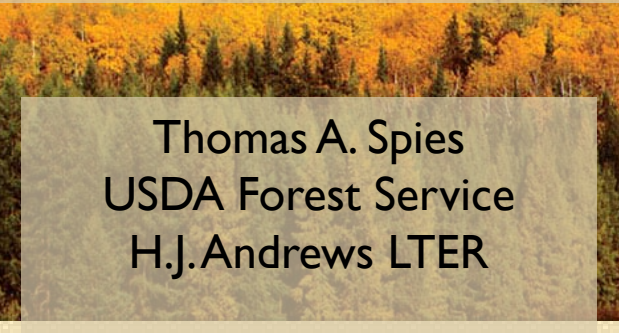


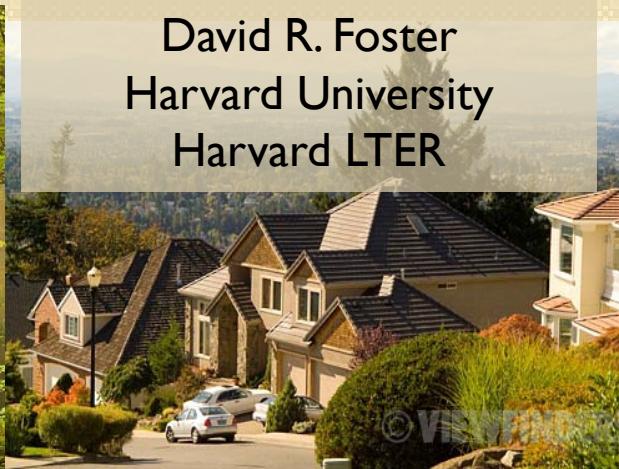


# Scenarios of Landscape Change: America's Forest Future

## A vision for LTER Research Contribution to Society



Thomas A. Spies  
USDA Forest Service  
H.J.Andrews LTER



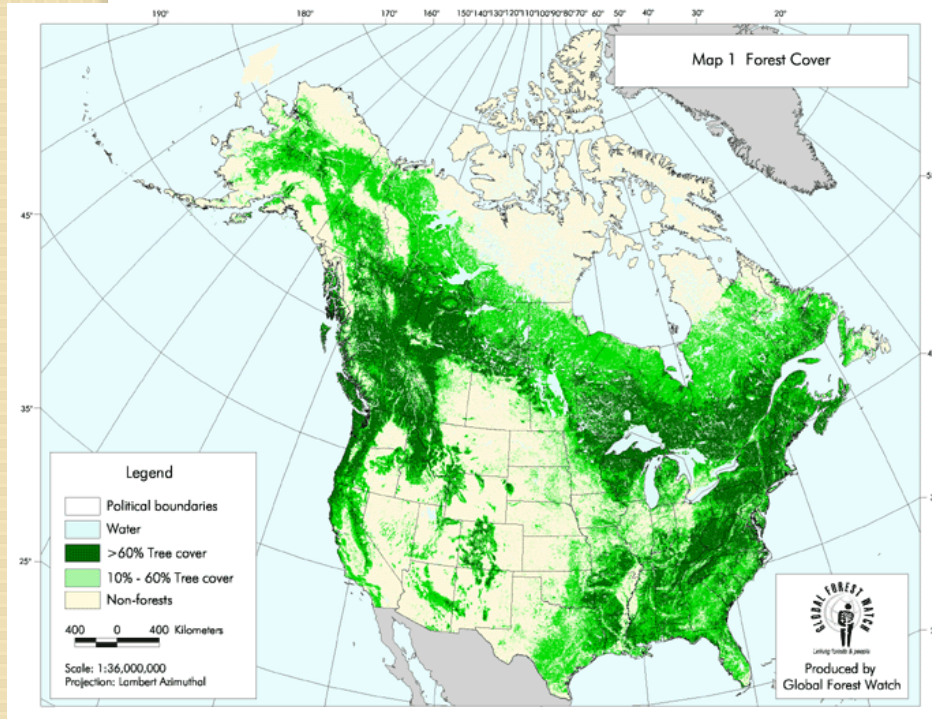
David R. Foster  
Harvard University  
Harvard LTER





# Objectives

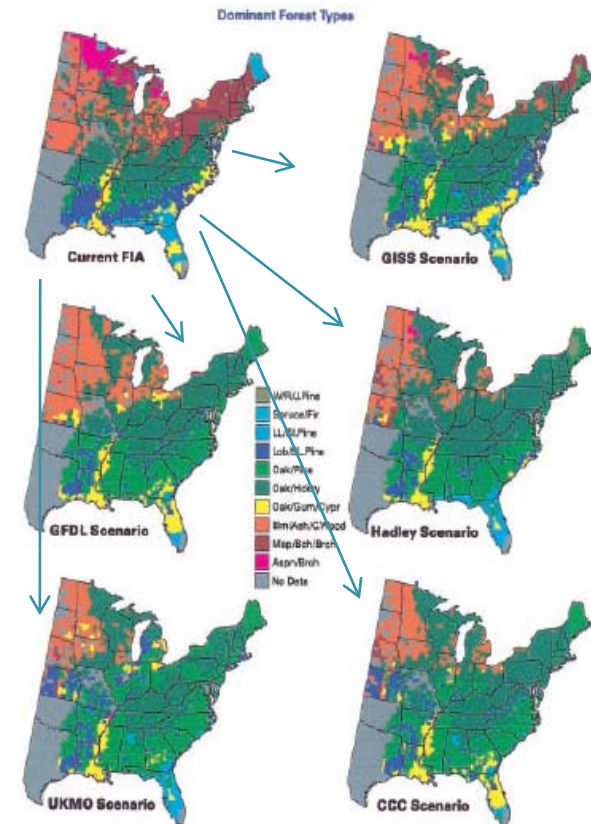
- Demonstrate how LTER network can help us understand the response of American forests to global change
- Describe a general approach that could serve as a model for network-wide scenarios for all ecosystems



## LTER Mission:

***Provide the scientific community, policy makers and society with the knowledge and predictive understanding necessary to conserve, protect and manage the nation's ecosystems, their biodiversity and the services they provide.***

Large Scale “Presses”  
like climate change require  
Large-Scale Systems Research

