Sustainable Biofuels and Bioproducts from our Forests: Meeting the Challenge

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Expanding Biofuel Production: Sustainability and the Transition to Advanced Biofuels Workshop
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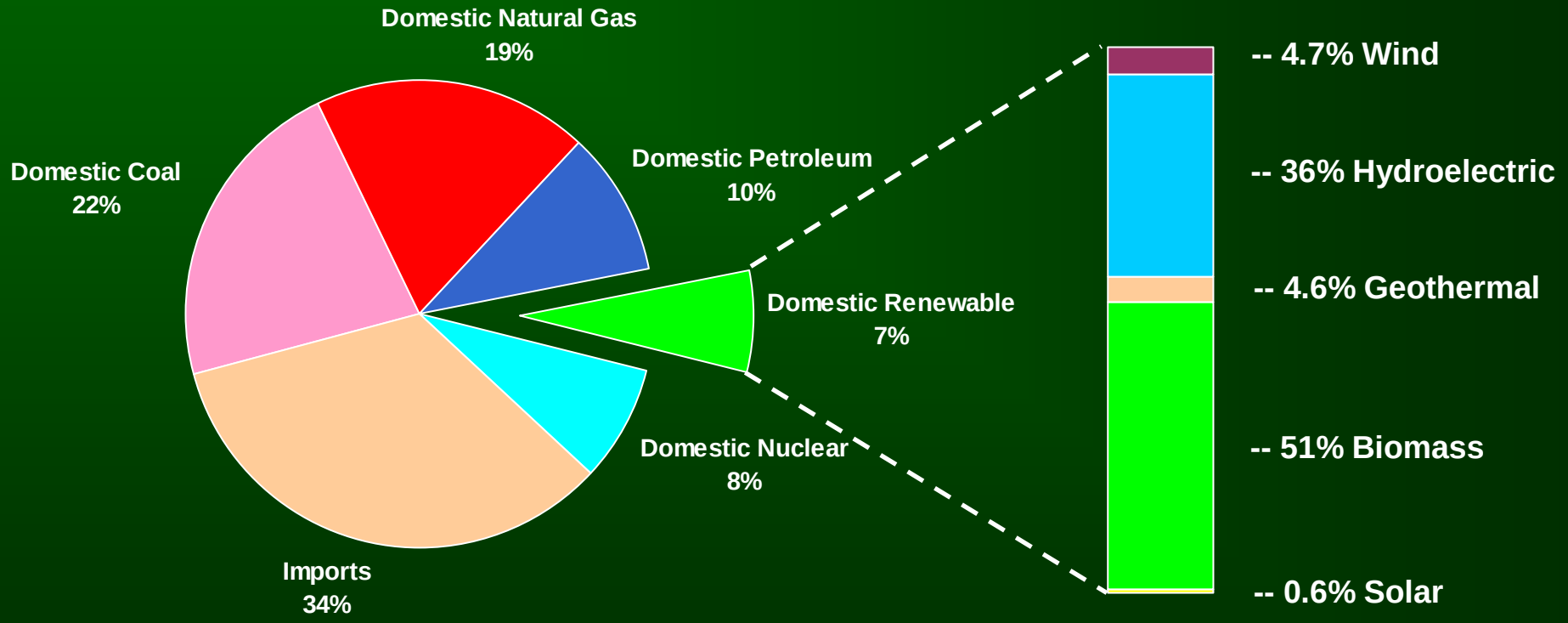
U.S. Energy Consumption Overview 2007

