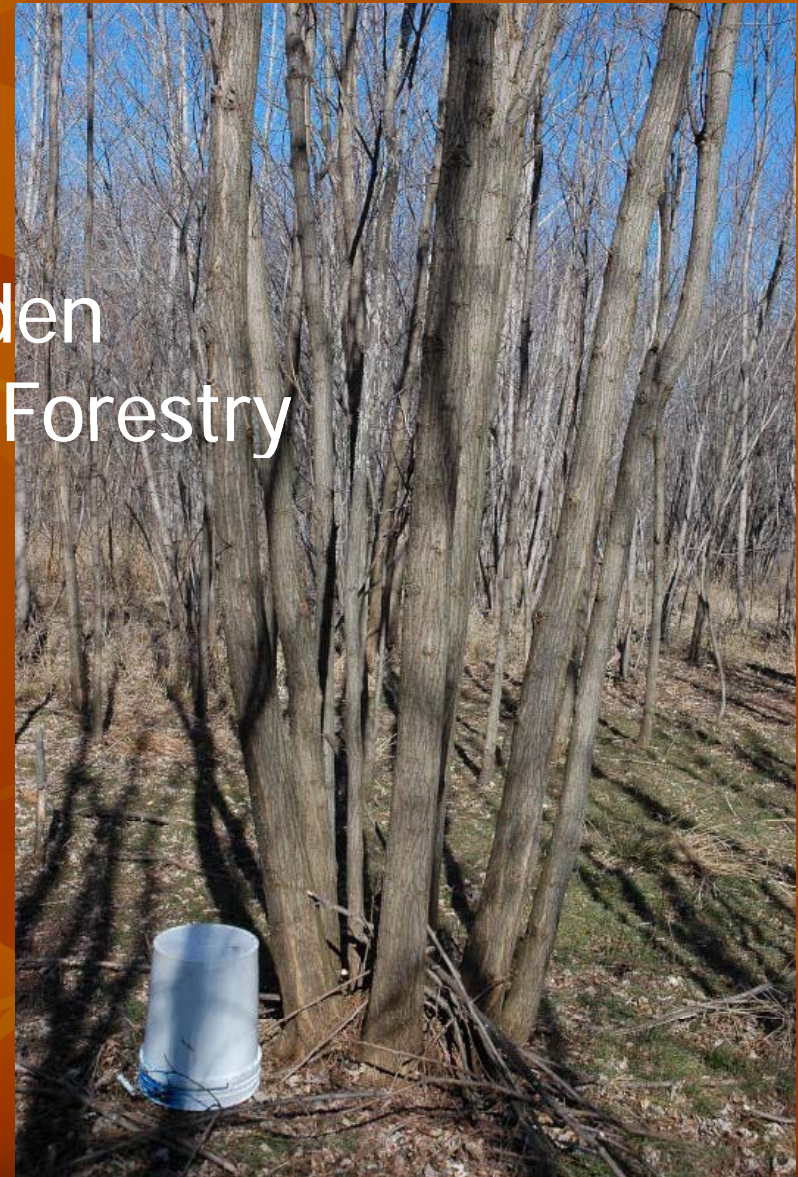


# Role of Forestry in Sustainability, Energy, and Carbon

Charles Barden  
KSU Professor of Forestry



# Advantages of Trees for Energy

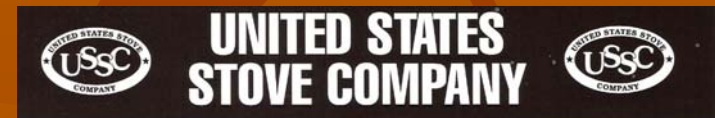
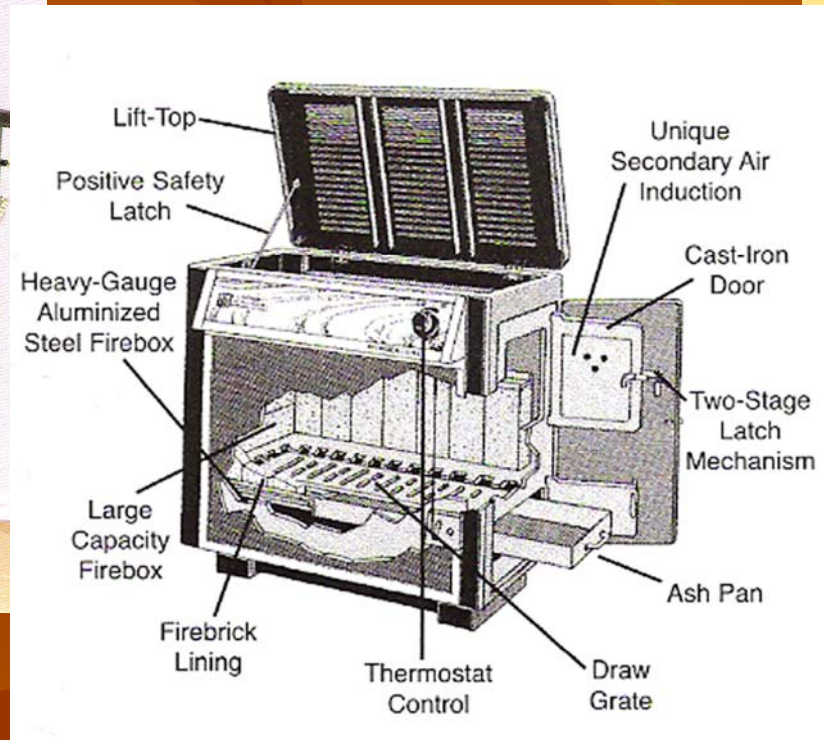
- Stores well in the field, flexible harvest
- Plant once, harvest resprouts several times, root system remains alive
- Low nutrient demands as a crop
- Dense energy source
- Carbon neutral, builds up soil C



# Wood Energy Solutions

- Need to have more home heating and industrial boilers using wood.
- Pyrolysis results in gaseous and liquid fuels, and charcoal (bio char). Charcoal can be used as a fuel or soil amendment for sequestration.
- Cellulosic ethanol is close to becoming a practical reality.

