

# Economic considerations and current status of woody biomass feedstock availability in Mississippi

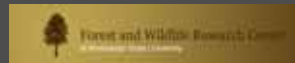
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# Presentation outline

1. Mississippi's potential for bioenergy
2. Production costs
3. Availability of woody biomass across MS regions
4. Expected cost and supply of woody biomass
5. Impacts of bioenergy development
  - Output, employment, value-added
  - Corn ethanol expansion
  - Hardwood versus fiber production (regeneration trends)
6. Conclusions



# Background

- Energy security, environment, and economic development
- Energy goals:
  - Increase ethanol fivefold by 2017
  - 30 x '30 Billion-ton study (Perlack and others)
  - 25 x '25 Vision
- Biomass: a good alternative to fossil fuels
  - Cheap, abundant, clean, good yield, etc.

# Mississippi's forest potential

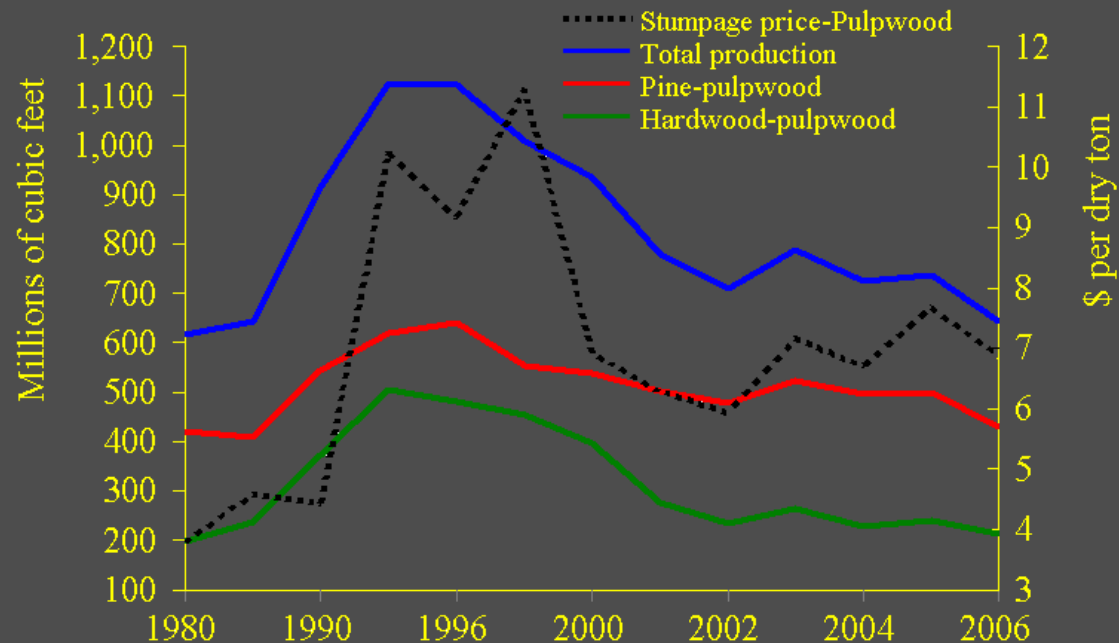
Mississippi's forest area:  
19.8 million acres (67%  
of total area)

- Hardwood: 9.2 million acres
- Pine: 7.6 million acres
- Oak-Pine: 2.9 million acres

- Total production 1.2 billion ft<sup>3</sup>

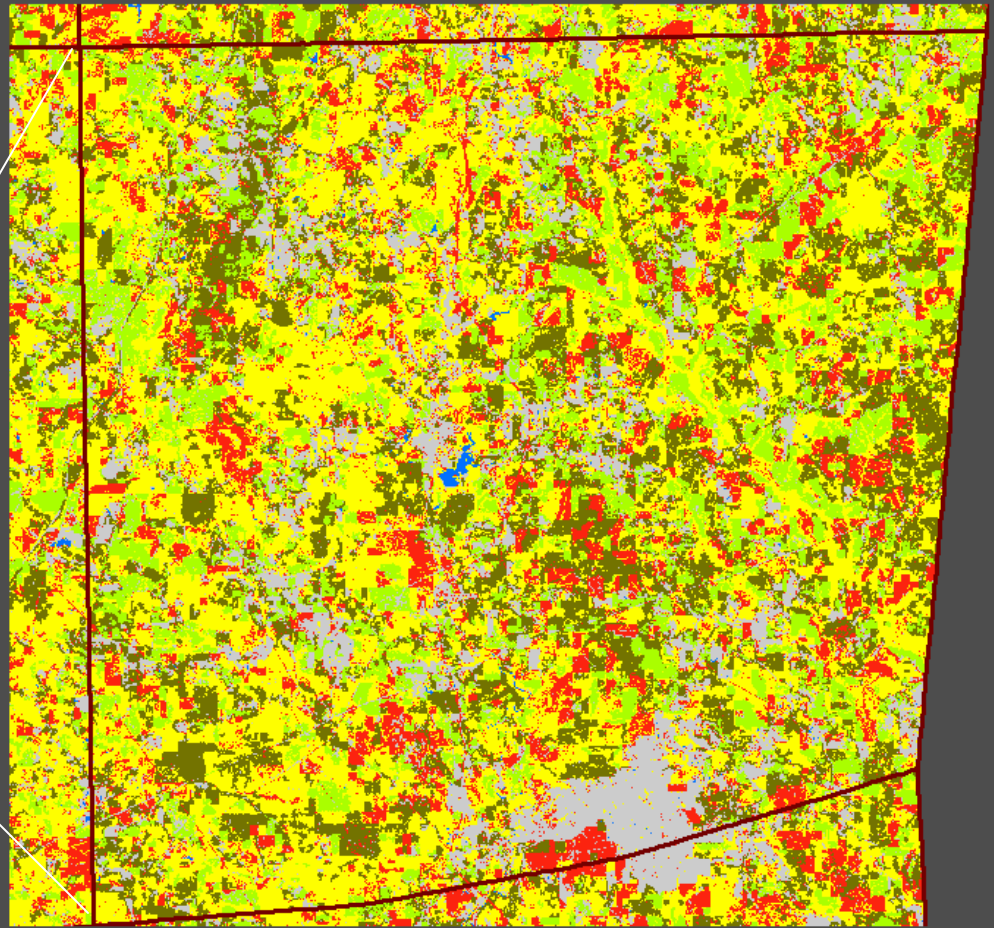
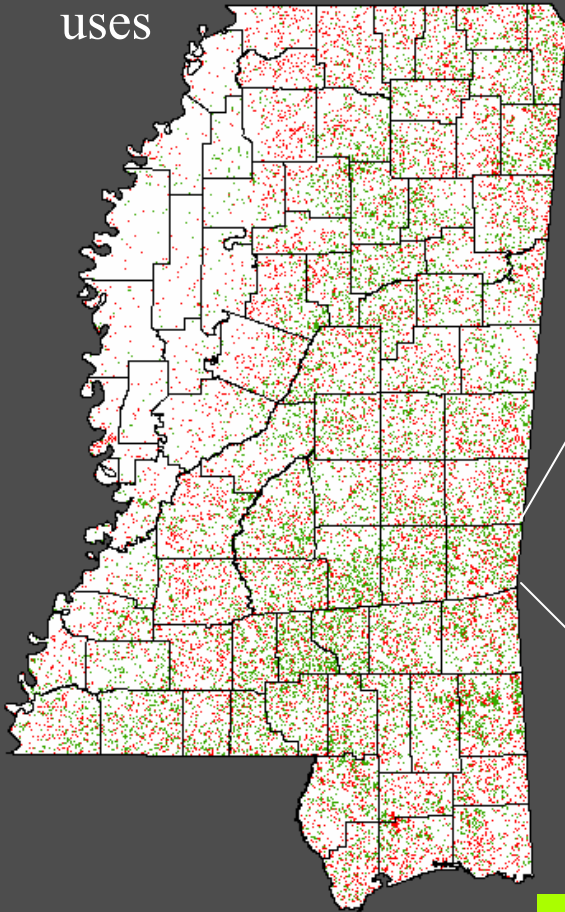
- It has been steadily reducing to 1990's levels



