

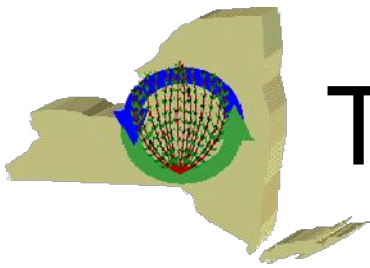
WOODY BIOMASS FEEDSTOCK

A yellow harvester is harvesting woody biomass in a field. The harvester is positioned on the left, and a red tractor with a trailer is on the right. The harvester's long arm is extended, dumping the harvested material into the trailer. The background shows a field of tall, thin woody plants under a clear blue sky.

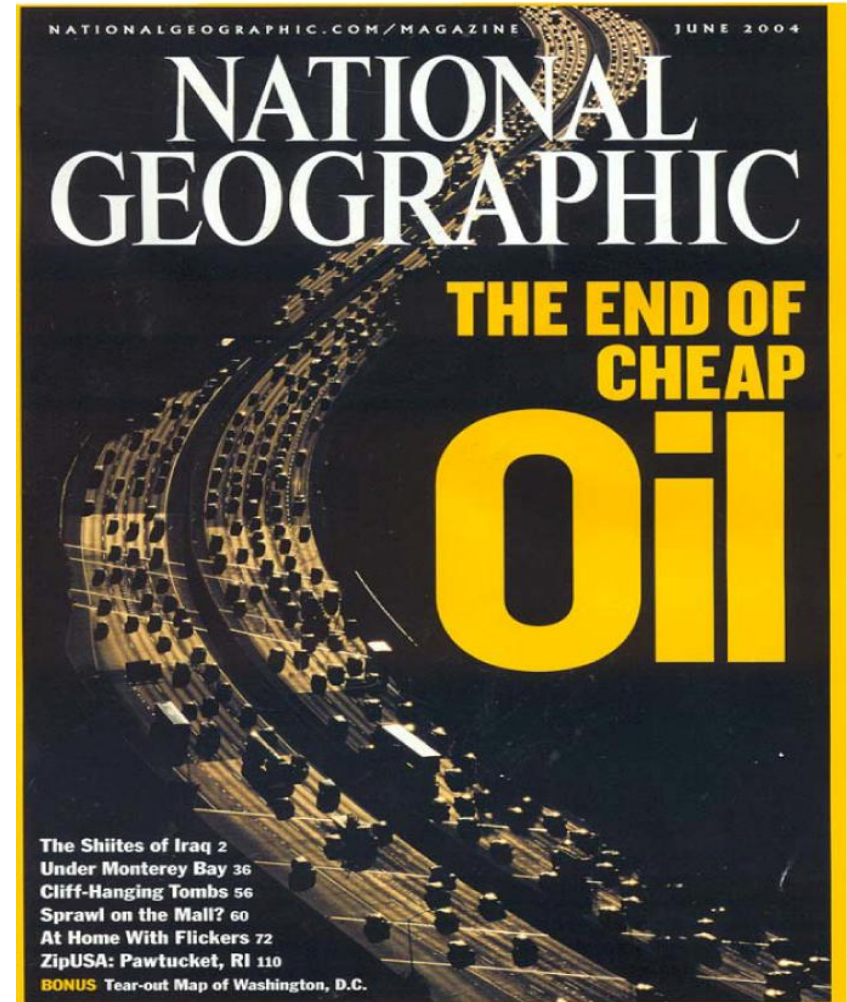
**E.H. White, L.P. Abrahamson, T.A. Volk, L.B. Smart and
T.E. Amidon**

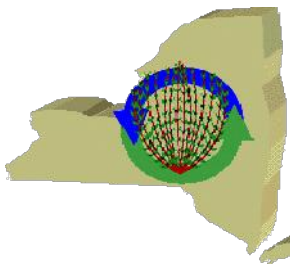
**SUNY - Center for Sustainable and Renewable Energy
SUNY- College of Environmental Science & Forestry
Syracuse, NY**

**Biomass and Energy for the Great Lakes Economy, June 9, 2008
Kingston, Ontario**



The Global Energy Situation





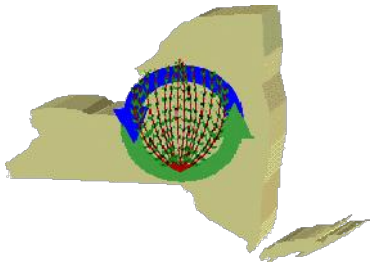
The President's Biofuel Initiative

“America is addicted to oil...”

