

# Forest Sector Modeling North America

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# Overview

- **Regarding Forest Sector Modeling:**
  - Questions and policy analysis
  - Technical constructs
  - Coevolving issues and analysis
  - Current directions
  - Challenges
- **Disclaimer...**



# Definition

- **A FSM is...**
  - A technical construct
  - A rhetorical device
- **For...**
  - Describing the historical and potential development of the forest sector and
  - Evaluating policy alternatives



# Forest Sector Modeling in the US

- **Date from 1877 to the present**
- **Central to policy discourse for more than 100 years**
- **Powerful rhetorical devices for policy debates**
- **Issues-analysis-policy have coevolved over time**



# Policy Episodes and FSM's

- Establishing the National Forests
- Expanding the NF's and developing research/inventory programs
- Restoring Private Forests and Rural Development
- 1877 Hough Report
- 1920 Clapper Report
- 1933 Copeland Report



# Policy Episodes and FSM's

- Expanding post-war timber production
- Timber-environment tradeoffs
- Market forecasting with perturbations
- 1958 Timber Resources for America's Future
- 1982/1990 RPA Timber Assessments
- 2000/2005 RPA Timber Assessments



# Market Failure Rhetoric

- 1877 Hough Report
  - Common property and the public domain—  
Timber famine
- 1920 Clapper Report
  - Timber famine—  
information failure on  
private lands; also  
monopoly power issues
- 1933 Copeland Report
  - Timber scarcity—related  
to private lands + equity  
(poverty in rural areas)



# Market Failure Rhetoric

- 1958 Timber Resources for America's Future
- 1982/1990 RPA Timber Assessments
- 2000/2005 RPA Timber Assessments
- Timber scarcity and economic growth constraints (nipf)
- Scarcity tied to public and private forest management
- No timber market failure—nontimber policy issues



# Methods

- **1877 Hough Report**
  - **High level inductive with exhaustive but anecdotal data**
- **1920 Clapper Report**
  - **Forest products consumption data and product price data**
- **1933 Copeland Report**
  - **Biological inventory data—growth and removals with extrapolation**



# Methods

- **1958 Timber Resources for America's Future**
- **1982/1990 RPA Timber Assessments**
- **2000/2005 RPA Timber Assessments**
- **Biophysical: inventory analysis, products accounting. Consumption and Production projections (The Gap)**
- **Price-endogenous spatial domestic market equilibrium, inventory simulation, forest land use and scenario analysis**



2010?



# Questions of the day...

- **Climate change**
- **Changing forest ownership**
- **Climate/energy policies**
  - Carbon / biofuels
- **New product technologies**
  - Especially biofuels
- **Urbanization/WUI**
- **Fire management**



# 2010 RPA Forest Assessment: Problem Statement



- The US Forest Service and forest sector needs timely forecasts of forest conditions, uses, and services... as they respond to various environmental, economic, and policy changes... to support assessments, planning, policy making.



# Big questions: forests and global forces



- How will global markets affect the use and condition of US forests?
- How will changing climate alter forest conditions and ecosystem services?
- Where will population growth and land development put pressure on imperiled forest types and species?
- In combination....



# Policy Rhetoric

- **Focus on ecological consequences...of multiple exogenous changes**
- **Evaluating implications of a broader complement of potential policy interventions... but not directly addressing timber sector issues**



# 2010 Forest Sector Model: US Forest Assessment System

- **Interdisciplinary analysis for addressing broad scale questions regarding US forests.**
  - **Economic-Ecological forecasting**
    - Scenario analysis
  - **Scaling up science delivery**
    - Delivering results from R and D
  - **Science “community building”**



# Challenges

- **Explicitly global analysis**
  - Wood products markets
  - Climate
- **Ecological reality in model outputs**
  - Detailed forest condition projections
  - Ties to ecosystem services
  - Scaling issues (markets versus ecological sections)
- **Developing interdisciplinary linkages**
  - Shared ownership
- **Anticipating the questions**
  - Building a general framework



# USF<sup>AS</sup>-Project mission

- **Develop a forest assessment framework that provides detailed projections of forest conditions and services consistent with environmental, economic, and policy changes.**