- Timber production value (2002): \$1.2 billion



# Land use, stand structure changes

One million acres have been converted to forestry uses



-  Juvenile stands → Thinning
-  Regeneration

Source: Mississippi Institute for Forest Inventory (MIFI)

# High potential for woody biomass in MS

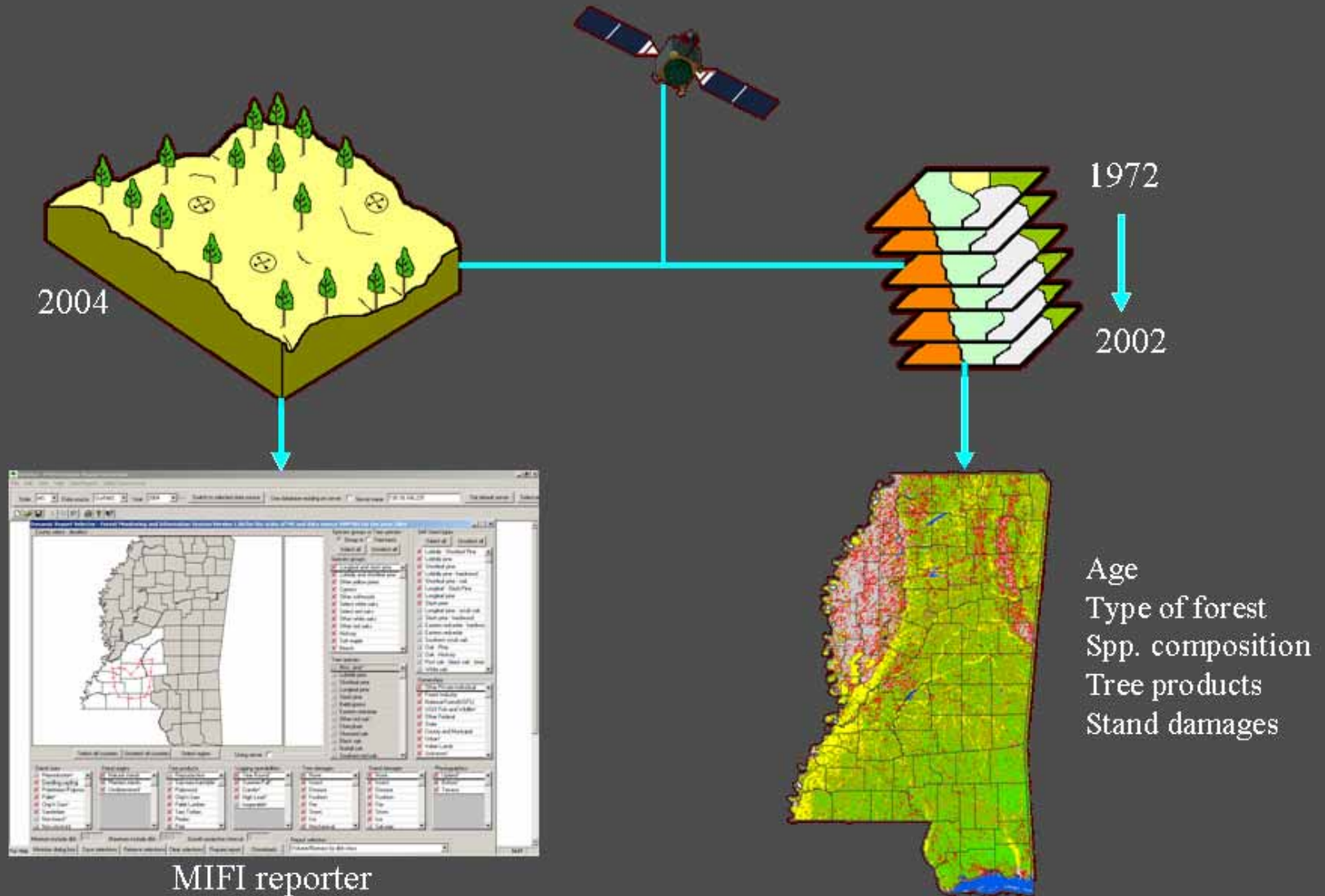
1. Additional revenue for landowners
2. Impacts on region's economy
3. Sources of woody biomass:
  - Logging residues
  - Thinning of young, overstocked stands
  - Urban waste
  - Mill residues



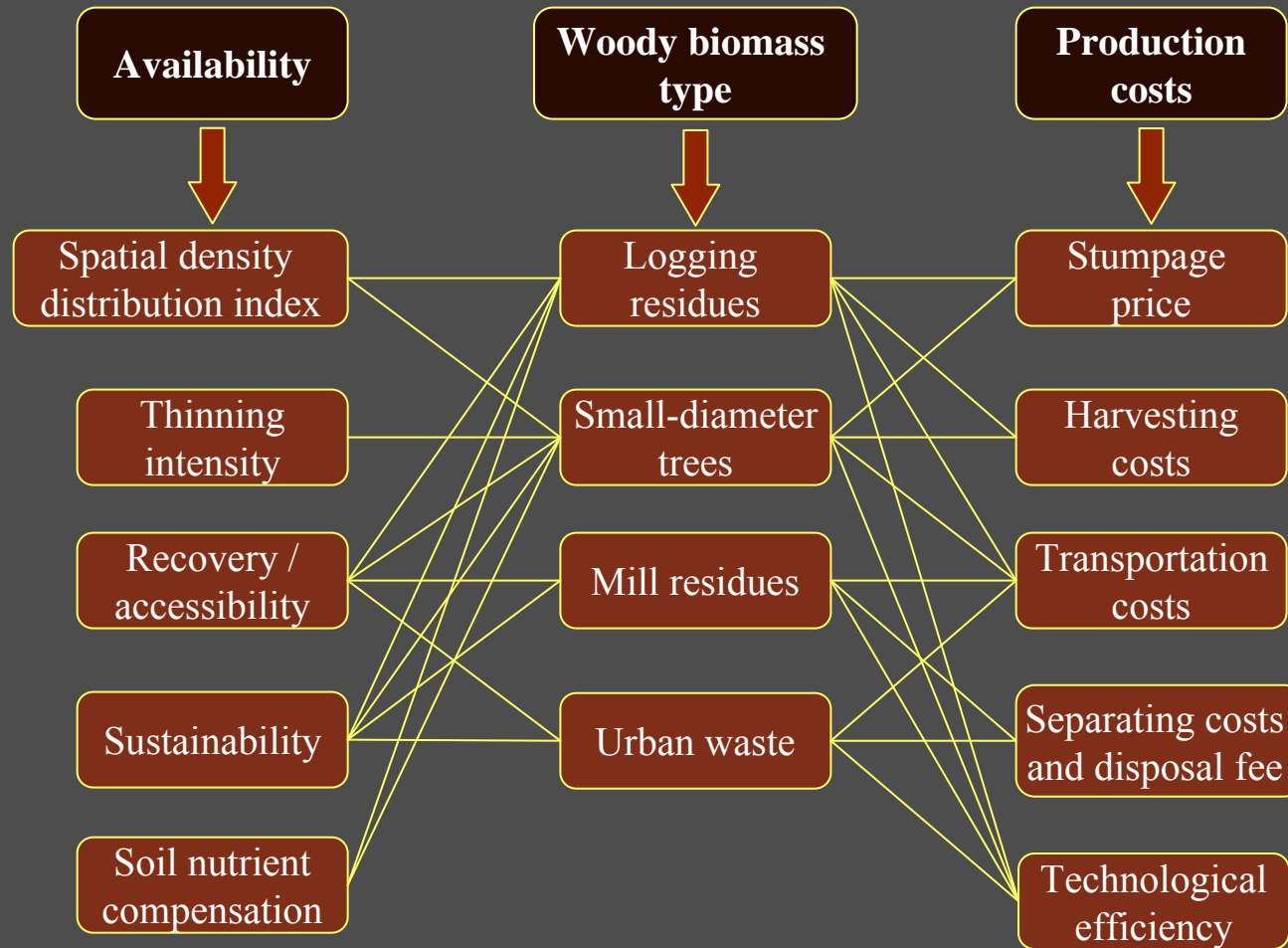
# Objectives

1. Estimate woody biomass availability for bioenergy conversion in MS
  - Stand density index (small-diameter trees)
  - Spatial density distribution (logging residues and small-diameter trees)
  - Sustainability of resources
2. Evaluate costs of production
  - Variability of stumpage, harvesting, and transportation costs
3. Analyze in-state impacts of bioenergy development in MS

