

# Climate Change & Forest Economics

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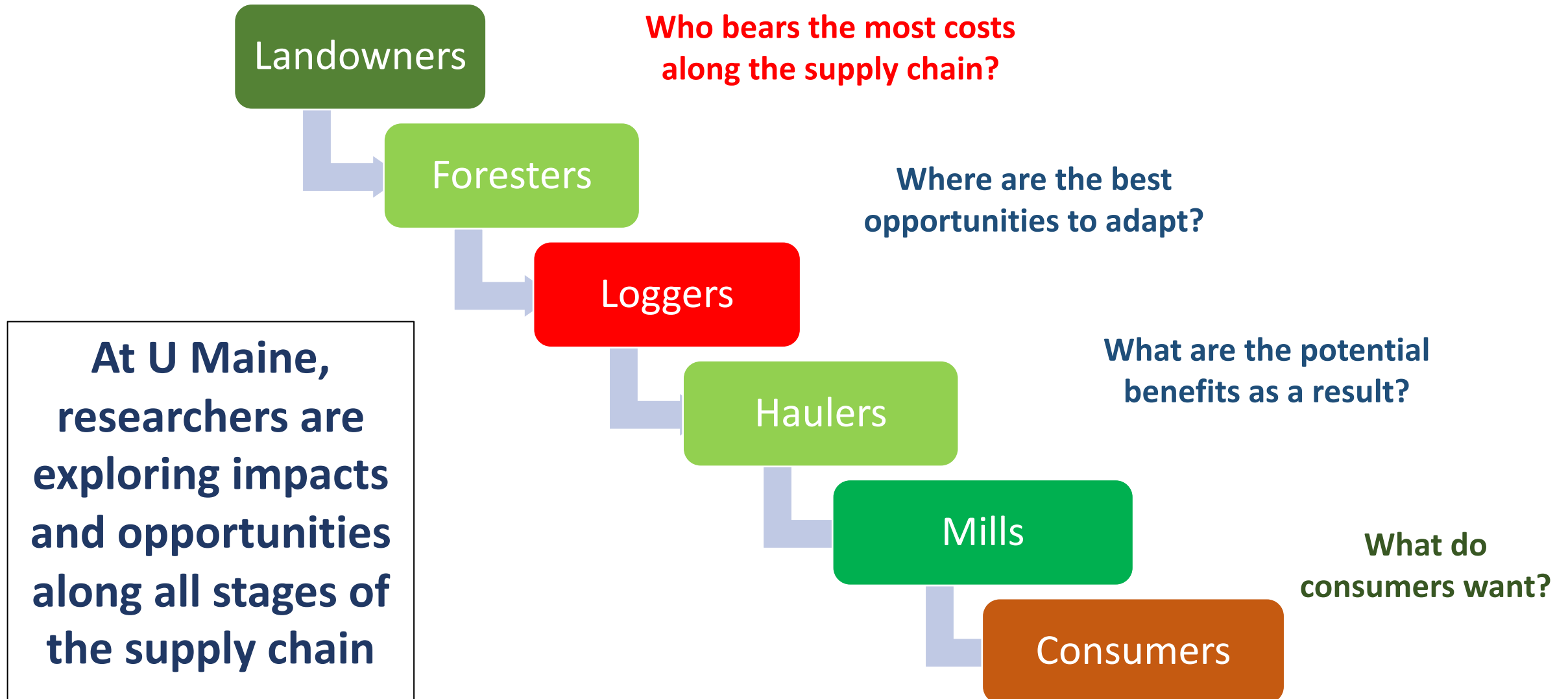
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# Climate Change: Economics & the Supply Chain

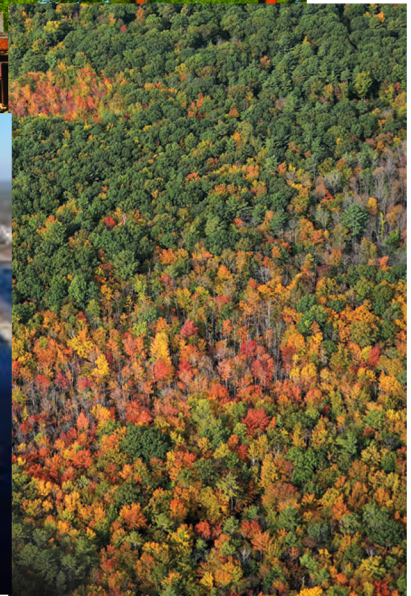


# Overview

- Most research on CC impacts in ME/New England focuses on physical changes
- CC impacts people and economies too
  - Forest productivity and species shift + changes in market demand
  - Management activities as form of adaptation
- Not just about impacts and adaptation. Forests have large mitigation potential too
  - Standing carbon, durable wood products, biomass-based energy

# Maine's Forest Industry Overview

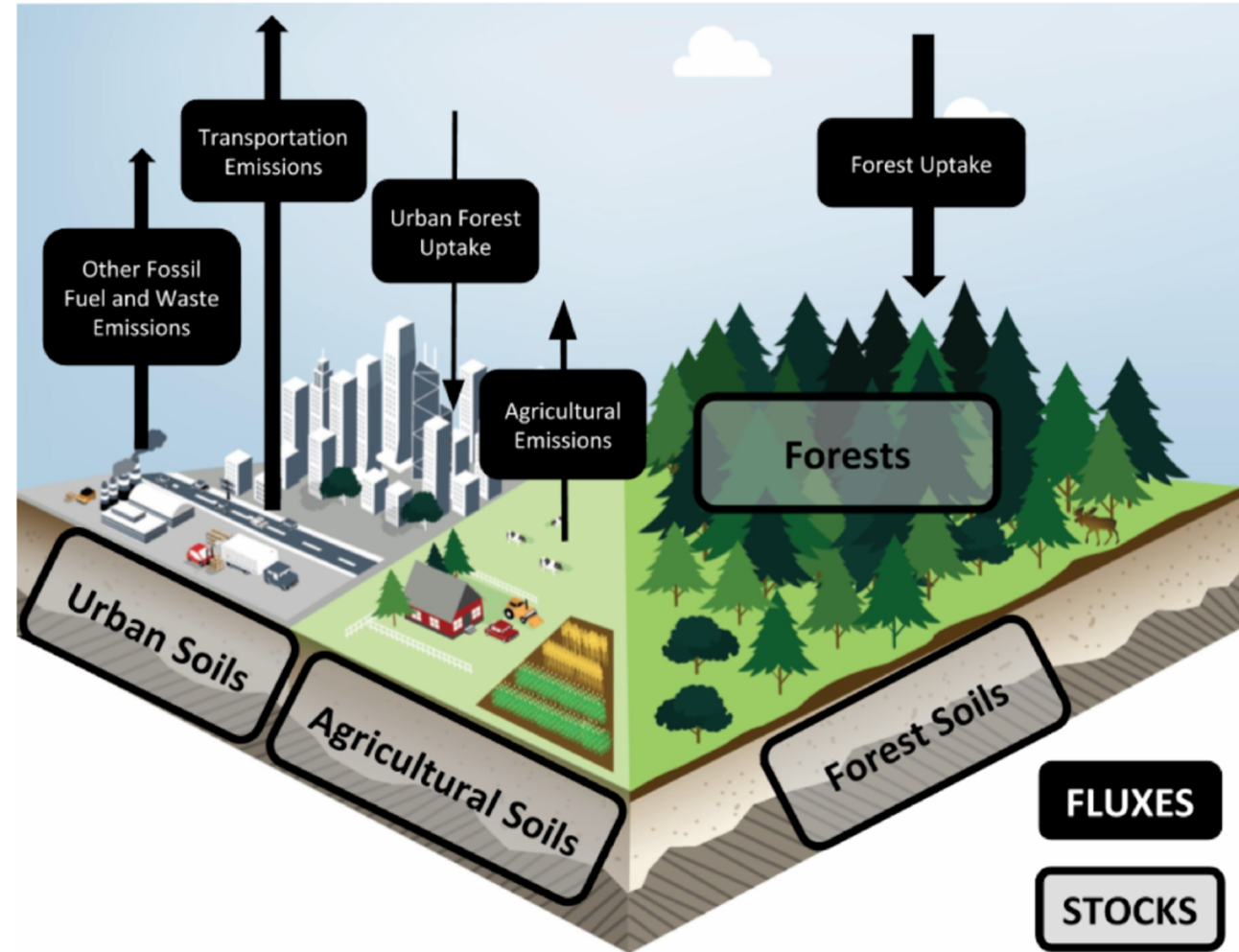
- \$8-10B in annual direct economic contributions
- Diverse yet integrated across sectors
- Additional economic benefits
  - Recreation
  - Wildlife habitat
  - Aesthetics





