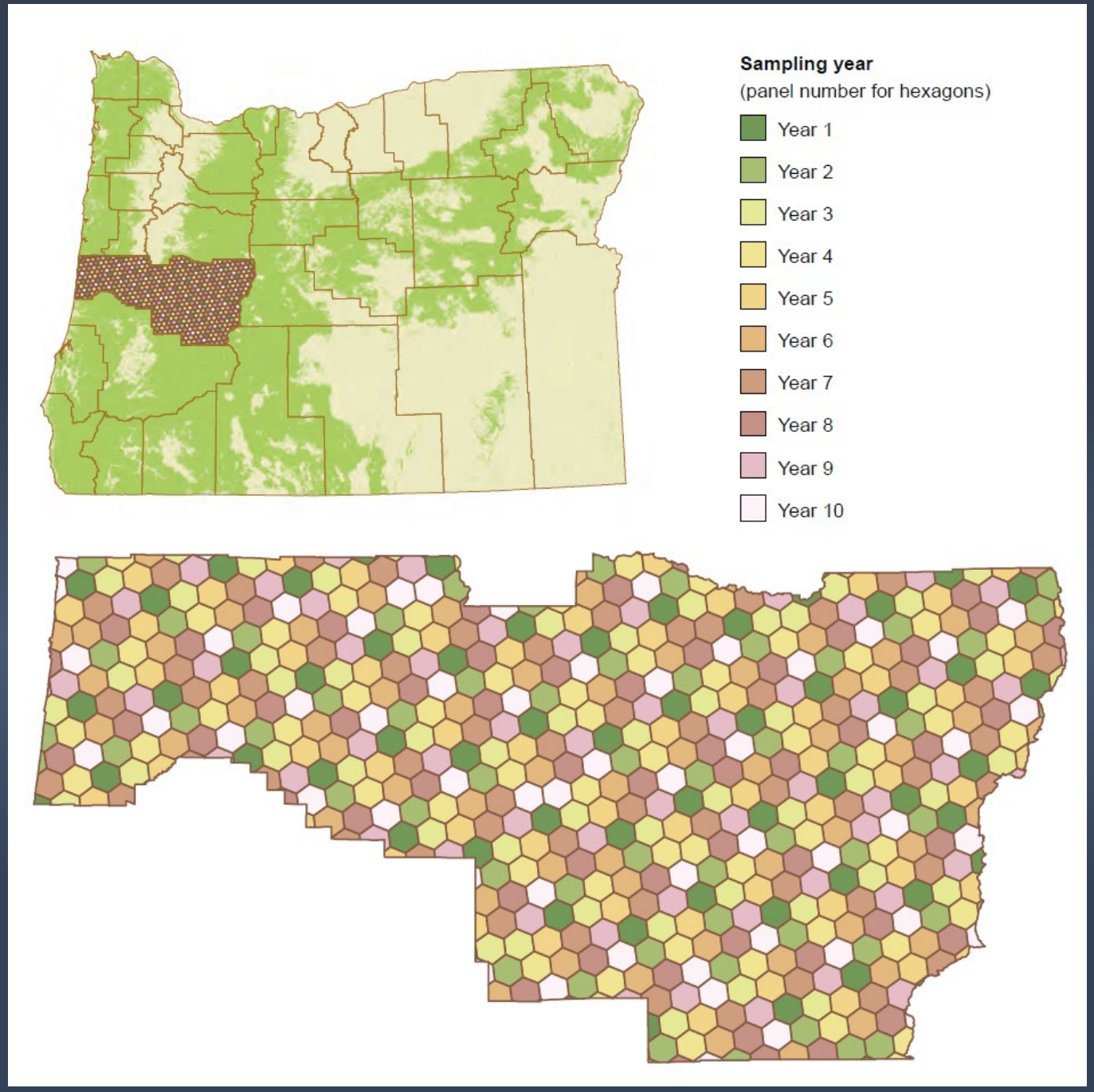
- We are the Nation's Forest Inventory
- Program authorized by Congress in 1928
- Initially an inventory of marketable timber
  - Periodic data collection - State-by-state basis, intervals varied by state
- 1998 Farm Bill - Annualized inventory for all forest resources
  - Annual inventory to provide data on status and trends
  - Inventory all forest lands, on all ownerships
  - Consistent sampling protocol, compilation, database, reporting requirements

