RPA-2020 and FIA: Resources Planning Act Projections

USDA FOREST SERVICE

DAVID WEAR, JOHN COULSTON, AND A LARGE CAST

RPA Forest Assessment ➔ Objective:

Address the ***important future issues*** about forest conditions and their uses in the United States

- ***Important***: of high economic/ecological consequence or concern to the public
- **Future**: requires understanding change and making projections of future forest conditions
- ***Issues***: framed as specific policy-relevant questions to be answered in the Assessment report

RPA 2020 ➔ Forest Assessment Outputs

2020 FOREST ASSESSMENT ISSUES

Climate's influence on future forests

Forest-based climate mitigation (carbon and energy)

Timber management and rural economic activity

Spatial assessment of timber supply potential

Land use change effects on forests

Forests and water

Change profile of the nation's forests (vulnerability)

SUPPORTING TECHNICAL ANALYSIS

Scenario-based projections of:

- forest product market activity
- detailed forest conditions
- Land use changes

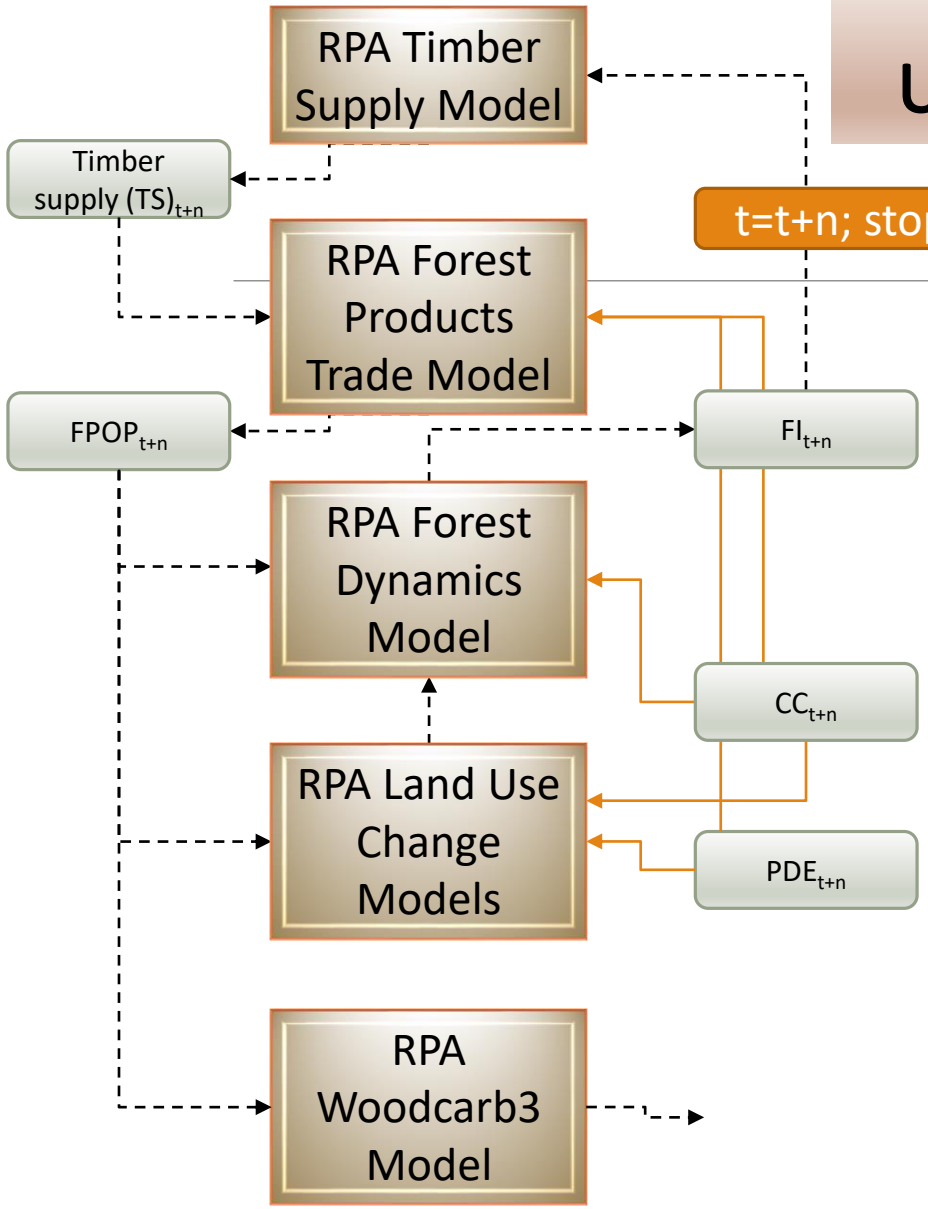
Hypothesis driven research on:

- Land use drivers
- Climate influences on forest type
- Timber harvest propensities/supply
- Demand dynamics
- Risk dynamics

Science Synthesis

- Climate
- Bioenergy

RPA-2020
US Forest Assessment System



Transparent
- moving to open-source platforms and public data
- Fully documented
- Archived

Modular
- Each component supports stand alone research
- With well defined linkages
- Allows for incremental contributions and verification.

