

USGS National Carbon Sequestration and Greenhouse Gas Assessment USGS LandCarbon Project

1. Assessment requirements and scope
2. Methodology and recent results
3. Assessment plan for FY11-12

Why is this Assessment Needed?

- Policy makers and stakeholders need to know a range of future potential choices, their effectiveness and consequences related to C and GHG mitigation.
- Need to improve spatial footprint of current knowledge to match the scale of policy applications
- Need to improve understanding of uncertainties related to carbon and GHG ecological processes
- Need for integrated knowledge about all ecosystems

Requirements and Scope

EISA Sec 712 Requirements

- Assess ecosystems: both terrestrial (forests, shrub and grasslands, croplands, wetlands) and aquatic (rivers, lakes, coastal waters)
- Estimate baseline and potential carbon stocks and sequestration capacities
- Cover fluxes of CO₂, N₂O, and CH₄
- Evaluate land management and ecosystem restoration activities
- Evaluate effects of natural and anthropogenic processes (e.g. climate change, wildland fire, land use and land cover change)
- Consultation and cooperation (e.g. USDA, Forest Service, EPA, NOAA, and DOE)

Why Estimating Ecosystem Carbon Stocks and Capacities?

- Carbon in ecosystems is a key indicator of the overall CO₂ emissions and carbon balance between lands and atmosphere
- Biomass and carbon are natural resources, and they are important ecosystem properties; increased land use and global climate change may lead to losses in the resources
- Carbon in ecosystems may be managed as credits to mitigate global climate change

Why is this Assessment Needed?

- Policy makers and stakeholders need to know a range of future potential choices, their effectiveness and consequences related to C and GHG mitigations
- Need to improve spatial footprint of current knowledge to match the scale of policy applications; need to improve understanding of uncertainties related to carbon and GHG ecological processes
- Other assessments exist, but there is an urgent need for integrated knowledge about all ecosystems



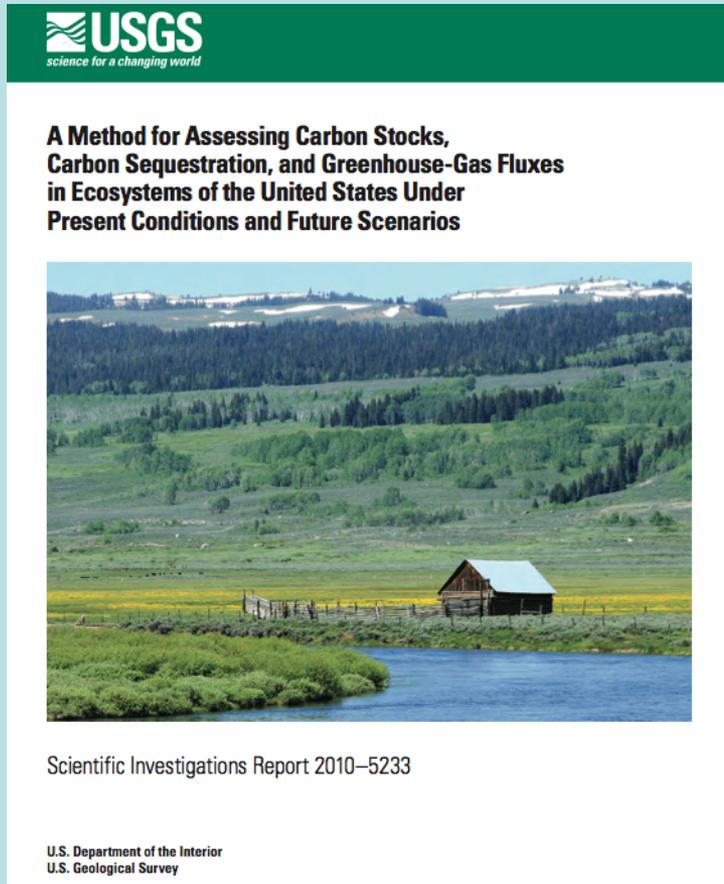
USGS National Carbon Sequestration Assessment – the Scope

Ecosystems (per IPCC)	Baseline (past-present)	Potential capacities	
		Reference	Mitigation
Forest			
Shrub/grass			
Wetlands			
Croplands			
Aquatic systems			

Carbon stocks, sequestration rates, fluxes of CO₂, CH₄, N₂O, effects of CC, land change, wildland fires, etc.

