# *Building a Sustainable Bioeconomy - A Path Forward for our Existing Industries, and for Emerging Approaches*

**ACEEE Ag Forum: Food and Energy from the Ground Up**

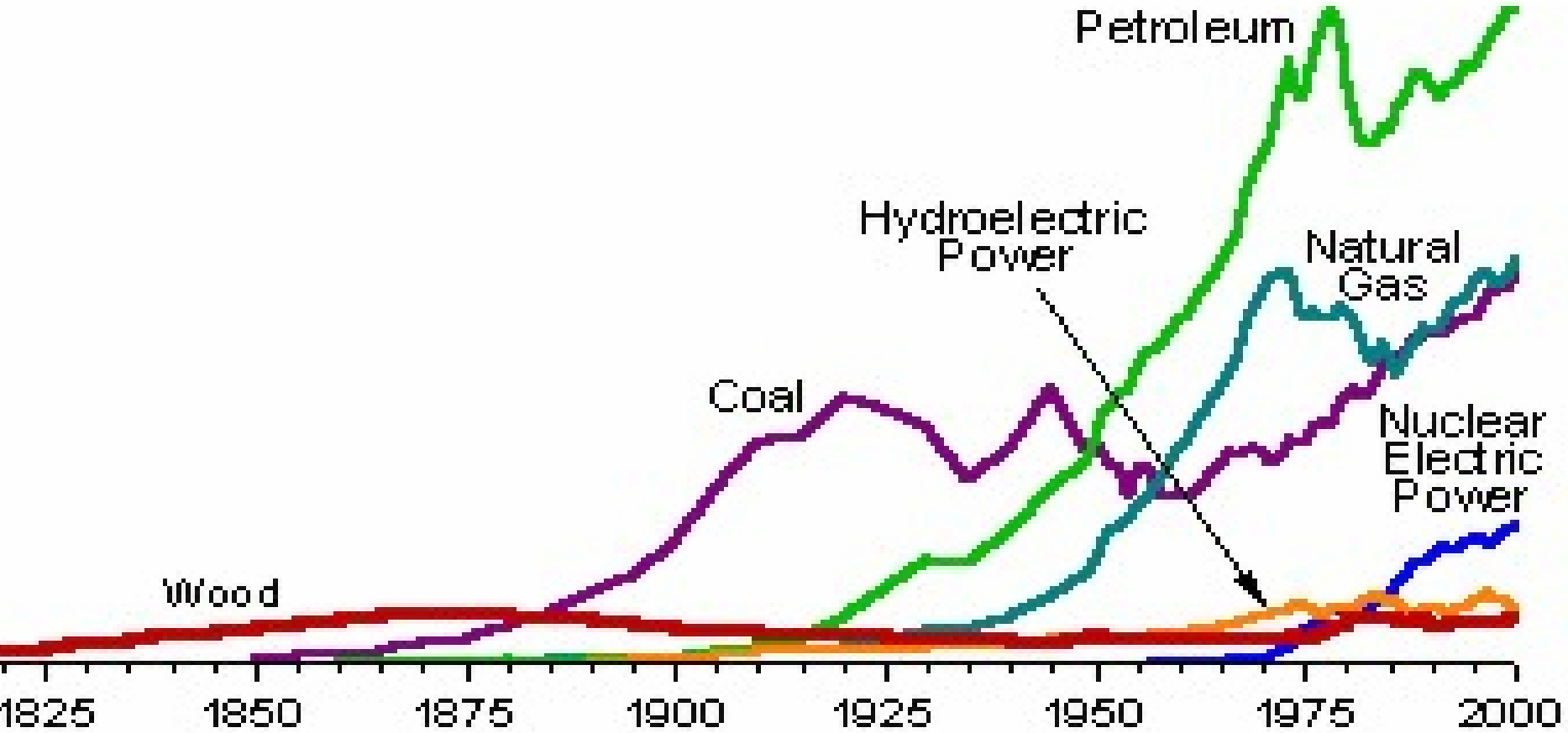
**Brendan Jordan**
**Great Plains Institute**