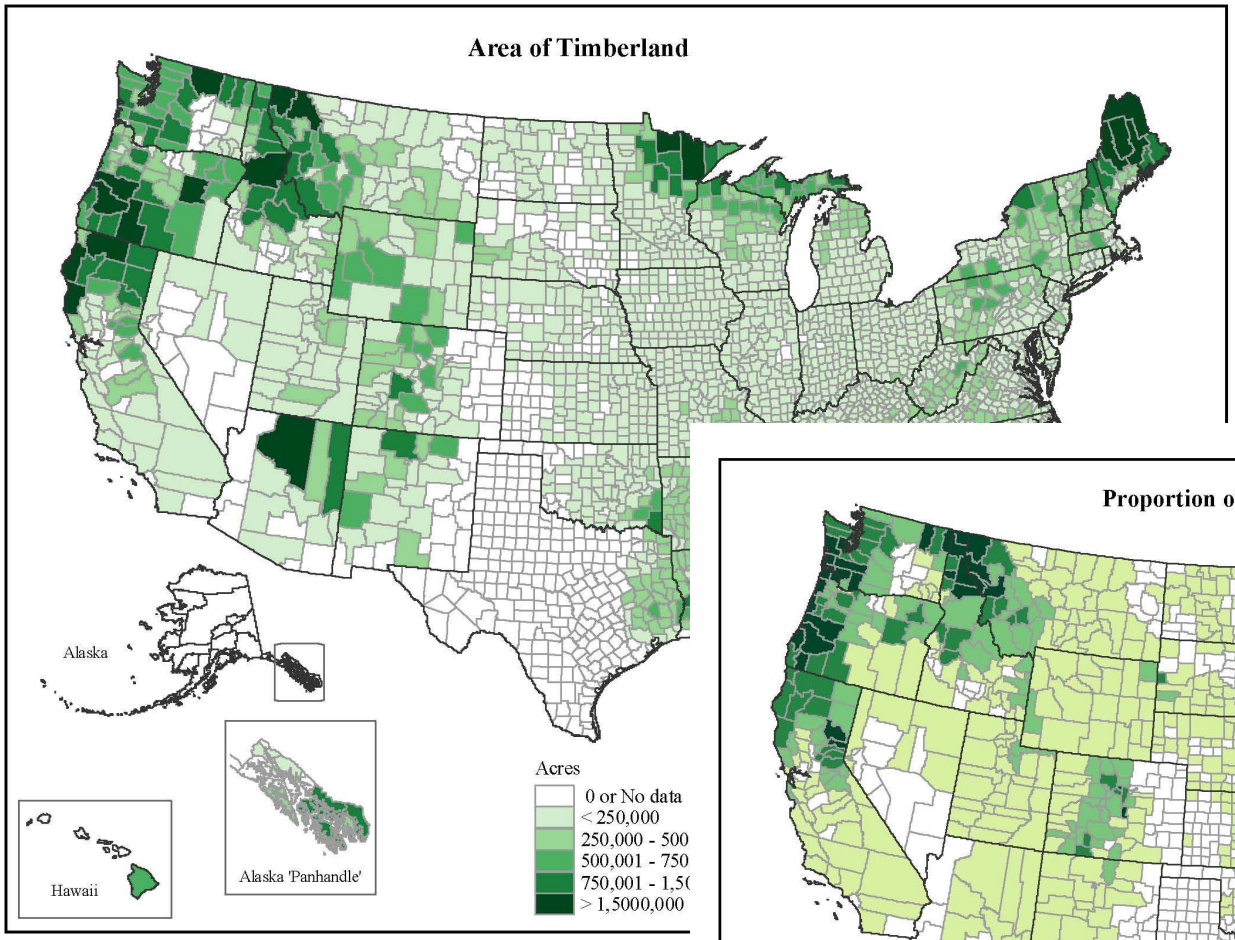
Domestic Energy Consumption = 101.9 Quadrillion Btu

