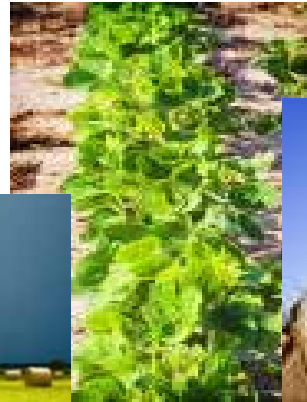


The Role of Agriculture in Climate Change Policy



National Association of State Departments of Agriculture
Bismarck, North Dakota September 23, 2008

“Strength from the Soil”



Debbie Reed www.DRDAssociates.org

Climate Change and Agriculture: What Agriculture Can do for Society

Presentation Overview:

- Global Climate Change...and Agriculture
- **Theory:** How to Address Global Climate Change...and Opportunities for Agriculture
- **Practice:** Overview of Congressional Activity...and Opportunities for Agriculture
- **Biochar:** A Carbon-negative Technology

Climate Change and Agriculture: What Agriculture Can do for Society

Premise

WE do not have the luxury of excluding *agricultural emissions reduction offsets* from GHG emissions reductions policies;

AND

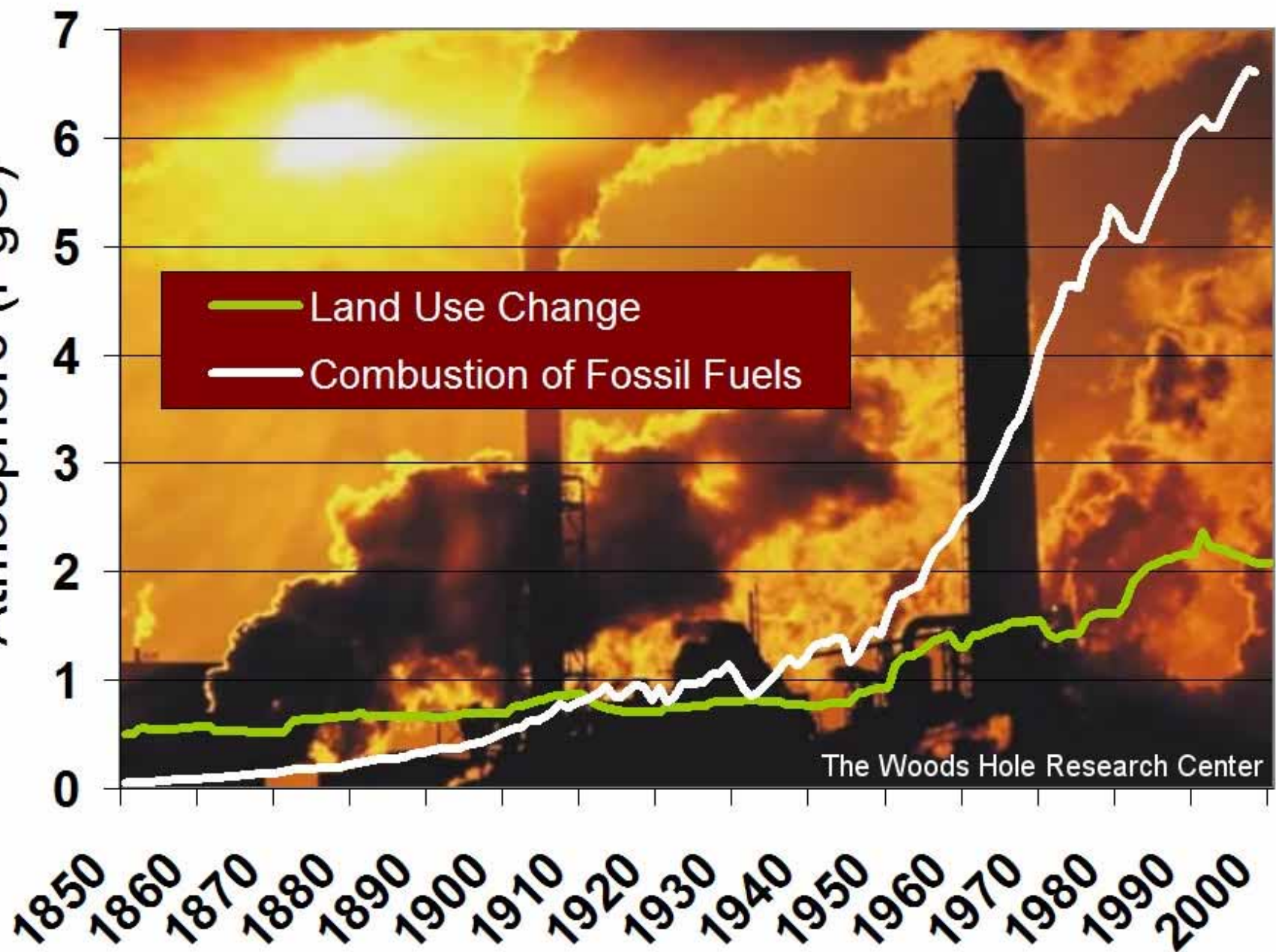
Agriculture should receive *full market value* for emissions reductions (and significant income generation opportunities exist).

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Annual Emissions to the Atmosphere (PgC)



The Woods Hole Research Center

Global Climate Change...

