Improving forest structure monitoring with GEDI

USFS – NASA
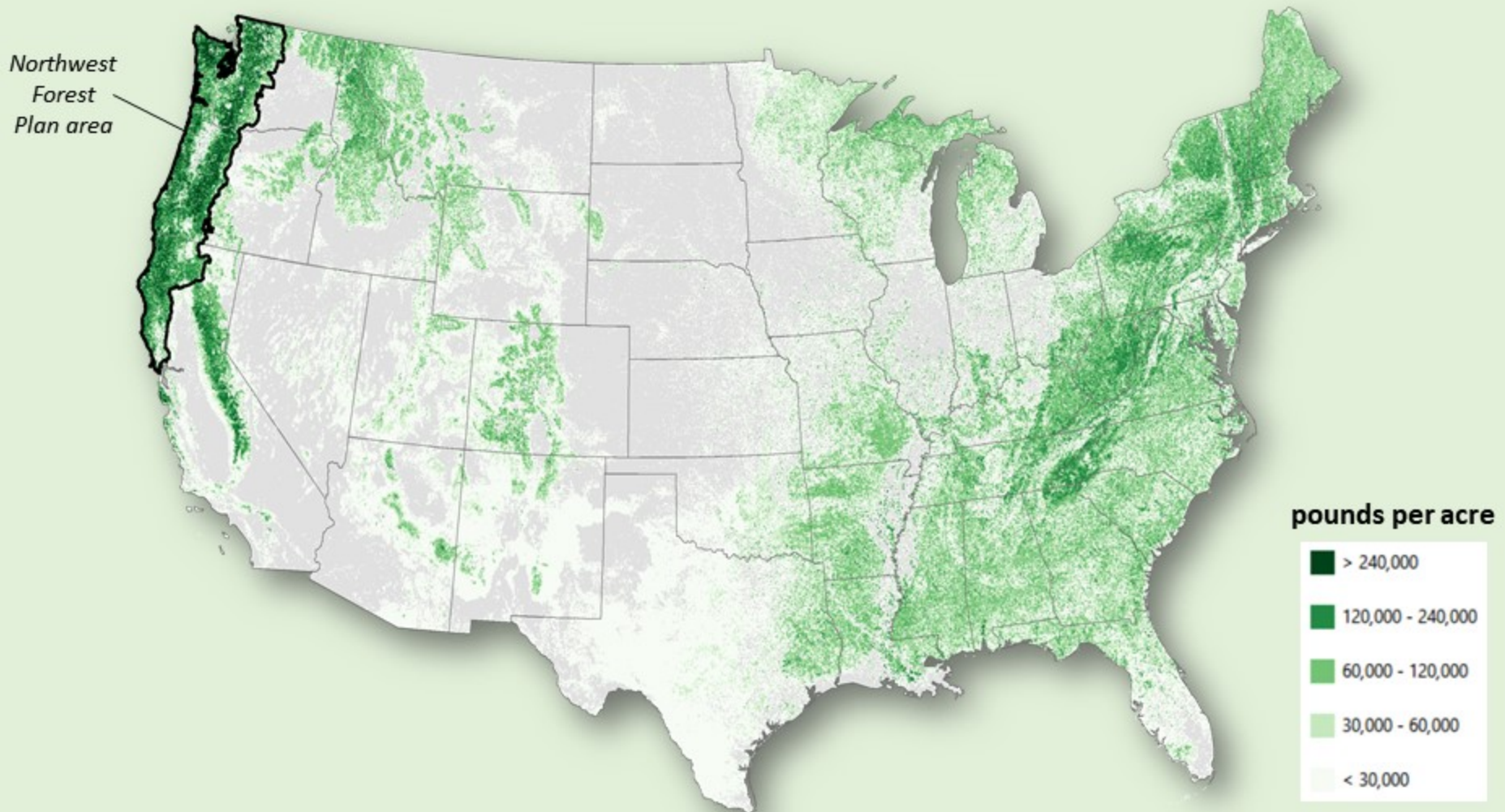Virtual Pitch Fest

- Raymond Davis
  US Forest Service - Pacific Northwest Region

- David Bell