Methodology and Recent Results

Methodology for the assessment



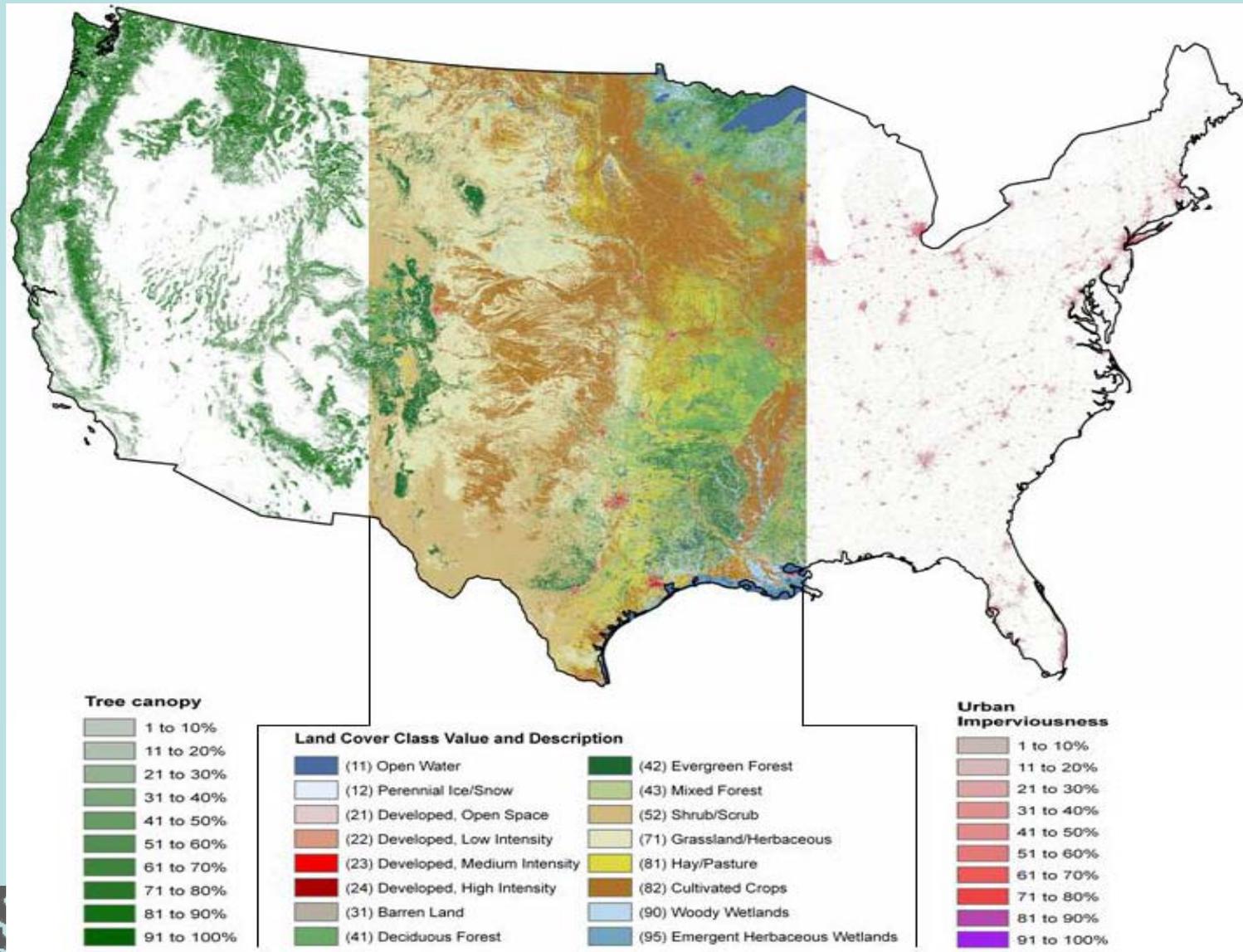
USGS developed this methodology in consultation with many other federal agencies and other organizations:

- USGS Science Investigations Report 2010-5233
- Available at <http://pubs.usgs.gov/sir/2010/5233>

Ecosystem definitions

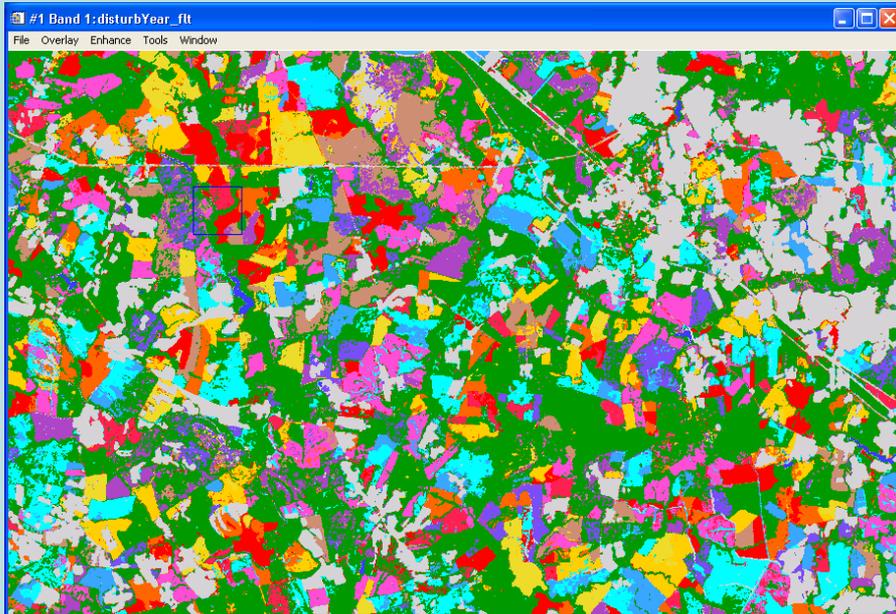
IPCC ecosystems	Land cover
Forests	Deciduous Evergreen Mixed Disturbed
Shrub and grasslands	Shrub/scrub grassland/herbaceous Sedge/herbaceous Lichens, Moss
Croplands	Cultivated cropland Irrigated land Pasture/hay
Wetlands	Forest wetlands Herbaceous wetlands Costal salt-marsh wetlands
Aquatic systems	Lakes, ponds, reservoirs Rivers Estuaries Coastal waters