If atmospheric CO₂ levels are to be stabilized at reasonable concentrations by 2050 (450-650 ppm CO₂), drastic reductions in emissions are required over the *next 20-30 years*.

--IPCC Special Report on Emissions Scenarios

During this critical 20-30 year period, ***all available emissions reductions measures must be utilized***, and new energy technologies must be developed.

Global Climate Change... and Agriculture

The Role of U.S. Agriculture in Climate Change Mitigation:

- Agriculture is both a **source of GHG**, and a **sink (GHG reservoir)**
- As a source of GHG, agriculture contributes approximately **8% of US GHG emissions** – mostly from small, diffuse, non-point sources
- N_2O and CH_4 account for the largest share of agricultural emissions (CO₂ equivalent basis)

Global Climate Change... and Agriculture

Agricultural Sources of Nitrous Oxide (N₂O) emissions:

- Soils
- Fertilizers
- Land application of manure



Global Climate Change... and Agriculture

Agricultural Sources of Methane (CH₄):

- Livestock (enteric fermentation, manure)
- Soils
- Rice cultivation

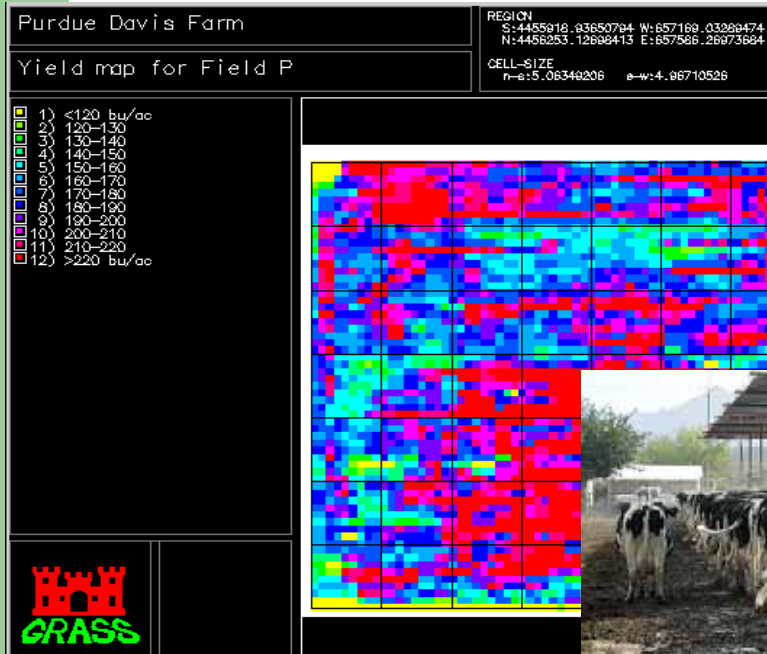


Global Climate Change... and Agriculture

The Role of U.S. Agriculture in Climate Change Mitigation:

- Reducing emissions from **agricultural sources** of GHG, or **displacing fossil fuels,**
or
- enhancing **terrestrial/biological sinks**
(**forest and soil carbon sequestration**)

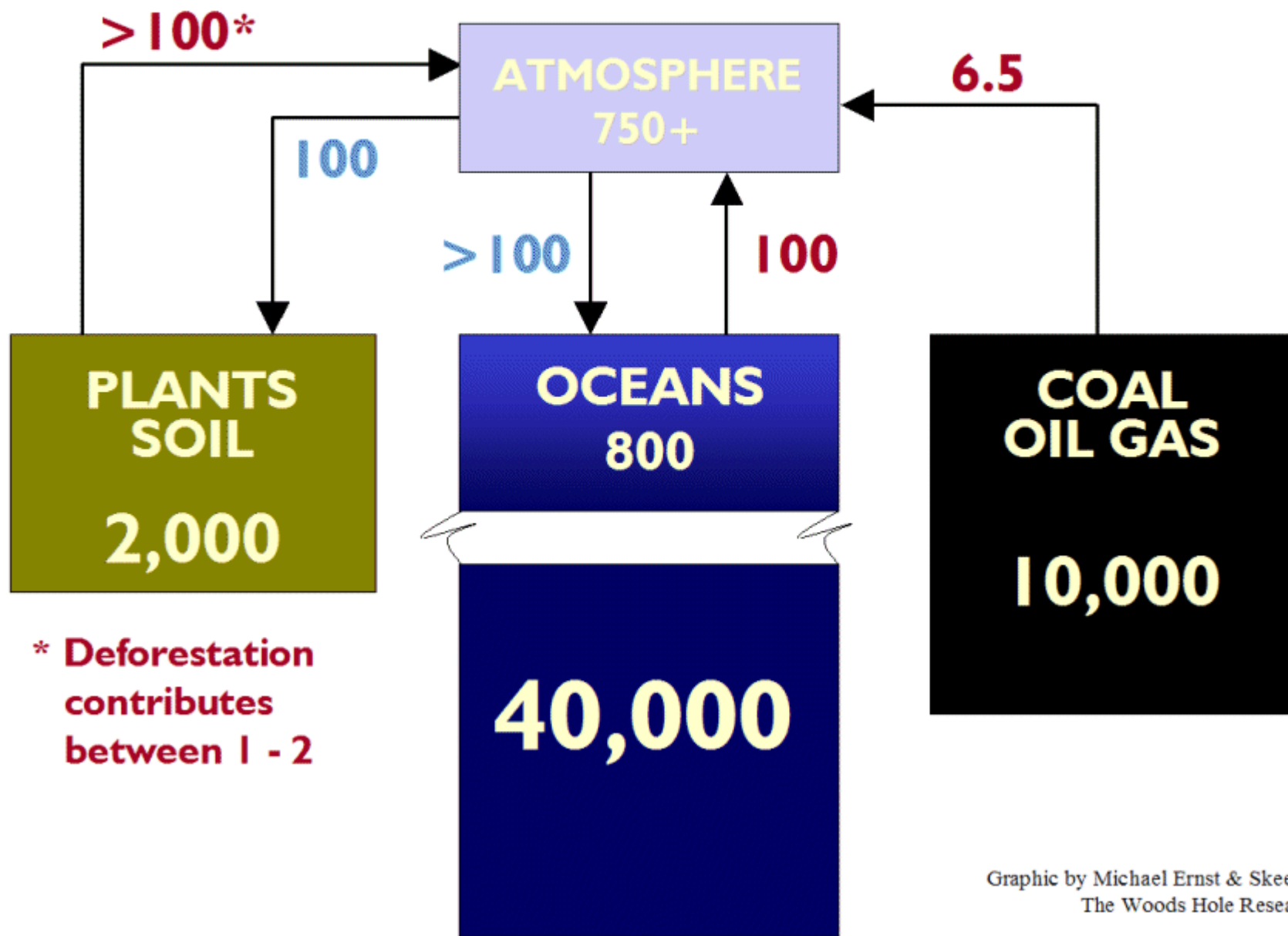
Global Climate Change... and Agriculture: Mitigation Options for Agriculture