Validated
- Peer review
- Backcasting/Forecasting structures
- Linked to observations (continuity with monitoring)
- Spatial/temporal validation

RPA Forest Dynamics Model

RPA Forest Dynamics Model

Role
- Projections of detailed forest conditions for all forested plots in the US Forest Inventory
- Projections of timber supply in each region for each time period

Mechanism:
- Stochastic plot transition models to address forest disturbance, forest harvesting/management, climate changes, aging, and land use change
- Plot records are projected using resampling/imputation from historical plot records
- Area frame is adjusted using projected change in forest area by county (land use)
- Spatial realizations of forest projection using imputation

Inputs
- Previous period's inventory; timber price outputs from Forest Products Trade Model; climate conditions; land use outcomes from Land Use Change Model

Outputs:
- Projections of forest conditions on all forested plots and companion 30m spatial realizations

Forest Inventory Dynamics Model

Projection model
- Transition modeling
- plot-condition imputation

Based on FIA plot observations
- All land uses included

Transitions are empirically derived

Additional considerations
- Novelty
  - Climate
  - Productivity change

Transitions addressed
- Land use change
- Disturbances (including harvest)
- Regeneration with forest type assignment
- Forest aging

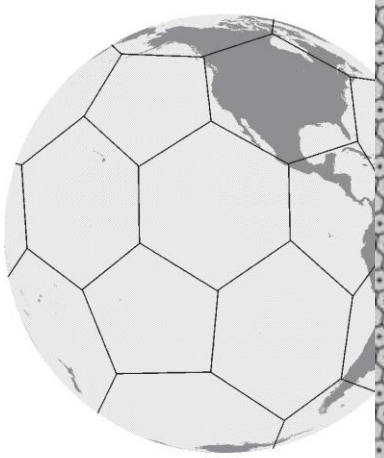
Imputation
- Partition donor sets based on clustering logic
- Random selection with replacement
- Consider novelty