What is FIA – Funding and Direction

- How is FIA funded?
  - Annual Congressional appropriations
  - Agreements with state cooperators, universities, government agencies
  - Partnerships with other branches of the Forest Service: National Forest Systems, State and Private, other R&D programs
- Who provides FIA direction and oversight?
  - 2014 Farm Bill set current national direction
  - Strategic plans implement direction – guided by national office, FIA regions, national stakeholders, and regional representatives

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
  - Some states “buy down” the cycle length and sampling grid intensity through matched contributions



FIA Sampling Strategy Today

10-Year Cycle: 1/10th of FIA field plots are sampled per year in western U.S.

FIA at PNW

- McSweeney-McNary Forest Research Act of 1928
- 1929 – Secured $30,000 of funding to conduct first survey in PNW region
- 1930 – Hired H.J. Andrews to lead timber survey, initiated in Washington County.
- 1933 – WA Co. survey completed including updates from first Tillamook burn

H. J. Andrews – Circa 1930

Forest Inventory in Oregon: The first 90 years

- 1929 – 1999, pre-annualized inventory design:
  - 1930's through 1990's PNW completed a forest inventory each decade except 1950
  - Resulting in 17 published reports summarizing forest statistics
  - Earliest published inventory report: 1934 (Andrews and Cowlin, Forest Resources of the Douglas-fir Region)

Gus Solomon Federal Courthouse, circa 1933

Forest Inventory in Oregon: The first 90 years

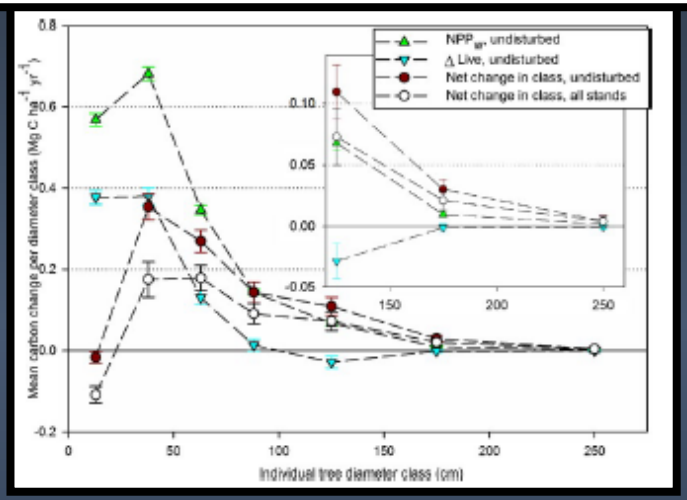
- Since 2000, annualized sample design:
  - As of 2018 – first plot remeasurement is 80% complete
  - Published five-year summary reports: 5, 10 and 15 years (in press)
  - In addition to peer reviewed research articles