# Mississippi Institute for Forest Inventory (MIFI)

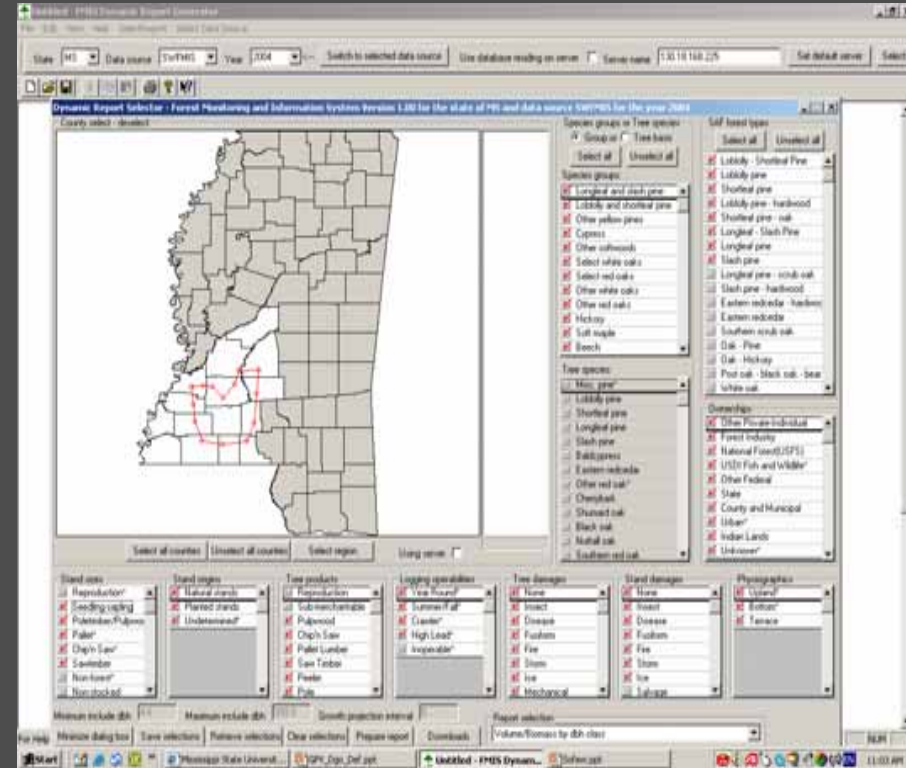


# Empirical framework



# Sources of information

- *Logging residues*, FIA TPO databases (1995, 1997, and 2002)
- *Small-diameter trees*, MIFI, FIA
- *Mill residues*, FIA, state surveys (Garrard and Leightley 2005)
- *Urban waste*, MS DEQ, US census
- *Production costs*, Timber Mart-South, local reports



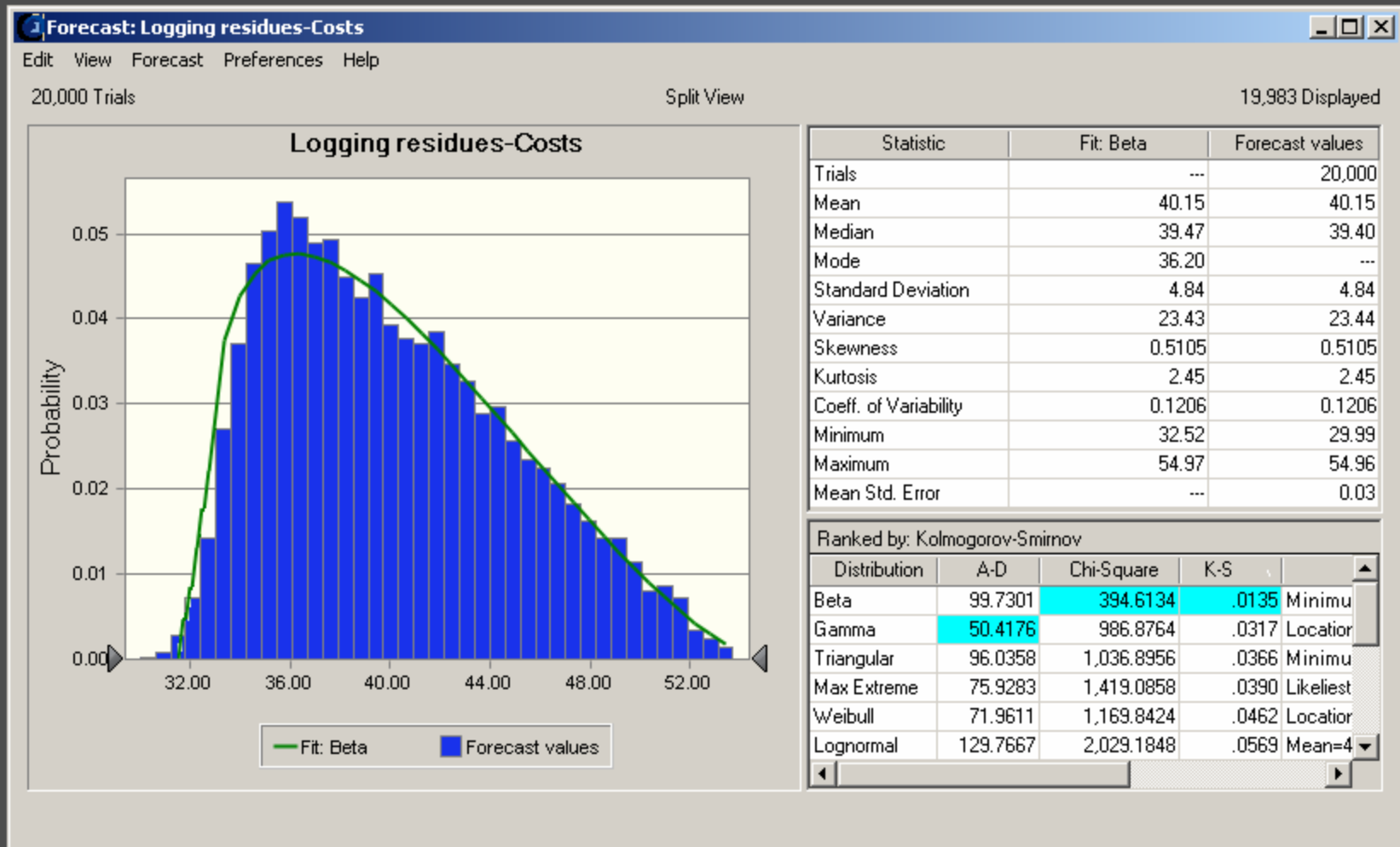
Available at <http://www.mifi.ms.gov/mission.htm>

# Woody biomass production costs

Costs	Logging residues	Small-diameter trees	Mill residues	Urban waste
Harvest (\$/dry ton)	5.82	12.66	0.00	0.00
Transportation				
Fixed (\$/dry ton)	6.96	6.96	6.96	6.96
Incremental (\$/dry ton/mile)	0.17	0.17	0.17	0.17
Cost (50mile-radius) (\$/dry ton)	15.46	15.46	15.46	15.46
Profit to logger (\$/dry ton)	3.19	4.22	2.32	2.32
Residual stumpage value (\$/dry ton)	4.70	5.99	0.00	0.00
Delivery price (\$/dry ton)	29.17	38.33	17.78	17.78
Chipping cost (\$/dry ton)	5.06	5.06	0.00	5.06
Selling, disposal / separating (\$/dry ton)	0.00	0.00	4.20	5.51
<b>Sum of costs (\$/dry ton)</b>	<b>34.23</b>	<b>43.39</b>	<b>21.98</b>	<b>28.35</b>