CH₄
N₂O

Global Flows of Carbon

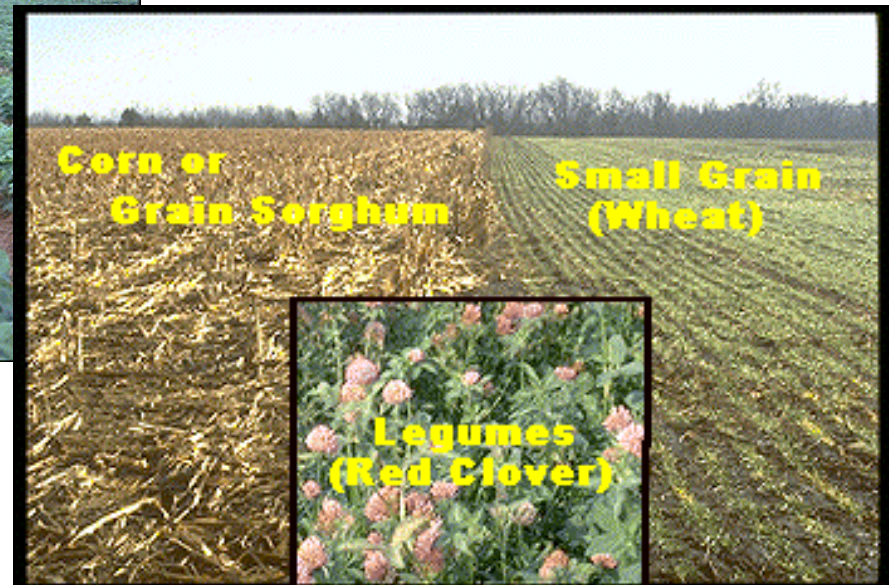
(Petagrams of Carbon/Year)



Global Climate Change... and Agriculture

Mitigation Options for Agriculture

**** Enhancing the soil carbon sink ****



- ***No-till***
- ***Cover Crops***
- ***Crop Rotations***

Global Climate Change... and Agriculture

Q: How do agricultural contributions compare to other available GHG emissions reductions options? (i.e., what's the competition)?

A: They are:

- *Real, proven*
- *readily available*
- *Implement now*
- *low-cost*

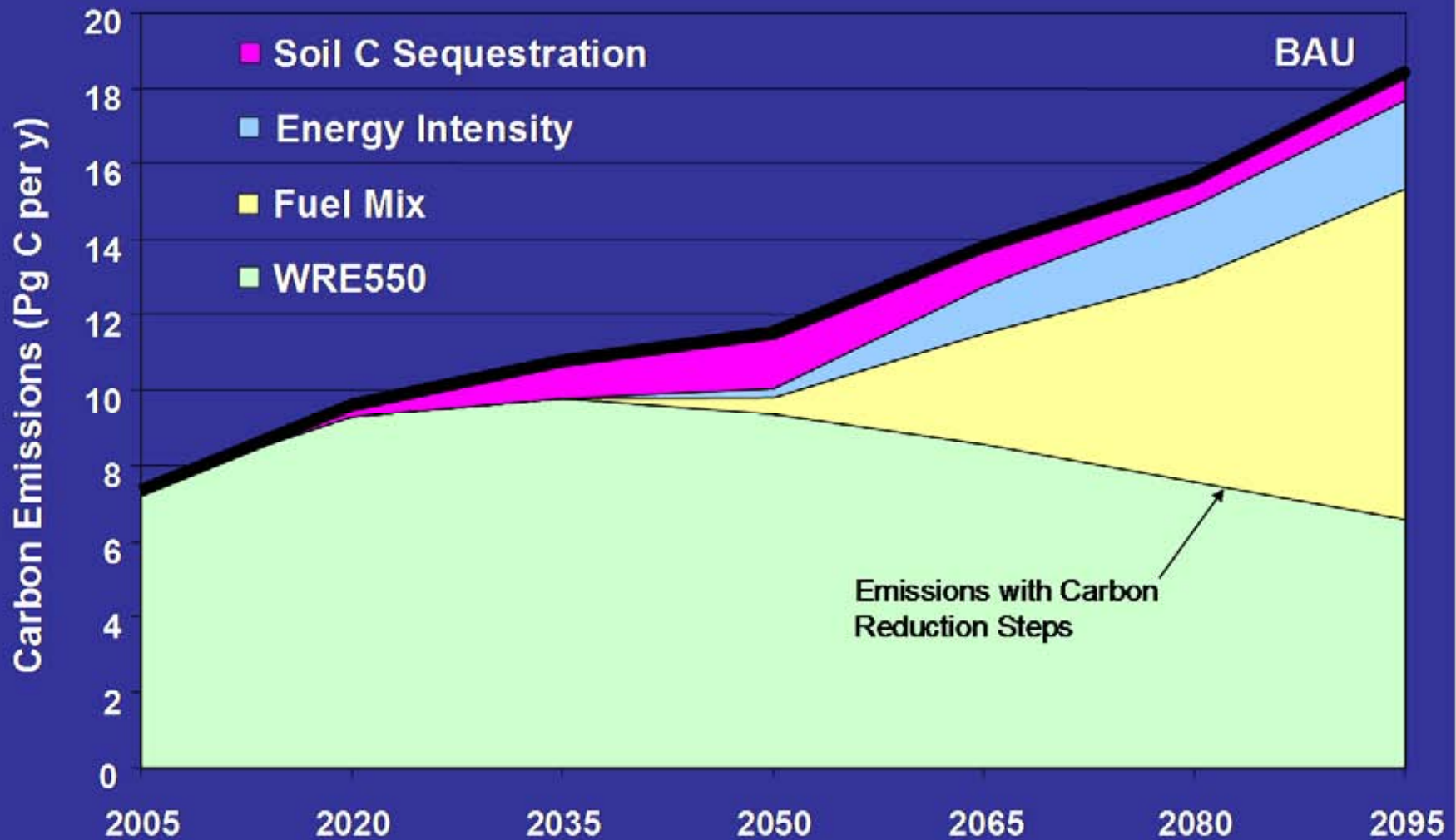


- ***NO ONE ELSE can make these claims!***

Potential CO₂ Reduction Options

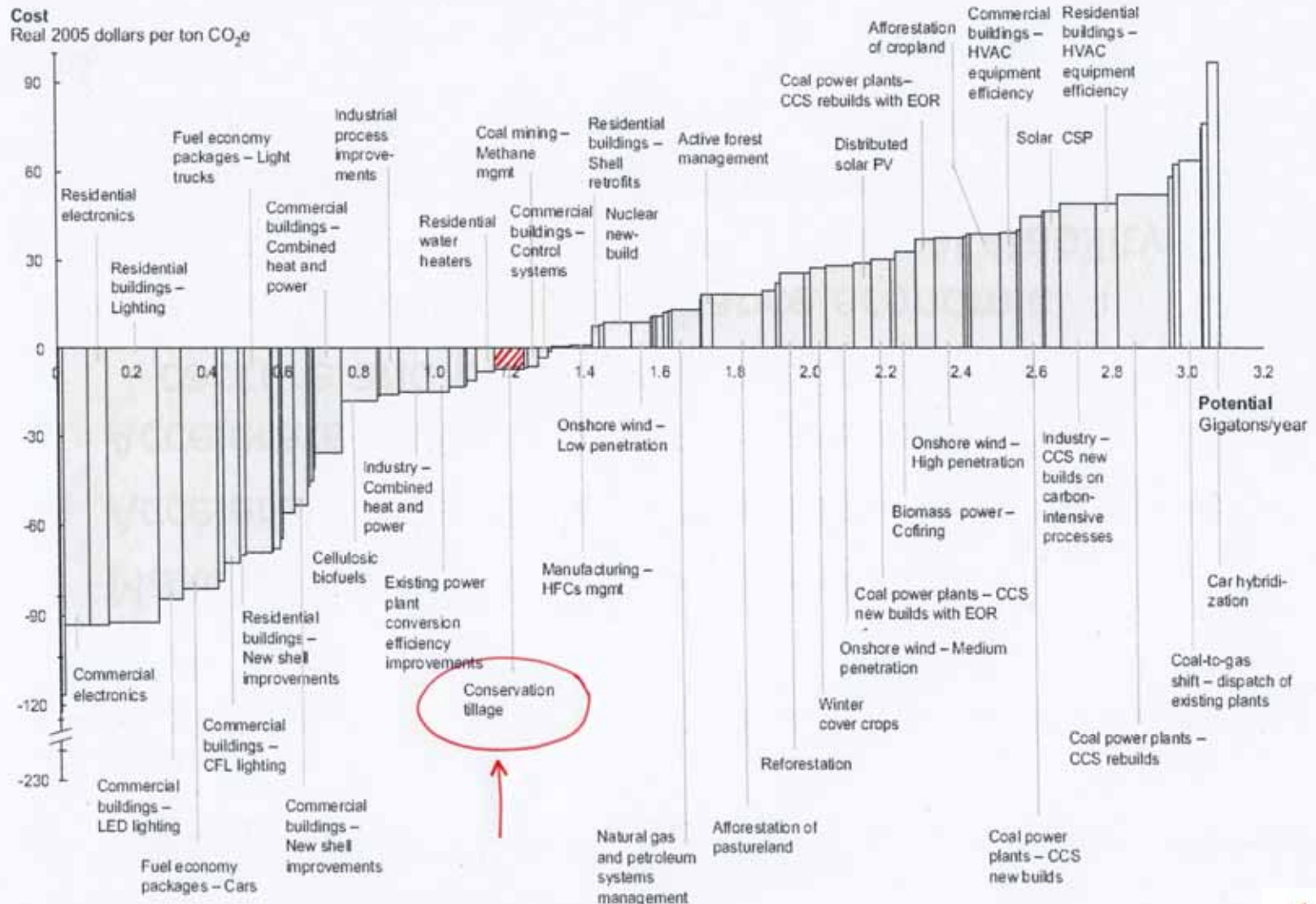
	Rapidly Deployable	Not Rapidly Deployable
Minor Contributor <0.2 PgC/y	<ul style="list-style-type: none"> • Biomass co-fire electric generation • Cogeneration and Hydropower • Natural Gas Combined cycle • Niche options 	<ul style="list-style-type: none"> • Photovoltaics • Ocean fertilization
Major Contributor >0.2 PgC/y	<ul style="list-style-type: none"> • C sequestration in Agricultural soils • Improved efficiency • Industrial Non-CO₂ gas abatement • Ag non-CO₂ gas abatement (CH₄, N₂O) • Reforestation 	<ul style="list-style-type: none"> • Biomass to hydrogen • Biomass to fuel • Cessation of deforestation • Energy-efficient transport • Geologic storage • High efficiency coal technology • Large-scale solar • Next generation nuclear fission