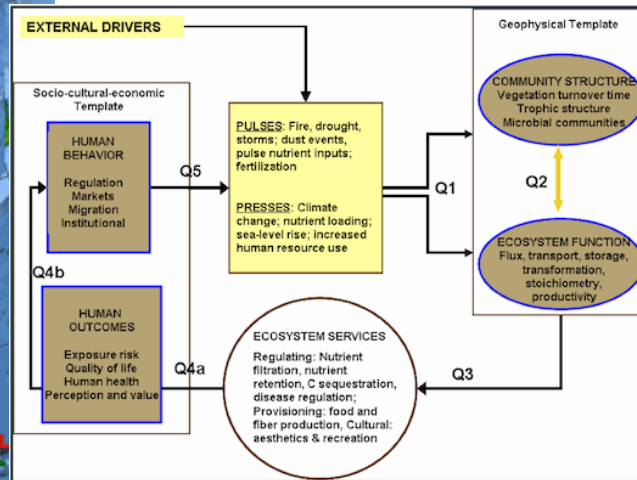


Potential Climate Change  
Responses of Vegetation

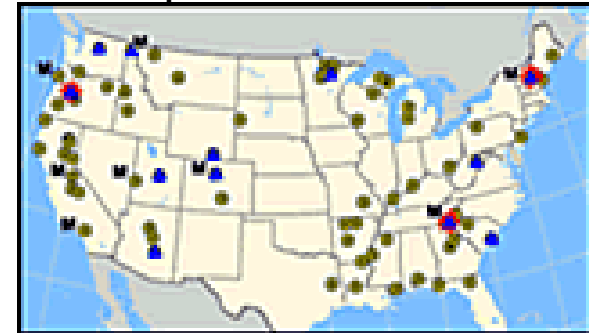
# Ecological Networks Provide Infrastructure



LTER

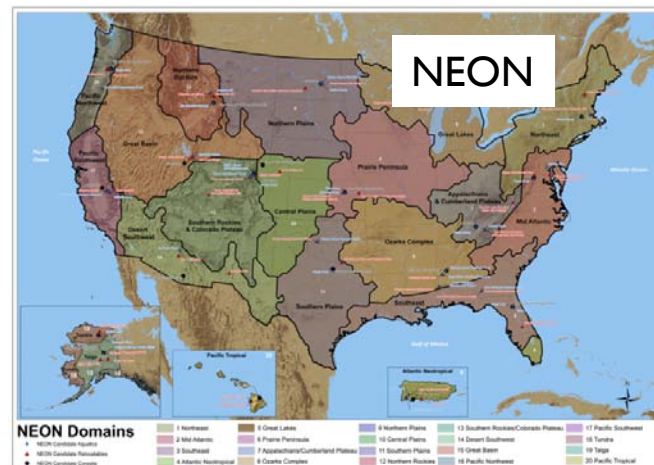


Experimental Forests



ULTRAs

Urban Long-Term Research



NEON

National Ecological Observatory Network

# LTER Scenarios and Modeling: Laying the Groundwork

## Scenario/Modeling Research Planning Efforts



**2004 NSF -- NEON Land Use Land Change Committee**

**2006 NSF – NEON Workshop - Harvard Forest**

**2008 NSF – LTER SC Discussion – Baltimore**

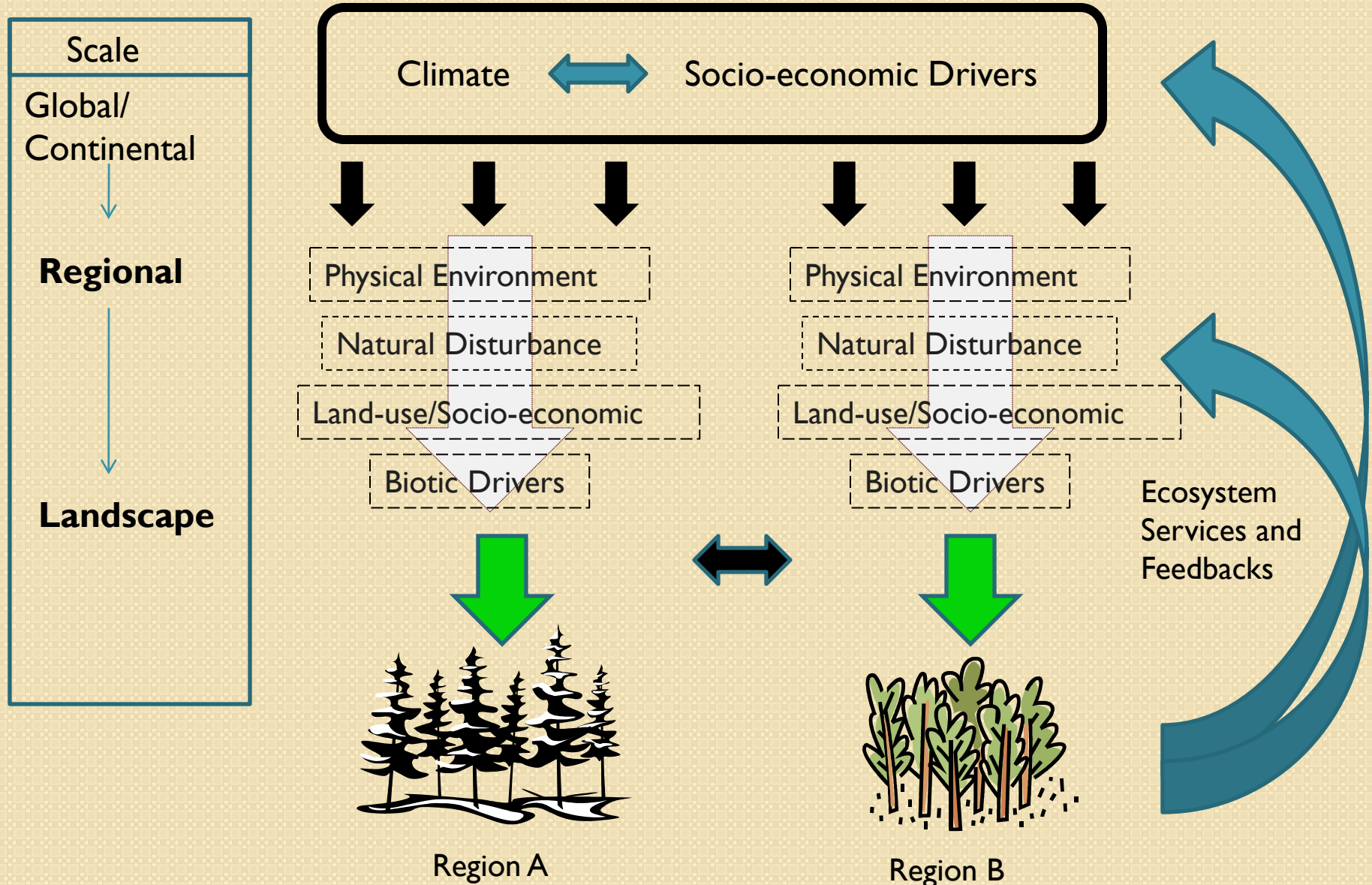
**2009 NSF – LTER Workshops - Harvard Forest, La Jolla**

