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# Solution Opportunities Regarding Global Change from the Agricultural and Forestry Sectors

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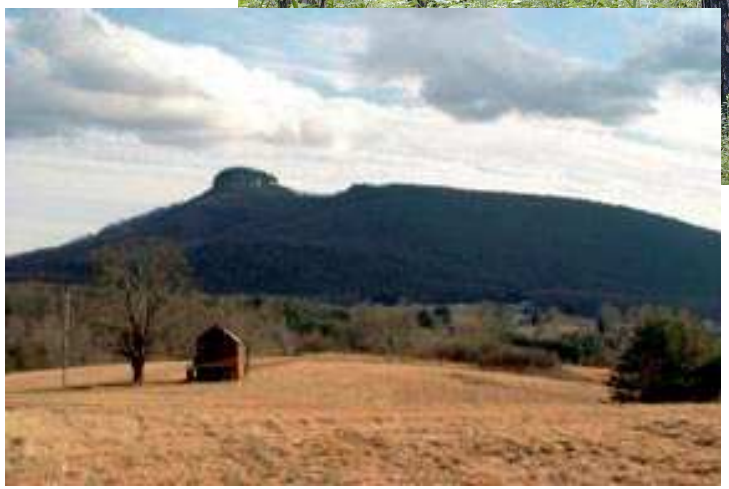
**COLLEGE OF AGRICULTURE AND LIFE SCIENCE**



# Objectives

- **Describe why “agriculture” & “forestry” are significant sectors to look to for global change solutions**
- **Provide a partial “laundry list” of some action items to be considered by the Climate Action Plan Advisory Group**
- **Discuss several action items in more detail that have promise for significant benefit**

# Opportunities are Enormous Because the Industries Are Large

- **Forestry is the state's second largest industry**
  - **18.3 million acres in NC (2002)**
  - **78% owned by 650,000+ individuals**
  - **Economic benefit to NC of $29+ billion**
- **Agriculture still very significant**
  - **9 million acres in NC (2004)**
  - **52,000 farms**
  - **Net farm income $1.9+ billion**

# Four General Ways for Agriculture and Forestry to Contribute Solutions

- **REDUCE EMISSIONS**
  - **$CO_2$ which constitutes most greenhouse gasses**
  - **$CH_4$ (methane)**
  - **$N_2O$**
- **PROMOTE CARBON SEQUESTRATION (capturing carbon from the atmosphere with live plants and storing it long term)**
  - **e.g. increase land area with plant crops and forests**
  - **Improve productivity (growth rates and health) of our crops and forests**

# Four Ways - Continued

- **SUBSTITUTE FARM AND FOREST BIOMATERIALS FOR OTHERS**
  - **Use and produce biofuels instead of burning fossil fuels**
  - **Use wood in place of other materials**
- **PRESERVE LAND IN FARM AND FOREST USE**

# However, a note of caution must be added!!!!

- Forestry lost one million acres to non-forest use between 1990 and 2002 (5%).
- Farm acreage in NC dropped 2+% between 2000 and 2004.
- However, could global change solutions from these sectors help retain land in farm and forest?

# Possible Key Actions – Agriculture*

- **Protect farmland from permanent conversion**
  - **Incentives**
  - **Conservation easements**
  - **Continued employment of use value taxation**
  - **BETTER MARKETS so that farming is more profitable**
- **Expand soil carbon storage**
  - **Conservation tillage**
  - **Less summer fallow fields**
  - **Increasing use of winter cover crops**
  - **Reduction of C loss through improved crop management**



*Items from a partial list being considered by Climate Action Plan Advisory Group

# Possible Key Actions – Agriculture

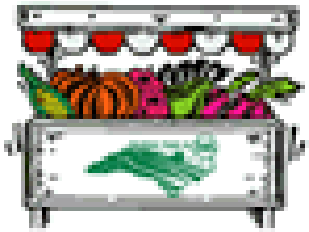
- **Improve feed efficiency**
  - **Reduces methane emissions**
- **Reduce emissions from land**
  - **Use improved nutrient management including precision agriculture and manure management**
  - **Use deep rooted species on field borders (helps manage soil N)**

# Possible Key Actions – Agriculture

- **Expand use of renewable energy on-farms and expand the use of farm products as feedstocks for off-farm energy production**
  - **Manure digesters**
  - **Farm gassifiers**
  - **Using biodiesel in farm equipment**
  - **Feedstocks for biodiesel**
  - **Feedstocks for ethanol production**
  - **Feedstocks for direct combustion**