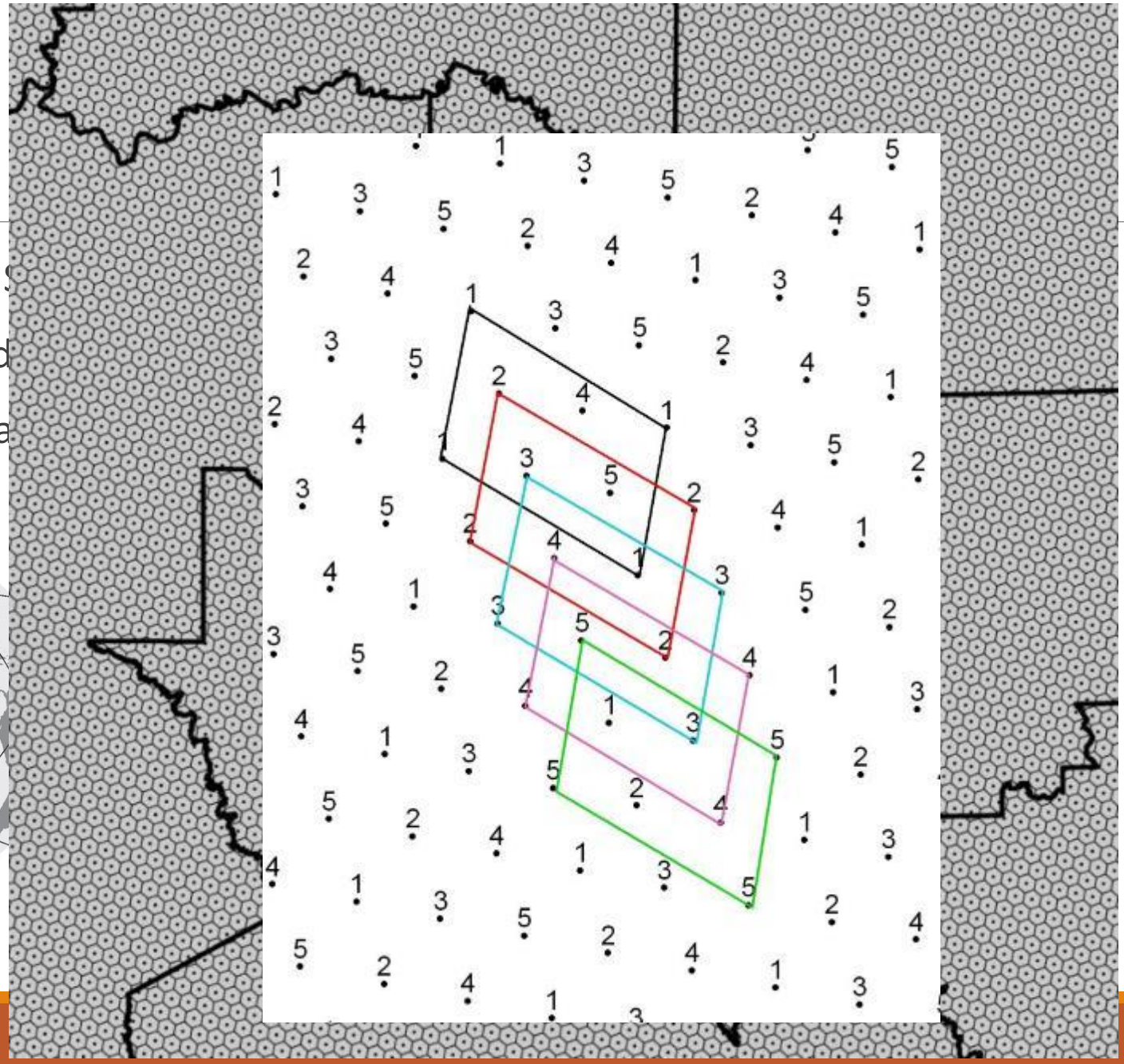
Data Used

We use data from the U

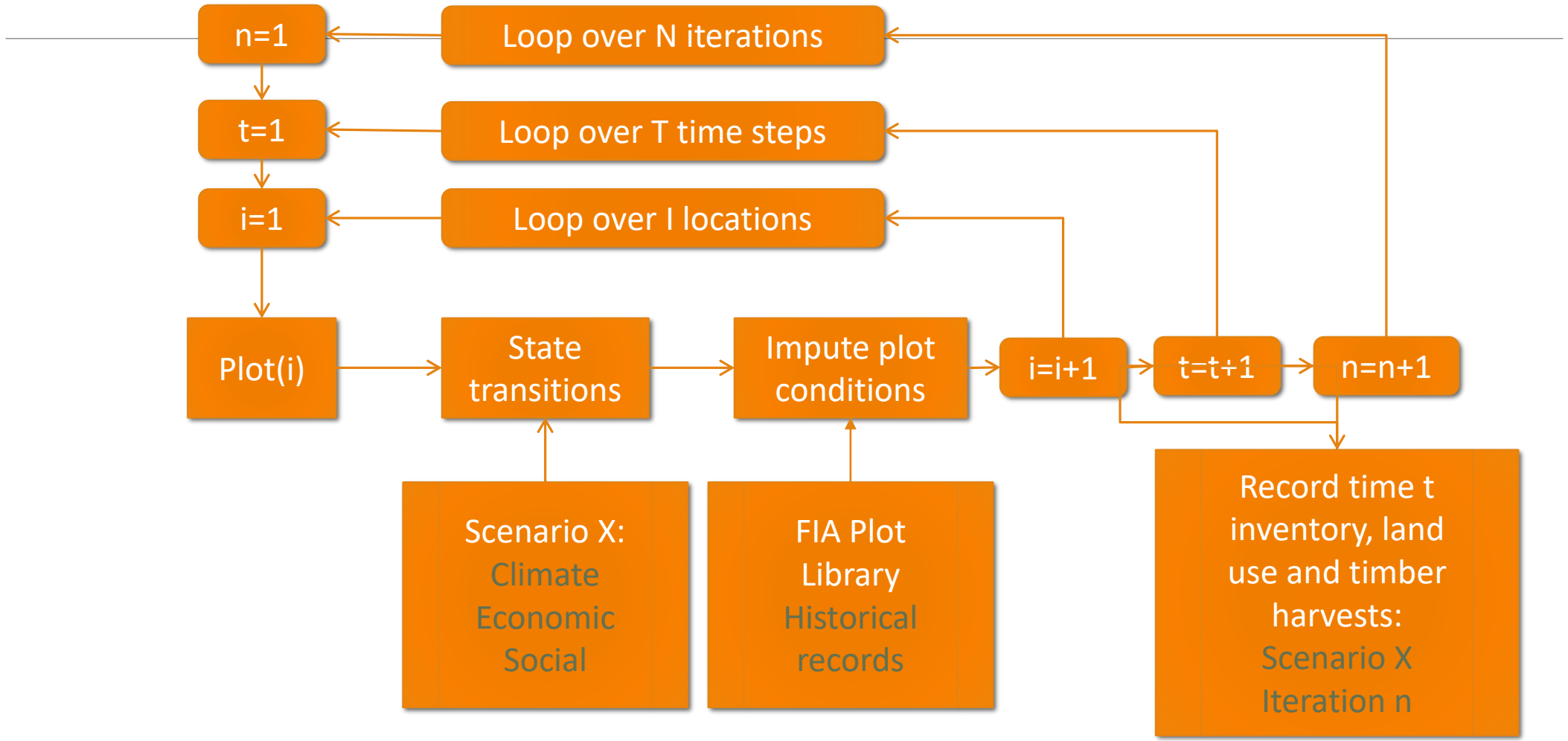
FIA is a longitudinal stud

Plot locations are perma



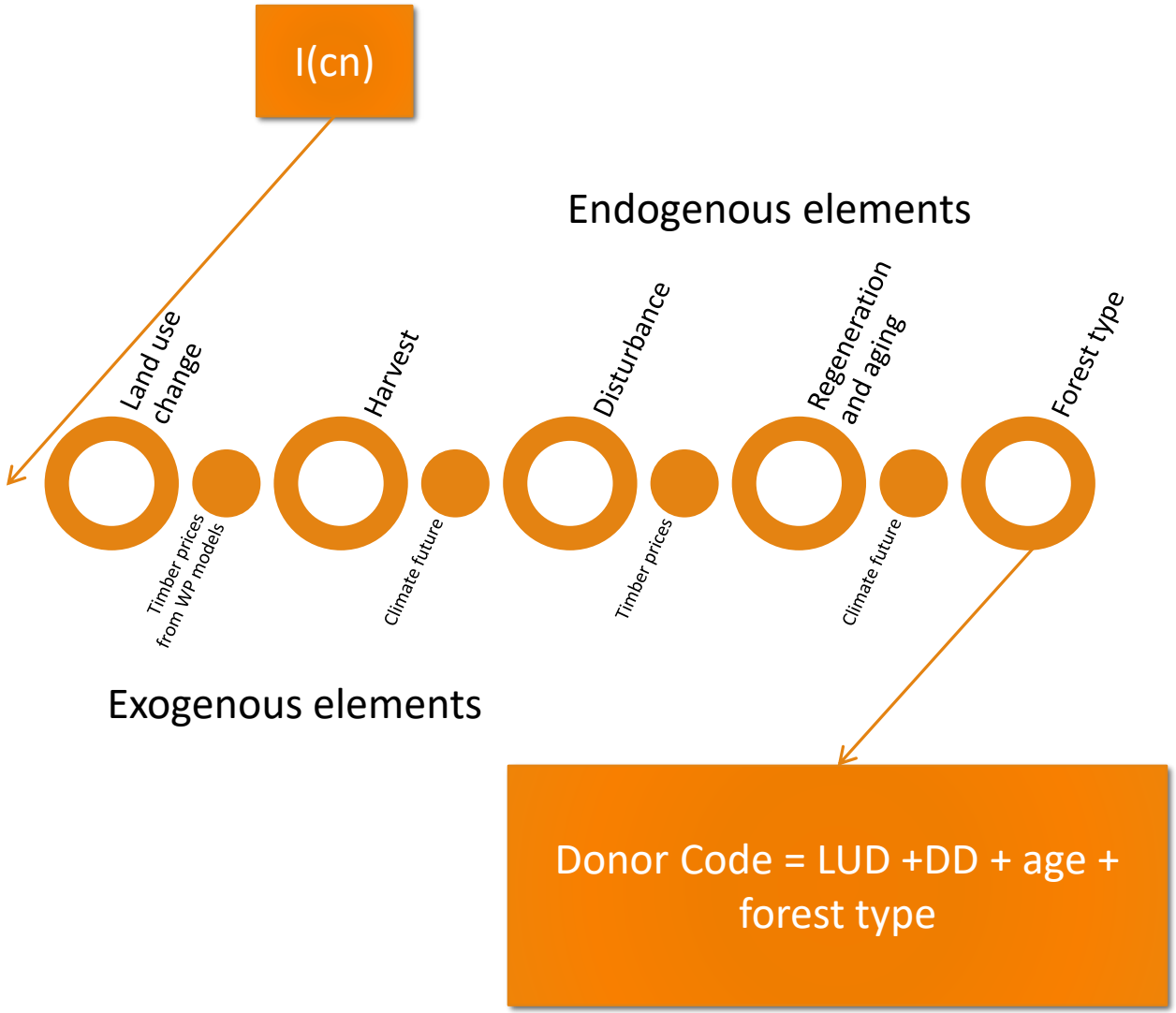


Forest Inventory Dynamics: model structure