NORTH CENTRAL BIOECONOMY CONSORTIUM

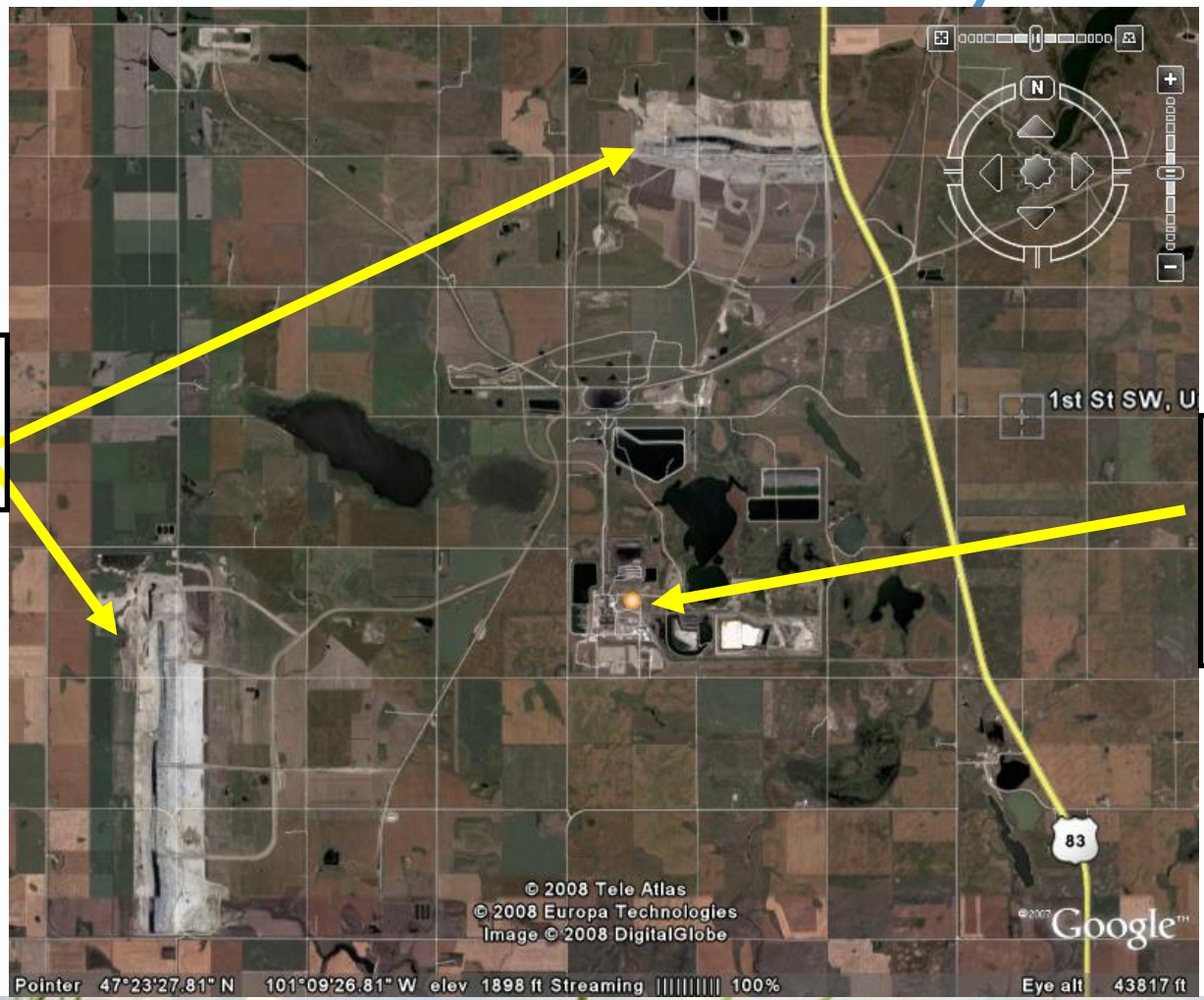
**“They’re making more people every day, but they ain’t making more dirt.”**