  US Forest Service - Pacific Northwest Research Station

- Sean Healey & Zhiqiang Yang
  US Forest Service – Rocky Mountain Research Station
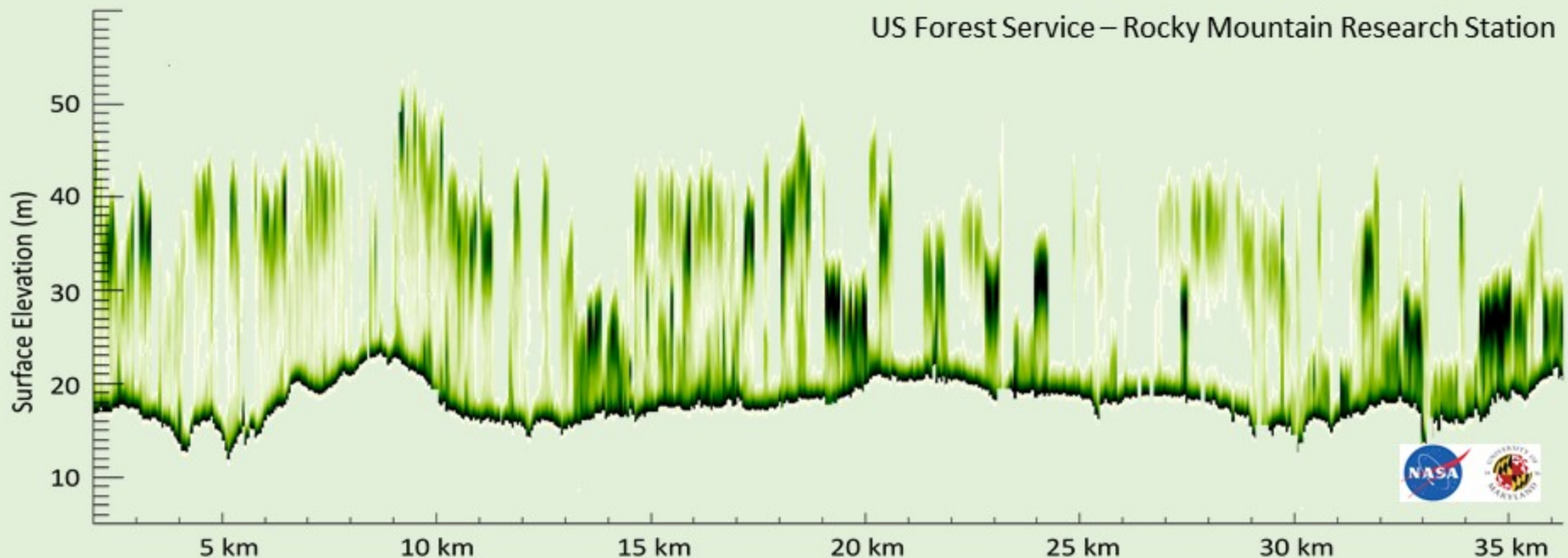
Improving forest structure monitoring with GEDI

