



Carbon Sequestration in Agro-Ecosystems

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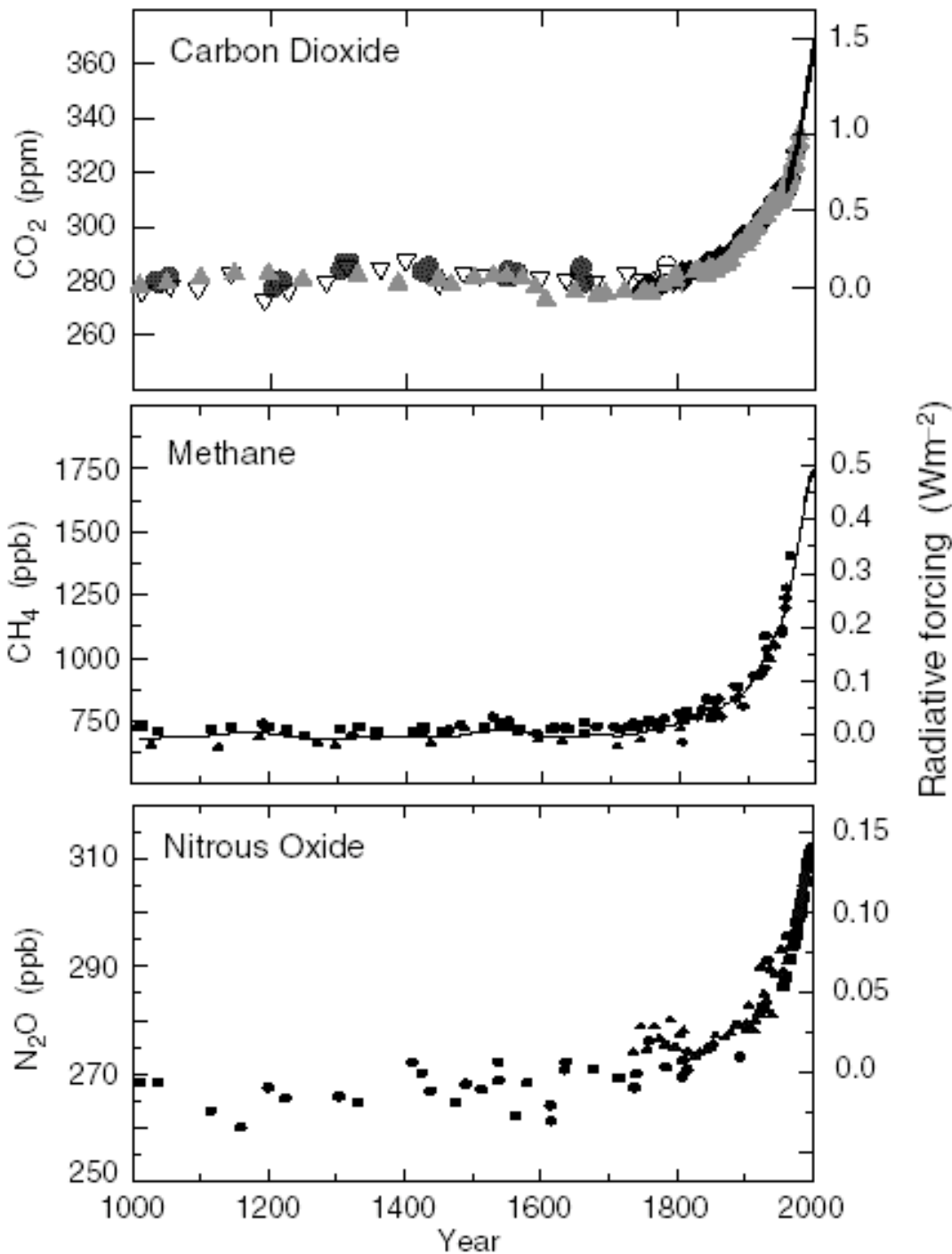


