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Economic Analysis of the Role of Forest Biomass in Bioenergy Production in Southern US

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Selected Poster prepared for presentation at the Agricultural & Applied Economics Association's 2014 AAEA Annual Meeting, Minneapolis, MN, July 27-29, 2014.

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Research Motivation

Is biomass boom a threat or opportunity for US South, which is a world leading producer of timber and wood products and owns about 100 million acres agricultural land?

With a drop in demand for pulp and paper products and increase in demand for wood pellet, wood pulp is expected to play a larger role in bioenergy production.

Studies differ in their projections of the role of forest-based bioenergy Vs. agricultural bioenergy likely to be produced in US south.

Estimation of the economic viability of bioenergy feedstocks needs to take into account joint forest and agriculture sector.

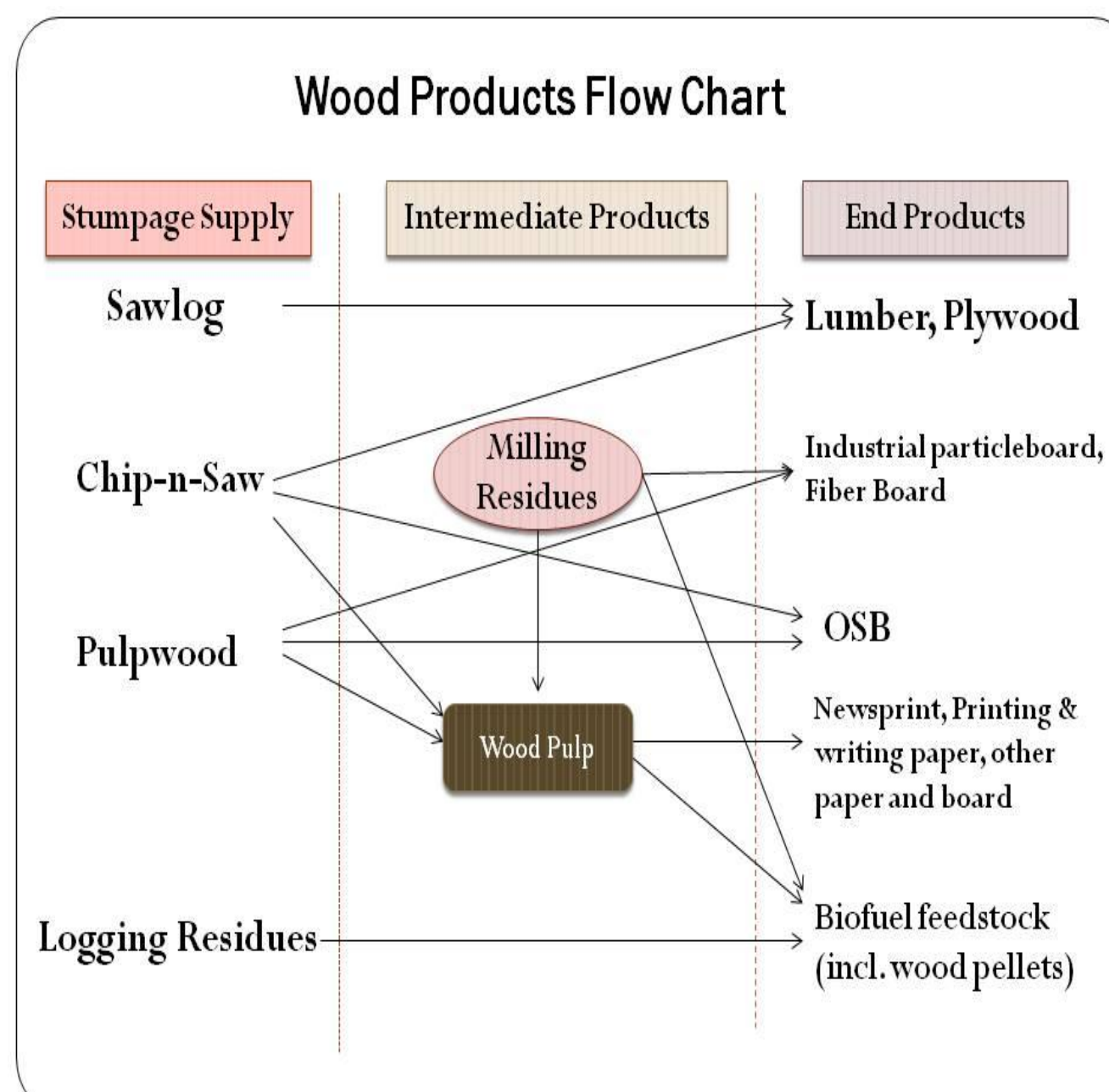
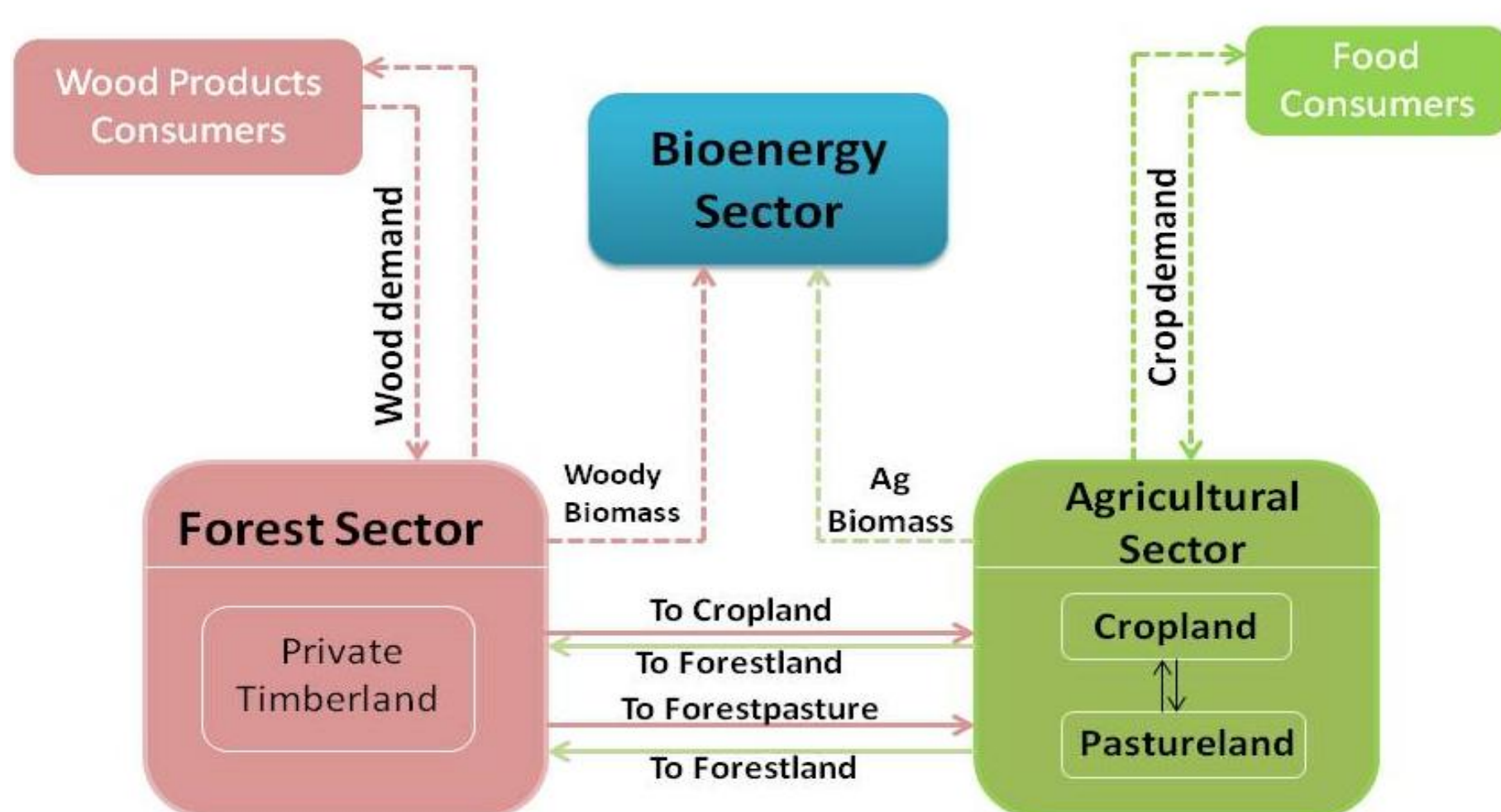
Research Objectives