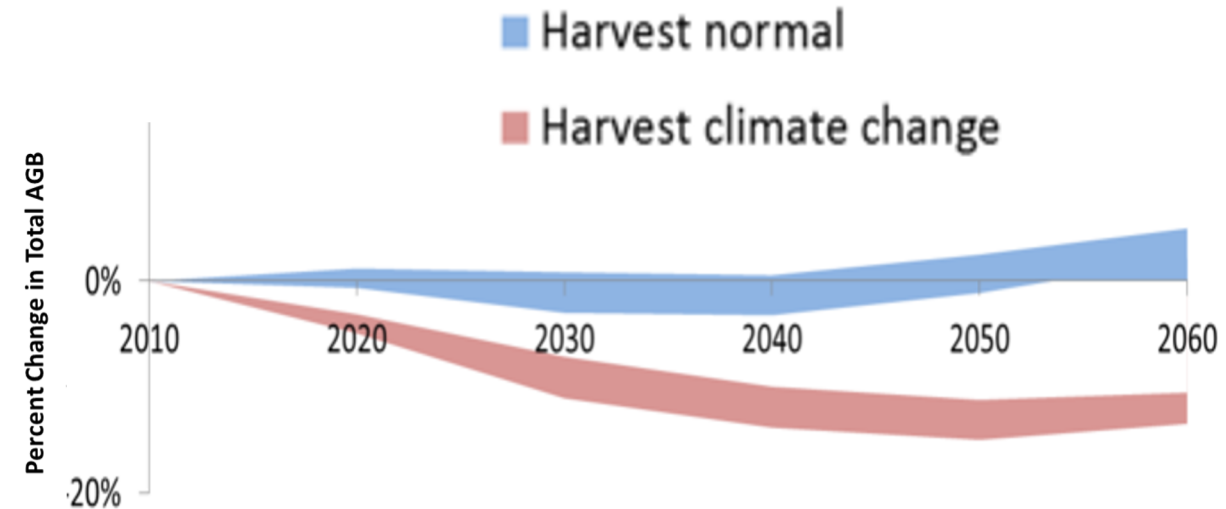
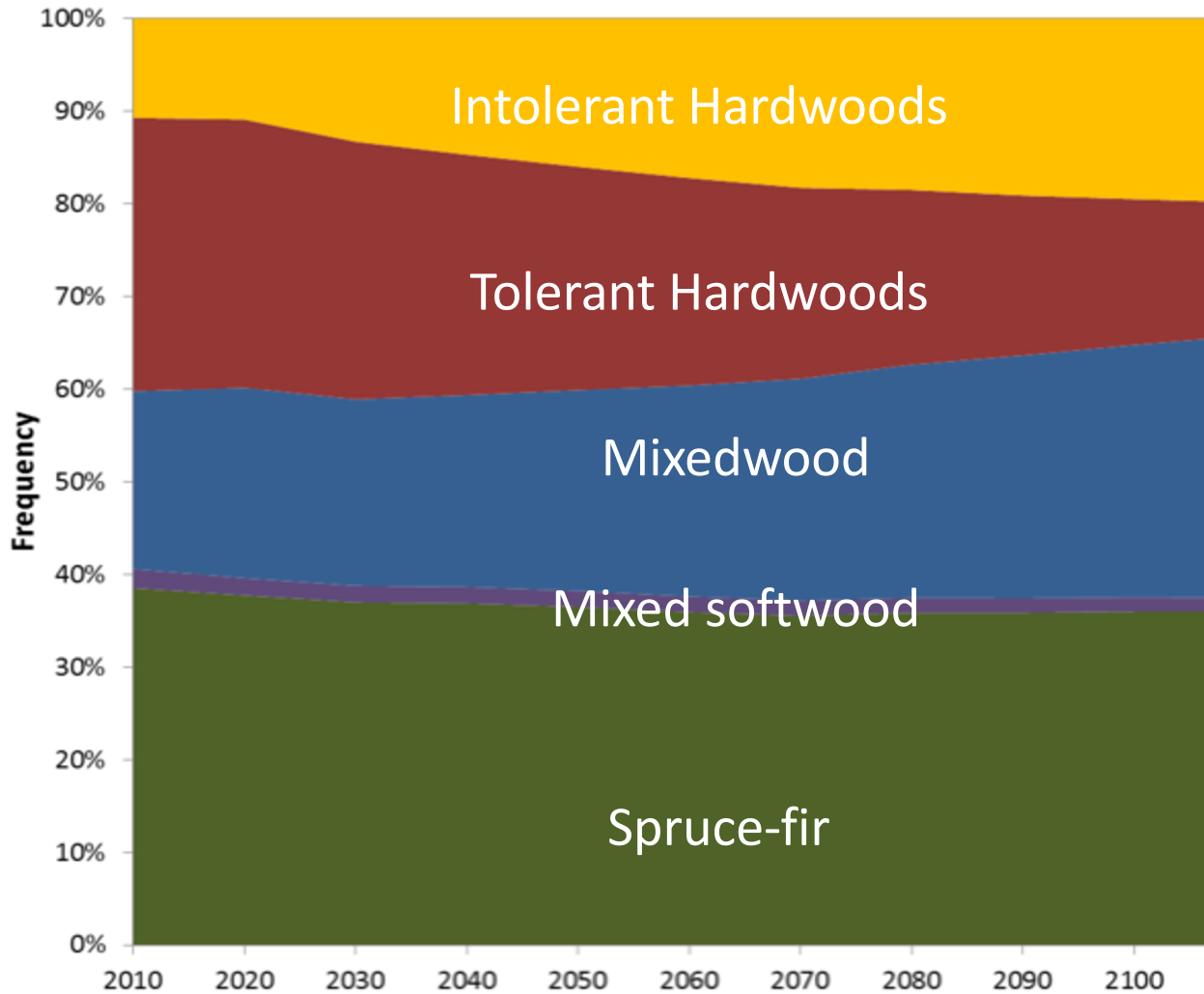
# Maine Forest's Importance to State's Annual Carbon Budget