**Will Rogers**

# U.S. Energy Use 1825-2000




# Coal Creek Station, ND

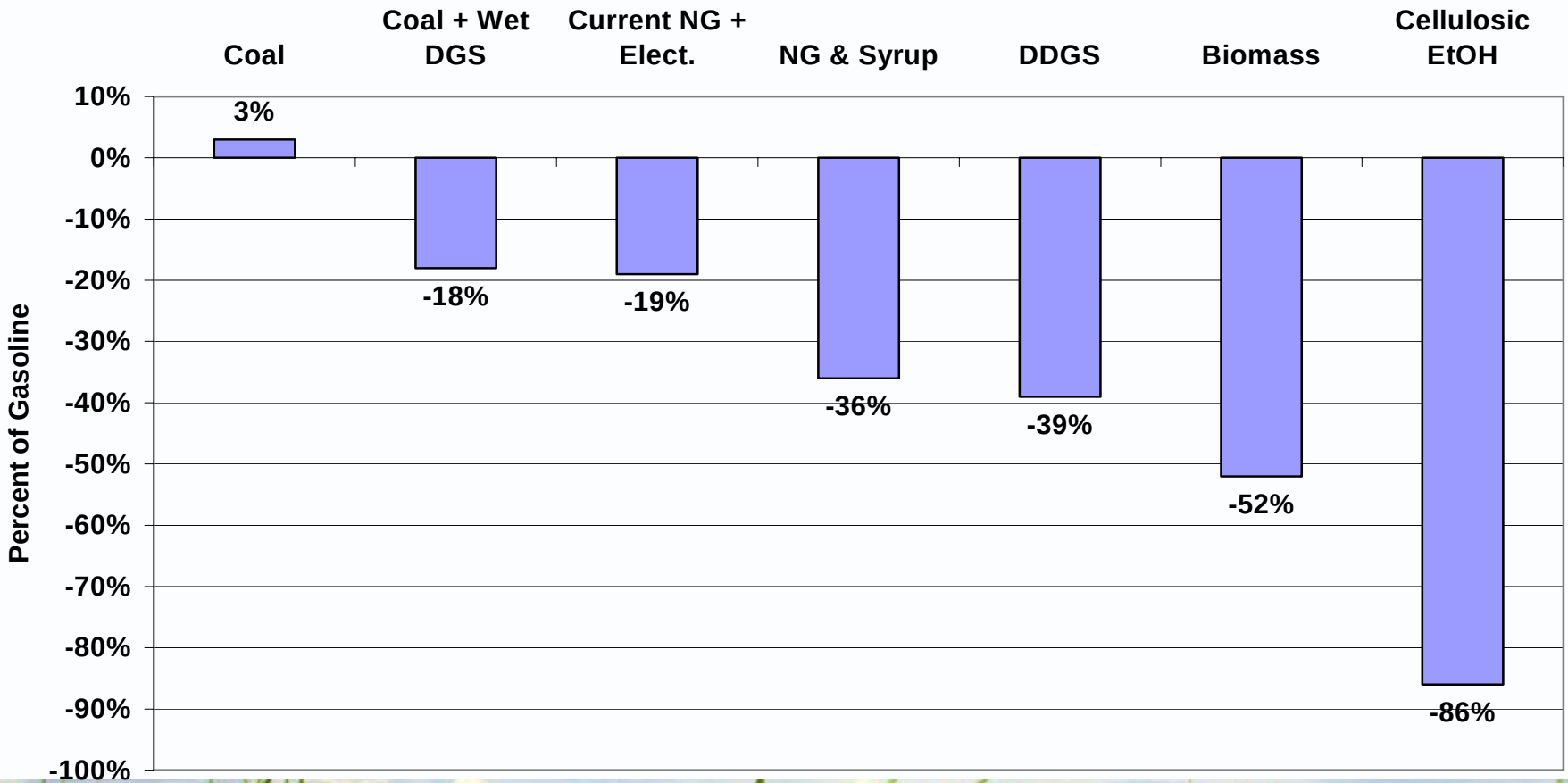



Falkirk Mine

Coal Creek Station

# Well to Wheels Greenhouse Gas Emissions Changes by Fuel Ethanol Relative to Gasoline

**Source: Wang, Wu and Huo, Environmental Research Letters 2 (2007)**

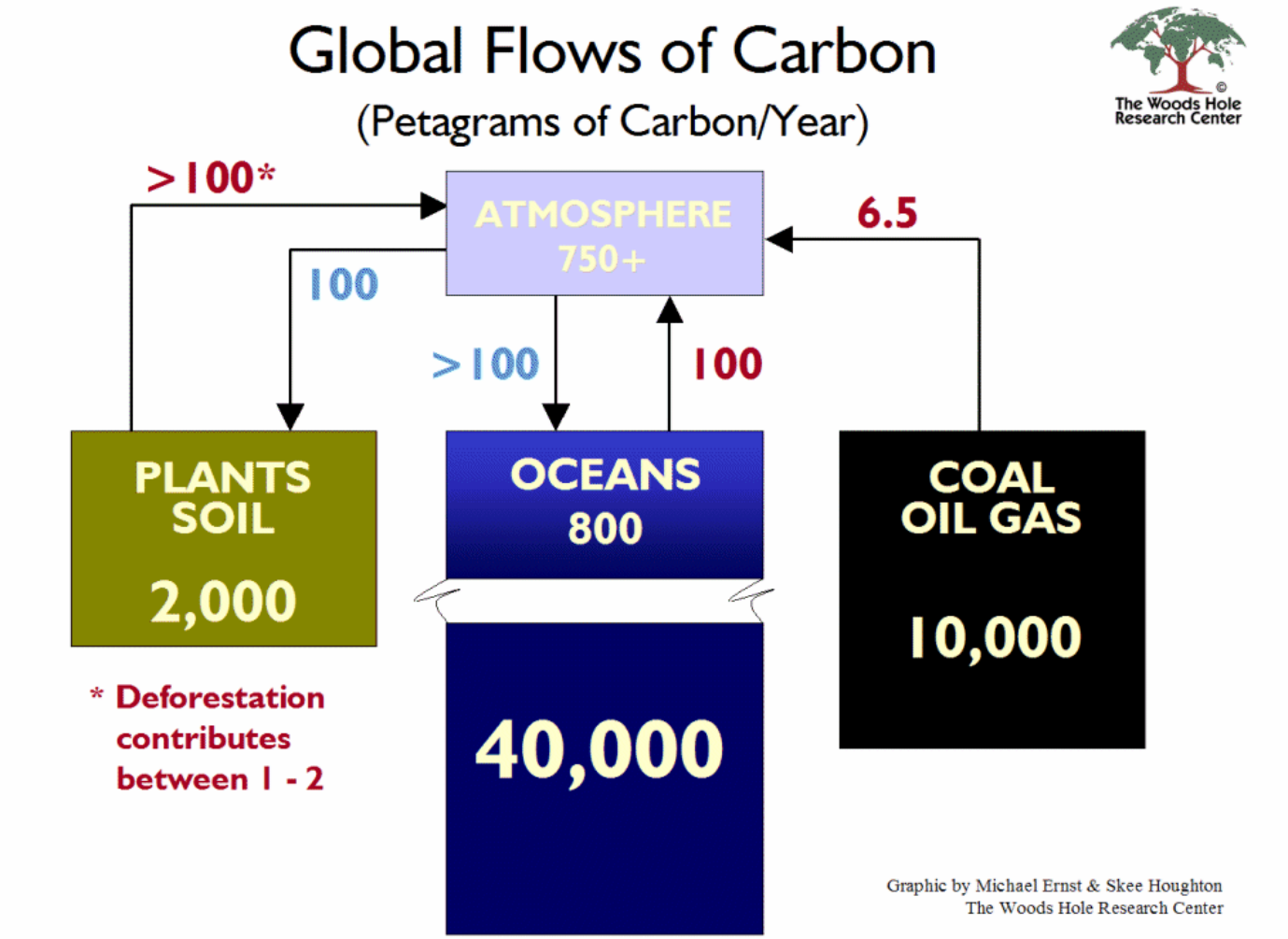


# Carbon Debt

**"Biofuels are a potential low-carbon energy source, but whether biofuels offer carbon reduction depends on how they are produced."**