Develop an integrated dynamic optimization model of the agricultural, forestry and bioenergy sectors in the US south to

- Estimate spatially explicit optimal mix of various agricultural and forest feedstocks and its implications for land use to meet the increasing bioenergy demand over the 2007-2035 period
- Analyze the implications of demand for bioenergy for southern timber and food market and social welfare

Methods

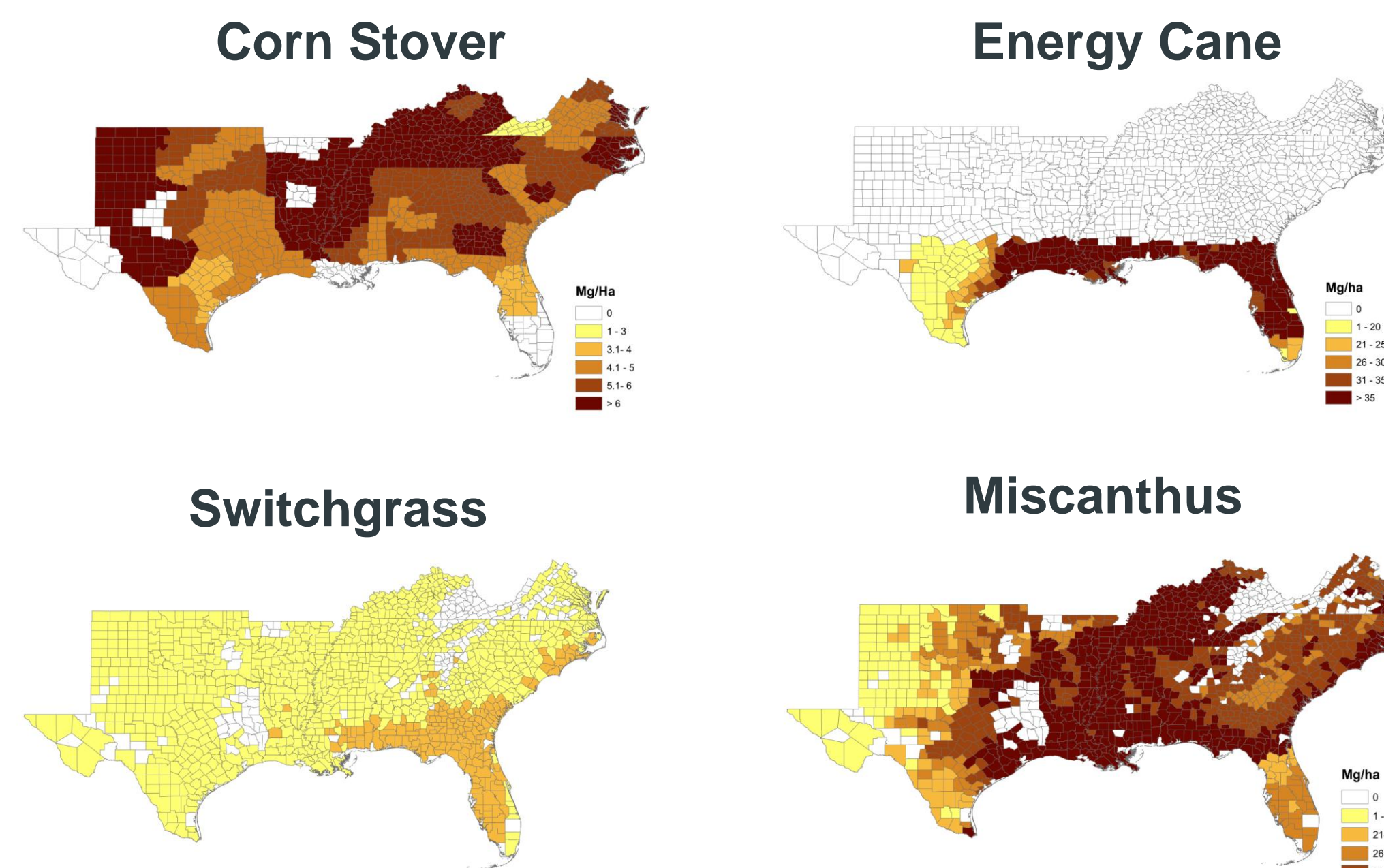
Integrated Ag-Forest Model for US South



