

Research Support for National Forest System Carbon Assessments

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Thanks to Greg Kujawa for Introduction Slides

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Project Purpose

- Provide technical support to NFS units to meet policy/business requirements simultaneously and consistently:
 - ▣ Climate Change Performance Scorecard Element 9
 - To make measurable progress on Scorecard Element 9 (Carbon Assessment and Stewardship); help units be able to answer “Yes”
 - ▣ 2012 Planning Rule Directives
 - FSH 1909.12, 12.4 – Assessing Carbon



Changing Forests... Enduring Values

Purpose (cont.)

□ New Policies (cont.):

▣ President's Climate Action Plan

- Cut Carbon Pollution - Reducing Other GHG Emissions
 - Preserving the role of forests in mitigating climate change
- E.O. - Preparing the United States for the Impacts of Climate Change
 - Sec 3. "...recognizing the many benefits the Nation's natural infrastructure provides, agencies shall, where possible, **focus on program and policy adjustments that promote the dual goals of greater climate resilience and carbon sequestration, or other reductions to the sources of climate change.**"



Changing Forests... Enduring Values

Application – Management Implications

- Questions that may be informed by the Assessment:
 - ▣ How is the (LMP) plan area playing a role in sequestering and storing carbon?
 - ▣ How have disturbances, projects, and activities influenced carbon stocks in the past and may affect them in the future?
 - ▣ Are existing conditions and trends of forest vegetation indicating the plan area is a carbon sink or carbon source?



Changing Forests... Enduring Values

Application – Management Implications

- Questions (continued):
 - ▣ Under existing plan guidance, what is the future trend of the plan area in sequestering and storing carbon?
 - ▣ Are there opportunities to change plan components to influence these trends?



Changing Forests... Enduring Values

Project Deliverables

Standardized data sets and reports

Phase 1

Part A.

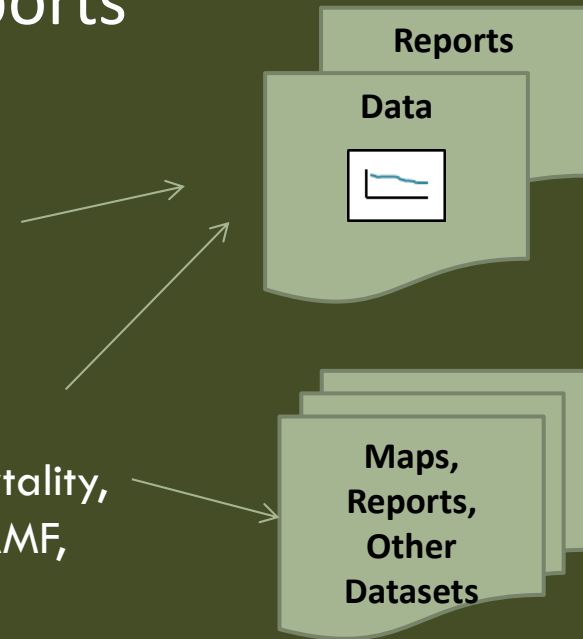
- Baseline Forest Ecosystem Carbon Stocks and Flux
- Harvested Wood Products (HWP) Pool

Part B. Disturbance History

- Influence of wildfires, insect/disease mortality, timber harvest, reforestation, etc. (ForCAMF, InTEC)

Phase 2

ForCaMF and InTEC will be moving towards customizable assessments.

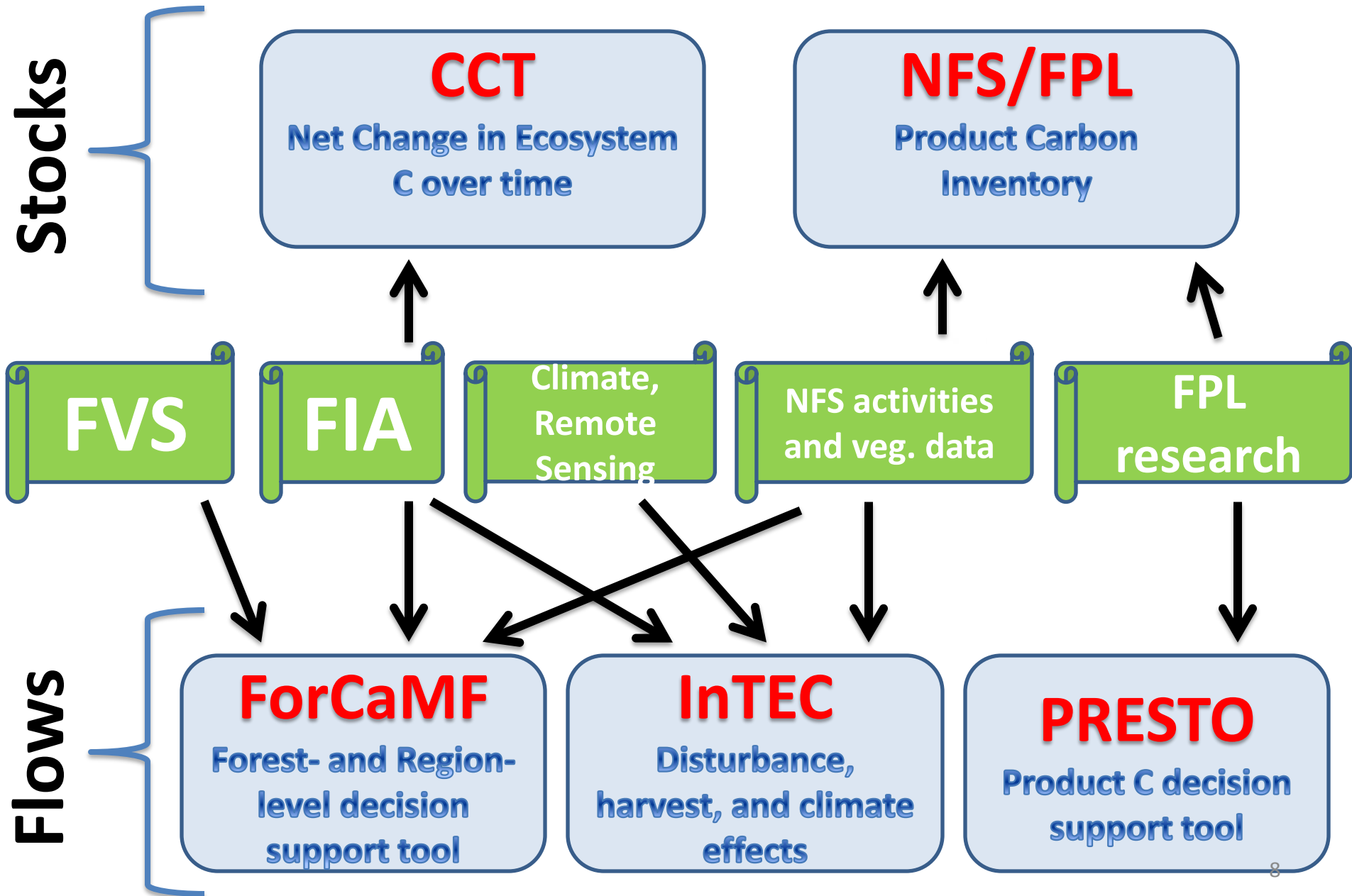


Changing Forests... Enduring Values

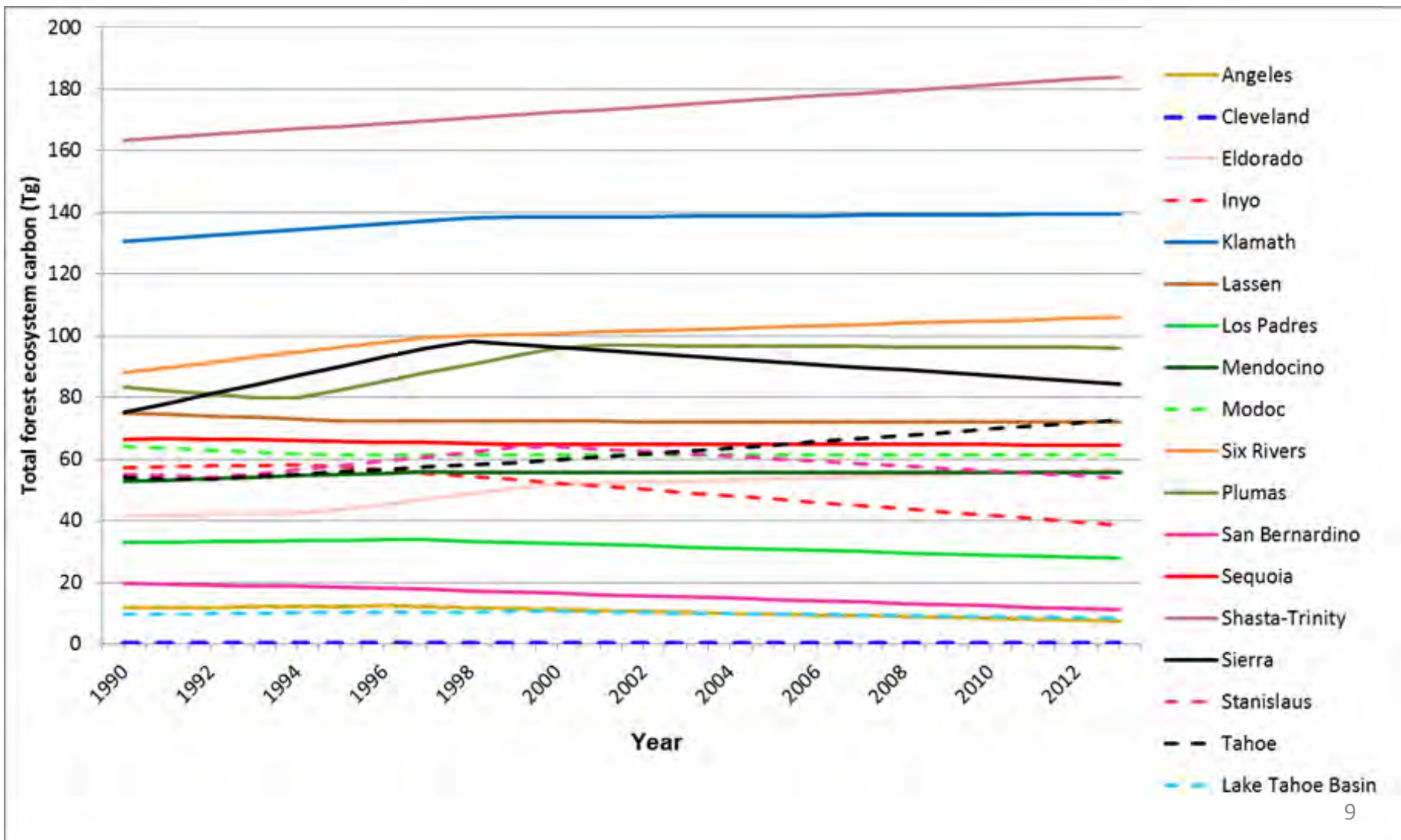
NFS Carbon Assessments: Some Challenging Technical Issues

- Ensure national consistency by harmonizing all methods with FIA carbon stock and productivity estimates
- FIA standard techniques are evolving:
 - CCT will reflect latest updates to methodology
 - Consider updating “standard” carbon tables (Smith et al. “green book”)
 - FVS carbon calculator needs updating (need for ForCaMF)
 - FIA-based input data sets to InTEC will be revised
- Need to harmonize biomass equations at different scales
- Attention to data management, standards, documentation, and QA/QC
- All supported by peer-reviewed scientific and technical publications

Scorecard Element 9: “Does the Unit have a baseline assessment of carbon stocks and an assessment of the influence of disturbance and management activities on these stocks?”