Transition modeling summary

Each plot (t) is taken to t+1 with transition model and assigned a donor code



Core research components

Forest “type” dynamics
- Empirically derived assemblages
- Climate change influences

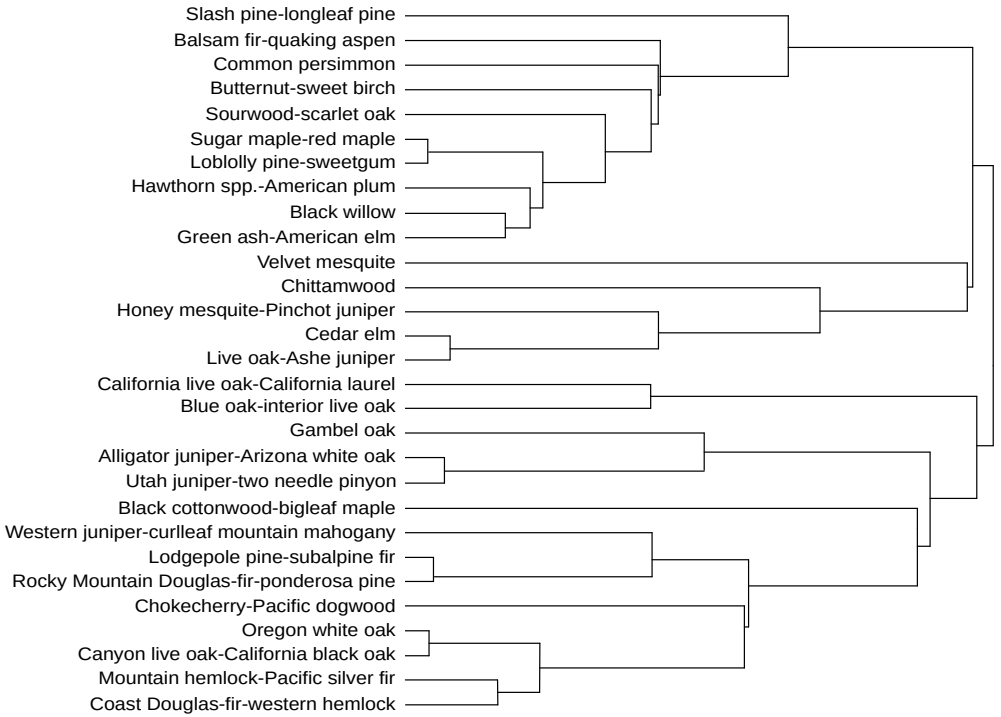
Disturbance probabilities