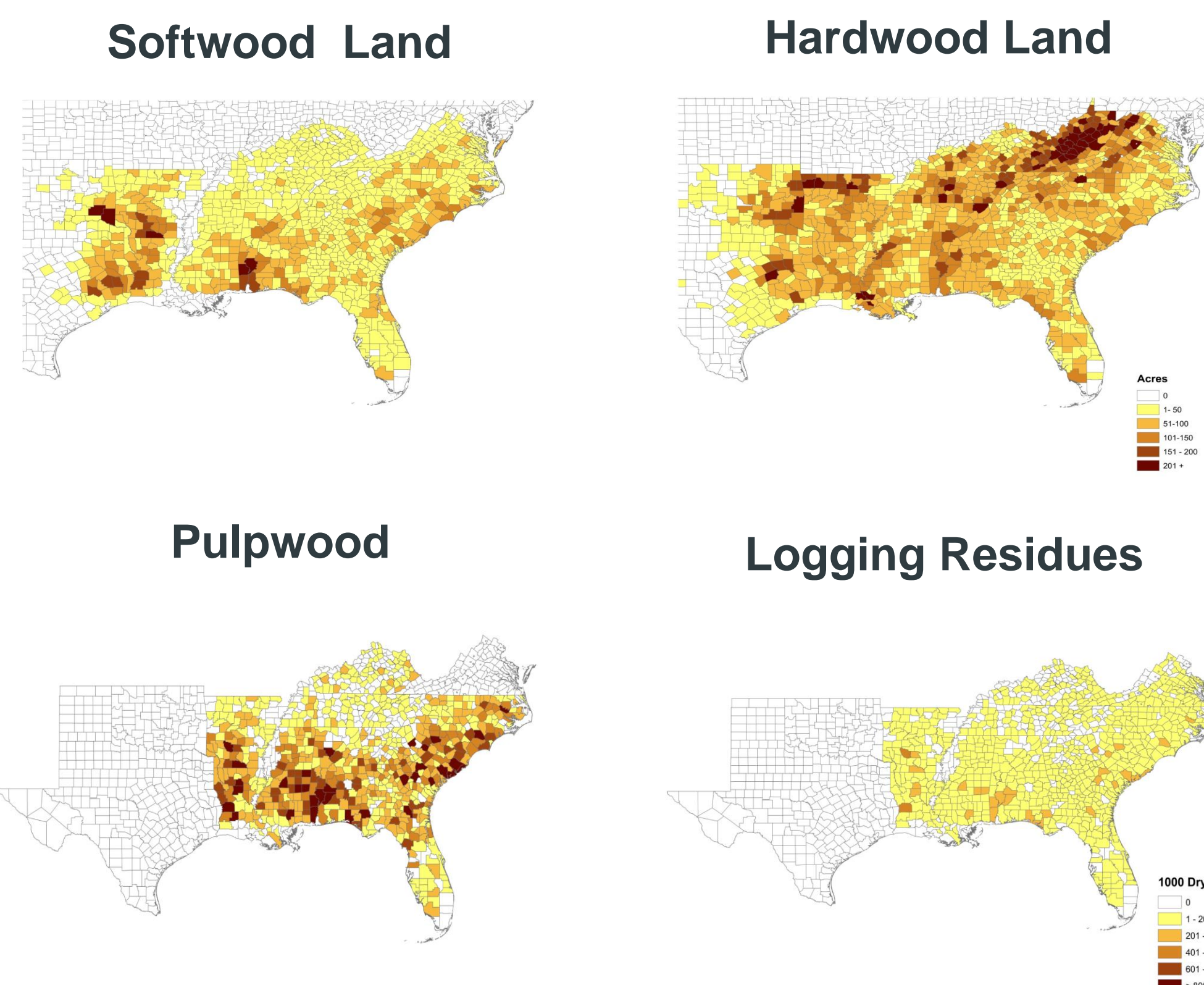
Model Key Features

- Integrated dynamic model of forestry and agricultural sector in US south with timber, crops, co-products, livestock, and biomass markets
- Spatial heterogeneity in returns to agriculture and timber for 295 crop reporting districts
- A broad source of second-generation biofuel source: crop residues, miscanthus, switchgrass, sugarcane, energycane
- Model can solve annually how many bioenergy to be produced from which feedstocks at which price and corresponding land use (change)

