



Foresters Counting Atoms: the US Forest Carbon Inventory

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Outline

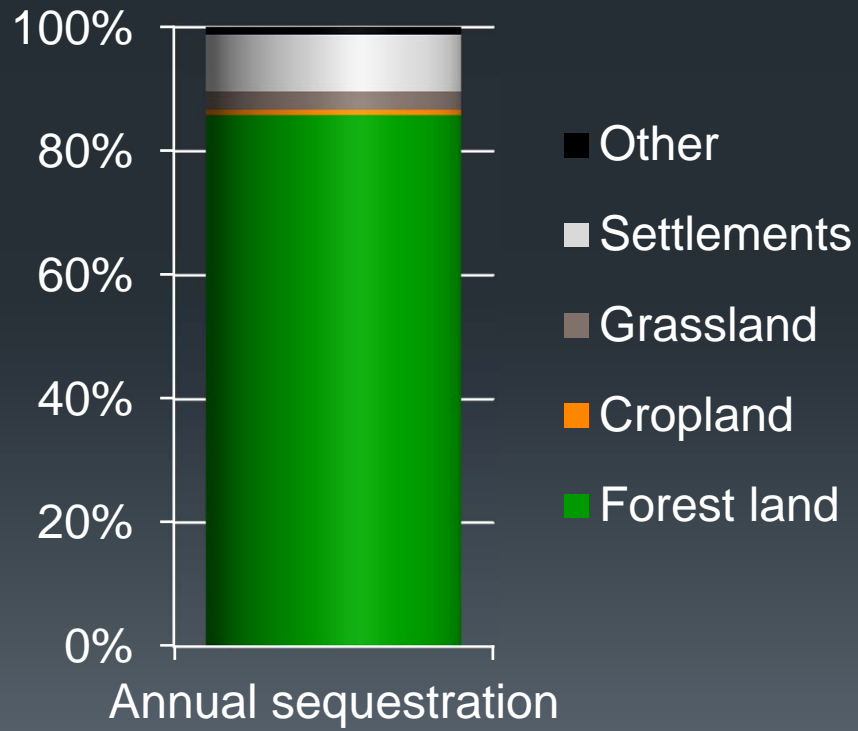
- Why inventory
- Reporting context
- Results
- Recent changes
- Extension and outreach
- Future work



Why inventory?

86%

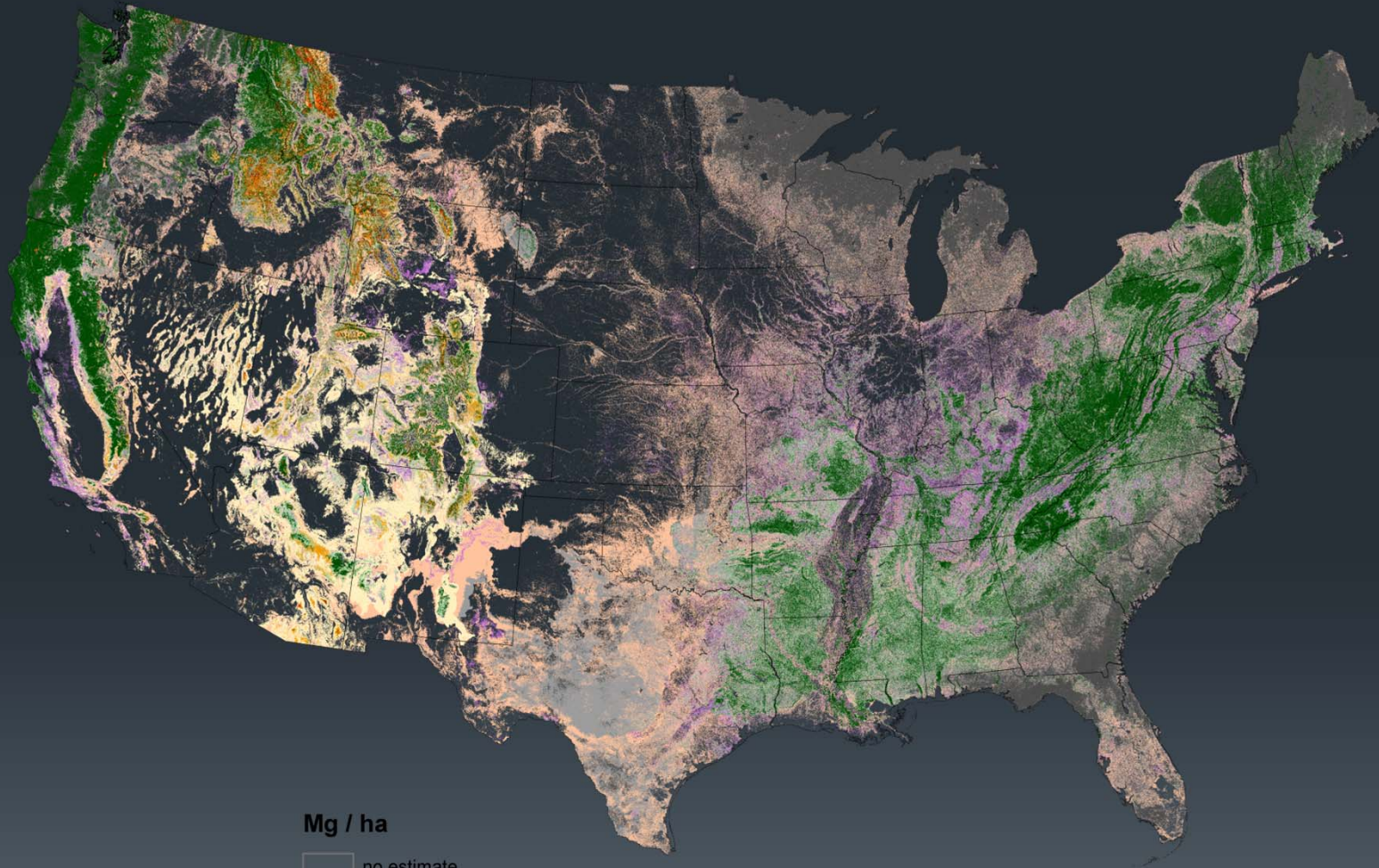
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Context: National GHG inventory report