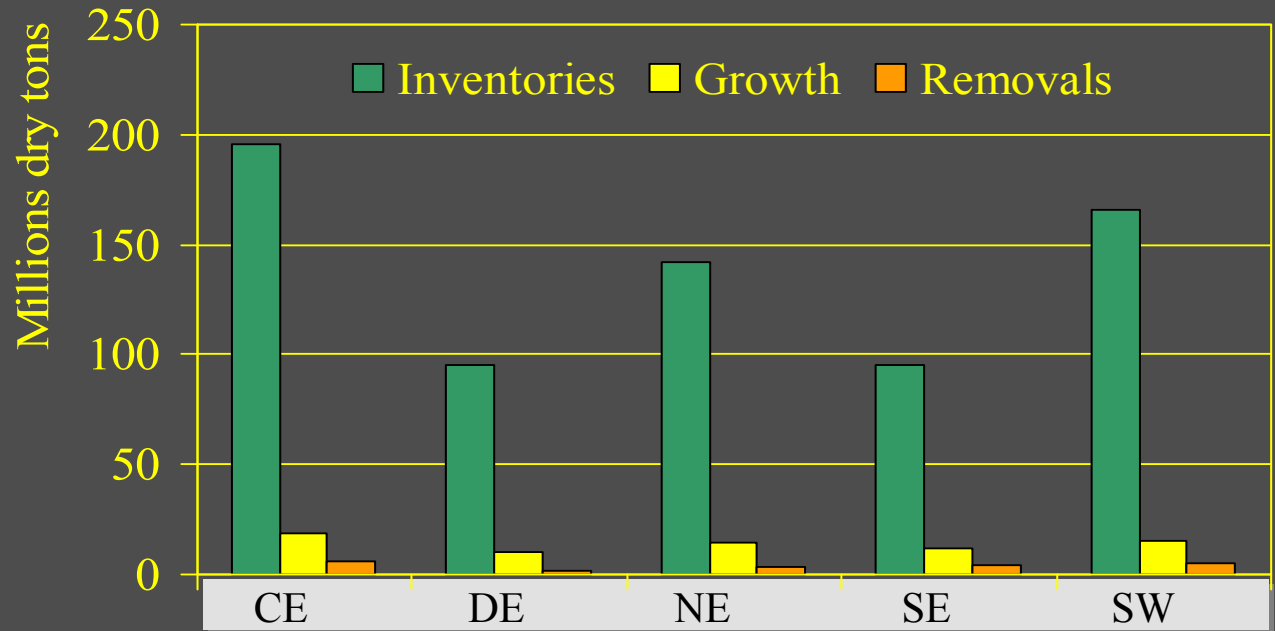
Source: Timber Mart-South, Petrolia (2006), Stuart and others (2006).

# Monte Carlo simulation of production costs

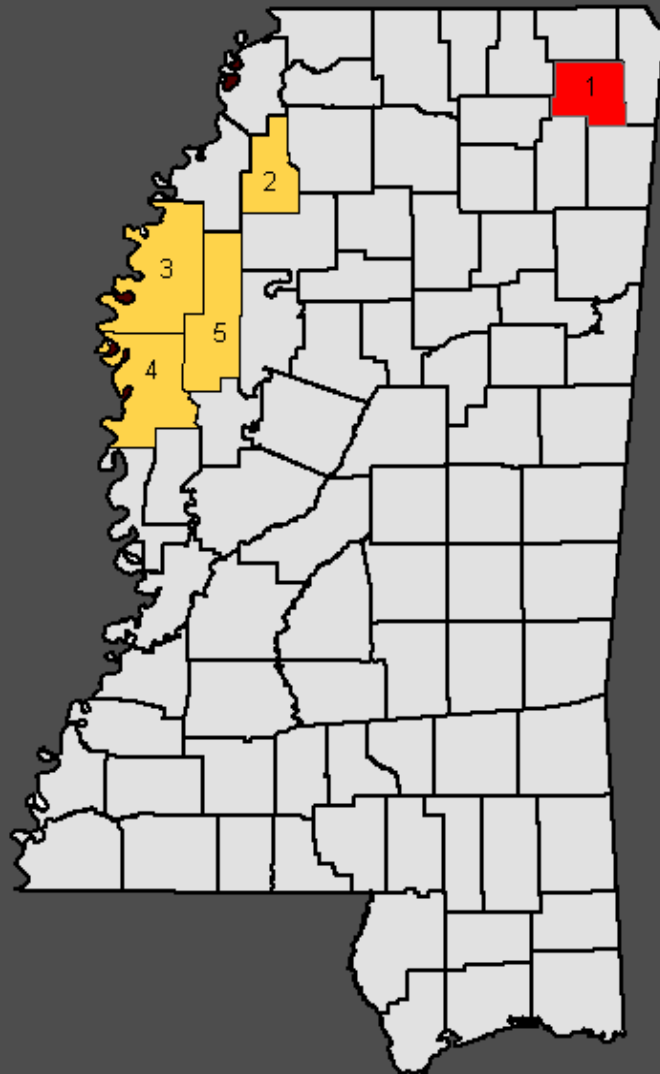


# Results

## Standing stocks



# Spatial, density restrictions



## Small diameter trees\*

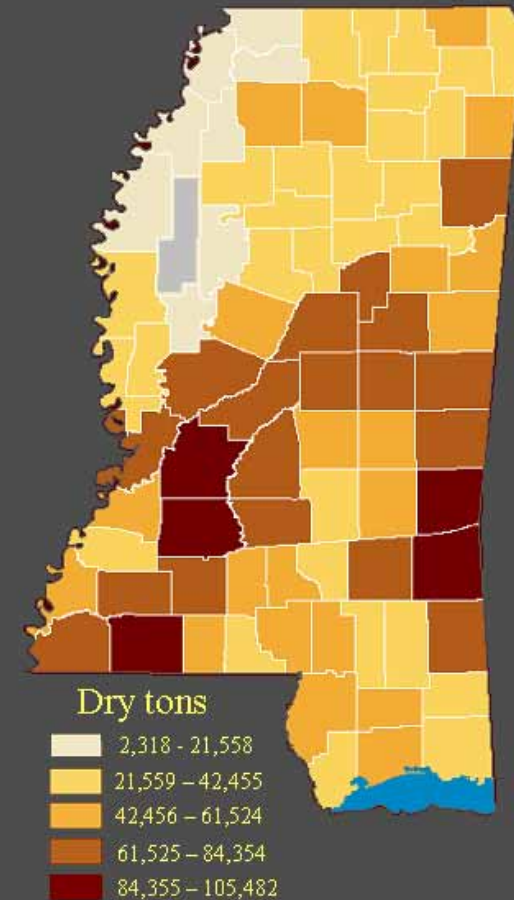
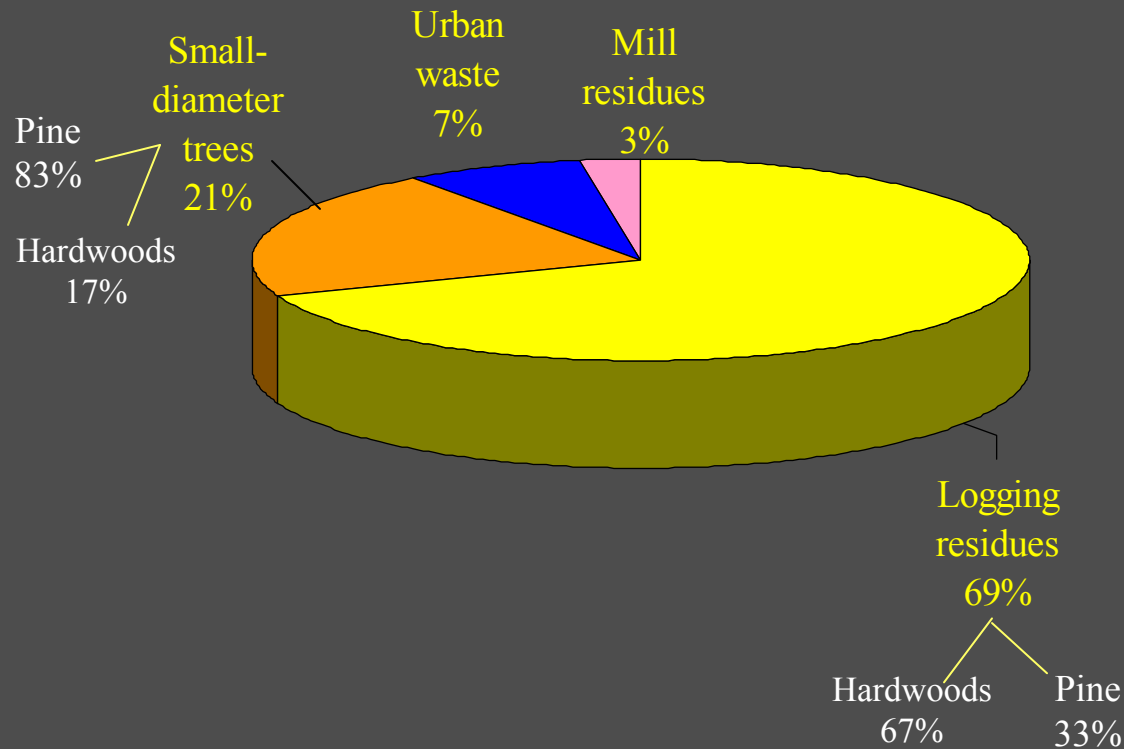
- Low spatial distribution index
- Low SDI