Carbon Emissions Reductions: WRE 550 with Soil Carbon Sequestration Credits



From: Rosenberg, N.J., R.C. Izaurralde, and E.L. Malone (eds.). 1999. Carbon Sequestration in Soils: Science, Monitoring and Beyond. Battelle Press, Columbus, OH. 201 pp.

McKinsey Study Shows U.S. Can Get Large GHG Cuts at Low Costs



Source: McKinsey, "Reducing U.S. Greenhouse Gas Emissions," November, 2007

Ag's Role in the New C Economy: What Agriculture Can do for Society

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Theory: How to Address Global Climate Change

Economy-Wide, Cap-and-Trade

CAP = amount of GHG that can be emitted in a year

- Established by policy
- Reduced every year (theoretically)
- Applies to emitters ID'd by policy

Theory: How to Address Global Climate Change

Economy-Wide, Cap-and-Trade

Allowance = legal tender, represents
1 ton GHG *emissions*

- Given/auctioned to capped entities
- Can be traded, sold on GHG market

Theory: How to Address Global Climate Change

Economy-Wide, Cap-and-Trade
Offset = legal tender, represents 1
ton GHG *reductions*

- Given to non-capped entities for proven, verified GHG reductions
- Can be traded, sold on GHG market
- Provide Cost-Containment!!

Theory: How to Address Global Climate Change

Economy-Wide Cap-&-Trade:

A New Economy

- CBO estimates allowances from cap-and-trade worth \$50 B - \$300 B/year
- Over 20 years = \$300 B - \$6 Trillion

Theory: How to Address Climate Change... and Opportunities for Agriculture



In theory, in a cap-and-trade system, agricultural emissions reductions that are proven and verified will receive **offsets credits** that can be traded or sold in GHG markets.....

Ag's Role in the New C Economy: What Agriculture Can do for Society

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Overview of Congressional Activity, And Opportunities for Agriculture

- 110th Congress: 165 climate change bills, resolutions, amendments introduced by July, 2007*
- Some bills -- not all -- would allow a role for agricultural sinks, and other agricultural emissions reductions
- 11 major bills in Senate, 10 in House, would/might provide some credit to agriculture for emissions reductions activities

*Pew Center on Global Climate Change, www.pewclimate.org

Overview of Congressional Activity, And Opportunities for Agriculture

- House Energy and Commerce Committee, led by Chairman John D. Dingell, released a white paper on Climate Change (10-3-07).
- **Conclusions:** “U.S. should reduce GHG emissions 60-80% by 2050.”
- “The central component of this program should be a cap-and-trade program.”



Overview of Congressional Activity, And Opportunities for Agriculture

Dingell/Boucher White Paper:

- “The agricultural sector’s direct emissions generally should not be included in the cap-and-trade program because of difficulties monitoring emissions and the large number of sources each with low emissions.”
- “This sector may present opportunities for emission reductions that would be measurable and might then provide offset or credit opportunities.”

Overview of Congressional Activity, And Opportunities for Agriculture

- Week of June 2, 2008: the [Lieberman-Warner Climate Security Act of 2008](#) debated by full Senate
- [Stabenow, et al Offsets Amendment](#) supported by major ag groups: increased domestic offsets, gave programmatic authority to USDA (previously EPA), plus...