# Possible Key Actions – Agriculture

- Develop more efficient farm to market routing of farm products (results in reduced transportation use)



North Carolina Farm Fresh

- Encourage windmill use on farms

# Possible Key Actions – Agriculture


- **Plant erodible or no-longer used cropland to trees (very large potential gain in carbon sequestration!  3.2 tons per acre per year for managed pine plantations vs. about 100 pounds a year for some crops)**

# Possible Key Actions – Agriculture

- **Establish dedicated biofuel crops such as switchgrass or hybrid close-grown trees**

# Possible Key Actions – Forestry

- **Reduce conversion to non-forest use**
  - **BETTER MARKETS through healthy forest industry!**
  - **Land trusts**
  - **Conservation easements**
  - **Incentives (tax, cost-sharing, others)**
  - **Continued employment of use value taxation**

# Possible Key Actions – Forestry

- **Increase use of residential and urban trees and promote better management of them**
- **Restore non-forest lands to forests (wetlands, pastures, cropland)**
- **Develop improved trees for special uses through genetic and biotechnology**

# Possible Key Actions – Forestry

## Employ Better Utilization During Harvesting

- Higher yields during logging
- Lower site prep & planting cost


# Possible Key Actions – Forestry

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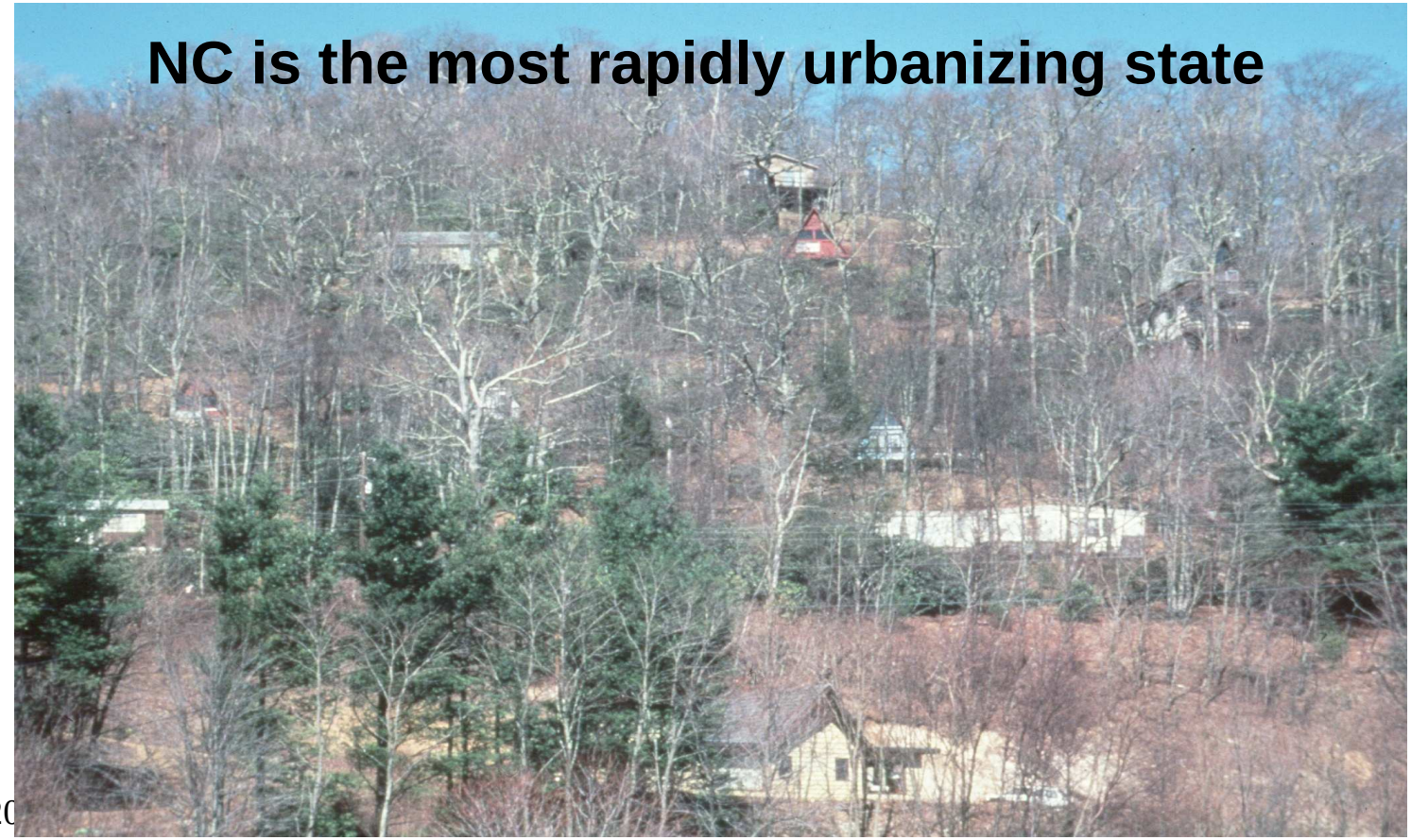
## Wildfire Risk Management/Firewise