**2010 LTER Science Council Ratification #1 Network-wide Initiative – Plum Island**

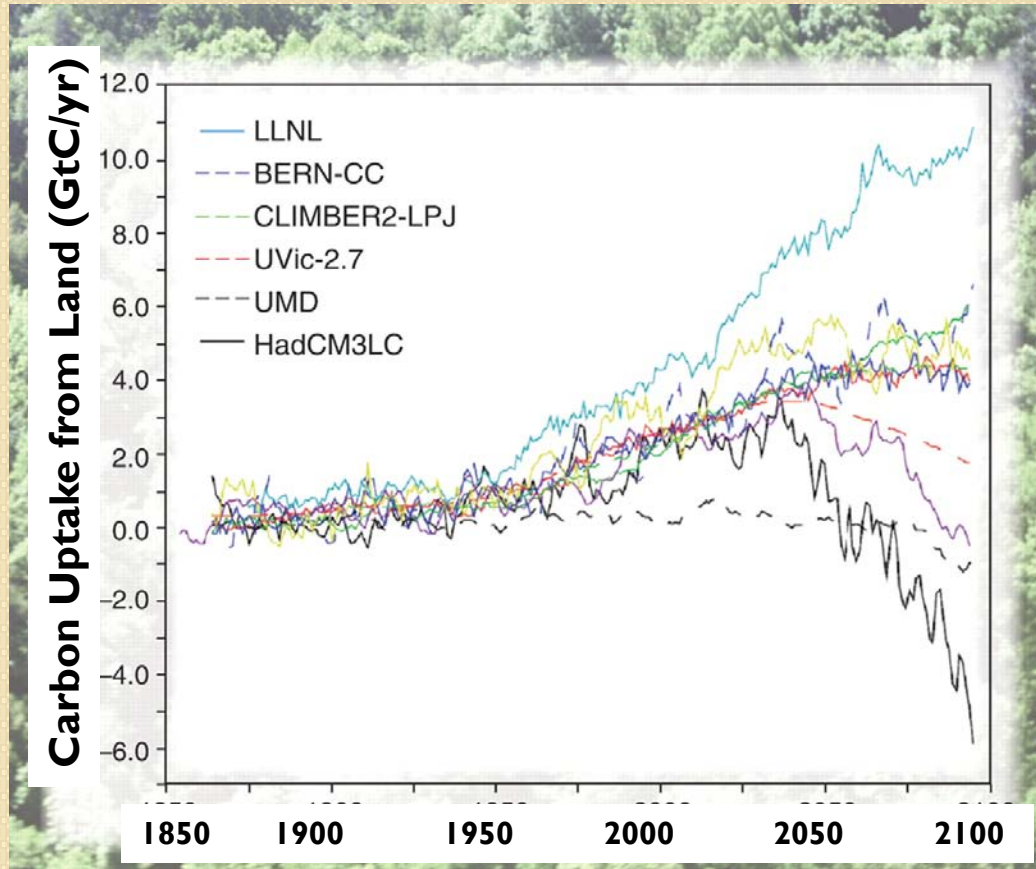
**2010 Planning Funds – NSF Ecosystems + LTER Network**



# Large Scale Climate and Socio-Economic Presses Interact with Regional and Landscape Processes



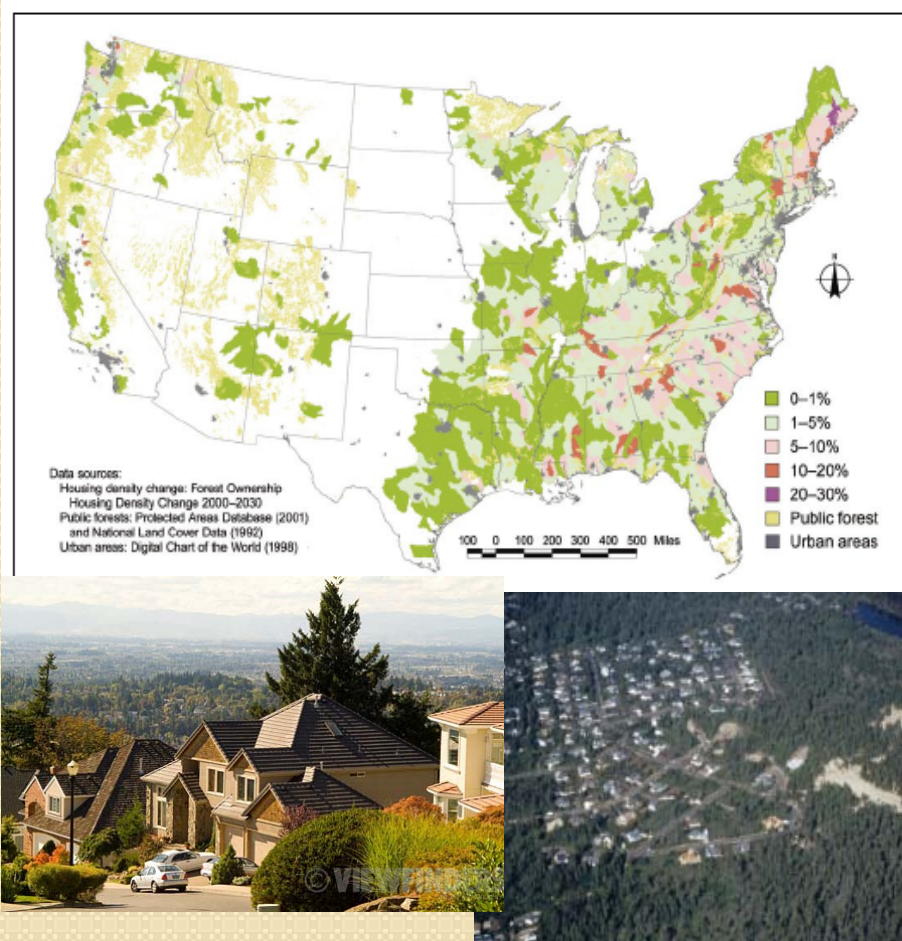
# Forests play an important role in climate regulation but there is large uncertainty about future climate-forest interactions



“...there is little agreement between different [global vegetation models], **making forest dynamics one of the greatest sources of uncertainty in predicting future climate**”

“Reducing this uncertainty requires work on several fronts....  
**physiological parameters, ...and ...models of disturbances, including fire and land-use change**”

## Land-Use Change

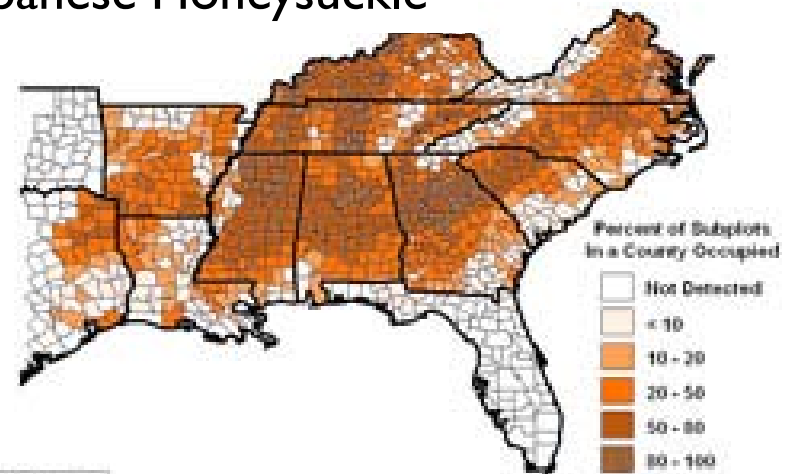


Percent of watersheds with private forests that are projected to shift from rural to exurban by 2030. Source RPA.