Land cover map from Landsat

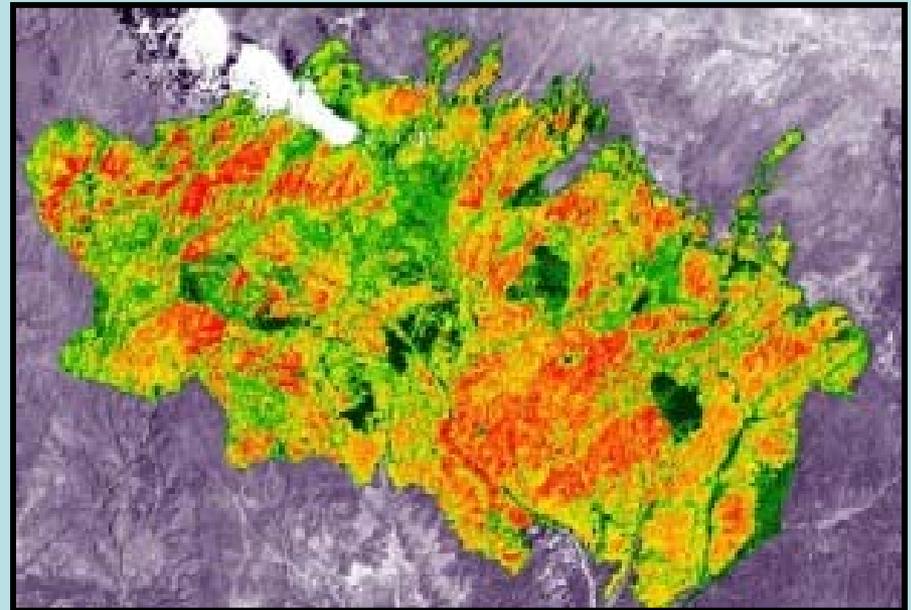


Observed Land Change

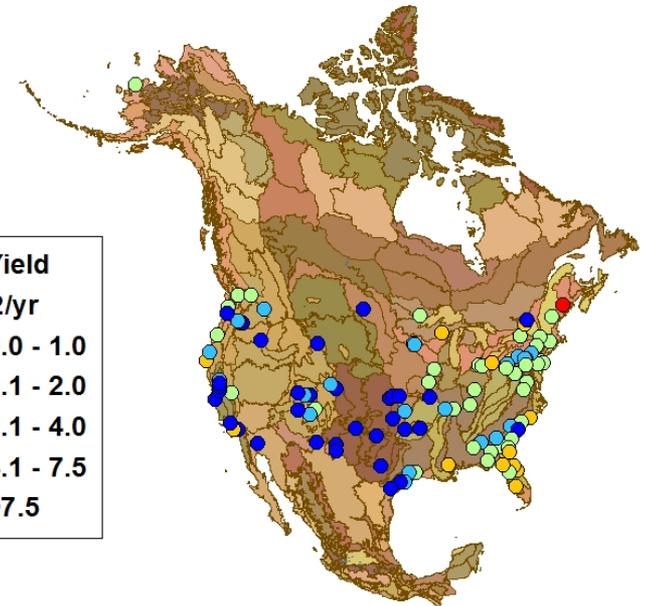
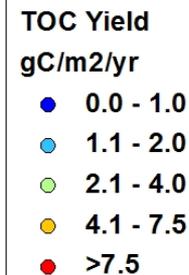
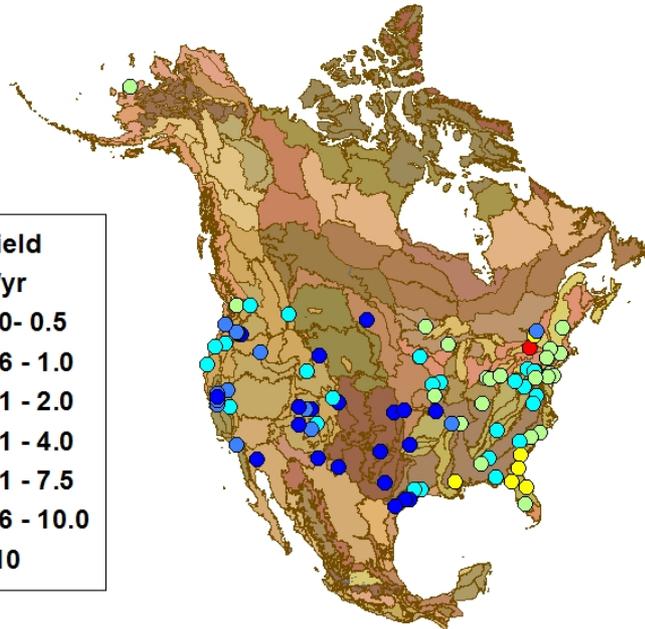
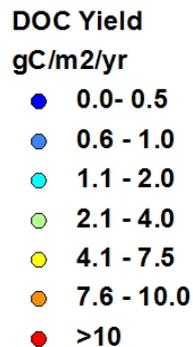
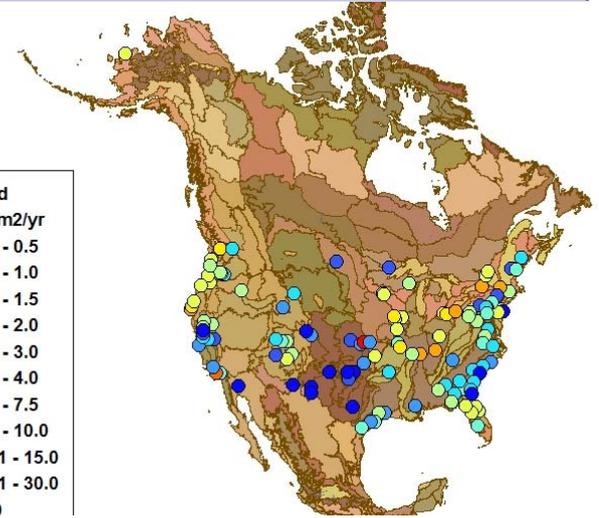
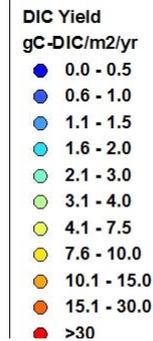
Forest cuts