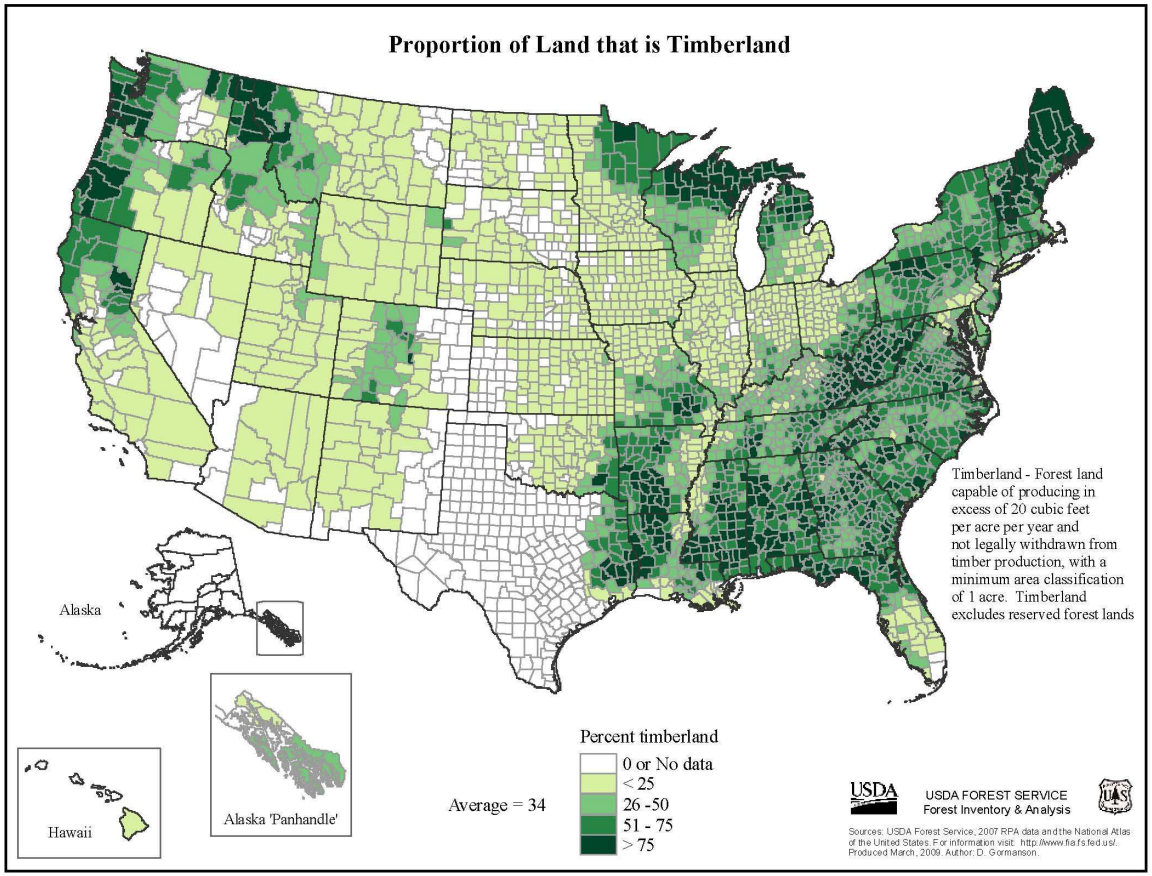
$Total_{RE}$ = 7.1 Quadrillion Btu



~ 65% of biomass is wood based

Source: http://www.eia.doe.gov/emeu/aer/contents.html



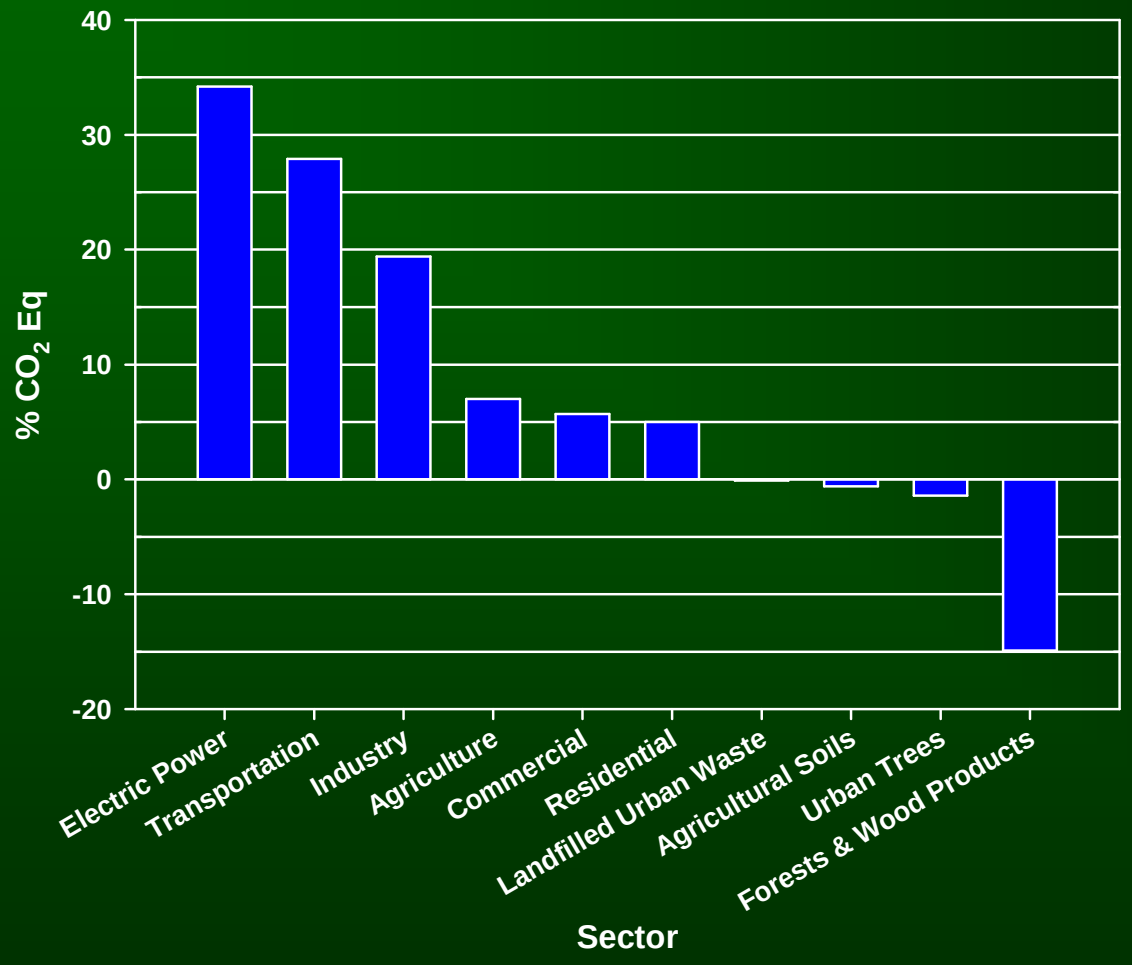


Source: 2007 RPA Tables http://www.fia.fs.fed.us/program-features/rpa/docs/2007_RPA_TABLES%20WO-GTR-78.xls

Regional Forest Statistics

State	Net Growing Stock Volume	Net Growth	Removals	Mortality		Ownership group: All Ownerships	National Forest	Other Public	Private Corp	Private non-corp
	Thousand cubic feet					*Thousand acres*				
Illinois	6,875,000	327,042	77,655	86,618		4,363	281	358	215	3,509
Indiana	8,281,000	356,241	101,337	66,446		4,533	178	473	294	3,588
Iowa	3,114,000	58,895	22,285	35,205		2,824	0	312	41	2,471
Michigan	28,029,000	761,216	364,343	282,430		19,023	2,497	4,503	2,631	9,392
Minnesota	14,931,000	469,632	372,294	237,615		15,112	1,761	6,373	1,164	5,814
Missouri	16,596,000	438,528	187,226	134,842		14,674	1,410	1,017	626	11,621
Ohio	12,324,000	311,430	72,430	62,531		7,645	222	471	902	6,050
Wisconsin	20,271,000	603,978	453,883	192,803		16,042	1,376	3,638	1,425	9,603