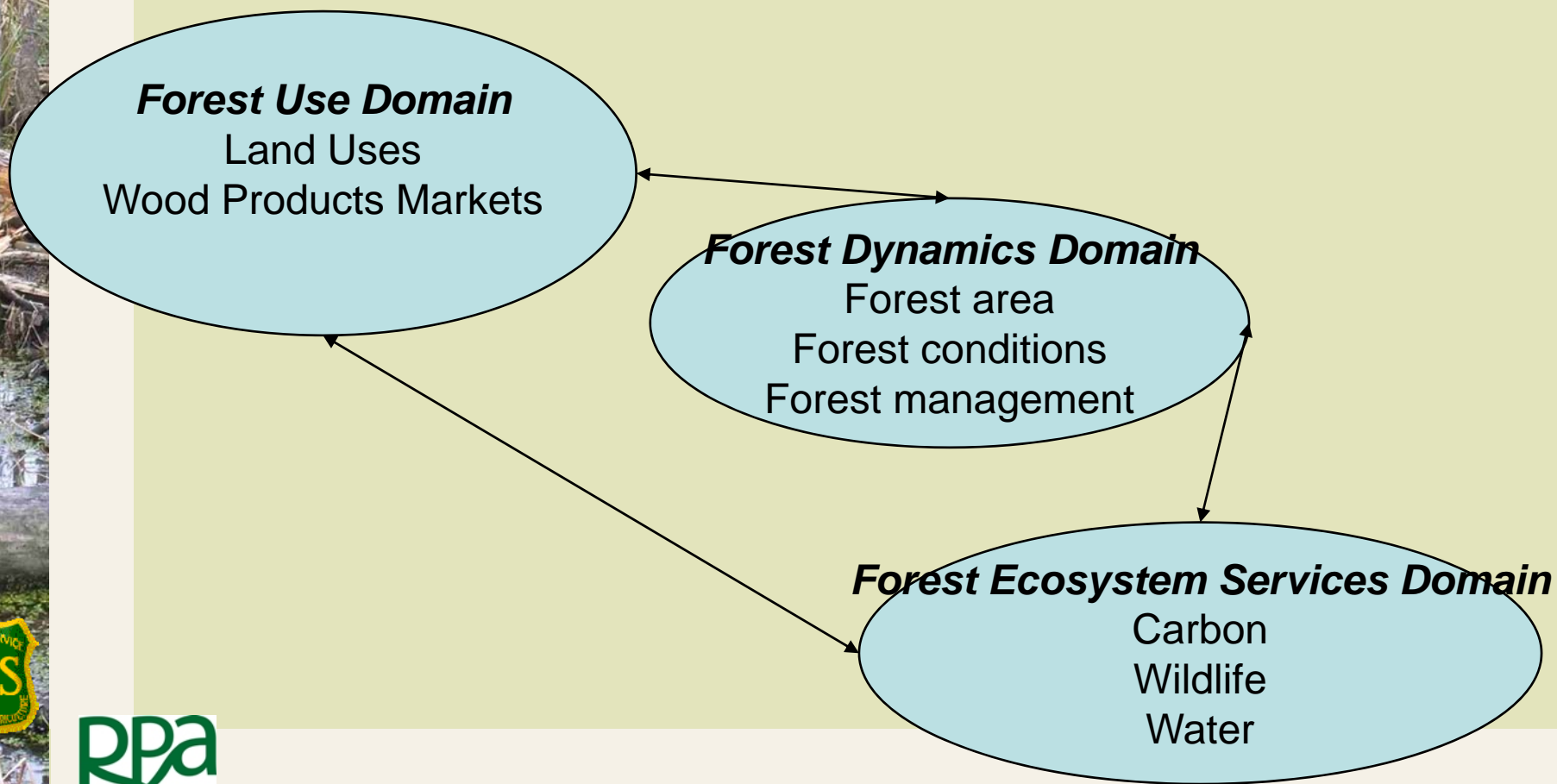


# Structure of USF<sup>AS</sup>

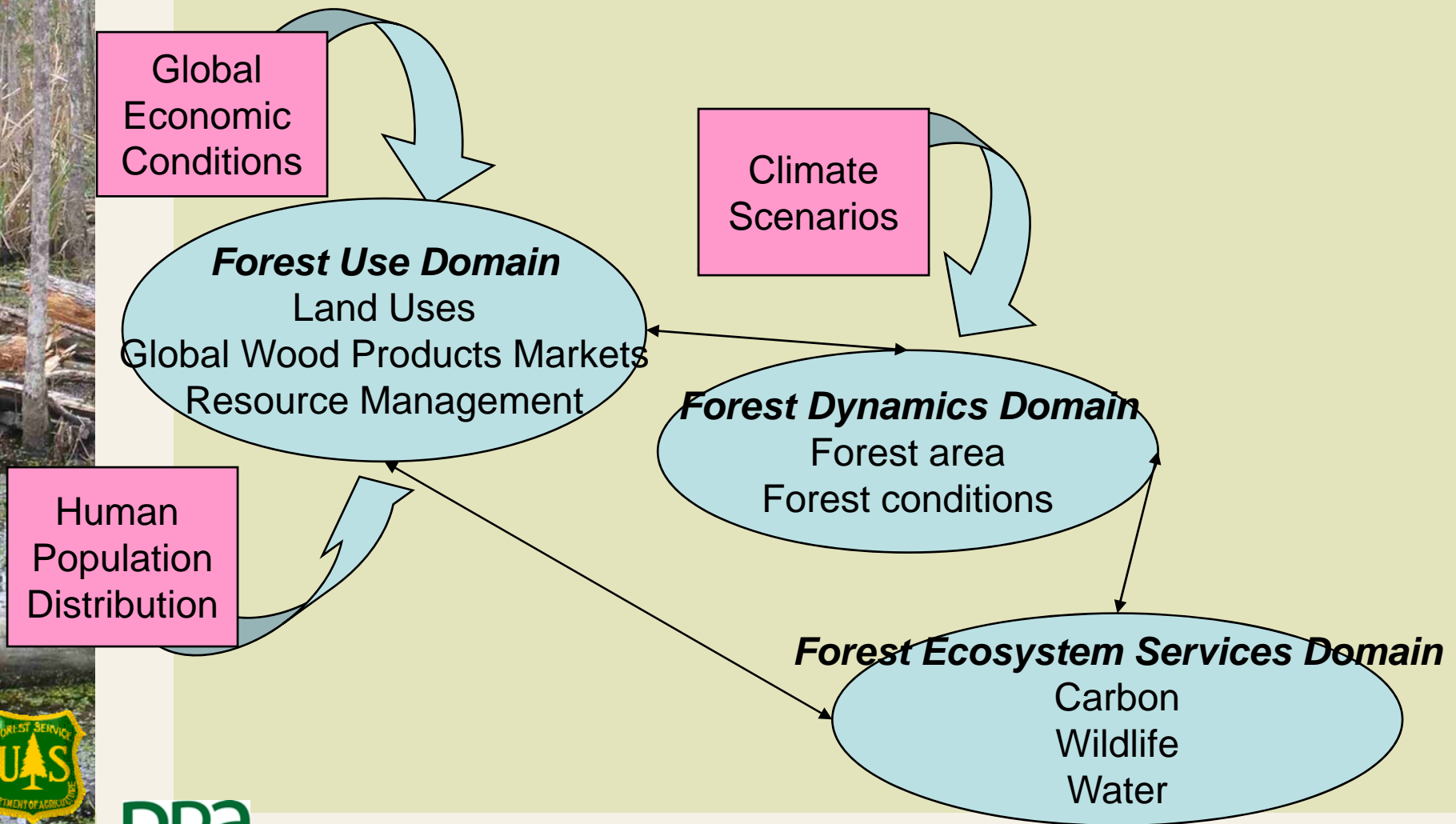
- **Three US Model Domains**
  - Forest Uses
  - Forest Dynamics
  - Ecosystem Services
- **Exogenous global factors—IPCC Scenarios**
  - Macroeconomic conditions
  - Climate
  - Human demographics



# USF<sup>AS</sup> Model Domains



# USF<sup>AS</sup> Model Domains



# Forest Uses Domain

- **Wood and Timber Products**
  - Price endogenous sector modeling
  - **GFPM (Buongiorno et al.)**
    - All countries
  - **USFPM (Ince et al.)**
    - Nested in GFPM
    - Three US Regions
- **Land Use Model (Plantinga and Alig)**
  - All land uses
  - Ag sector and development
  - County grain



