University of Idaho
College of Natural Resources

PREVENTING EMBERS: HOW A STRATEGIC HARVEST EXPANSION AND THINNING PROGRAM CAN SPUR RURAL ECONOMIES AND REDUCE FIRE EMISSIONS IN THE WESTERN US

Zoey Roberts[1*], Greg Latta[1], Olakunle Sodiya[2*], Justin Baker[2], Raju Pokharel[3], and Sara Ohrel[4]

[*] *Graduate student*
[1]College of Natural Resources, University of Idaho
[2]College of Natural Resources, North Carolina State University
[3]College of Agriculture and Natural Resources, Michigan State University
[4]U.S. Environmental Protection Agency

Western Forest Economists Meeting September 29, 2023

Disclaimer: Results and views expressed here do not reflect EPA or EPA policy

@UIDAHOCNR

e-newsletter and reports
http://www.uidaho.edu/cnr/pag

LAND USE AND RESOURCE ALLOCATION (LURA) MODEL

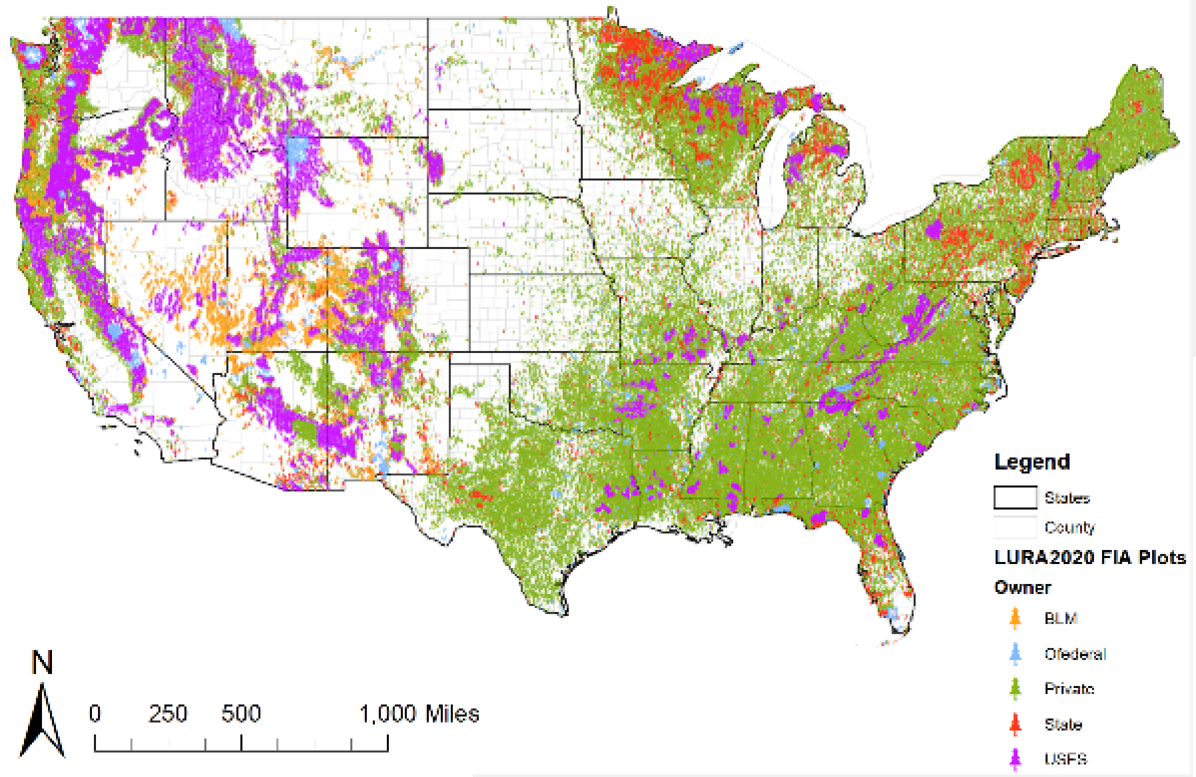
- Background on LURA model
- Use of LURA to evaluate forest processing facility siting
- Fire in LURA
- Our plan to site facilities in fire prone forests

LURA MODEL BACKGROUND

Balance supply and demand with price sensitive demand

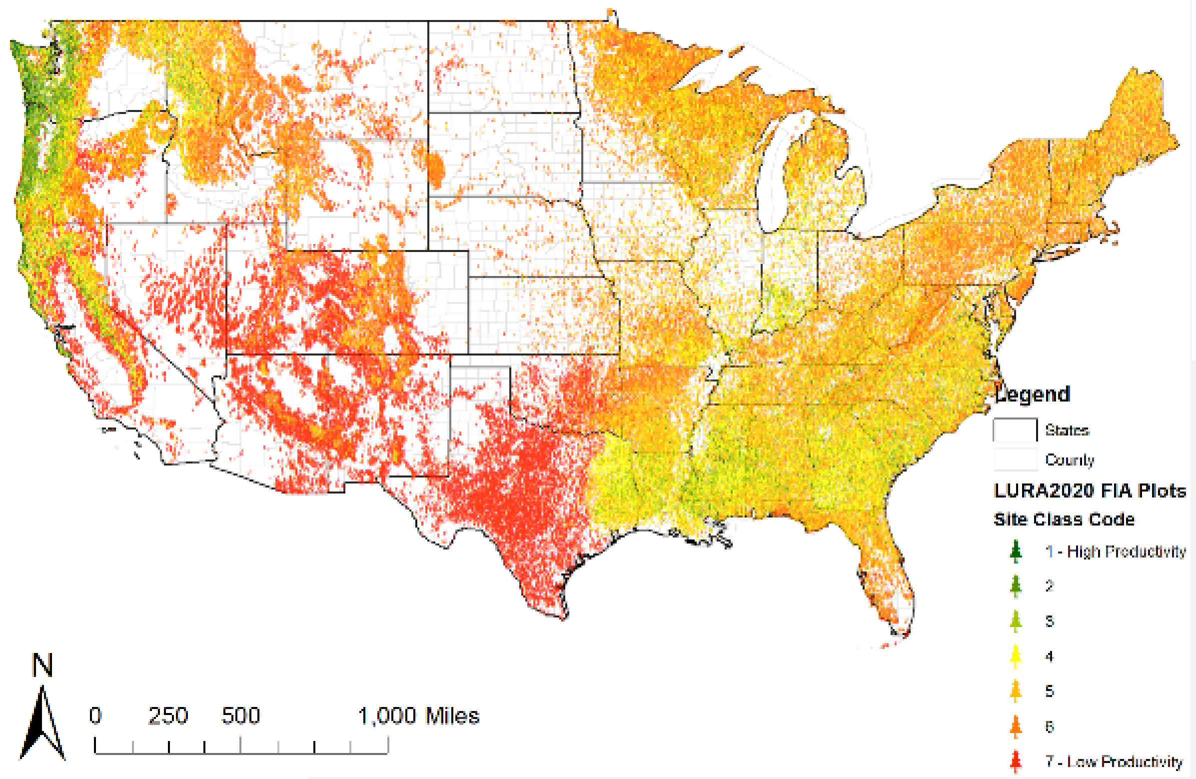
1. Which has a forest land base representation (164k plots)
2. And a forest products market representation (3.4k mills)

LURA Static Supply Forest Ownership

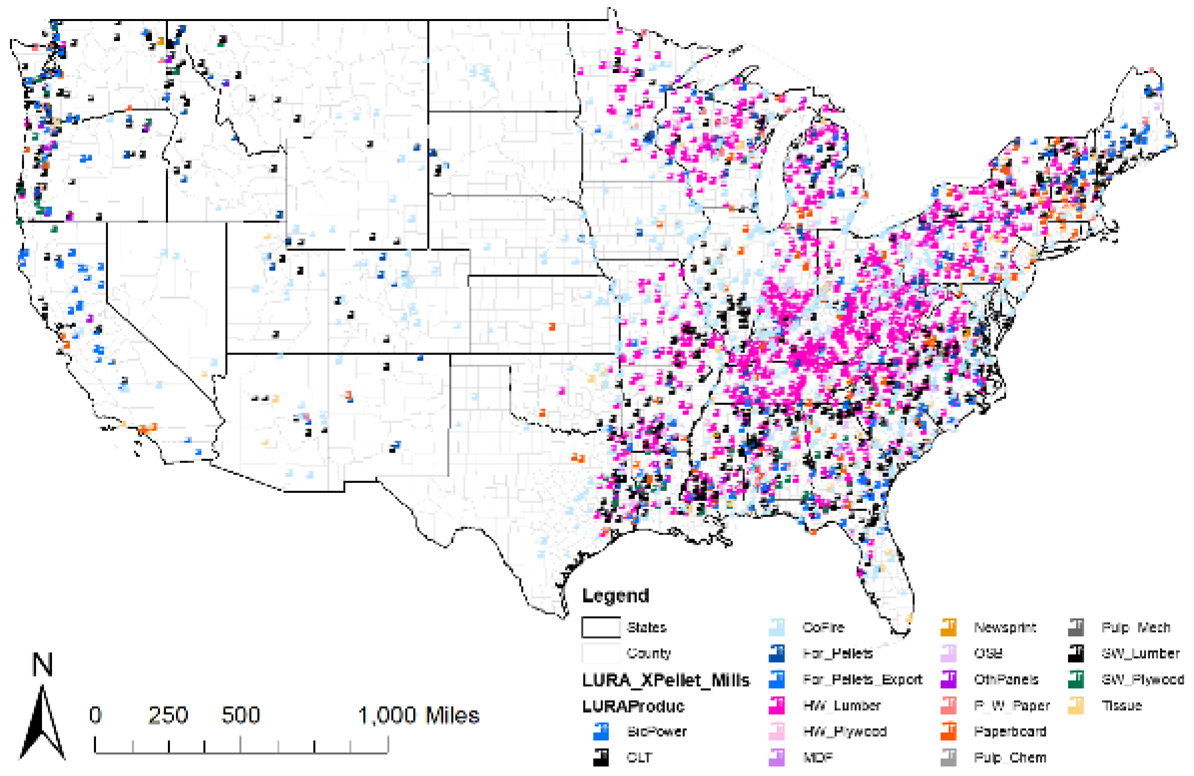


Owner	Acres	Percent
BLM	31,101,654	5%
Ofederal	20,505,041	3%
Private	427,520,906	63%
State	60,609,602	9%
USFS	136,510,772	20%
Total	676,247,974	100%