- Compiled annually and submitted to the UNFCCC (UN Framework Convention on Climate Change)
- Coordinated by EPA
- Reporting guidelines established by IPCC (Intergovernmental Panel on Climate Change)
- Includes emissions and sinks associated with:
 - Energy
 - Industrial Processes
 - Waste Management
 - Agriculture, **Forestry**, and Other Land Uses

A lot of forest carbon to inventory



Mg / ha

no estimate

Live biomass

< 25

25 - 50

> 50

Soil Organic Carbon

< 25

25 - 50

> 50

Dead Wood and Forest Floor

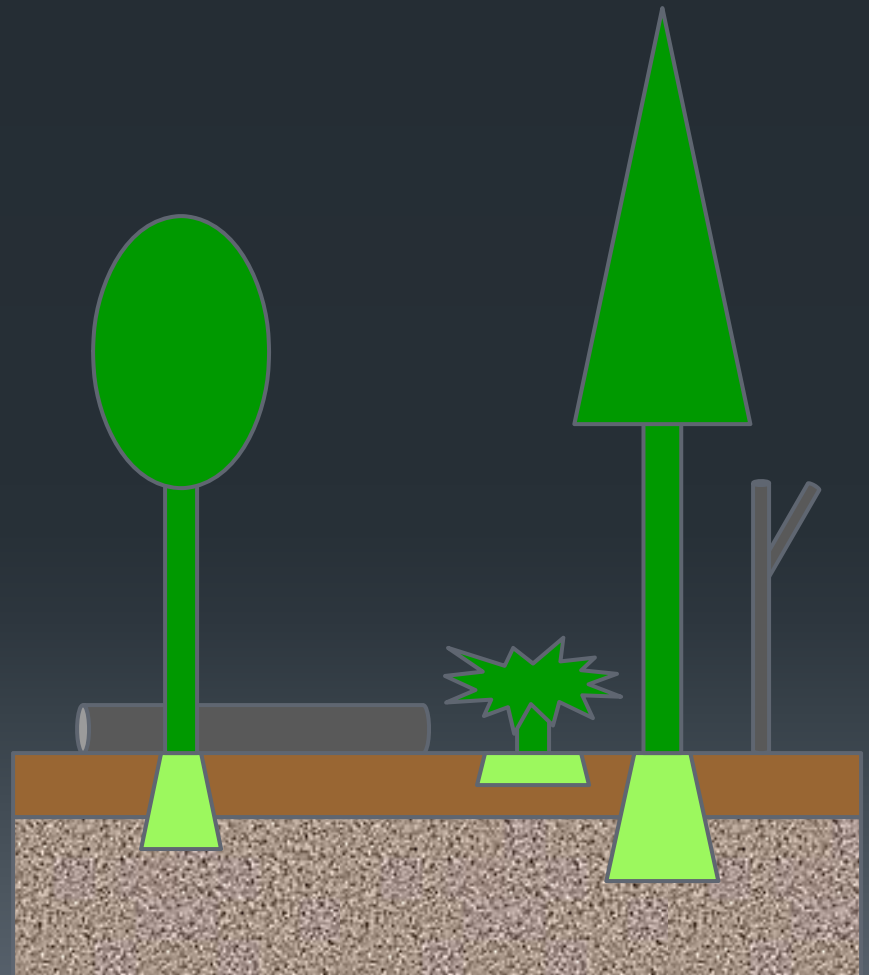
< 25

25 - 50

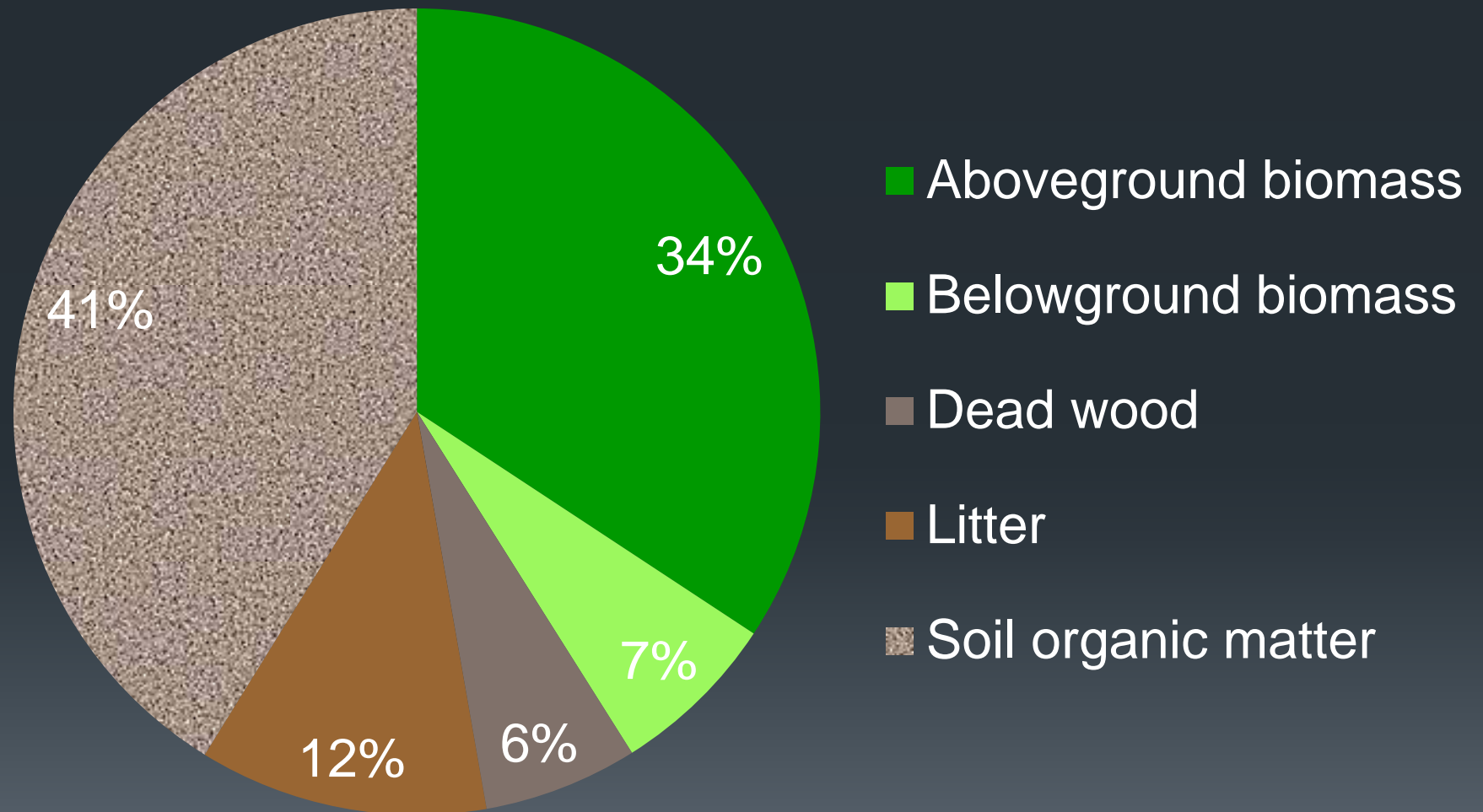
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Diversity of carbon pools