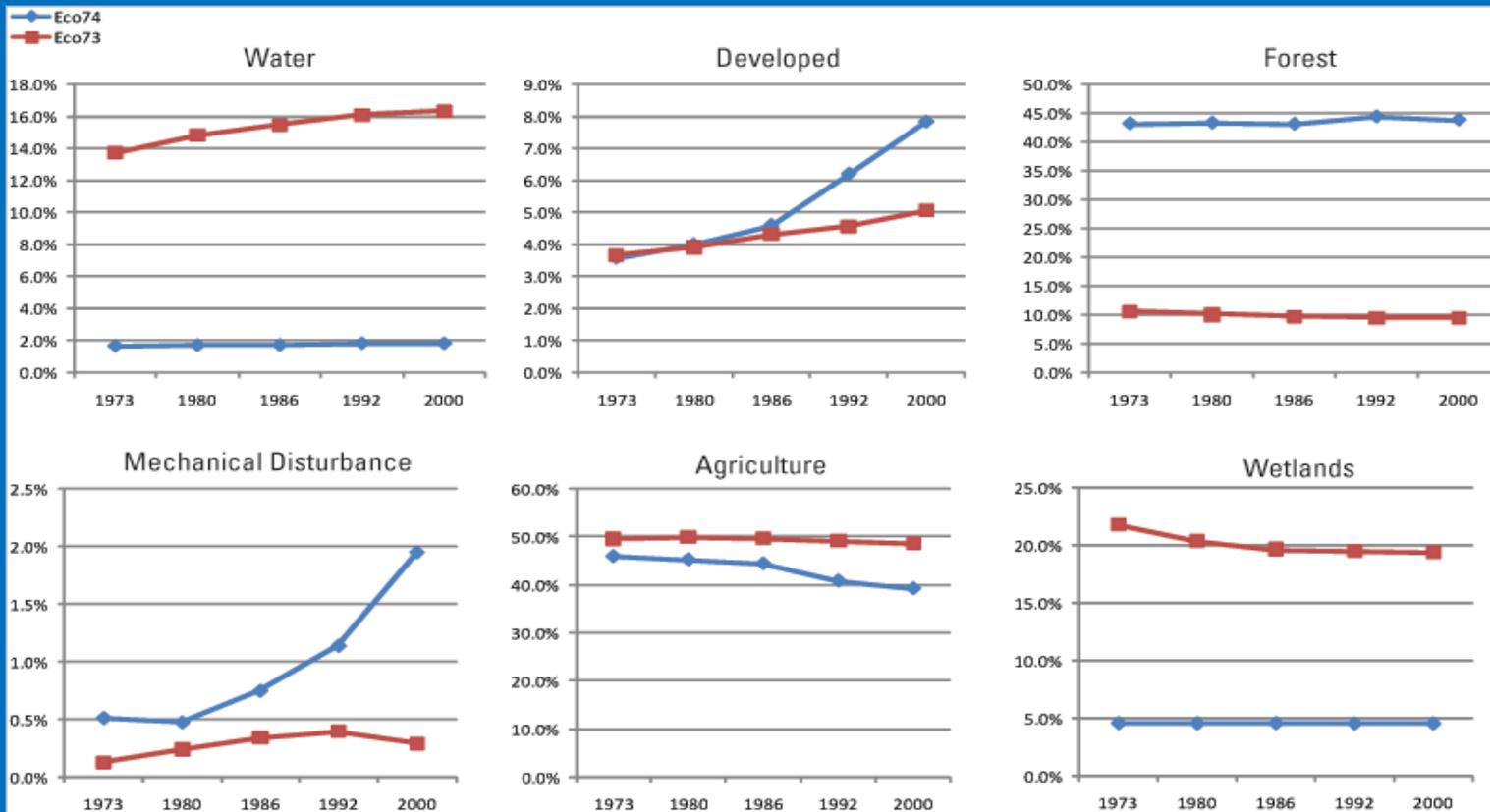
Wildland fires



Measured water chemistry data, including dissolved and particulate organic carbon