Live aboveground woody biomass

Northwest Forest Plan area

pounds per acre

- > 240,000
- 120,000 - 240,000
- 60,000 - 120,000
- 30,000 - 60,000
- < 30,000

Maps were produced by Ty Wilson and Doug Griffith (barrywilson@fs.fed.us, dgriffith@fs.fed.us). Tile layers produced by Bryan Hemmer (bhemmer@fs.fed.us).
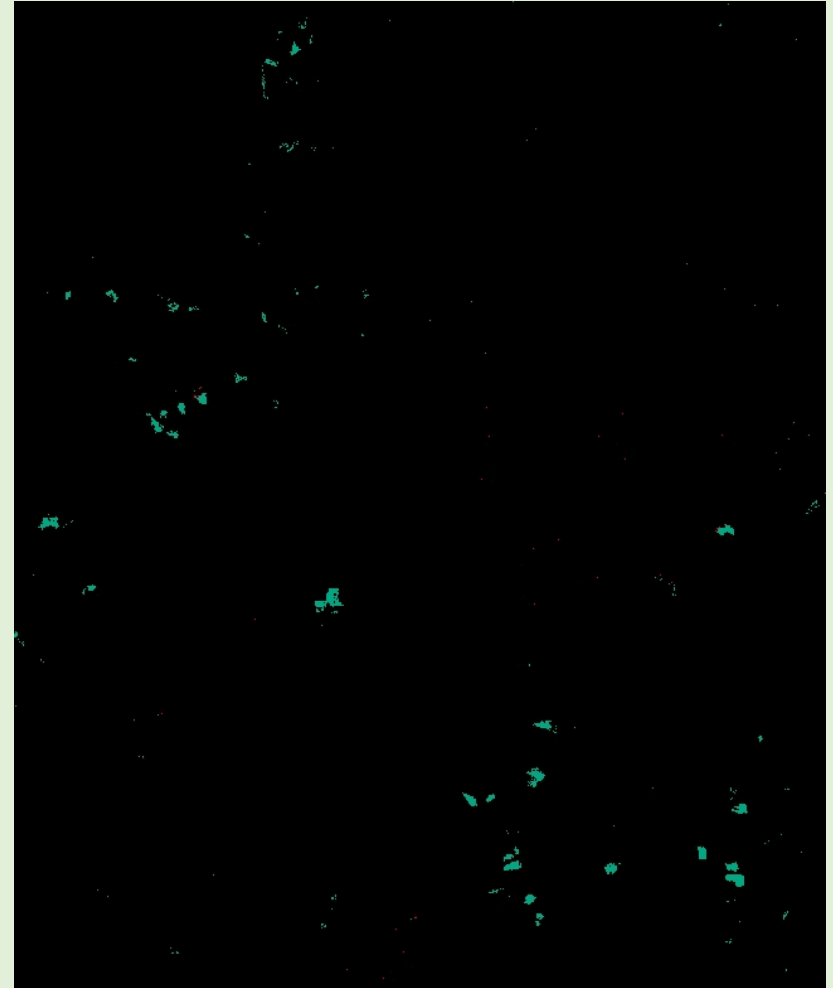
Northwest Forest Plan Effectiveness Monitoring

Changes in older forest
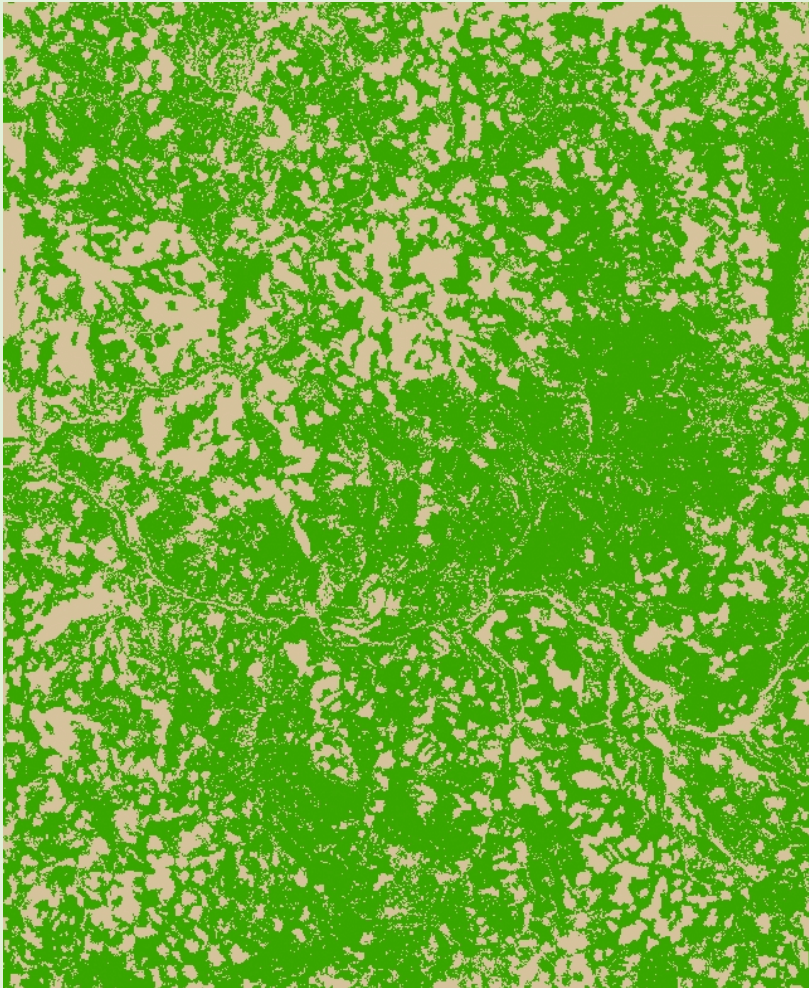
Young forest　　　Old forest