- Fire / I&D / Weather
- Links to condition and climate

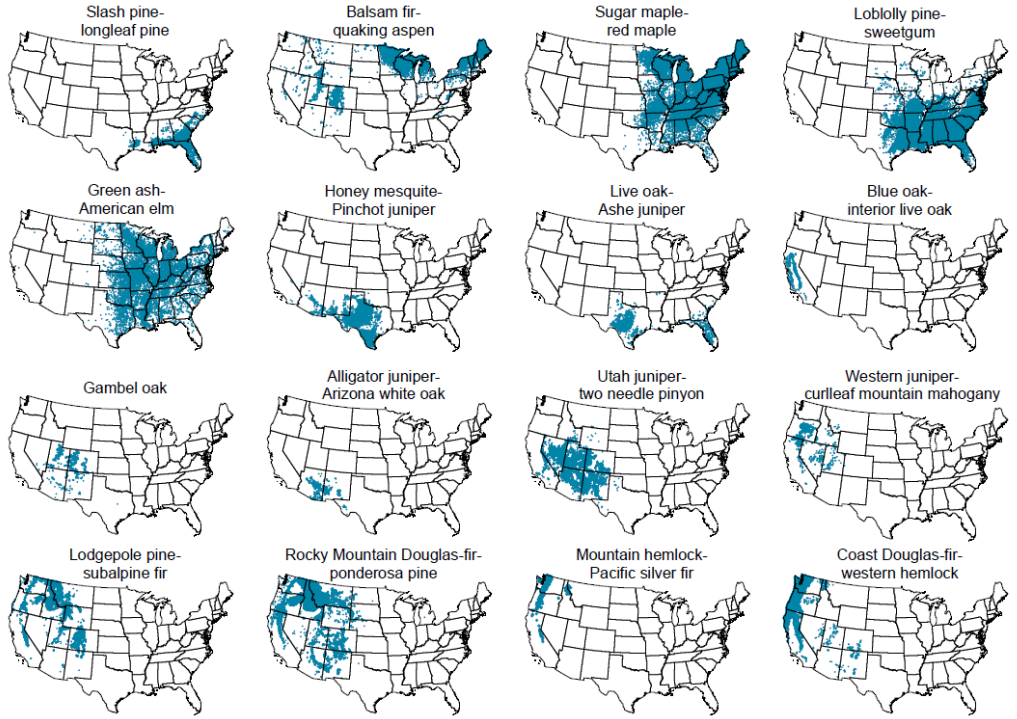
Harvest/management choices
- Harvest model with links to timber supply

Land use change
- Either multinomial outcomes or expansion factor approach
- Likely the latter?