# Wood is most efficient when burned as a solid fuel 60%-80%



*"Keeping North America Warm Since 1869"*



**WONDERWOOD CIRCULATOR - MODEL 2941B**

# Energy Equivalents

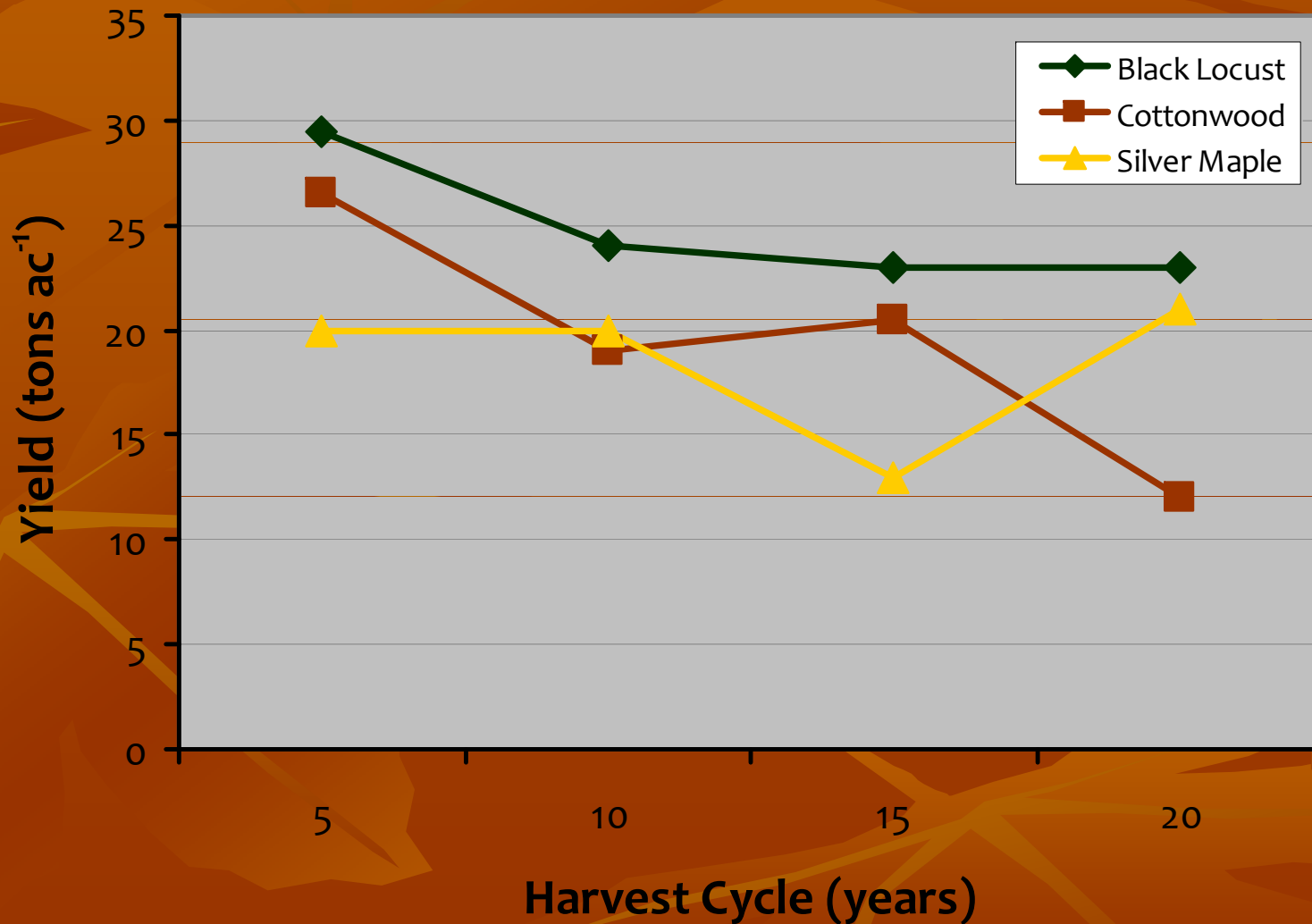
- Natural gas, a Therm is 100,000 Btu.
- A barrel of oil, 42 gallons, 5.8 million Btu.
- A cord of bur oak has 26.5 million Btu, which is = to 265 Therms of gas, or 4.6 barrels of oil.
- Burning wood will save fossil fuels.

# K-State Forestry Research Results

DOE-sponsored during the 1970-90's

- Black locust planted at 4'x4', 2,800 per acre
- At Age 4 the mean annual increment was still increasing at a rate of 16%.
- At age 7, trees averaged 25' tall and 4" in diameter, yielding 35 tons/acre, or 17 cords.

# Air-dry yield in conventional-spacing trials (1980) with five-year cutting cycles





# Black locust near Manhattan, planted 1980, harvested 4 times, with 9 years of regrowth





# Other Solutions

- Establish new and renovate old windbreaks.
- Tree plantings for carbon sequestration.
  - 775 acres Marais des Cygnes NWR in 2008
    - Could not convince a local utility to buy C credits
    - Conservation Fund marketed to others

# Windbreak Benefits

- Buildings- result in 15-20% reduction in winter fuel bills.
- Livestock- Reduce winter livestock feed costs, and increase calf survival.
- Crop fields- Reduce soil erosion, increase crop yields via reduced summer Et.



# Great Plains Forestry Project

- Established 3,500 miles of windbreaks in the 1940's.
- Planted almost 40 million trees.
- Many old windbreaks are ready to be harvested for wood products.
- Many old windbreaks were bulldozed and burned, to accommodate larger equipment.



# Windbreaks near Dodge City