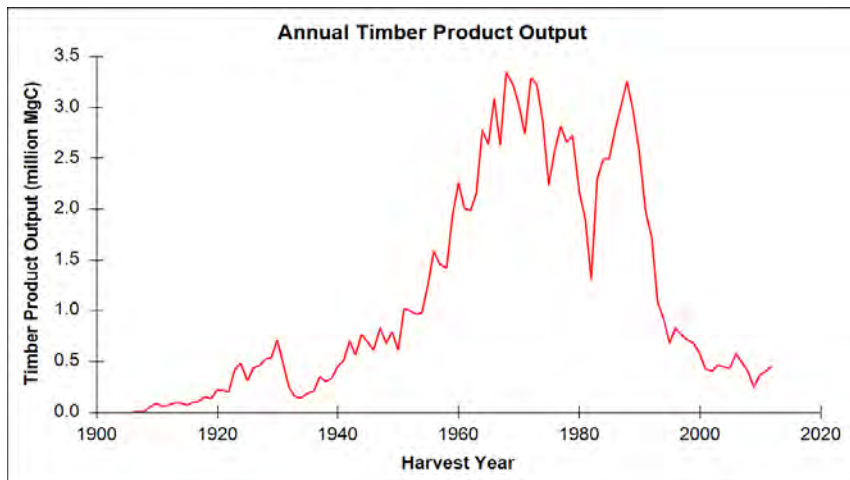


Carbon Stocks of National Forests, Region 5 from FIA's Carbon Calculation Tool (CCT)

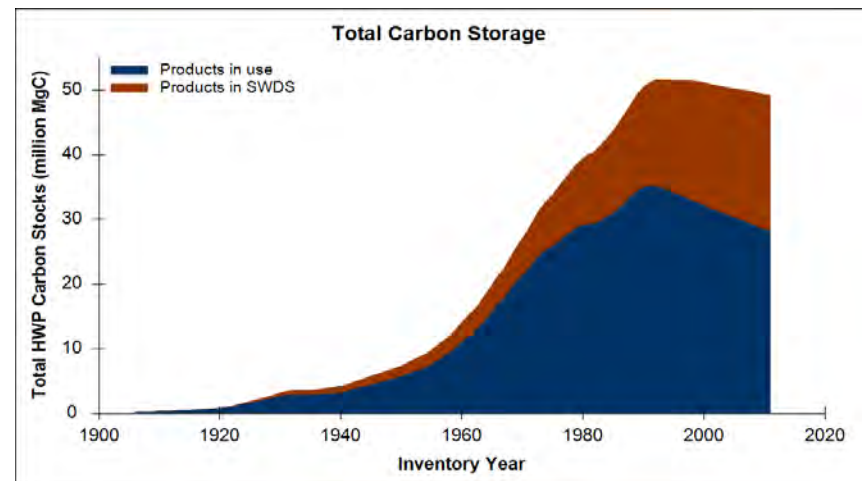


Harvested Wood Products, Region 5

Annual timber product output in the PSW Region, 1906 to 2012



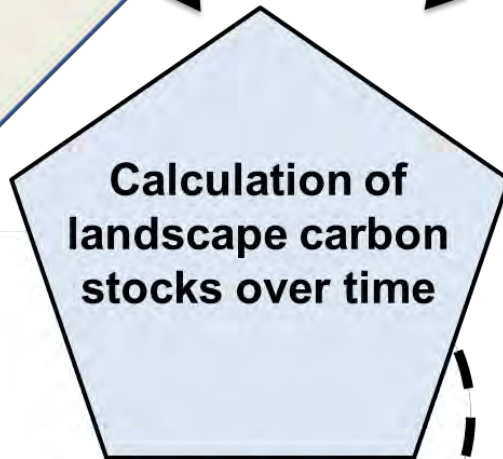
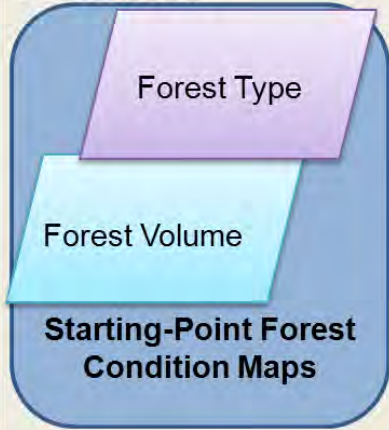
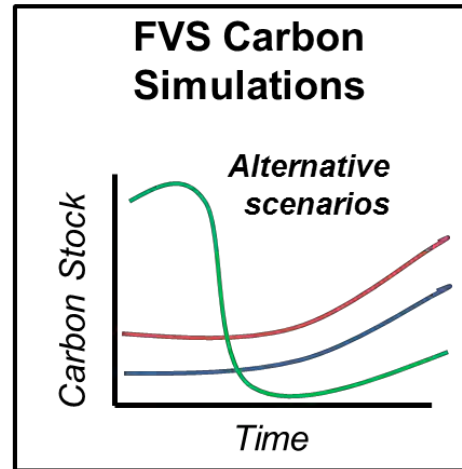
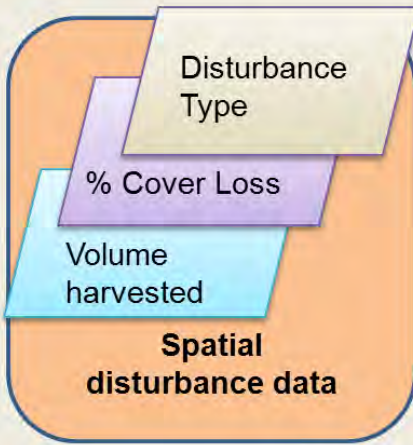
Cumulative total carbon stored in HWP manufactured from PSW Region timber



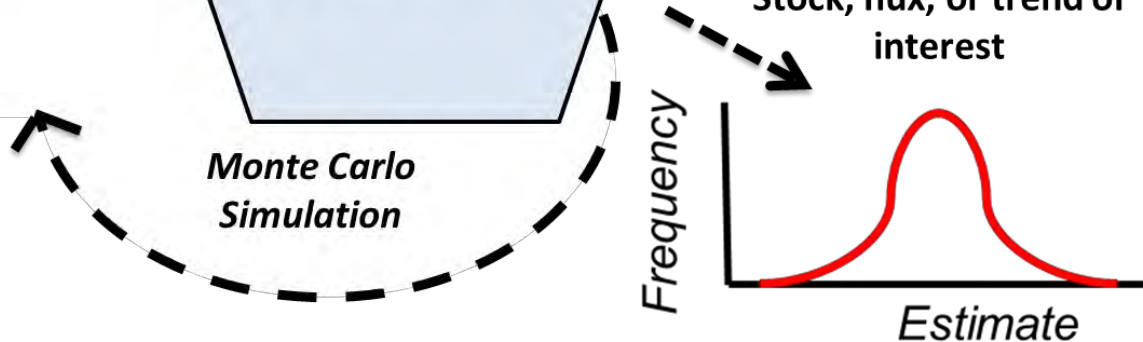
From Keith Stockman

Inputs

- Calibrated to FIA and mgt. records
- Can be altered to evaluate alternative scenarios