“...ethanol not just from corn, but from wood chips and stalks or switch grass”

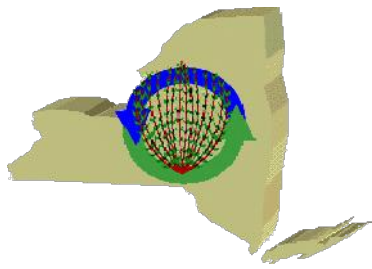
◆ President's Goal:

- Biofuels can be at 35 billion gallons per year by 2017.
- Biomass is the only available renewable energy source that can replace liquid transportation fuels.

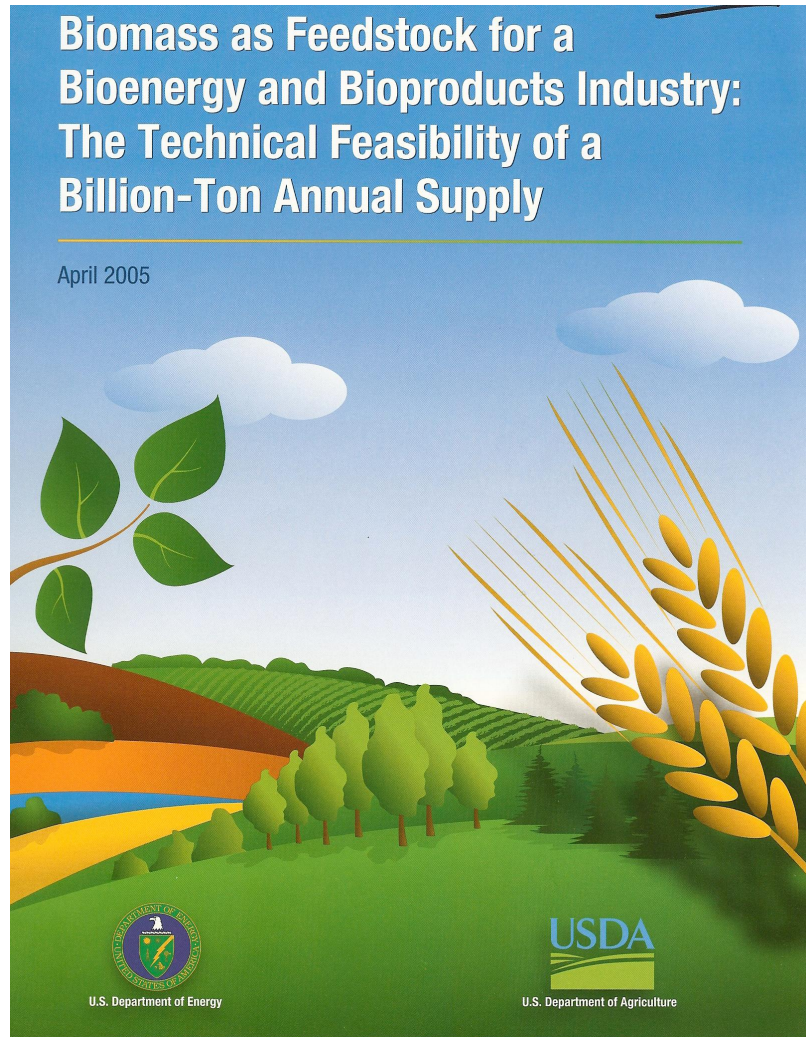


Woody Biomass as biofuels/ oil substitution

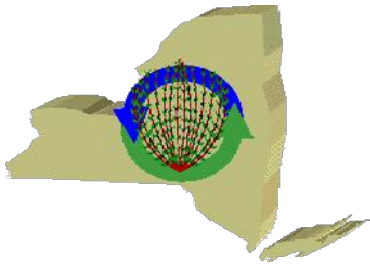
- ◆ National Security
- ◆ Environment
- ◆ Moral Issue
- ◆ Rural Economics
- ◆ Climate Change