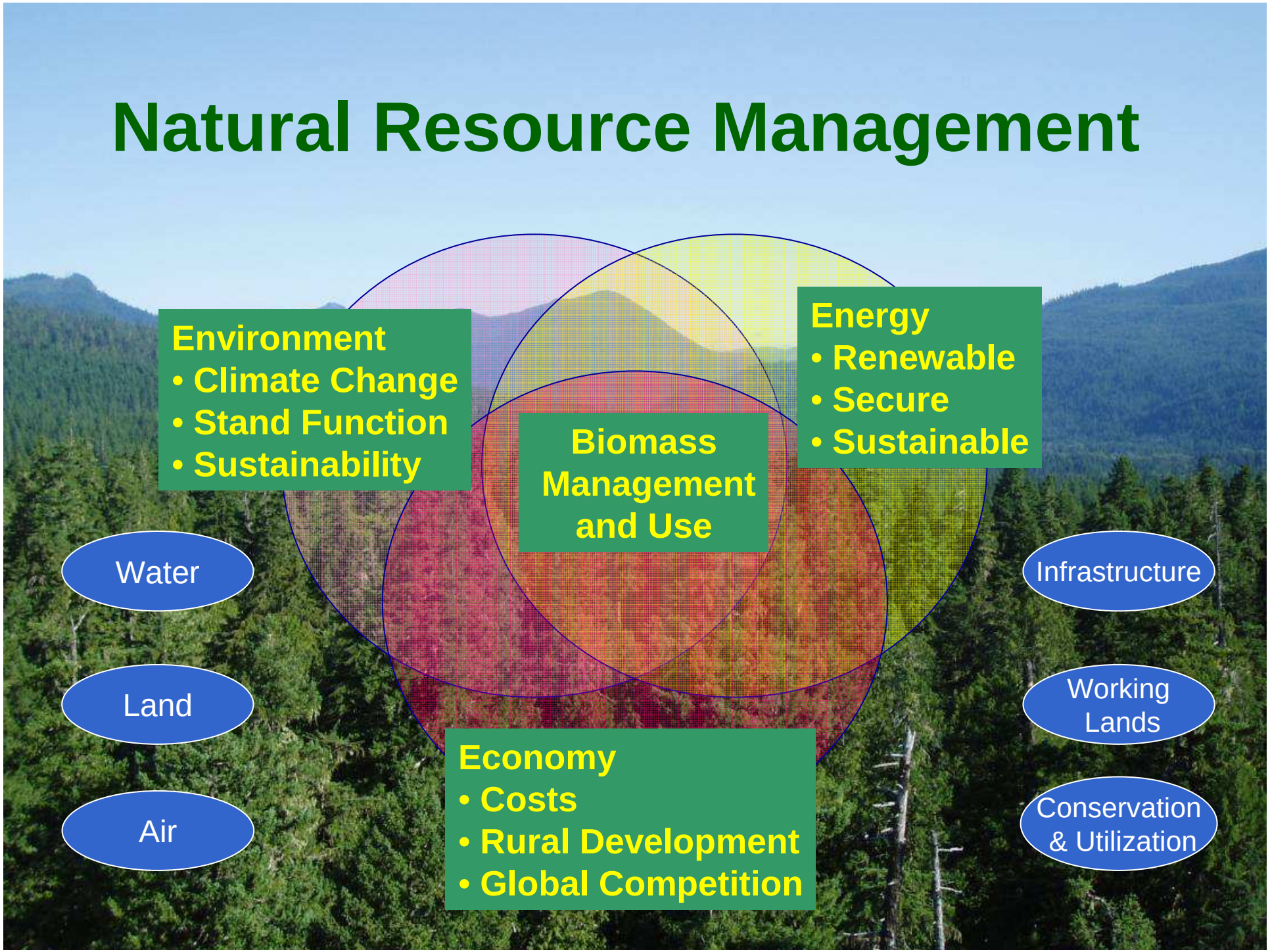
Percent Total US GHG Annual Emissions by Sector (2007)



Note: Negative numbers denote sequestration; forests, trees and wood products sequester 14% US GHG emissions annually

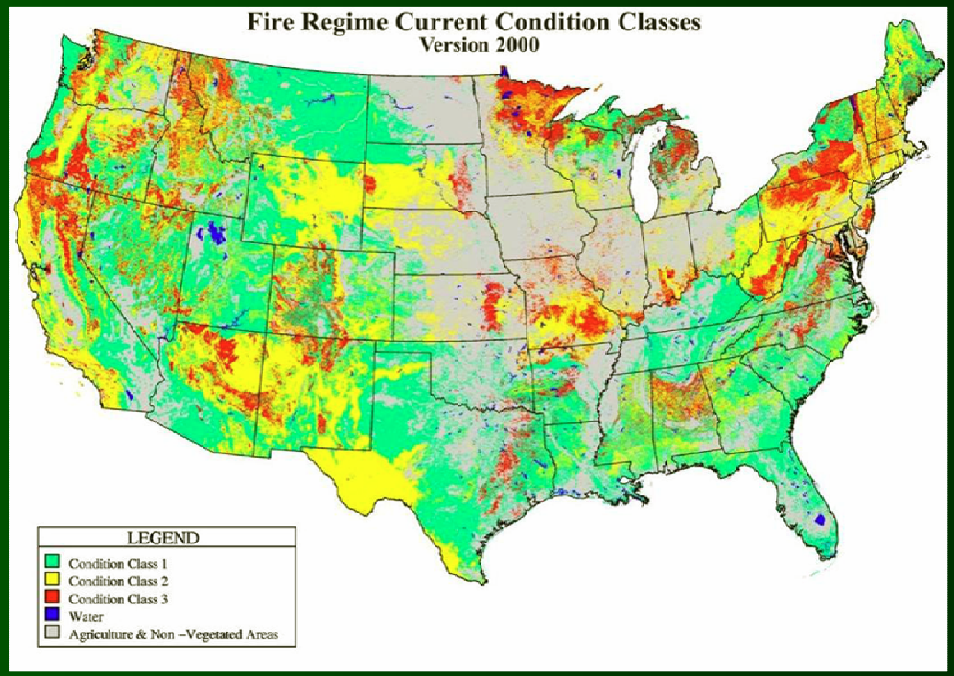
Source: http://www.epa.gov/climatechange/emissions/usinventoryreport.html

