Modeling the Interaction between Climate and Timber Harvest: A Fully Coupled Approach

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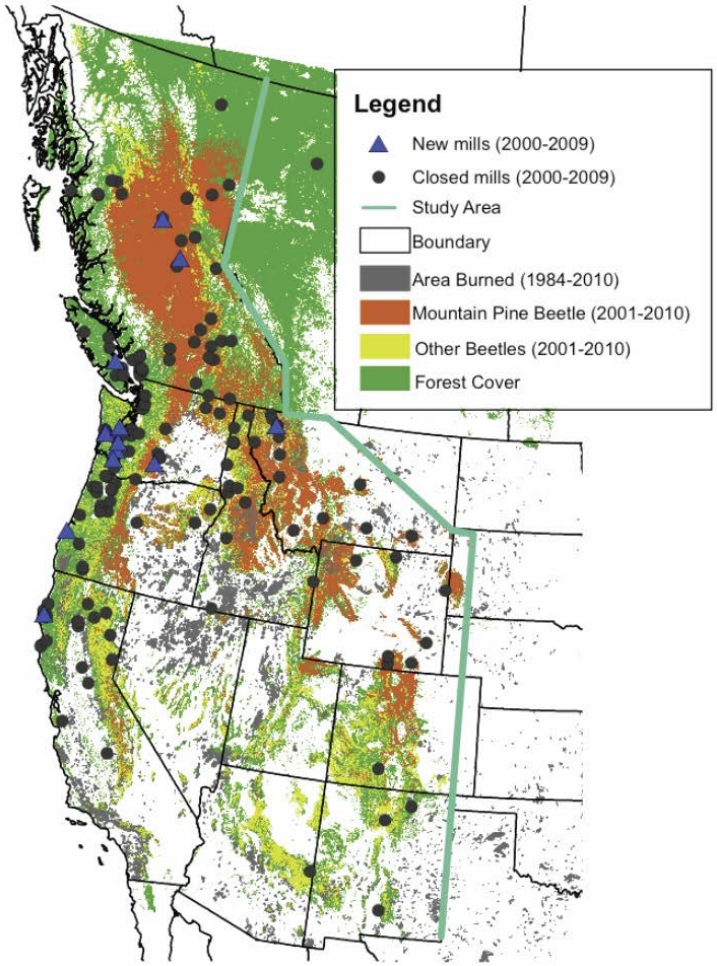
Introduction

- Forest Mortality, Economics, and Climate (FMEC)
  - Improve CLM's capabilities of modeling land disturbances in the western U.S. (fire, draught, timber harvests, pest infestations)

- Improving wood harvests in CLM
  - Replacing prescribed harvests with flexible harvest algorithm
  - Theoretically founded, yet speedy
  - Models feedback between harvest and climate.



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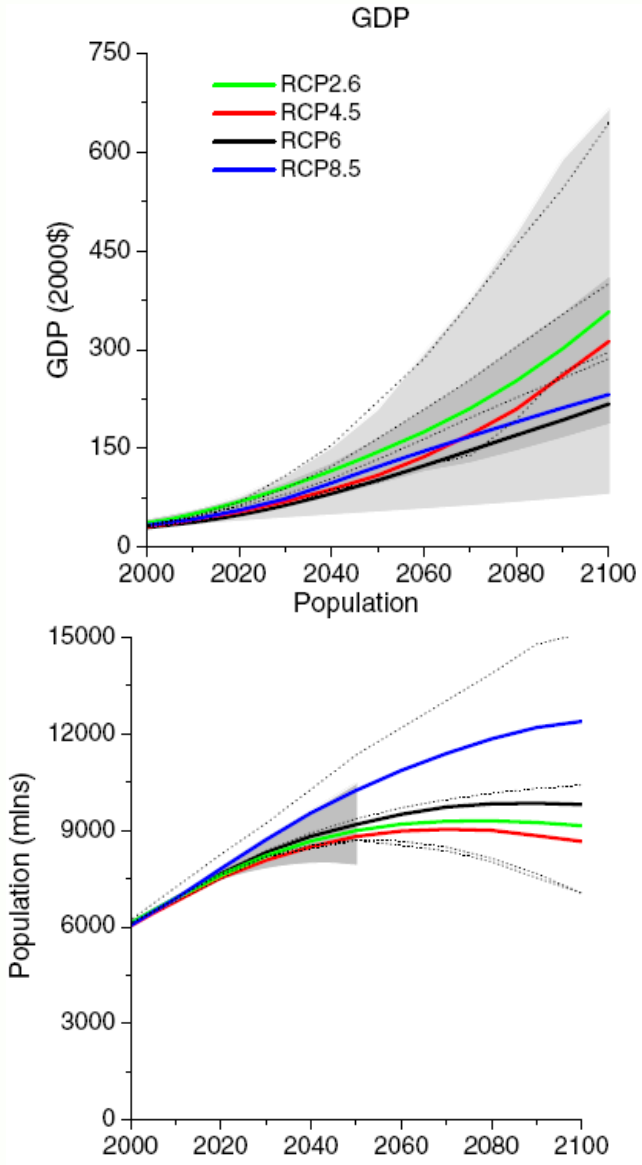
Model Overview

