USDA Forest Service
Woody Biomass Feedstock Research

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Forest Service Research & Development
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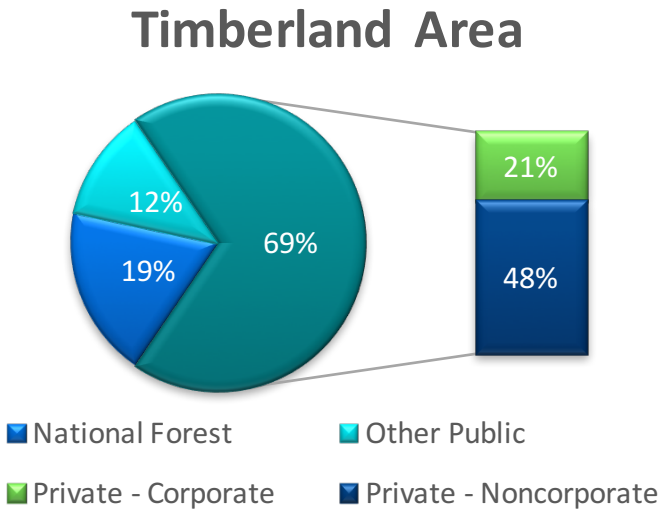
Forest Service R&D Mission

- **Improve the health and use of the Nation's forests and rangelands**
  - **~750 million acres forest;**
  - **~587 million acres range/grassland**



Forests: A Strategic Asset

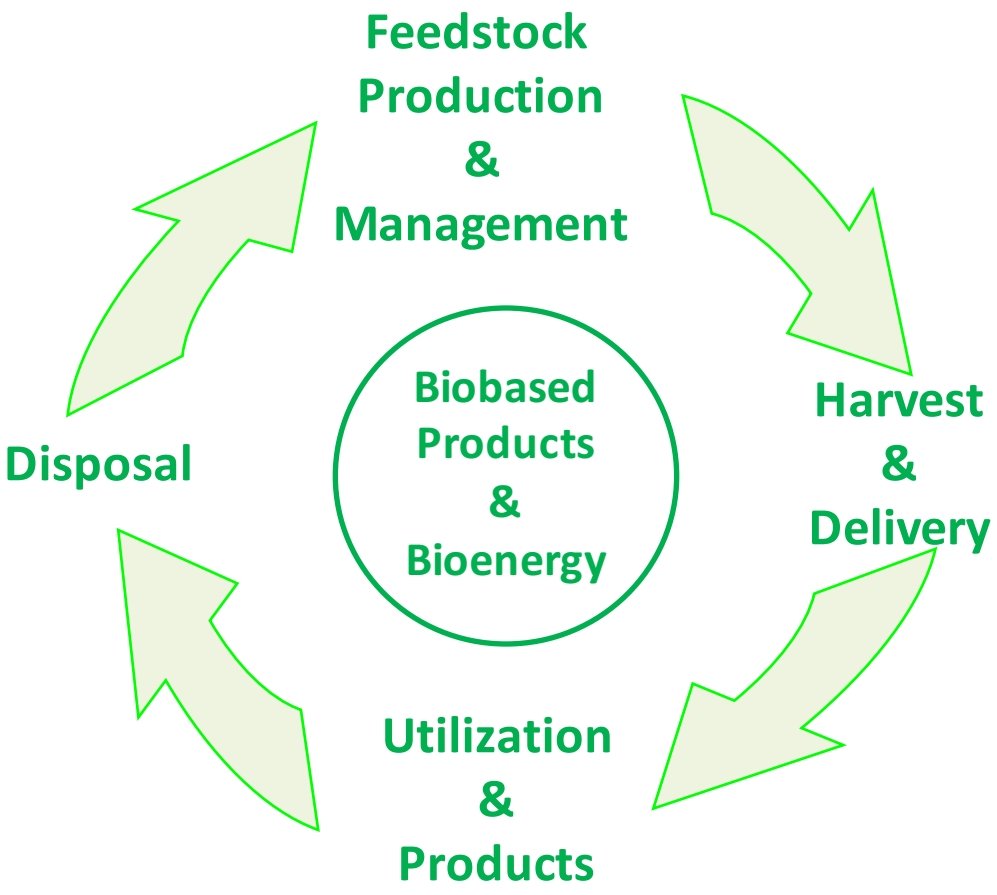
- **Energy Security**
- **Environmental quality**
- **Economic opportunity**