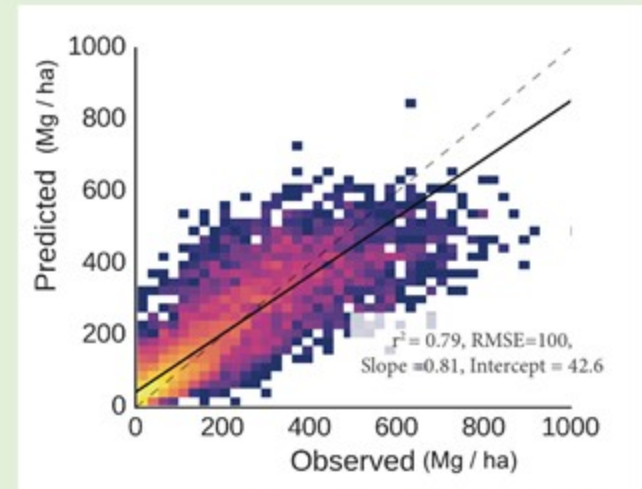## Causes of those changes

Timber harvesting　　　Wildfire

Nearest neighbor approach to vegetation mapping

- Flexible method for integrating remote sensing and forest inventory

- Spectral saturation makes mapping of old-growth forest structure with optical remote sensing challenging

$r^2 = 0.79$, RMSE=100, Slope =0.81, Intercept = 42.6

Kennedy et al. 2018. ERL

Gradient (CCA) space
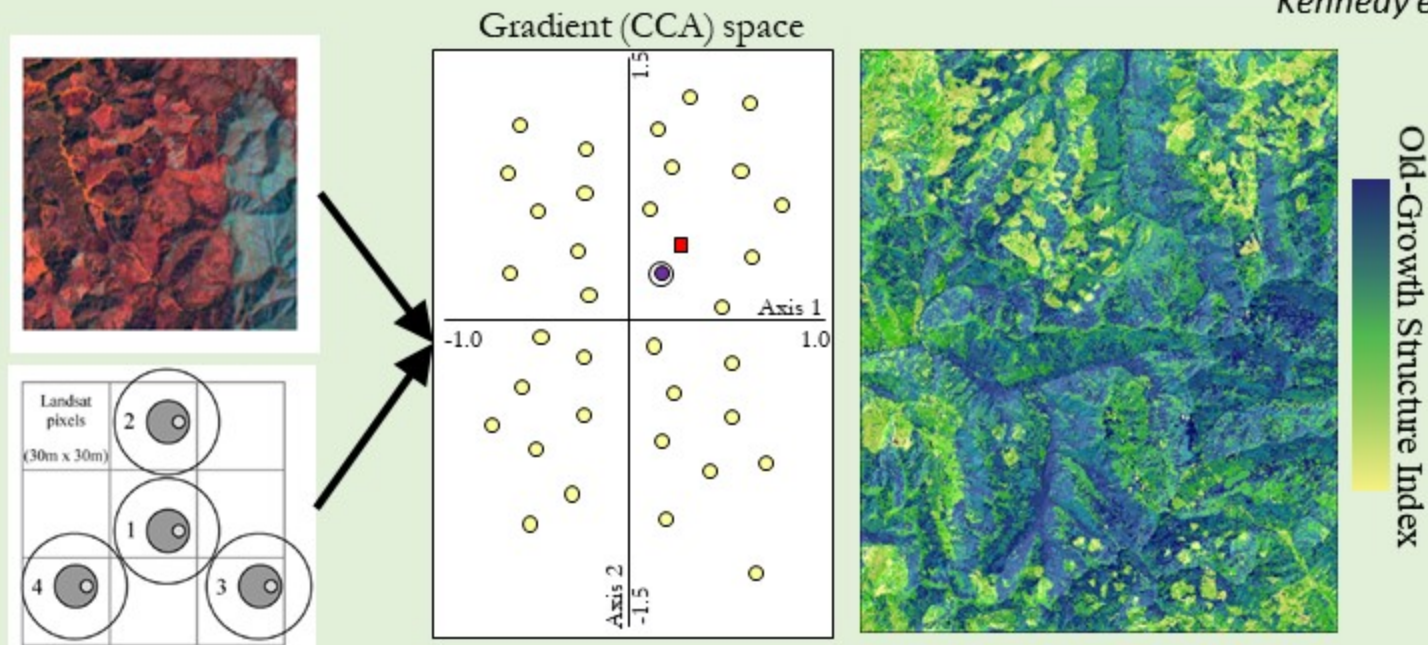
- Incorporating remote sensing of height (e.g., lidar) into NN mapping improves accuracy (Zald et al. 2014. RSE)