Consortium for Agricultural Soils Mitigation of Greenhouse Gases



K-State Research and Extension

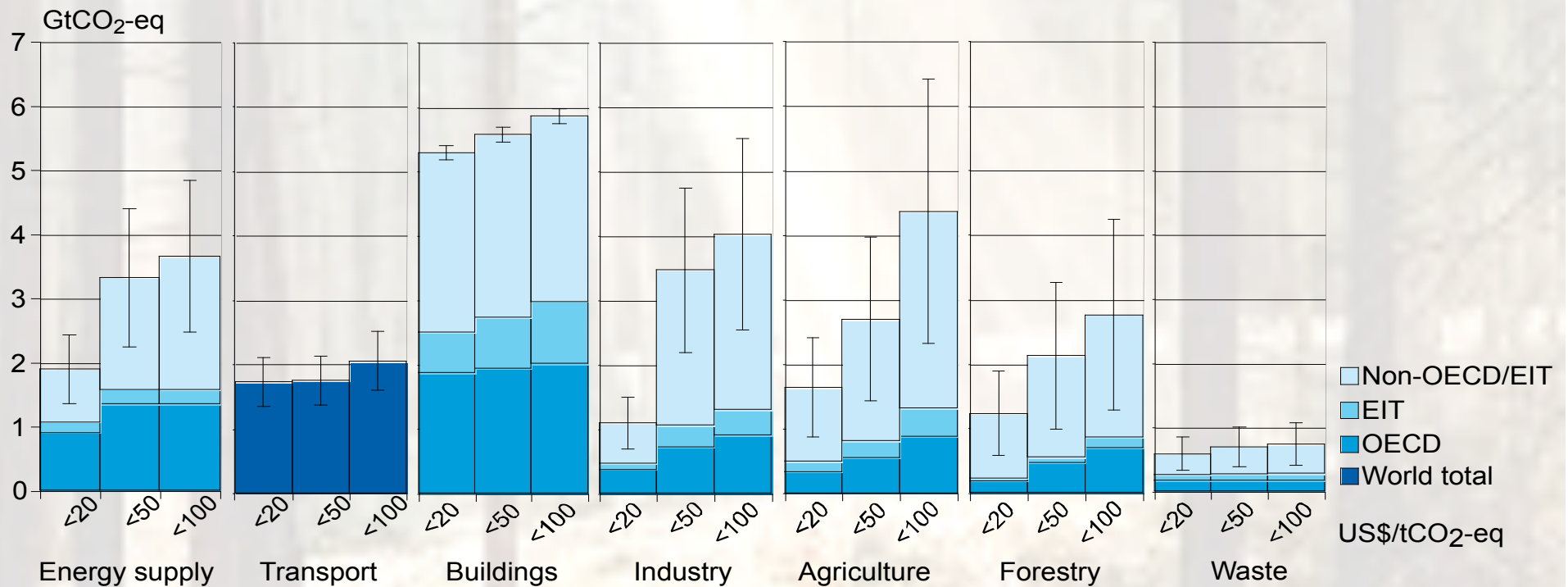
Atmospheric concentration



Atmospheric
Concentrations
of CO₂,
Methane (CH₄),
and Nitrous
Oxide (N₂O)
from 1000 A.D.

From IPCC (2001)

Global economic mitigation potential for different sectors at different carbon prices



IPCC, 2007

Agriculture

- A large proportion of the mitigation potential of agriculture (excluding bioenergy) arises from soil C sequestration, which has strong synergies with sustainable agriculture and generally reduces vulnerability to climate change.
- Agricultural practices collectively can make a significant contribution at low cost
 - By increasing soil carbon sinks,
 - By reducing GHG emissions,
 - By contributing biomass feedstocks for energy use
- There is no universally applicable list of mitigation practices; practices need to be evaluated for individual agricultural systems and settings

Agricultural management plays a major role in greenhouse gas emissions and offers many opportunities for mitigation

- **Cropland**

- Reduced tillage
- Rotations
- Cover crops
- Fertility management
- Erosion control
- Irrigation management