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# Possible Key Actions – Forestry
## Salvage



**Average annual mortality in NC 1990-2002: 426 million cu ft**

# Possible Key Action - Forestry

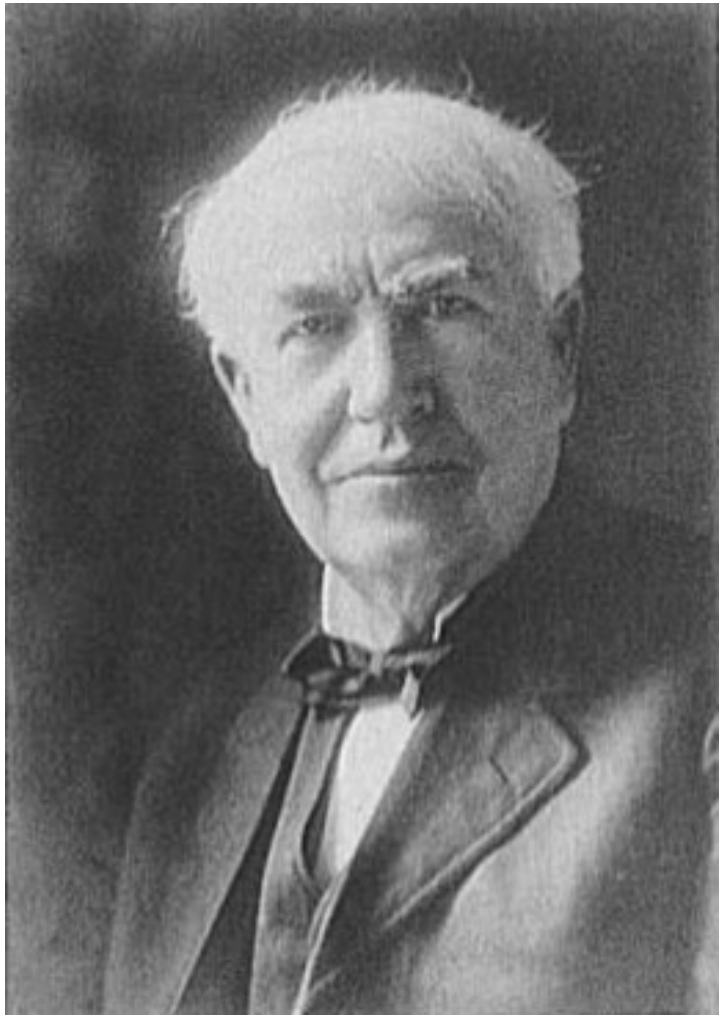
- **Improve carbon sequestration through nutritional amendments including ag wastes**

# What Items Might Be the Biggest Bang for the Buck for Ag & Forestry?

1. **Using "biomass" for direct production of energy**
   - **Steam for heating and chilling**
   - **Electric power generation**
2. **The Biomass-Based Biorefinery**