U.S Cap-and-Trade: What Role for Agriculture?.

- (1) Agricultural emissions reductions are a low-cost, high-impact, readily available means of *near-term** GHG reductions
- (2) However, it is not clear that they will be included in future policies to reduce GHG emissions – not for *credit*, anyway, and not always for *full credit*
- (3) If not included, *from the start*, it is a huge missed opportunity: society and agriculture



Biochar 101: Climate and Soils

Q: What is *biochar*?

A: **Biochar** is a charcoal-like substance produced from the controlled, incomplete combustion of biomass with no or limited oxygen. Used as a soil amendment, **biochar** creates a stable organic carbon reservoir that is *virtually permanent* (hundreds to thousands of years).



What is Biochar?



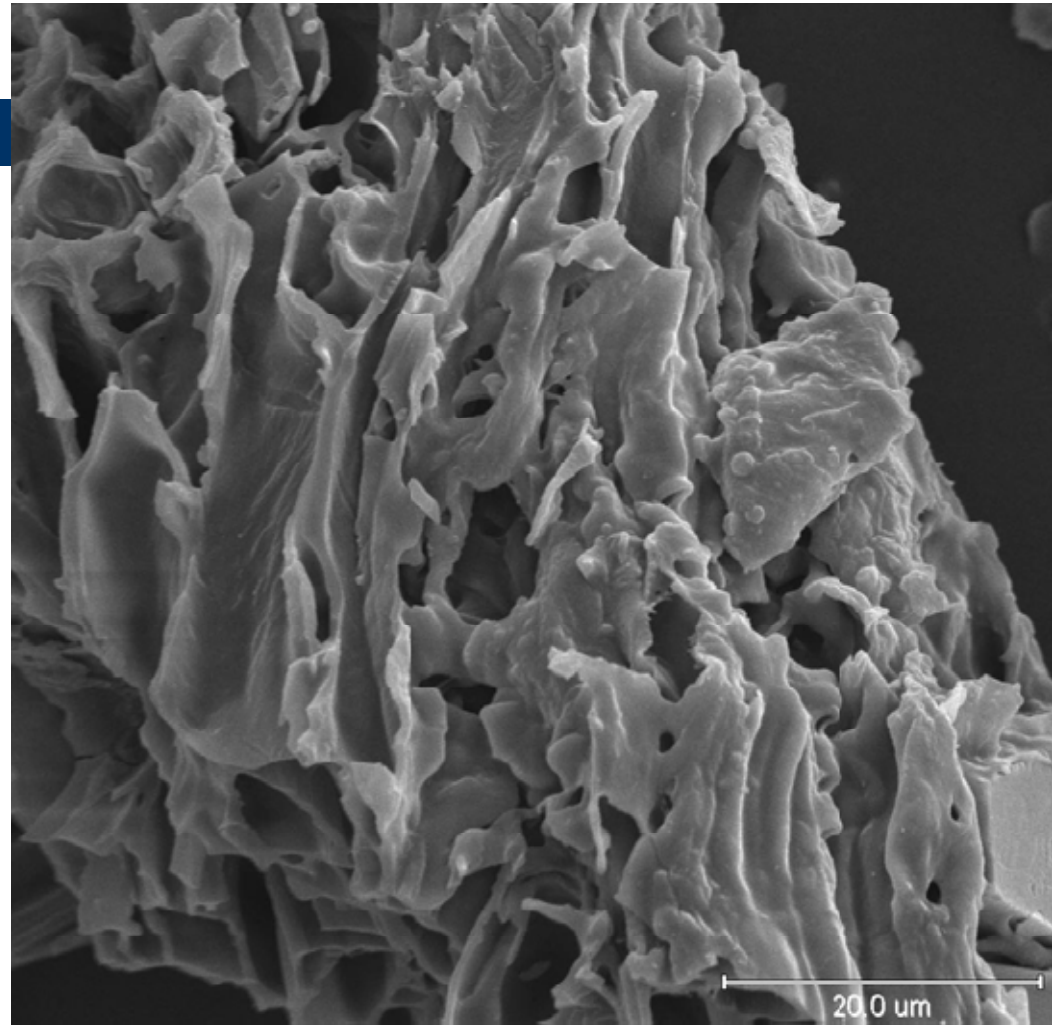
- In soil...biochar is extremely recalcitrant to decomposition

- During formation, the porous, crystalline biochar structure adsorbs bio-oils, nitrogen, phosphorus, other nutrients from feedstock

- Very high surface area

- Soil microorganisms & H₂O inhabit the pores

- ...nutrient leaching is inhibited, but nutrients are *bioavailable* to plants





Some Impacts of Biochar

Air and GHG Impacts:

- Nitrous oxide emissions reduced 50-80% from cropland with added biochar
- Methane emissions suppressed
- Stable, virtually permanent* soil carbon pools
 - (*for hundreds to thousands of years)

Water Quality Impacts:

- Biochar strongly adsorbs phosphate
- Reduces leaching of N and P

Impacts of Biochar: *Crops*

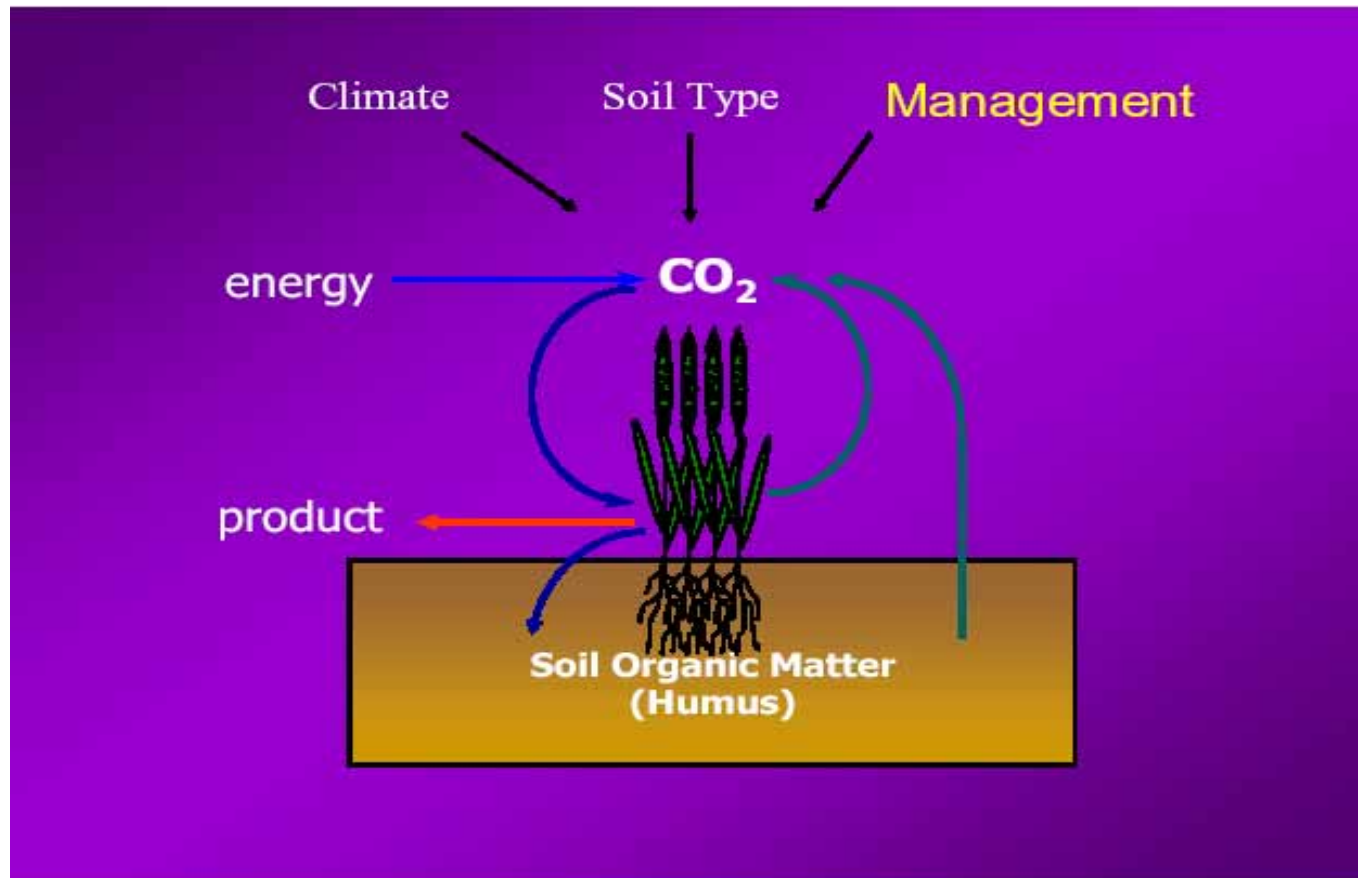


Photos: Robert Flanagan, SAFFE, China (2008)

The CO₂ Cycle & Carbon 'Sinks'



- CO₂ is captured by photosynthesis, fixed into biomass
- Biomass decays into CO₂: into atmosphere, soils