Bioenergy and Bioproducts R&D

- **Goals**
  - Sustaining existing and restoring selected systems
  - Enhancing capacity to meet future resource needs
  - Managing for increasing levels of benefits
  - Reducing investor risk
  - Contributing to U.S. energy security, environmental quality, and economic opportunity

- **Research**
  - Sustainable, economical forest biomass systems for public & private lands
  - Competitive conversion technologies for biofuels and innovative bioproducts
  - Information and tools for decision support and policy analysis

Sustainability Across the Supply Chain



Develop & Deploy

- options
- strategies
- systems
- practices
- products

To Deliver:
sustainable goods, services, & values

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

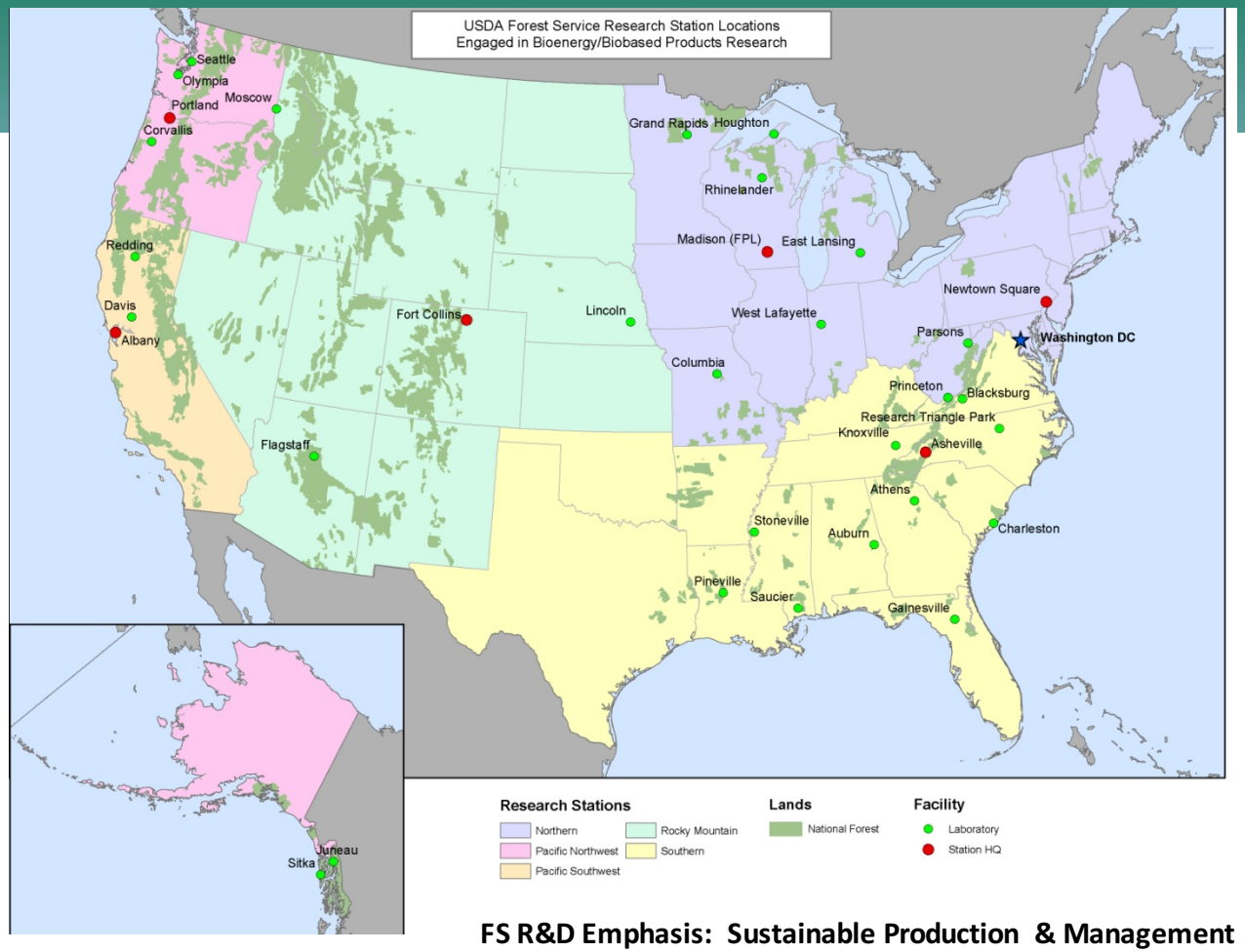
Uses

Fuels:
- Liquid Transportation Fuels
- Hydrogen

Electricity and Heat

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

FS Energy R&D Locations

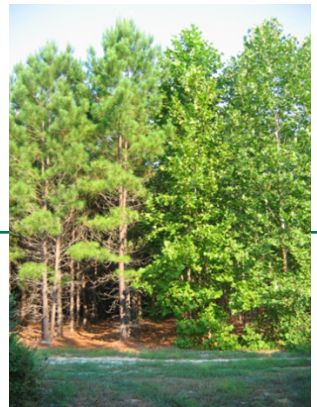


FS R&D Emphasis: Sustainable Production & Management