Carbon Pool	% of State's Annual Fossil Fuel Emission
Forest carbon stocks + annual growth	60%
Forest products	15%
Total forestry sector	75%
Net Land Sink	78%



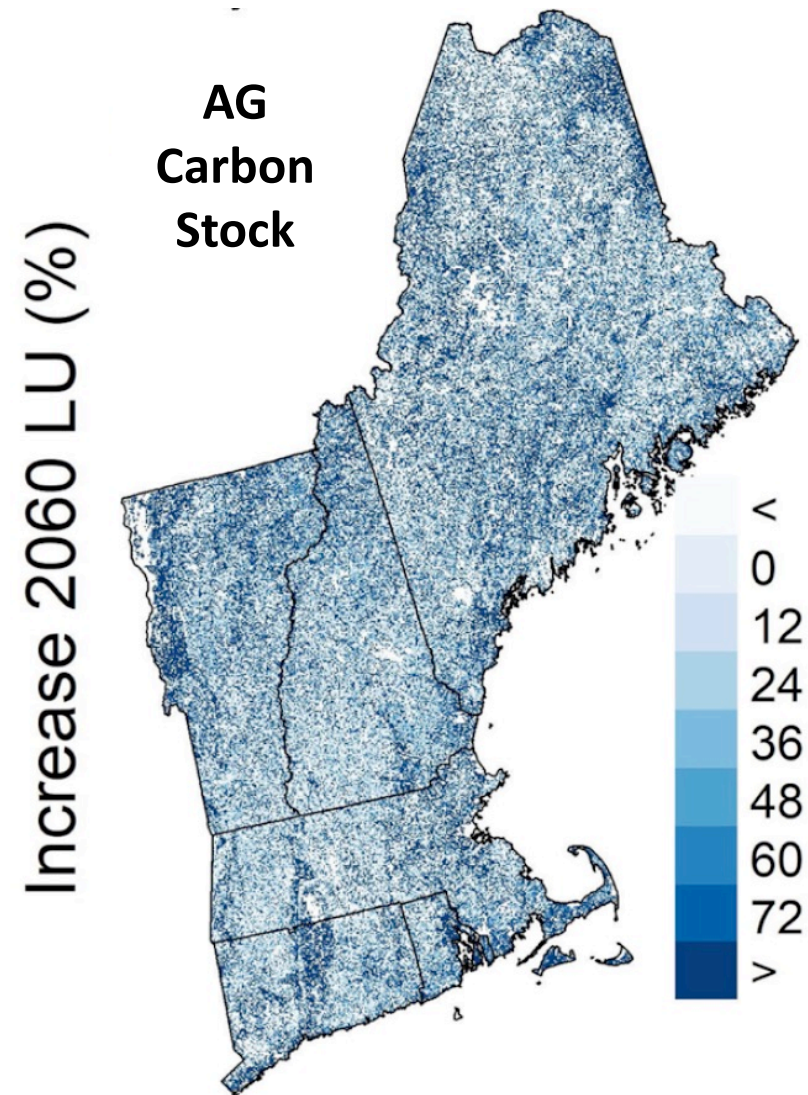
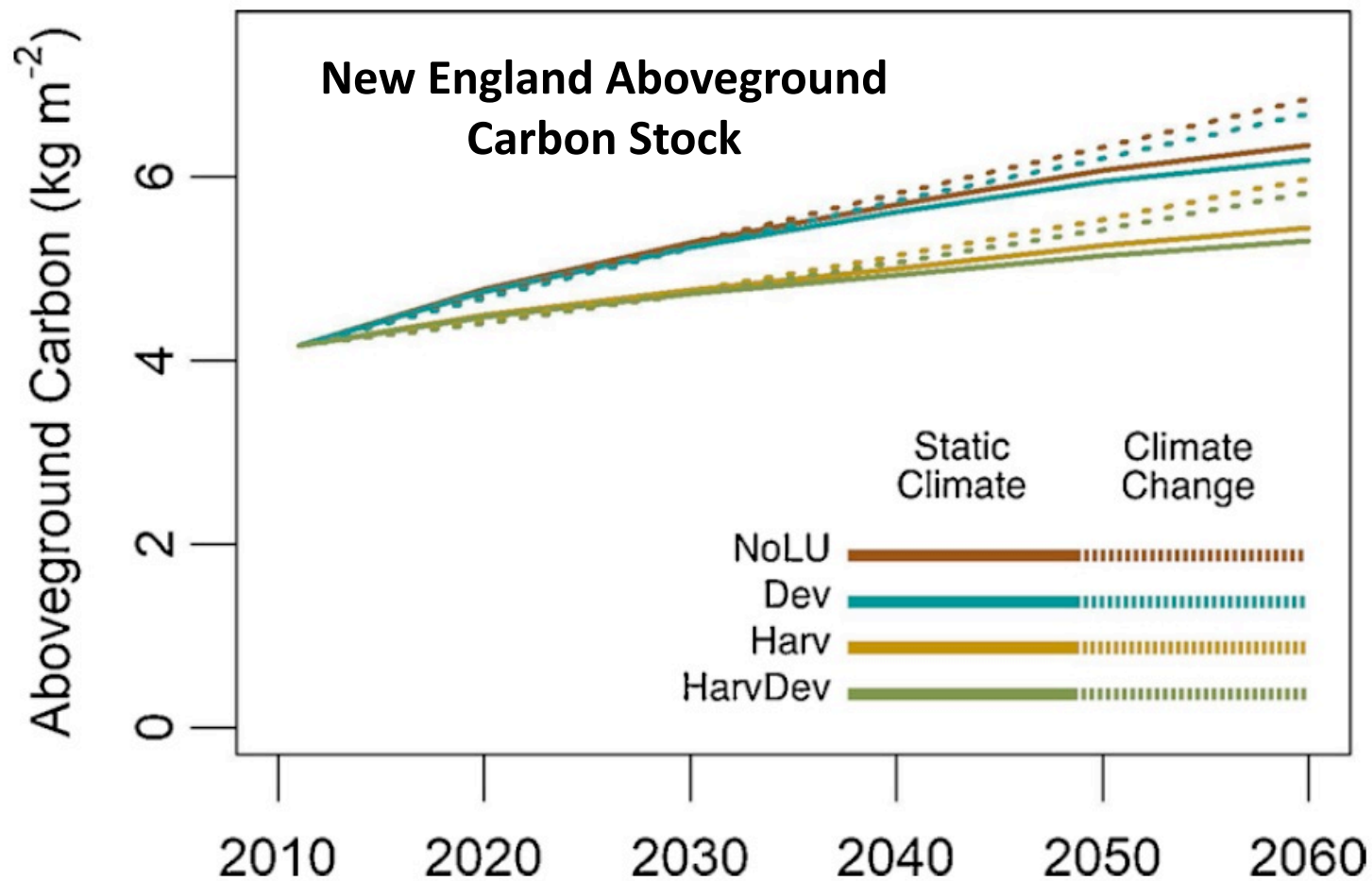
[crsf.umaine.edu/forest-climate-change-initiative/carbon-budget](https://crsf.umaine.edu/forest-climate-change-initiative/carbon-budget)