**WHY ARE THESE SO IMPORTANT?**

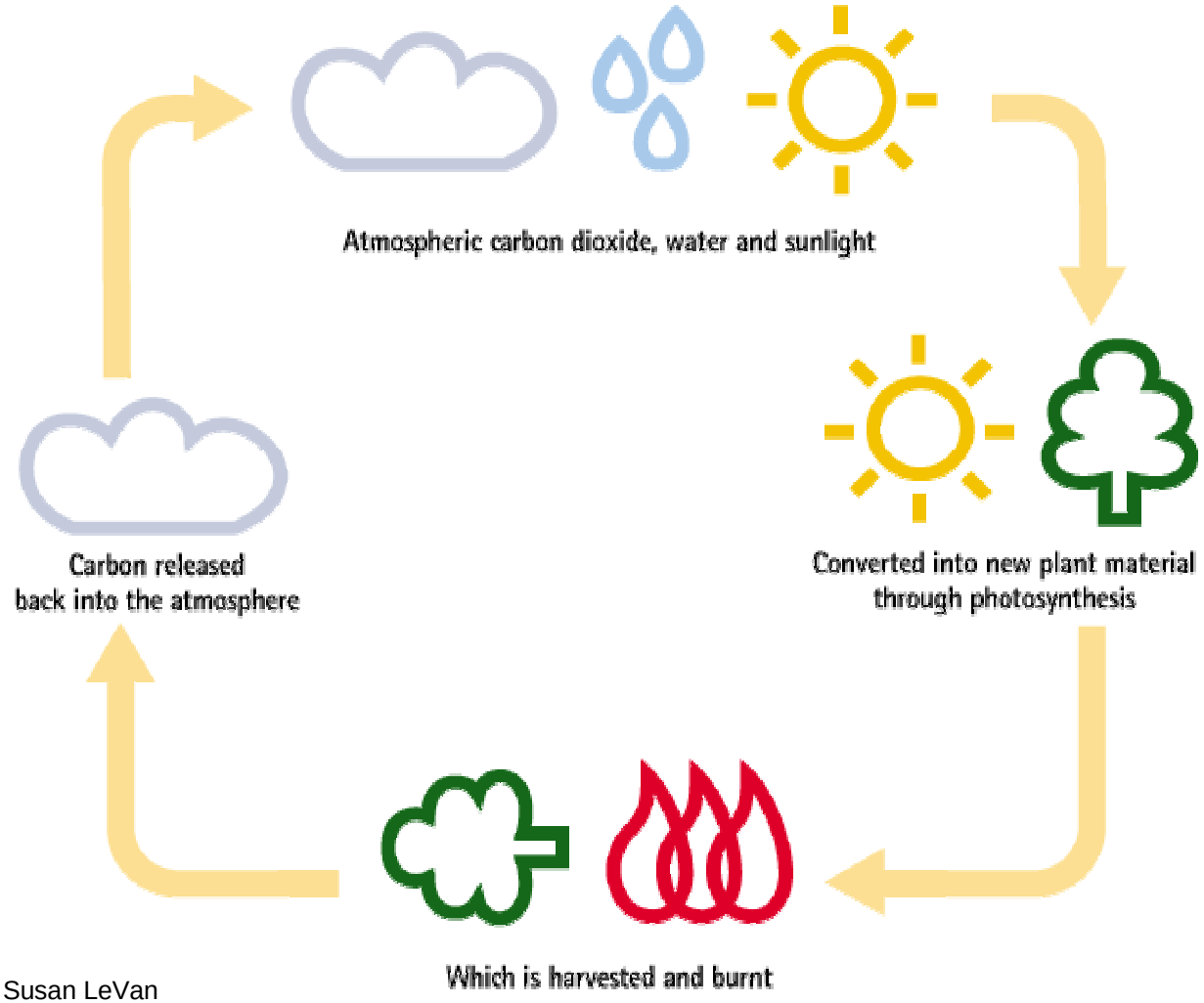
# Thomas Edison (1847-1931)



“I'd put my *money* on the sun and solar energy. What a source of power! I hope we don't have to wait 'til oil and coal run out before we tackle that.”

# *So what's are the least expensive solar collectors currently available?*

# Biomass – It's All about the Carbon Cycle

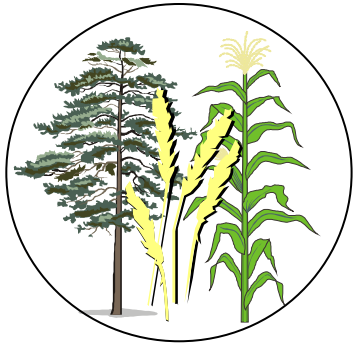





Graph from Susan LeVan

# Biomass. It's a Significant and Realizable Opportunity

Chemical Products



Fuels

Electric Power



Graphic borrowed from Fred Deneke

# Agricultural Biomass

- Agriculture biomass includes crop, animal, and processing residues (straw, corn stover, sugarcane, animal manure, orchard prunings, hulls, shells, pits, seeds, and waste water from food processing operations

- Dedicated agriculture crops such as corn, sorghum, switchgrass, etc.