# Global change is more than climate change

## Invasive Species

### Japanese Honeysuckle

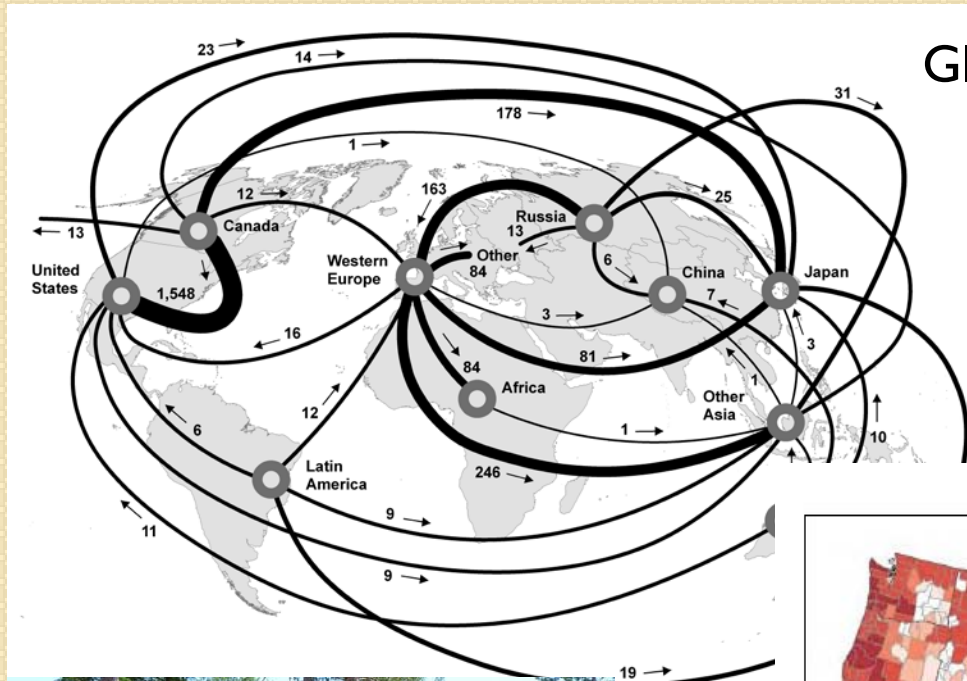


World Forest Census  
1990–2000  
1990–2000  
1990–2000

FIA

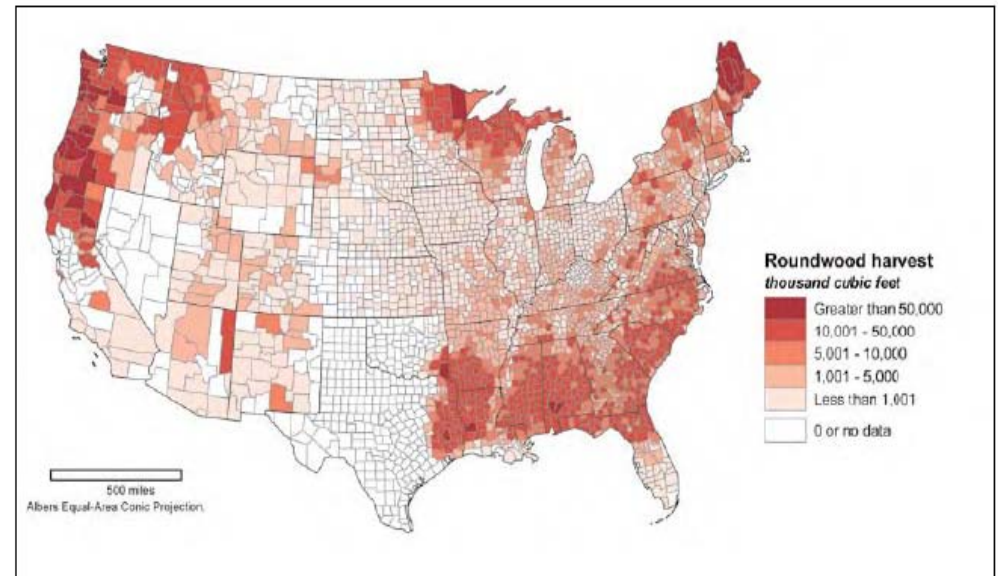


# Wood Flows: Sources and Sinks



Global Flows of Wood

National Sources of Wood

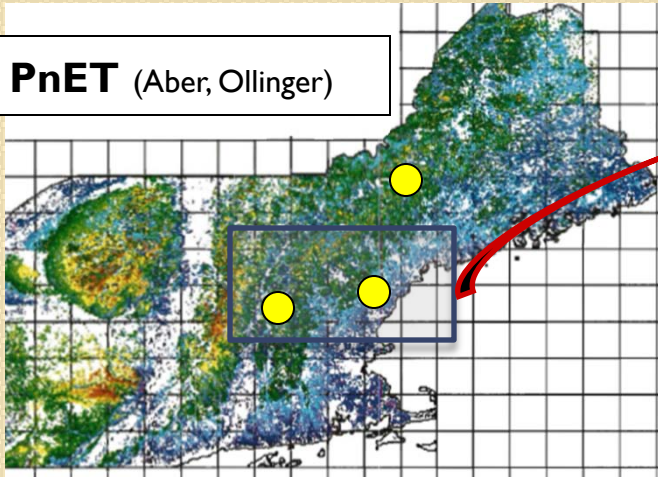


# Scientific Questions

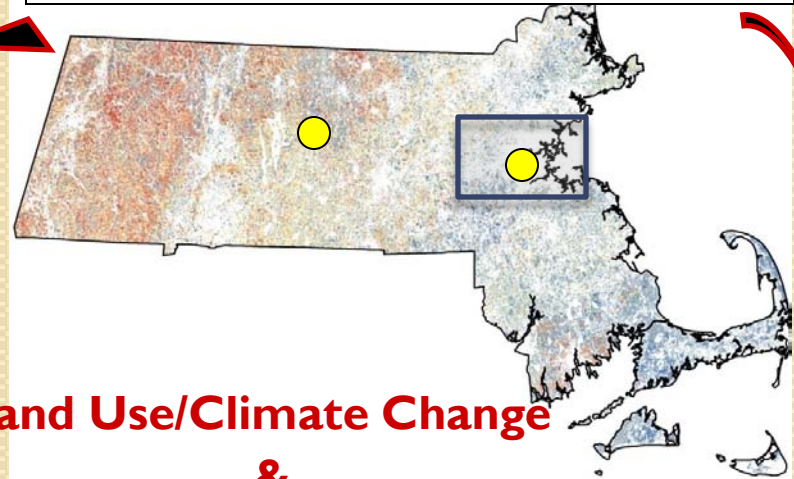
- How do global pressures affect ecosystems at regional and landscape levels?
- What are socio-ecological interactions within and among regions?
- What characteristics best predict vulnerability, resilience and adaptability to global change?
- What are the ecological thresholds in the different regions?