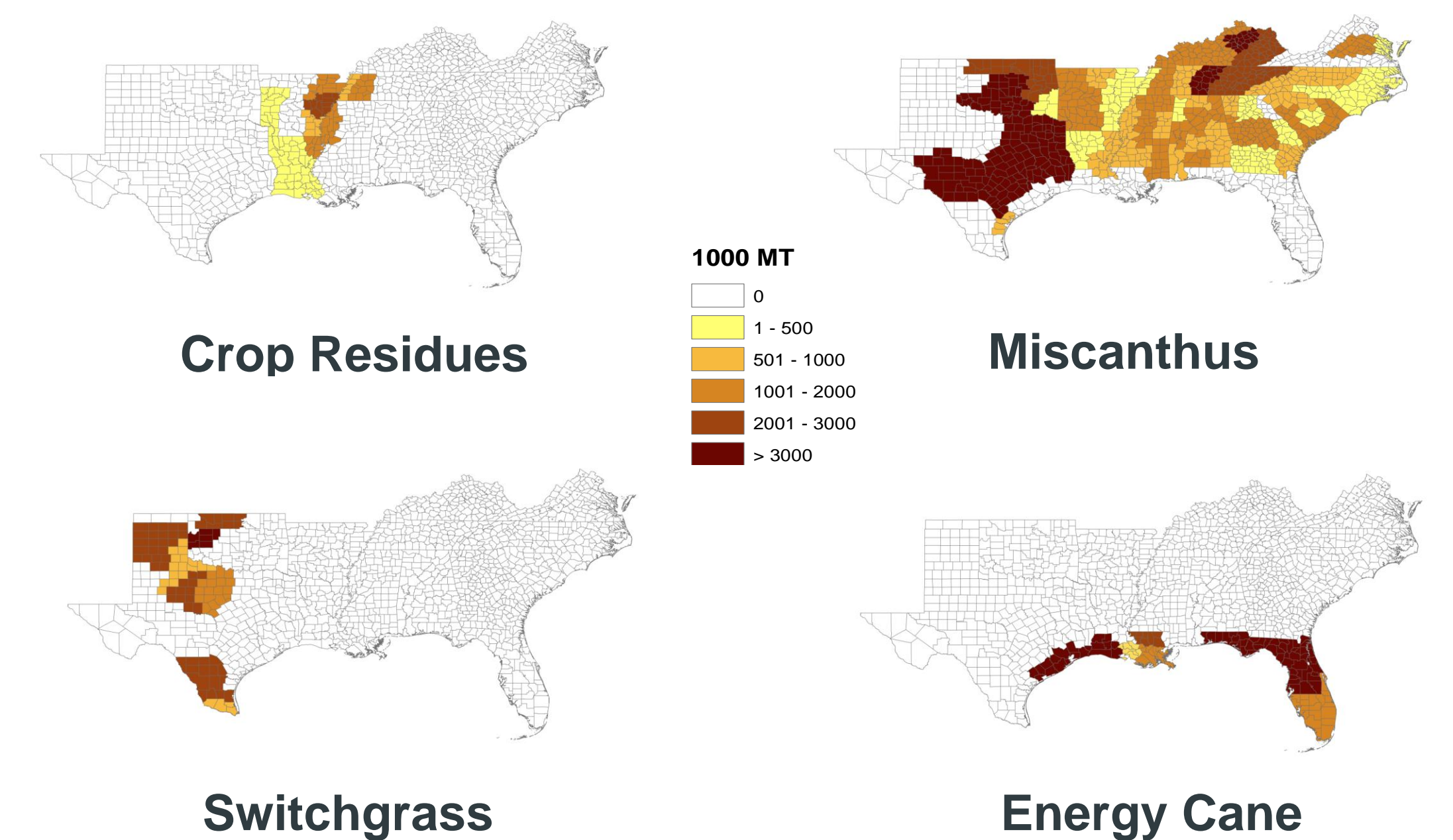
Harvestable Yield of Crop Residues and Energy Crops