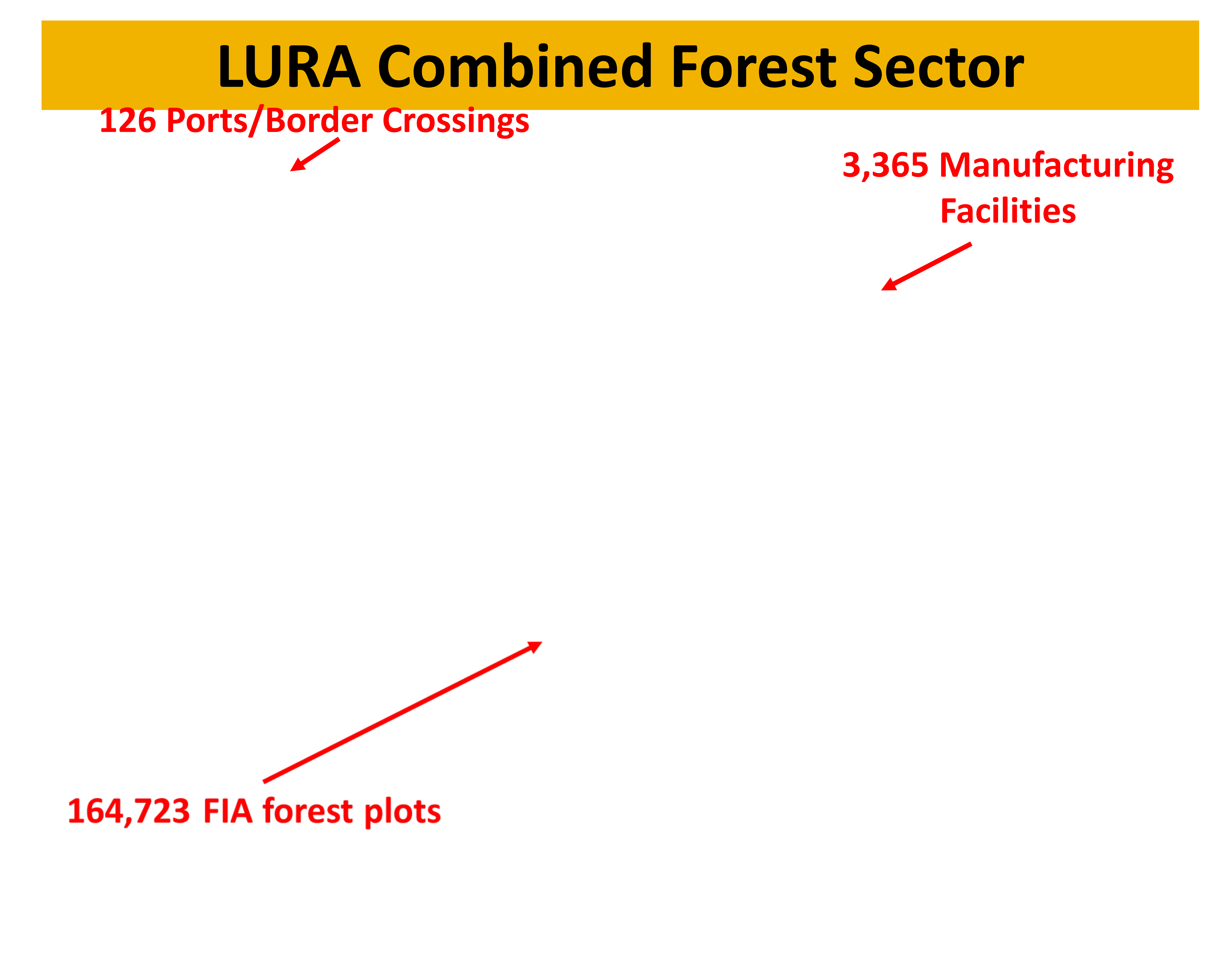
LURA Static Supply Forest Productivity



LURA Static Demand Mill Locations



LURA Combined Forest Sector

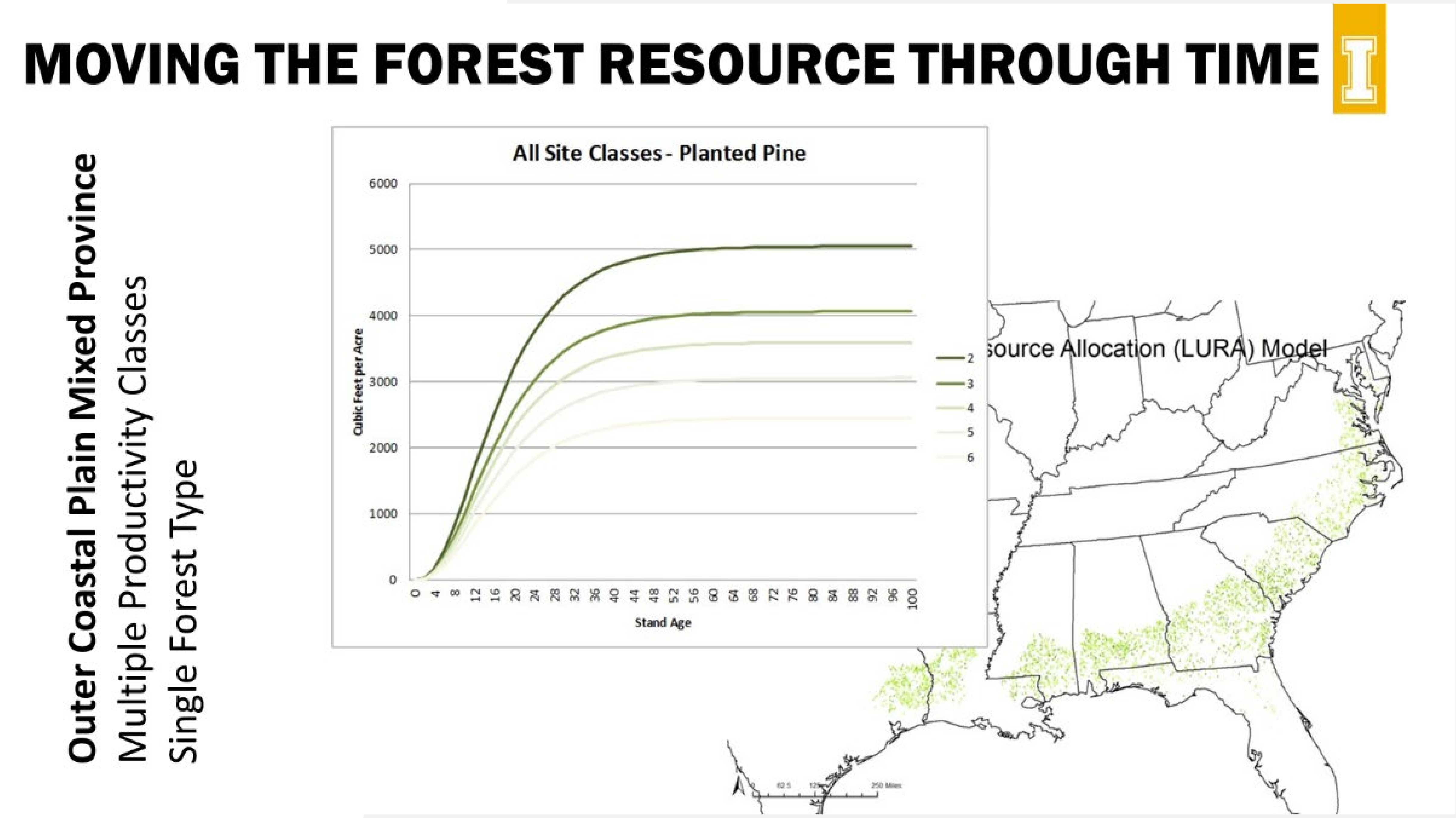


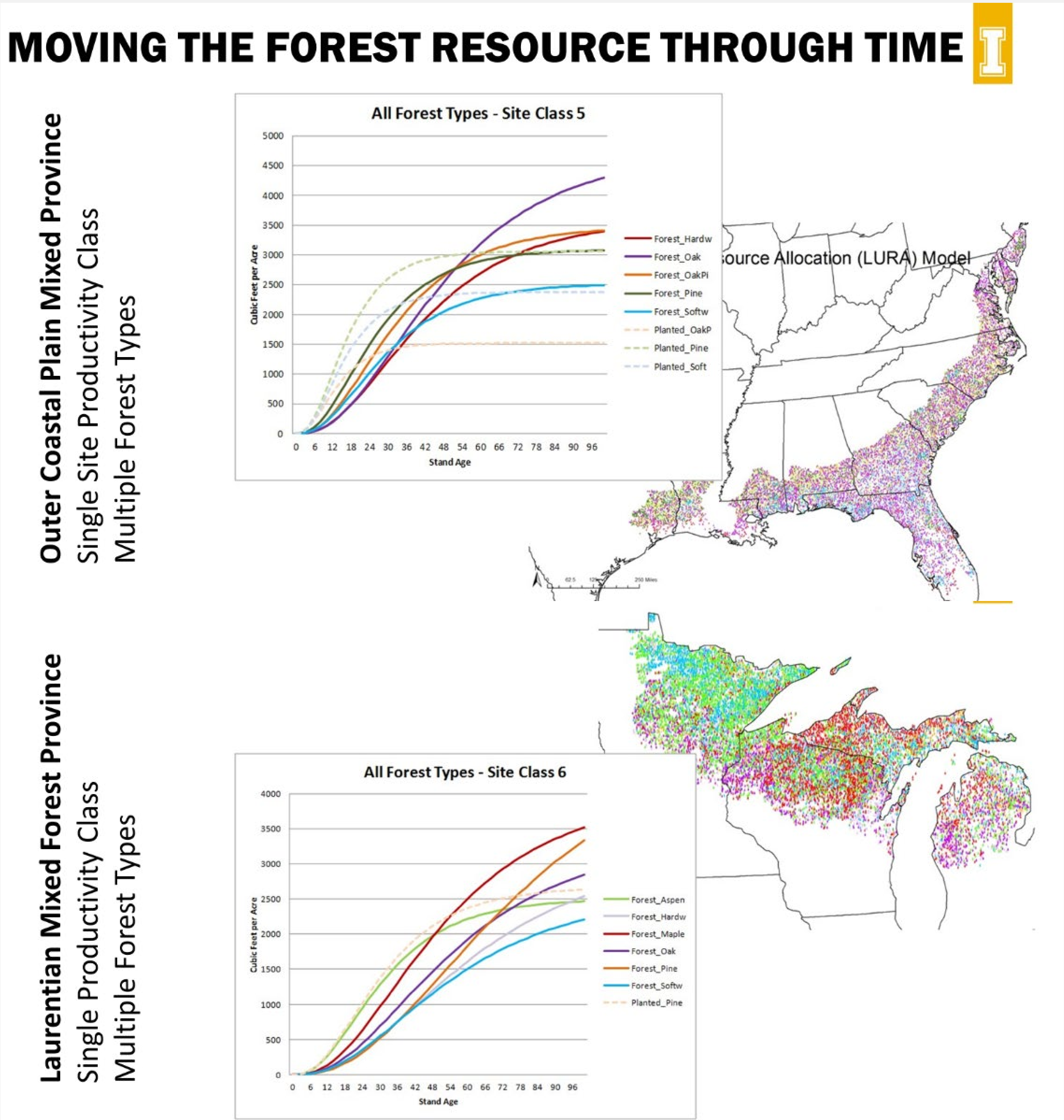
Latta, G., J. Baker and S. Ohrel. 2018. A land use and resource allocation (LURA) modeling system for projecting localized forest CO2 effects of alternative macroeconomic futures. *Forest Policy and Economics* 87(2018):35-48.

LURA MODEL BACKGROUND *– DYNAMIC SUPPLY*

Balance supply and demand with price sensitive demand

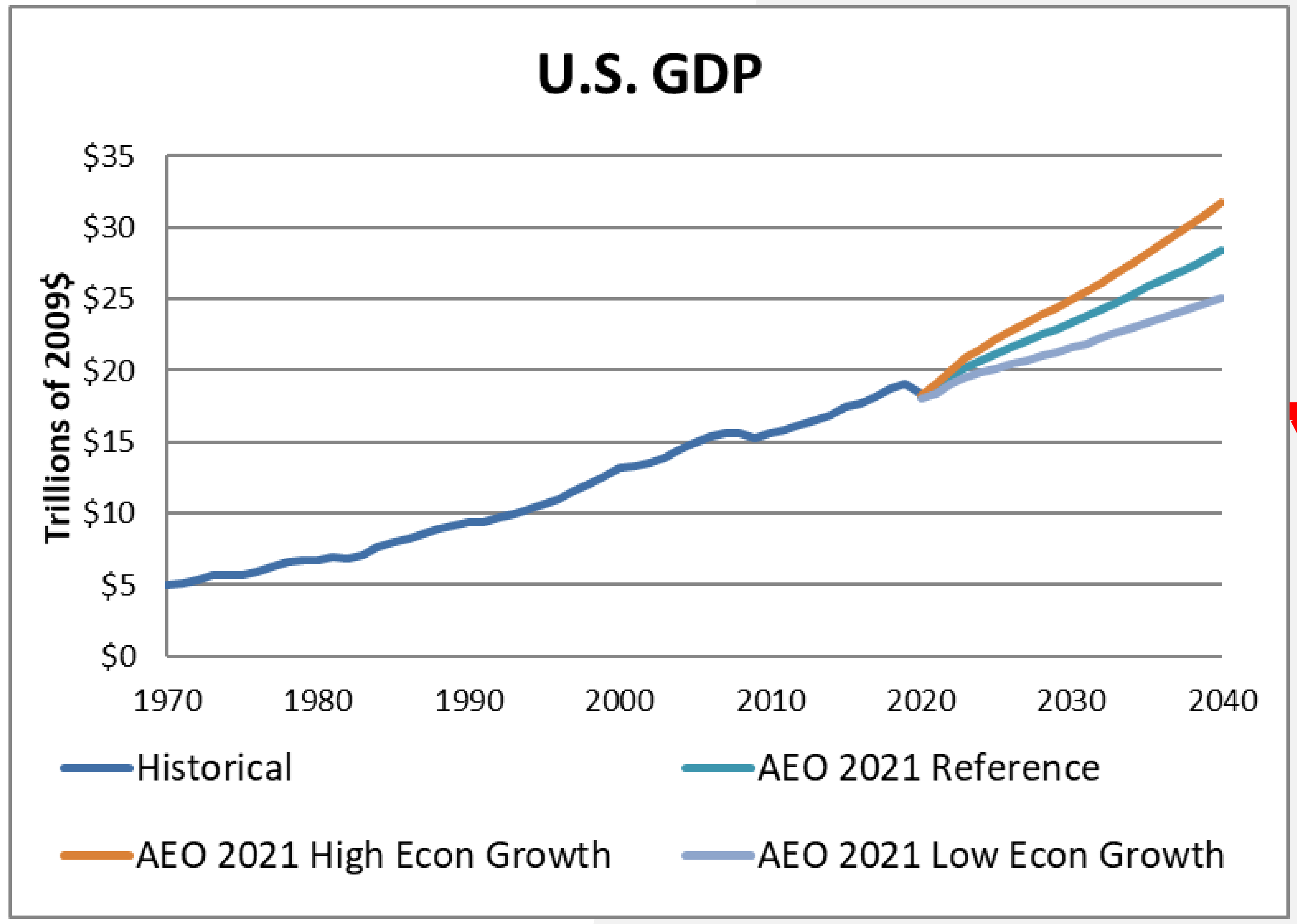
1. You need to move the resource through time
2. LURA uses yields specific to ecoregion, forest type and site productivity class