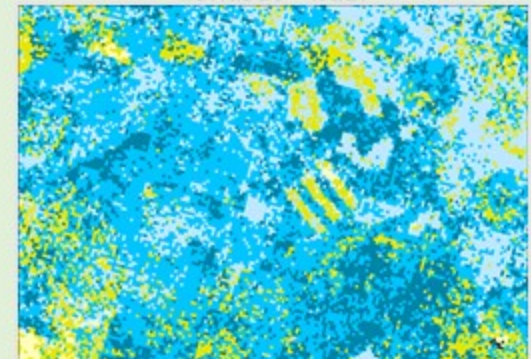- However, wall-to-wall lidar at regional scales is not available

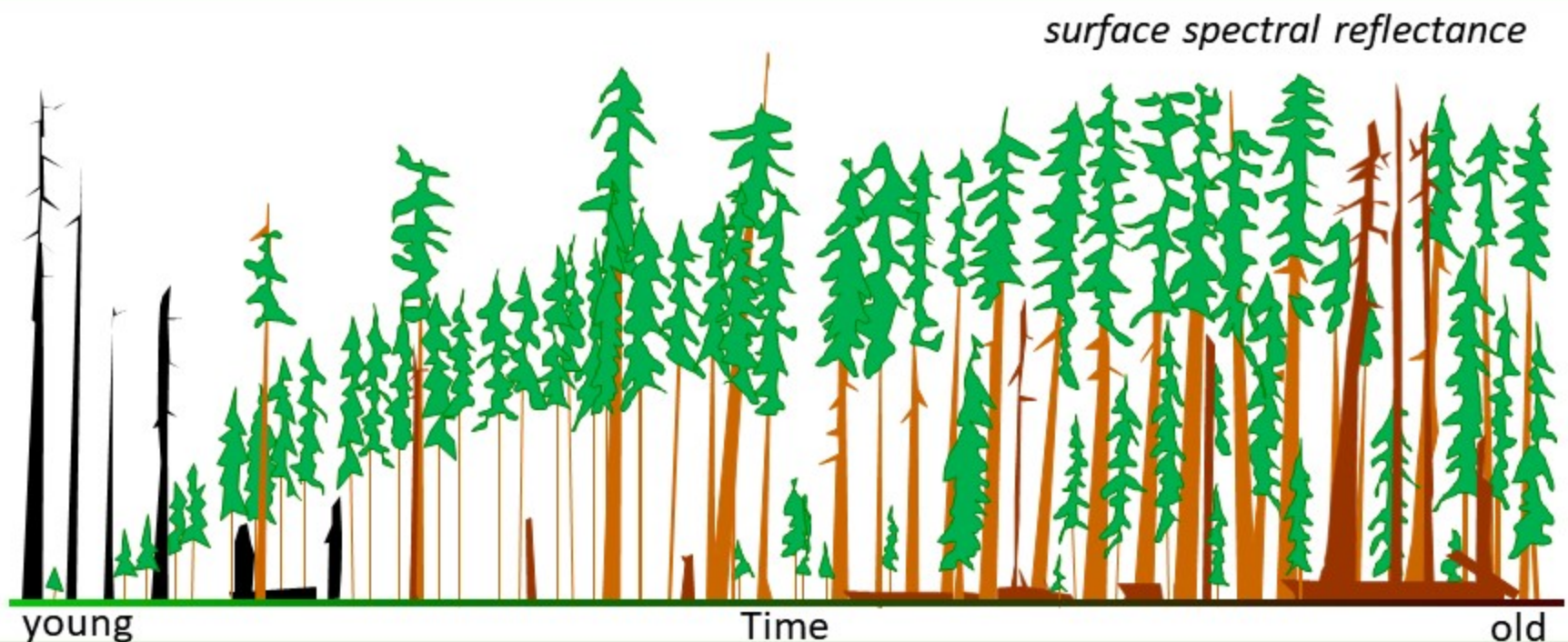