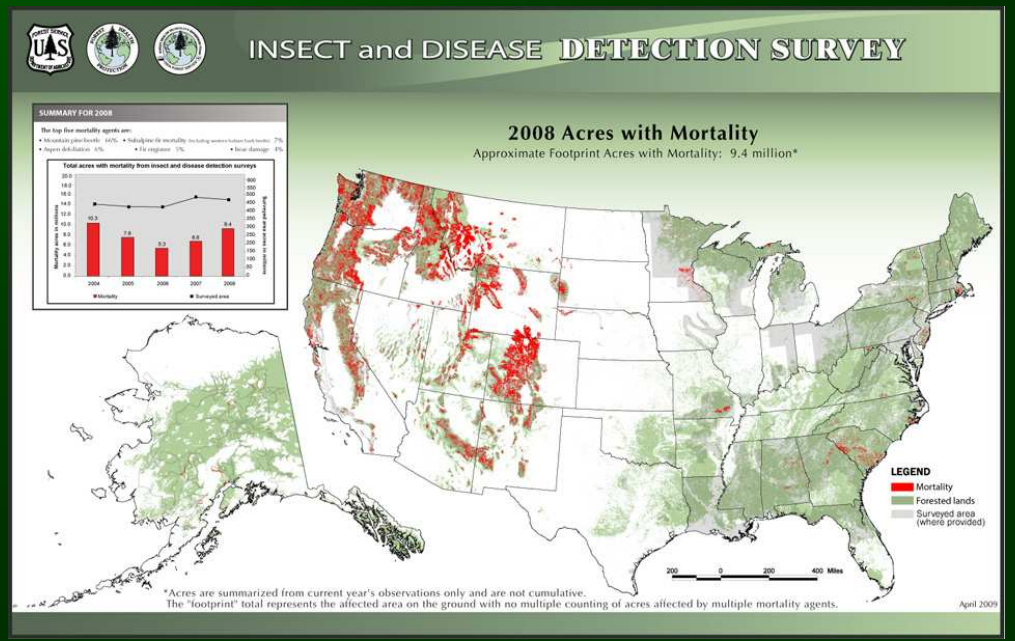
Natural Resource Management



Points to Ponder

- Large volumes of biomass
  - Fire risks
  - Declining health
  - Reduction of services
  - Many forms and shapes
  - Can produce even more
- Declining infrastructure
  - Industry decline
  - Offshore investments and imports
  - Worker (capacity) shortage
  - Reduced investments
- Markets and barriers
  - Cyclic booms and busts
  - No markets
  - Higher costs
  - Very distributed
- Ownership
  - Forest land – 56% Private
  - Timberland – 70% Private





Forests: A Strategic Asset

- Energy security
- Environmental quality
- Economic opportunity

Woody Biomass

- Derived from any and all parts of trees
  - Bole, limbs, tops, roots, foliage
- Insect-, disease-, or fire- damaged or killed
- Purpose-grown wood for energy
- Conventional forestry
- Pre- and post consumer paper and wood products
- Pulping liquors

The Opportunity & Potential

Feedstock

- Forest Residues
- Hazardous Fuel Treatments
- Short Rotation Woody Crops
- Wood Waste
- Conventional Forestry
- Mill Wastes & Residues

Conversion

- Manufacturing
- Co-firing
- Combustion
- Gasification
- Hydrolysis
- Digestion
- Pyrolysis
- Extraction
- Separation

Uses

Fuels:
- Ethanol
- Other Liquid Fuels
- Hydrogen

Electricity and Heat

Biobased Products
- Composites
- Specialty Products
- New Products
- Chemicals
- Traditional Products

Desired Resource Outcome

- Forest systems
  - Healthy
  - Productive
  - Supply goods, services, and values

We will expect forests to produce

- Wood
- Water
- Non-wood products
- Recreational opportunities
- Habitats
- Climate change mitigation
- Energy

Challenge

- NOT merely
  - Sustaining existing systems
  - Restoring selected systems
- IS ALSO
  - Enhance capacity of systems to meet future resource needs
  - Managing systems to provide for increasing levels of a variety of benefits