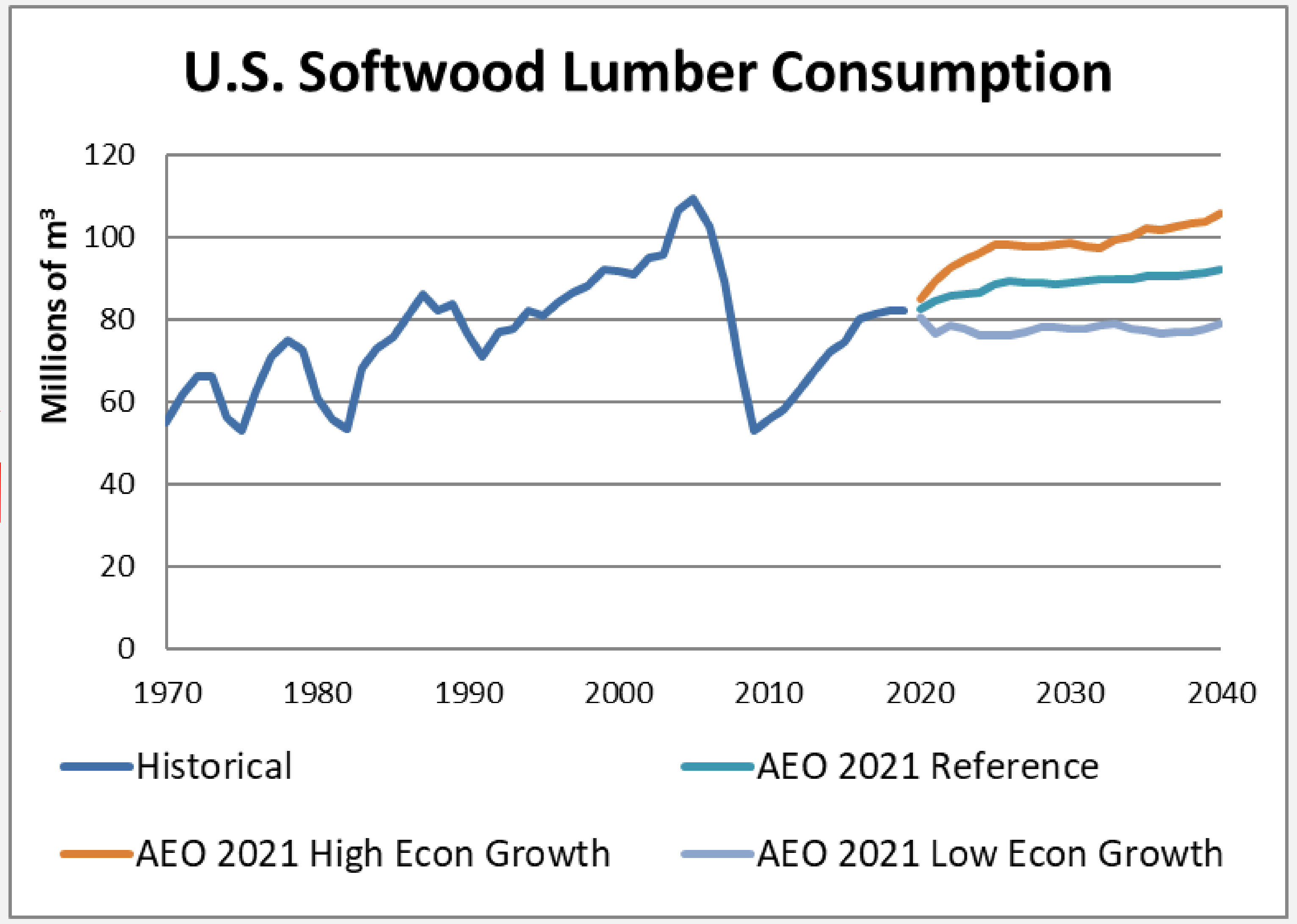


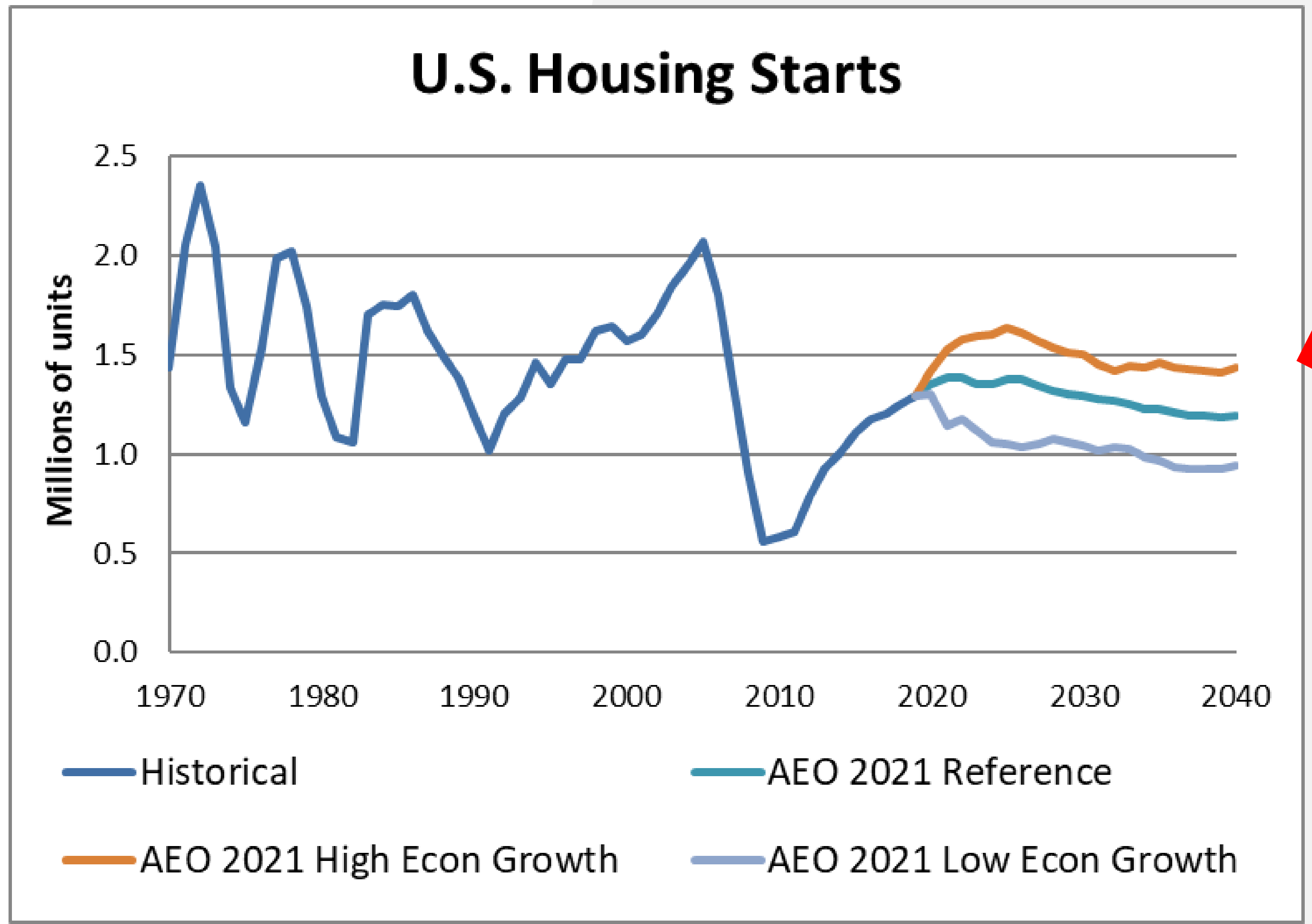


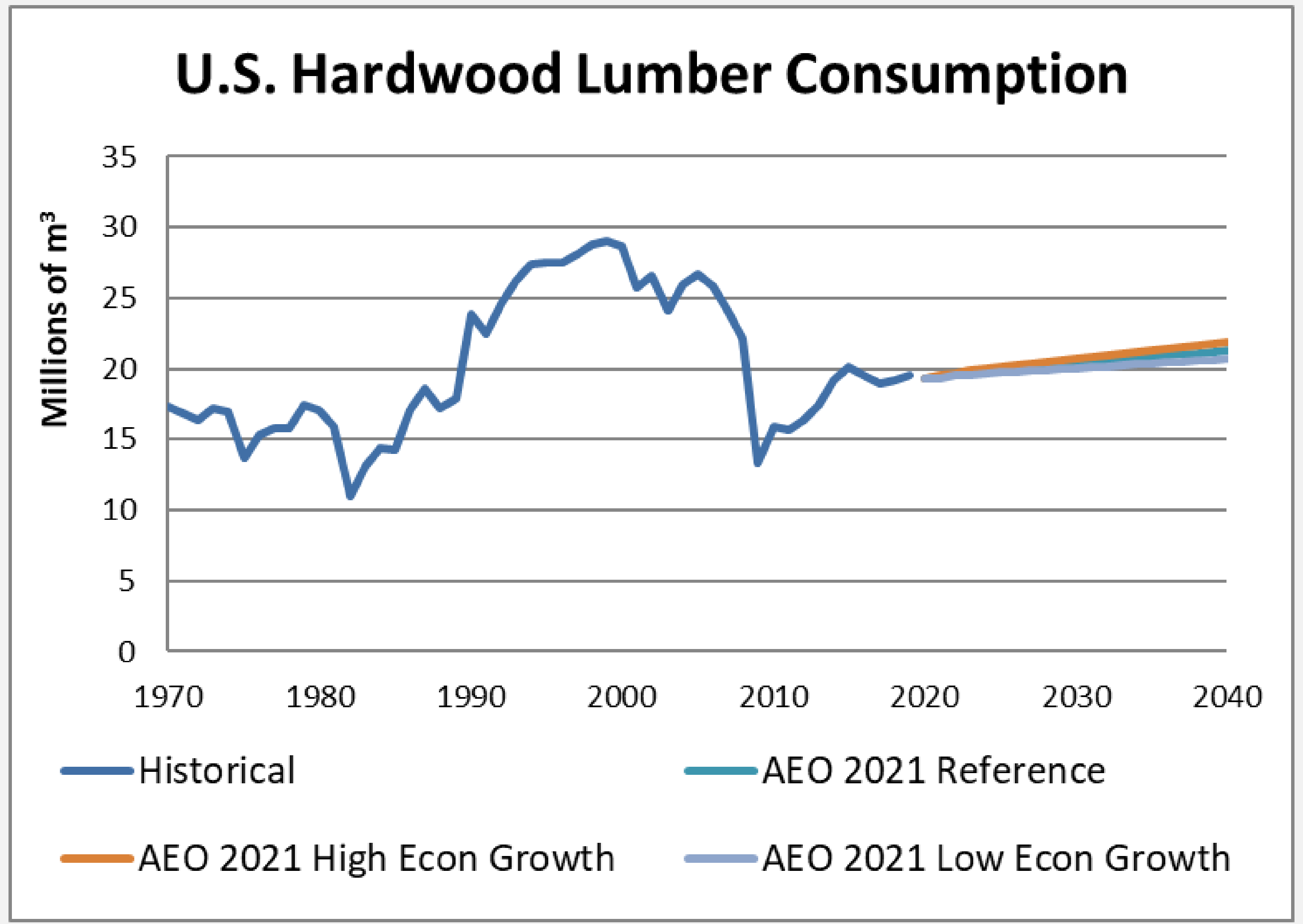
LURA MODEL BACKGROUND *– DYNAMIC DEMAND*

2) And move demand through time

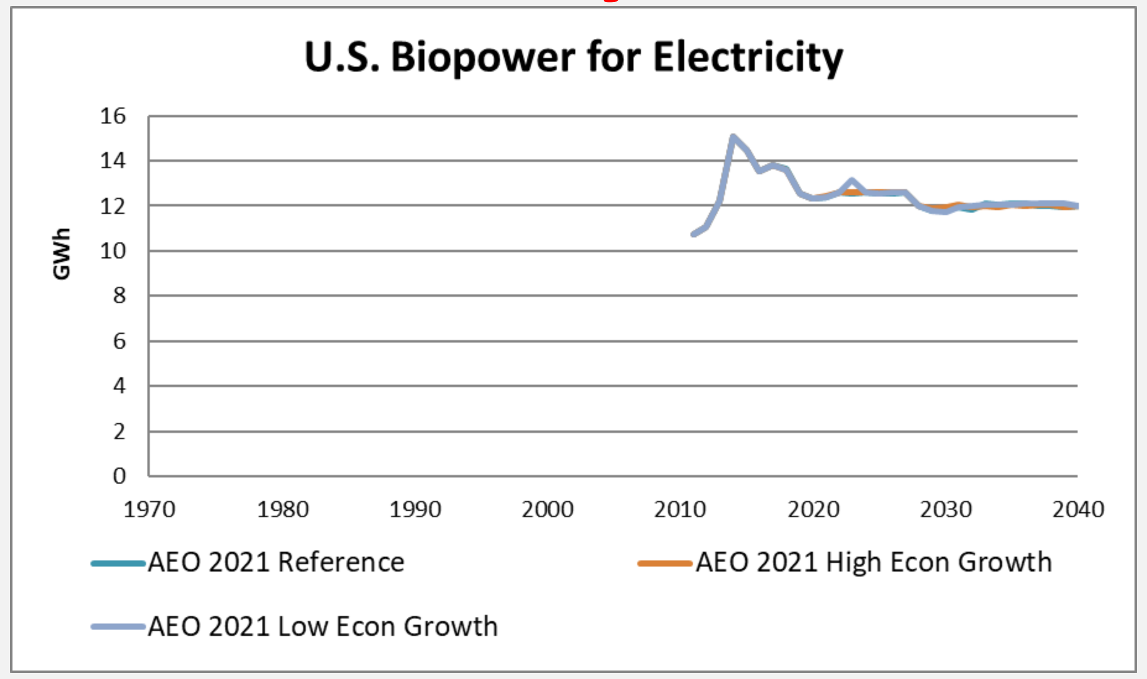






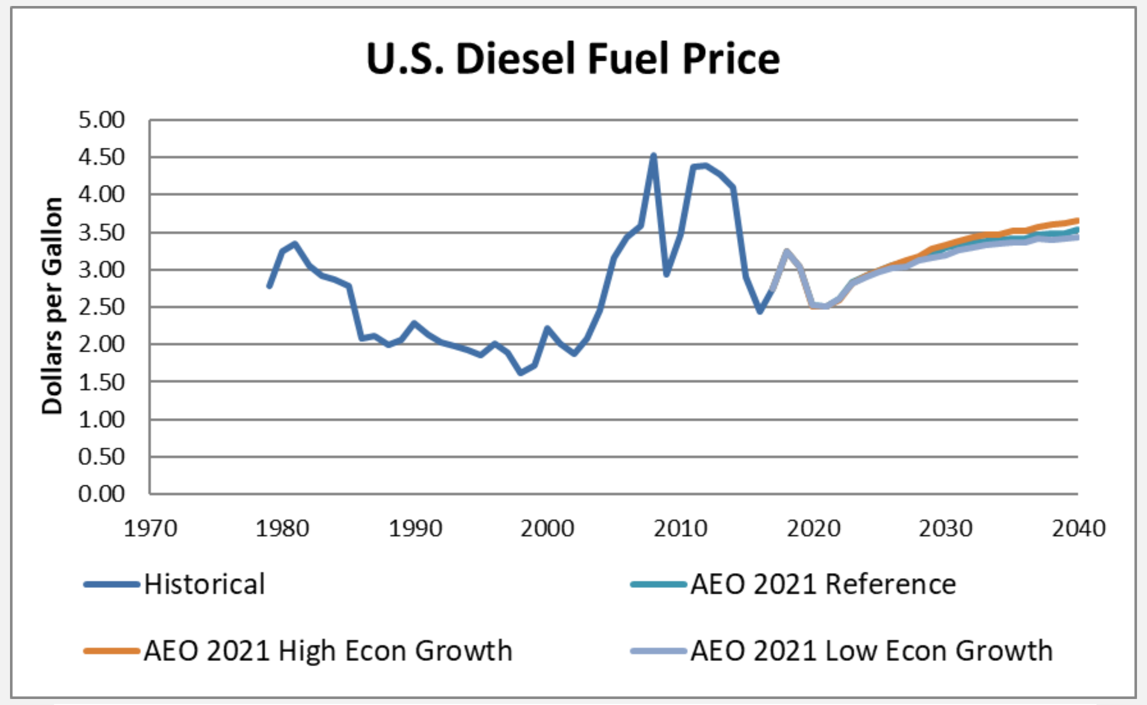


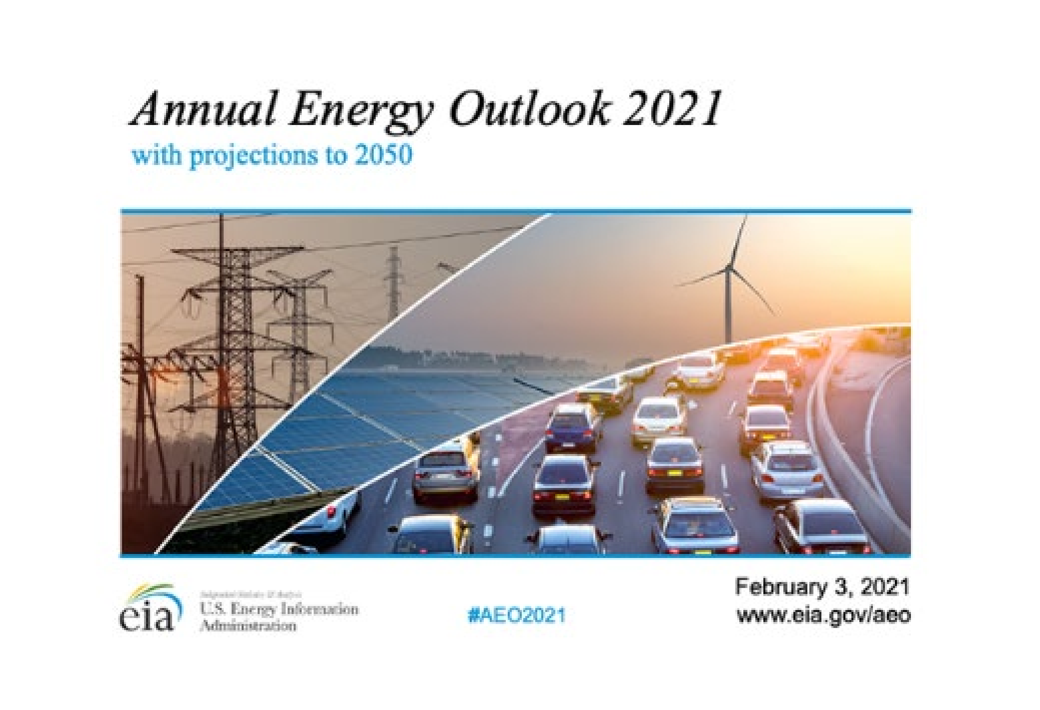
Taken directly from AEO



Taken directly from AEO

(not really demand, but affects demand)