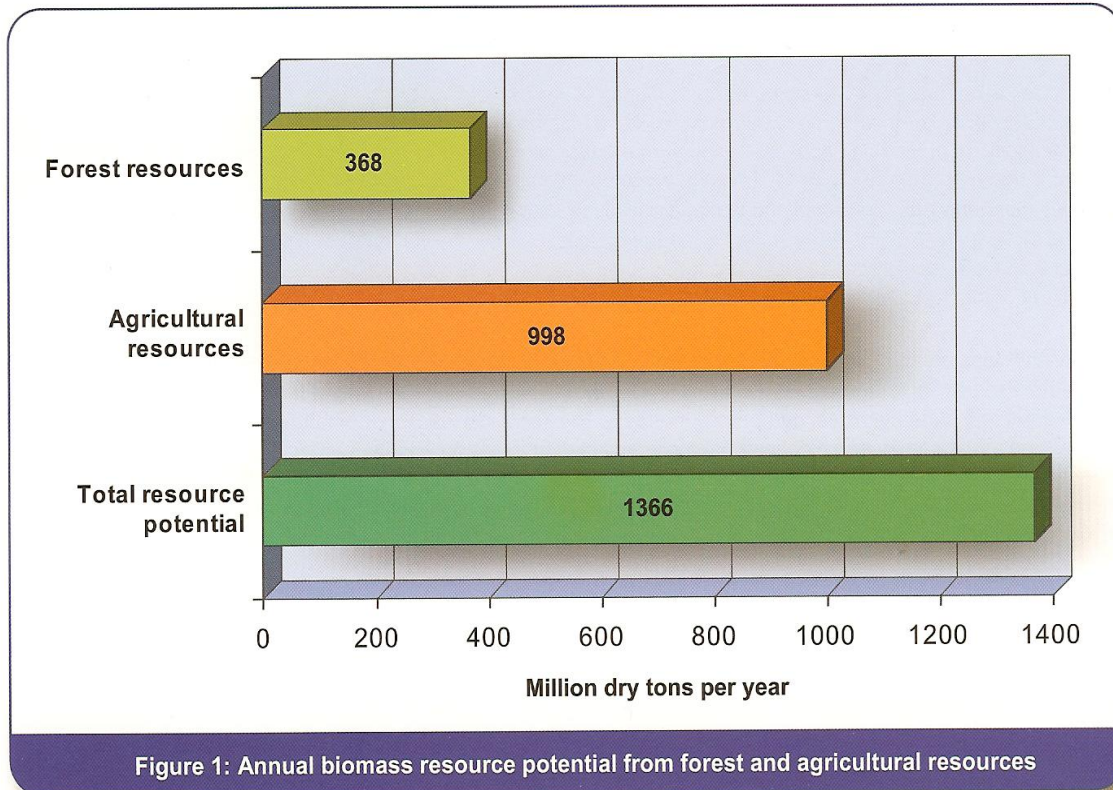
National Biomass Supply



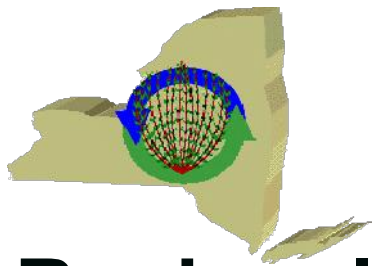
- ◆ Assessment of whether land resources in the US could sustainably produce over 1 billion tons of biomass
- ◆ Enough biomass to replace about 30% of the country's petroleum consumption



National Biomass Supply



- ◆ Over 1.3 billion tons from forest and agricultural land that is currently not being utilized
 - 368 million odt yr⁻¹ from forests
 - 998 million odt yr⁻¹ from agricultural land including 377 million odt from perennial crops