# Down-Scaling and Model Linkages

**PnET** (Aber, Ollinger)

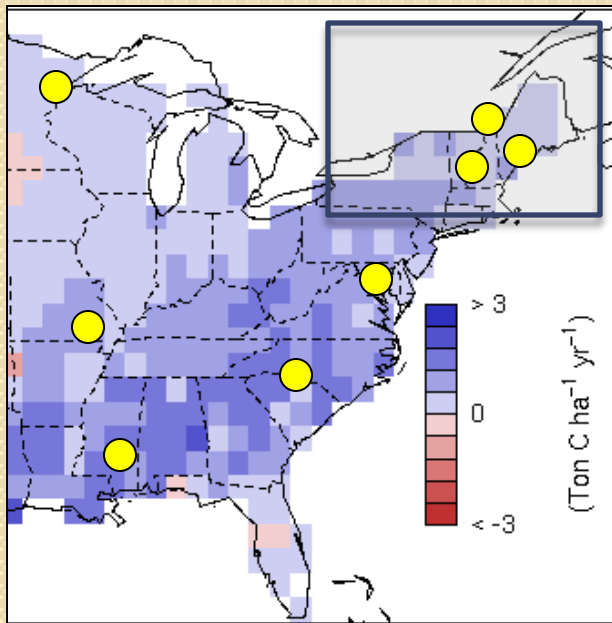


**LANDIS-II** (Thompson, Foster, & Kittredge)

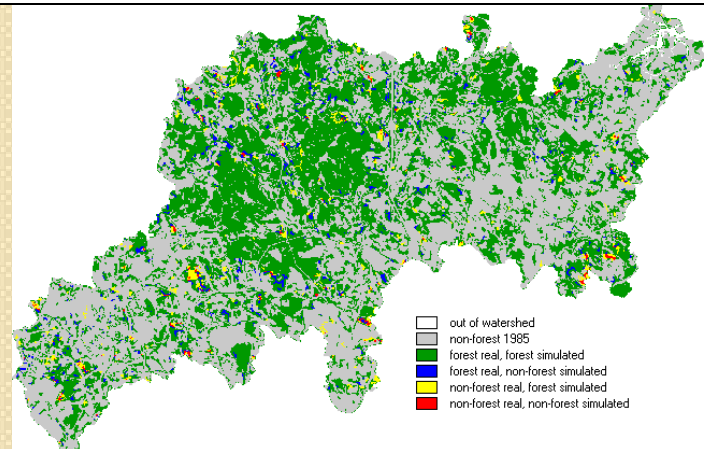


**Land Use/Climate Change  
&  
Carbon Sequestration**

**Ecosystem Demography**  
(ED; Moorcroft et al.)

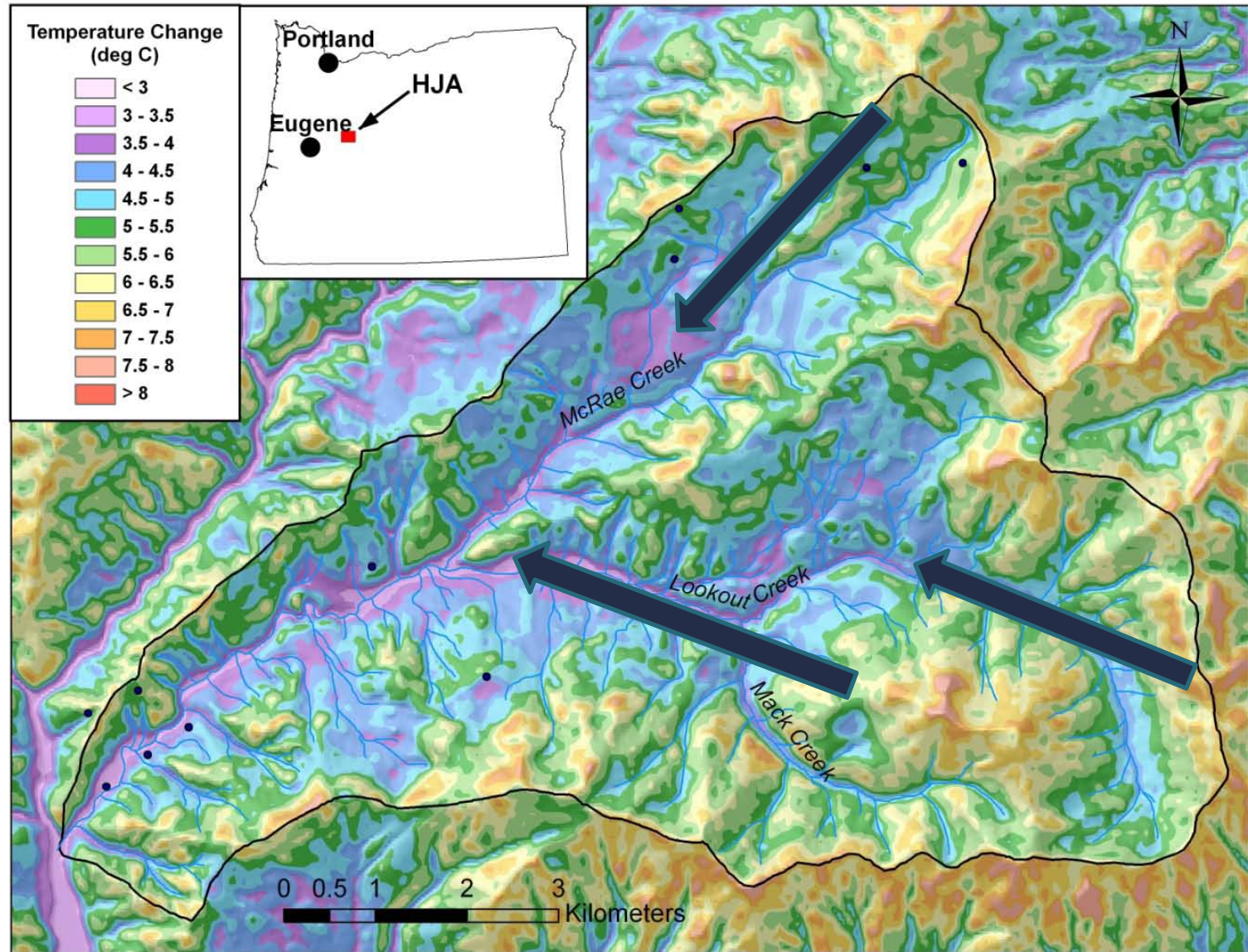