# Forest Productivity More Variable with Climate Change



Some areas may see higher growth due to *longer growing seasons*,  
Other areas may decline due to greater *droughts* and *pest* occurrence  
*Forest management* a strong influence of future trends

# Harvest Regimes & Land Use Change also affect Forest C



# Maine's forest managers aware of impacts & adapting

## What are the top climate change related impacts to the forest products industry?

**20** CFRU members responded during Jan. Meeting



**65%**

Respondents selected increases in insects and pathogens as a top 5 impact



**60%**

Selected increases in extreme precipitation events



**55%**

Selected shifts in forest composition



**40%**

Selected increases in invasive species

## Which management decisions would you be willing to adopt/advise?

**94%**

Improve road/culvert maintenance and construction

**70%**

Thin trees out of overly dense forests

**63%**

Foster connected landscapes to promote natural migration of species

**63%**

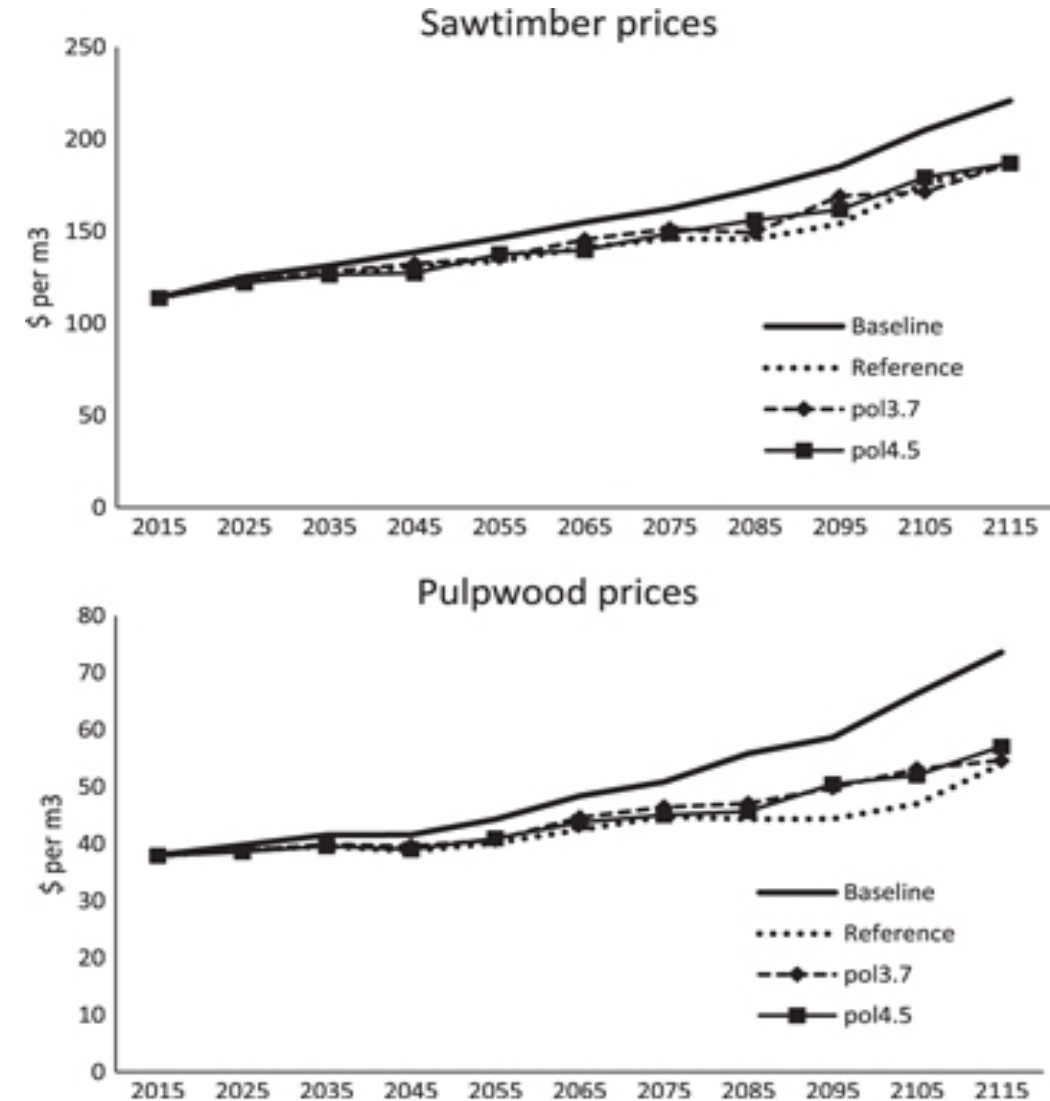
Create early detection programs for new invasions of undesired exotic species





# CC Impacts + Timber Markets

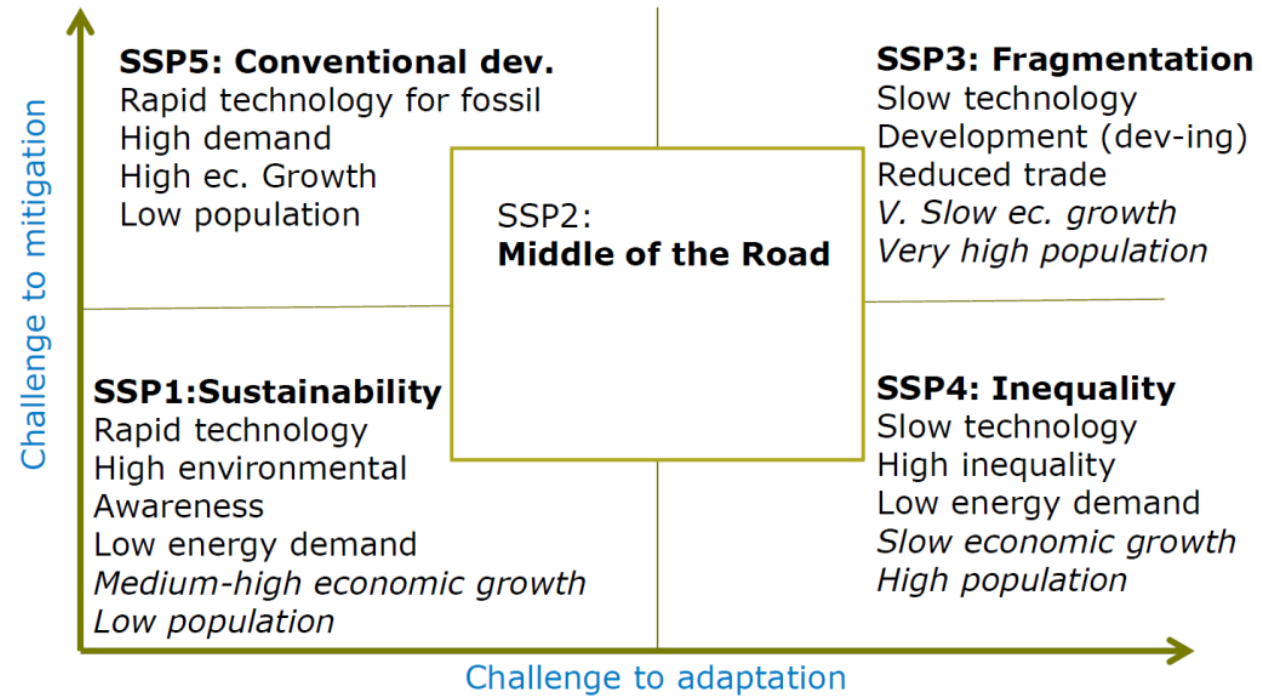
- Naively, can take estimated changes in forest productivity and species distribution to quantify economic impacts of CC
- However, more complex than that because humans can adapt. Thus, can utilize economic models to account for that.
- At present, more info available at national and global scale.