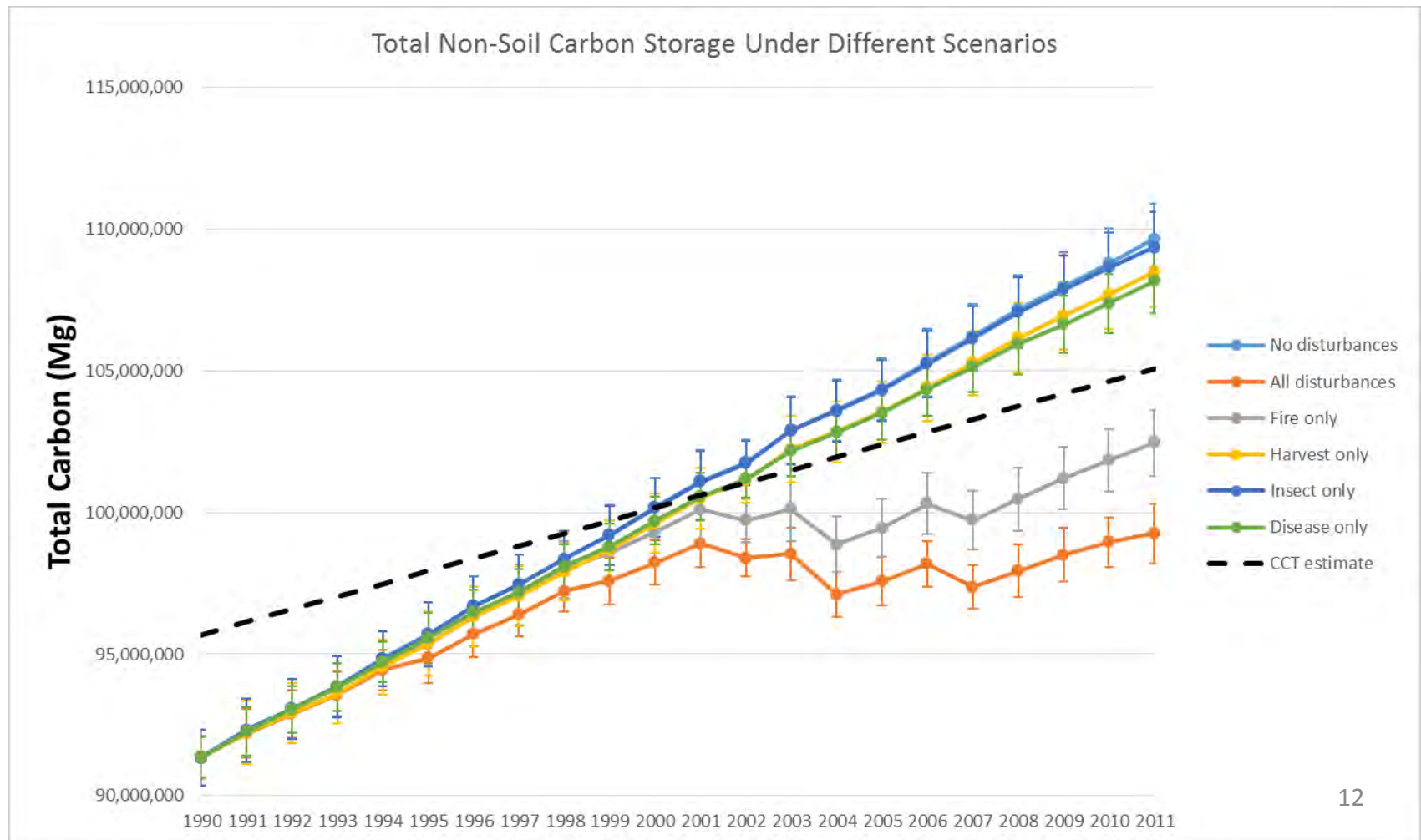


ForCaMF Forest Carbon Management Framework

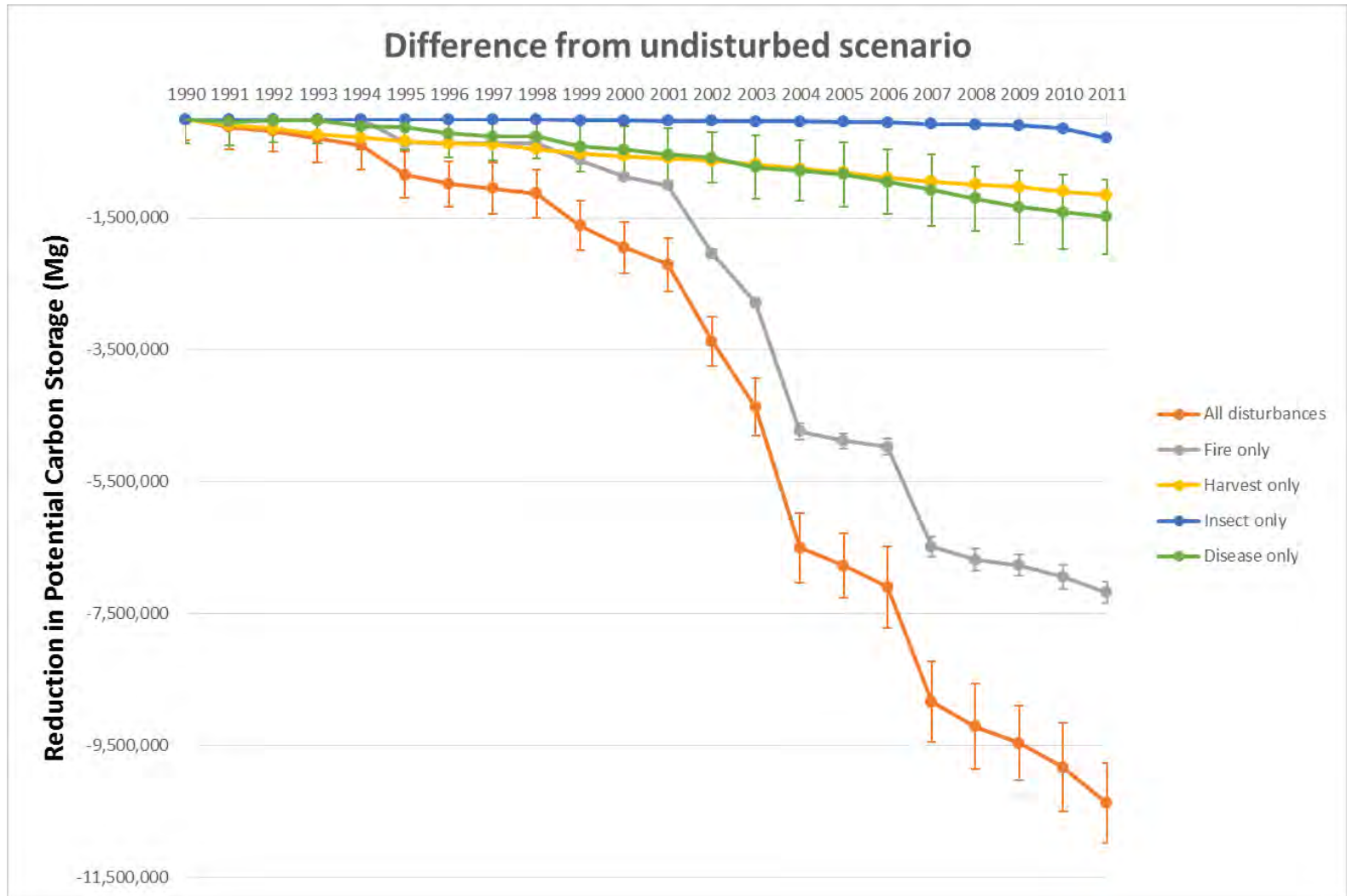


Preliminary ForCaMF Carbon Estimates for the Flathead NF, compared to CCT estimate

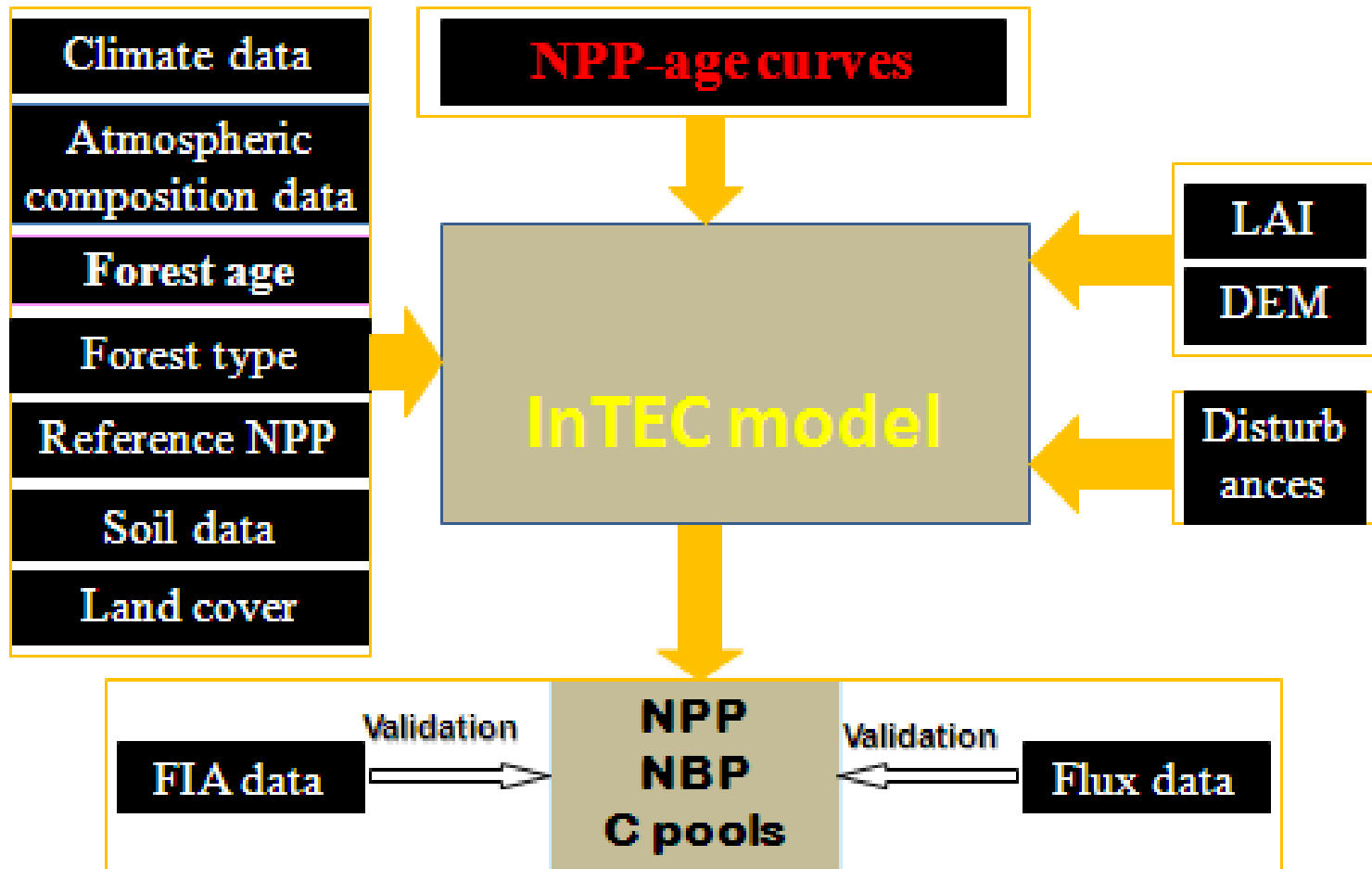
- Different scenarios are achieved by modifying the disturbance maps input into ForCaMF
- The “All disturbances” scenario is the actual estimate. Others quantify relative effects of different disturbance processes.
- ForCaMF uses the same estimate of Live Tree Carbon (and distribution across the range) as CCT – differences are <10% and are mostly due to differences between how CCT and FVS model non-tree stocks