lidar height data
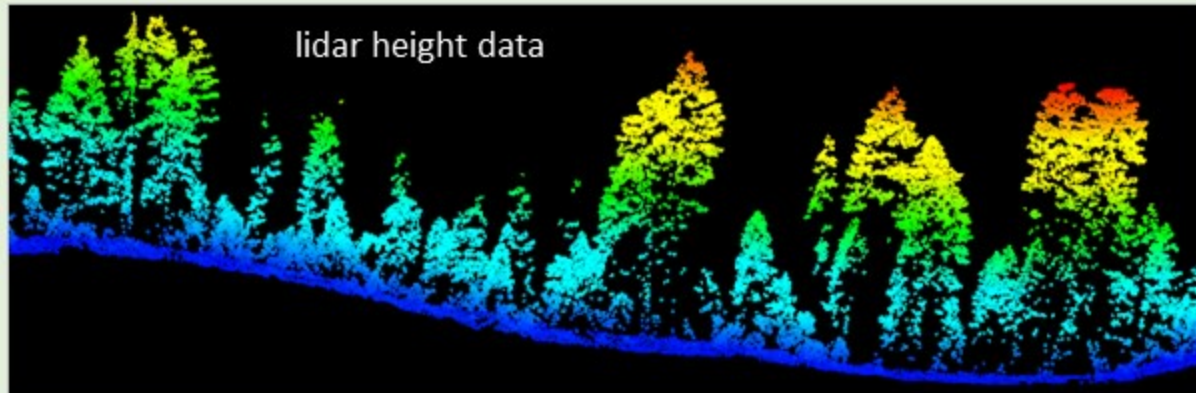
Landsat only
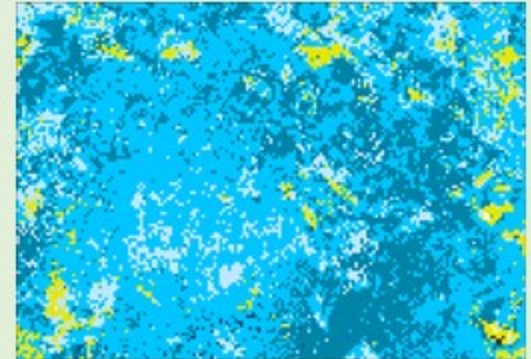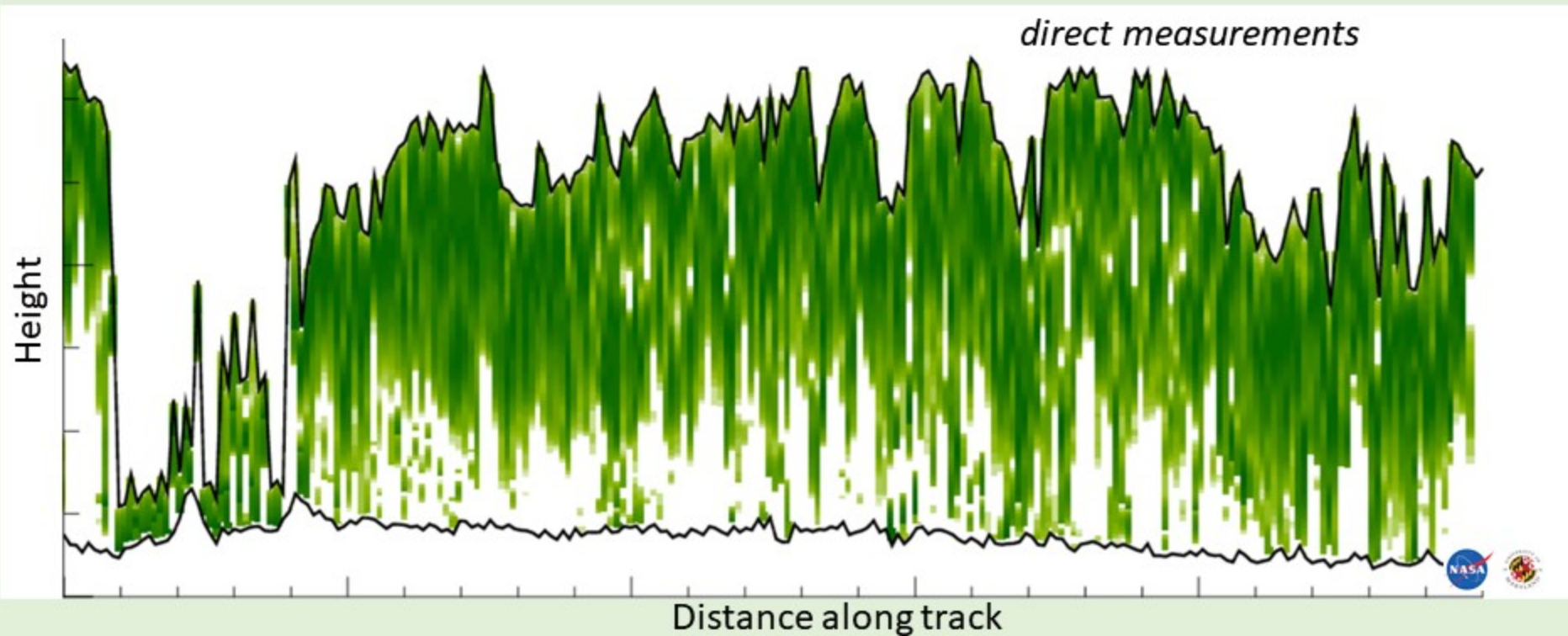