https://www.eia.gov/outlooks/aeo/

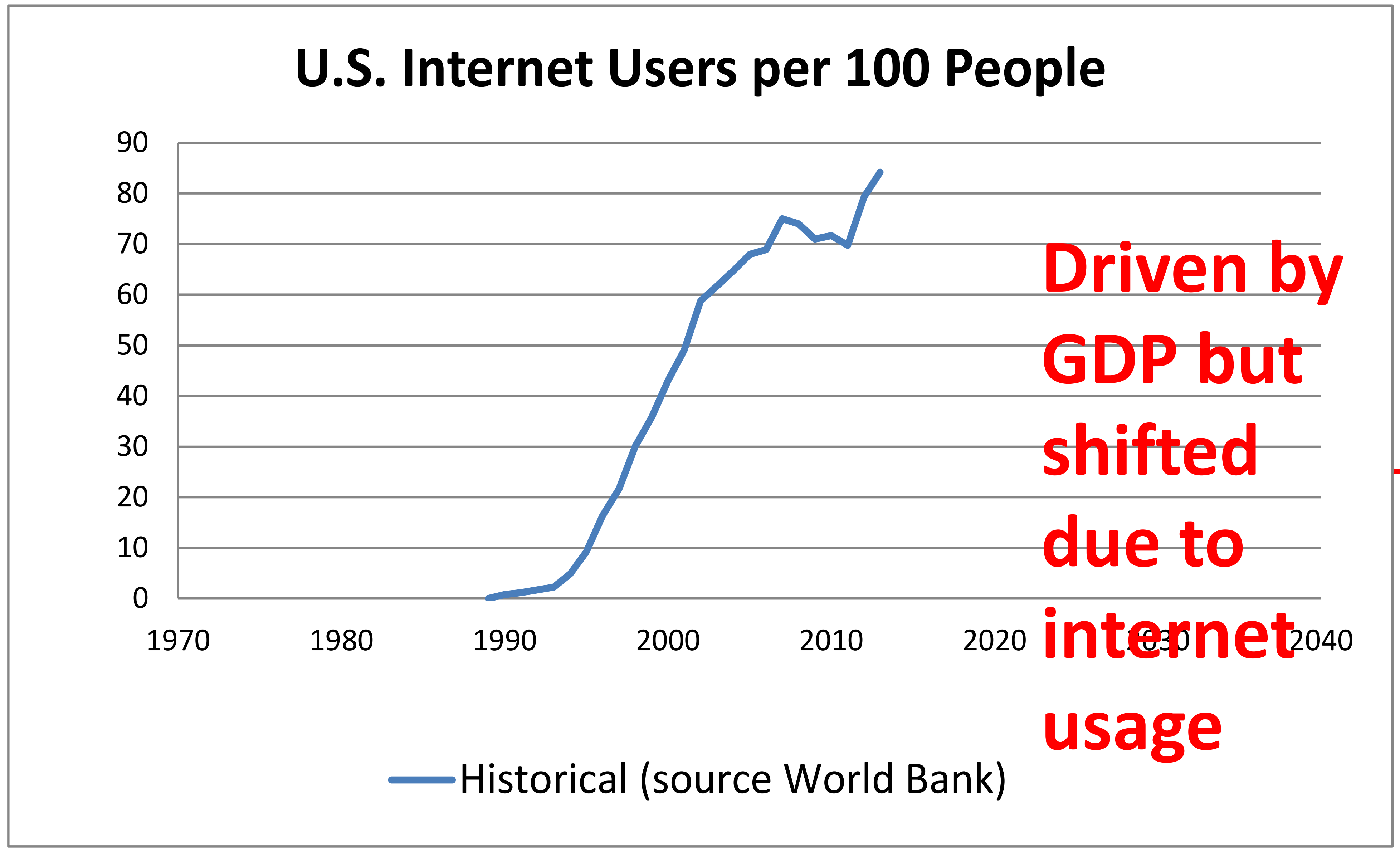
MOVING FOREST PRODUCTS THROUGH TIME

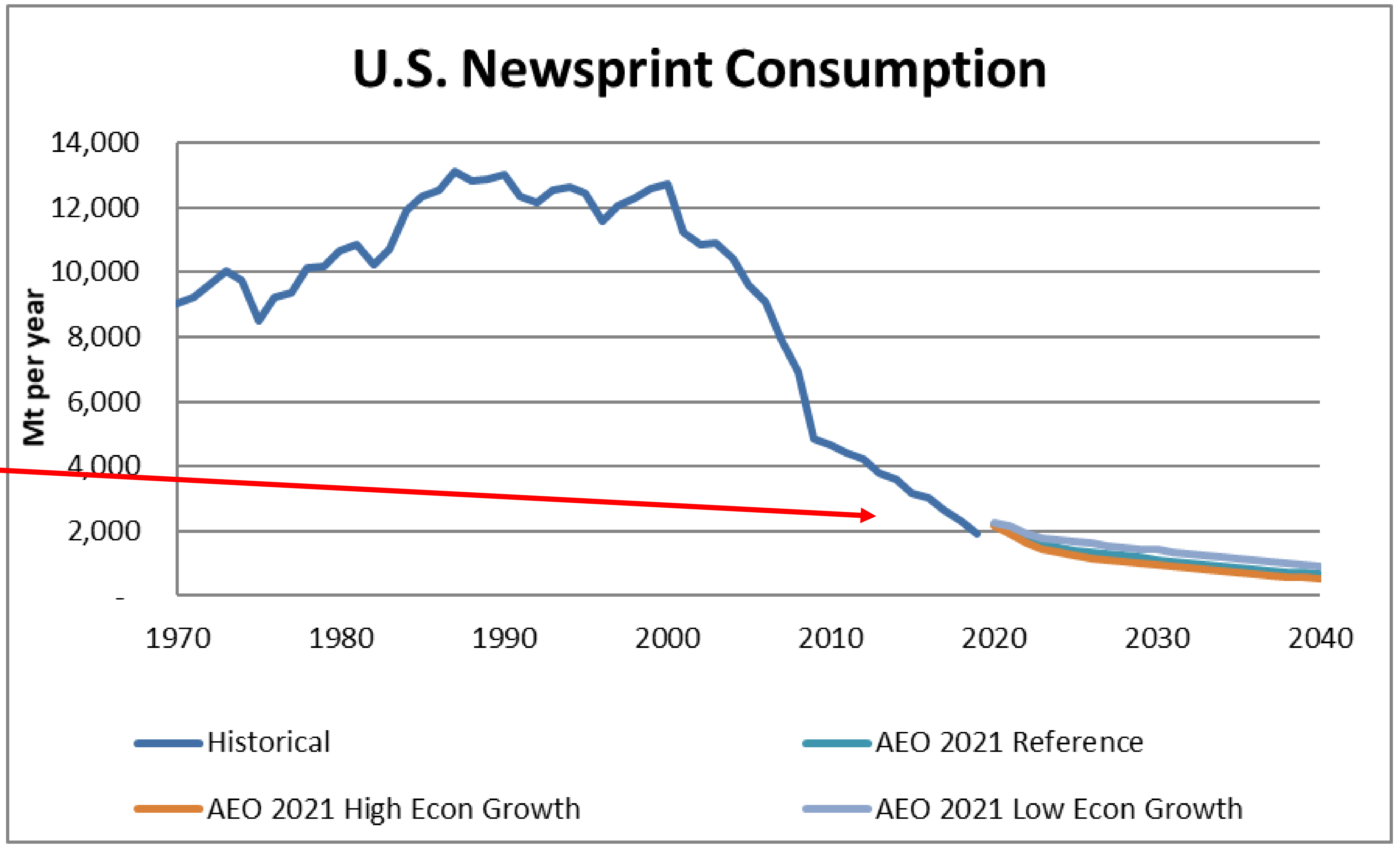
Pulp Market Demand Projections

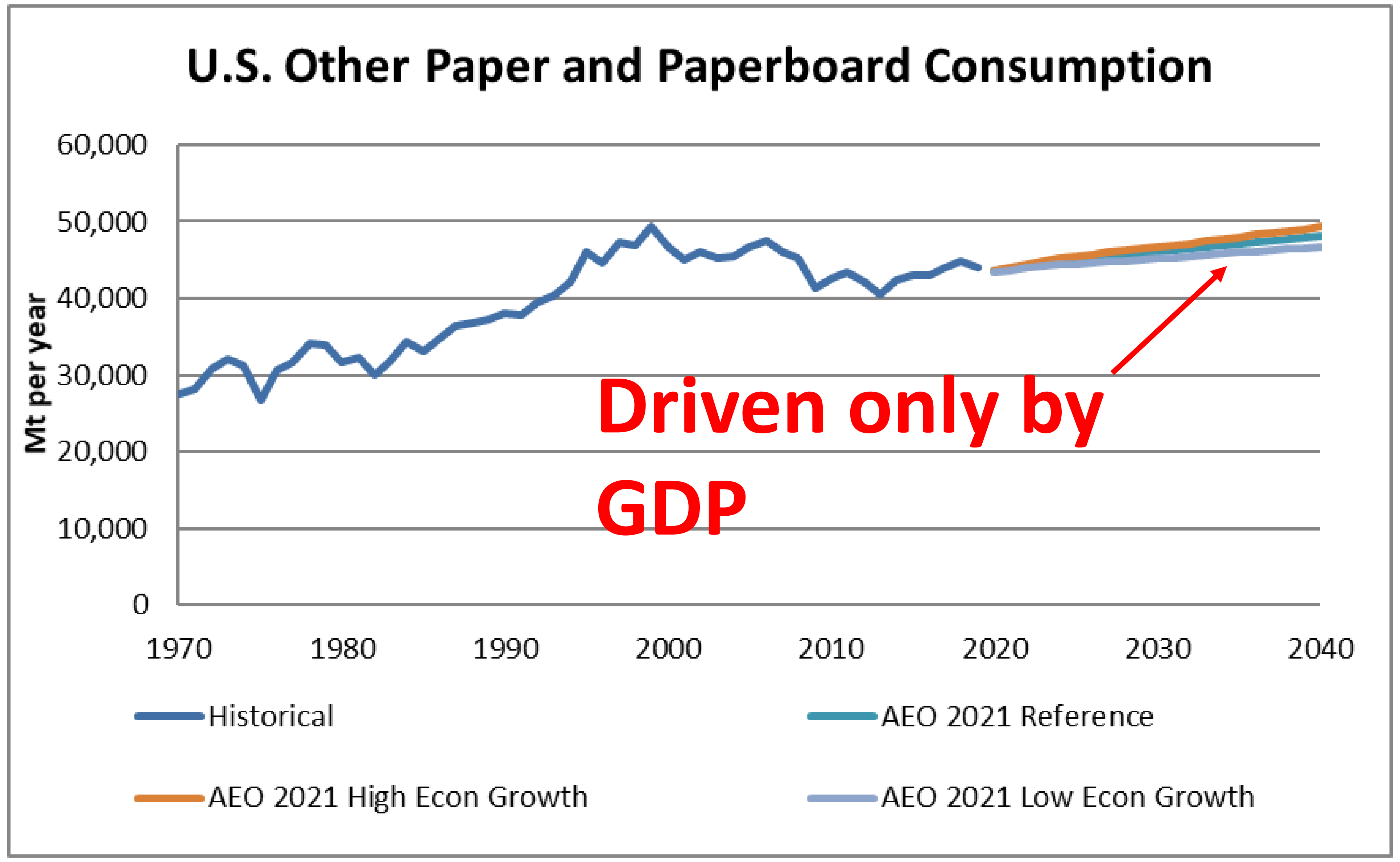
Multiple economic indicators

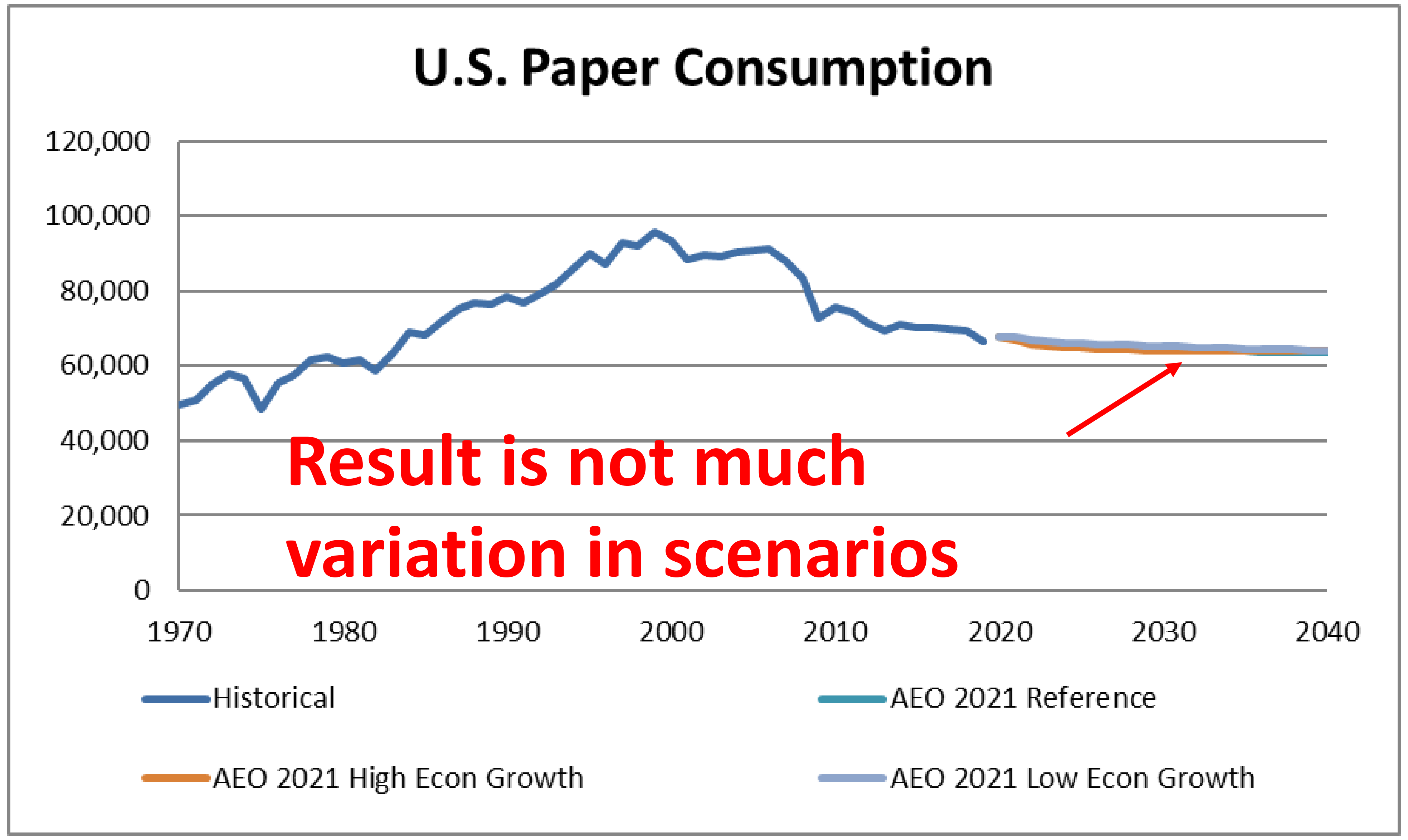
Multiple future economic scenarios

Latta, G., Plantinga, A., and M. Sloggy. 2016. The effects of Internet use on global demand for paper products. *Journal of Forestry* 114(4): 433-440.

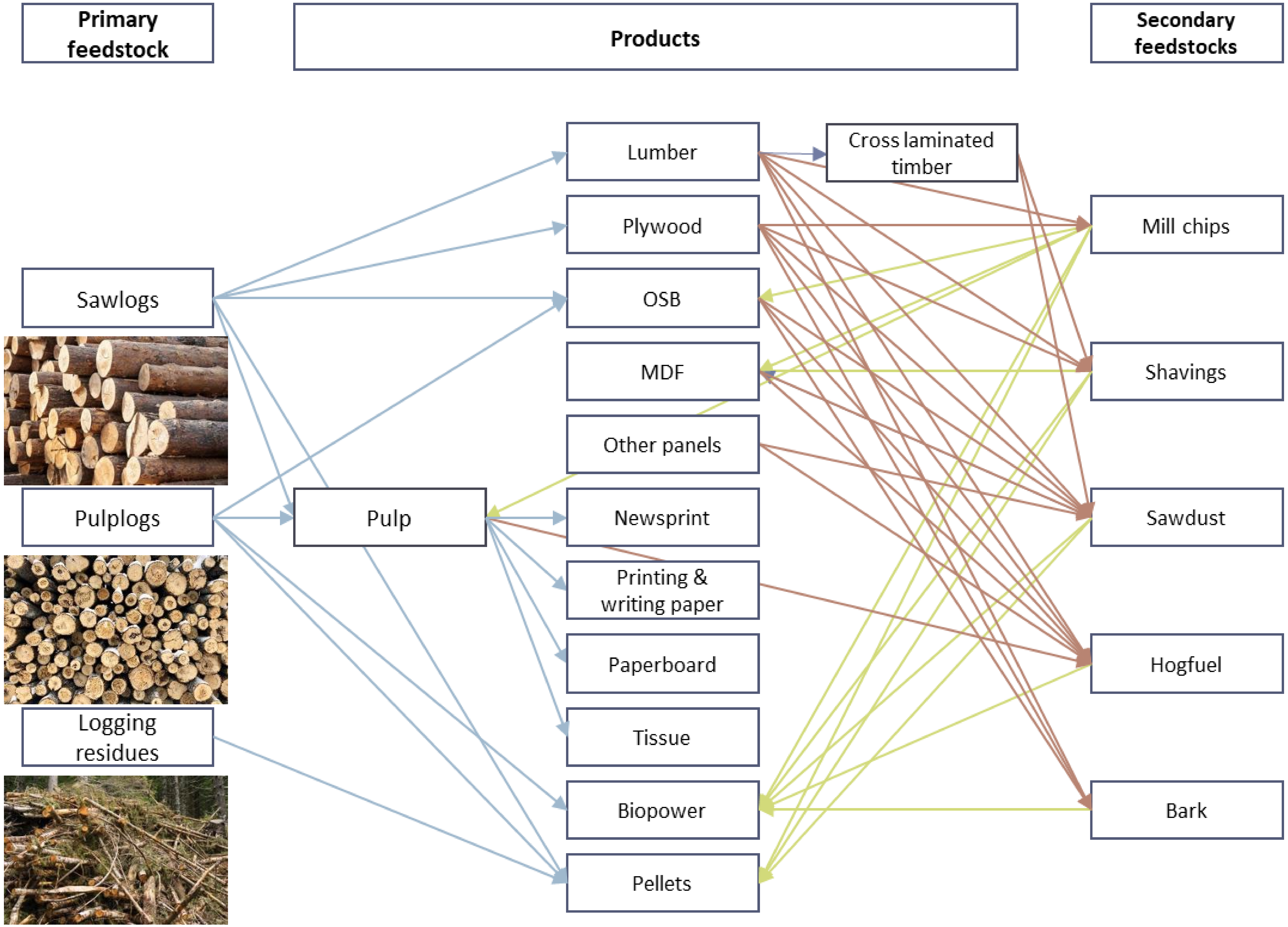








LURA CASCADING WOOD FLOW



Primary feedstocks used in wood products and energy

Residues generated in wood products production

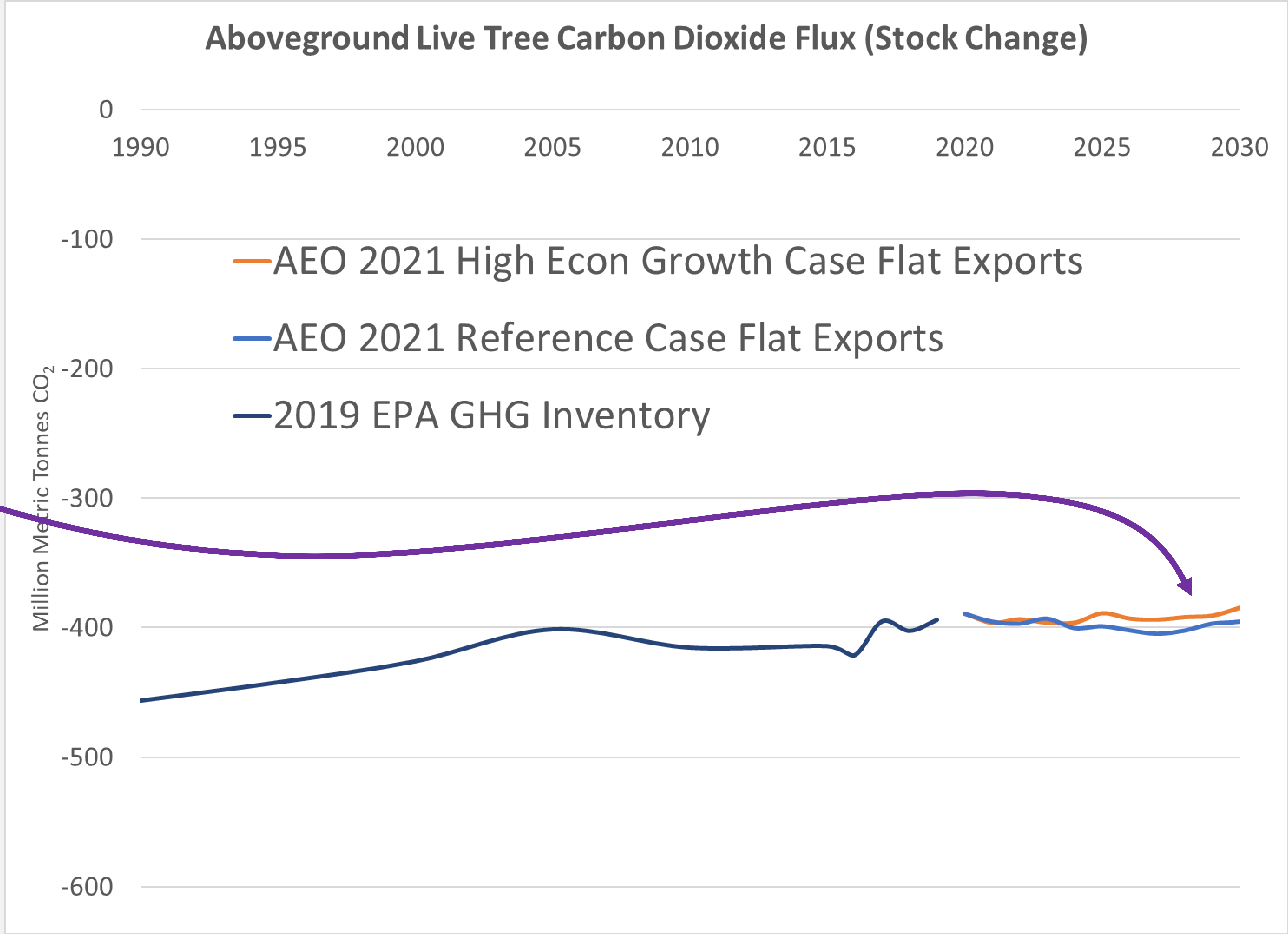
Residues used in wood products and energy