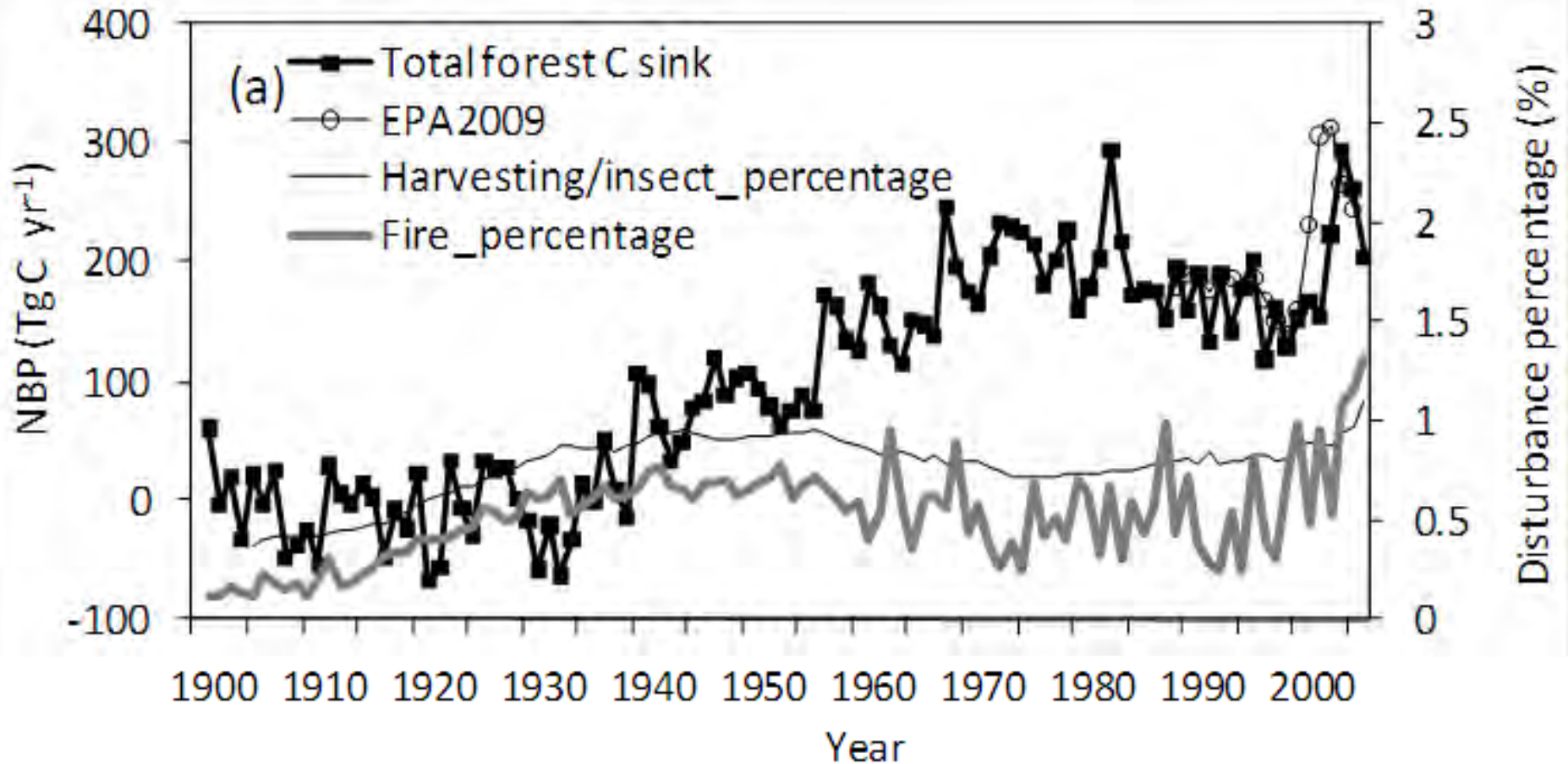
ForCaMF Results for Flathead NF, Region 6



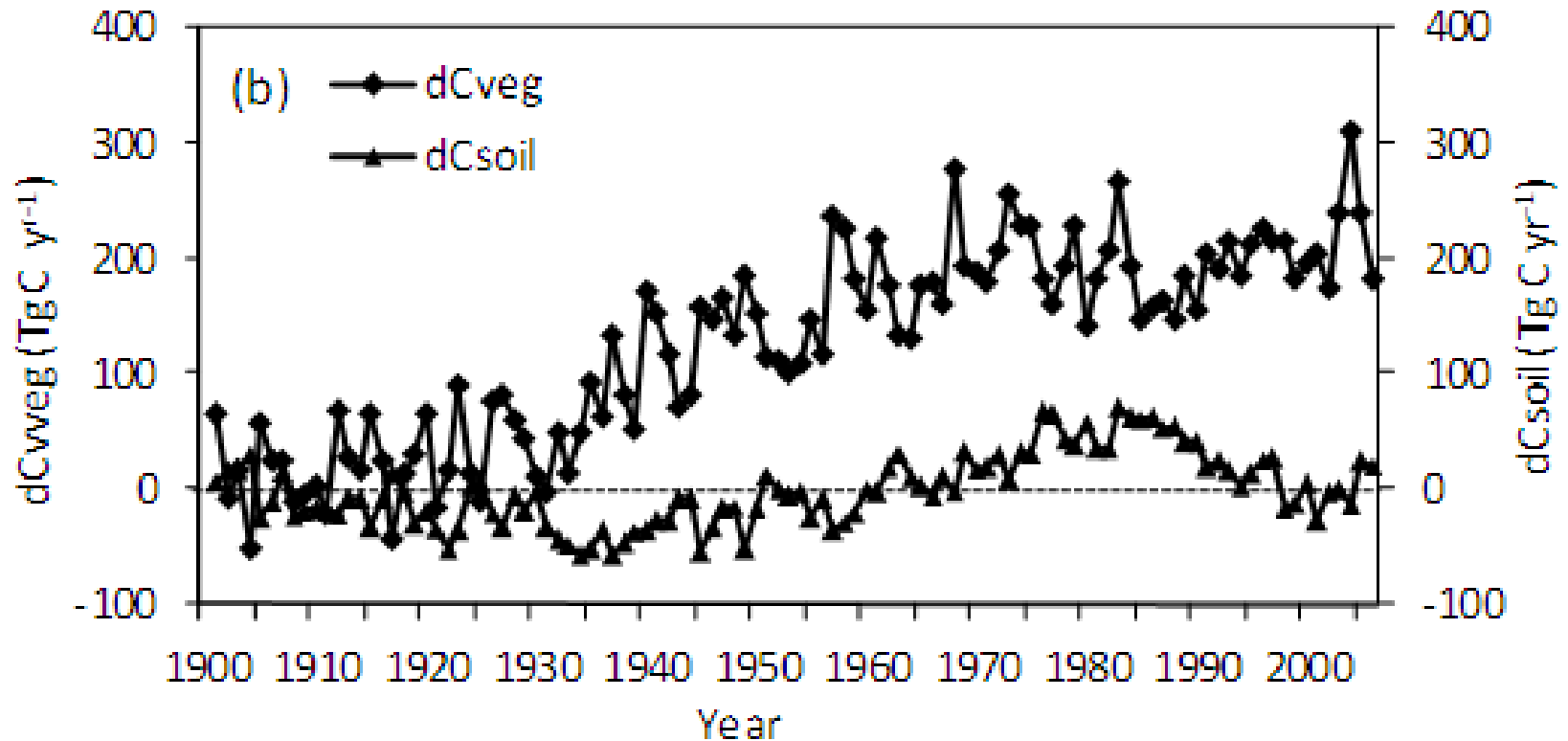
Assessment of Climate, Harvest, and Disturbance Impacts (InTEC Model)



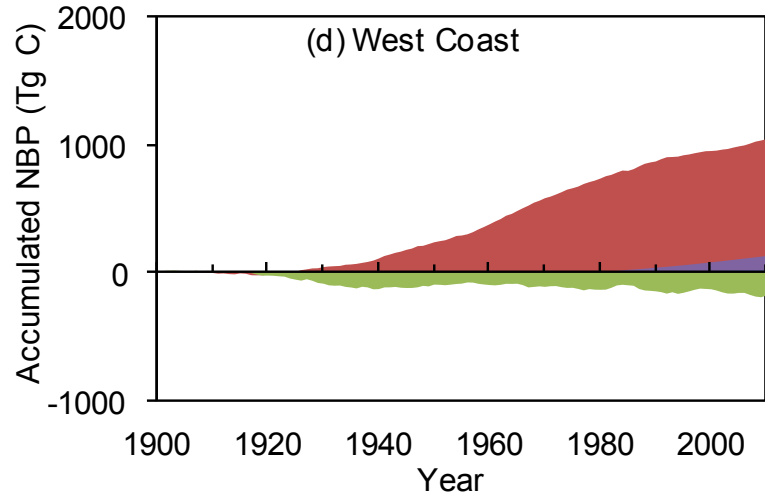
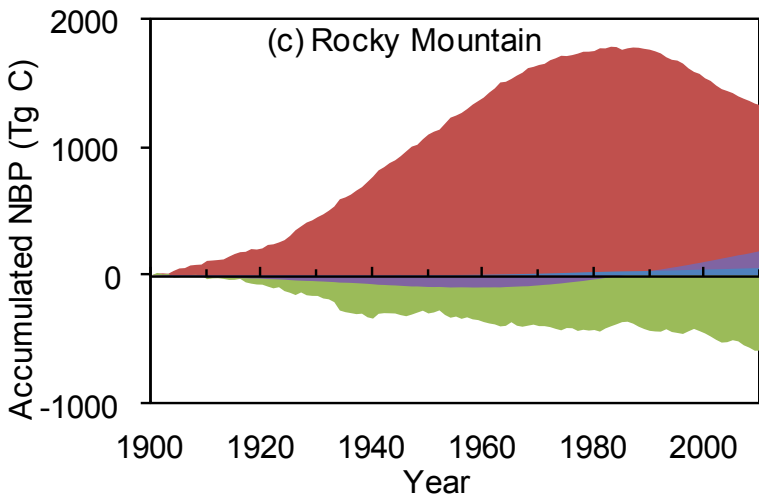
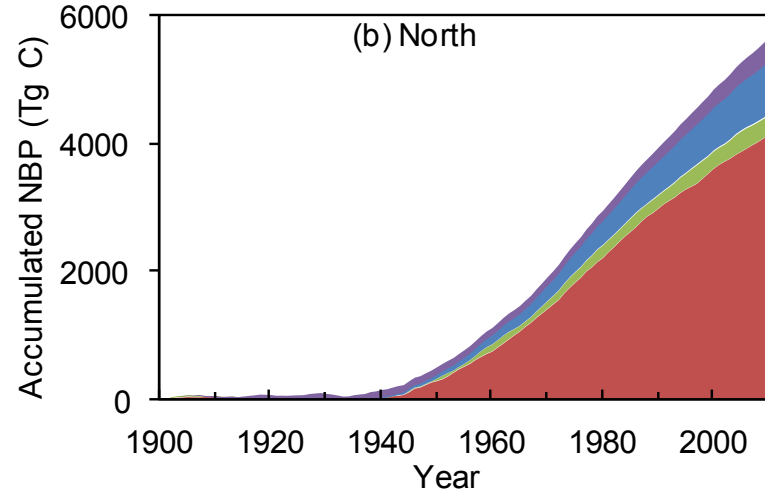
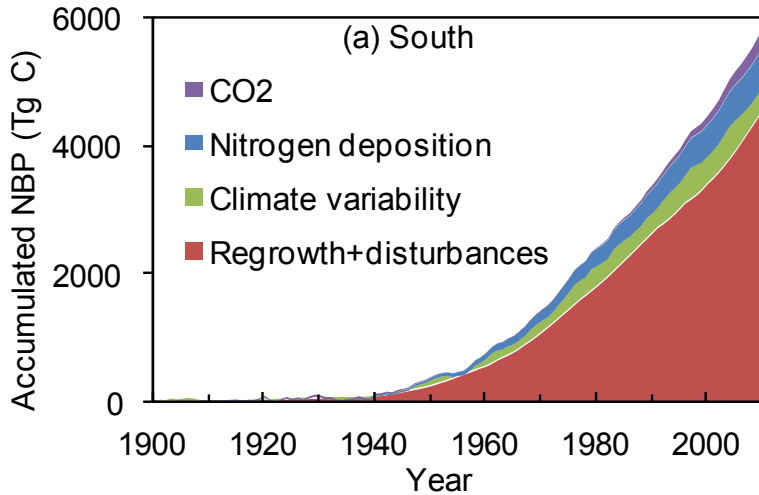
Net Biome Production and Area Disturbed for the Conterminous U.S., 1900 - 2009