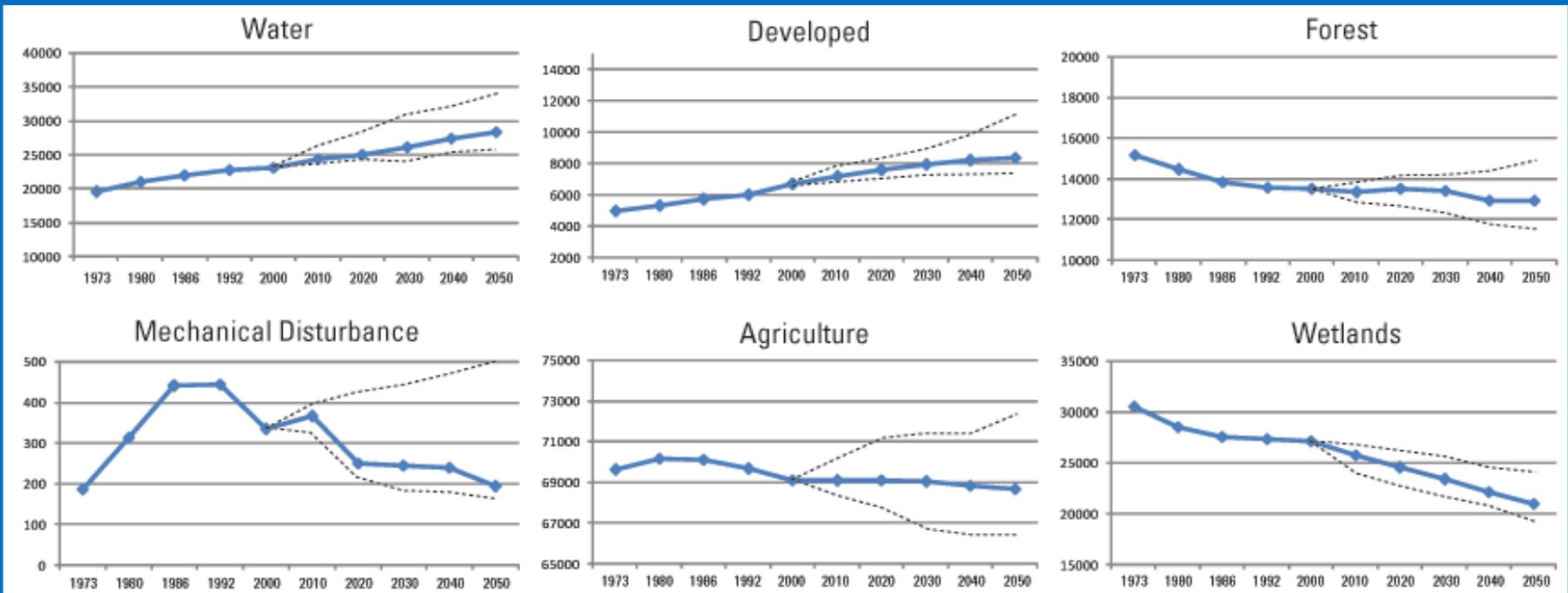


Recent LULC Trends – Key Input Data for Constructing Future LULC Scenarios



Per period change in the Mississippi Valley Alluvial Plain and the Mississippi Loess Plains ecoregions as measured by the USGS Land Cover Trends research project. Composition is measured as a percent of ecoregion area.

Reference Scenarios Developed

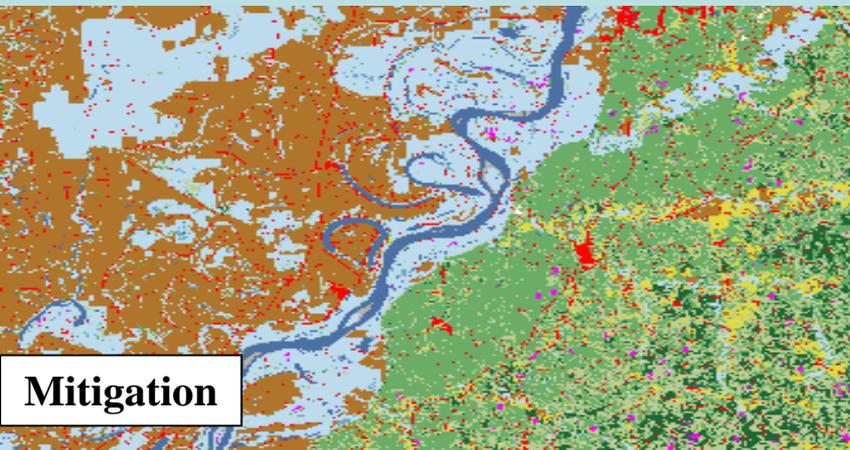
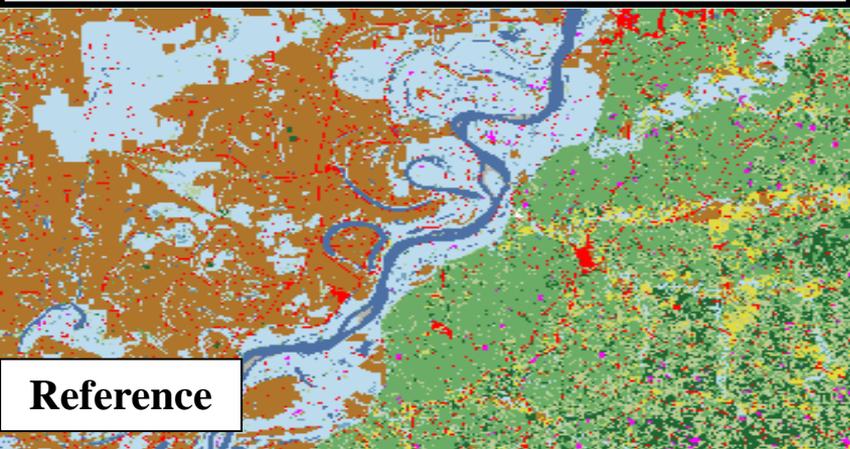