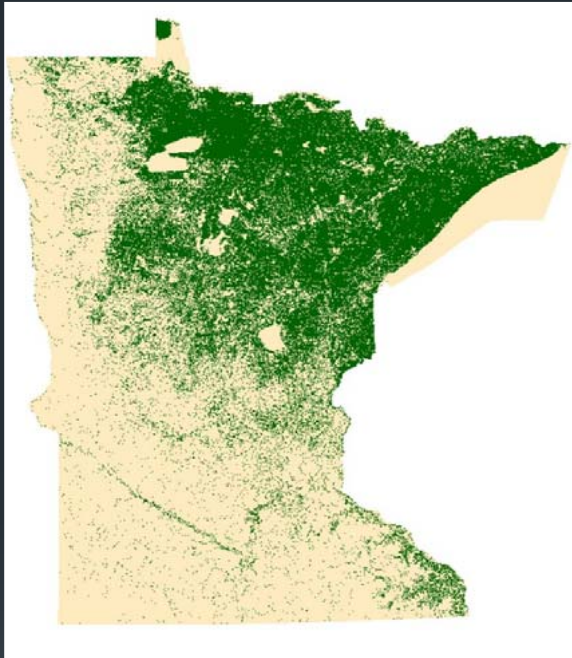
- Aboveground biomass
- Belowground biomass
- Dead wood
- Litter
- Soil organic carbon



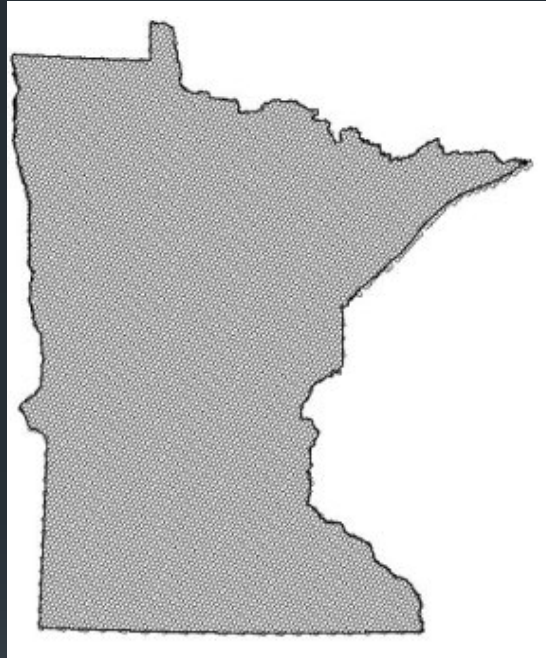
Forest carbon pools across US



FIA inventory



Phase 1



Phase 2
1 plot per 2,430 ha



Phase 3
1 plot per 38,880 ha

Field vs. models

- Live Tree = Measurement
- Standing Dead Tree = Measurement
- Litter = **Model**
- Downed Dead Wood = **Model**
- Soil Organic Carbon = **Model**
- Belowground = **Model**



VS.