**GEOMOD** (Pontius, Schneider, Polsky)



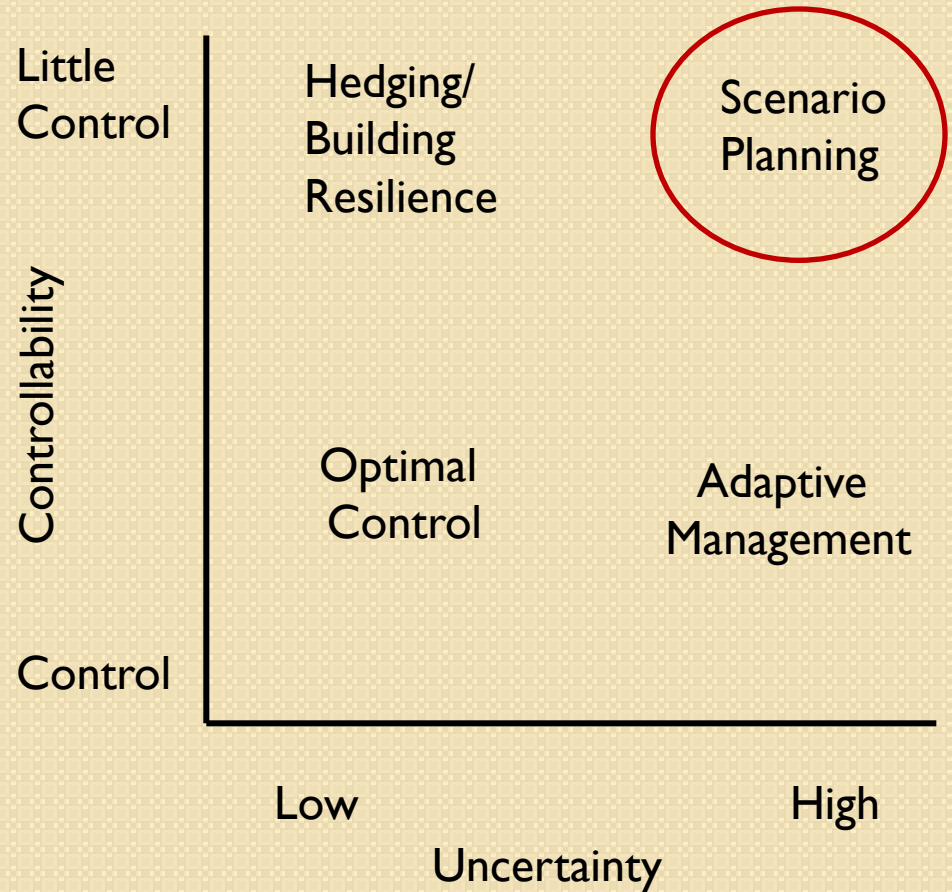


# Climate Change Interactions with Topography



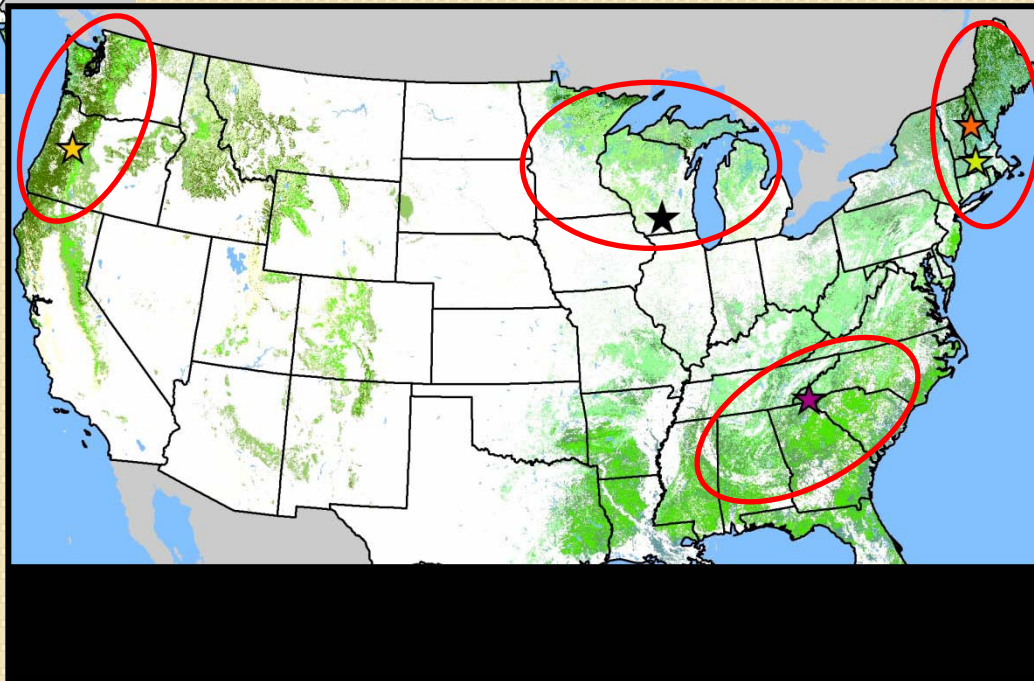
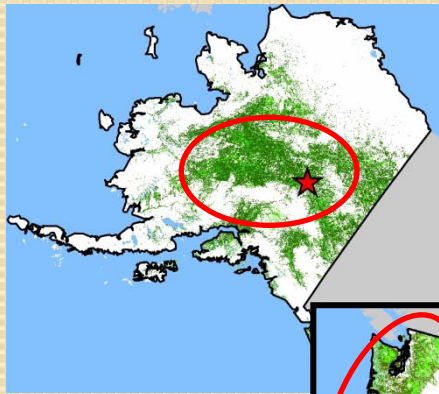
# Policy/Management Issues

- Environmental policy in a dynamic and diverse world
- Tradeoffs/options in production of ecosystem services
- Decision support for risk management