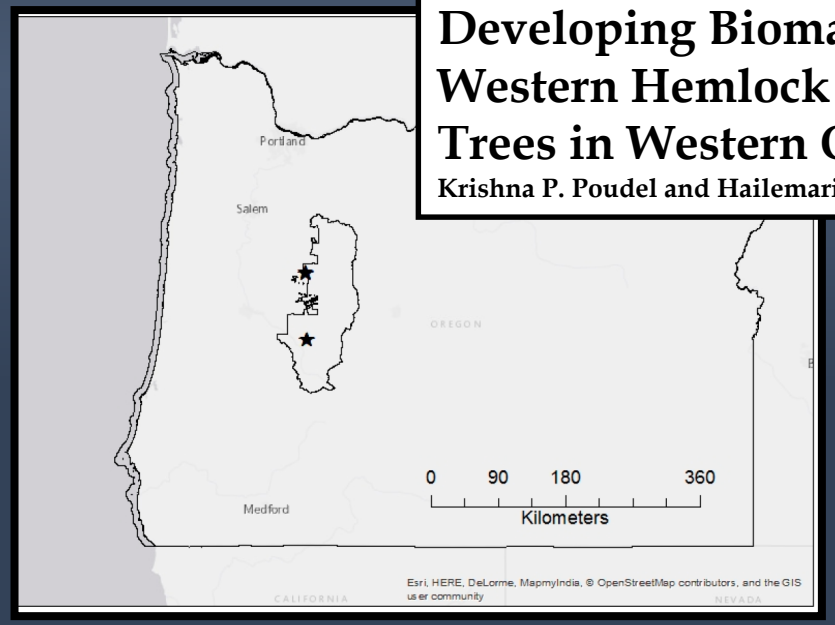
Gus Solomon Federal Courthouse, circa 2018

Published Research

A 6 year longitudinal study of post-fire woody carbon dynamics in California's forests
Bianca N.I. Eskelson, Vicente J. Monleon, and Jeremy S. Fried

Carbon stocks and accumulation rates in Pacific Northwest forests:
role of stand age, plant community, and productivity
Andrew N. Gray,1,† Thomas R. Whittier,2 and Mark E. Harmon2





Article
Developing Biomass Equations for Western Hemlock and Red Alder Trees in Western Oregon Forests
Krishna P. Poudel and Hailemariam Temesgen *

Analysis of spatial correlation in predictive models of forest
variables that use LiDAR auxiliary information
F. Mauro, V.J. Monleon, H. Temesgen, and L.A. Ruiz

Recent carbon related published research

- Gray, A. N., T. R. Whittier, and D. L. Azuma. 2014. Estimation of Above-Ground Forest Carbon Flux in Oregon: Adding Components of Change to Stock-Difference Assessments. Forest Science 60:317-326. http://treesearch.fs.fed.us/pubs/49089
- Gray, A. N. and T. R. Whittier. 2014. Carbon stocks and changes on Pacific Northwest national forests and the role of disturbance, management, and growth. Forest Ecology and Management 328:167-178. http://www.treesearch.fs.fed.us/pubs/46566
- Gray, A. N., T. R. Whittier, and M. E. Harmon. 2016. Carbon stocks and accumulation rates in Pacific Northwest forests: role of stand age, plant community, and productivity. Ecosphere 7:e01224. http://treesearch.fs.fed.us/pubs/52237
- Temesgen, H., D. Affleck, K. Poudel, A. N. Gray, and J. Sessions. 2015. A review of the challenges and opportunities in estimating above ground forest biomass using tree-level models. Scandinavian Journal of Forest Research. 30:326-335. http://treesearch.fs.fed.us/pubs/49620
- Turner, D. P., W. D. Ritts, R. E. Kennedy, A. N. Gray, and Z. Yang. 2015. Effects of Harvest, Fire, and Pest/Pathogen Disturbances on the West Cascades Ecoregion Carbon Balance. Carbon Balance and Management 10:12. http://www.treesearch.fs.fed.us/pubs/49508
- Turner, D. P., W. D. Ritts, R. E. Kennedy, A. N. Gray, and Z. Yang. 2016. Regional carbon cycle responses to 25 years of variation in climate and disturbance in the US Pacific Northwest. Regional Environmental Change:2345-2355. https://www.fs.usda.gov/treesearch/pubs/55267

FIA: National Program Carbon Efforts

USDA FOREST SERVICE

Forest Service National Links Go!

Forest Inventory and Analysis National Program

(enter query) Search

- U.S. Forest Service
- Forest Inventory & Analysis
  - Regional Offices
  - Program Features
  - FIA Data and Tools
  - FIA Library
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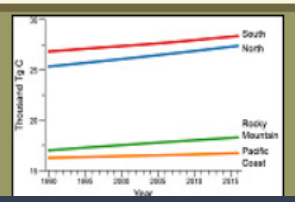
Forest Carbon Estimation

Welcome to Forest Carbon Estimation in the FIA program!! On this page you will find: standard estimates by domains of interest, emerging research and associated highlights, documentation, important links, and general background regarding carbon estimation in the FIA program.