No-till seeding in USA

- **Grasslands**

- Grazing management
- Fire management
- Fertilization



Climate

Soils

Management

Sunlight

CO₂

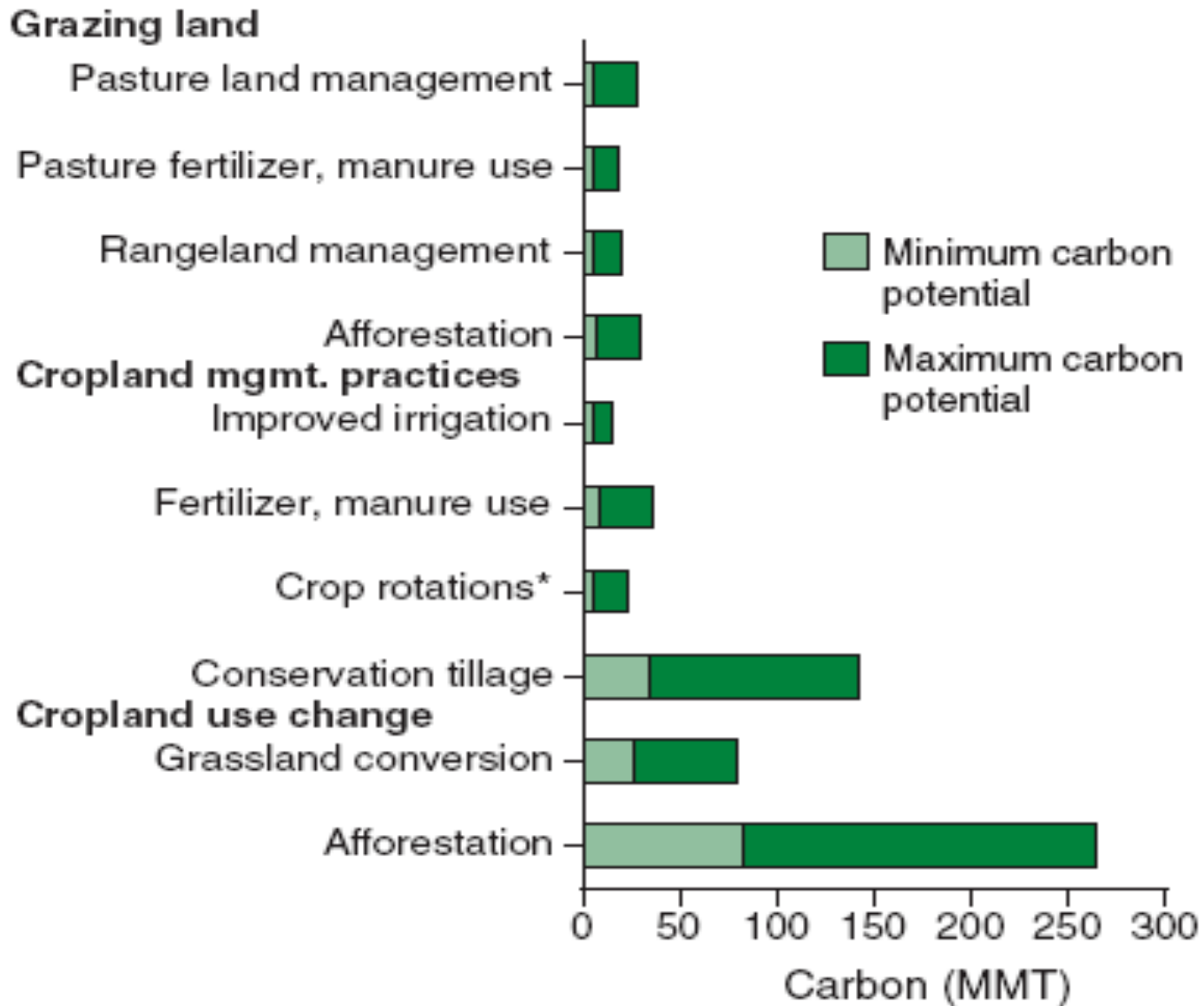
**Harvestable
Yield**



***Soil Organic Matter
(Humus)
Microbial Activity***



Estimated potential carbon sequestration