# Forest Futures Approach

## Focal Regions for LTER Forest Future Research



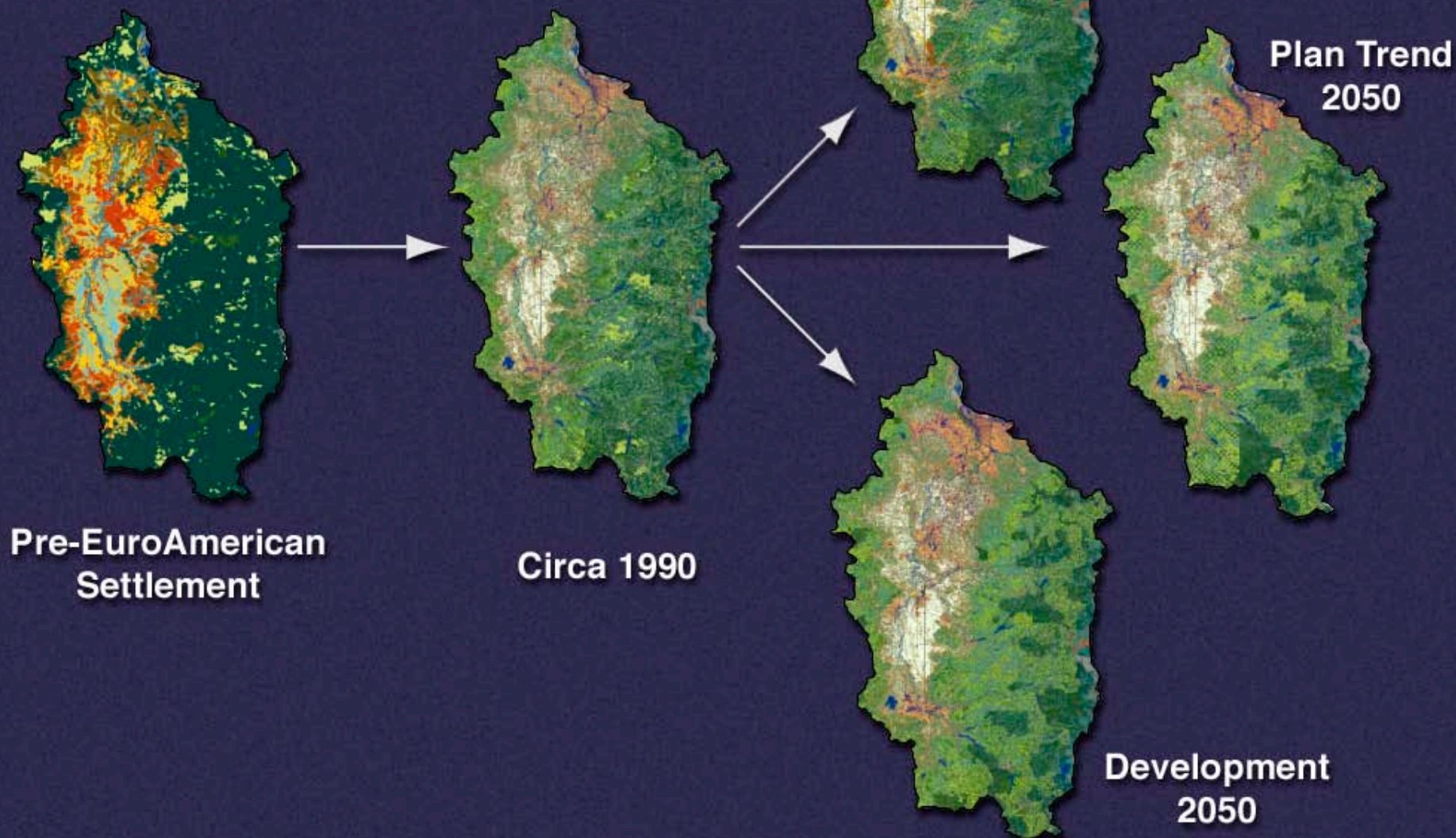
- ★ BONANZA CREEK
- ★ COWEETA
- ★ H J ANDREWS
- ★ HARVARD FOREST
- ★ HUBBARD BROOK
- ★ NORTH TEMPERATE LAKES



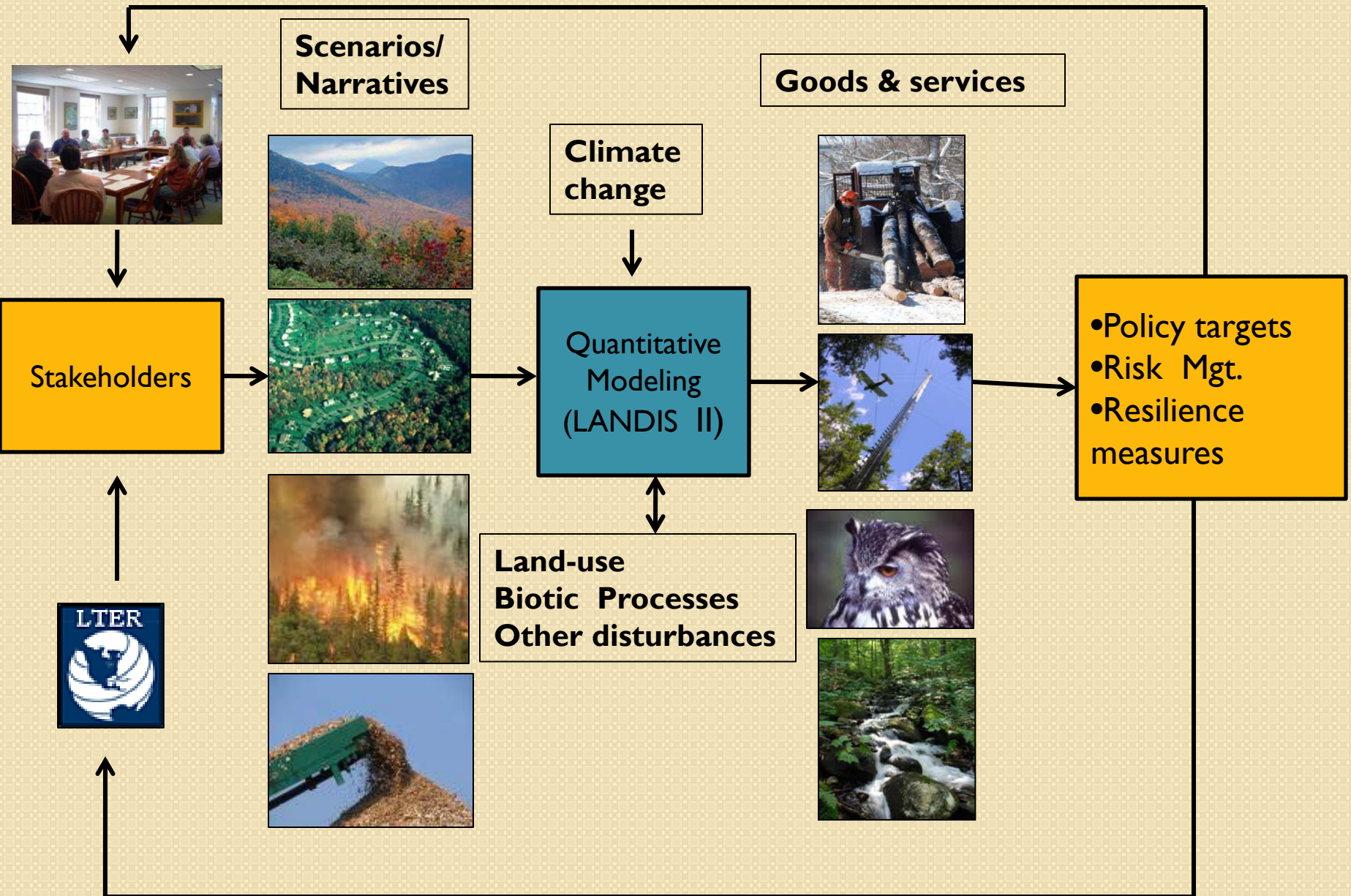
# Landscape/Regional Scenarios and Assessment Experience

- Willamette Futures Project
- Coastal Landscape Analysis and Modeling Study (CLAMS)--Oregon
- Southern Forest Assessment
- Upper Lake States—Landis Modeling
- Massachusetts—Landis Modeling
- Alaska—LTER Fairbanks Landscape project