InTEC Includes Soil C (Century Model)



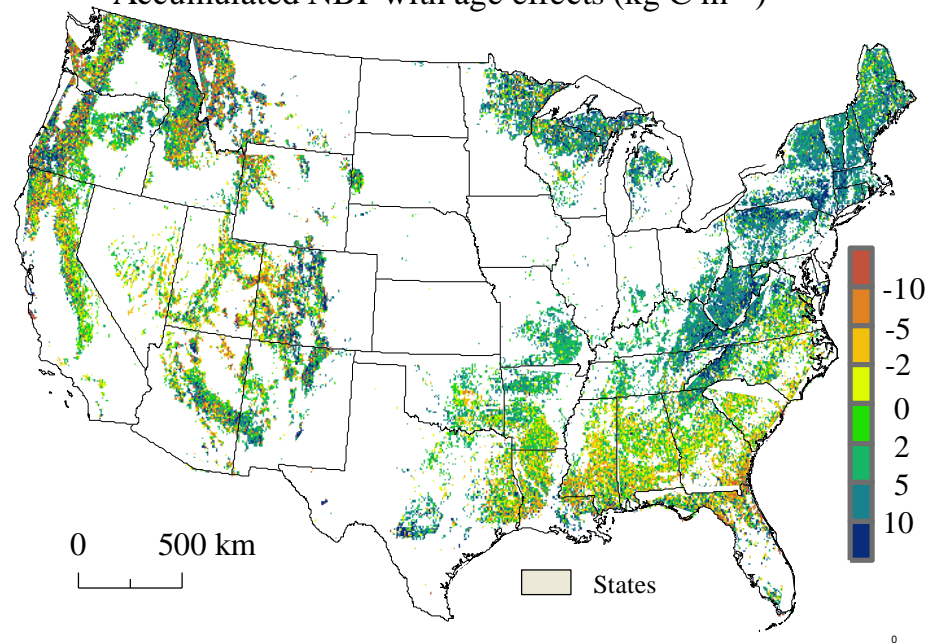
Effects of Main Factors on Accumulated NBP (kg C m⁻², 1901-2010)



Effects of Disturbance and Climate on Accumulated NBP (kg C m^{-2} , 1901-2010)

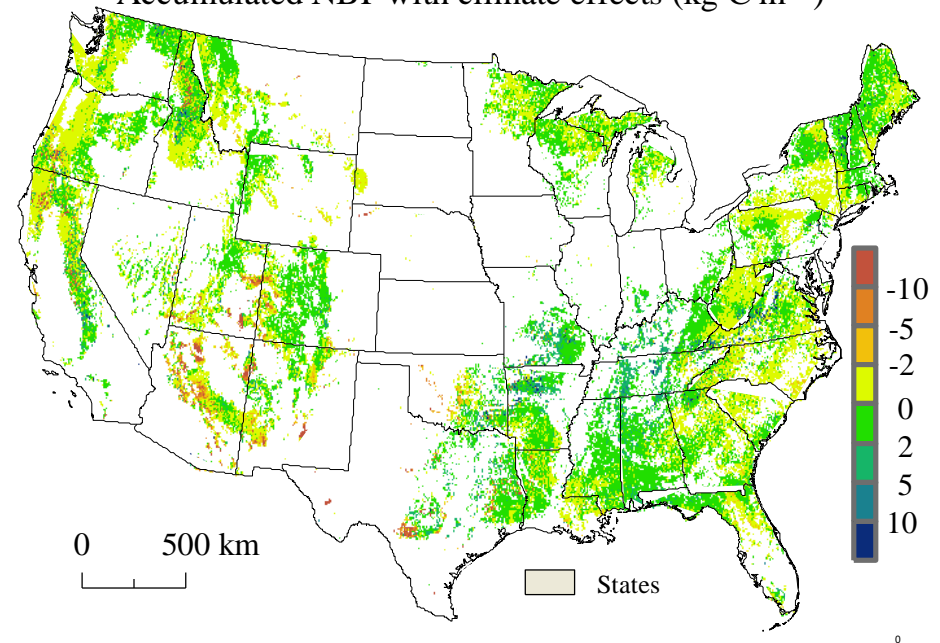
Disturbance/regrowth

Accumulated NBP with age effects (kg C m^{-2})

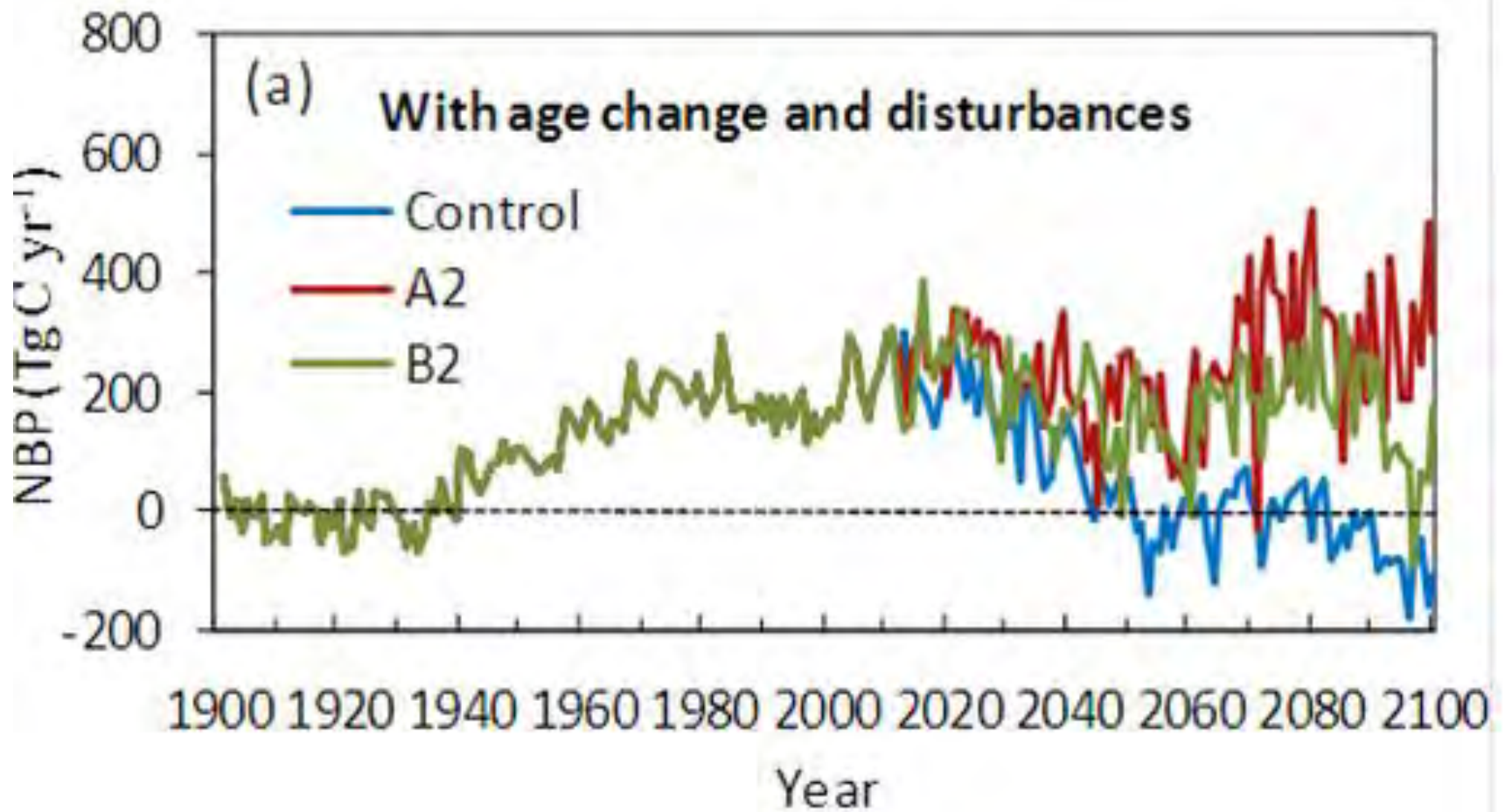


Climate

Accumulated NBP with climate effects (kg C m^{-2})



Projections for Different Climate Scenarios



Some Key Datasets for Each NF (1)

- Forest types matched to FIA types
- Disturbance maps back to ~1985
 - Insects, fire, harvest
 - Magnitude of impact
- Harvesting history back to ~1900 from cut and sold reports
- “Standard” estimates of carbon stocks from FIA, for multiple dates where possible

Some Key Datasets for Each NF (2)

- Leaf area index
- Productivity-age curves
- Forest age map
- Meteorological and atmospheric data
 - Temperature, precipitation, radiation, etc.
- Soil characteristics
 - Water holding capacity, depth, texture
- Land cover map
 - Forest/rangeland/other

NFS Carbon Assessments: Schedule and Potential Pilot Study Forests

- Chequamegon-Nicolet (R9)*
- Region 1/Nez Perce-Clearwater
- Region 8/Pisgah and Francis Marion
- Region 5/Sierra-Sequoia (Proposed)

*Assessment completed before project began



United States Department of Agriculture

Past and Prospective Carbon Stocks in Forests of Northern Wisconsin

A Report from the Chequamegon-Nicolet National Forest
Climate Change Response Framework



Forest
Service

Northern
Research Station

General Technical
Report NRS-127

January 2014

Northern Wisconsin Pilot Study: Carbon Assessment Objectives

- **Baseline assessment:** describe past and current carbon stocks in forests and wood products of Northern Wisconsin, and changes in carbon stocks
- **Strategic carbon management analysis:** develop and assess impacts of several mitigation scenarios