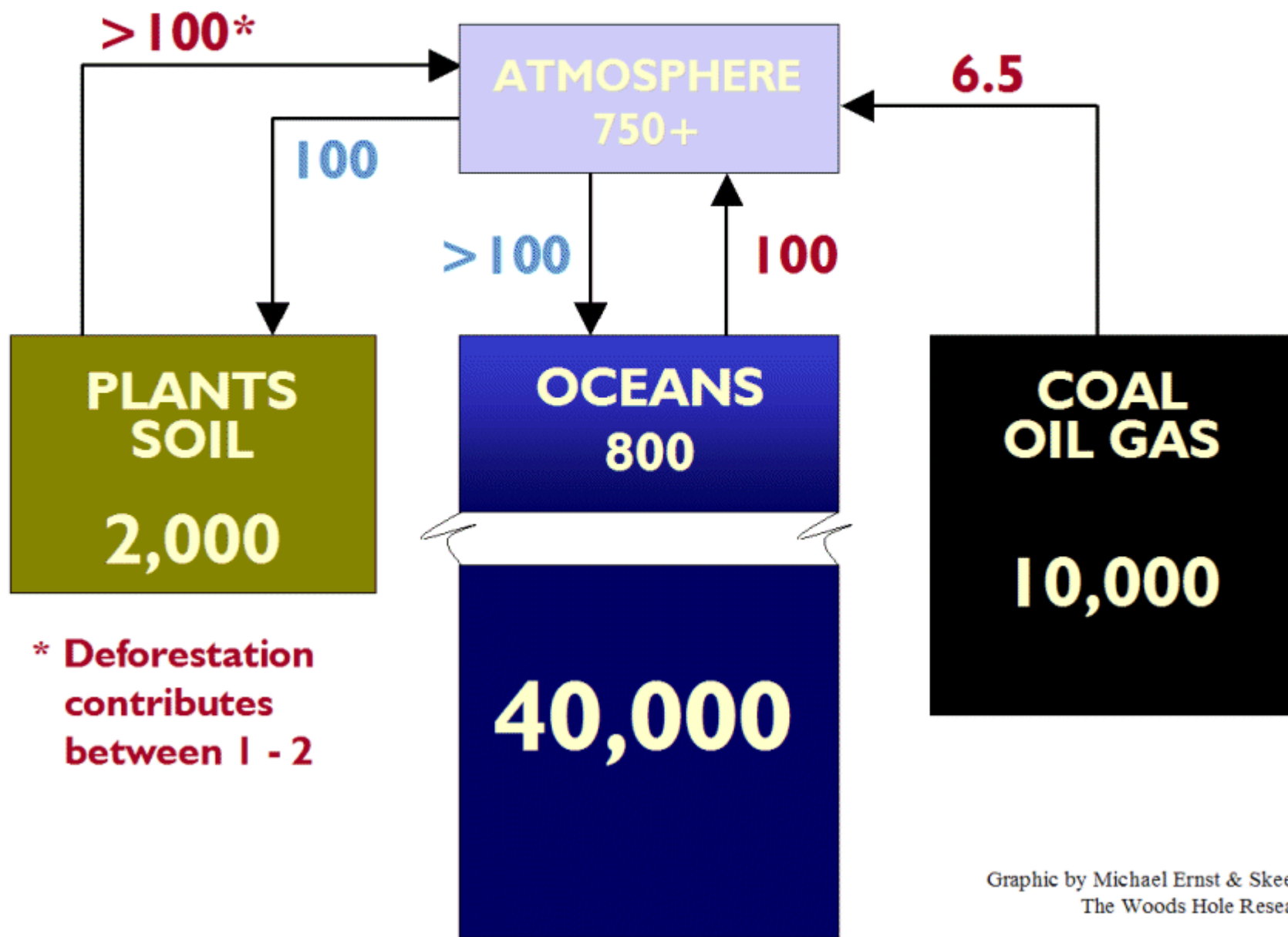
Source:
C.W. Rice,
KSU

Climate Change & CO2 Cycle: How does Biochar fit in?

- **BIOCHAR** halts the decay of biomass carbon in a virtually permanent carbon sink, preventing atmospheric re-release
- Pyrolysis of biomass captures up to 50% of C from biomass in the stable biochar structure
- IT IS A **CARBON-NEGATIVE** PROCESS
- If practiced on large enough scale, can lead to significant negative CO2 trends

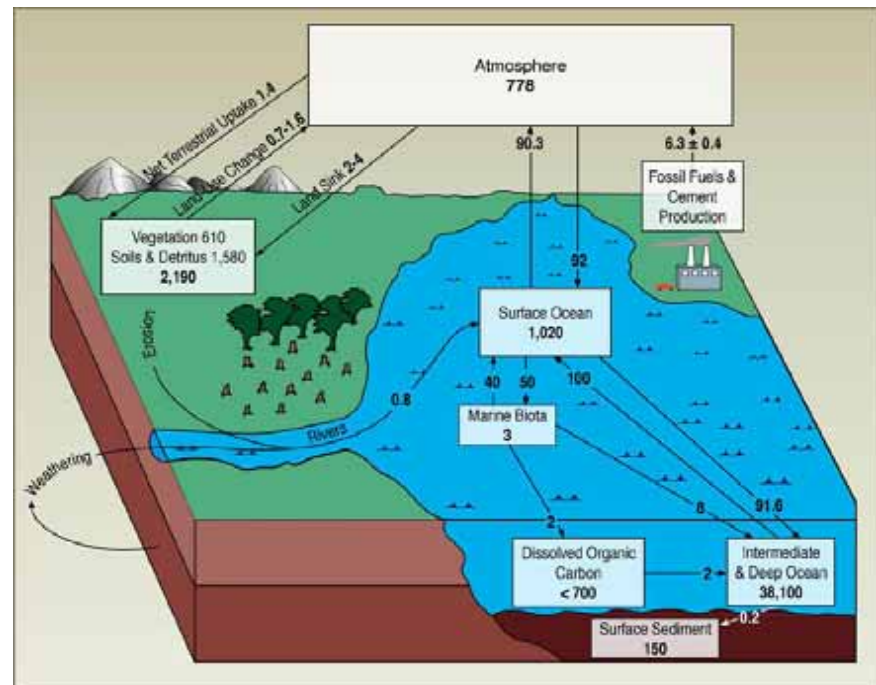
Global Flows of Carbon

(Petagrams of Carbon/Year)



Biochar & Climate Change

- Since all atmospheric CO₂ passes through biomass every seven years, the production and utilization of biochar on a large enough scale would lead to significant negative trends in global CO₂.



International Biochar Initiative (IBI)



International
Biochar Initiative

www.biochar-international.org