Considerations

- Resource availability, sources, production and management, feedstock supply components
- Harvesting and operations technologies, in-forest pre-processing technologies, transportation
- Conversion technologies, feedstock characteristic needs, conversion efficiencies, costs
- Integrated management systems
- Information, data, decision tools
- Development/deployment of biomass energy facilities

Foundations

- Science-based
- Objectively and feasibly measurable
- Clearly and quantifiably related to bioenergy/bioproduct production

Challenges

- Provide quantities of wood needed for energy
  - double renewable energy production[1]
  - RFS 36 Bgal biofuels/year by 2022 with 20 Bgal non-corn[2]
  - Replace 15% of current US gasoline consumption with ethanol from wood – ~21 billion gallons of gasoline annually[3]
- Maintain & enhance forest health and productivity
  - Ensure conservation & sustainable delivery of wood products and other benefits
  - Avoid/mitigate potential negative impacts
  - Capitalize on benefits working forests provide in the landscape
- Reduce Costs & increase efficiency
  - Feedstock production & management
  - Harvest, collection & delivery
  - Conversion processes
- Reduce Investor Risk

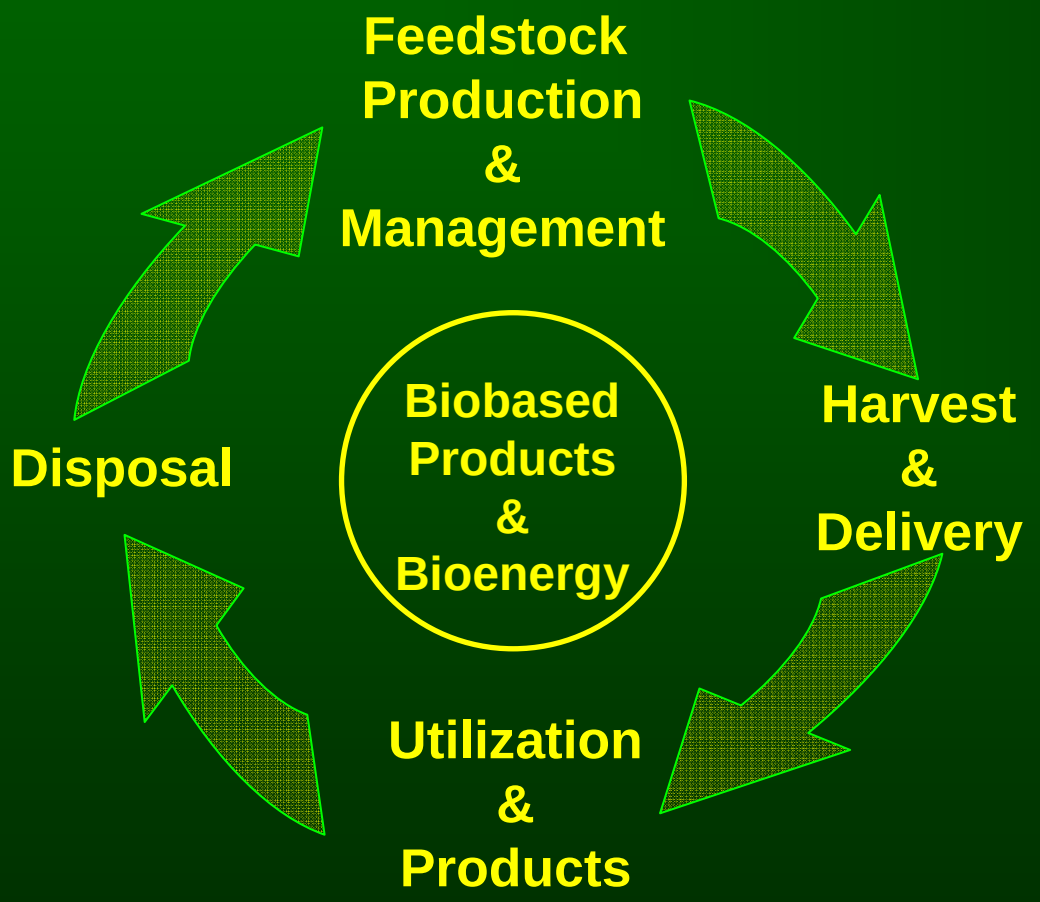
[1] http://change.gov/newsroom/entry/american_recovery_and_reinvestment/, 1/3/09
[2] EISA 2007 (Energy Independence and Security Act of 2007)
[3] FS Chief Gail Kimbell, 9/7/07