- 1 Prentiss
- 2 Quitman
- 3 Marshall
- 4 Washington
- 5 Sunflower

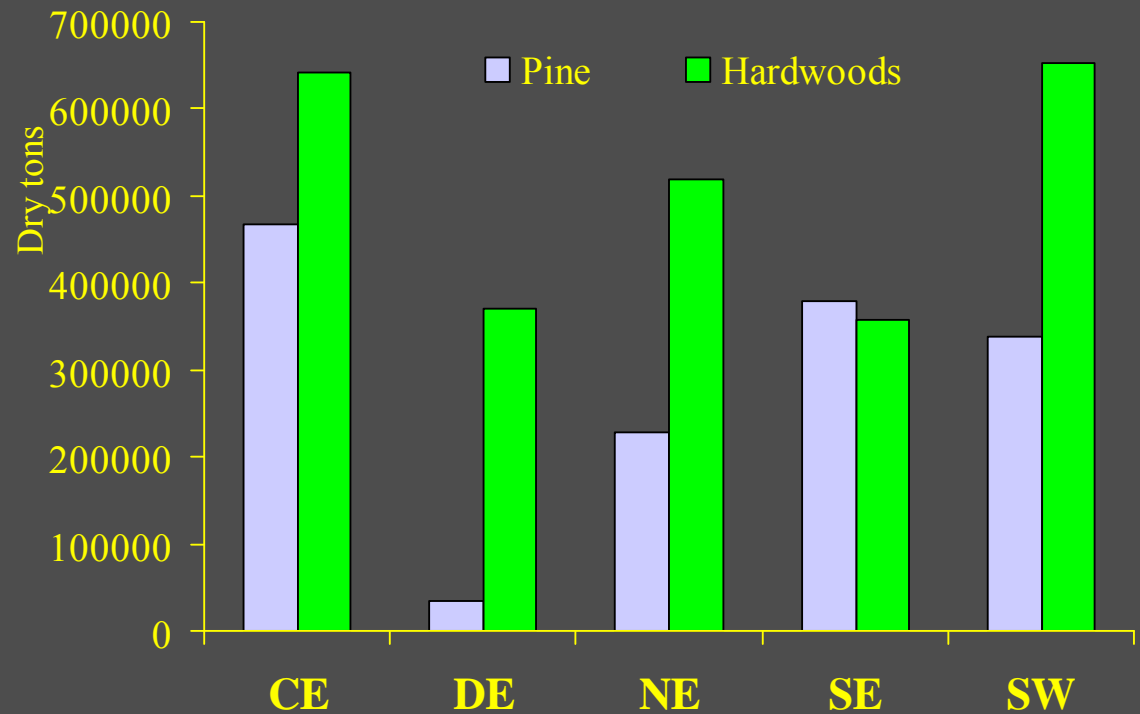
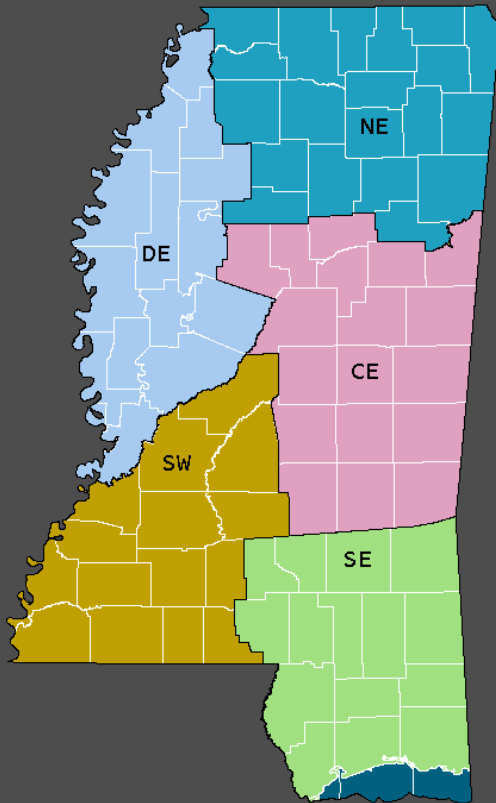
\* The actual spatial density of logging residues was larger than the minimum spatial distribution index in all counties (except in Sunflower county)

# Available biomass

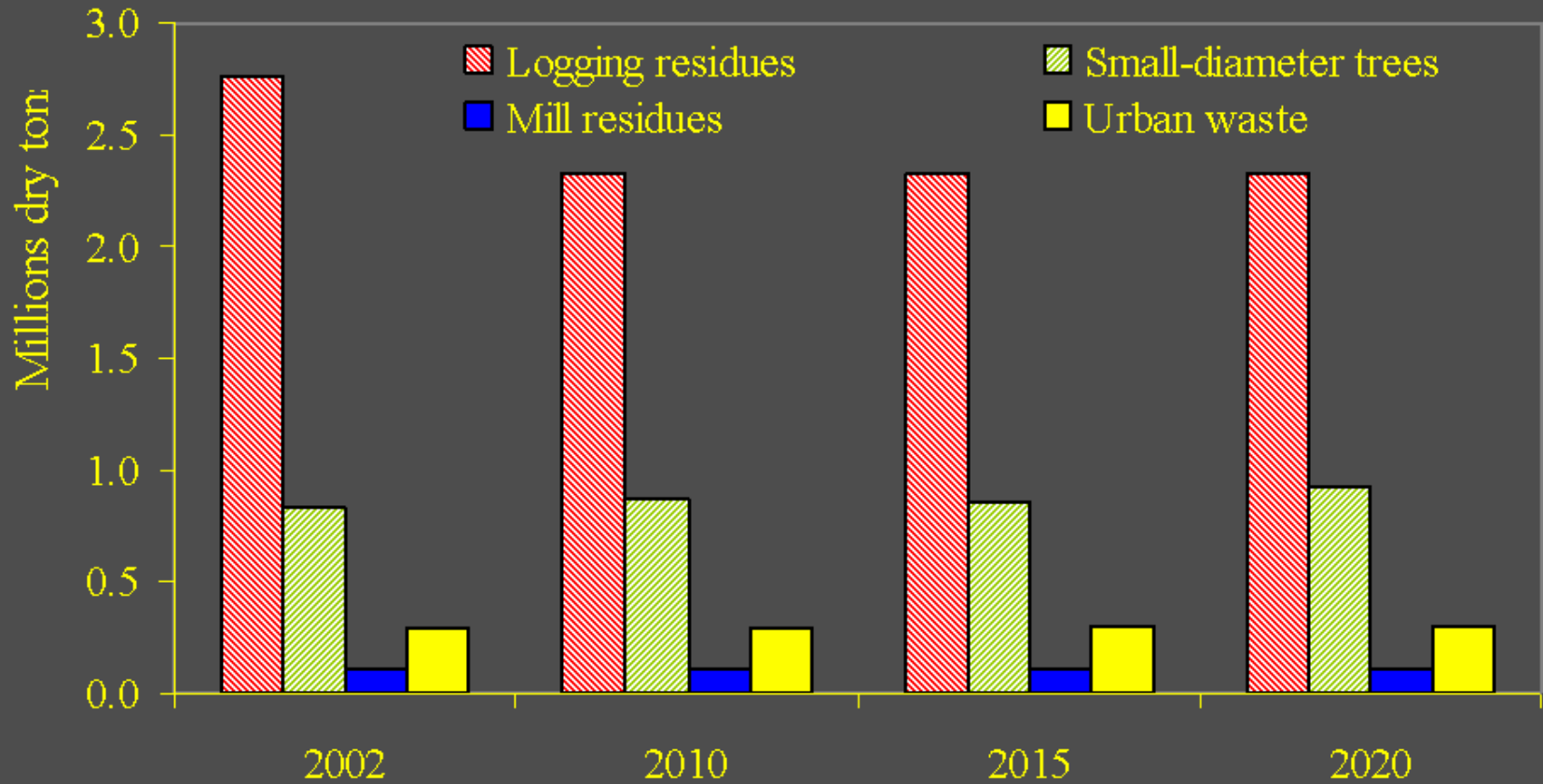
Available biomass per year:  
4.0 million dry tons