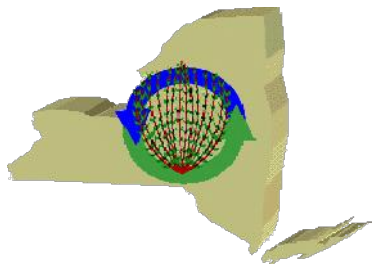


Regional Perennial Energy Crops



Hybrid Poplar





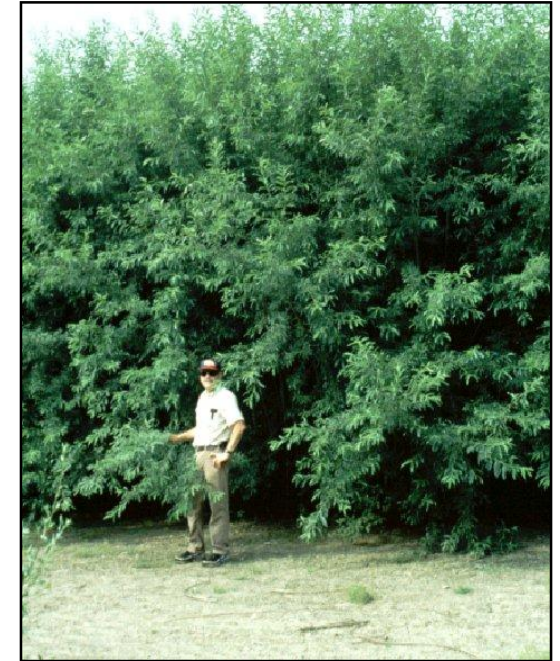
Woody Biomass Feedstocks



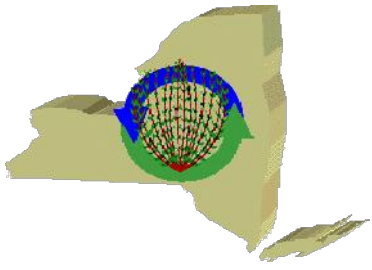
Wood Residues from wood product manufacturers and urban sources



Sustainably harvested low value wood from forests (Commercial and TSI harvests)

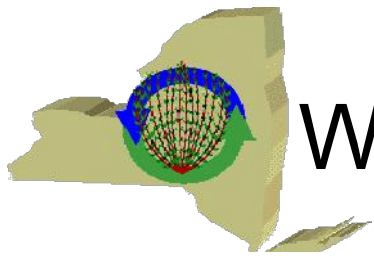


Short-rotation woody crops (willow) grown on under utilized open farm land



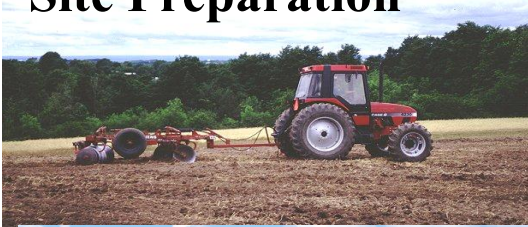
Forest Woody Biomass

- ◆ National net annual growth of forest woody biomass on almost 500 million acres of US timberland exceeds removals by almost 50%
 - » North Central States – 95%
 - » Northeastern States – 125%
 - » New York State – 300%



Willow Biomass Production Cycle

Site Preparation



Plant



Coppice



Three-year-old after coppice



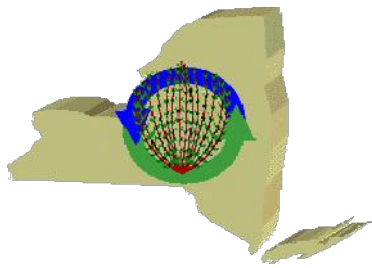
One-year-old after coppice



First year growth



Early spring after coppicing



Bioenergy Benefits

Natural Gas

1 → 0.40

cO₂ Recycled

100 % Carbon Closure

(Assumes 0.1 ton/acre/yr increase in soil carbon)

1J In

55J Out

11-16J Out

Feedstock
Production
(62%)