* Used in 2012 National Greenhouse Gas Inventory of Forests (LULUCF)

Volume → biomass → carbon

- Component ratio method (CRM) for biomass estimation
- National volume/biomass study



Improving the accuracy of standing dead tree estimates

Indirect estimates → direct estimates → improved direct estimates

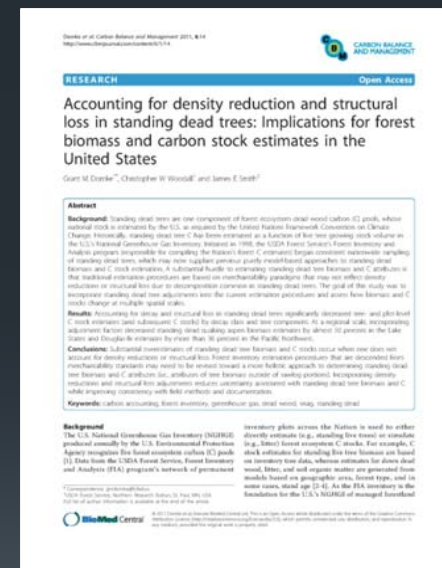
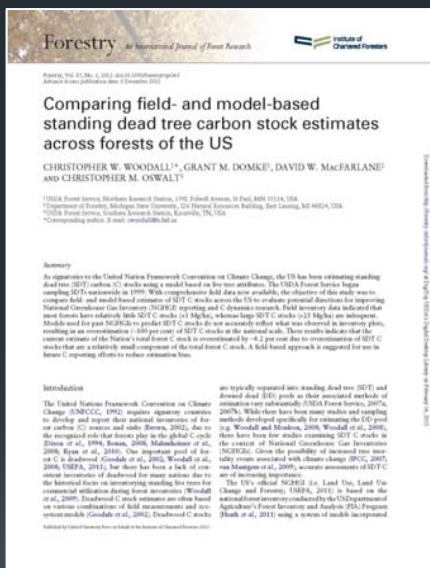