- Pre-Processing
  - Transportation Cost
    - Crow Flies versus transportation network
  - Ownership
  - Economic Parameters and data

- Processing *(4km x 4km res.)*
  - Reads restart file
  - Derives harvest levels and spatial distribution of harvest by calculating a spatial market equilibrium (Supply=Demand).

- Edits restart file/ provides outputs
  - Edits harvest input in restart file
  - Obtains a variety of module specific output



(van Vuuren et al. 2011)

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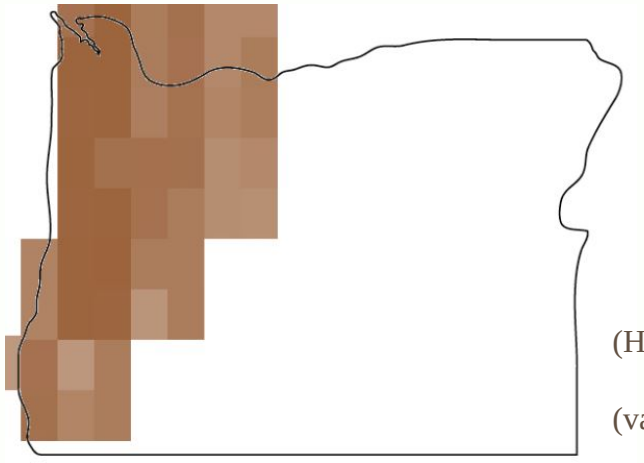
Harvest Output

Top: Default Harvest Data
Bottom: Module Generated Data

Percent	Color
0	
0.001	
0.003	
0.005	
0.007	
0.009	
0.011	



(Hurtt et al. 2006)

(van Vuuren et al. 2011)

- Target Harvest:
  - 26,339,477 m3
- Module Harvest:
  - 26,986,234 m3

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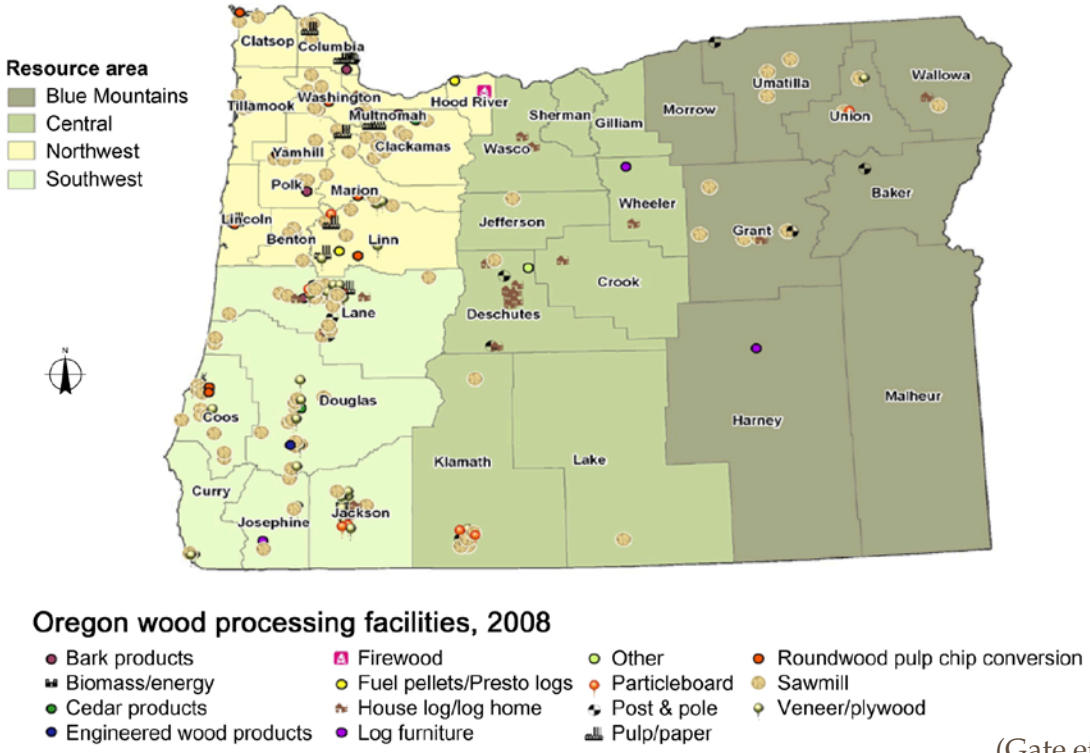
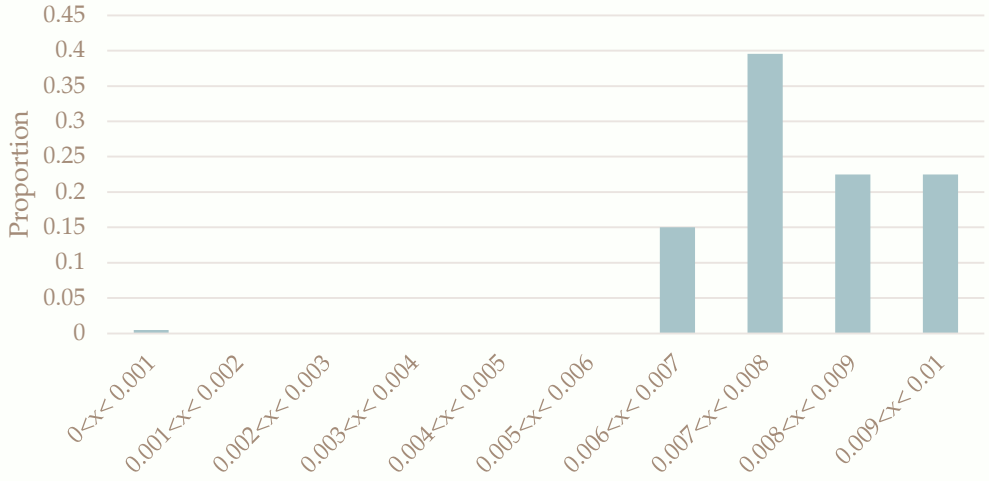
Harvest Output