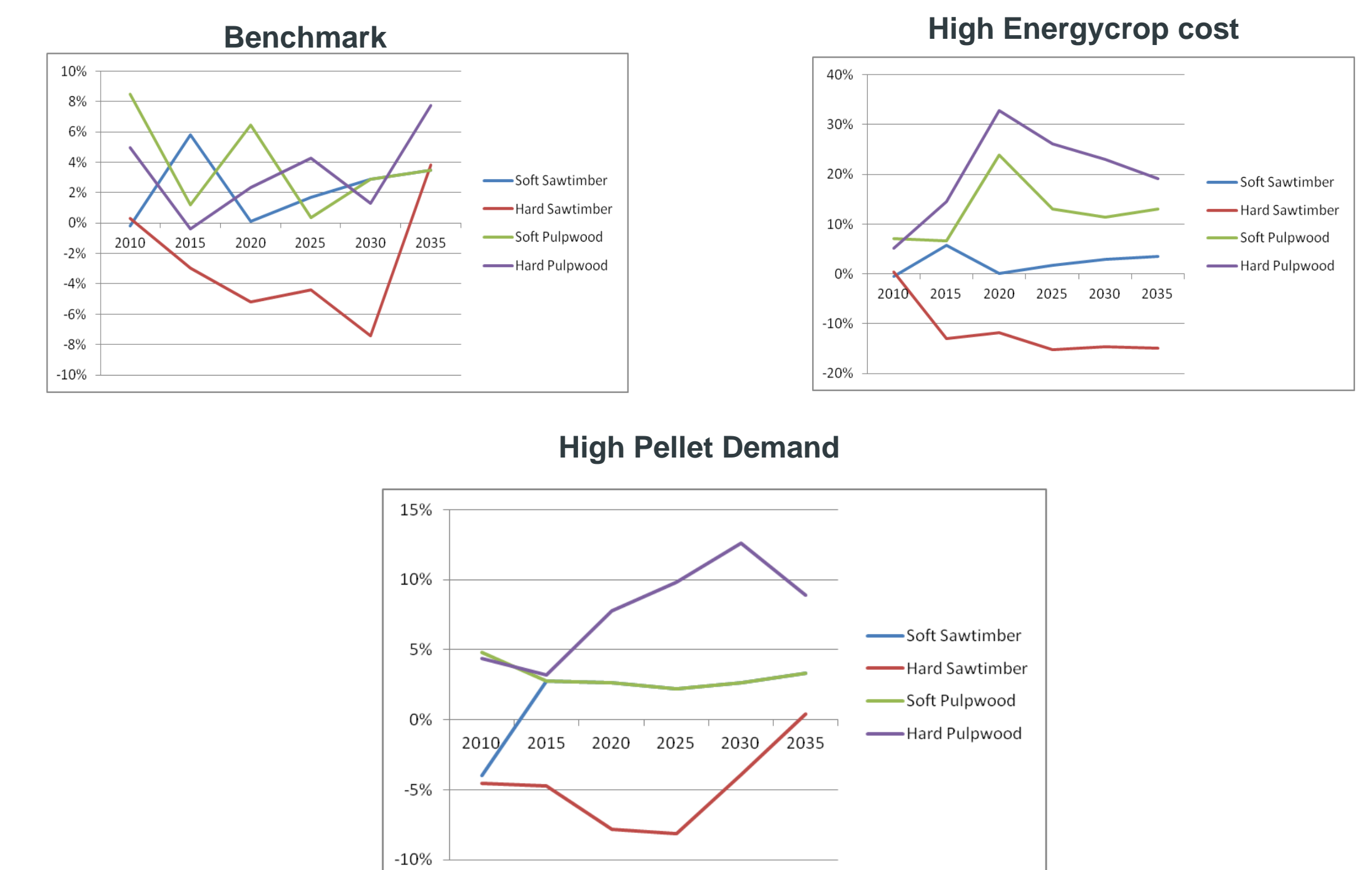
Distribution of Forest Land and Biomass