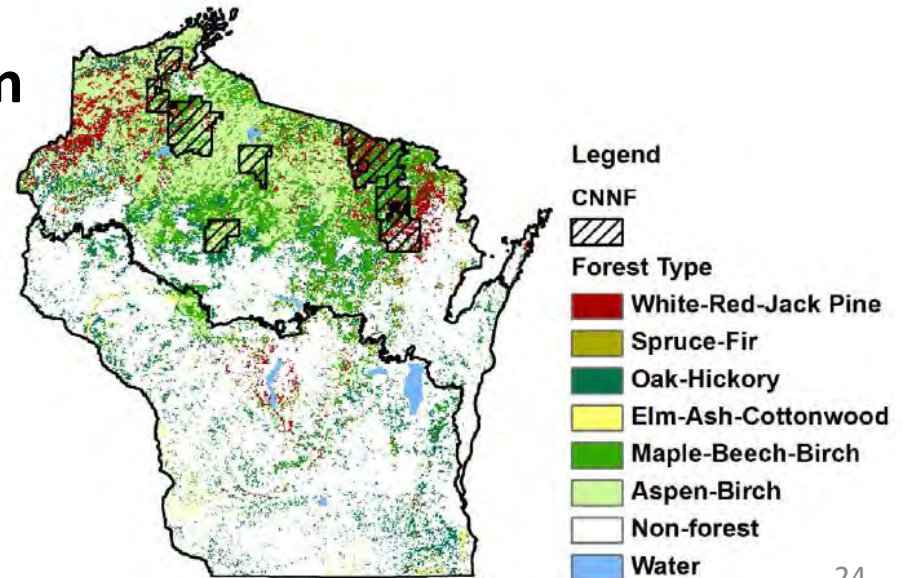
Ecoregion Province 212 (Northern Wisconsin)

3 major owner groups:

National Forest

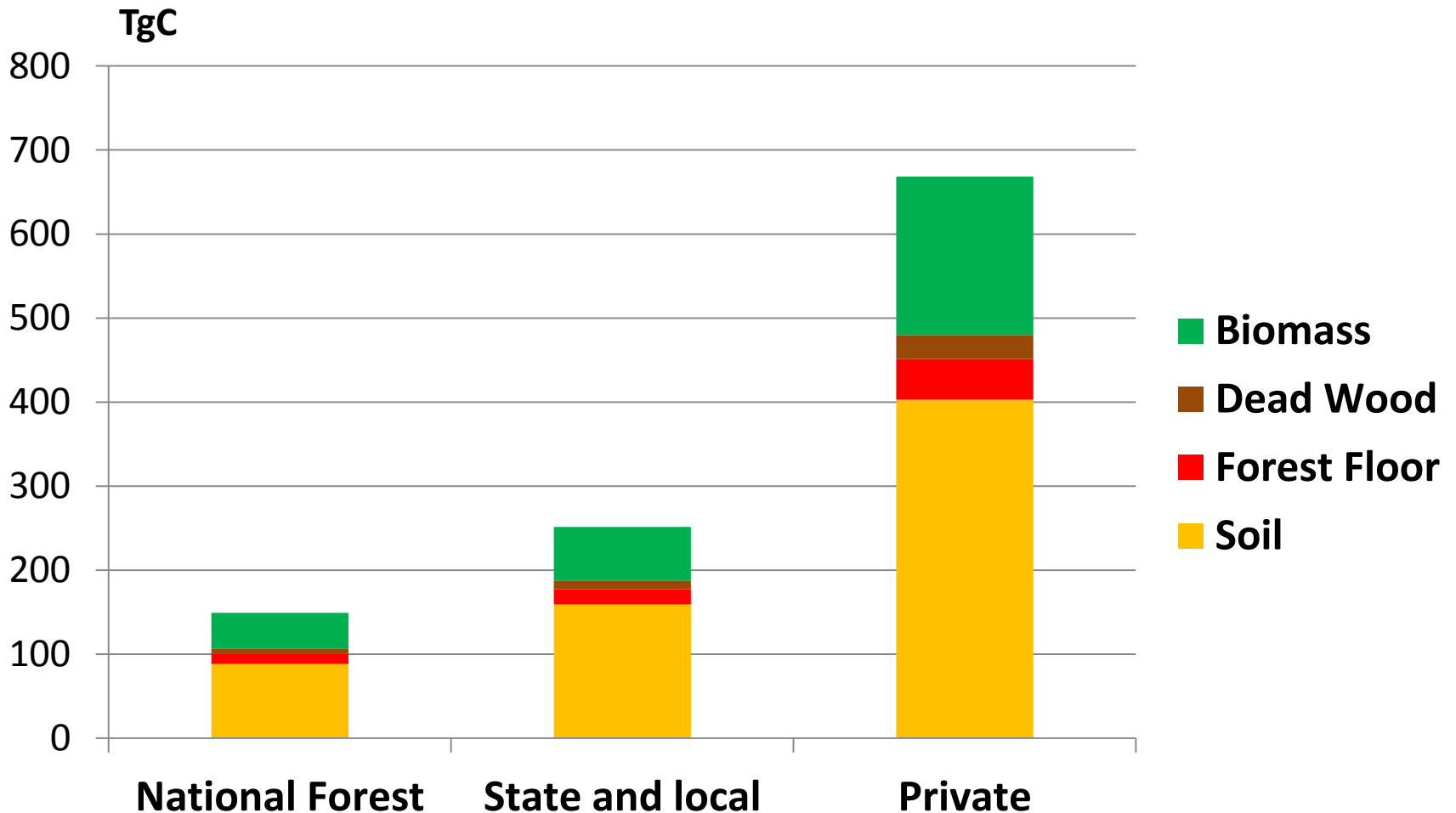
Other Public

Private



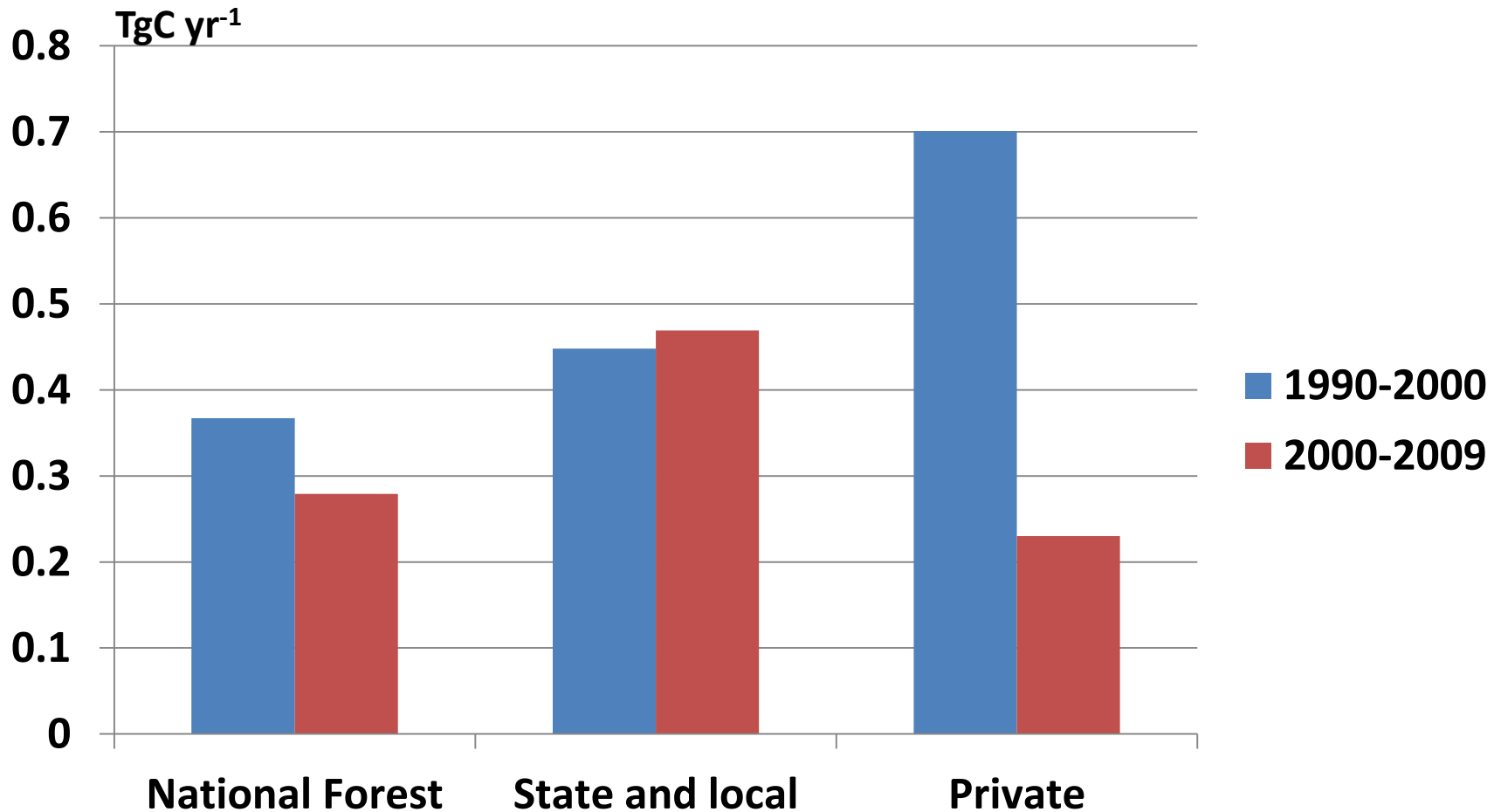
Carbon Stocks by Ownership Class and Carbon Pool, Northern Wisconsin Forests, 2009

(from FIA – Carbon Calculation Tool)