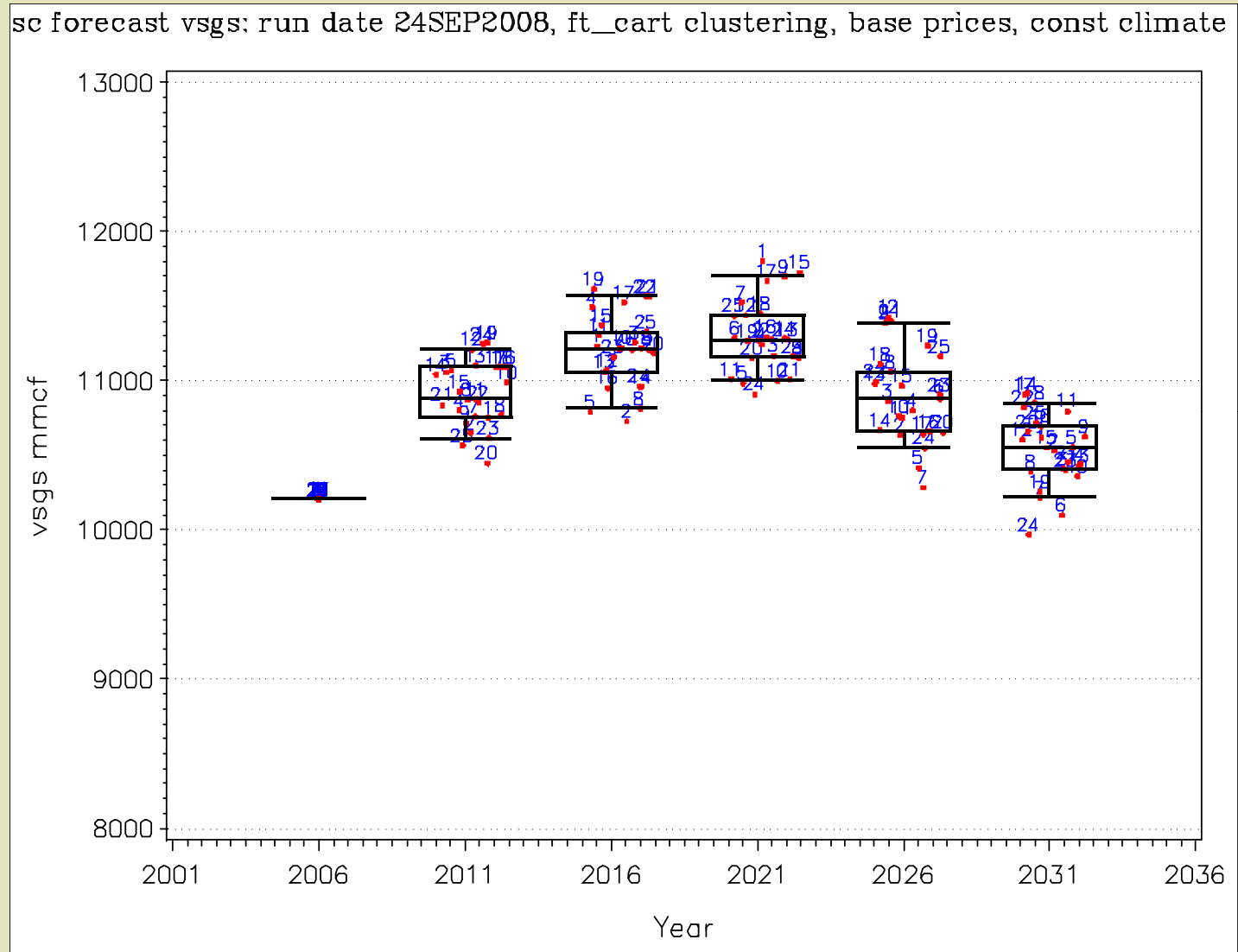
# Forest Dynamics Domain

- **Monte Carlo forest inventory simulations (Wear, Huggett, Abt)**
  - **Forest inventory at the plot level**
    - Takes advantage of the new FIA design
  - **Harvest model**
    - Economic choice model
    - Defines timber supply through aggregation
  - **Unharvested plot transitions**
    - Climate
    - Forest Succession
    - Natural disturbance





# Monte Carlo Approaches



# Ecosystem Services Domain

- **Tied to forest inventory and land use**
  - Carbon accounting
  - Biodiversity (birds)
  - Water
  - Others?