# Availability of woody biomass by species groups



# Biomass projections



# Expected Cost of woody biomass

(50-mile procurement radius and plant capacity at 52 million gallons of ethanol per year)

Logging residues



\$40 / dry ton

Small-diameter trees



\$49 / dry ton

Mill residues

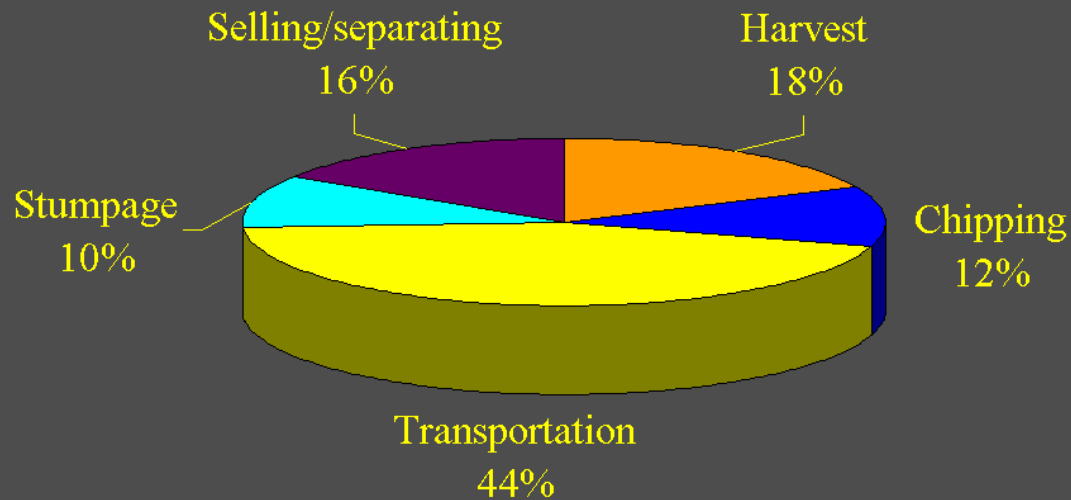


\$31 / dry ton

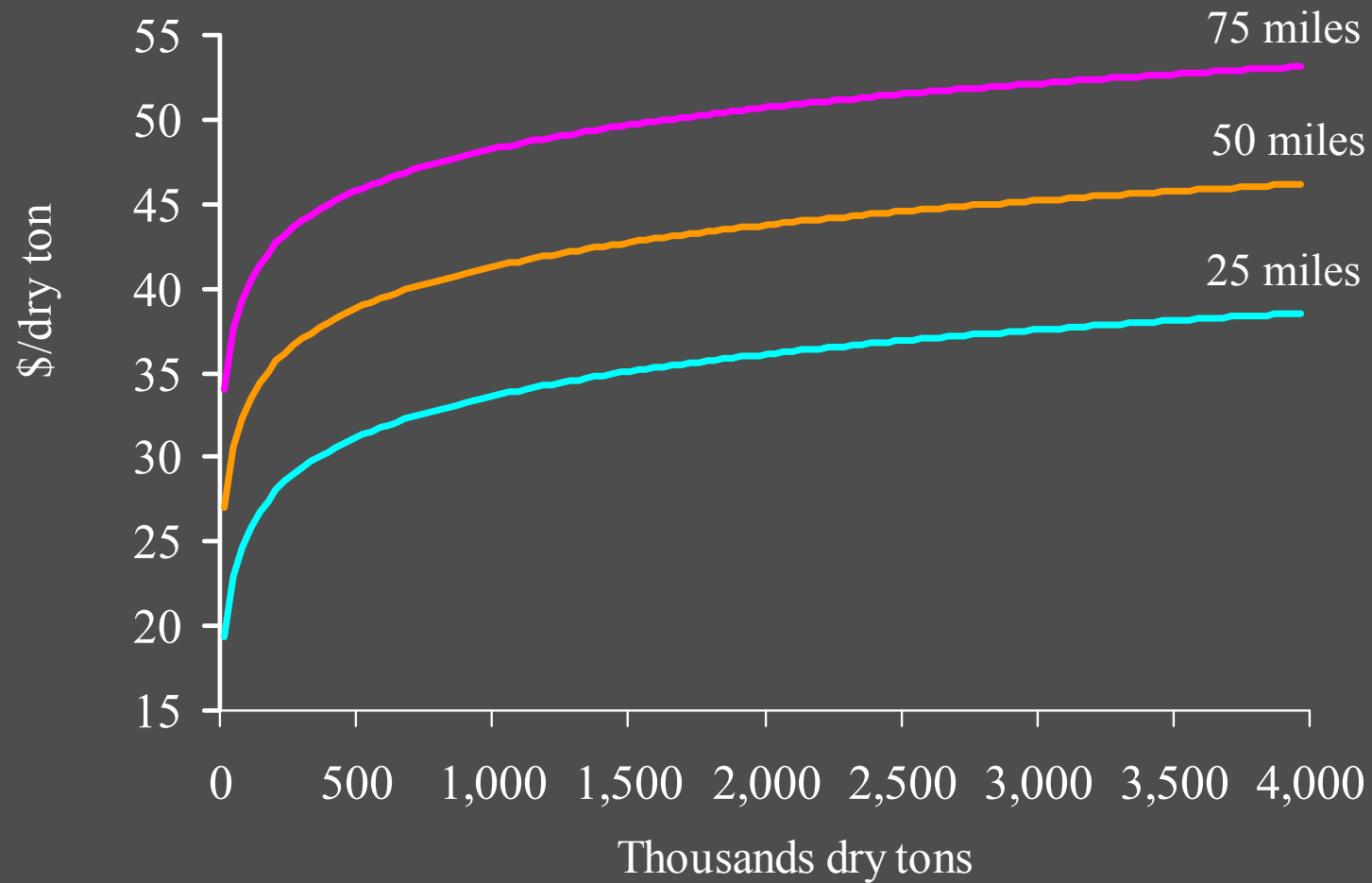
Urban waste



\$36 / dry ton



# Supply curves (After Monte Carlo simulation)



# Impacts of woody biomass utilization for bioenergy purposes

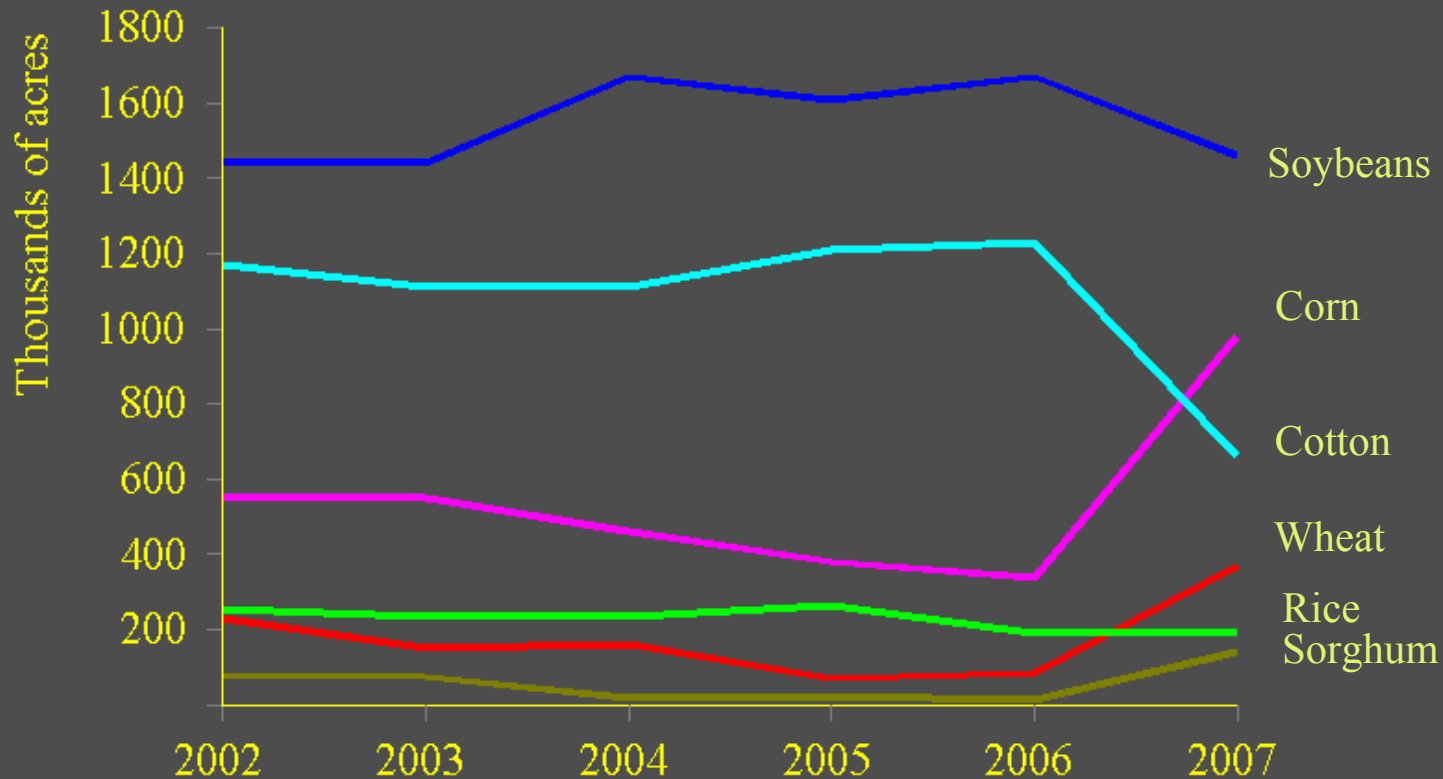
- Increase of jobs, wages, expenditures, and regional production