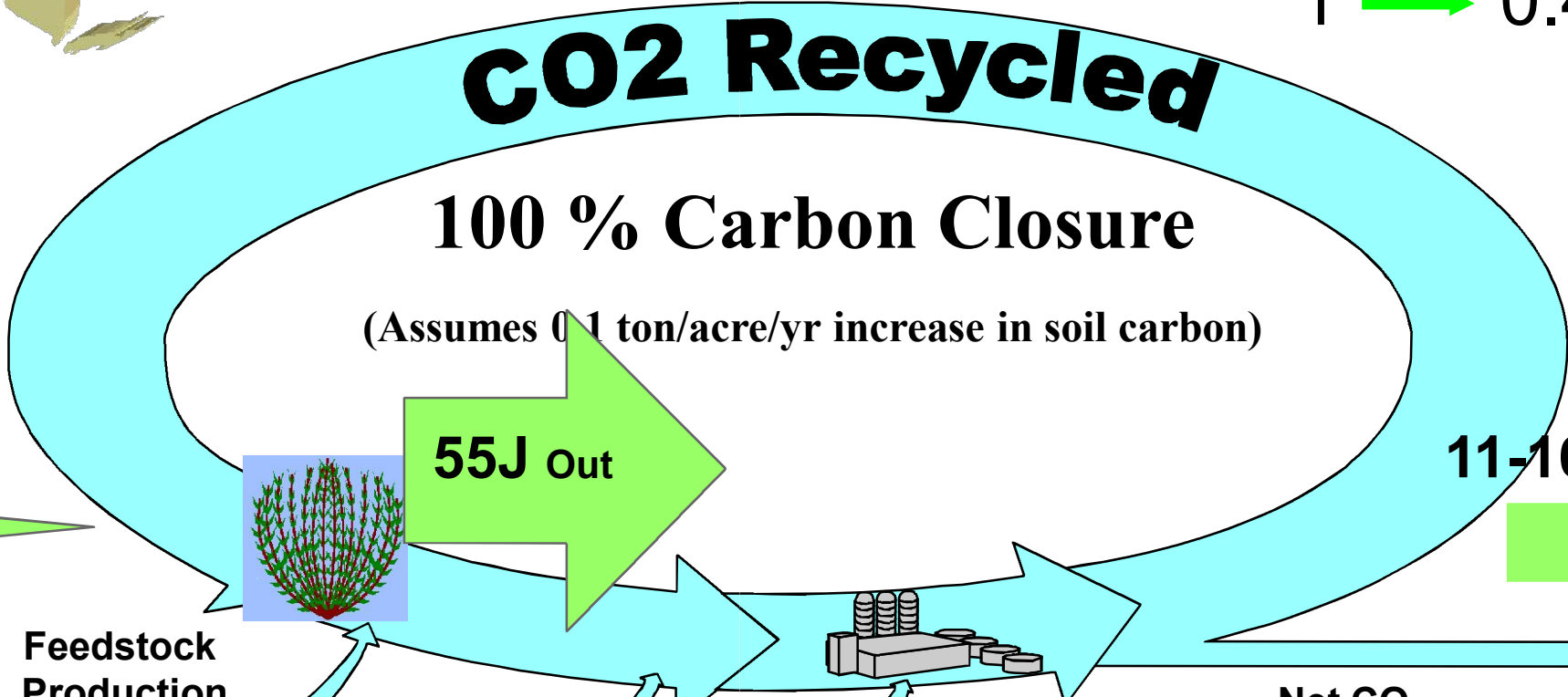
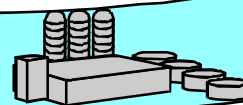
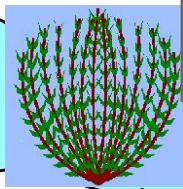
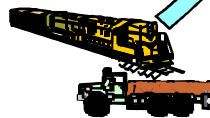
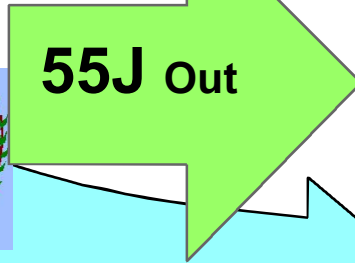
Transportation
(12%)

Power Plant
Construction
(26%)

Net CO₂
Emissions: 0%

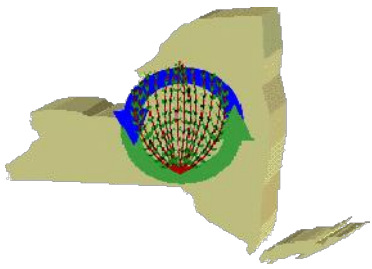
Ethanol

1 → 1.67



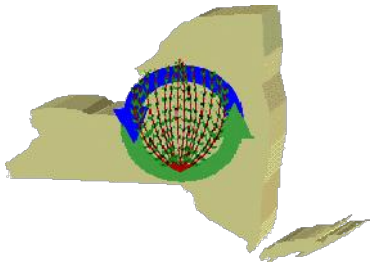
(Adapted from Mann and Spath, 1997 and Heller et al., 2003)