Accurate estimates of carbon in forests are crucial for forest carbon management, carbon credit trading, national reporting of greenhouse gas inventories to the United States Framework Convention for Climate Change, calculating estimates for the Montreal Process criteria and indicators for sustainable forest management, and registering forest-related activities for the national 1605(b) Voluntary Reporting of Greenhouse Gases Program and other greenhouse gas registries for States and regions.

Draft of New Forest Carbon Accounting Framework

Please follow this link to access the draft pdf documentation

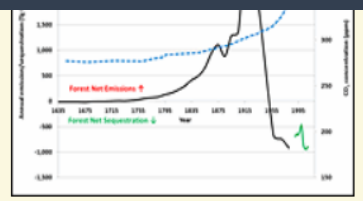


14.1

Percentage of the US' CO_2 emissions sequestered in forests and associated wood products in 2012

Website: https://www.fia.fs.fed.us/forestcarbon/

- Evaluate Our Service
  We welcome your comments on our service and your suggestions for improvement.



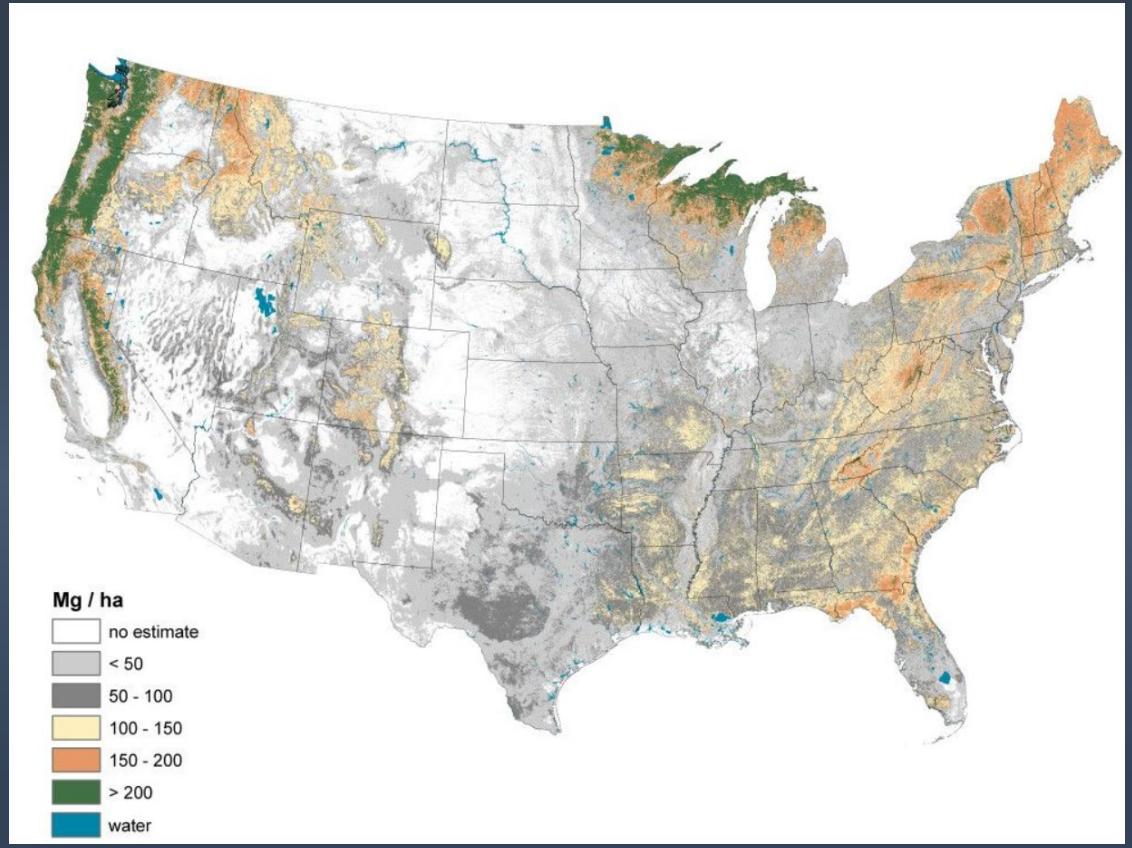
emissions of any land use in our Nation. Reliable estimates of this ecosystem service is essential to our society.