Scenarios developed for southeastern region of US

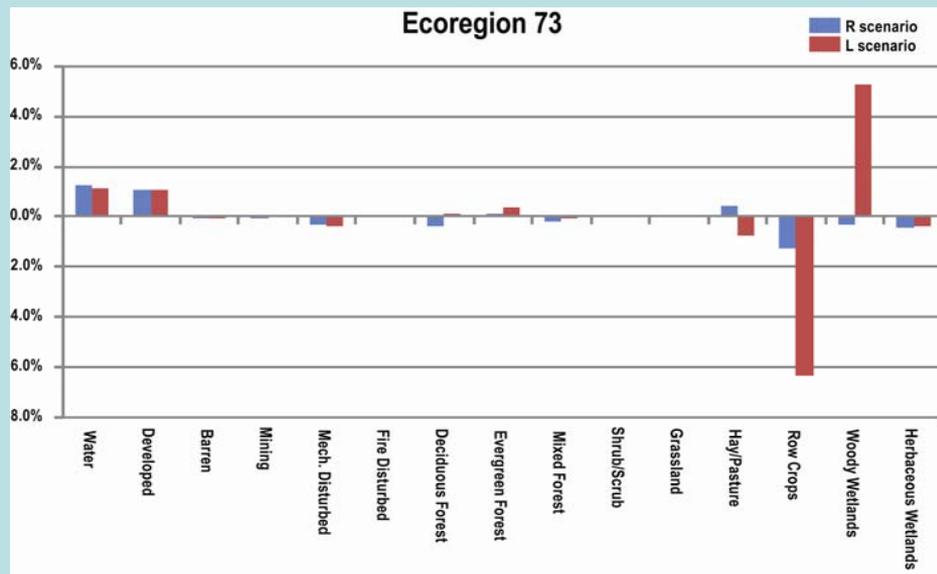
- Blue line = IPCC A1B
- Dash lines = A2 and B1