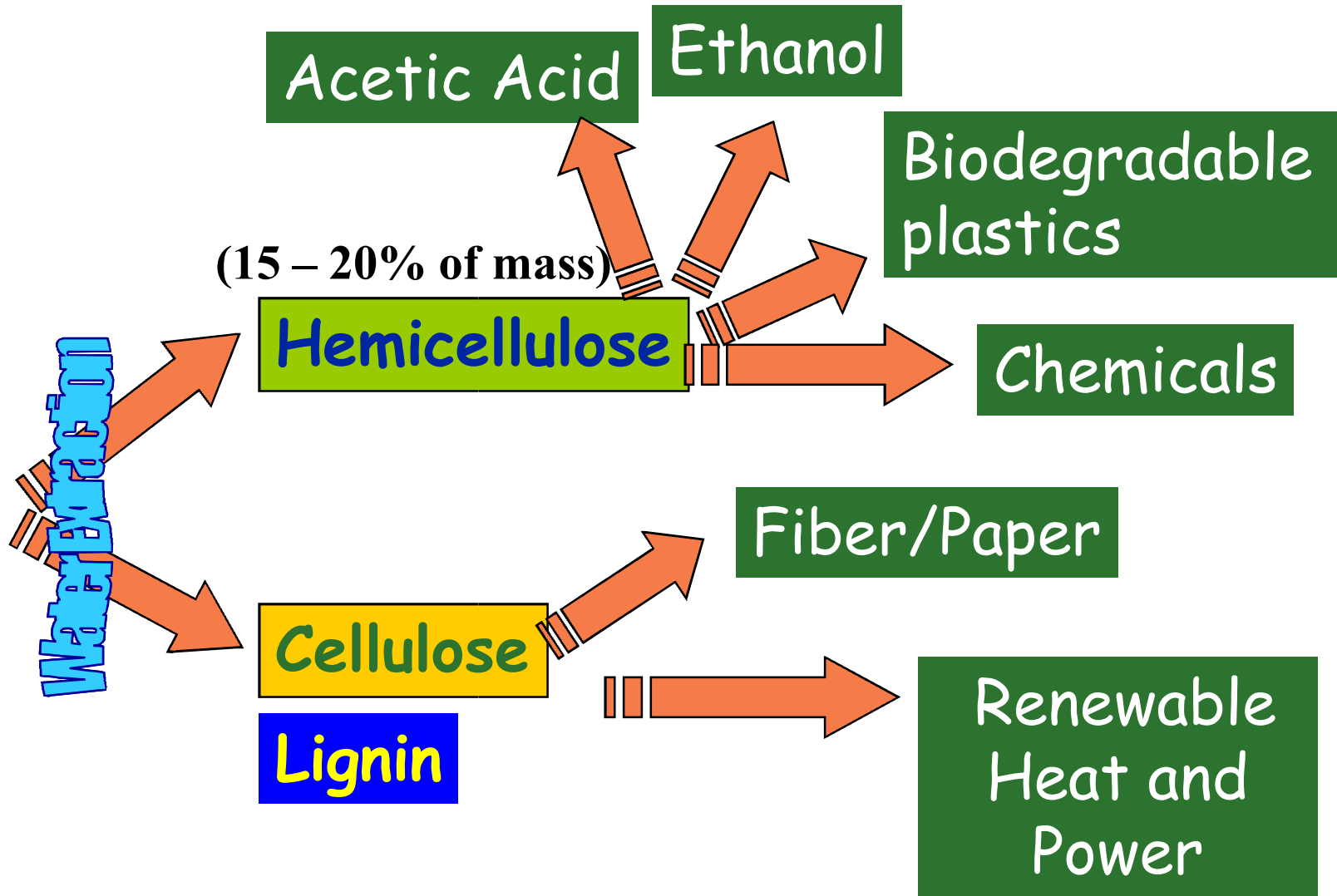
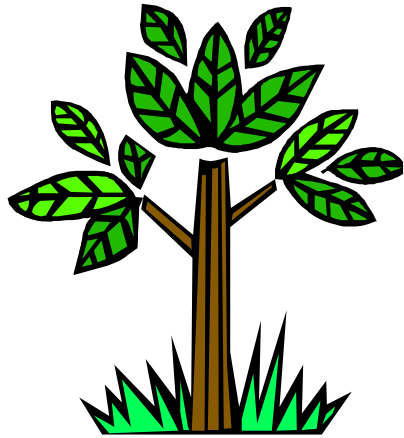