Total

Live AG

FIA National Program: Carbon Assessments

- US EPA Greenhouse Gas Inventory
- National Climate Assessment
- National Forests Carbon Assessments
- FAO Global Forest Resources Assessment
- UN Land use, Land change and Forestry Assessment



Total forest ecosystem carbon density imputed from forest inventory plots, conterminous U.S., 2000-2009

Oregon Forest Ecosystems Carbon Report

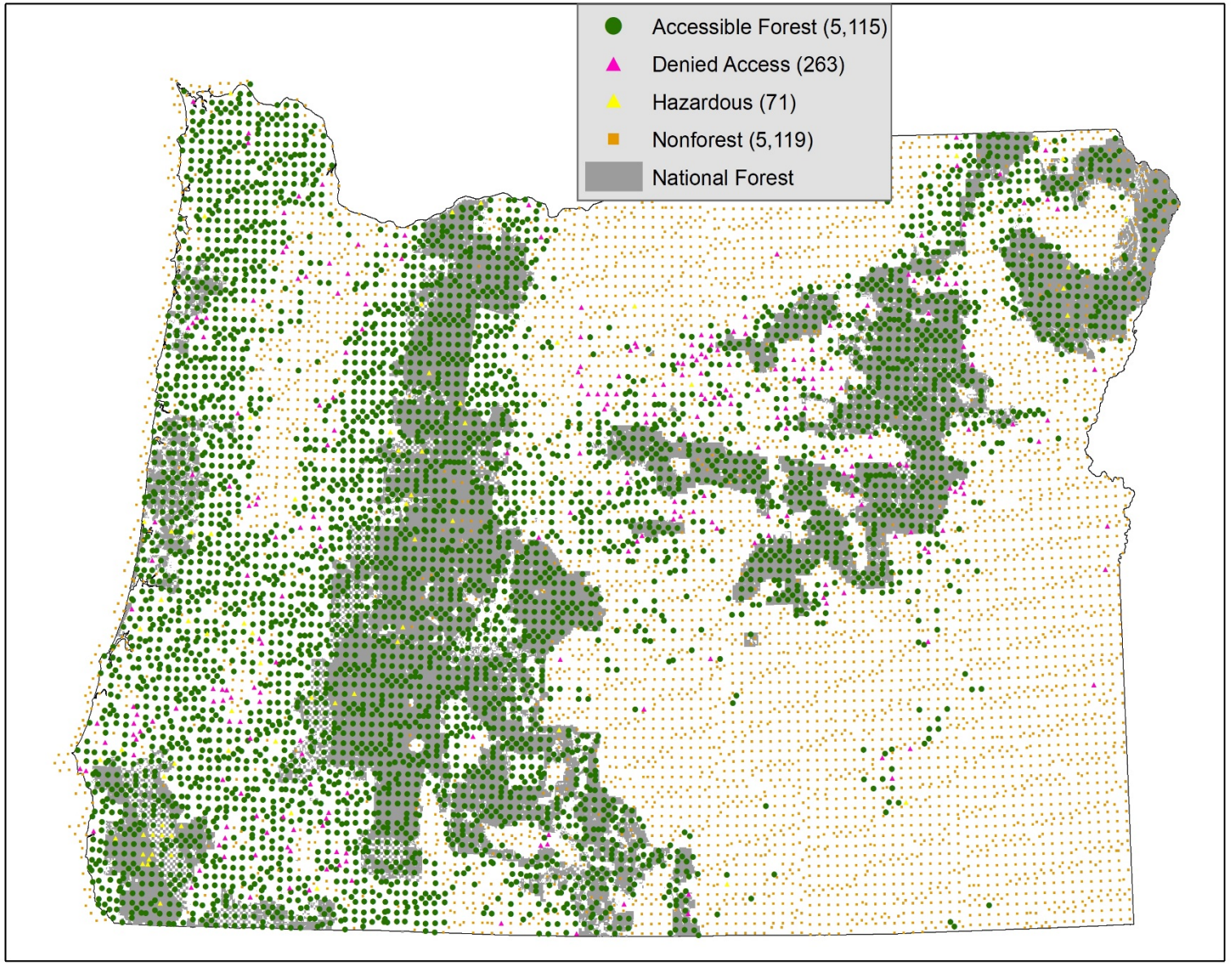
- Based on Oregon FIA plot measurements collected 2001 through 2016
- Uses California forest carbon report as basis and approach to
  - Provide summaries of total forest carbon stocks and flux by pool using regional biomass equations for components as found in US National Greenhouse Gas Inventory
  - Provide current statewide rate of net annual forest carbon sequestration and emissions
  - Determine annual forest carbon flux based on measured growth, removals, and mortality