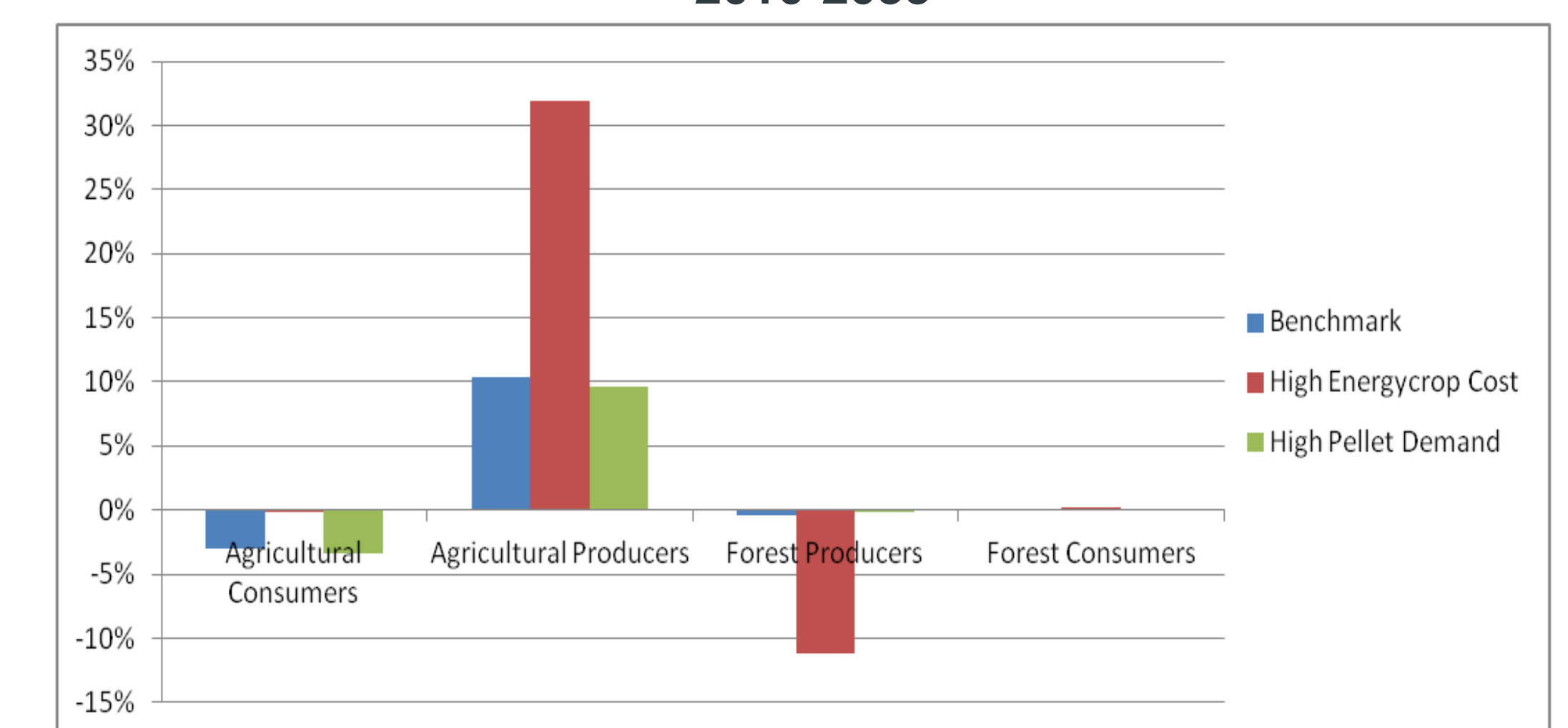
Acreage under Cellulosic Feedstocks in 2035, Benchmark