SOME EXAMPLE RESULTS *- NATIONAL*

- Here we will focus on live trees, but other carbon pools are available

Not much change here as the demand projections have been coming down in recent years

(Cumulative difference is 60 Mt CO_2)



Negative numbers reflect CO2 leaving the atmosphere into terrestrial pools

BIOENERGY APPLICATIONS – CHOOSING SITES

- Logging residue supply for biorefinery siting

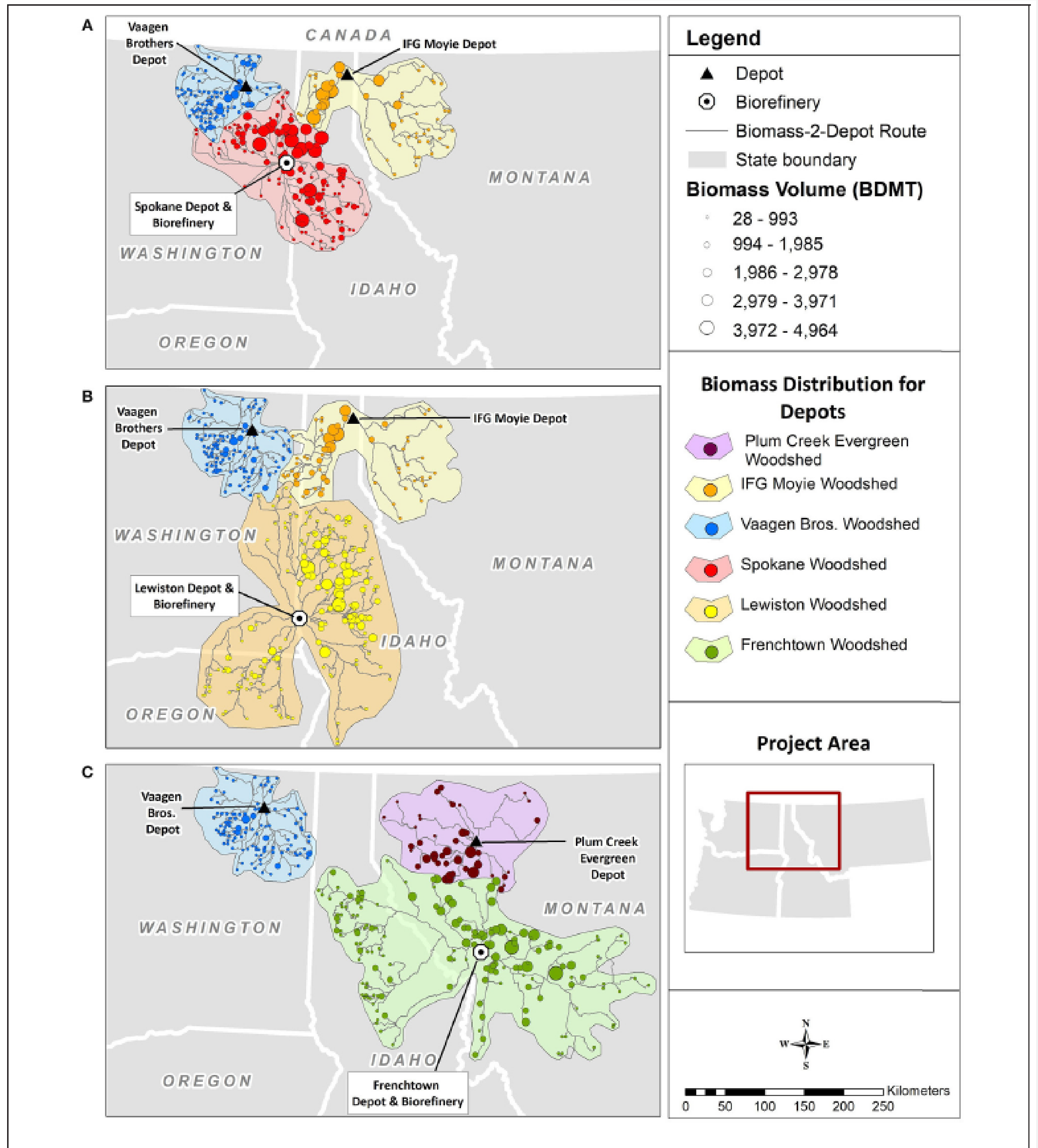
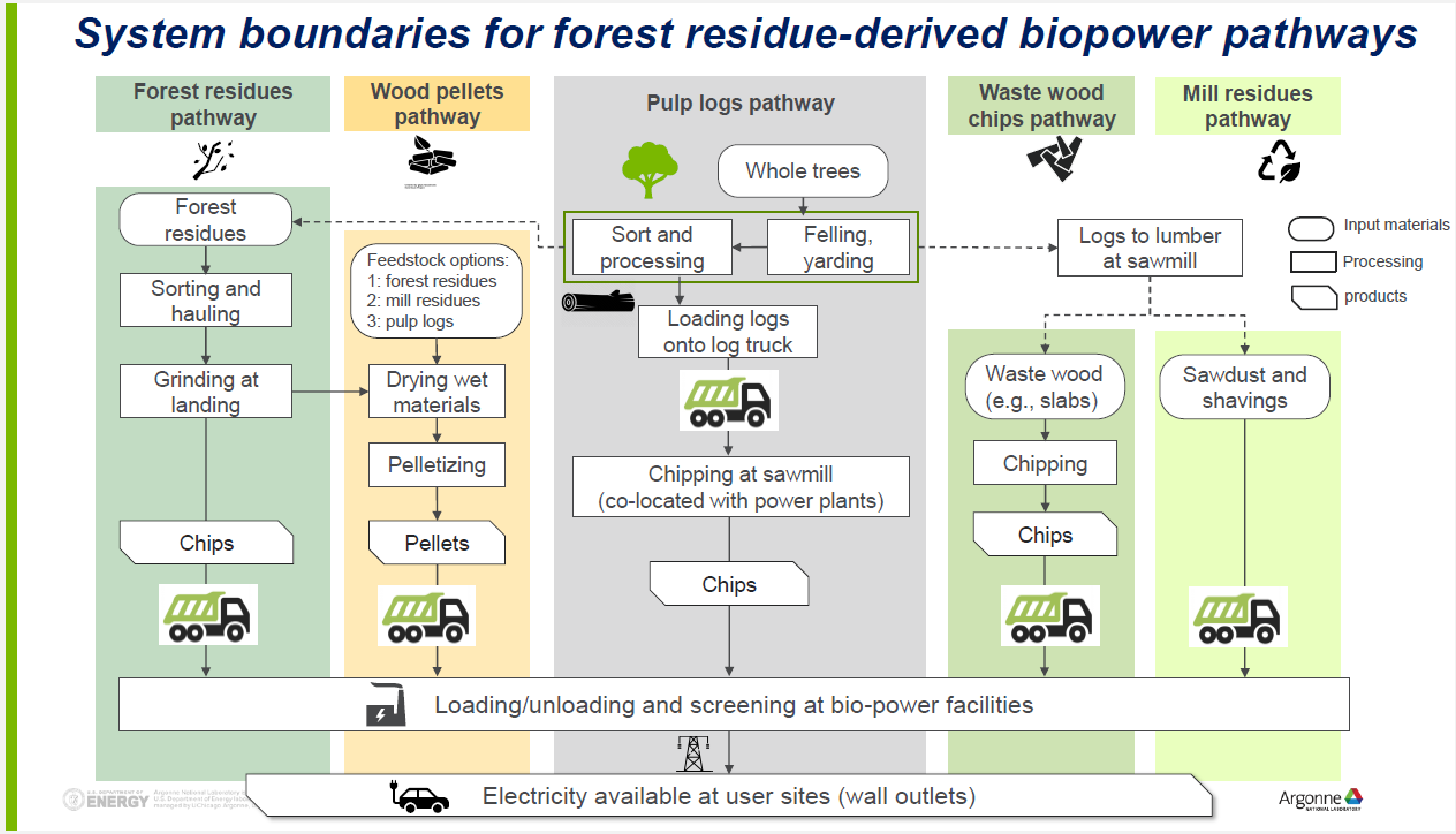


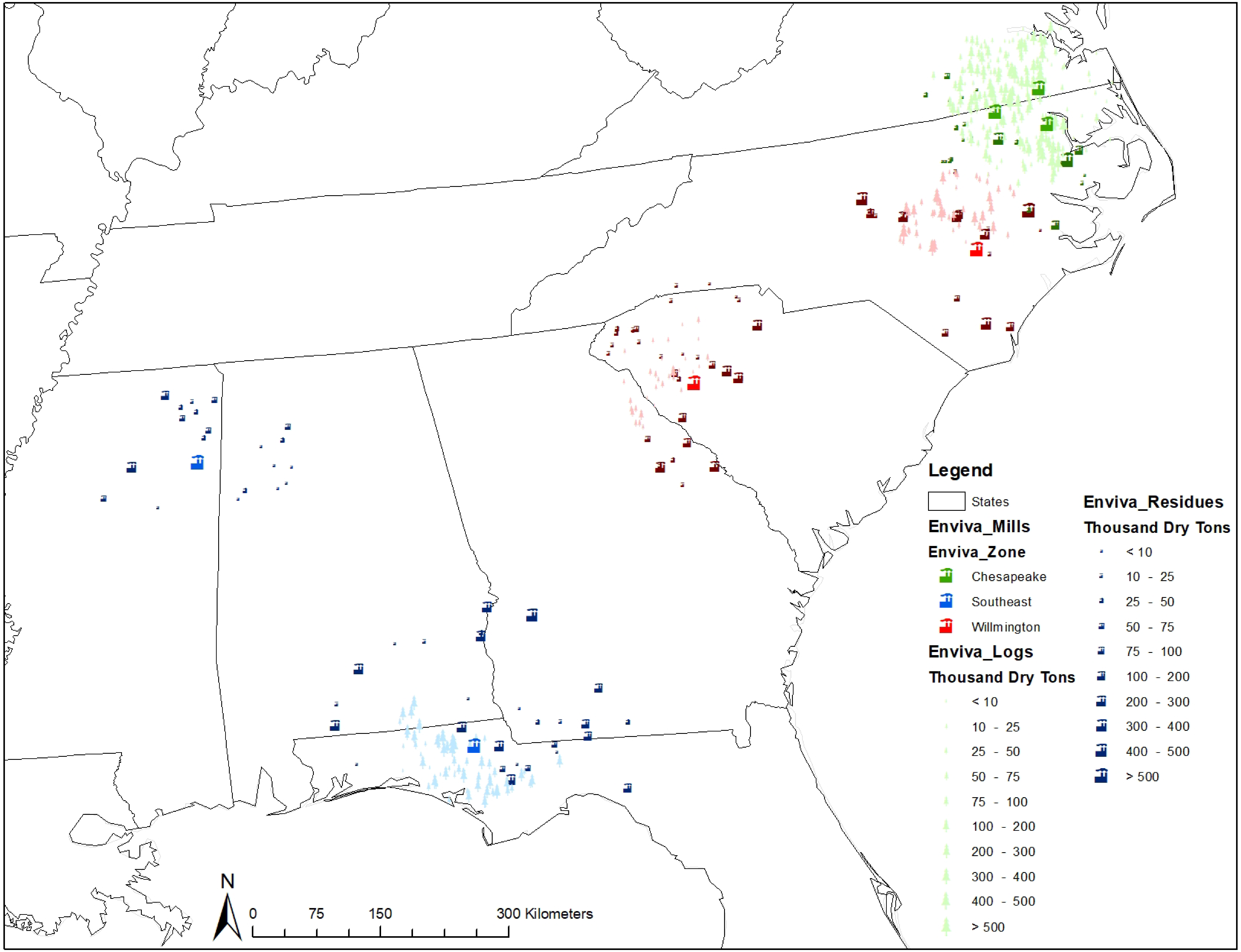
FIGURE 3 | Biomass source point distribution and depot "woodshed" service areas for the (A) Spokane, (B) Lewiston, and (C) Frenchtown biorefinery.

Martinkus, N., G. Latta, S.A.M Rijkhoff, D. Mueller, S. Hoard, D. Sasatani, F. Pierobon, and M. Wolcott. 2019. A Multi-Criteria Decision Support Tool for Biorefinery Siting: Using Economic, Environmental, and Social metrics for a Refined Siting Analysis. *Biomass and Bioenergy*. 128(2019):105330

- Argonne National Laboratory GREET model Biopower Module



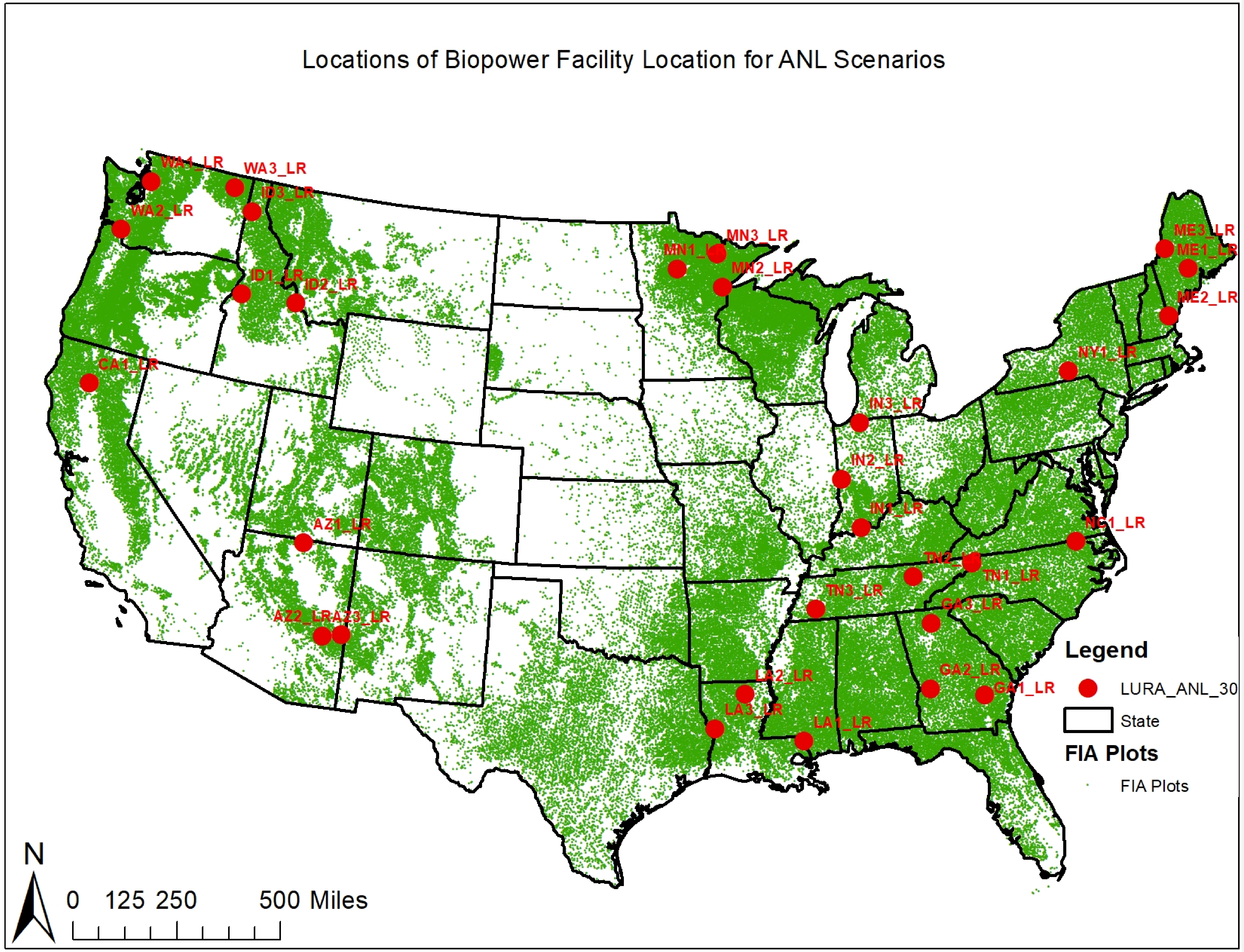
Xu, H., G. Latta, U. Lee, J. Lewandrowski and M. Wang. 2021. Regionalized Life Cycle Greenhouse Gas Emissions of Forest Biomass Use for Electricity Generation in the United States. Environmental Science & Technology. https://doi.org/10.1021/acs.est.1c04301