MIFI Region / industry	Multipliers		
	Employment (# of jobs)	Output (\$)	Value-added (\$)
CE	2.57	1.58	1.91
DE	2.62	1.56	1.78
NE	2.43	1.57	1.91
SE	2.02	1.53	1.77
SW	2.32	1.63	2.09

Source: IMPLAN 2004 Database, REMI (2006), Gan and Smith (2007)

# Impacts of woody biomass utilization for bioenergy purposes (continued..)

- No expected changes in forestland trends (e.g., conversion to other land uses) due to corn expansion

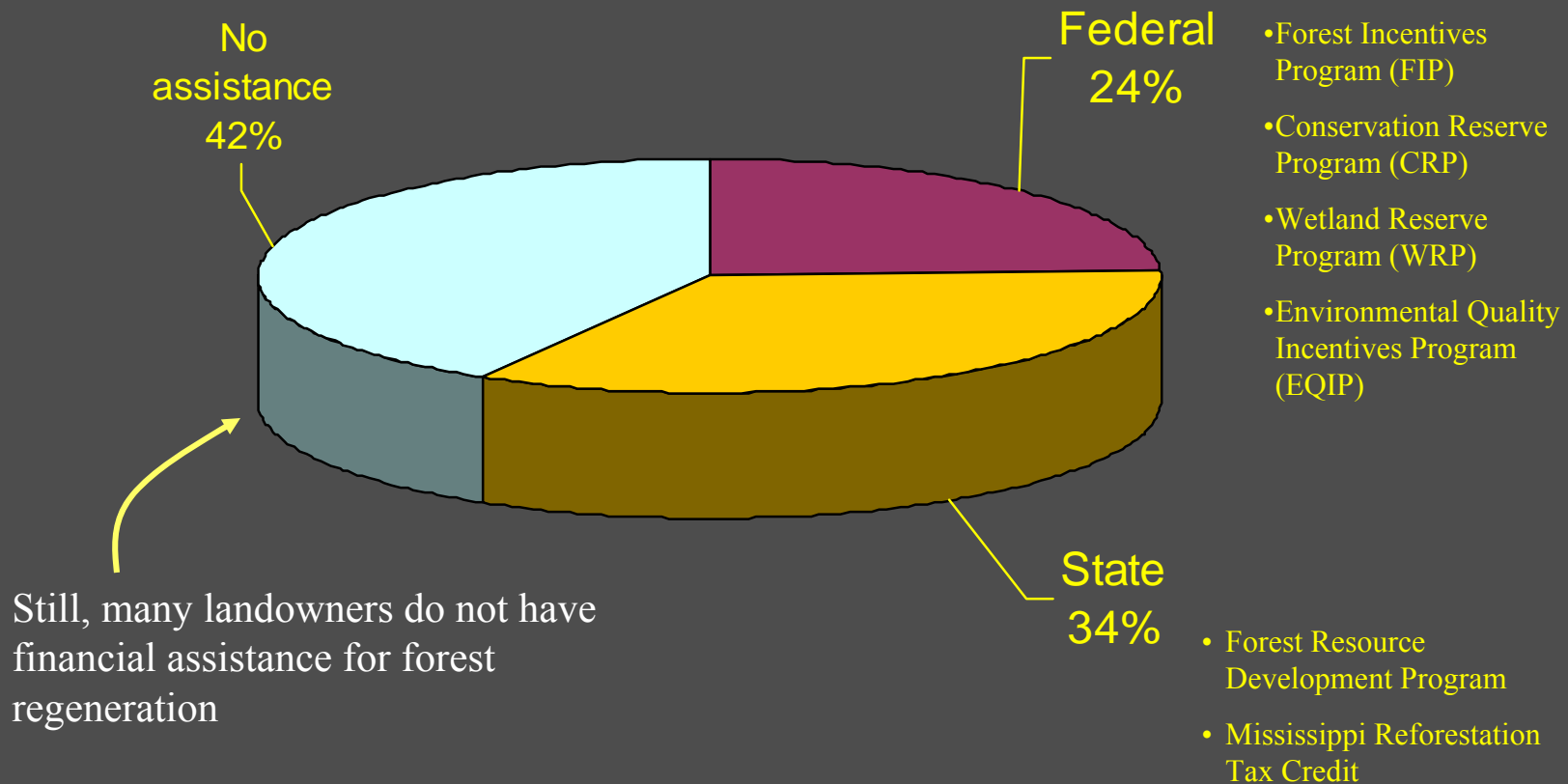


Source: USDA Economic Research Service, 2007

- In fact, forest lands increased more than one million acres in the last 10 years (thanks to CRP, WRP, and state programs)