- Spatial Differences:
  - More harvesting in the east (primarily Ponderosa)
  - Harvesting pattern driven by mill location, transportation costs, and ownership.

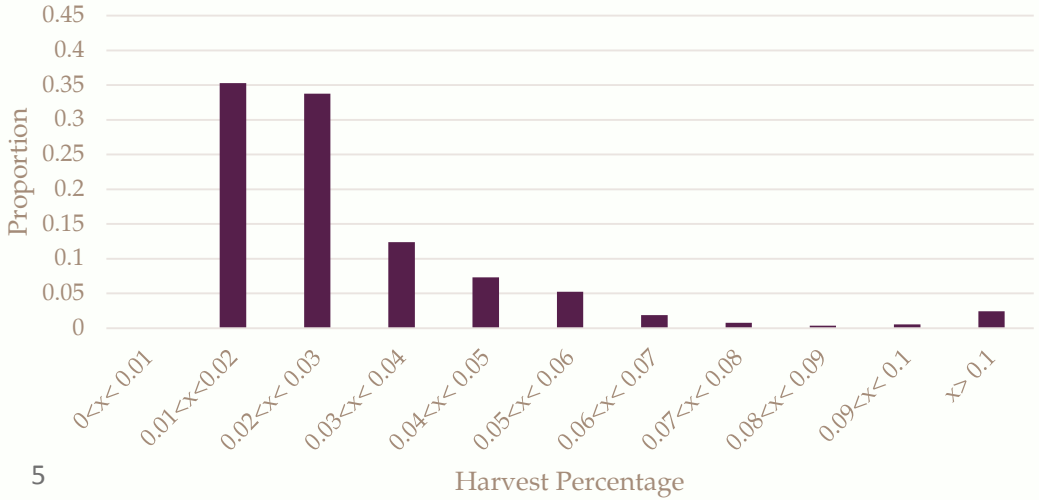


(Gate et al. 2012)