- **Southeastern – logistics, operations, transport, srwc, sustainable productivity**
- **Northern – conversion/products, srwc**
- **Northwestern – hazardous fuel reduction, sustainable productivity, srwc**

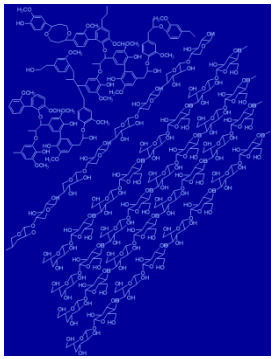
Sustainable Production and Management Research

- Sustainable Soil Productivity
- Integrating Feedstock Production into Forest Management Systems
- Short Rotation Woody Crops
- Forest Operations Research
- Best Management Practices



Conversion and Bioproducts Research

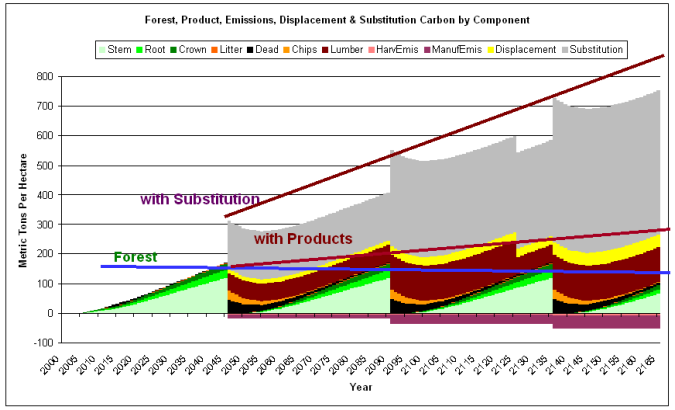
- Lignocellulosic constituent chemistry
- Wood to biofuels conversion
  - Thermochemical
  - Biochemical
- Biorefinery Technologies/VPP
- Cell wall and intermediates

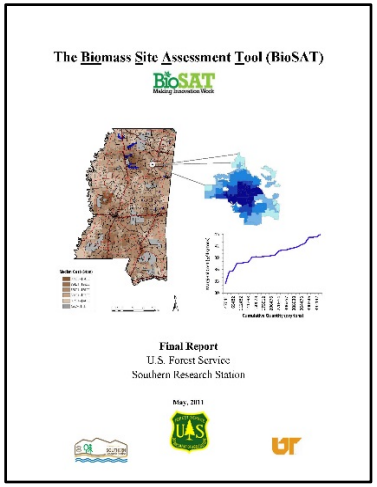


Decision Support and Policy Analysis Research

- Lifecycle analysis
- Siting models
- Sustainability criteria
- Operations cost reduction models
- Integrated land use and markets models

Carbon as the Sustainability Metric: from Forest, Product and Substitution Pools (concrete frame vs wood)