# Future Implications – Policy, Impacts, and Adaptation

- Lots of plausible futures depending on where society goes
- IPCC framework:
  - Physical Impacts → RCPs
  - Socio-economic impacts → SSPs
- Which pathway for Maine/NE/US?
- We live in a global world



# Shared Socio-economic Pathways & Forest Area Change

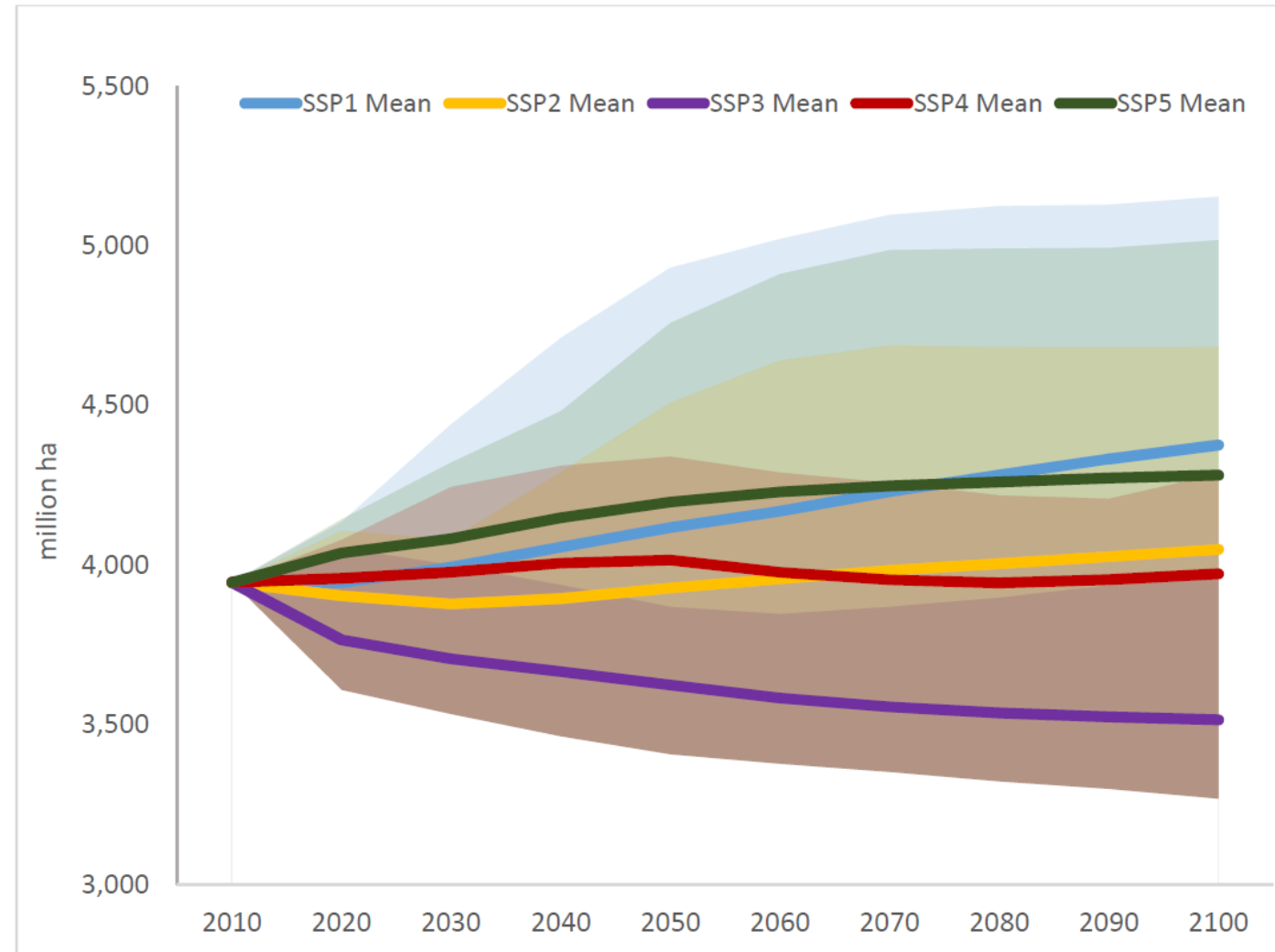
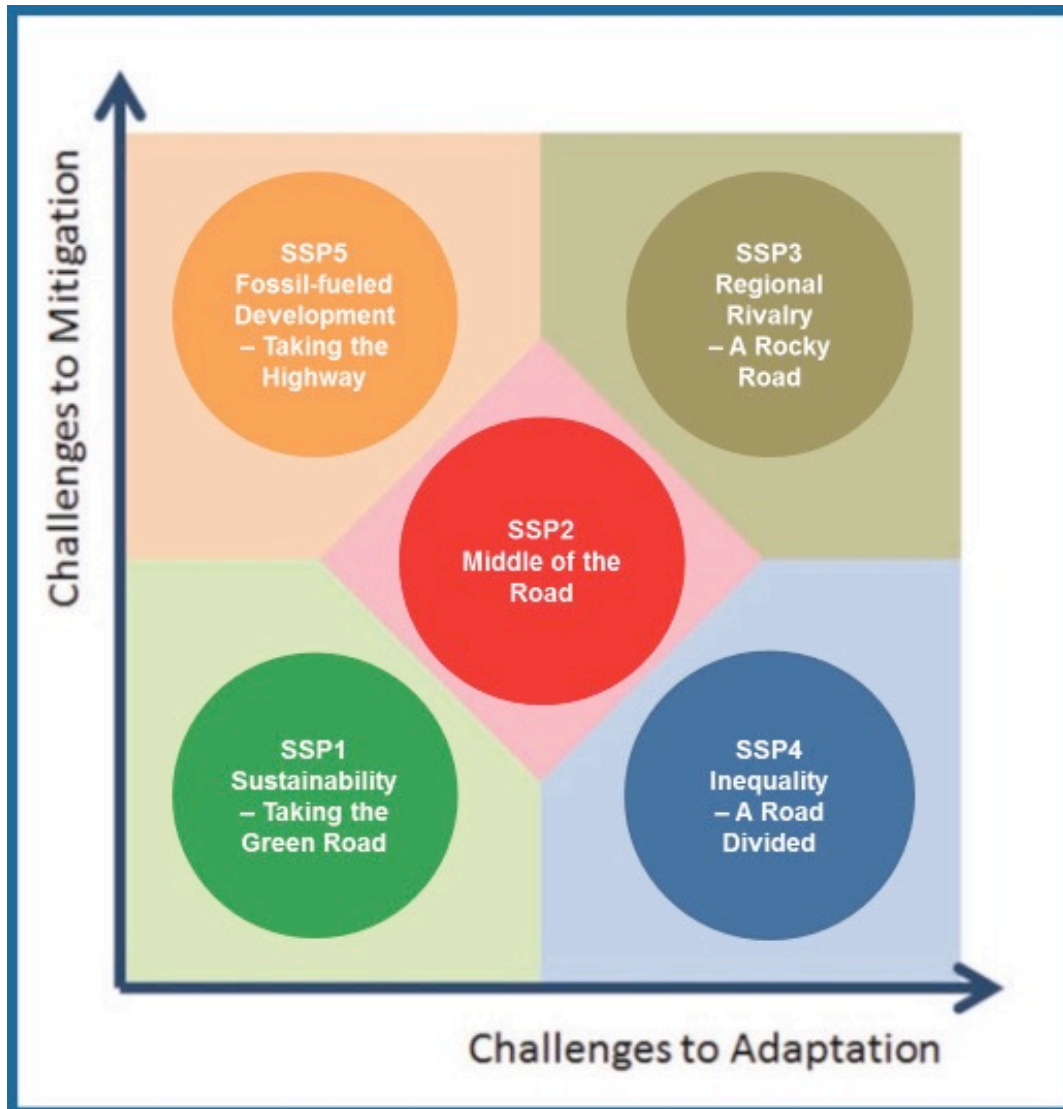
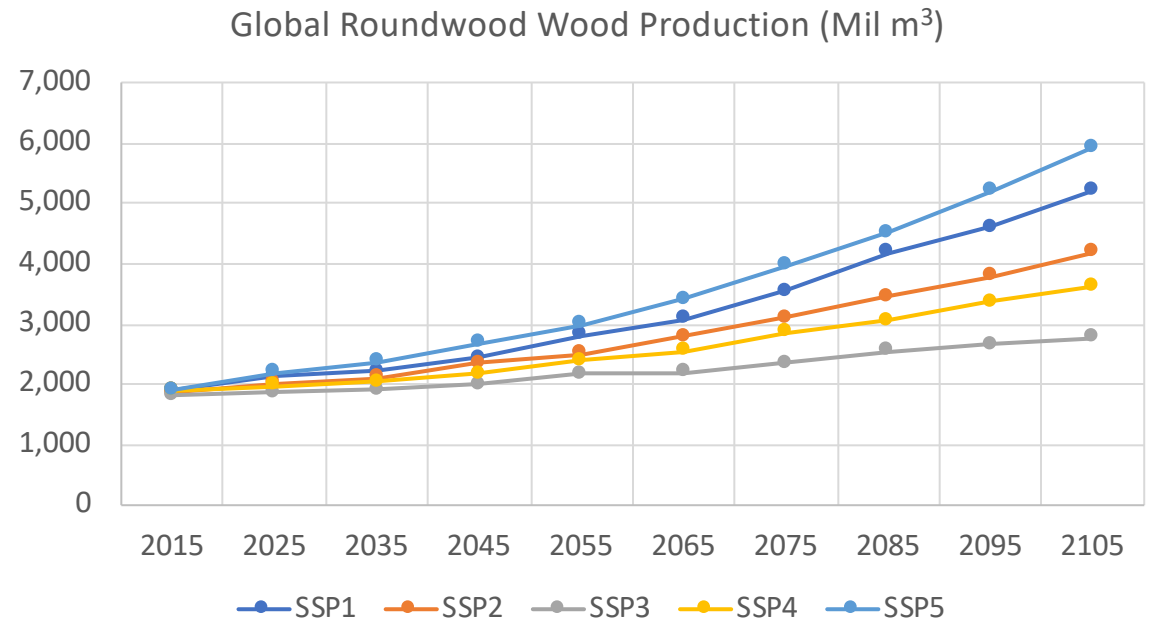
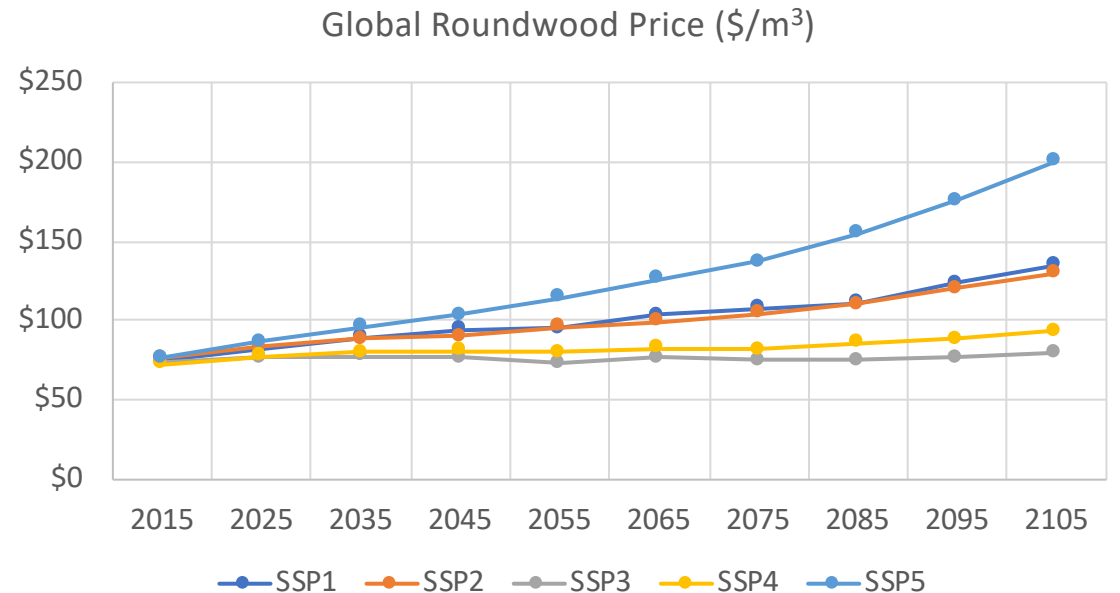