REGIONAL DIFFERENCES IN FEEDSTOCK MIX

EXAMPLE 2 OF BOTTOM-UP *– ADDING BIOENERGY*

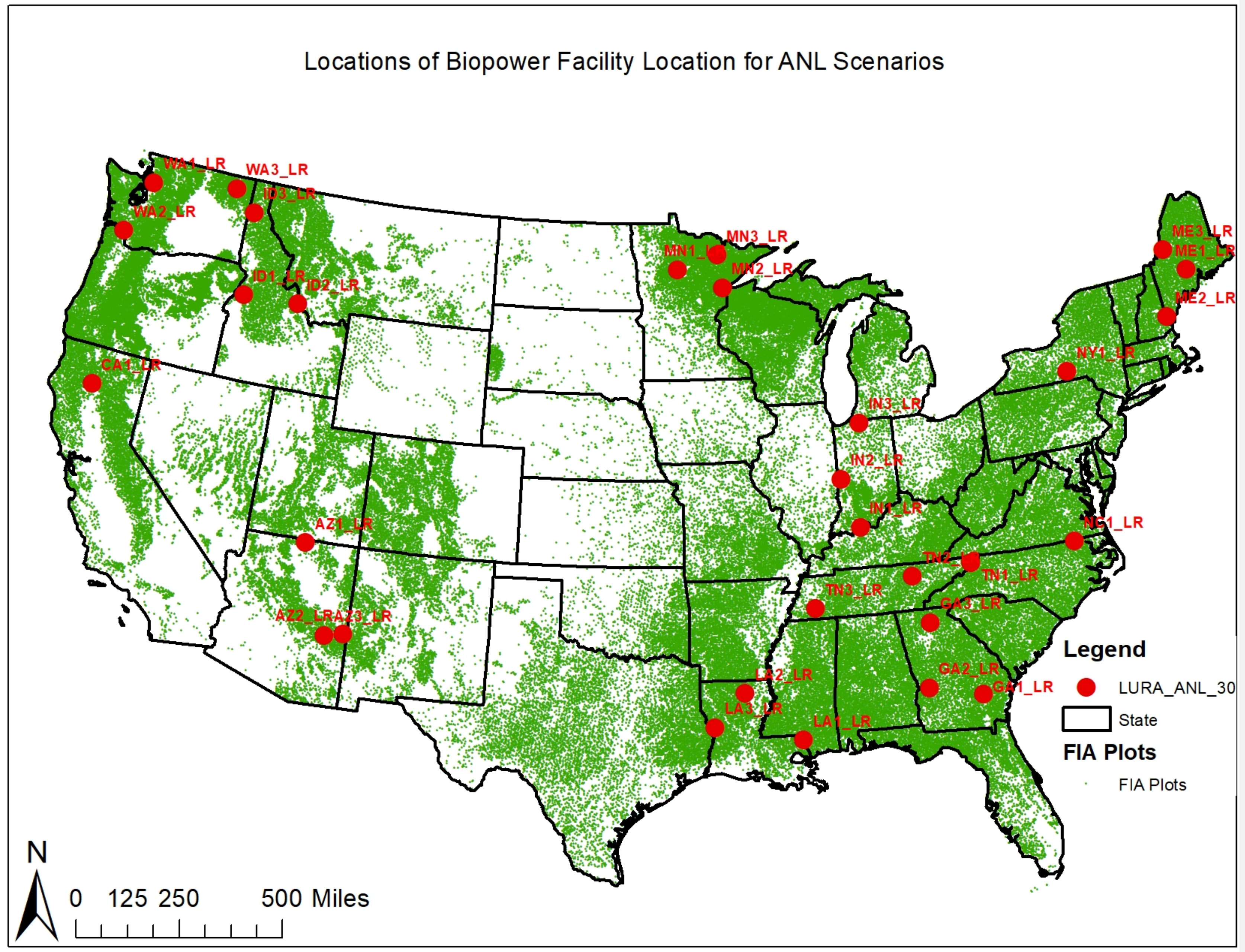
- Adding a 20 MW forest-based biopower facility in 30 different locations spanning region, forest density, and industry density
- Results to be incorporated in Greenhouse gases, Regulated Emissions, and Energy Use in Technologies (GREET®) model for LCA

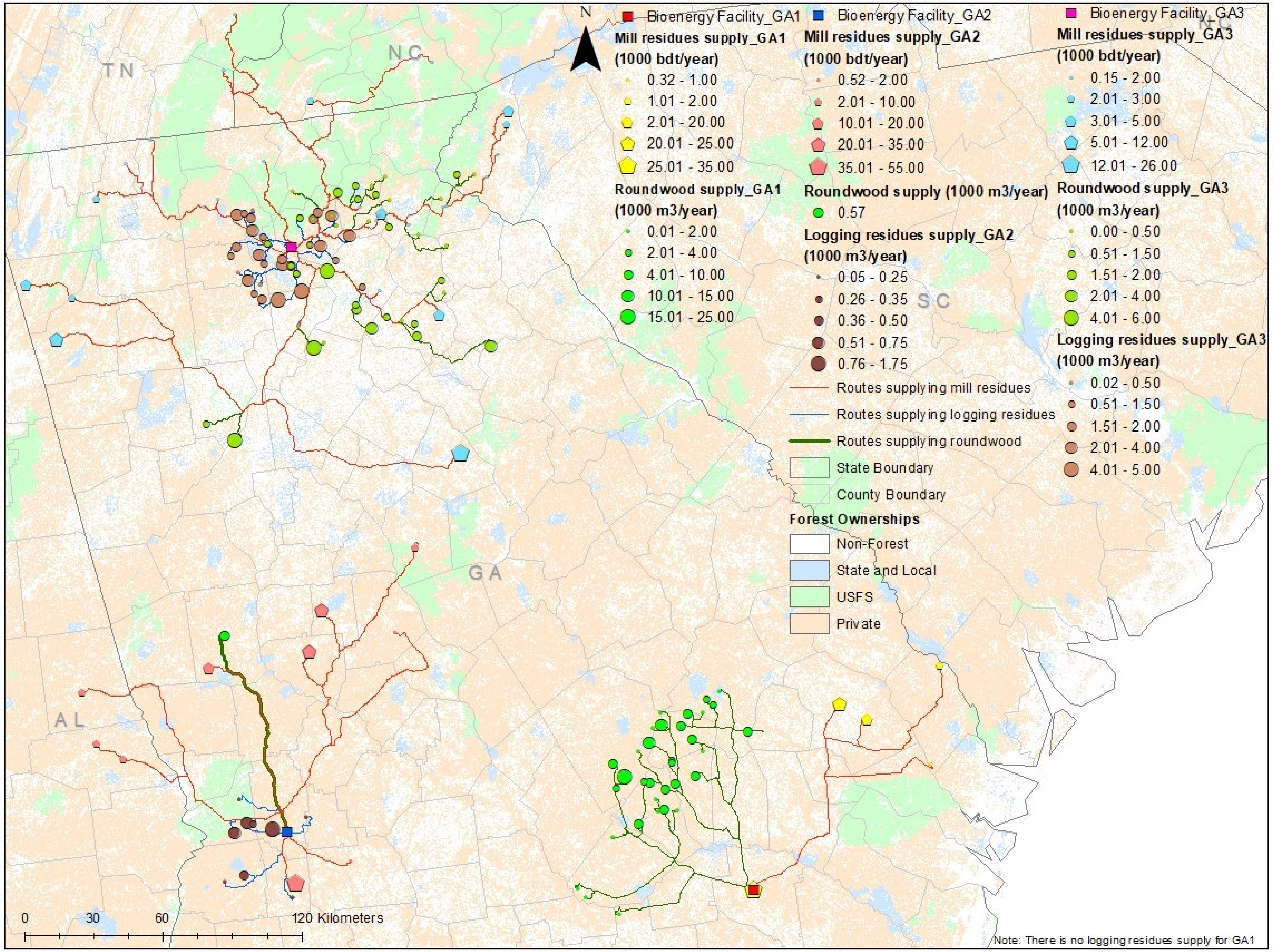


From: Xu, H., G. Latta, U. Lee, J. Lewandrowski, and M. Wang. *In Review*. Regionalized Life Cycle Analysis of Forest Biomass Use for Electricity Generation in the United States. *Submitted to: Environmental Science & Technology*

EXAMPLE 2 OF BOTTOM-UP *– ADDING BIOENERGY*

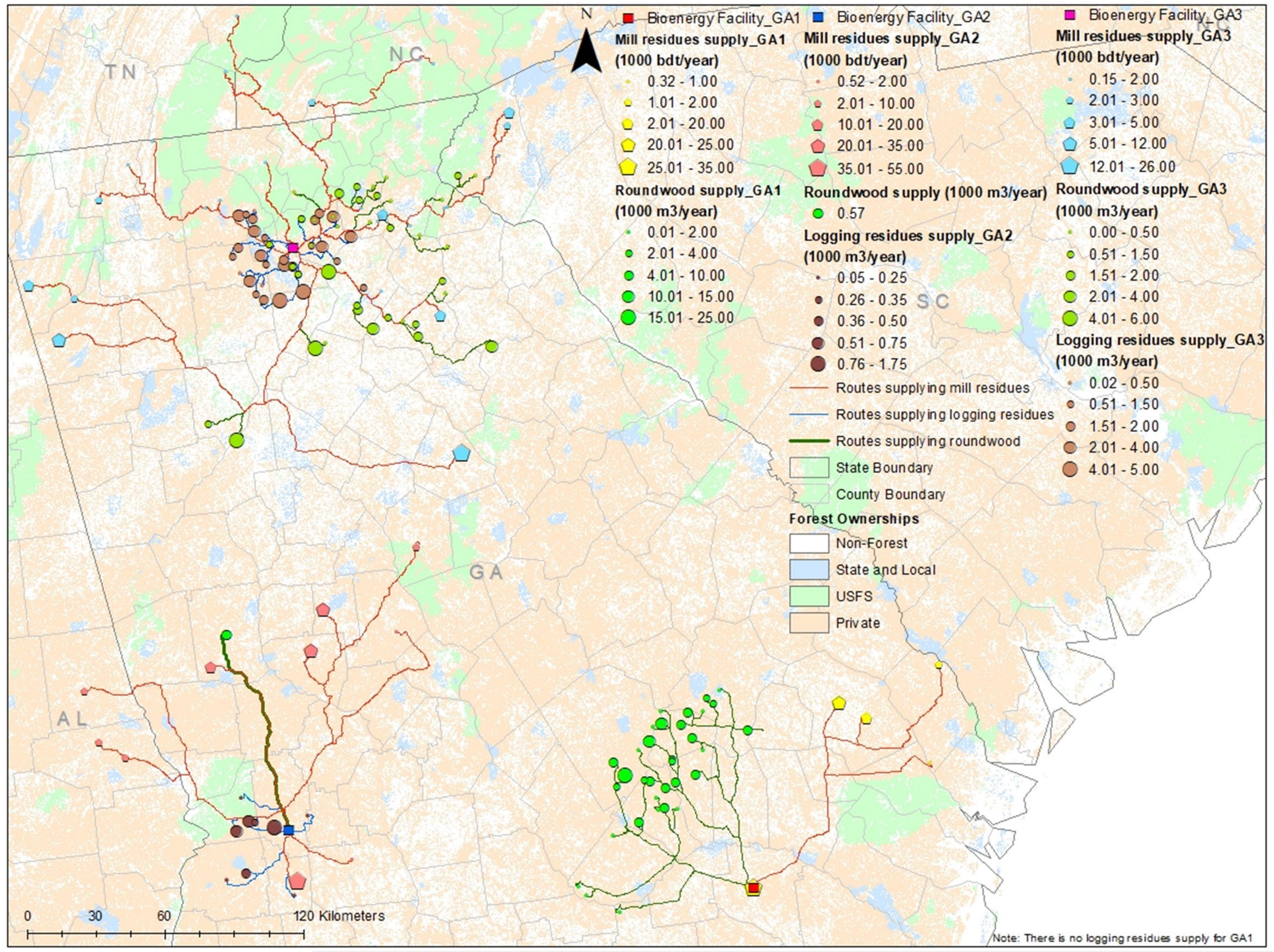
- Adding a 20 MW forest-based biopower facility in 3 different locations in Georgia

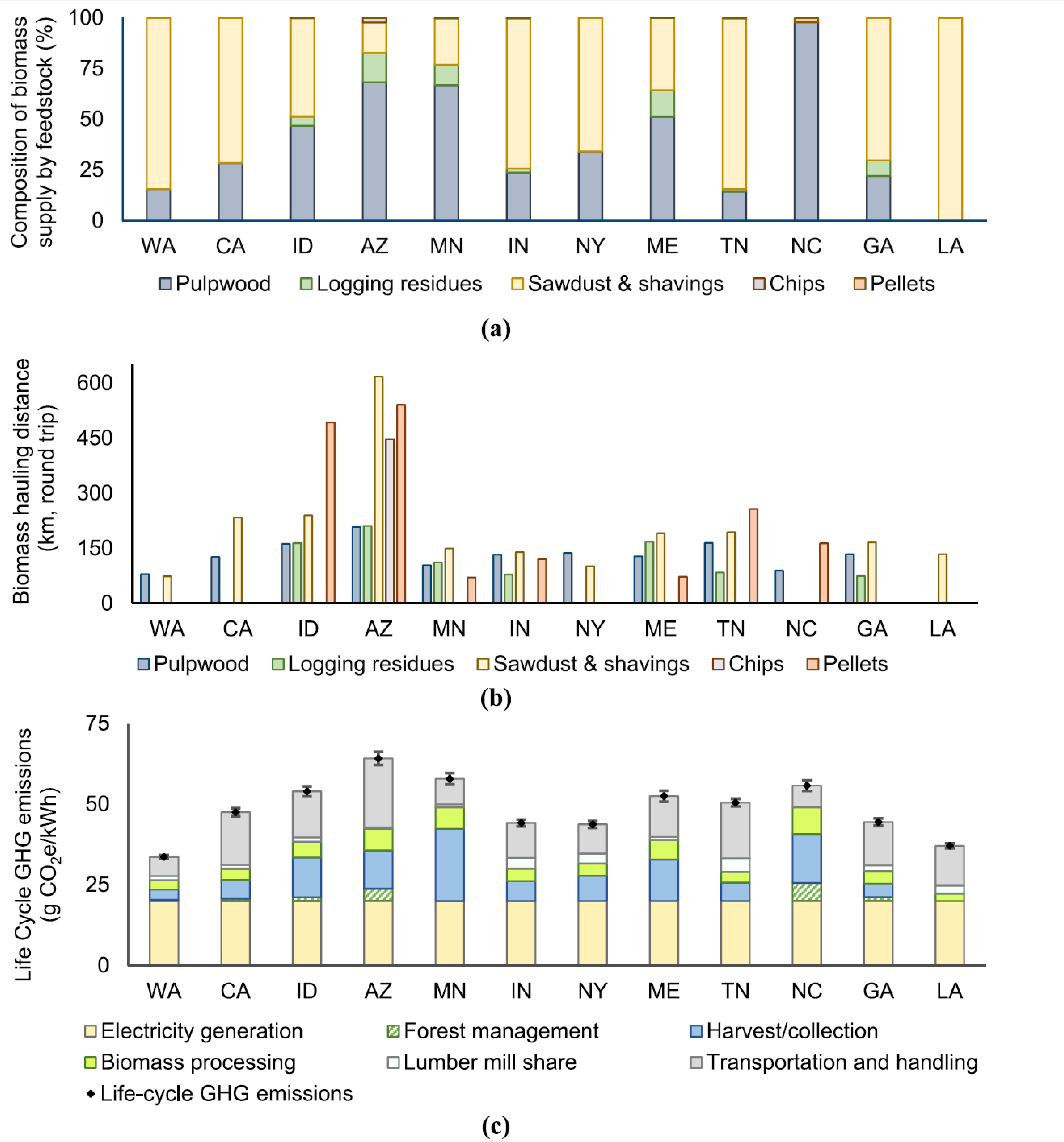




From: Xu, H., G. Latta, U. Lee, J. Lewandrowski, and M. Wang. *In Print*. Regionalized Life Cycle Analysis of Forest Biomass Use for Electricity Generation in the United States.