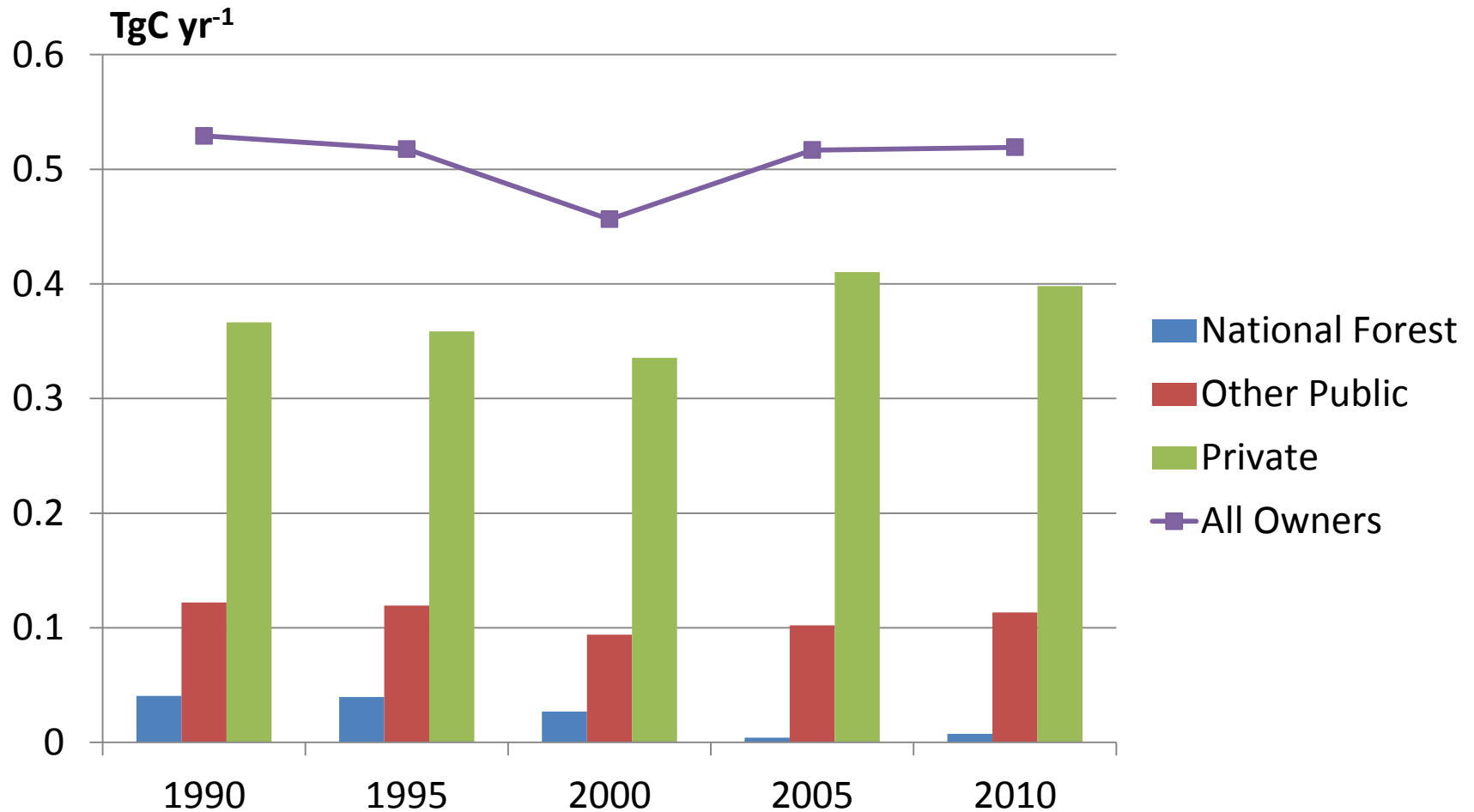
Average Annual Change in Carbon Stock by Ownership, Northern Wisconsin Forests, 1990-2010

(from FIA – Carbon Calculation Tool)



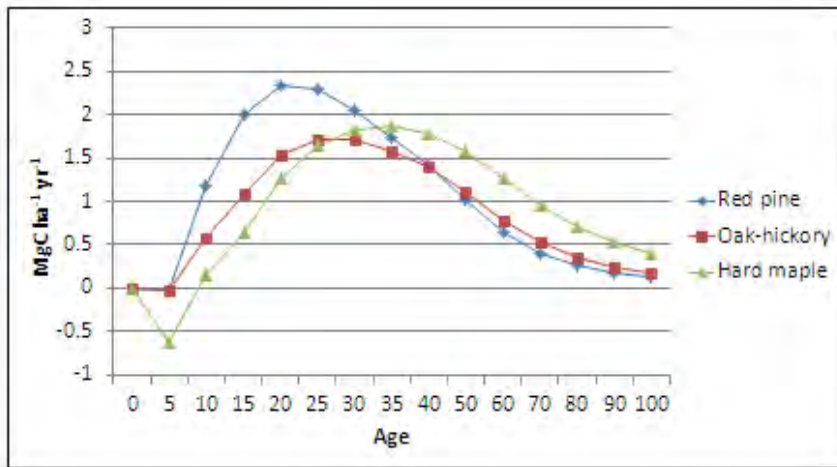
Possible causes of declining rate of sequestration: increased harvesting, aging forests, and increasing disturbances

Change in C stocks of harvested wood products (in use and landfills), Northern Wisconsin (from PRESTO)

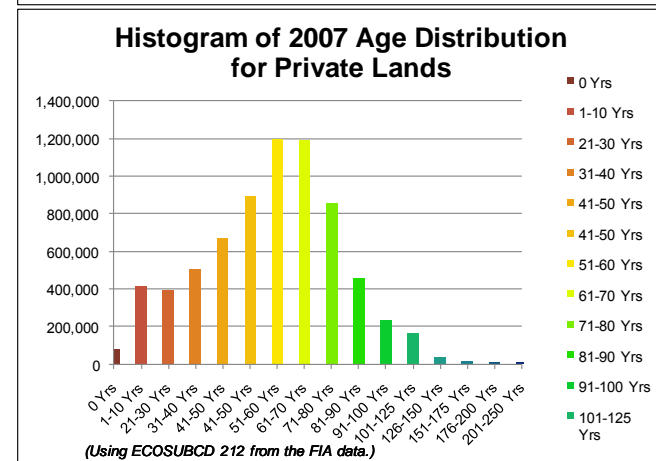
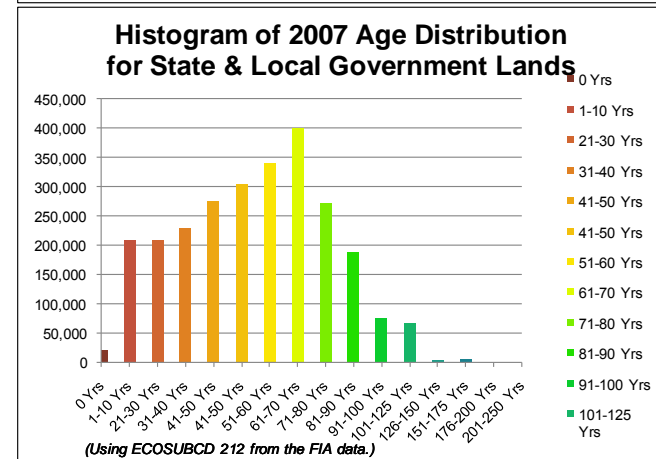
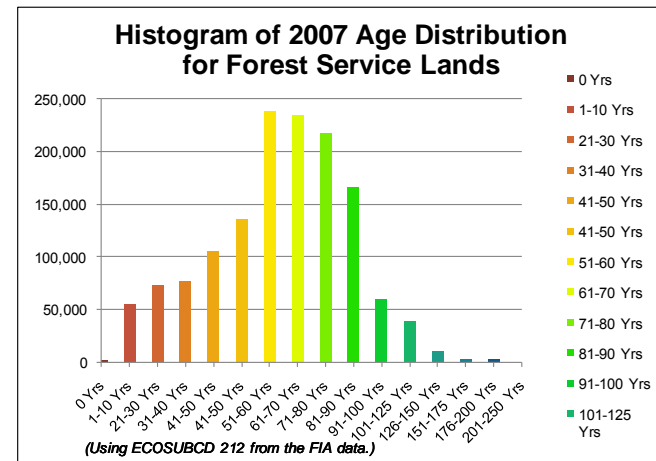


Simple simulations by combining age-class distributions with carbon yield curves

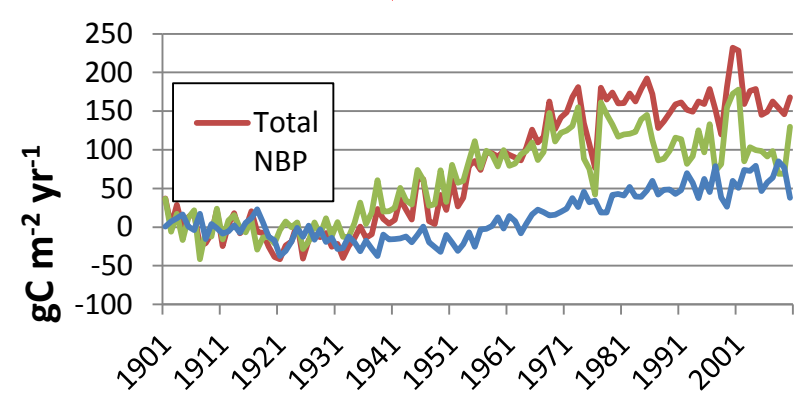
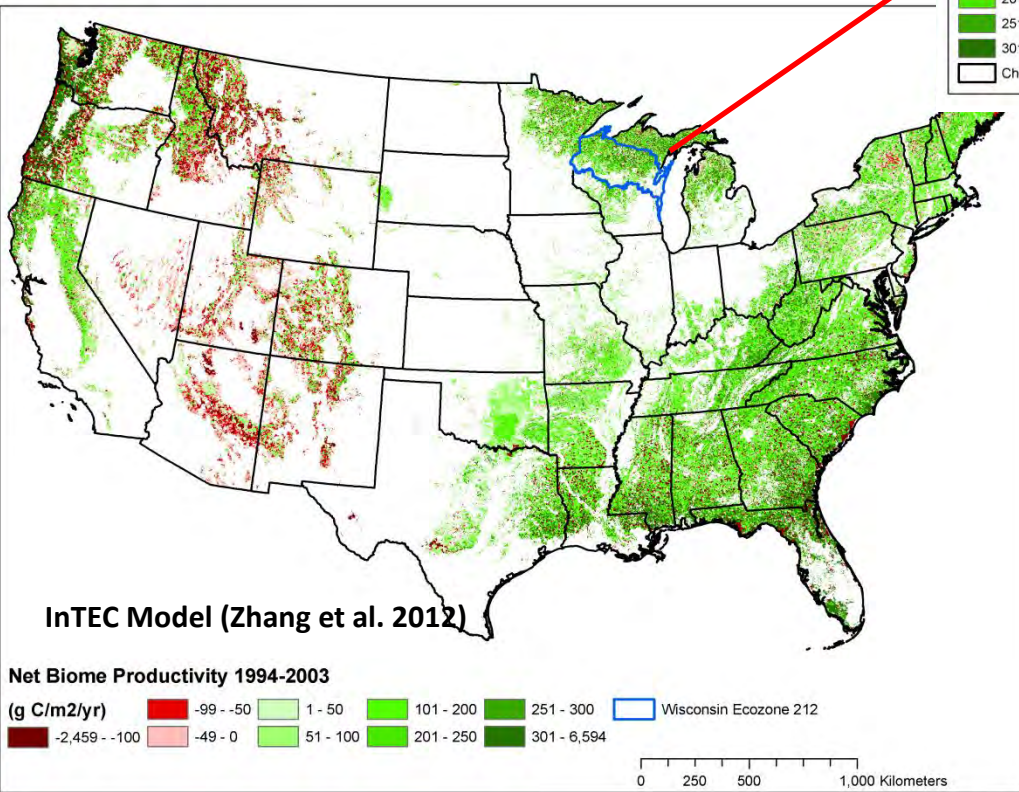
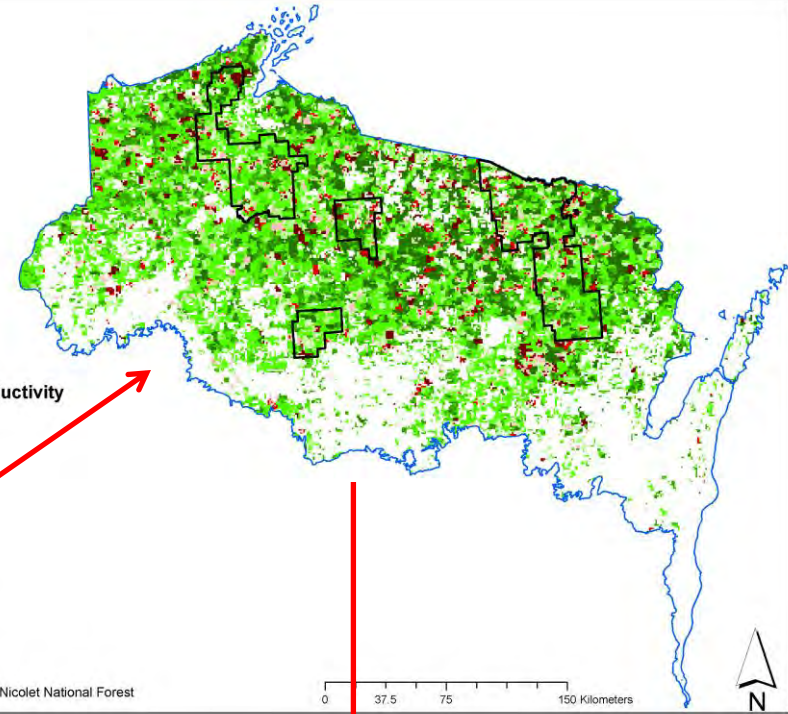
Net ecosystem production