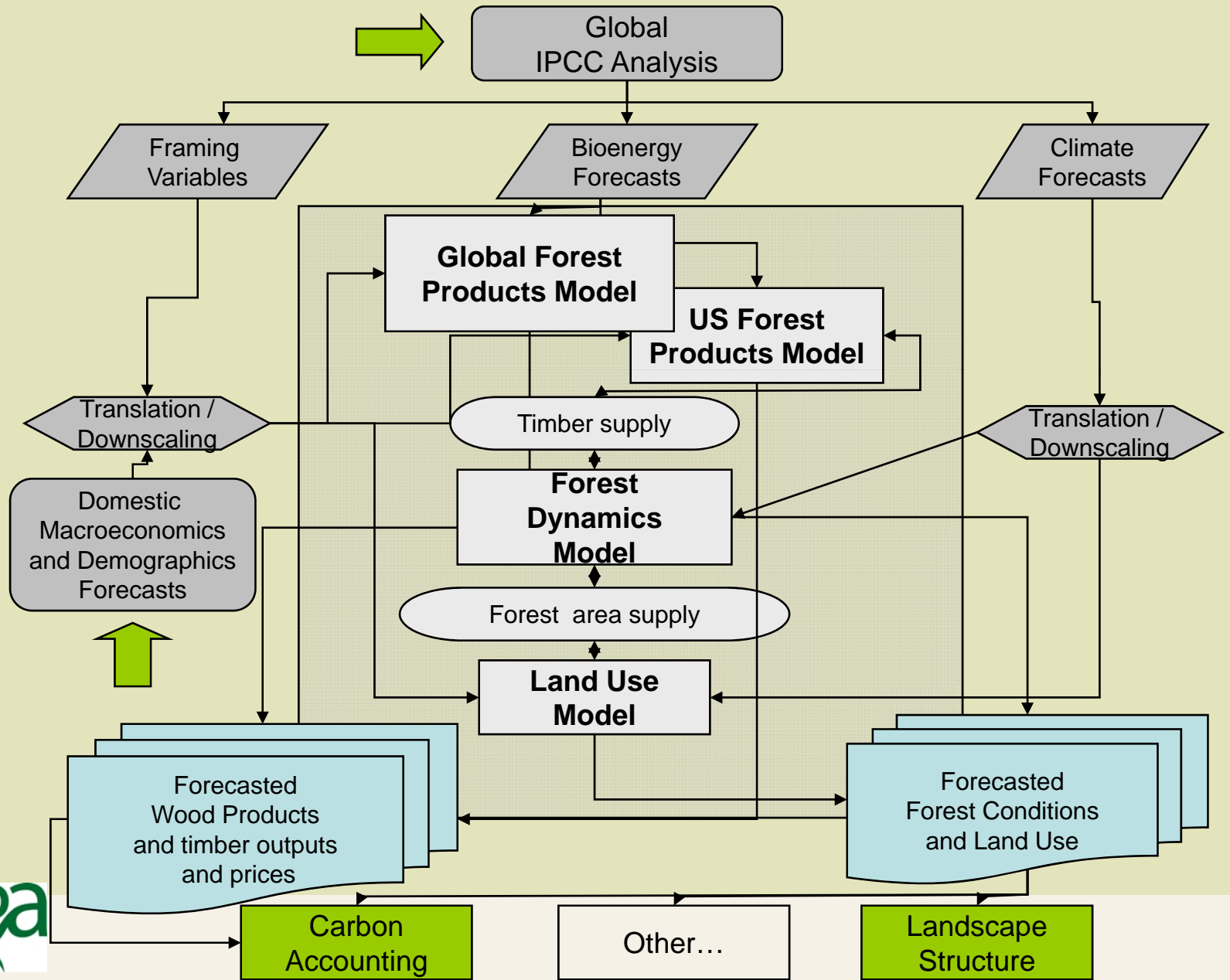


# USF<sup>AS</sup> Products

- **Continuously updated forecasts of forest conditions**
  - Web access to multiple scenarios
  - New inventory design supports regular updates
- **Reporting at survey unit, state, ecosystem levels**
  - Multiple audiences
- **RPA reporting on 5-year cycle**
- **On-demand issue analysis—new scenarios**



# 2010 RPA Assessment Models and Scenario Analysis



# IPCC Scenarios

- **Exogenous drivers**

- Global and Domestic macroeconomics
- Population and demographics
- Climate
- Policies



- **Projections (10,50 year)**

- Detailed forest inventories: all states
- Wood products and timber market activity (global and domestic)
- Land use for all counties in US
- Ecosystem services: carbon, others



# Project management

- **Meta design and “quasi-open source”**
  - Requires documentation
  - Requires protocols for linkages
- **Domain-level work teams**
  - Cross-Station
  - Universities
  - Post-Docs
- **Separable components (modules)**
  - Manageable chunks
  - Building community of participants



# Contrast to previous efforts

- **Layering**
- **Inventory data are still critical foundation**
- **Price endogenous spatial equilibrium to simulate markets**
  - Domestic to global
- **New techniques to build supply from the “ground-up” and generate useful biological/ecological data**



# Conclusions

- **After 125 years the questions have recently changed...**
  - Focus less on the internal workings of the forest sector
  - More on external forces and their impact on forests
  - Focus has shifted from domestic issues to global issues
  - Focus now on ecological/environmental consequences of economic activity at subregional resolution



# Conclusions

- **Market change is still relevant for understanding the future**
  - Emergence of new markets
  - Optimal depreciation and replacement in the wood products sectors
  - Timber supply related to new ownerships
- **Uncertainty is high and important**
  - Need for explicit accounting of uncertainty in projections