Woody Biomass advantages over Agricultural sources

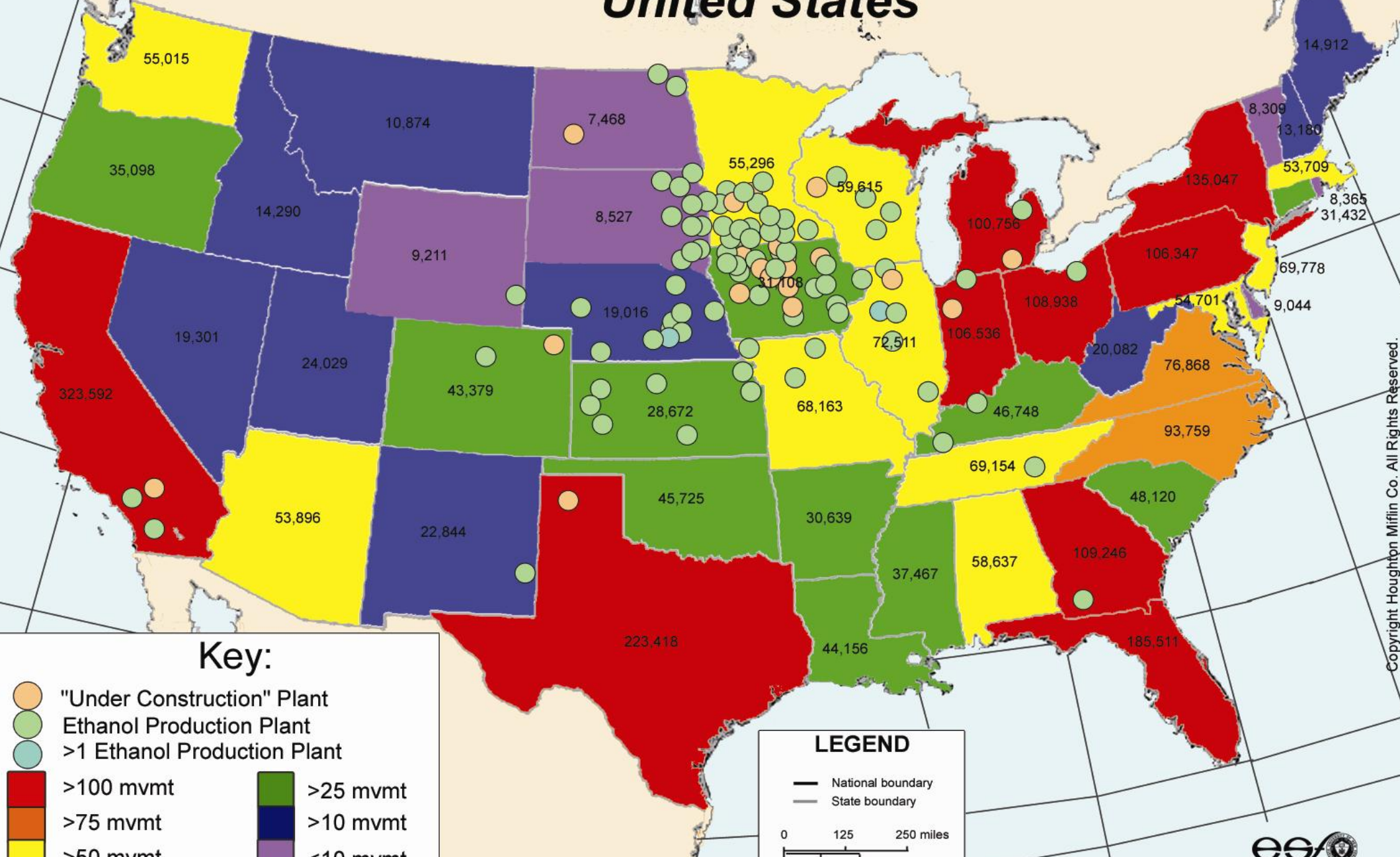
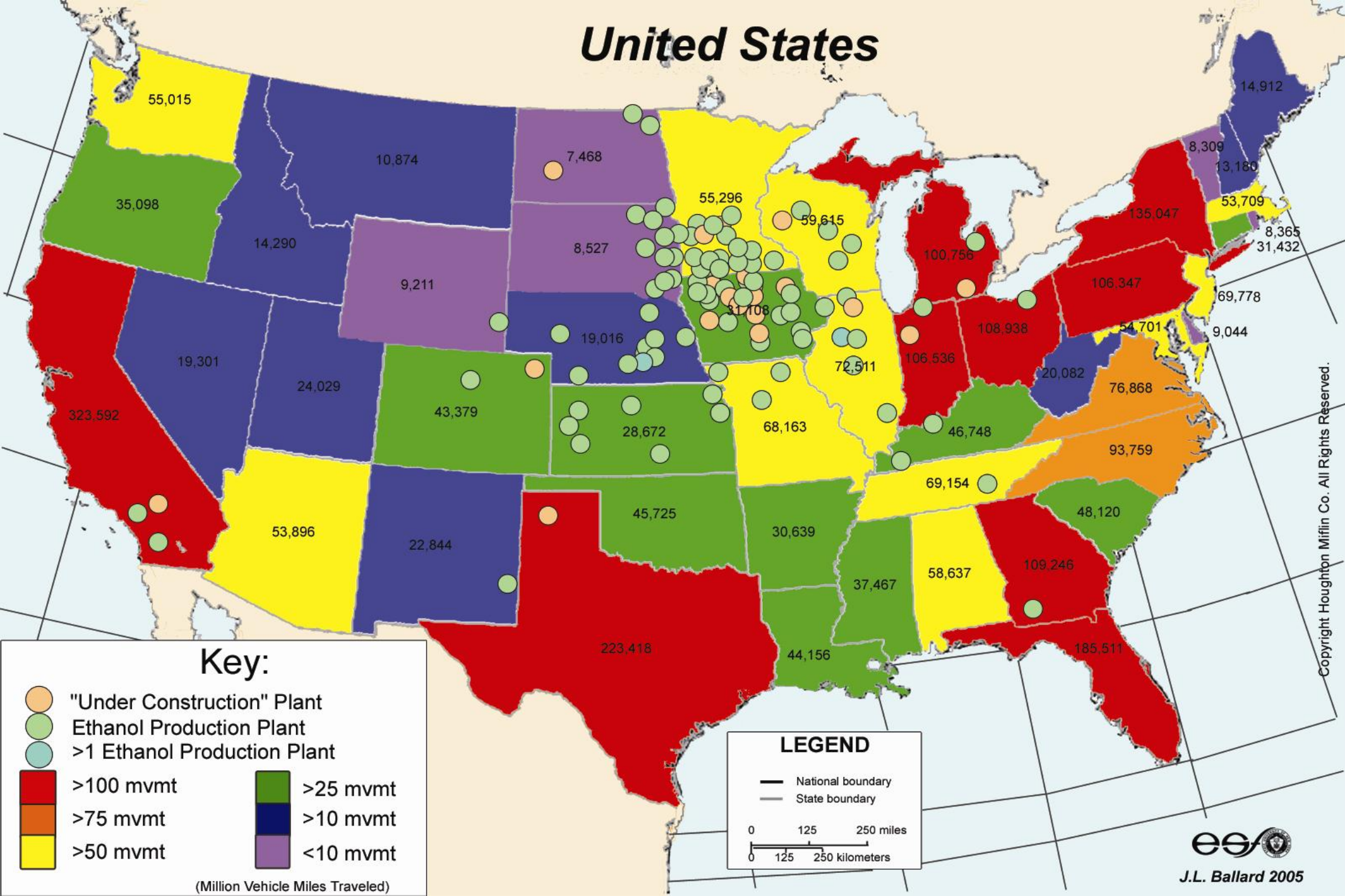
- ◆ **Available year round from multiple sources**
 - » Not dependent on single source material
- ◆ **Net Energy Ratios for bio-energy and bioproducts including biofuels are large and positive**
 - » More energy output than fossil fuel input
- ◆ **Can be Sustainably managed and produced while simultaneously providing environmental and socioeconomic benefits**
- ◆ **Physical-chemical characteristics of woody biomass are fairly consistent from multiple sources**
- ◆ **Forest Products Industry & wood-based renewable energy Industry have developed technical and engineering competencies to manage woody biomass**