CAVEATS LOCAL CONTEXT MATTERS

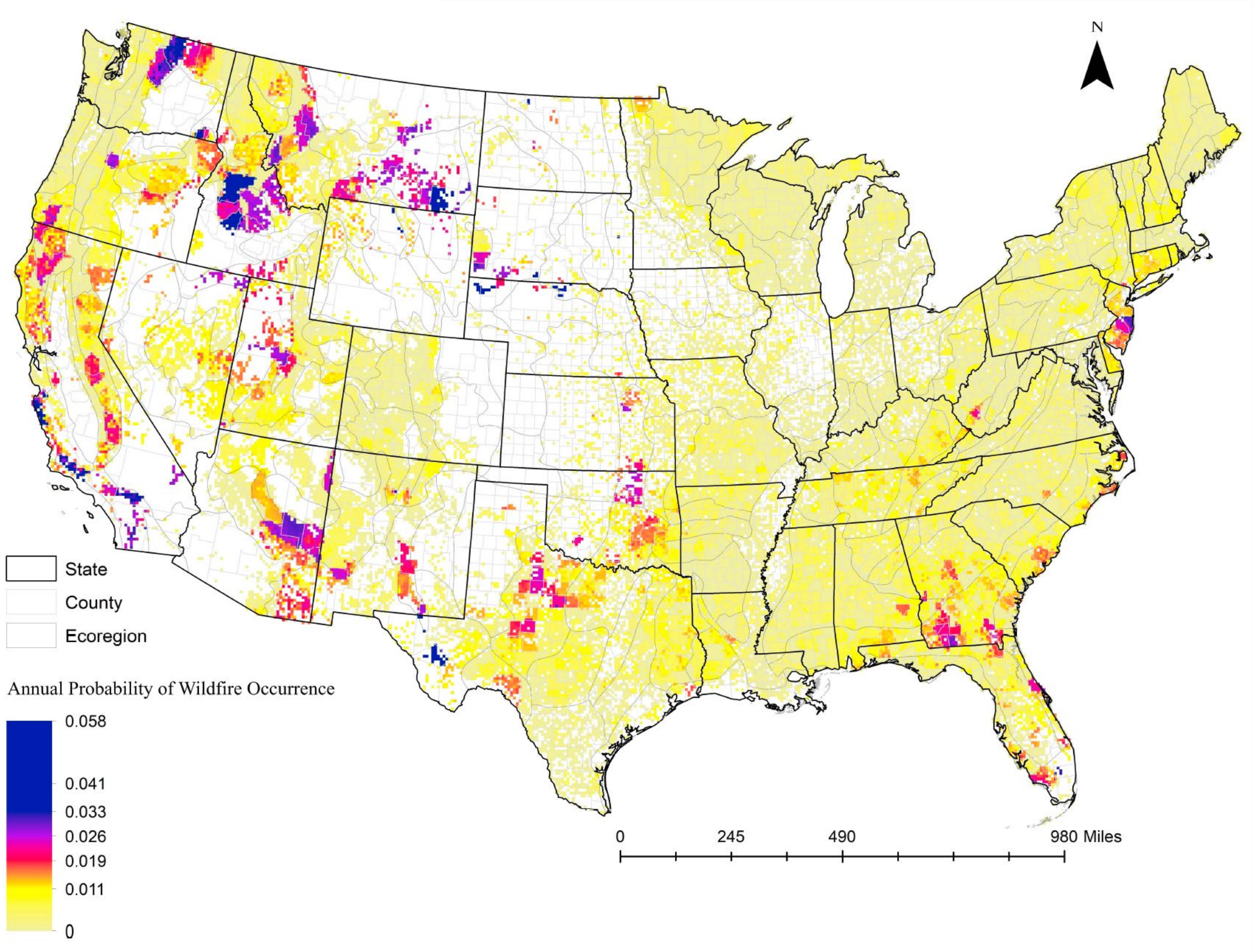




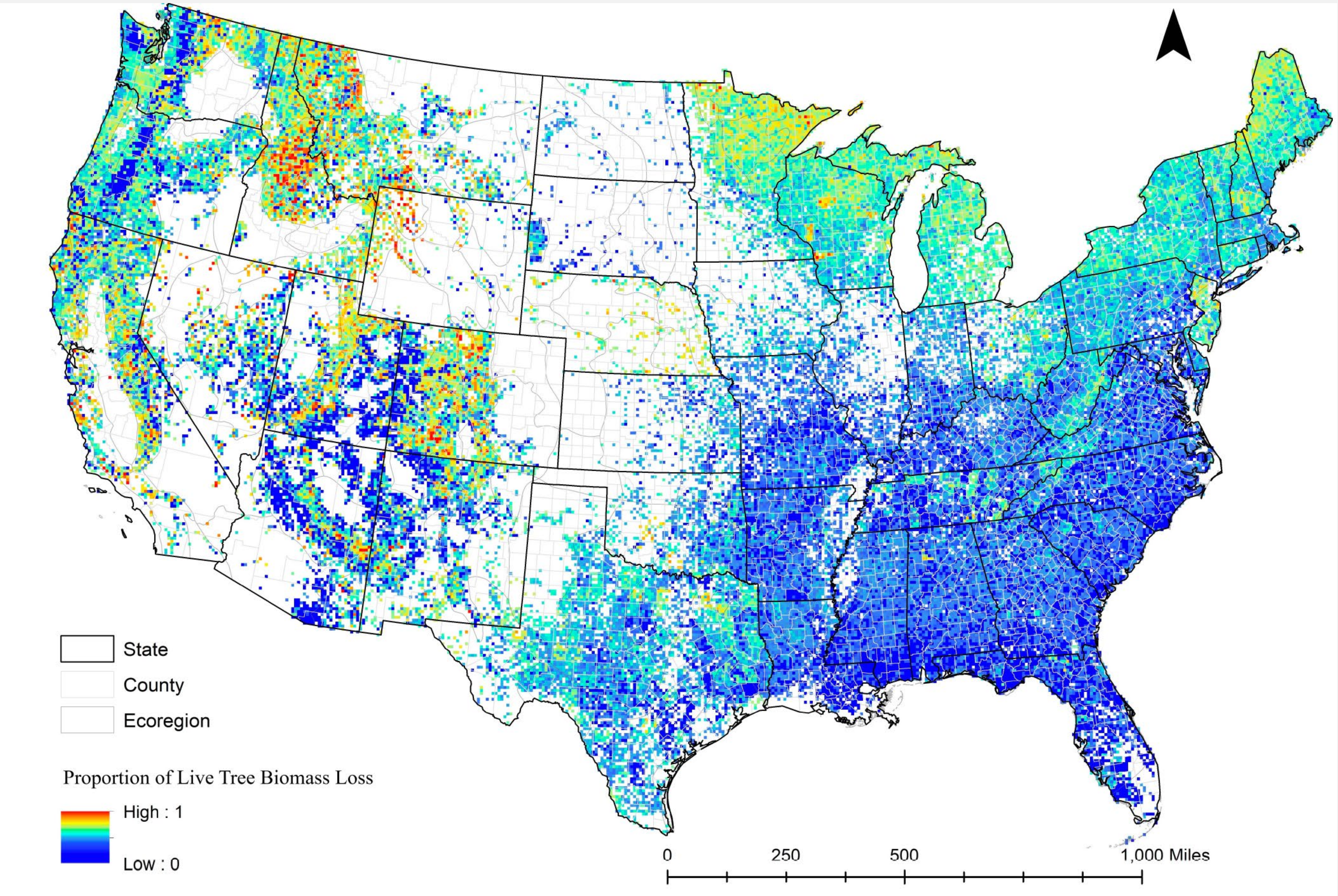
WILDFIRE IN LURA

- There are two primary equations that dictate how fire occurs in the model

Probability a fire will occur (function of climate)



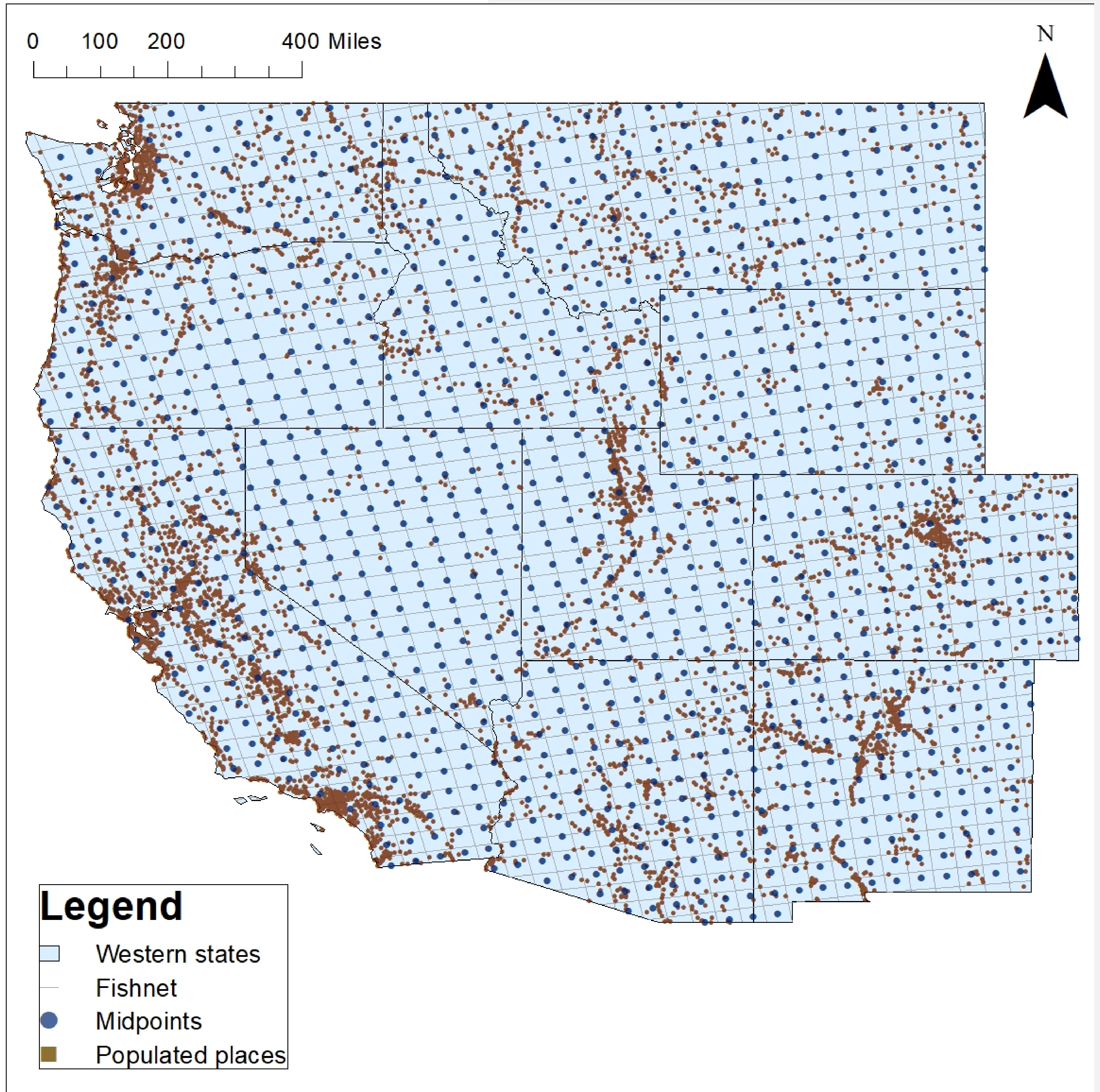
Mortality that will occur if there is a fire ***(brings in biomass)***



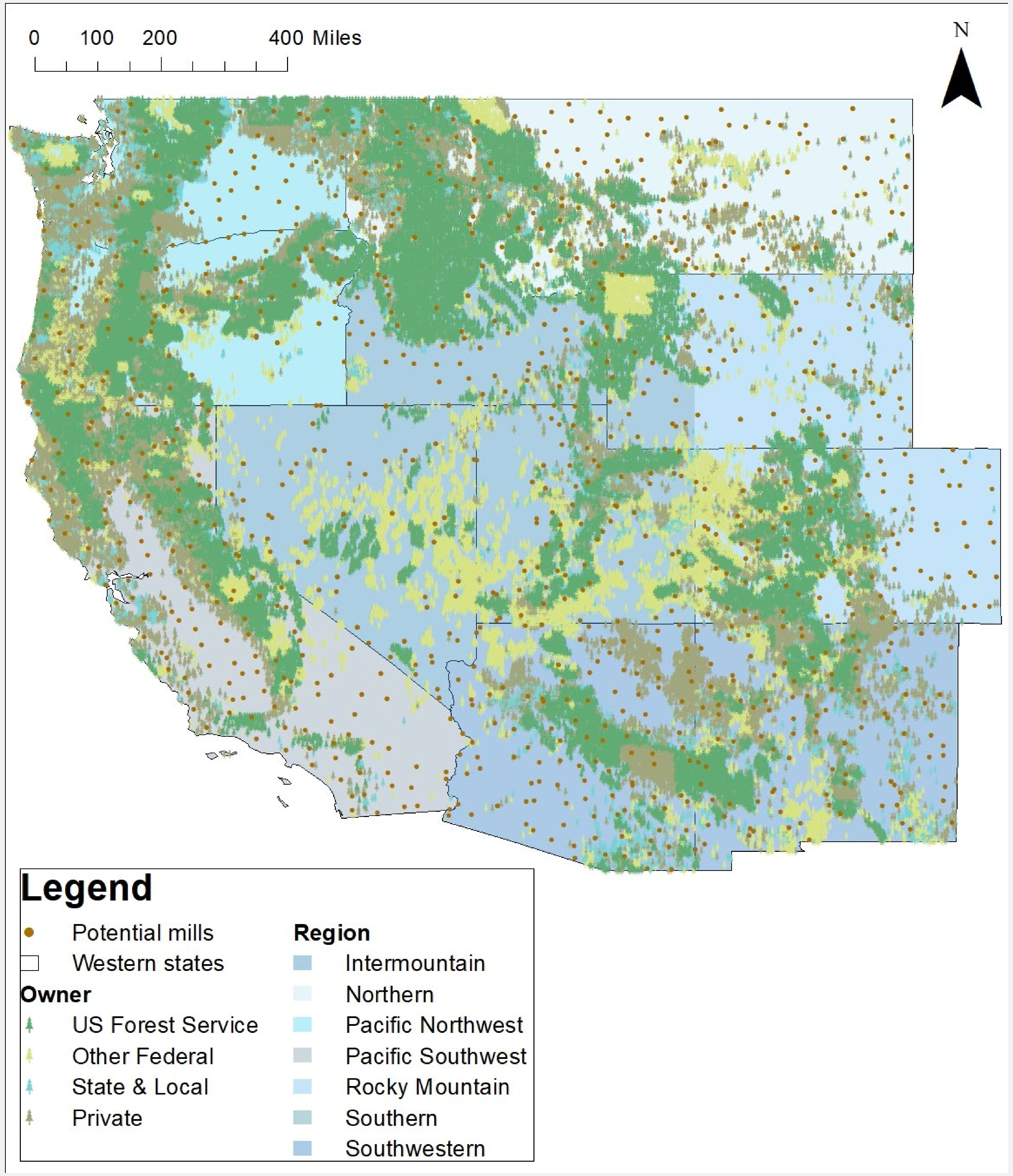
Pokharel, R., G. Latta and S. Ohrel. 2023. Estimating Climate-Sensitive Wildfire Risk and Tree Mortality Models for Use in Broad-Scale U.S. Forest Carbon Projections. Forests. 14(302). https://doi.org/10.3390/f14020302

SMARTER APPLICATIONS – CHOOSING SITES

1. Laid out a 50km grid
2. Chose the closest town to the grid midpoint



3. Eliminated areas with no town in the grid cell



SMARTER APPLICATIONS – CHOOSING SITES

- Adding a mill where the fire mortality is highest and mill competition is lowest

Mortality at each forest location around the potential mill location site
(Relative to the average)

$$Score_{location} = 0.5 * \left(\frac{\sum_{forest} 1 + \sum_{mill} 1}{\sum_{forest} 1}\right) * \sum_{forest} \frac{\left(\frac{Mortality_{forest}}{\overline{Mortality}}\right)}{Drive_{Time\,forest,location}} - 0.5 * \left(\frac{\sum_{forest} 1 + \sum_{mill} 1}{\sum_{mill} 1}\right) * \sum_{mill} \frac{\left(\frac{Capacity_{mill}}{\overline{Capacity}}\right)}{Drive_{Time\,location,mill}}$$