Highlights of ongoing work

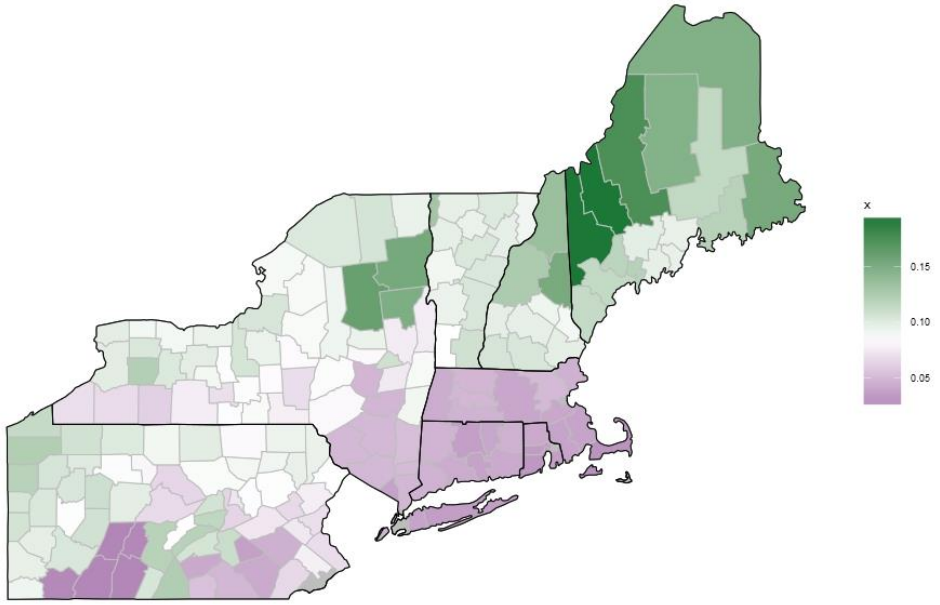
Forest Species Assemblages



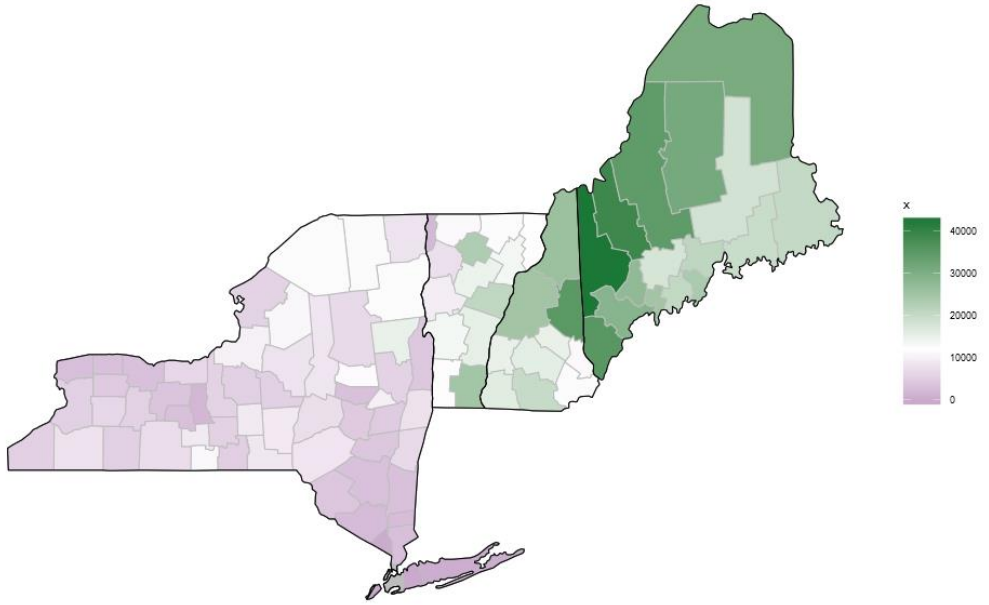


Harvest Choice Models

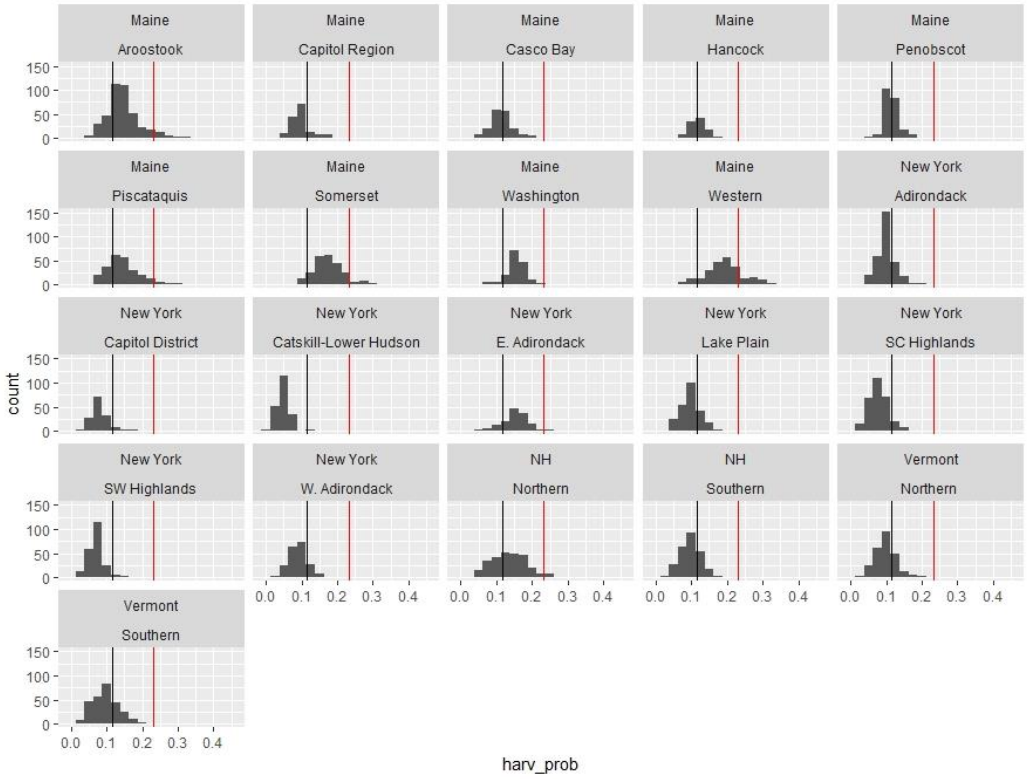
Harvest Prob(Total Area)