Aerial image

Landsat + lidar

Mapping the old growth structure index

- Represents forest succession (young to old)

- Density of large live trees

- Live tree size class distribution

- Dead wood components

surface spectral reflectance

young   Time   old

The GEDI measurements

- Forest canopy height

- Canopy vertical structure

- Surface elevation

direct measurements

- OBIWAN is an application for making customized GEDI-based carbon estimates

- It links GEDI shots to ancillary data (entire Landsat and Sentinel-1&2 archives, for example) through Google Earth Engine

- We could use the same platform and ancillary data to model forest structure from GEDI across the entire Pacific NW
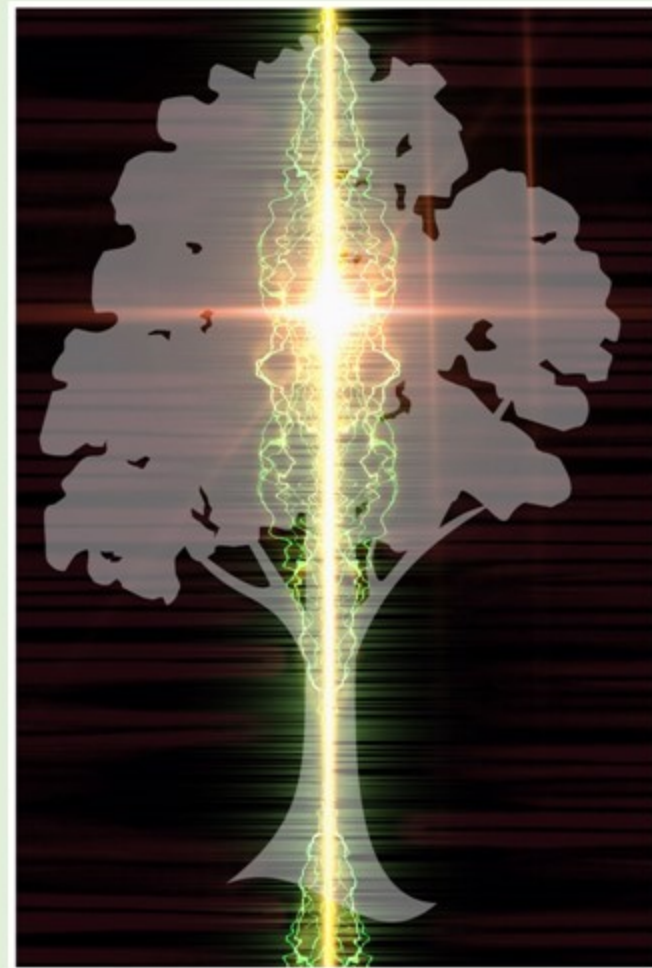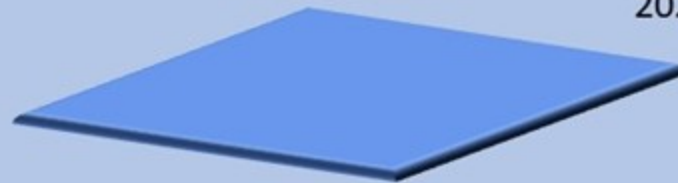