Oregon Forest Ecosystems Carbon Report

- Forest carbon stocks by pool:
  - Above-ground live trees: Based on FIA regional biomass equations, adds foliage
  - Above-ground dead trees: Same as live trees, including reductions for decay
  - Roots on live and standing dead trees: Use National FIA protocol
  - Down wood: Use collected measurements and National FIA estimation protocol, piles not included
  - Understory vegetation: As modeled and populated in FIADB
  - Forest floor: Use collected measurements and national estimation protocol
  - Organic soils: As modeled and populated in FIADB using Domke et al. 2017

Oregon Forest Ecosystems Carbon Report

- Forest carbon flux by pool based on re-measured plots: 2001-2006 to 2011-2016
  - Use condition classification at the initial measurement
  - By pool
    - Trees - live and dead: FIA growth, removals (harvest), and mortality estimation protocol
    - Down wood: Flux based on plot level change
    - Below-ground, live and dead roots: Net change based on FIA modeled estimates
    - Understory: Net change based on FIA modeled estimates
    - Forest floor: Flux based on plot level change
    - Soil: Modeled using FIADB estimates from Domke et al. 2017
- Forest Management Reference Levels: 2001-2010 as basis of stock-change
- Land use change – forest land conversions

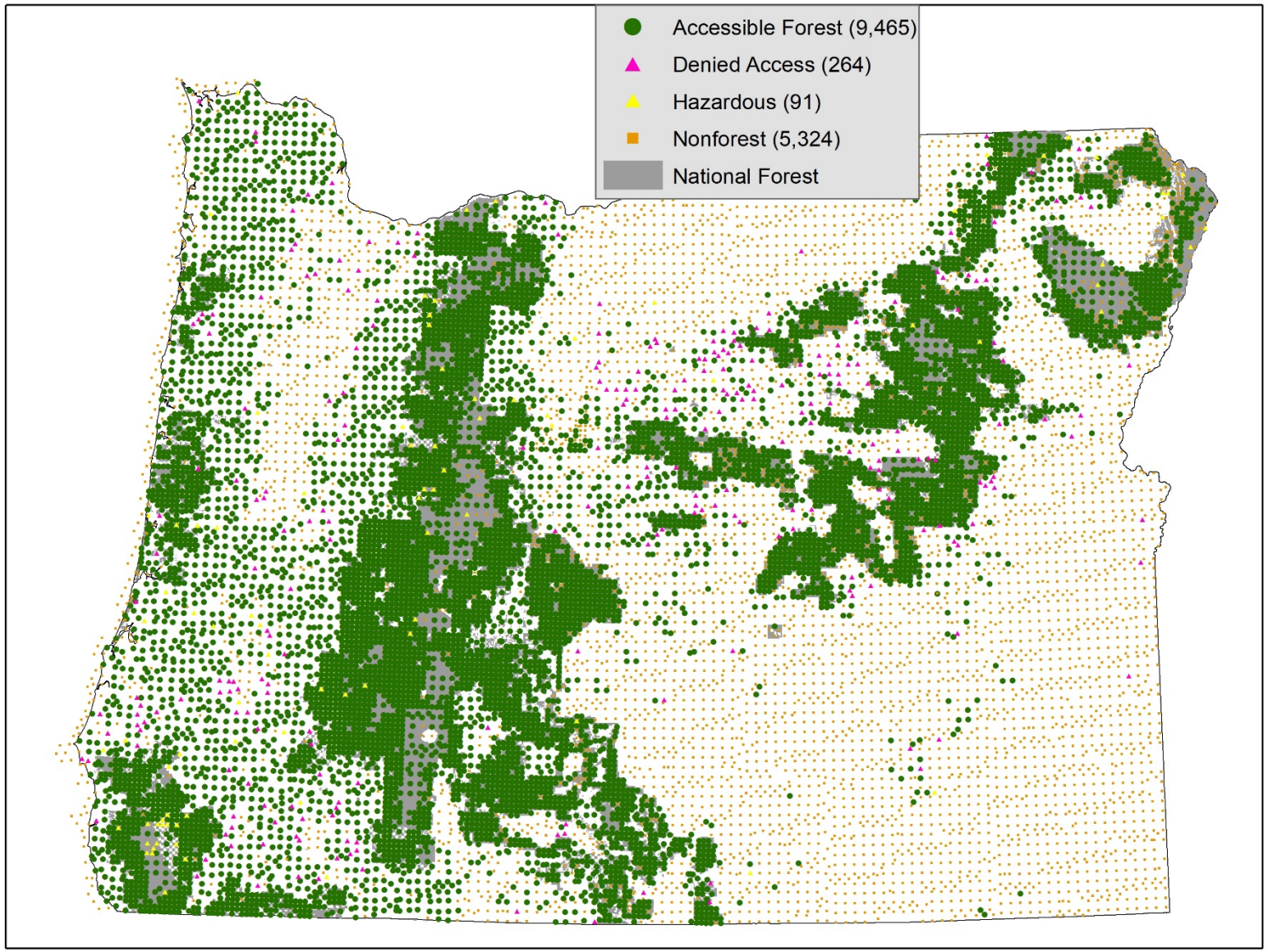


FIA Field Measured Plots in Oregon: Base grid 2007-2016

- Plot density of approx. 1 per 6,000 ac.