- Rapid fiber forest crops such as silage alder, hybrid poplar, sycamore, and willow

# Forest Biomass

- Forest biomass includes harvesting and thinning residues, and thinnings from hazardous fuel reduction, habitat improvement, and other ecosystem restoration projects
  - **Trees & woody plants, including limbs, tops, needles, leaves, and other woody parts**
  - **Grown in a forest, woodland, or rangeland**
  - **Products of forest management, restoration, & hazardous fuel reduction treatments**
  - **For energy, it will not include higher value traditional forest products including sawtimber, chip ‘ saw, veneer poles, and pilings**

# Electricity


# Heating & Chilling *(Fuels for Schools)*



**Darby, MT**

# Combinations (District Energy *St. Paul, MN)*

- Urban wood waste
- Daytime
  - Heating & cooling to downtown
  - Electricity to grid
- Night
  - Cooling downtown
  - Uses electricity

# Animal Wastes Products for Electricity and Liquid Fuels

Electricity, Poultry Litter - Minnesota

Electricity, Poultry Litter - Scotland

Electricity, Poultry Litter – New Bern


Ag Bio-diesel

# THERE IS EXISTING USE IN NC Residues and Wood Wastes

- Maybe 225+ plants with 300+ boilers
- Sawmills
- Furniture plants
- Dry kilns
- Co-generators
- Brick plants
- Many long-term users of renewable


# The new industrial biorefinery

**Biomass Feedstock**

– Trees
– Grasses
– Agricultural Crops
– Agricultural Residues
– Animal Wastes
– Municipal Solid Waste

**Conversion Processes**

- Enzymatic Fermentation
- Gas/liquid Fermentation
- Acid Hydrolysis/Fermentation
- Gasification
- Combustion
- Co-firing

## USES

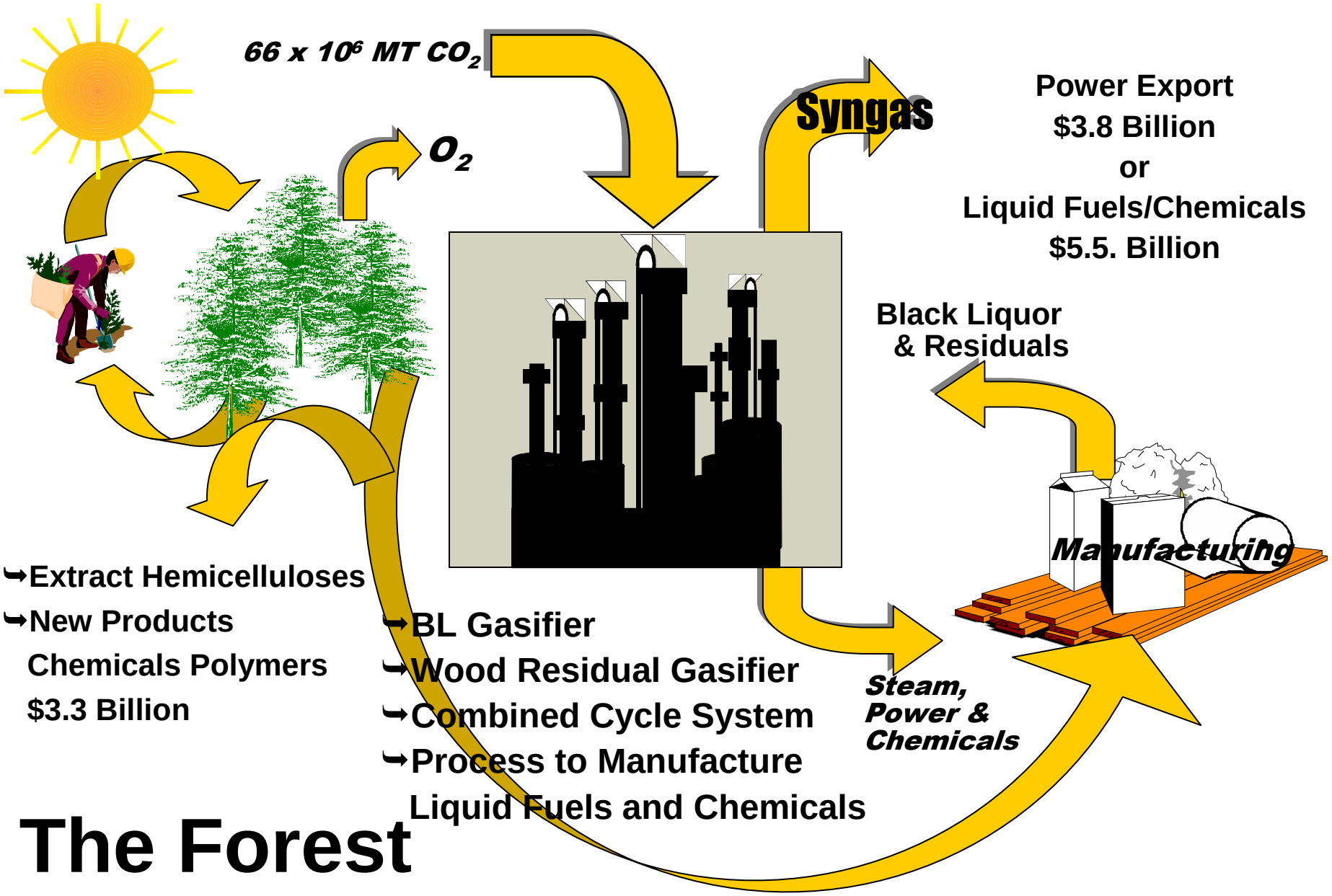
**Fuels:**
– **Ethanol**
– **Renewable Diesel**