OBI-WAN
Forest Carbon Reporting

GEDI ECOSYSTEM LIDAR

NASA

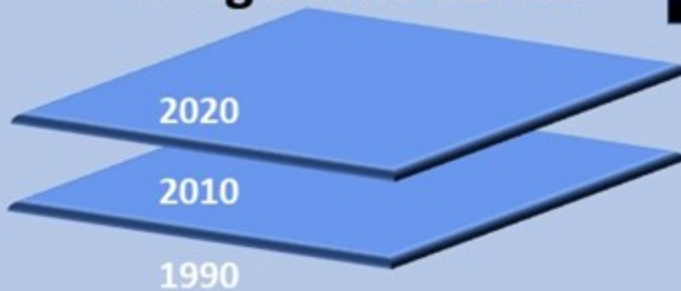FIA *The Nation's Forest Census*

What does it look like?

GEDI waveforms
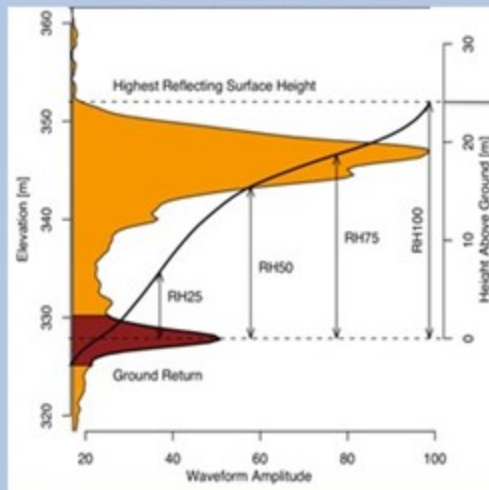
Contemporary imagery

2020

X

Make Structure Model

Apply model to image time series → **Modeled structure time series**

2020
2010
1990

2020
2010
1990
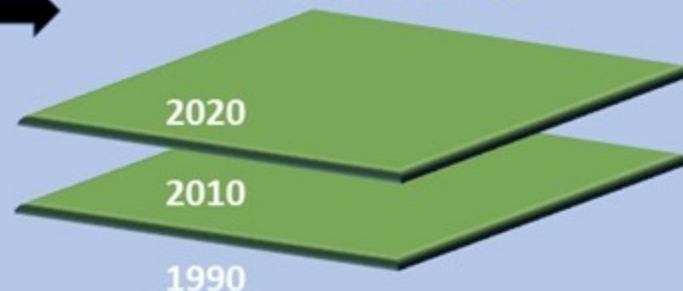
Improving old-growth forest structure mapping

- Improved wall-to-wall inputs = improved maps

- Quantify the improvement with validation data from FIA plots

- Support regional monitoring and planning efforts

- Increase capacity to address complexity and scope of forest policy issues (climate change, sustainability, etc.)

Thank You!