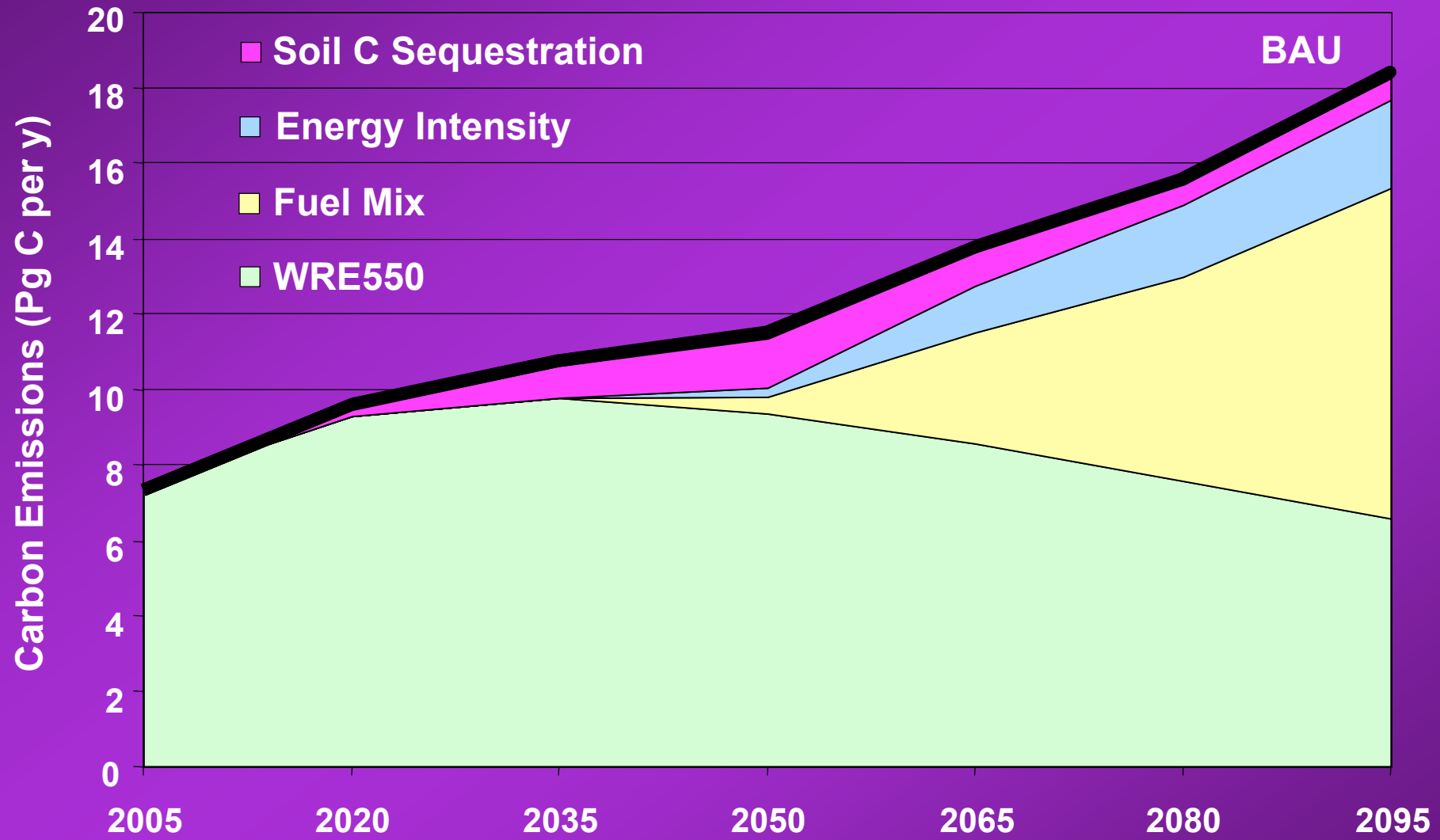
* Includes winter cover crops and elimination of summer fallow.

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[ERS 2004]

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Carbon Emissions Reductions: WRE 550 with Soil Carbon Sequestration Credits