Some Critical Information In Hand

- Resource Assessments
  - Billion Ton Report
  - Resources Planning Act Assessments
  - Regional Assessments
  - FIA
- Life Cycle Analyses
  - CORRIM
- Soil Productivity
  - National Long Term Soil Productivity Study
  - Soil carbon syntheses
  - Whole-tree logging and harvest impact studies
- Water quality
  - Best Management Practices (42 states)
- Habitat and biodiversity studies
- Forest Certification Programs

* Items listed as examples – not exhaustive

Integrated Biobased Products And Bioenergy Approach



- Research & Development
- Synthesis
- Development of
  - options
  - strategies
  - systems
  - practices

  For sustainable goods, services, & values

Critical Research

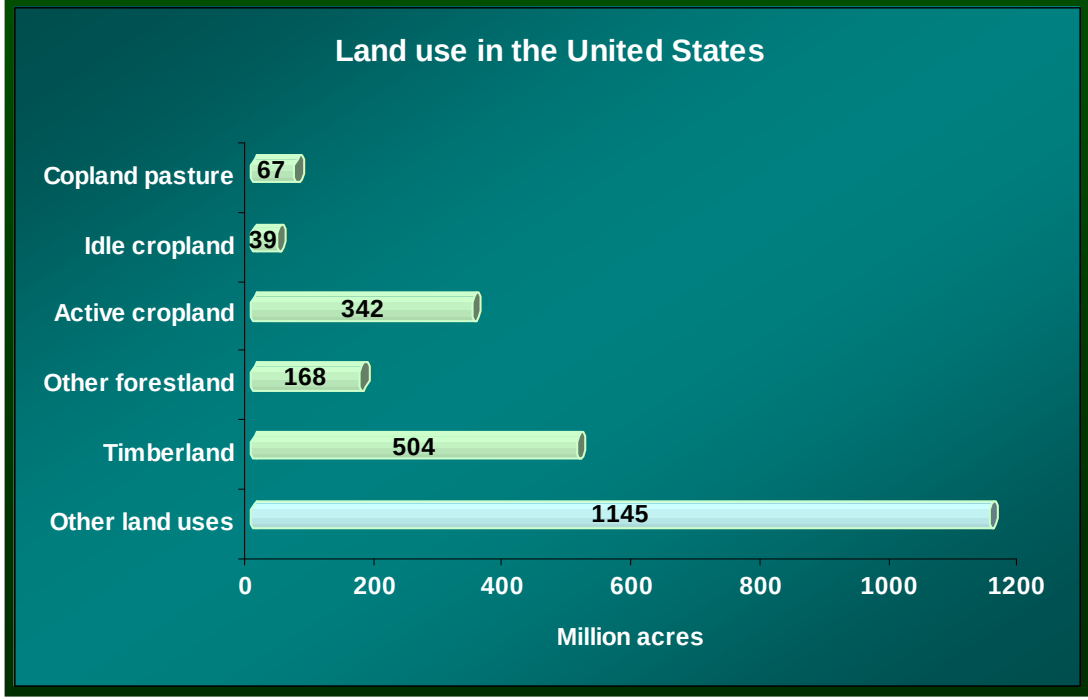
- Sustainable and economical forest biomass management and production systems
- Competitive biofuels and biopower conversion technologies and bioproducts
- Information and tools for decision-making and policy analysis

. . . Sustainability

Thank you

The Biomass Feedstock Resource Base

- About one-half of the land in the contiguous U.S.
  - Forestland resources -- 504 million acres of timberland, 91 million acres of other forestland
  - Agricultural resources -- 342 million acres cropland, 39 million acres idle cropland, 68 million acres cropland pasture



Forest resources

- Logging residues and other removals
  - Traditional logging activities
  - Cultural operations on timberlands
- Forest thinnings (fuel treatments)
  - Timberland
  - Other forestland
- Industry processing residues
  - Primary wood processing mill wastes
  - Secondary wood processing mill wastes
- Urban wood wastes
- Fuelwood
- Pulping liquors (black liquor)
- Conventional Forestry
- Short Rotation Woody Crops

So we must

- Manage through changing conditions
  - Environmental
  - Economic
  - Supply & demand
  - Global economy
- Continue to supply goods, services, and values
- Including energy