Management for pests, wildlife? Thinning, i.e. biomass removal

Photo credit: USDA Forest Service, Black Hills National Forest

Mountain pine beetle management

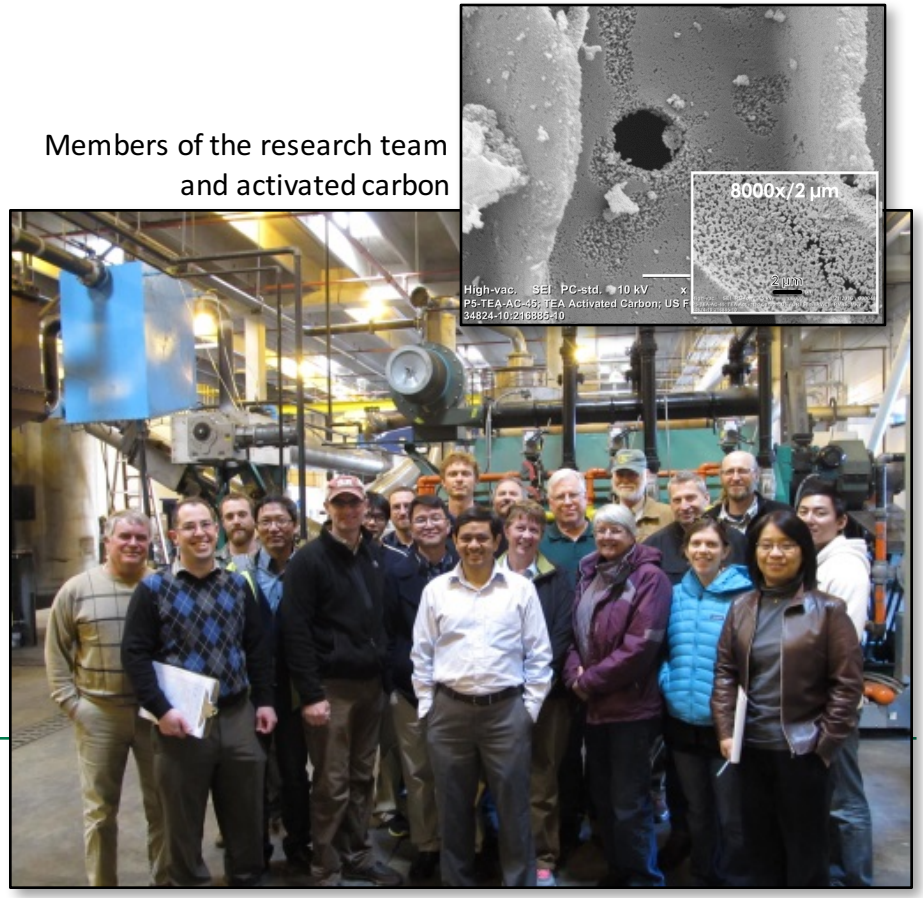
Photo credit: Keith Konan

2001-2009 1.1 Million ha treated on FS lands

Integrating Sustainable Biofuels and Bioproducts into Forest Industry Supply Chains

- Led by USFS R&D, RMRS
- Logging & mill residue emphasis
- Pyrolysis pathway
- Components
  - Operations research
  - Spatial analysis
  - Financial analysis
  - Activated carbon
  - Catalysts/Fuels
  - Biochar application

Members of the research team and activated carbon



Biochar Research

Biochar spreader developed by MTDC

- biochar pellets (or bulk biochar
- skid trails and log landings
- up to 30% slope
- does not increase bulk density if there is a forest floor present
- travels forward and backward

Umatilla NF mine reclamation study

- deployed wood chips, biochar, and Class A biosolids
- combination of all 3 amendments has given the best 2 yr results
- planted grass plugs
- biochar helps hold nutrients leaching from the biosolid

Bitterroot NF thinning project with masticated wood, biochar, and fertilizer

- biochar plots had a 200% increase in diameter growth
- masticated wood was as beneficial as biochar in the short term, but that is starting to taper off after 5 years

Operations Research

Determining the production rate and cost to remove bark during harvesting to increase the biomass value

Bunch drying to reduce hauling and processing costs. Small feller-buncher piles had a lower overall average moisture content

Short Rotation Woody Crops (SRWC)

SRWC – Ecosystem Services Research

- **Ecological**
  - Carbon implications of poplar energy crops throughout the energy supply chain
  - Predicting & mapping biomass of poplar energy crops
  - Biofuels, bioenergy, & bioproducts from short rotation woody crops
  - Siting poplar biomass systems to increase productivity & ecosystem services
  - Water use efficiency of poplars
- **Economic**
  - Enterprise budgets for poplar feedstock production
  - Optimizing species selection & economic performance of woody crops in the Southeastern, USA
- **Social**
  - Landowner adoption preferences

SRWC – Environmental Technologies Research

- **Phytoremediation**
  - Phytoremediation of inorganic & organics contaminants
  - Phyto-Recurrent Selection: a method for selecting genotypes for phytotechnologies
  - Salt tolerance & salinity thresholds of woody energy crops
  - Long-term monitoring of hybrid poplars used for phytoremediation in the eastern USA
  - Mitigating nonpoint source pollution impacts on nearshore health in the Great Lakes basin, USA
- **Urban Afforestation**
  - Freshkills (Staten Island, New York): landfill to park conversion
- **Mine Reclamation**
  - Reclaiming & restoring lands degraded from mining
  - Biochar: a sustainable soil amendment

Thank you

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- http://www.fs.fed.us/research/biomass-bioenergy/