Proportion of Harvest Percentages within a given range



- Default
  - Count: 7680
  - Max: .009
  - Mean: 0.0079



- Module Generated
  - Count: 533
  - Max: ~.96
  - Mean: ~.035

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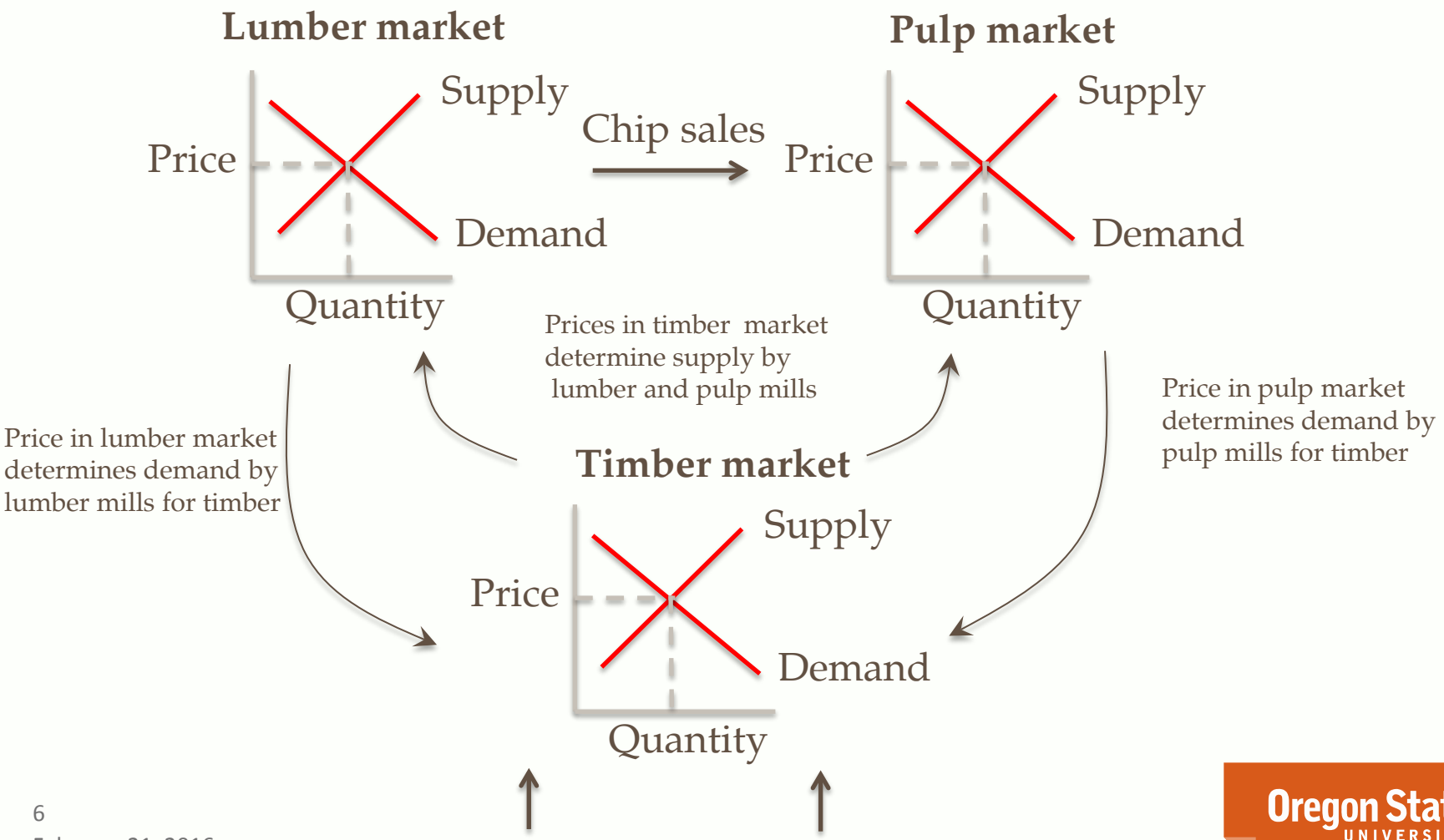
Solution Technique: Overview



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Private forest owners supply timber to the mill offering the highest price net of transportation costs

Module Output and Future Use

Elgin Lumber Mill in Union County, Oregon

Photo Credit: Gary Halvorson, Oregon State Archives

- Carbon Policy Scenarios
- Economic effects and responses to Beetle Outbreaks and Wildfires
- Changes in land values and productivity

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Thank You!

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References

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- Hurtt, G. C., S. Frolking, M. G. Fearon, B. Moore, E. Shevliakova, S. Malyshev, S. W. Pacala, and R. A. Houghton. "The underpinnings of land-use history: Three centuries of global gridded land-use transitions, wood-harvest activity, and resulting secondary lands." *Global Change Biology* 12, no. 7 (2006): 1208-1229.

- Van Vuuren, Detlef P., Jae Edmonds, Mikiko Kainuma, Keywan Riahi, Allison Thomson, Kathy Hibbard, George C. Hurtt et al. "The representative concentration pathways: an overview." *Climatic change* 109 (2011): 5-31.