Accounting for decay and loss

Model → Field-based

CRM
+
Density Reduction Factors

CRM
+
Density Reduction Factors
+
Structural loss Adjustments

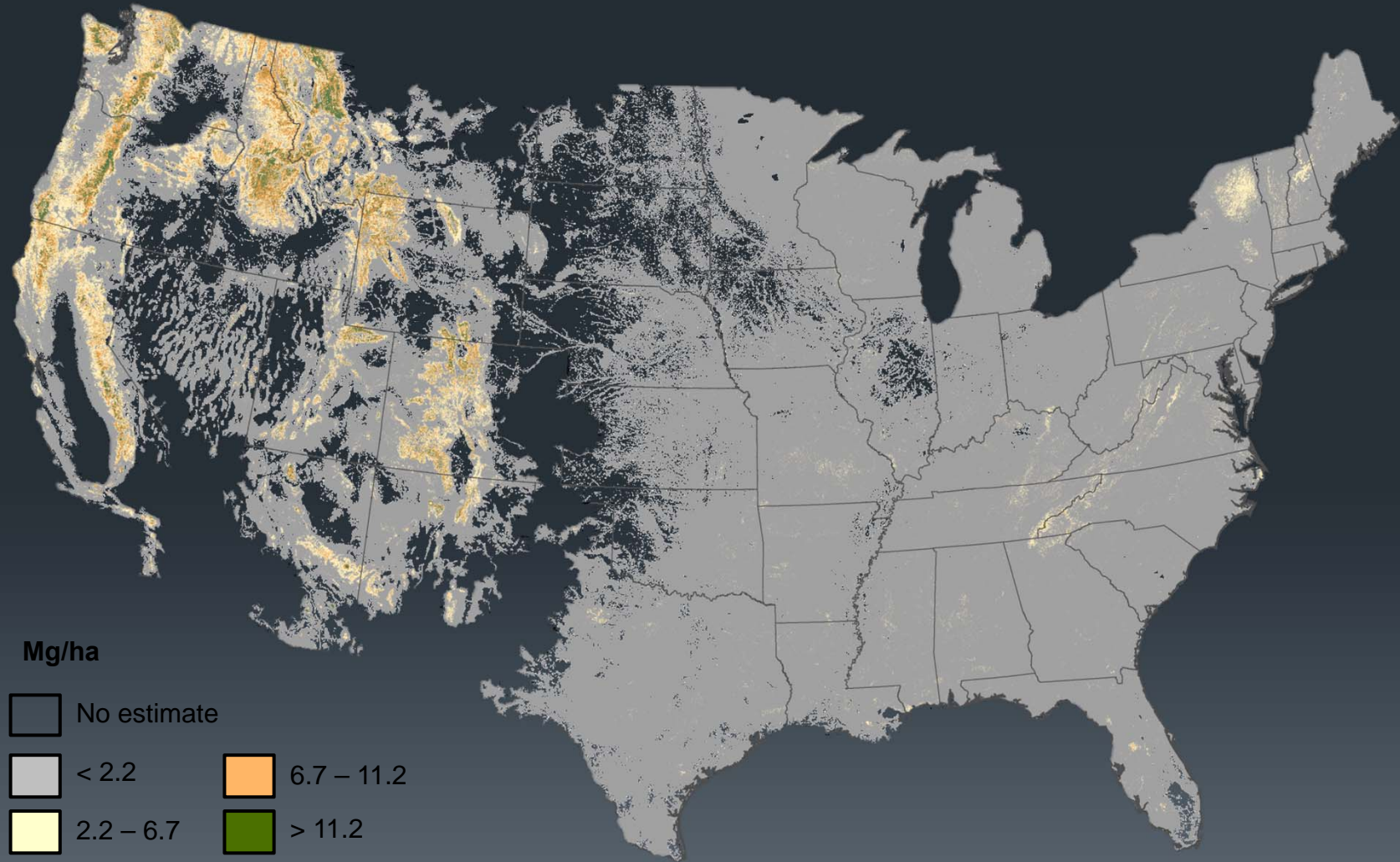


Woodall, C.W., Domke, G.M., MacFarlane, D.W., and Oswalt, C. 2012. Comparing field- and model-based standing dead tree carbon stock estimates across forests of the United States. *Forestry* 85: 125-133.

Harmon M.E., Woodall C.W., Fasth B., Sexton J., Yatkov M.: Difference between standing and downed dead tree wood density reduction factors: a comparison across decay classes and tree species. USDA Forest Service, Northern Research Station 2011, Res Pap NRS-15.

Domke, G.M., Woodall, C.W., and Smith, J.E. 2011. Accounting for density reduction and structural loss in standing dead trees: Implications for forest biomass and carbon stock estimates in the United States. *Carbon Balance and Management* 6:14.

Standing dead biomass



Differences in dead tree carbon

Decay class 1



Decay class 2



Decay class 3



Decay class 4



Decay class 5



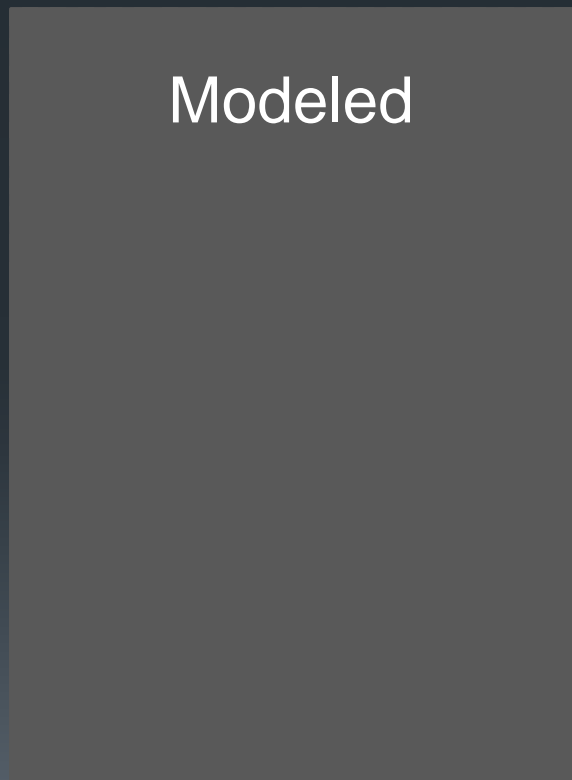
Method

CRM:	91.2 kg C	74.8 kg C	29.4 kg C	2.4 kg C	0.4 kg C
CRM+DRF:	89.2 kg C	61.2 kg C	19.6 kg C	1.7 kg C	0.3 kg C
CRM+DRF+SLA:	87.9 kg C	49.1 kg C	12.1 kg C	1.0 kg C	0.2 kg C

Baseline trend recalculations (2010)