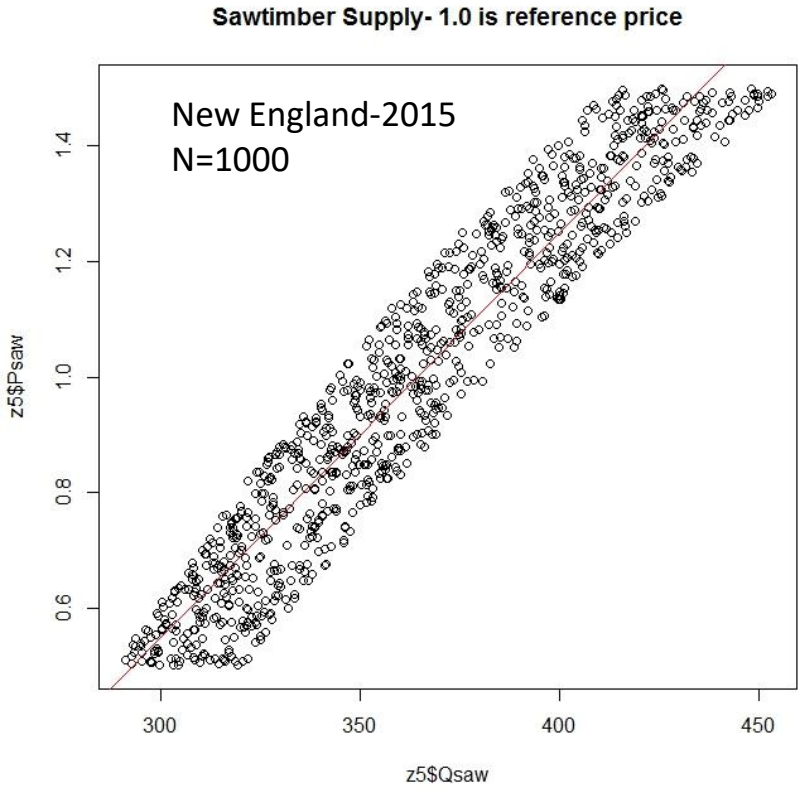


Expected Pulpwood Removals / Total Area

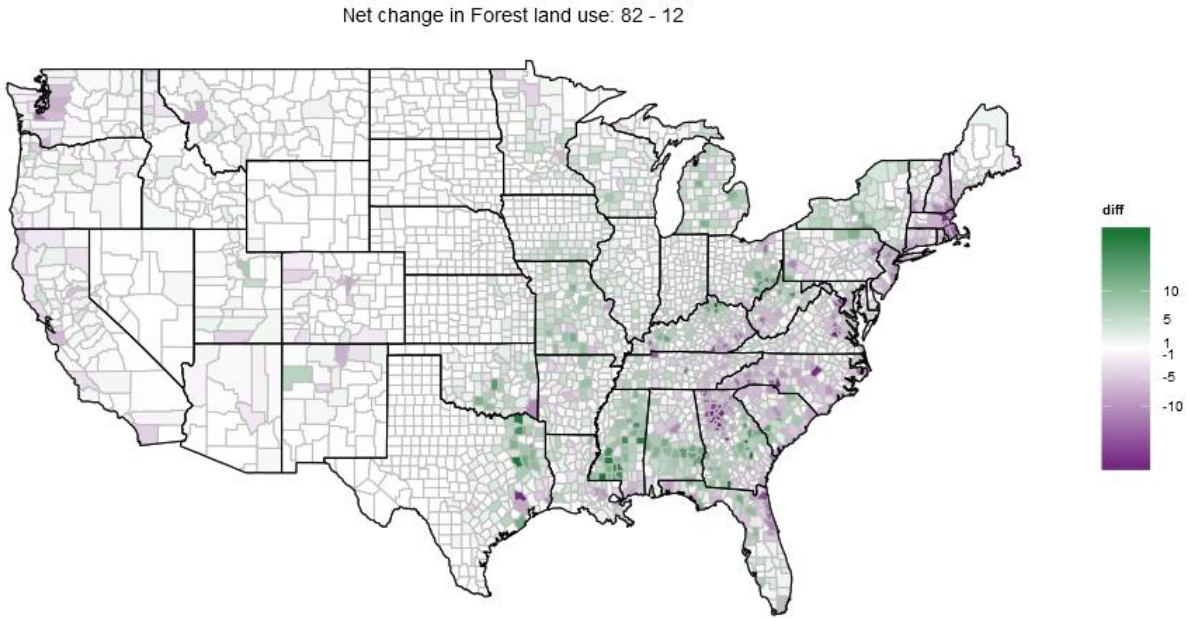


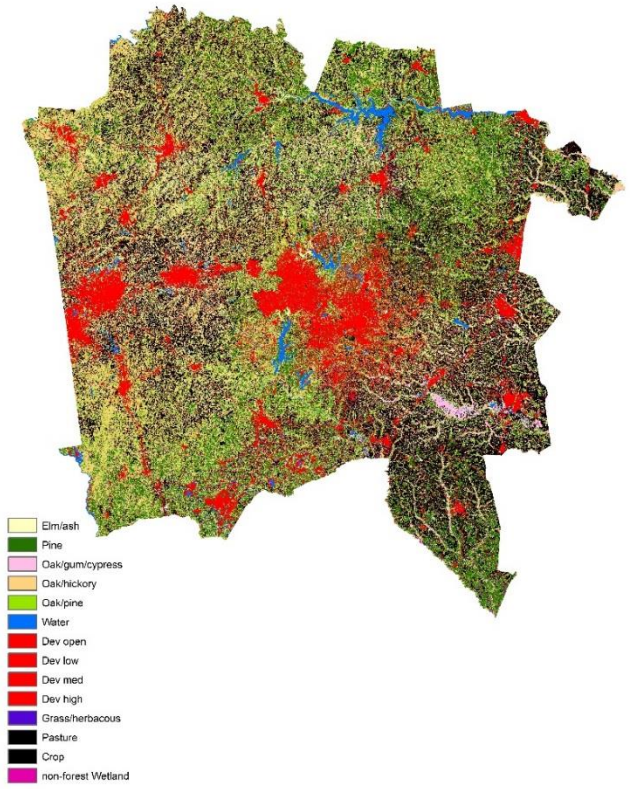
Timber Supply Models



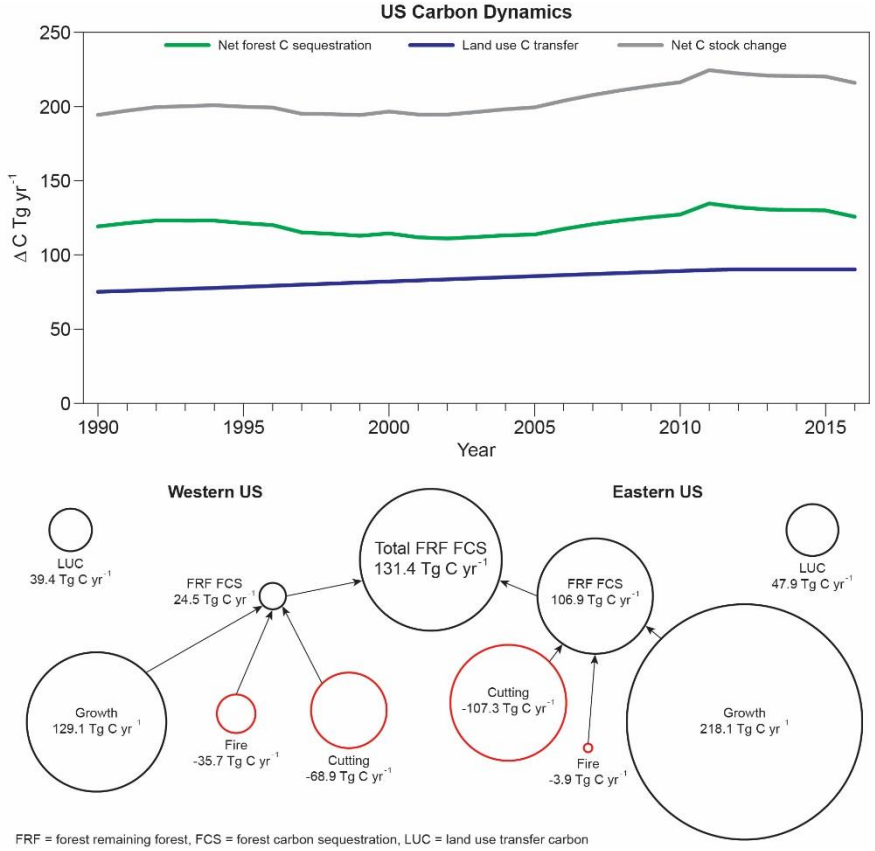


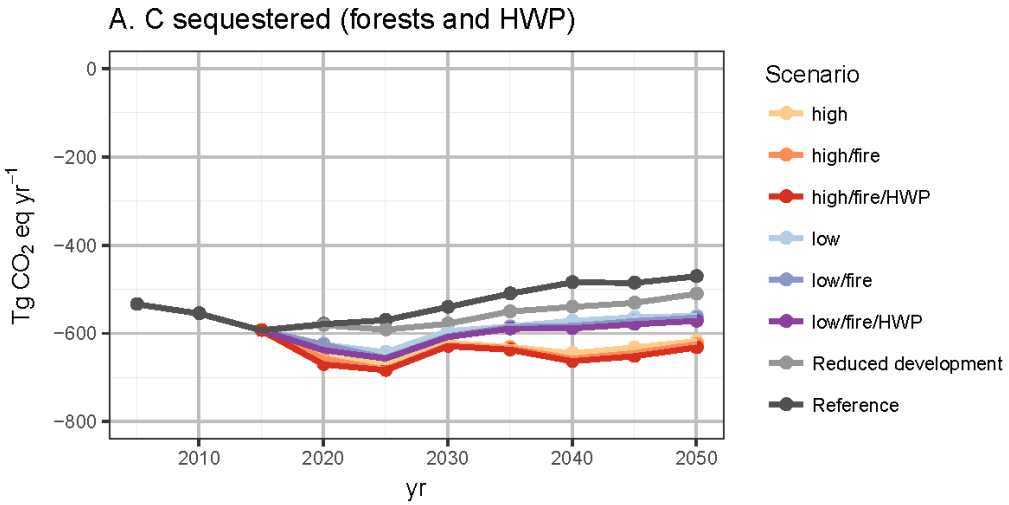
Land use change models





Forest Carbon

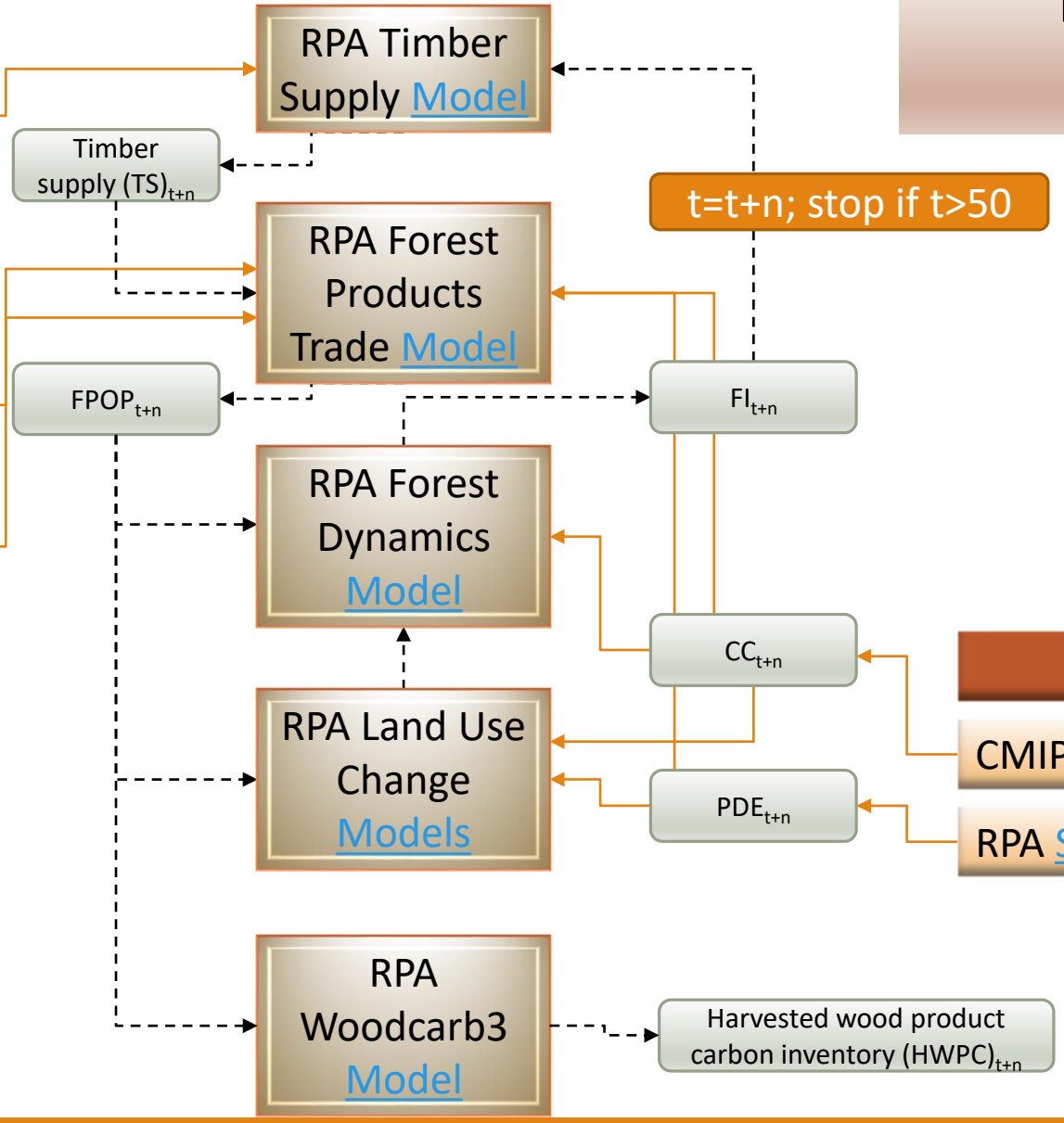




RPA-2020 USFAS

Starting conditions

- Forest Inventory $(FI)_t$
- Land Use $(LU)_t$
- Climate Conditions $(CC)_t$
- Forest Products Outputs and Prices $(FPOP)_t$
- Population, demographics, and economics $(PDE)_t$



Scenario Data

- CMIP5 (RCP)
- RPA Scenario (RCP,SSP)

Primary scenario projections (50 yr)

- Forest conditions (FIA plots; 30m raster)
- Land uses (counties; 30m raster)
- Forest products outputs and prices (countries; US regions)
- Timber harvest/management (plots)
- Forest carbon (plots) and wood products carbon (nation)

Concluding remarks

Producing a library of future forest conditions

- Across several scenarios (coherency)
- Multiple realizations

Projecting forest conditions at the unit of observation

- Big data ---more data makes models better (really!)
- Replacing theoretical constructs with empirical models informed by theory
- Allows for direct modeling of relevant mechanisms of change
- Defines a seamless link between trends in observed and projections
- Allows for various aggregations
  - Small region timber supply estimates
  - Subregional assessment reports
    - Southern Forest Futures Project
    - Northern Forest Futures Project

RPA Timber Supply Model	D.N. Wear, R. Li, J. Coulston, R. Abt, J. Prestemon	FSR&D, North Carolina State University
RPA Forest Products Trade Model	J. Prestemon, C. Johnston, K. Abt, P. Nepal, J. Buongiorno, D.N. Wear	FSR&D, University of Wisconsin, North Carolina State University
RPA Forest Dynamics Model	J. Coulston, D.N. Wear, J. Costanza, R. Li, A. Webster	FSR&D, North Carolina State University, ORISE
RPA Land Use Change Models	D.N. Wear, J. Coulston, T. Kim, E. Brooks, K. Blessman, T. Ozer Kaya	FSR&D, Virginia Tech
RPA Woodcarb3 model	J. Coulston, E. Marland	FSR&D, Appalachian State University

I think I see the ultimate deliverable