**Fargione et al, "Land Clearing and the Biofuel Carbon Debt". Science Express Feb. 7, 2008**

# More carbon in biosphere than atmosphere



# SOC change over time

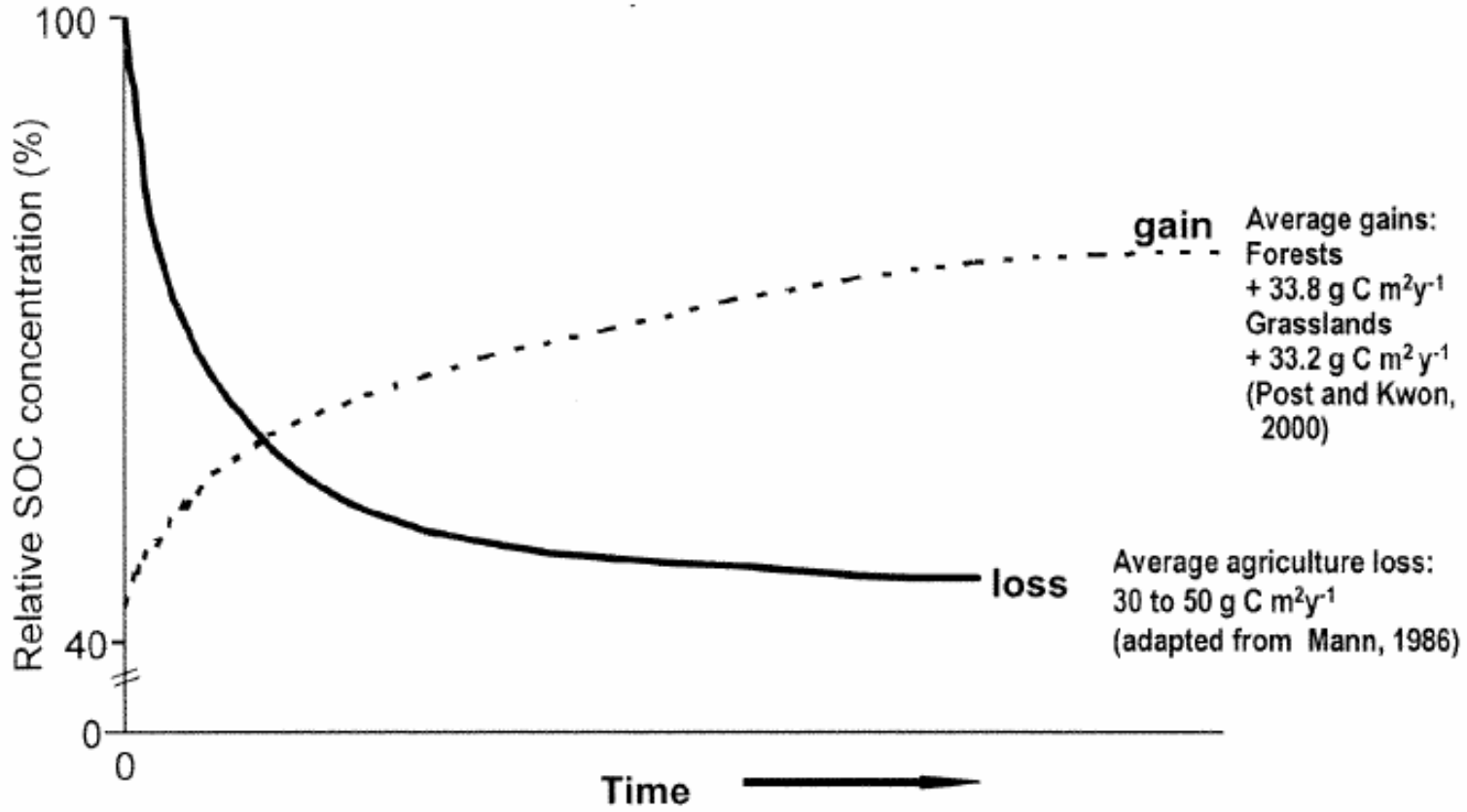
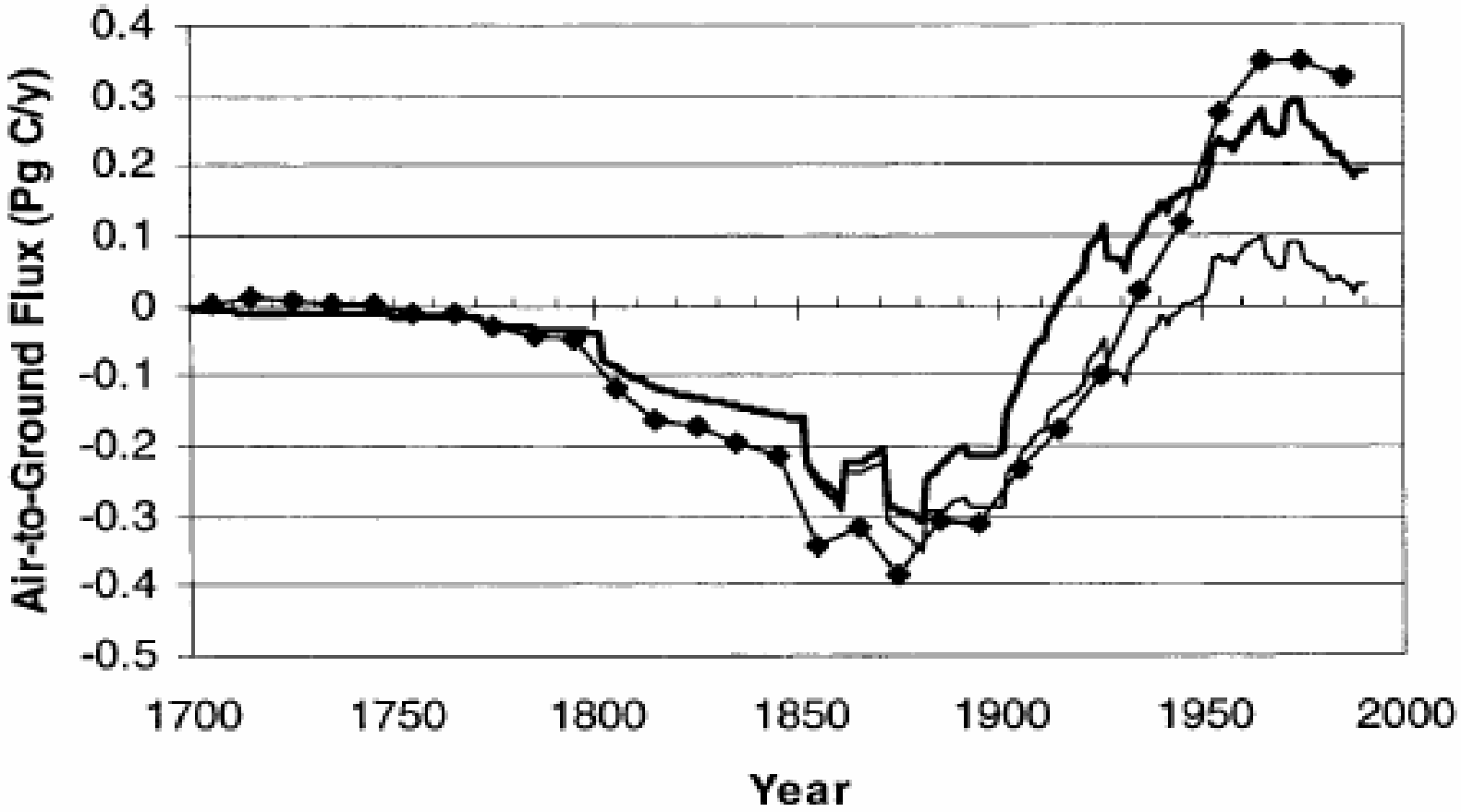



**FIGURE 1.** Soil carbon losses following cultivation of forests and grasslands to agricultural ecosystems, and potential C sequestration by adoption of RMPs. The time 0 on the x-axis represents the time of conversion to agricultural land use and time of adoption of RMPs.