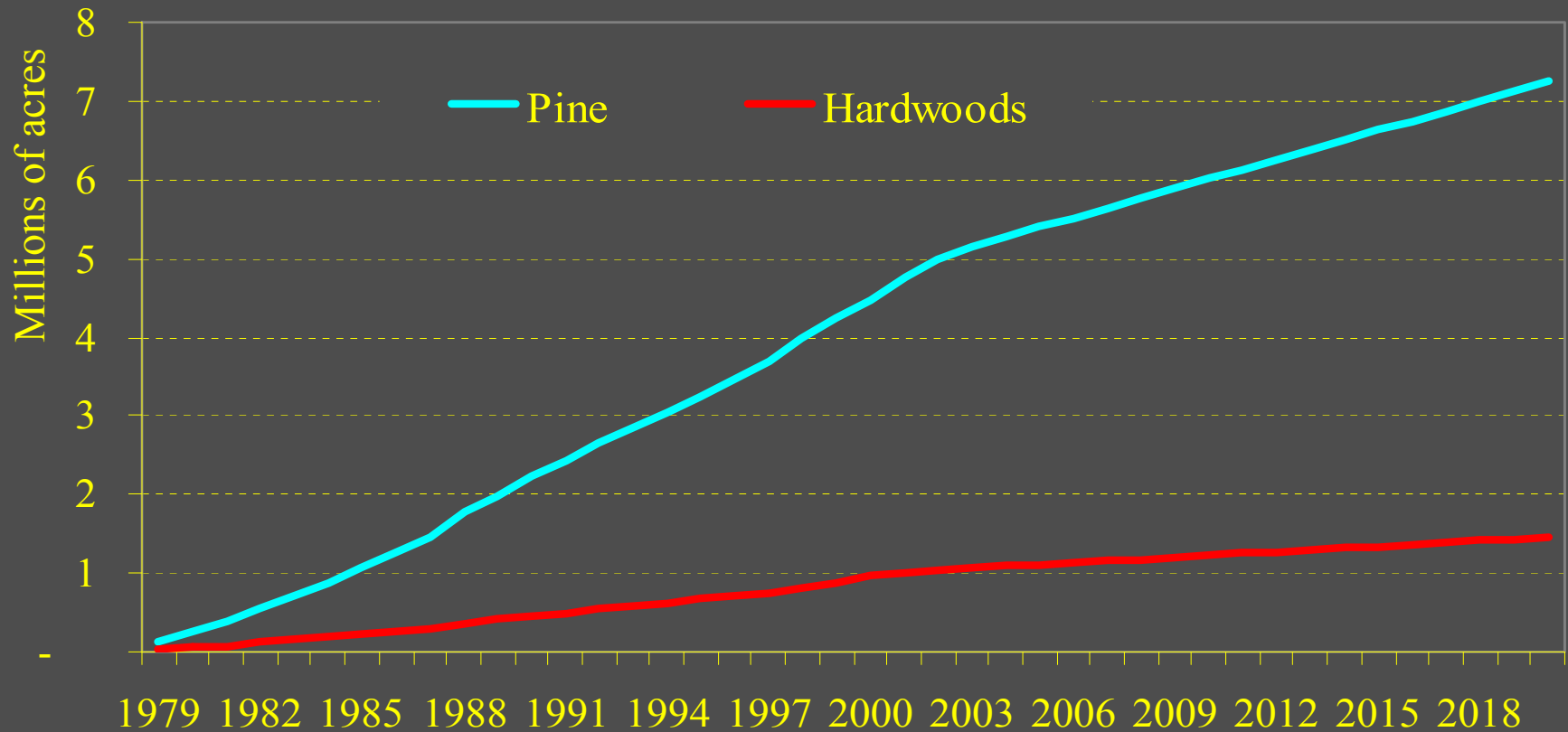
# Impacts of woody biomass utilization for bioenergy purposes (continued..)

## Financial assistance for forest regeneration for NIPF



# Impacts of woody biomass utilization for bioenergy purposes (continued..)

Historical trends and projected forest regeneration by species group



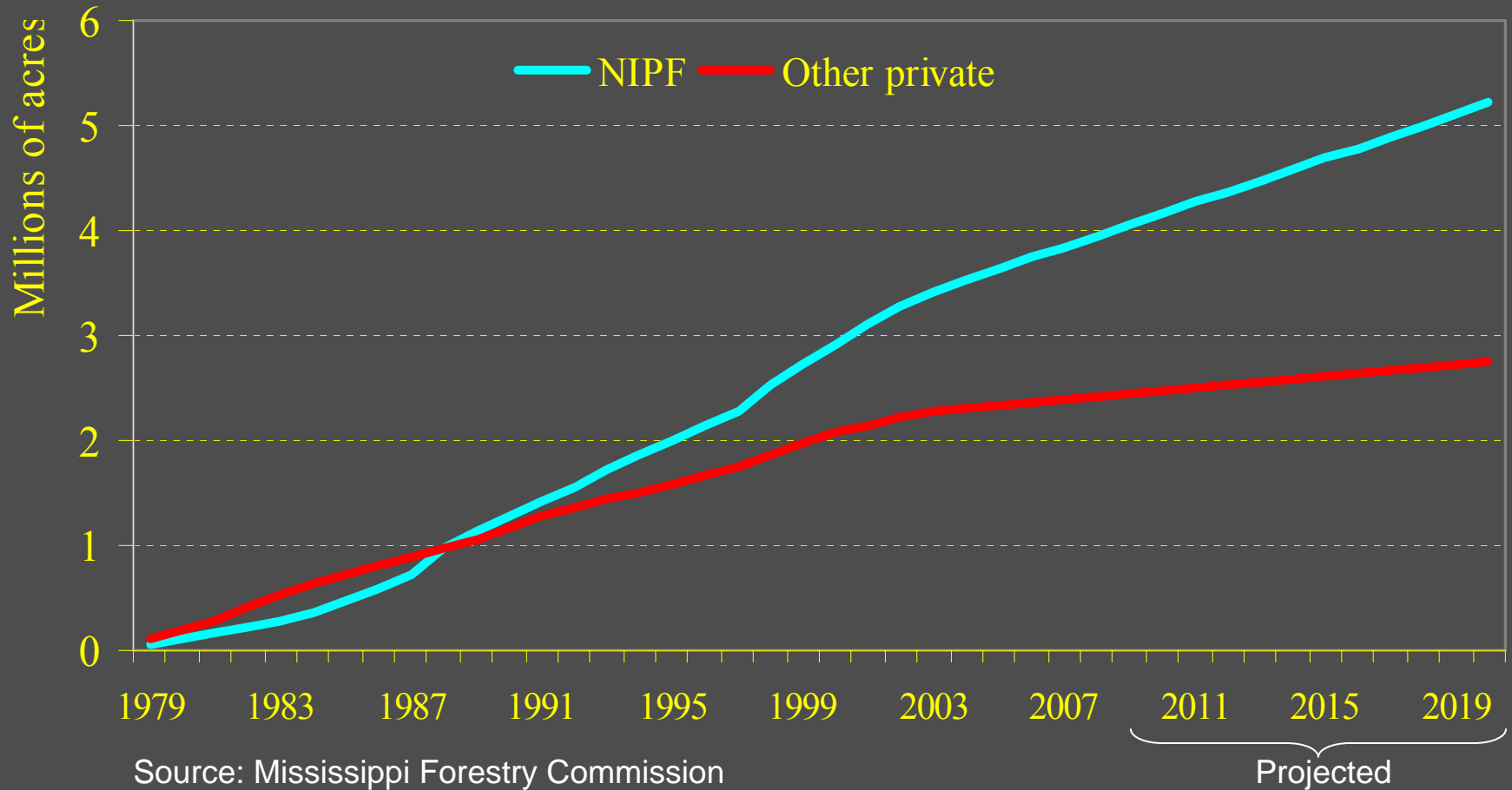
Source: Mississippi Forestry Commission

Projected

These trends suggest less carbon stored as a result of less hardwoods planted

# Impacts of woody biomass utilization for bioenergy purposes (continued..)

Historical trends and projected forest regeneration by  
ownership type



# Conclusions

- Landowners can benefit from new markets for small-diameter products and logging residues
- Development of cellulosic ethanol could bring several benefits to local economy
- About 4 million dry tons of woody biomass are available each year in MS
  - It can generate about 1,000 MW of electricity or 320 millions of gallons of ethanol
- The largest feedstocks, logging residues (69%), can be produced at \$40/dry ton
- Transportation costs accounts for more than 40% of total production costs

# Conclusions

- The expansion of corn ethanol has brought a redistribution of crop lands. However, no impacts on forest lands conversion into agricultural uses are expected in the short term.
- Forest trends suggest that pine plantations will be more likely to occur on old agriculture and converted hardwood-forest lands (Sohngen and Brown 2006).
  - The amount of CO<sub>2</sub> stored (woody biomass) is different for hardwoods and pine. It could be possible that less CO<sub>2</sub> would be stored in the next years
- More research is necessary to analyze landowners' perceptions toward bioenergy development