A1B Prototype

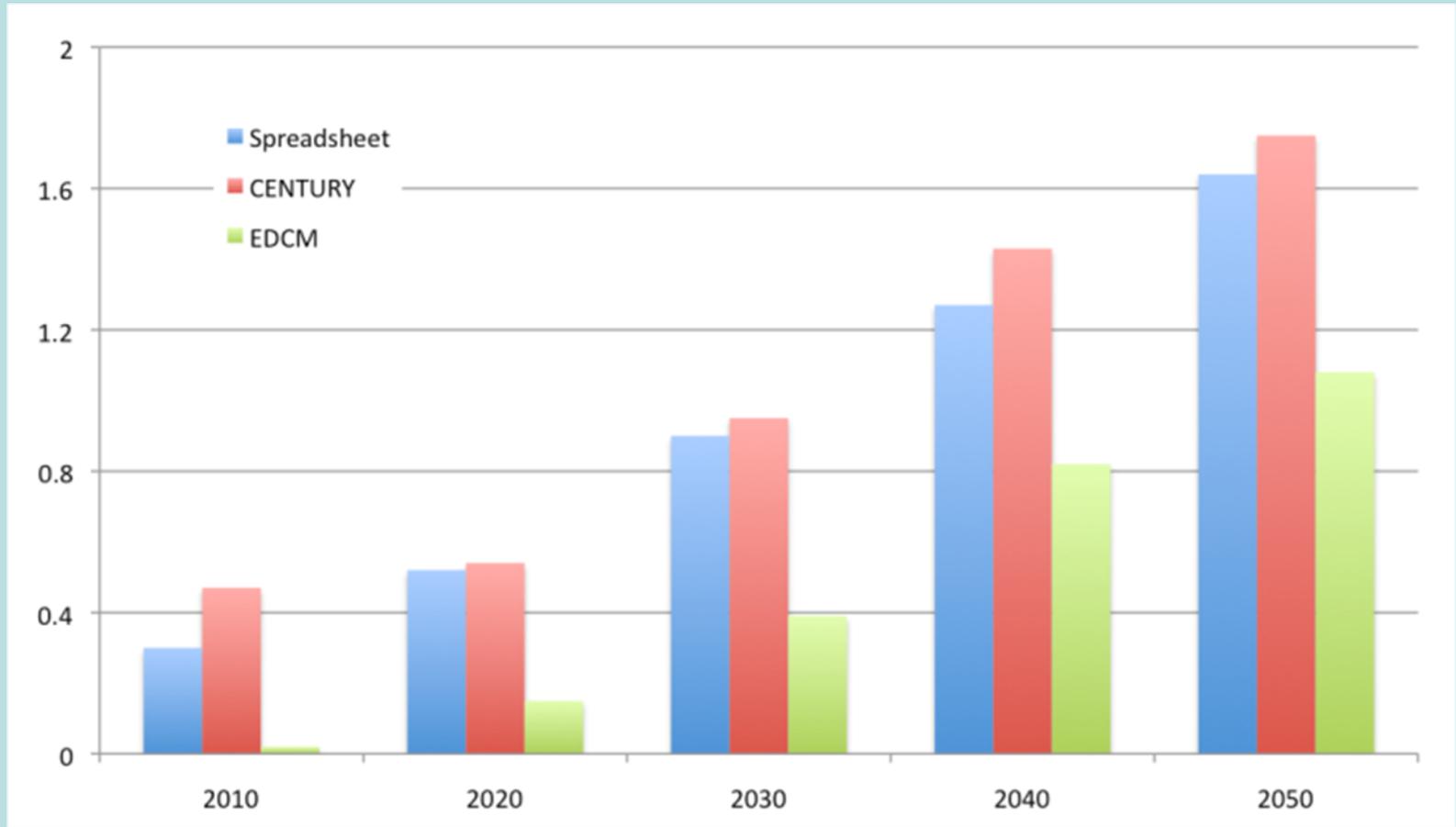


- **Model Run 2001 to 2050**
- **Reference Scenario - IPCC A1B**
- **Mitigation scenario includes:**
 - **Forested Wetland restoration in Mississippi Alluvial Plain**
 - **Increased afforestation in Mississippi Loess Plain**
 - **Eliminate deforestation (other than forest harvest and replant)**
 - **Eliminate wetland loss**
 - **Increase conservation tillage**
 - **Altered crop rotations**
 - **Increase forest cutting cycle period**

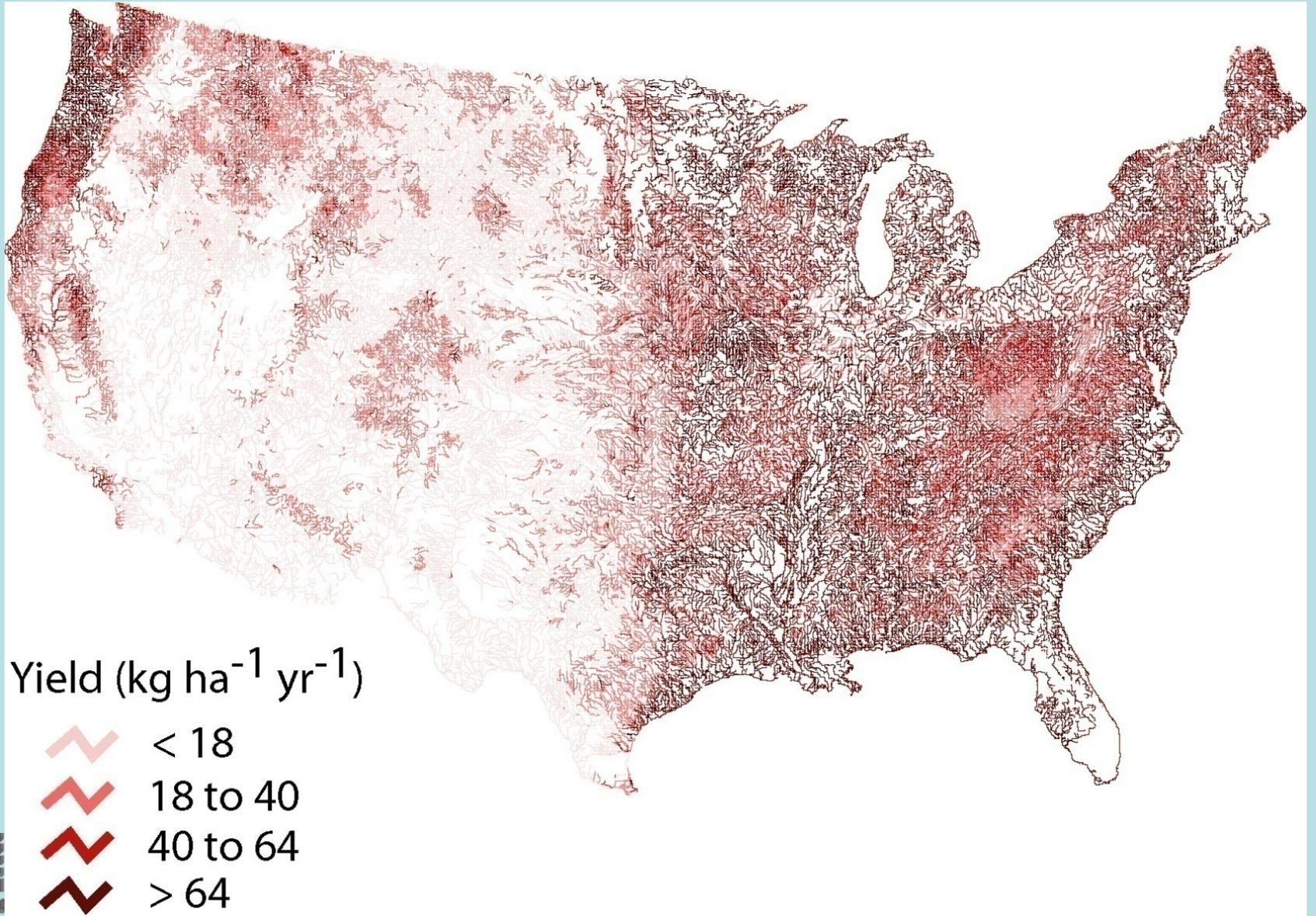


Modeling Results of Future Land Use and Land Cover Projections [terrestrial ecosystems]