Figure 1. Popp et al. (2017) range of projected forest land cover for 5 SSPs, 2020-2100.

# Forest Sector Pathways

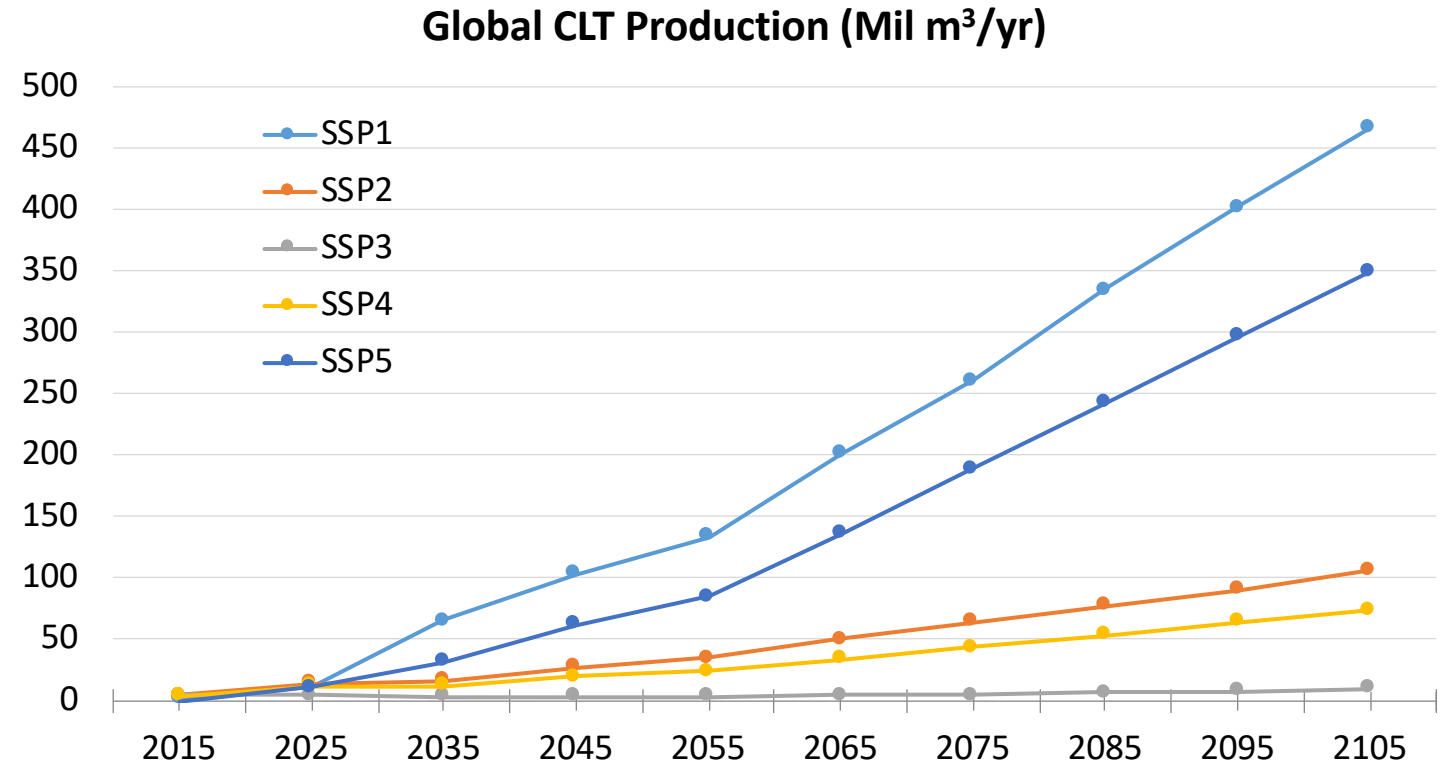
**Dynamic timber supply model** can be used to examine impacts of **five forest sector pathways** or alternative futures on **local, national, and global forest industry**. Key drivers include:

- Wood product demand
- Bioenergy demand
- Land use regulation
- Environmental policy
- Technological change
- Forest investment response

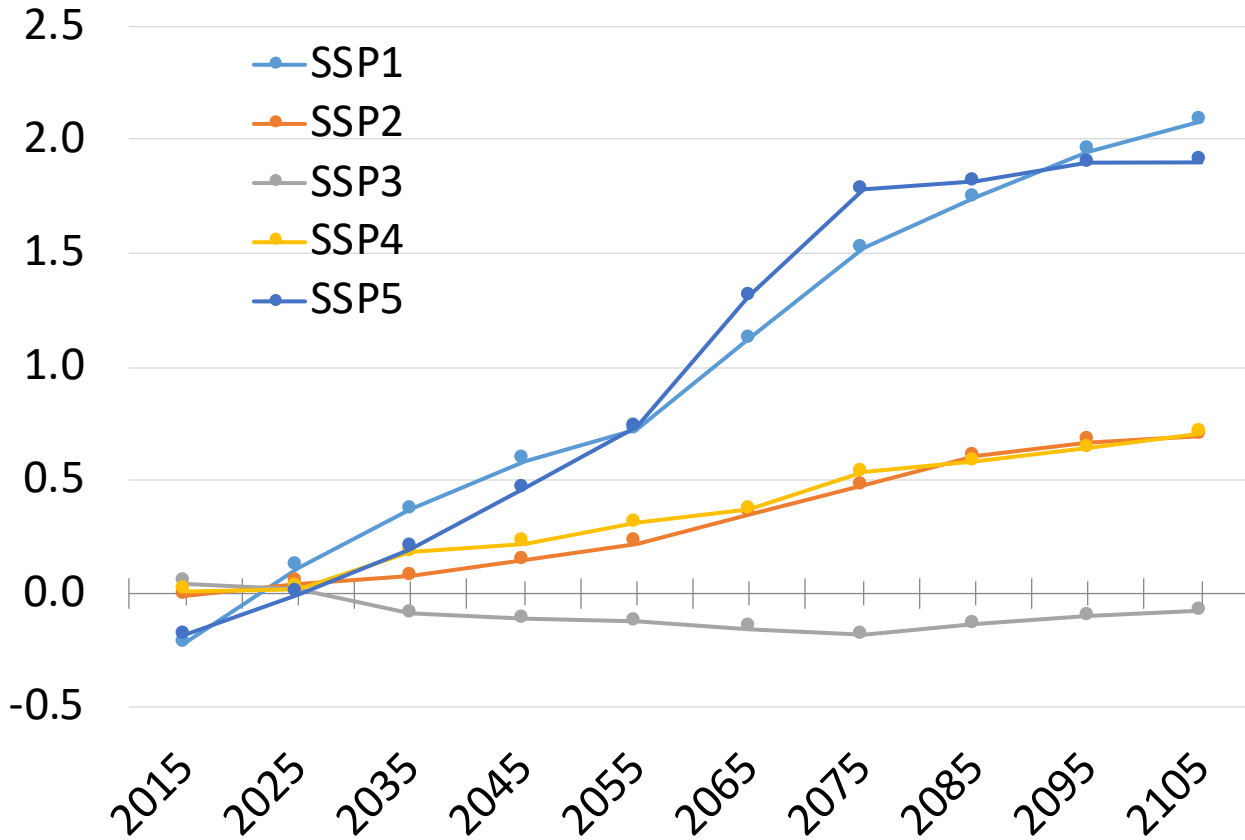


# Impacts of Expanded CLT Production

- CLT projections based on trends in urbanization, wood-based construction, consumer preferences, technological change, etc.
- Production by 2100 ranges from 10 to 460 million m<sup>3</sup>/yr