- 2011 started remeasurement

- 2016 field season 60% of plots remeasured



FIA Field Measured Plots in Oregon: Base plus R6 Intensified grid 2007-2016

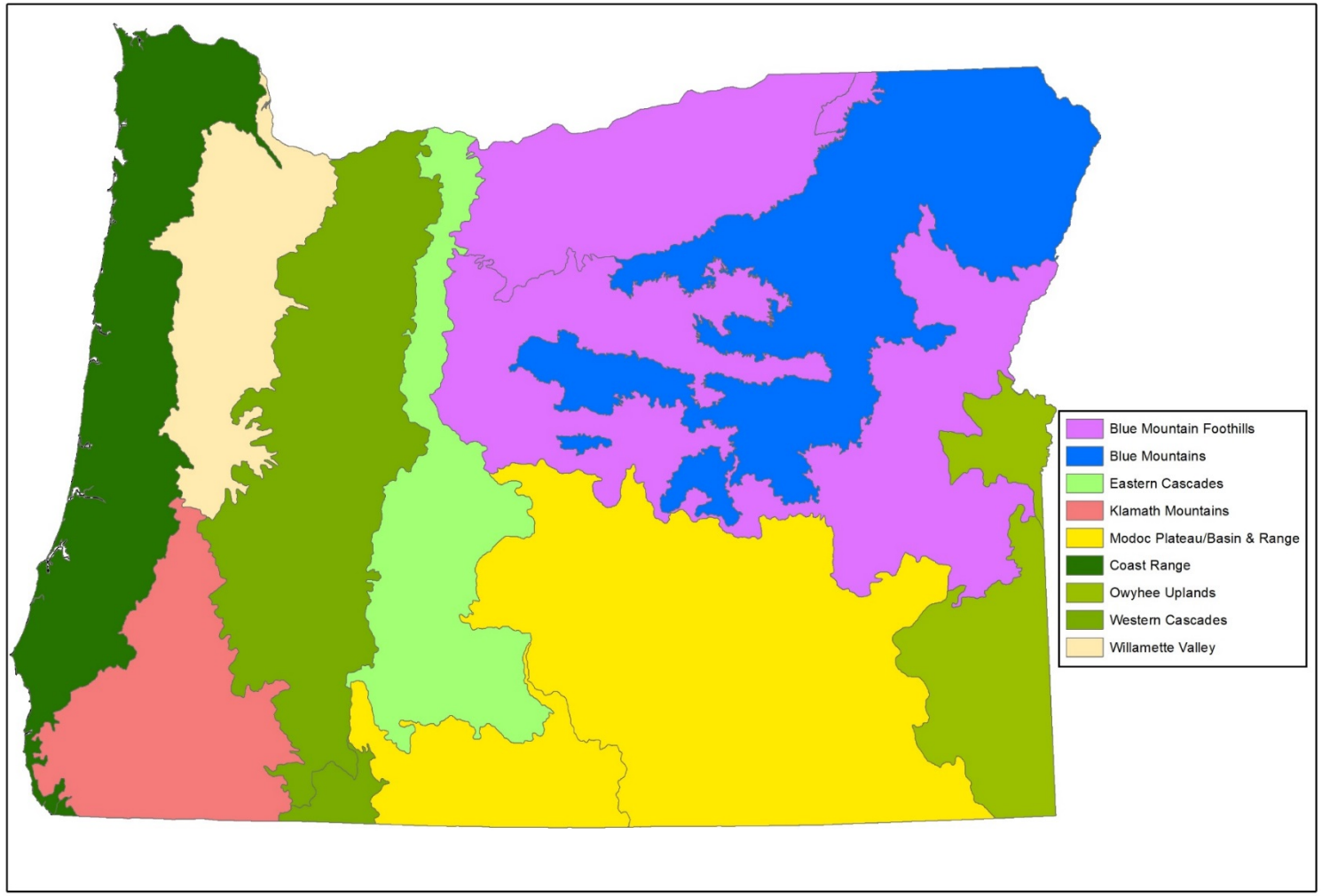
- Adds 4,350 National Forest plots

- Plot density of 1 per 1,850 ac. outside of wilderness

Oregon Forest Ecosystems Carbon Report

- Forest ecosystem summarized results: carbon stocks, flux, and trend
  - Stocks and flux by pool, ownership, and land status
    - National Forest
    - Other Federal
    - State and local governments
    - Private corporate
    - Private non-corporate
  - Stocks and flux by FIA forest type
  - Stocks by region, use ecoregions from Cleland et al. 2005

OR ecoregions, grouping sections from FS ecomap (Cleland et al. 2005)



Proposed Ecoregion Lumping:

- Columbia Basin with Blue Mountain Foothills
- Snake River with Owyhee Uplands (all non-forest)
- Southern Cascades with Western Cascades
- Modoc Plateau with Basin and Range

Draft Results – Oregon annual statewide C flux on forest land, 2001-2006 to 2011-2016

Carbon Pool	Net Flux – Million Metric Tons CO_2 eq.	
	Total	**SE**
Aboveground Live[1]	32.8	3.1
Aboveground Dead Trees[2]	-7.0	1.0
Belowground Live Roots[3]	6.5	0.7
Belowground Dead Roots[4]	-0.3	0.2
Net Flux	**32.0**	**3.7**
Forest Floor	0.6	0.1
Soil Organic Carbon	-0.2	0.3

1 = includes live trees, foliage, and live understory
2 = includes standing dead and down dead wood
3 = includes live tree and understory roots
4 = includes dead tree roots