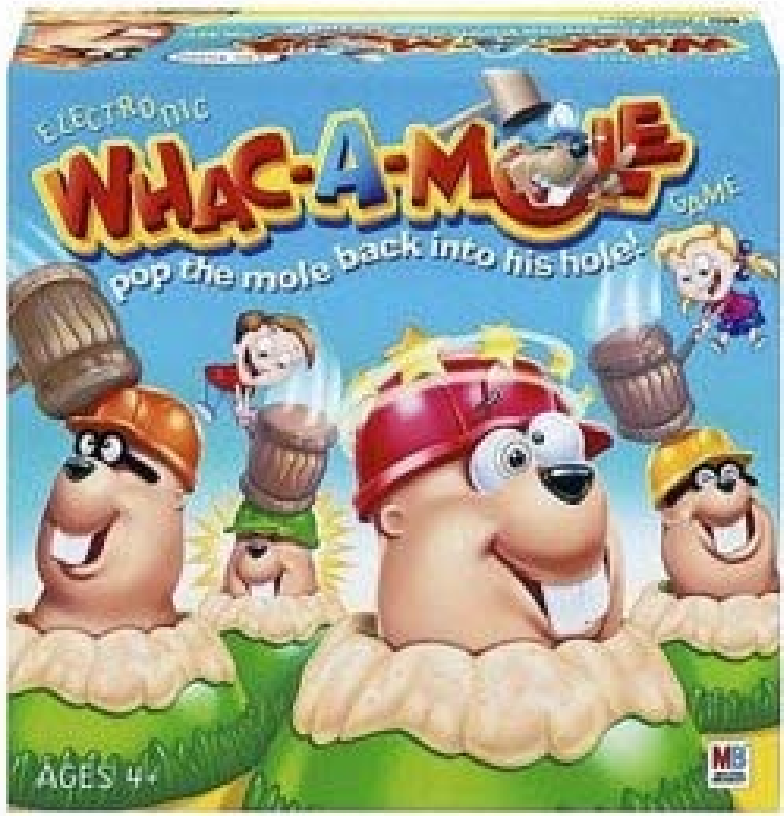
# Long-term trend in US terrestrial sink



# Carbon debt payback

| | |
|---|---|
| Brazilian Amazon to soybean biodiesel | ~320 years |
| Brazilian Cerrado to soybean biodiesel | ~17 years |
| Brazilian Cerrado to sugarcane ethanol | ~37 years |
| Indonesian or Malaysian lowland tropical forest to palm biodiesel | ~86 years |
| Indonesian or Malaysian peatland tropical forest to palm biodiesel | ~420-840 years |
| U.S. Central Grassland to corn ethanol | ~93 years |
| CRP to corn ethanol | ~49 years |

# Searchinger et al simplified…



# Searchinger conclusions:

- Corn ethanol from existing corn land~ 167 year payback
- Switchgrass ethanol from existing corn land ~ 50 year payback
- Scenarios improve the payback: yield improvements, improved efficiency for corn ethanol

# New York Times, Feb. 8, 2008

- Title: “Biofuels deemed a greenhouse gas threat”
- “Almost all biofuels ***used today*** cause more greenhouse gas emissions than conventional fuels.”
- “When you take this into account, most of the ***biofuel that people are using or planning to use*** would probably increase greenhouse gases substantially,” said Timothy Searchinger

# In fact:

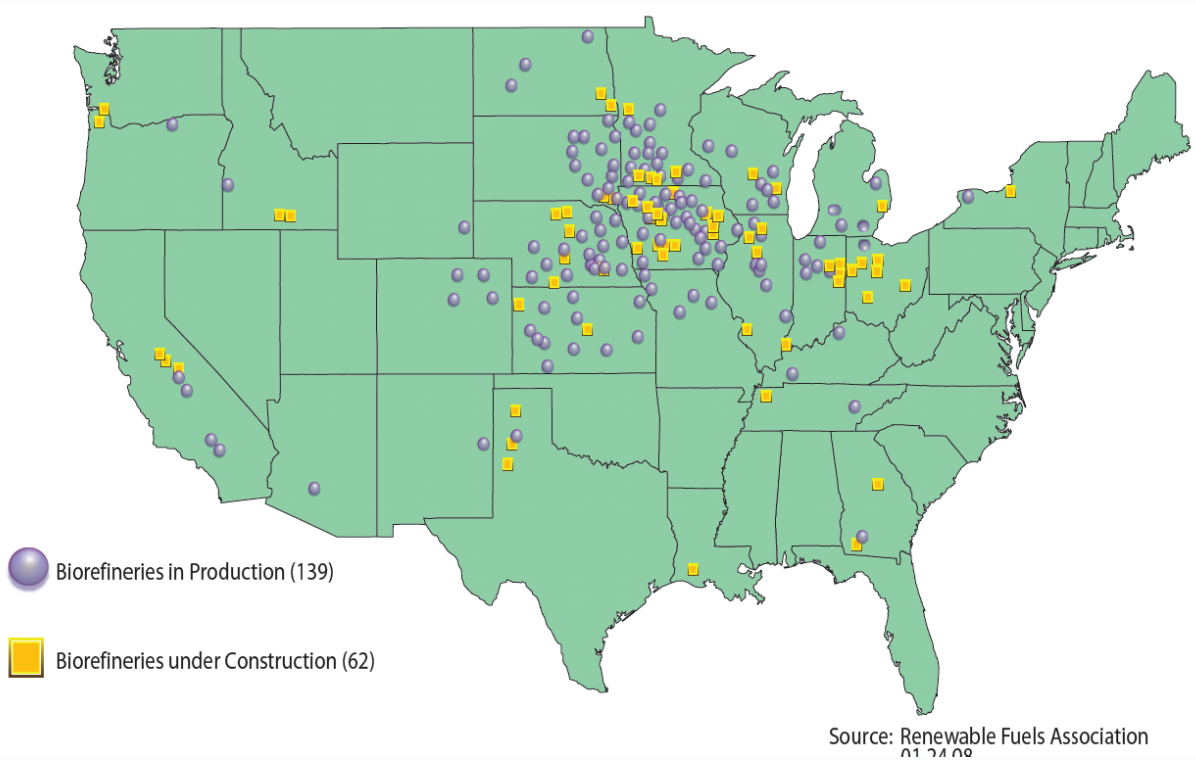
- Both Fargione and Searchinger are hypothetical “worst case scenarios”
- This is an opening bid, not the final word
- But there is some basic truth to their arguments: land use effects are important, large, and previously uncounted in most GHG calculations.