**Power:**
– **Electricity**
– **Heat**

**Chemicals**
– **Plastics**
– **Solvents**
– **Chemical Intermediates**
– **Phenolics**
– **Adhesives**
– **Furfural**
– **Fatty acids**
– **Acetic Acid**
– **Carbon black**
– **Paints**
– **Dyes, Pigments, and Ink**
– **Detergents**
– **Etc.**

**Food and Feed**

From Doug Kaempf - DOE




# The Forest Biorefinery

(borrowed from Susan LeVan)

**Net Revenue Assumptions:**

| | |
|---|---|
| Acetic Acid - $1.73/gallon | Purchased Electricity - $43.16/MWH |
| Ethanol - $1.15/gallon | Exported Electricity - $40.44/MWH |
| Pulp - $100/ton net profit | Renewable Fisher Tropsch Fuel - $57/bbl |

# Many Cobenefits of Implementing Solutions in Ag & Forestry Sectors

- Using renewable fuels
- Using carbon-neutral fuels
- More incentives to keep land in farms and forest
- Keeping $$$ spent for energy in North Carolina
- New jobs in rural areas

# Potential Benefits to NC of an RPS*

- Economic (net gain) Benefits
  - Lower rate impact than new nuclear + coal!
  - 3,000+ net jobs per year
  - $1.5 billion more in wages through 2017
  - $2.7 billion increase in Gross State Product
  - Keeps more $'s circulating in NC economy

- Social Benefits
  - Creates local wealth statewide; close to the land
  - Strengthens rural counties
- Environmental Benefits
  - Helps resolve hog and poultry waste/pollution issues
  - Improves air and water quality
  - Reduces NC's $CO_2$ emissions by several million metric tons

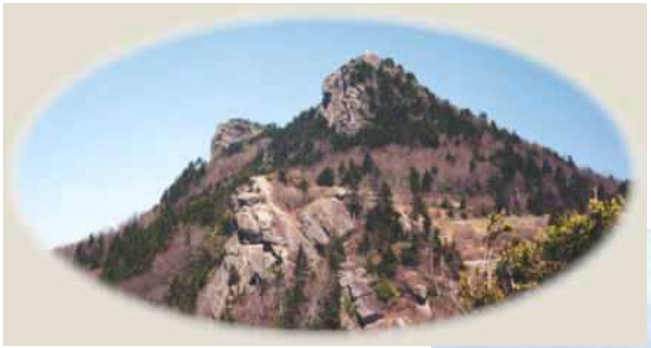


* Ivan Urlaub, NC Sustainable Energy Association

# Co-Benefits - Continued

- Forest health is improved
- Strategies to reduce emissions are generally soil friendly
- Reduced dependence on foreign energy sources
- Improved national balance of trade
- Markets for ag and forestry waste products

# There Can Be a Price to Waiting: Example Spruce/Fir Plant Community in NC Mountains


# Summary

- Agriculture and forestry have solutions to offer – with help!
- Terrific traditional and new partners exists to help identify and implement solutions
- Many, many co-benefits of turning to agriculture and forestry
- As Snuffy Smith said years ago: “Times a wastin’!”

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# QUESTIONS?