Additional C sequestered (Tg C)



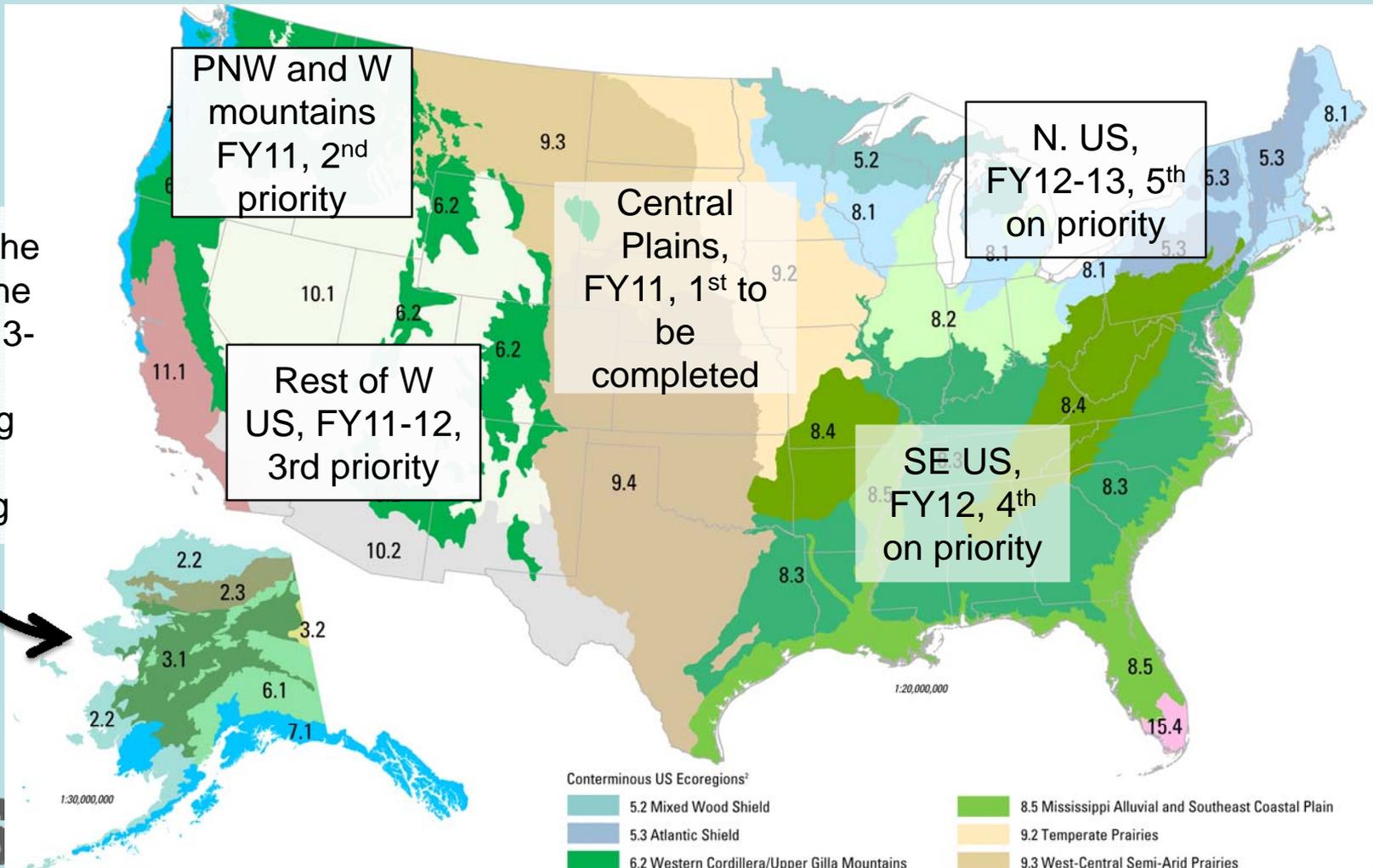
SPARROW Predictions: TOC Incremental Yield



Assessment Plan

Assessment conducted by region [currently funded for FY11-12]

AK and the rest of the US, FY13-14, pending future funding





Summary

- Land use/land cover change is primary driver of carbon stocks and sequestration in ecosystems
- Assessment requires measured and observed data, sophisticated methods and models (from other federal agencies and the USGS)
- We will begin to generate results this year; final products in FY12
- Products: USGS reports and GIS maps by regions, showing: 1) estimates of C stock and sequestration trends and capacities by ecosystems, 2) estimates of GHG flux in and out of the ecosystems, and 3) analysis of contributions of natural and land-use/land-management processes
- The USGS project team is eager to collaborate with other agencies and organizations to 1) reduce duplication, and 2) enhance assessment quality