# Both authors endorse some kind of biofuels policy

- Searchinger at al: use “waste” products such as crop residue, municipal waste, crop wastes, and fall grass harvests from reserve lands.
- Fargione et al: use marginal lands, particularly planted with high diversity prairie plantings

# What do we do?

1. **Don't rush to conclusions on the GHG question.**

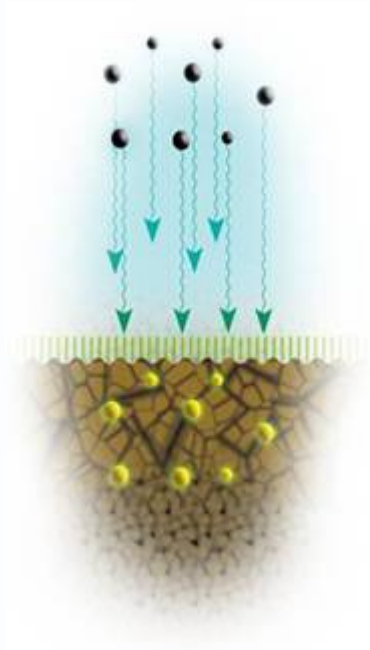


# 2. Ask for what you want

**“Create a uniform, regional low-carbon fuels policy – implemented at the state level as a standard, objective or incentive – and report annually on progress.** Convene affected stakeholders to develop the common policy, including reporting mechanisms and other details.”

-MGA Energy Security and Climate Stewardship Platform

# 3. Move towards lower carbon biofuel systems



- **Crops that sequester soil carbon**
- **Reduce fossil inputs to biorefining**
- **Other strategies to remove carbon from the air:**
  - Biochar
  - Geologic sequestration