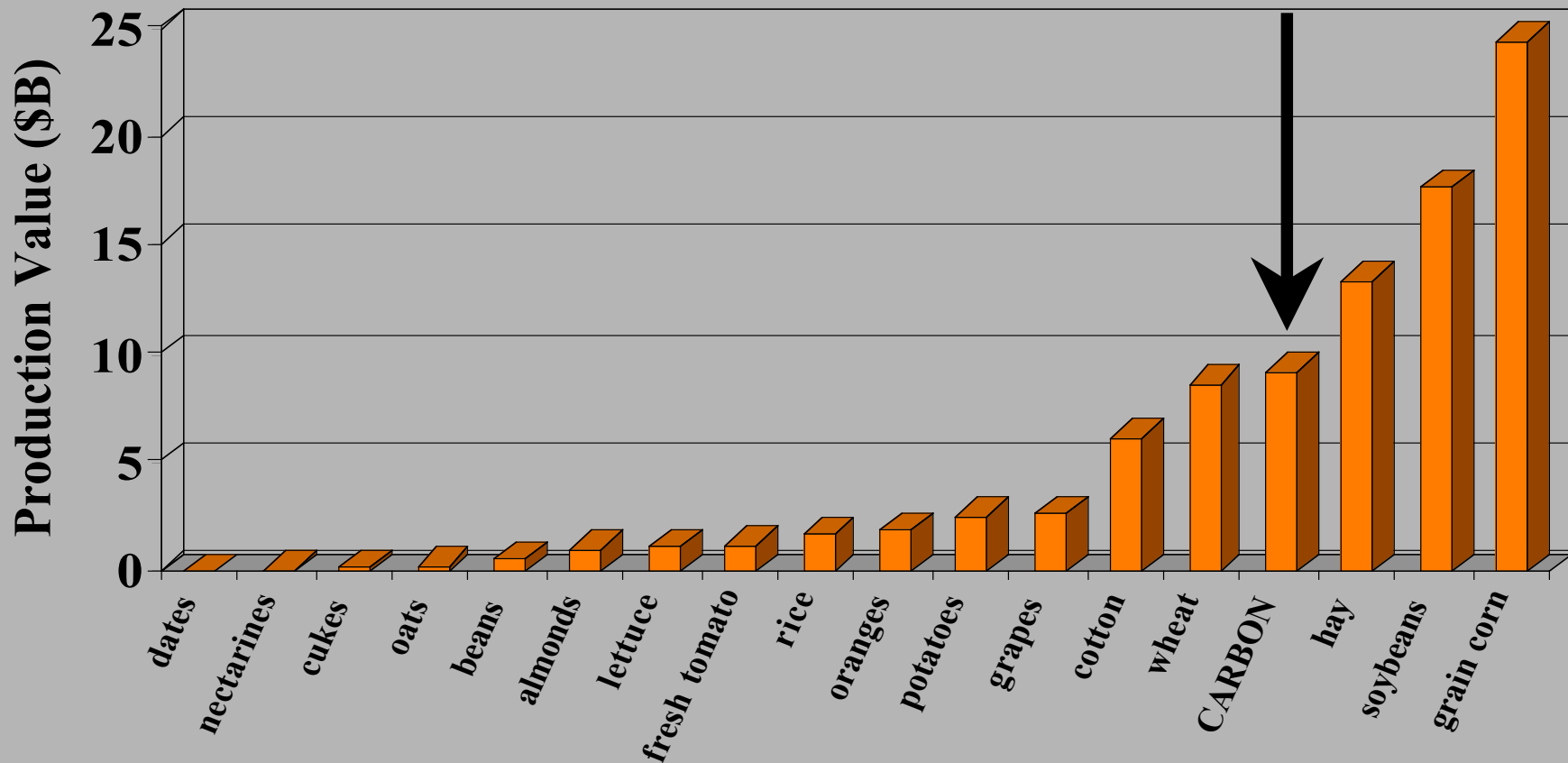
From: Rosenberg, N.J., R.C. Izaurrealde, and E.L. Malone (eds.). 1999. Carbon Sequestration in Soils: Science, Monitoring and Beyond. Battelle Press, Columbus, OH. 201 pp.

So What is the Potential?

- *Globally*
 - It is estimated that soil has the potential to offset 30% of the annual CO₂ emissions
- *United States*
 - It is estimated that soil has the potential to offset 15% of the annual CO₂ emissions
 - Additional options for N₂O and CH₄
- The economic potential is ~30-50% of that value

*Illustrative Ranking of Carbon as a Crop in U.S.
Per Proposed GHG Limits in
Senate Bill 280 (Lieberman-McCain) 1/12/07*

Carbon at \$10/MT CO₂e,



[Crop Source: USDA - National Agricultural Statistics Service – US Crop Rankings - 1997 Production Year Ranking Based on Value of Production]

Summary

- Soil C sequestration
 - Available technology at low cost
 - Significant impact on emissions: “Bridge to the Future”
- Agricultural soil C sequestration
 - Keeps land in production thus providing food security and rural economic development (no leakage)
 - Improves soil quality
 - In many cases increases profitability for the farmer
 - Provides other environmental benefits to society
 - Water quality (less runoff, less erosion)
 - Flood control
 - Wildlife habitat
 - May help adapt to climate change as well as mitigate
- *Therefore a Win-Win Situation*

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- Websites

www.soilcarboncenter.k-state.edu/

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