Percentage Change in Timber Prices Relative to BAU

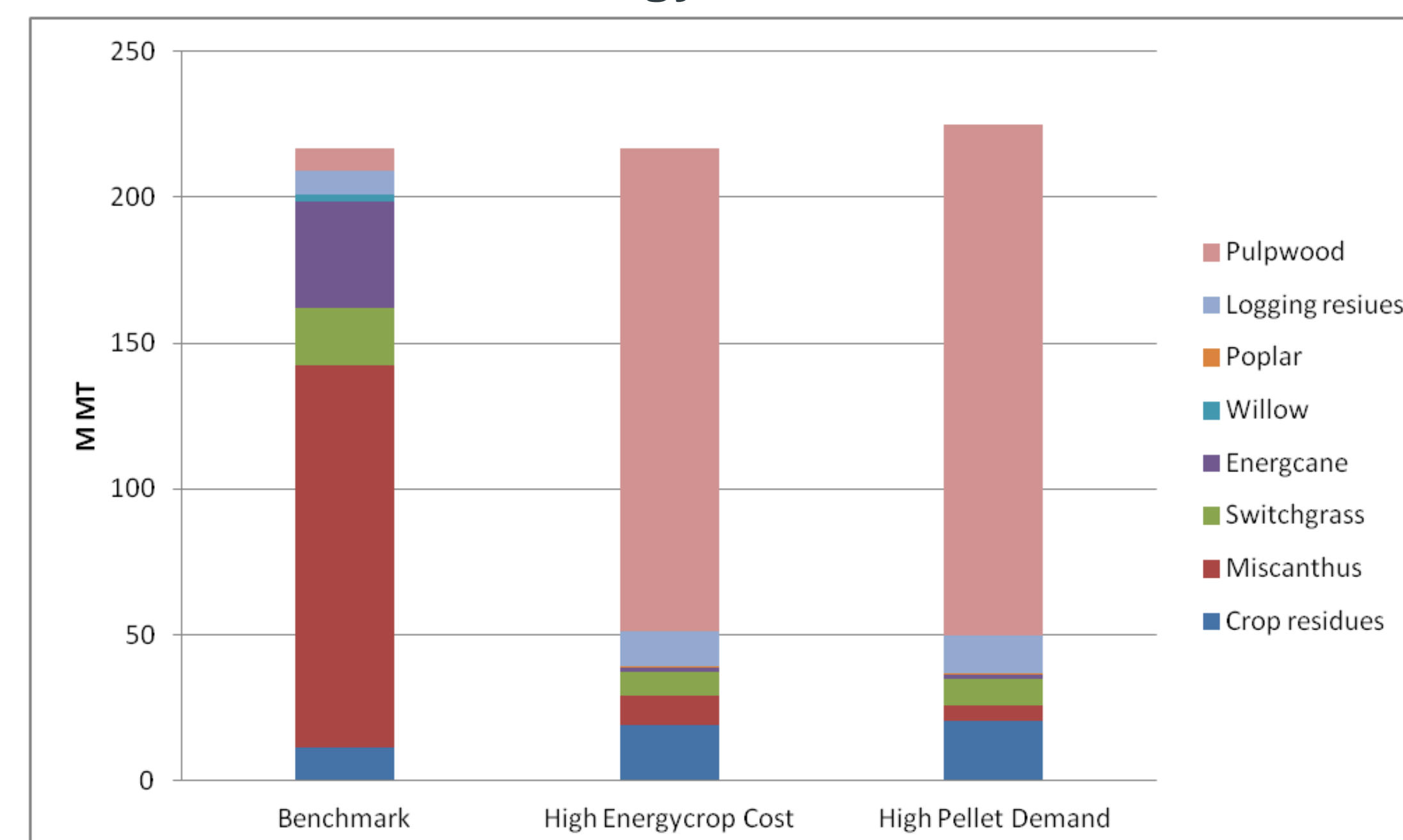


Change in Timber Prices and Social Welfare Relative to BAU, 2010-2035



Results

Mix of Bioenergy Feedstocks in 2035



“High Energycrop Cost” : production cost of energy crops are about 20% more than benchmark case
 “High Pellet Demand” : double of wood pellets demand in benchmark case

Conclusions

- Differences in parametric assumptions significantly change the mix of bioenergy feedstocks
- High yielding energy crops such as miscanthus plays a leading role in fulfilling the biomass demands
- With the absence of energy crops, pulpwood and logging residues contribute more than 80% of total biomass
- Woody biomass as a major feedstock for bioenergy would cause more forestland pasture to be converted to forest land and significantly increase pulpwood price

* Funded by the Energy Foundation and Energy Biosciences Institute