# Many options for soil sequestration exist

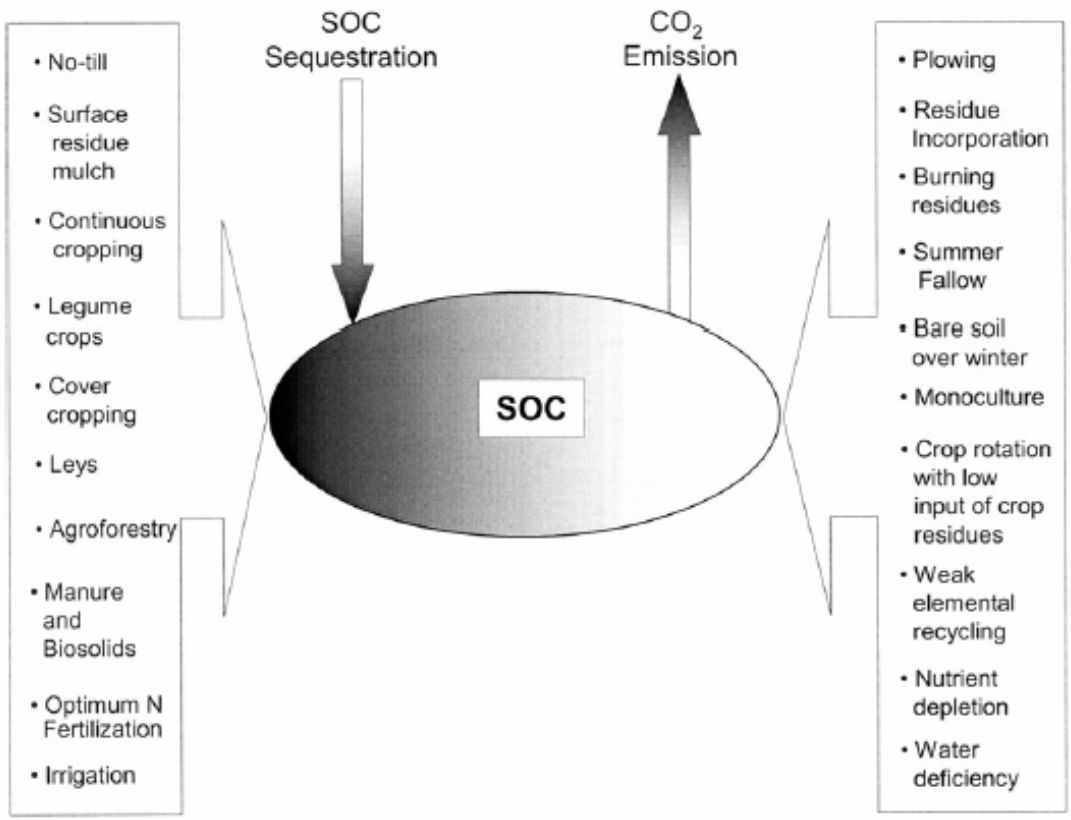
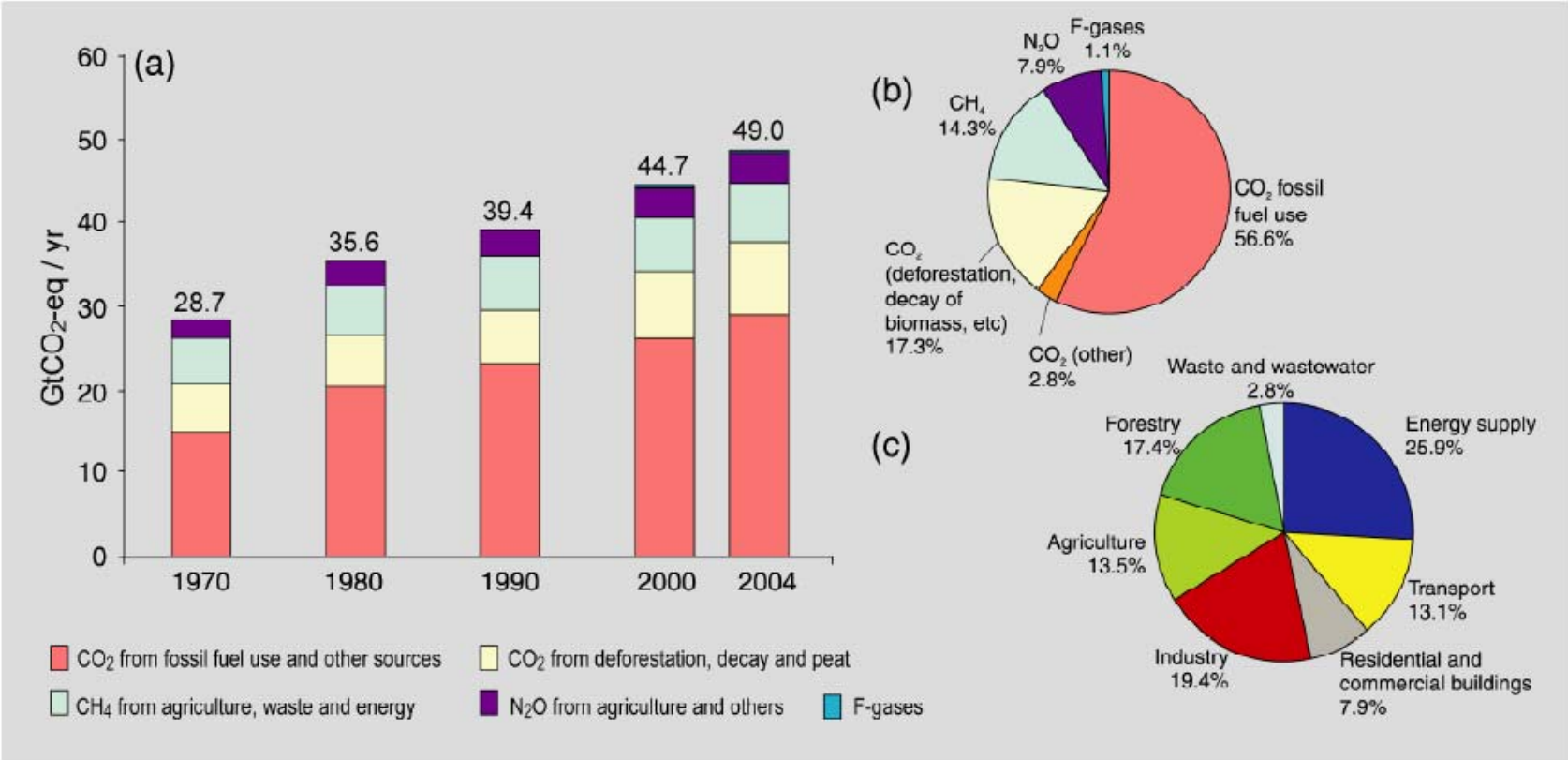
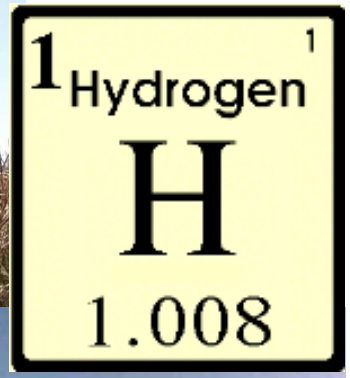



**FIGURE 2.** Effect of crop management practices on SOC sequestration.

# 4. Address agricultural emissions in a comprehensive way



# 5. No “silver bullet” solution




# Thank you!

**Brendan Jordan**
**Great Plains Institute**
**bjordan@gpisd.net**
**(612) 278.7152**