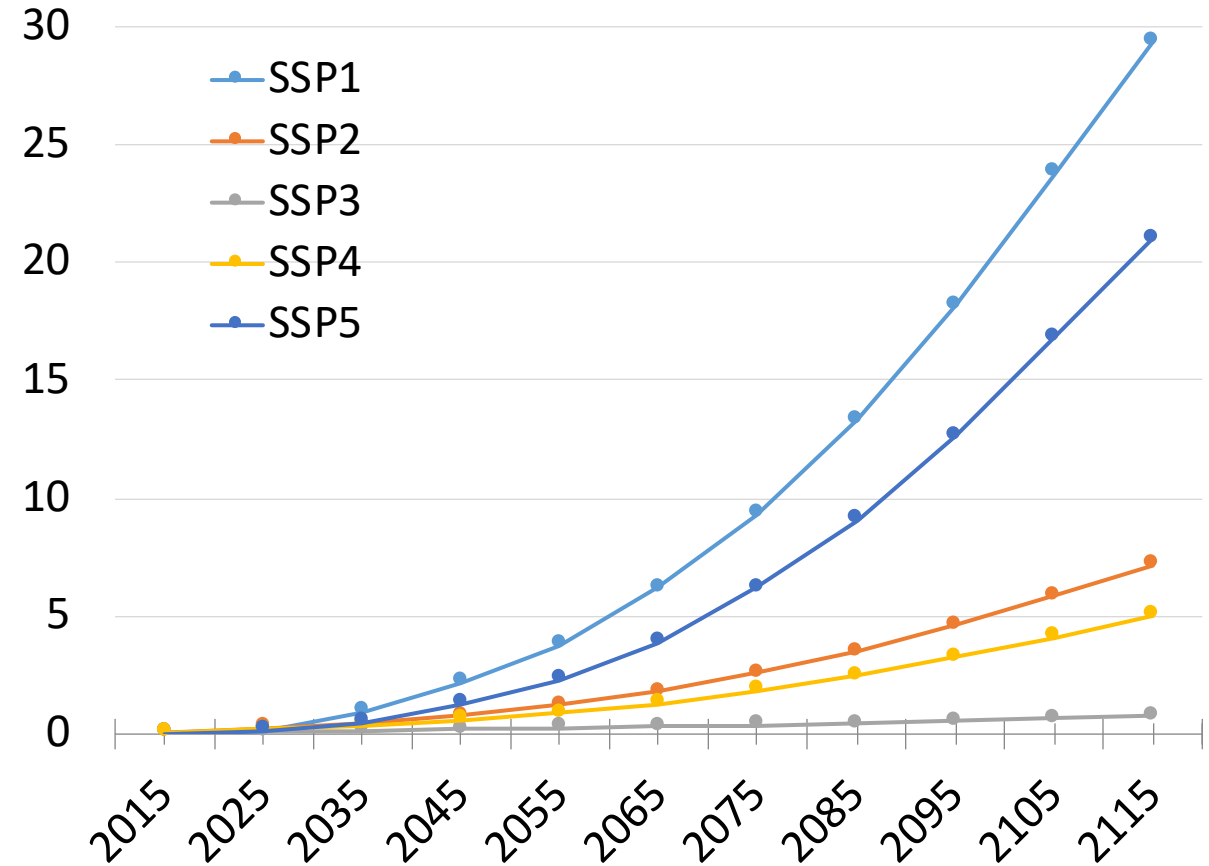


### Global Forest Carbon Stock (GtC)



More CLT → larger increases in aboveground and harvested wood product carbon stocks (price incentive)

### Global CLT Avoided Emissions Stock (GtC)



More CLT → greater levels of avoided emissions from other building materials (substitution effect)

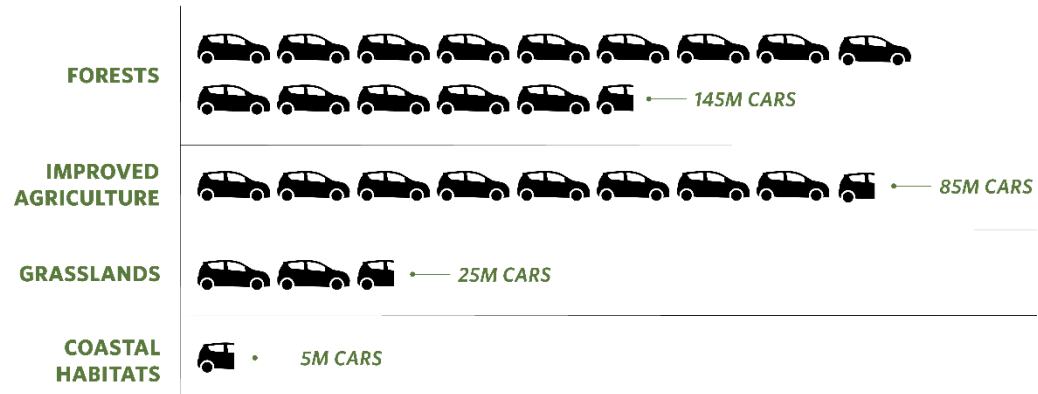


# Mitigation Potential

- Not just about impacts and adaptation. Forests also have large CC mitigation potential

## NATURAL CLIMATE SOLUTIONS

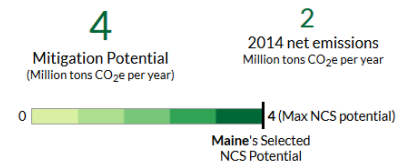
In the U.S., nature has potential to remove **21% of the nation's carbon pollution**—equivalent to removing emissions from **ALL cars and trucks on the road**...and then some.



U.S. Mitigation Potential: Approximate Number of Cars Removed Each Year in Millions

= 10M cars

## Natural Climate Solutions for the U.S.



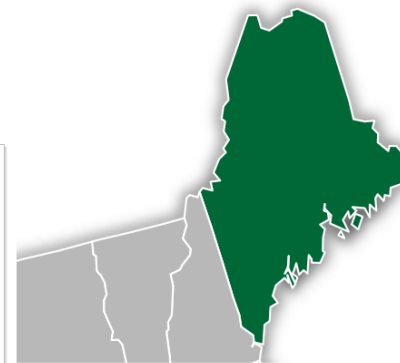
Maine

Full Extent

National State

Click map to select state

Mitigation Pathways	Marginal Abatement Cost \$ per ton of CO <sub>2</sub> e
Reforestation	Off \$10 \$50 \$100 Max
Avoided Forest Conversion	Off \$10 \$50 \$100 Max
Fire Management	Off \$10 \$50 \$100 Max
Urban Reforestation	Off \$10 \$50 \$100 Max
Avoided Grassland Conversion	Off \$10 \$50 \$100 Max
Grassland Restoration	Off \$10 \$50 \$100 Max
Alley Cropping	Off \$10 \$50 \$100 Max
Cover Crops	Off \$10 \$50 \$100 Max
Cropland Nutrient Management	Off \$10 \$50 \$100 Max
Improved Manure Management	Off \$10 \$50 \$100 Max
Improved Rice Cultivation	Off \$10 \$50 \$100 Max



Pathway	NCS Mitigation (Mt CO <sub>2</sub> per year)	Area Available (million acres)
Reforestation	3.21	1.3
Avoided Forest Conversion	0.51	0.08
Cover Crops	0.08	0.17
Avoided Grassland Conversion	0.08	0
Alley Cropping	0.06	0.03
Urban Reforestation	0.06	0.03
Cropland Nutrient Management	0.03	N/A
Grassland Restoration	0.01	0
Improved Manure Management	0	N/A
Fire Management	N/A	N/A
Improved Rice Cultivation	N/A	N/A

# Current Knowledge Gaps?

- Not a lot Forest Econ + CC research in Maine/NE...
- What else would we like to know?
  1. What CC-related policies are likely to be most influential on forest-dependent economies?
  2. Which CC impacts are expected to have the largest impact on forest sector profitability? (e.g., changing winter effect on harvest operations)
  3. How will markets shift as a result of CC and related policy?
  4. What can forest managers do to adapt to CC?

# Question/Comments

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