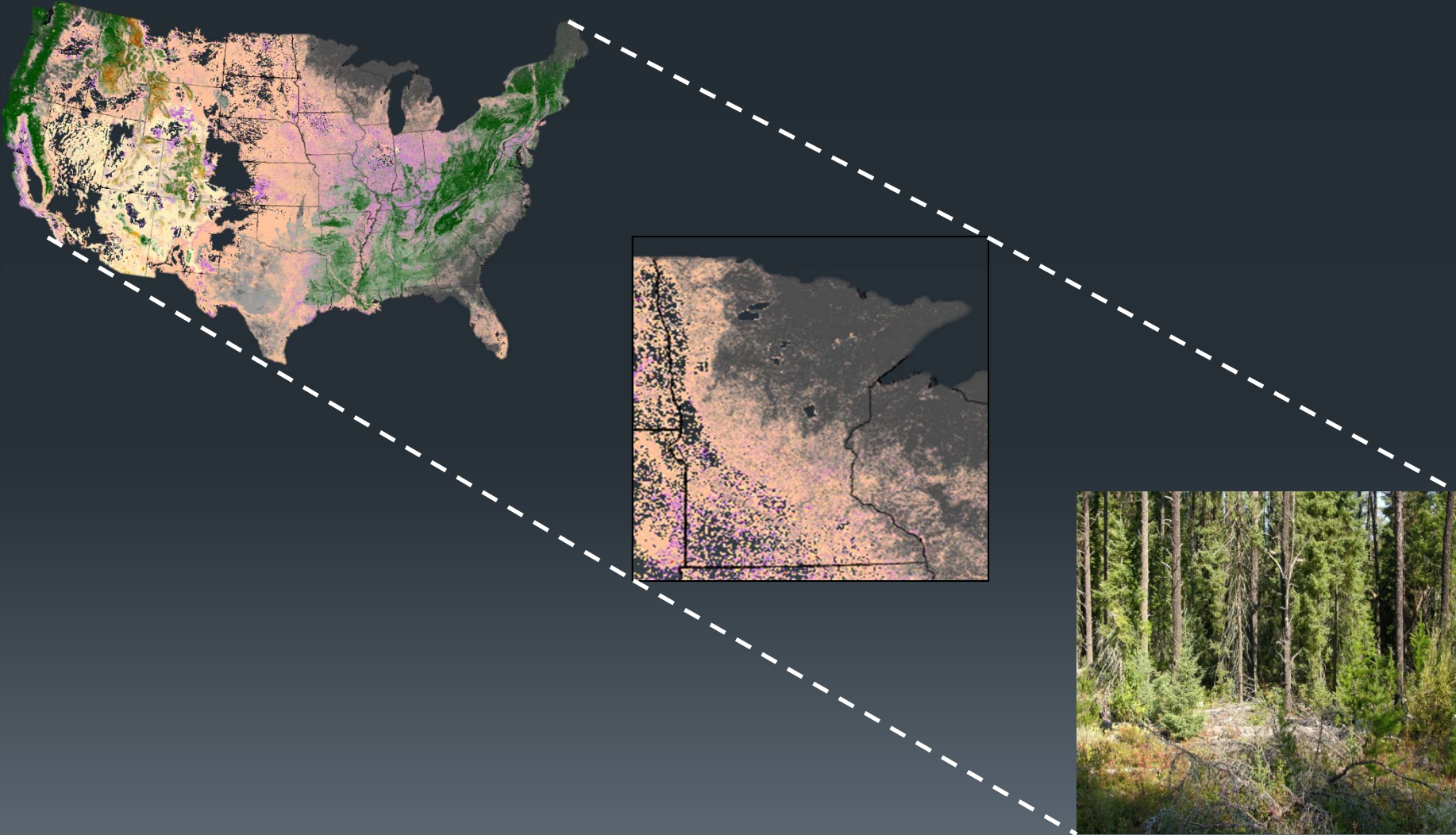
Baseline stocks



Stock change



So what?



Extension and outreach



- Operational forest carbon assessment and management framework (downscaling to National Forest System)
- Scaling effects in aboveground biomass density: Estimating tree-level biomass using very high resolution satellite imagery, Lidar and inventory data
- Updates to USDA forest carbon accounting guidelines
- International programs support to build technical capacity in other nations

Future work

- National volume/biomass study
- Down dead wood
- Soil organic carbon
- Foliage model
- Belowground biomass model
- Downscaling



Summary

- Primary charge: deliver forest carbon estimates to the EPA
- Science: estimation of forest carbon pools (e.g., standing dead trees and down dead wood)
- Extension: downscaling, methods development
- Outreach: IP, guideline development



Thanks!