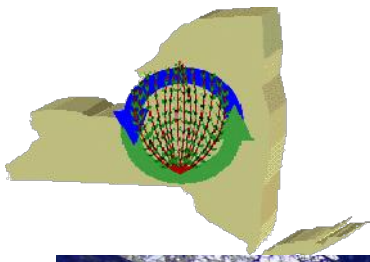


Pulp & Paper Biorefinery



United States

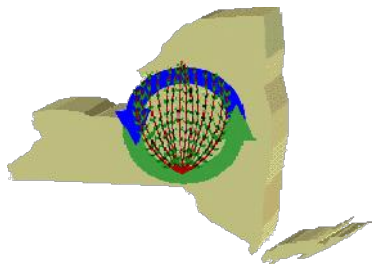




Now is the Time for Action



- ◆ “The stone age did not end for lack of stone, and the oil age will end long before the world runs out of oil.”
 - Sheikh Zaki Yamani, former oil minister for Saudi Arabia



The Coming Age of Wood

Egon Glesinger - 1949

...forests can be made to produce fifty times their present volume of end products and still remain a permanently self-renewing source for raw materials....

Only forests – no other raw material resource – can yield such returns. The forest can, and must, end the chronic scarcities of material goods that have harassed man's experience since the beginning of history

Acknowledgements

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USDOE Biomass Power for Rural Development
Program