50-year mitigation potential is 3.8 TgC per year compared with current baseline 1.5 TgC per year

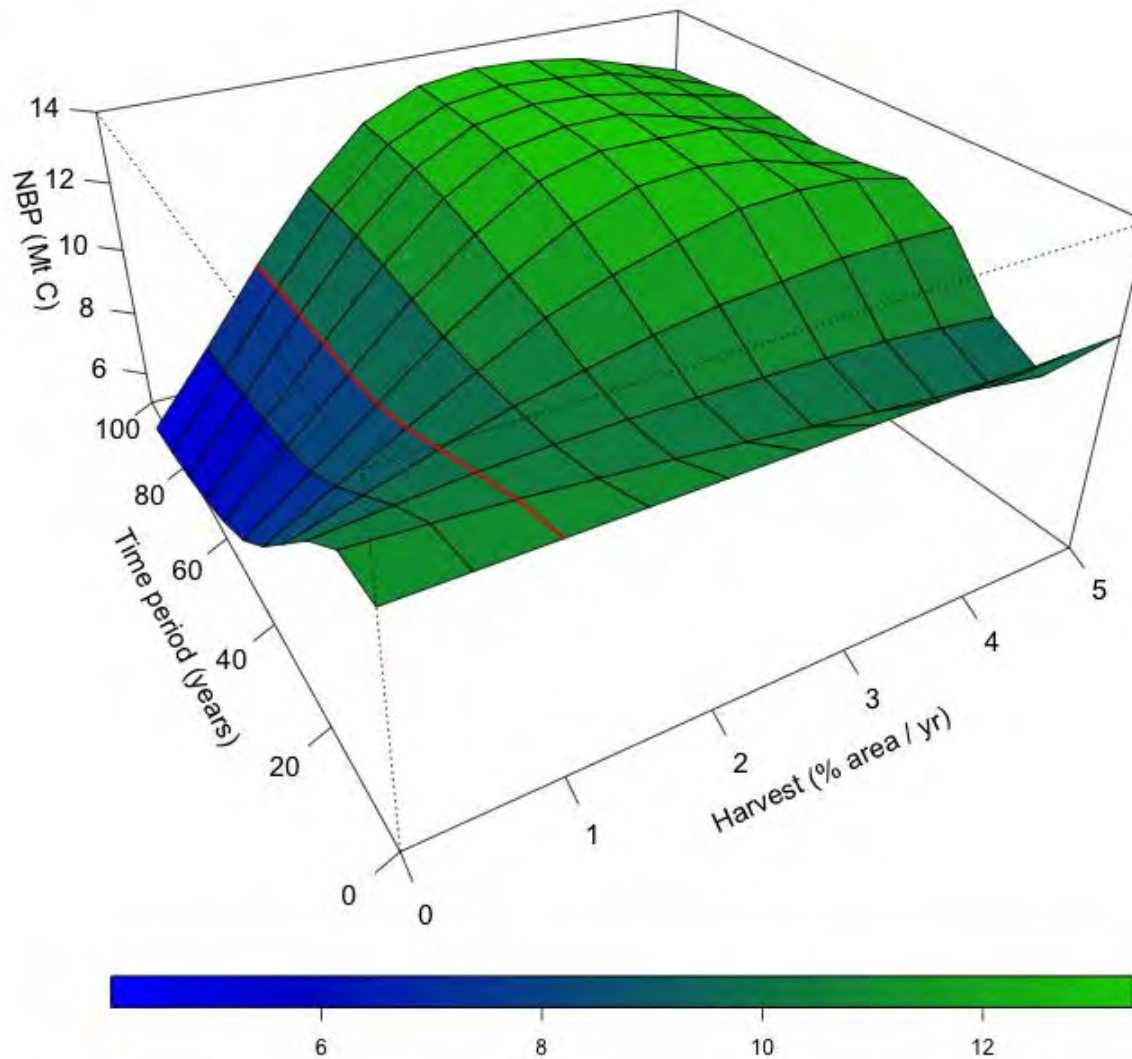


Downscaling with InTEC: Spatial and Temporal Change in Carbon Stocks, Northern Wisconsin and Chequamegon-Nicolet National Forest

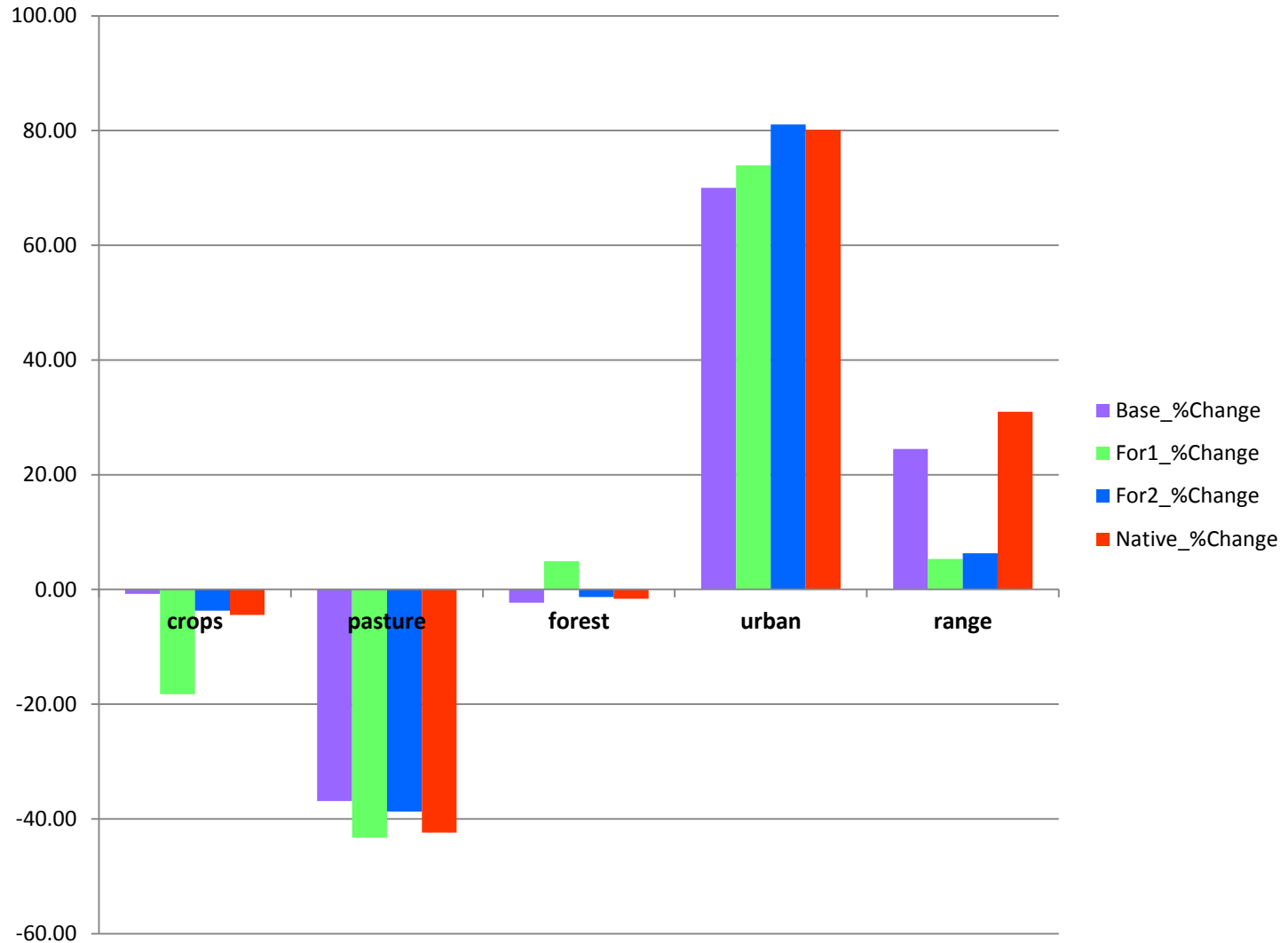


Potential NBP for the CNNF in the next 100 years

(Graphic from Tom Gower using Biome-BGC)



Predicted Future Land Use in Northern Wisconsin by Scenario

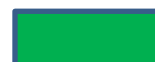


Status of Support for NFS Carbon Assessments

<i>Technology or product</i>	2013		2014		2015	
1. Estimates of carbon stocks from FIA (published or direct from data base)	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
2. Estimates of change in carbon stocks from FIA (Carbon Calculation Tool)	Yellow	Green	Green	Green	Green	Green
3. Estimates of change in carbon stocks in harvested wood (online calculators)	Yellow	Yellow	Green	Green	Green	Green
4. Assessment of management and disturbance scenarios (ForCaMF)	Yellow	Yellow	Yellow	Yellow	Green	Green
5. Assessment of climate, harvest, and disturbance impacts (InTEC)	Yellow	Yellow	Yellow	Yellow	Green	Green
6. Assessment of forest plans and effects on future carbon stocks	Light Gray	Light Gray	Yellow	Yellow	Yellow	Green
7. Fully functional user-support system including data sets and basic estimates	Light Gray	Light Gray	Light Gray	Light Gray	Yellow	Green



Pilot studies



Full deployment

Summary/Outcomes: Fully Functional User-support System for NFS Carbon Assessments

- Basic datasets useful for many kinds of analyses
 - Consistent and comprehensive
- Estimates of past and prospective carbon stocks for each National Forest
- Easily accessible
- Contacts for support in FS research and universities
- Minimize time needed for resource analyses