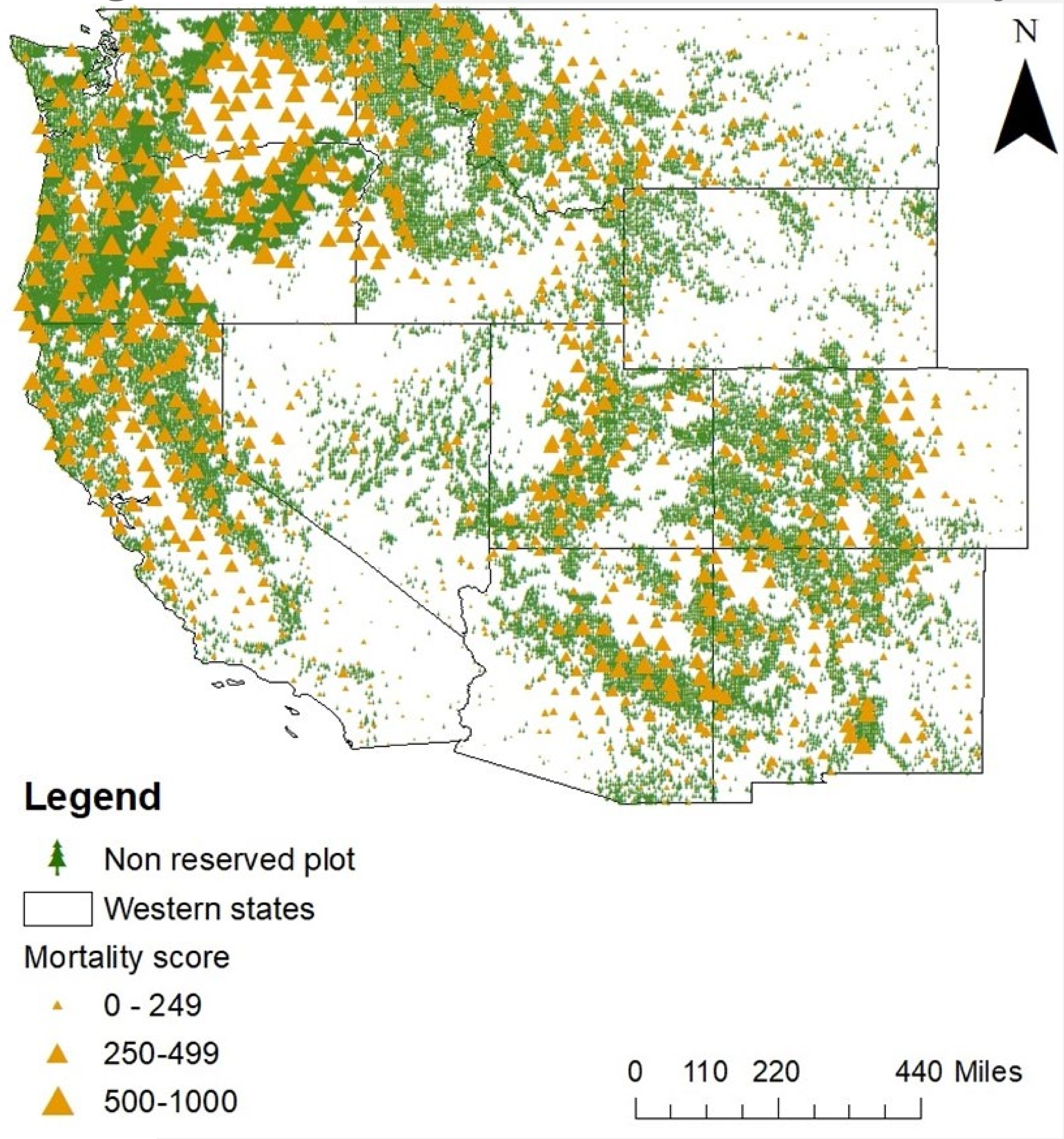
This is because we have a lot more forest plots than mills so this scales the two factors (10 forest plots, 2 mills, (10+12)/10=1.2

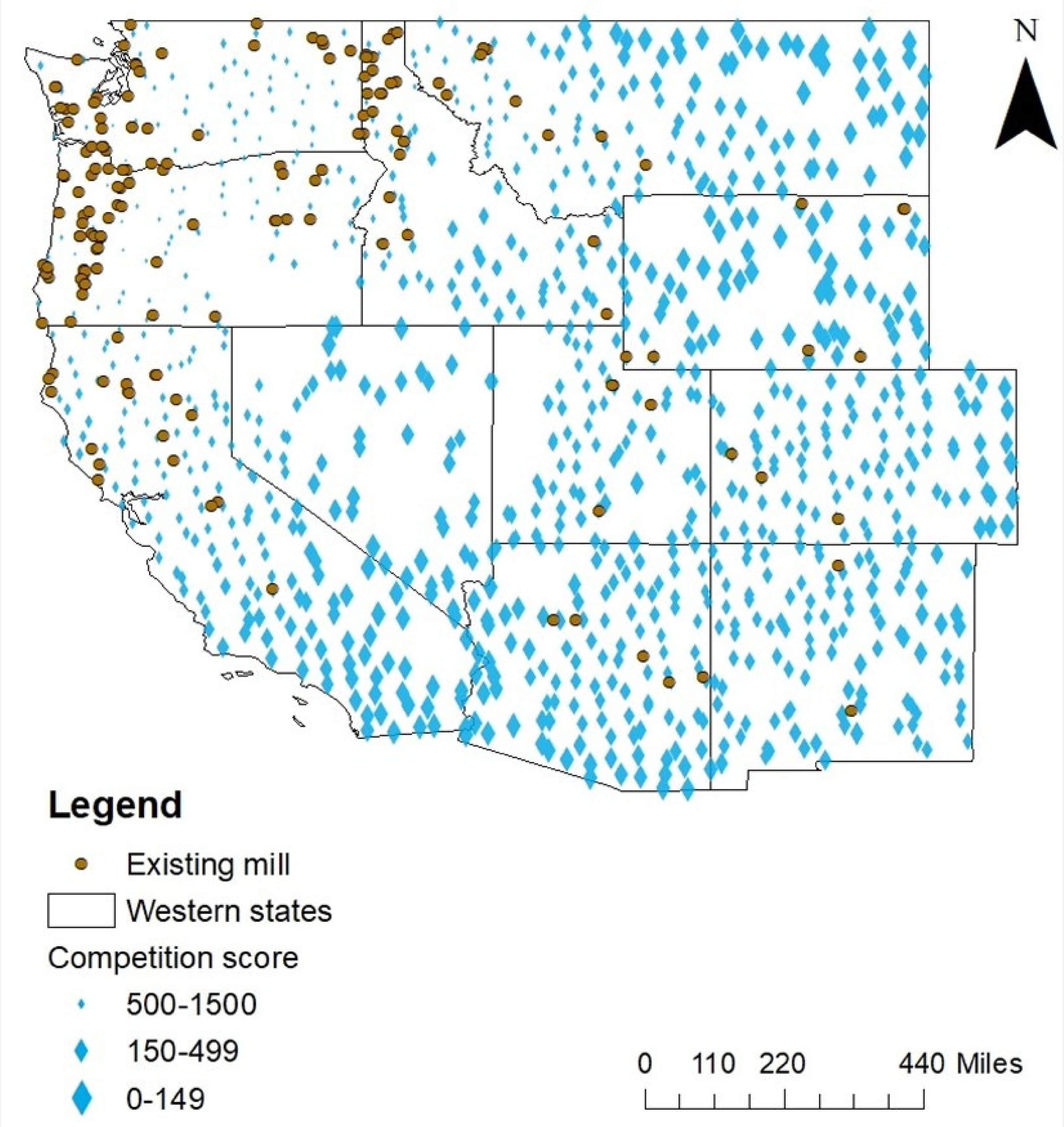
Over the rive time from forest to potential location
(the farther away the lower the value)

And (10 forest plots, 2 mills, (10+12)/2=6

SMARTER APPLICATIONS – CHOOSING SITES

- Adding a mill where the fire mortality is highest and mill competition is lowest

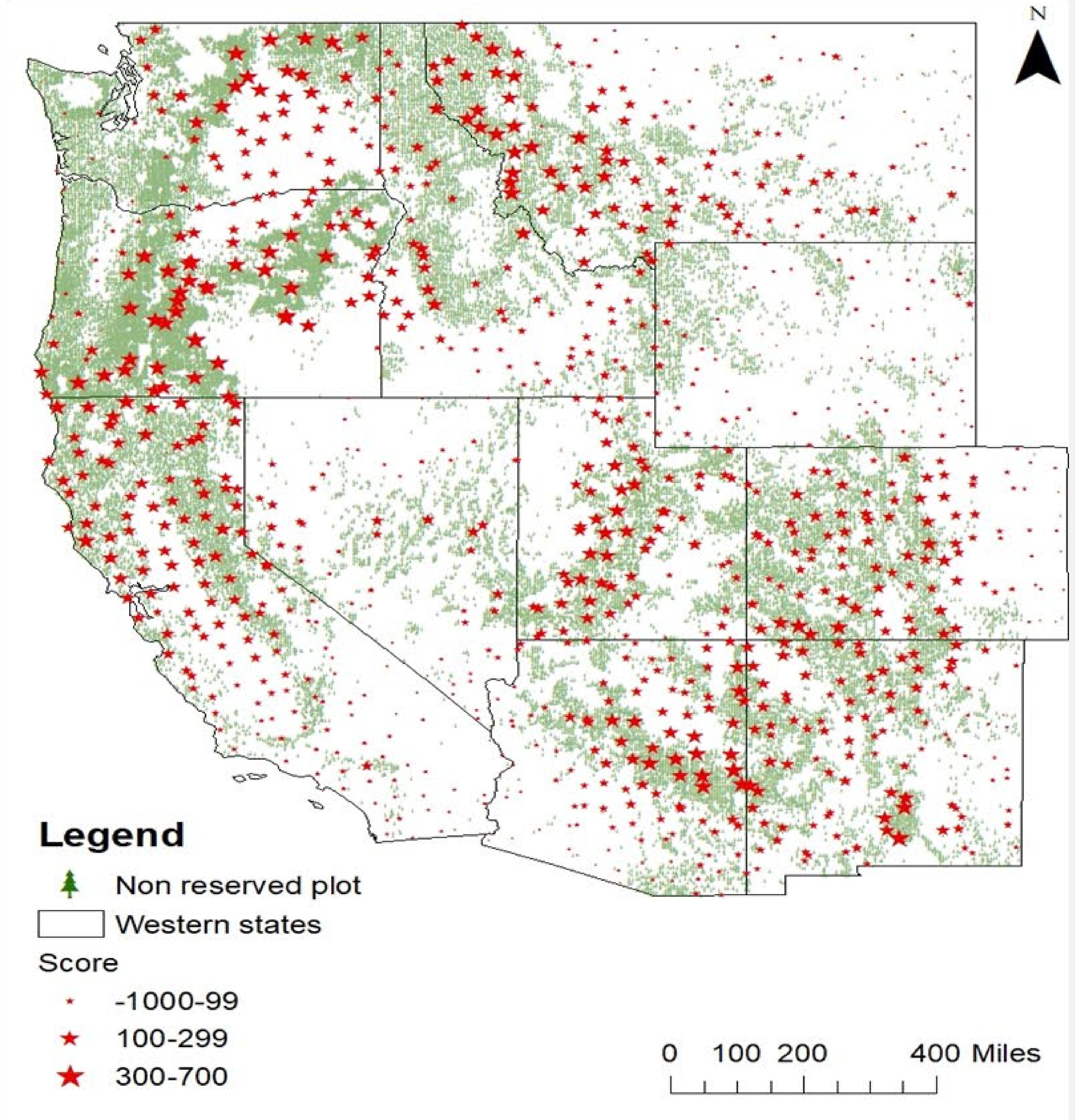




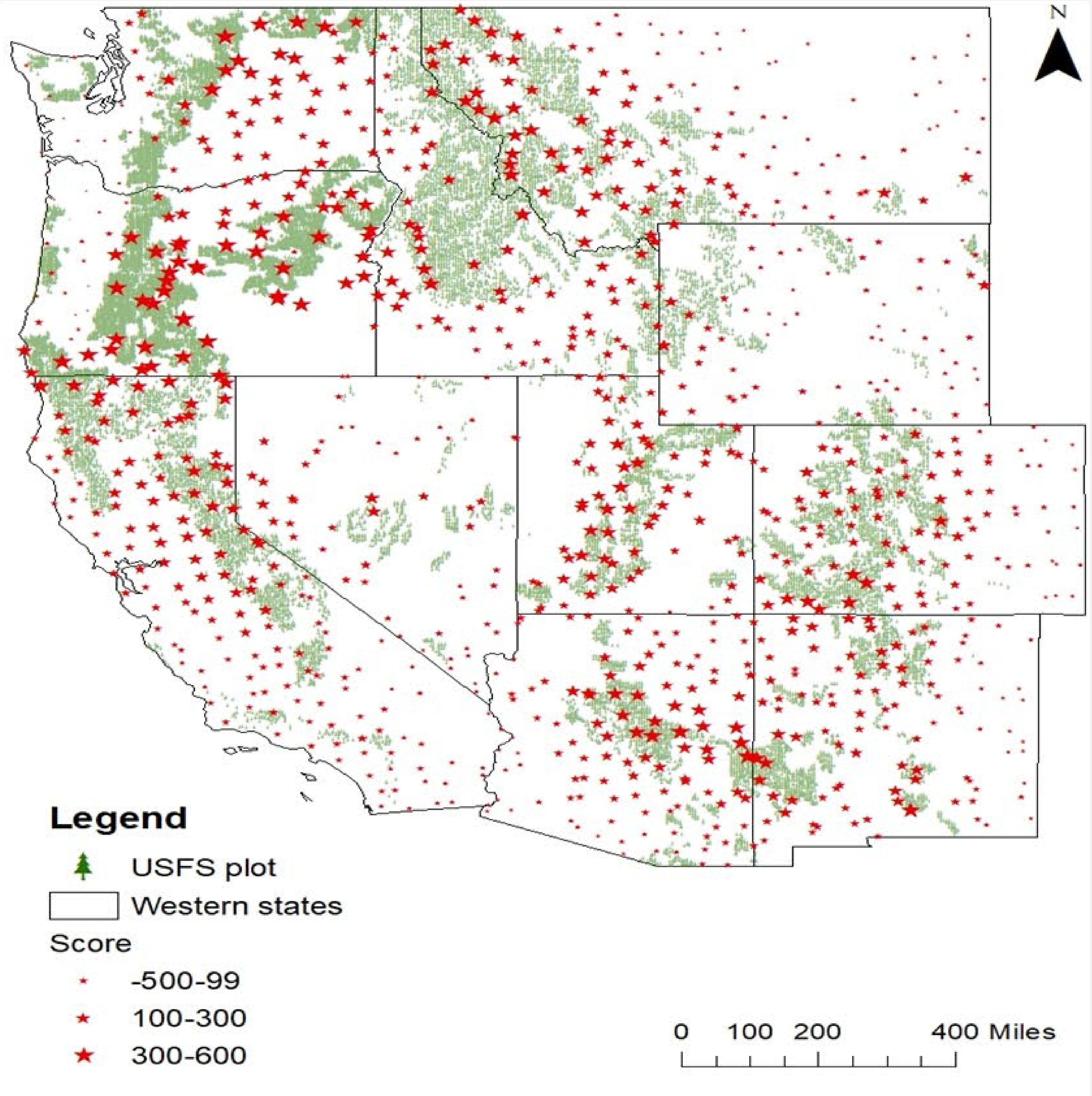
SMARTER APPLICATIONS – CHOOSING SITES

- Now we will add mills at the highest scoring locations and evaluate market and fire consequences

ALL OWNERSHIPS



USFS ONLY



SCENARIOS

In each case the LURA model is solved for the 2020-2038 period with the additional facilities added in 2023.

- The scenarios explore two primary sensitivities – scale of the program and scope of forest ownership participation.
  - Scale – How many 100,000 m3/year facilities are added
    - One in each of the six regions
    - Three in each of the six regions
  - Scope – What ownerships is the thinning performed in
    - All ownerships
    - US Forest Service only
- We may also look at co-locating pellet facilities

CONCLUSION

- What do we hope to accomplish
- It's been argued that thinning forests to reduce fire risk /improve forest health does not make sense as a mitigation strategy
  - The idea being that the carbon debt (the emission of cutting the trees) would take many years to be paid back
- *Can you use market forces to "inset" the industry by utilizing wood that had a high probability of burning*
  - *Leakage works both ways*

Thank You