# Trajectories of Landscape Change in the Willamette Basin



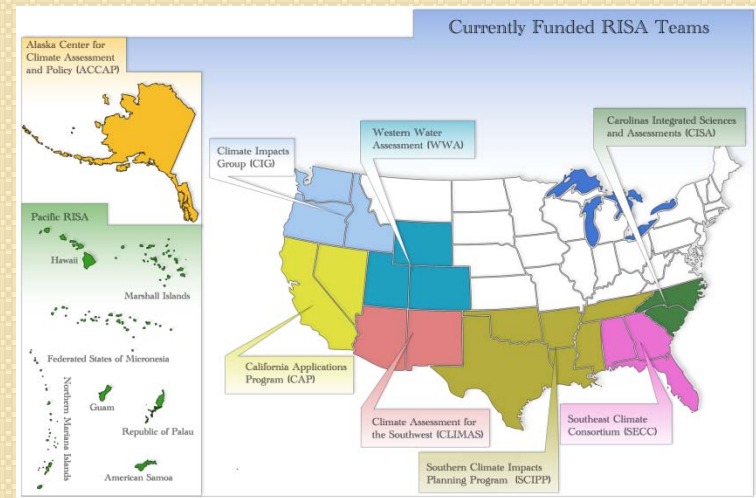
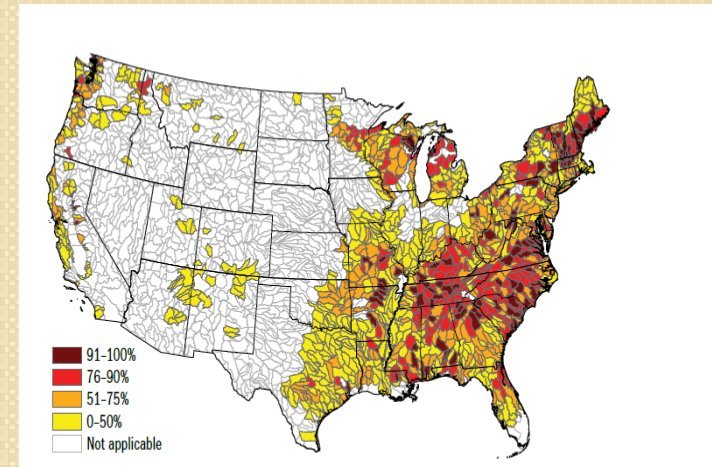
# Integrated Forest Scenarios-Modeling





# Other Assessments--Potential Partners

- Regional Planning Assessments (RPA) - USFS
- Reg. Integrated Sci.Assessments (RISAs) - USGCRP
- Forests on the Edge - USFS
- Southern/Northern Forest Futures - USFS
- Assessing Carbon Stocks – USGS
- Global Forest Resource Assessment – US FAO
- Forest Sustainability/Wood Bioenergy – Pinchot Institute/The Heinz Center
- Beyond Old Growth – NCSE
- Global Markets Forum – NCSE
- EPA-NSF ULTRA urban assessment





# Niche and Comparative Advantage for LTER Forest Futures

- Downscaling to landscape-level
- Functioning Network
- Leverage long-term data and research
- Regional and landscape research community capacity
- Integrated ecological systems experience
- Training for LTER and future scientists—  
scenarios and socio-ecological systems

# Next Steps

- Proposal to NSF Macro Systems
- Work with existing resources to further develop vision and plans
- Coordinate with ULTRAs, NEON, potential partners
- LTER Strategic Communication plan



# Conclusions

- Global drivers of forest change
  - Climate
  - Socio-economic processes
  - Biotic processes
- LTER and other networks are well positioned
- Forested systems are a good place to start
- Potential to work with partners (e.g. USFS, USGS, EPA) is large

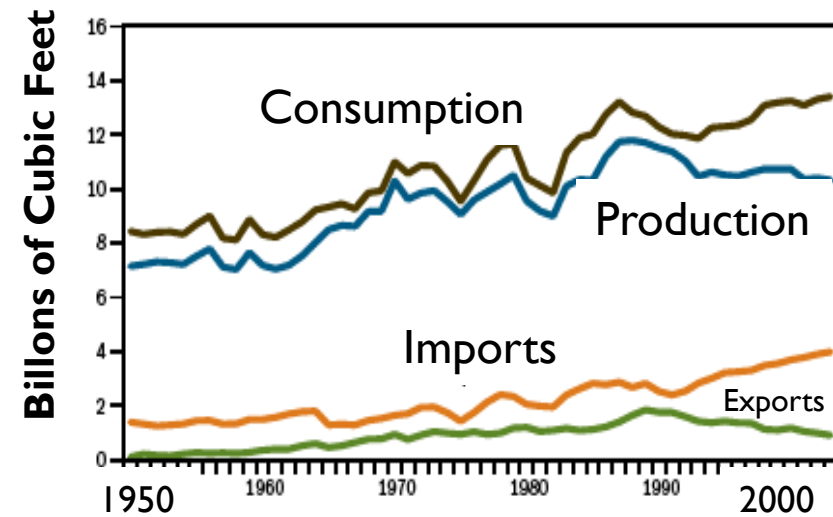
# Conclusions

- Many critical scientific gaps in knowledge exist related to global climate and socio-economic pressures on regional and landscape level ecosystems
- Scenarios approach would provide policy makers and society with context for decision making and risk management





# Forest Products, Production and Consumption Are Changing



Trends in roundwood volume

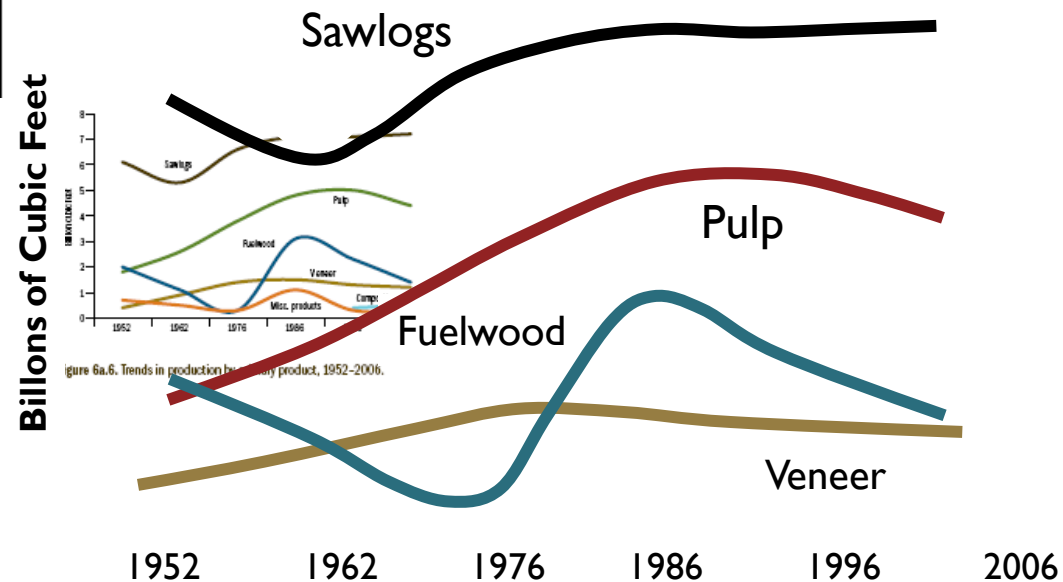


Figure 6a.6. Trends in production by product, 1952-2006.

Trends in productivity by product

