



# Agriculture's Opportunity in Mitigating Greenhouse Gases

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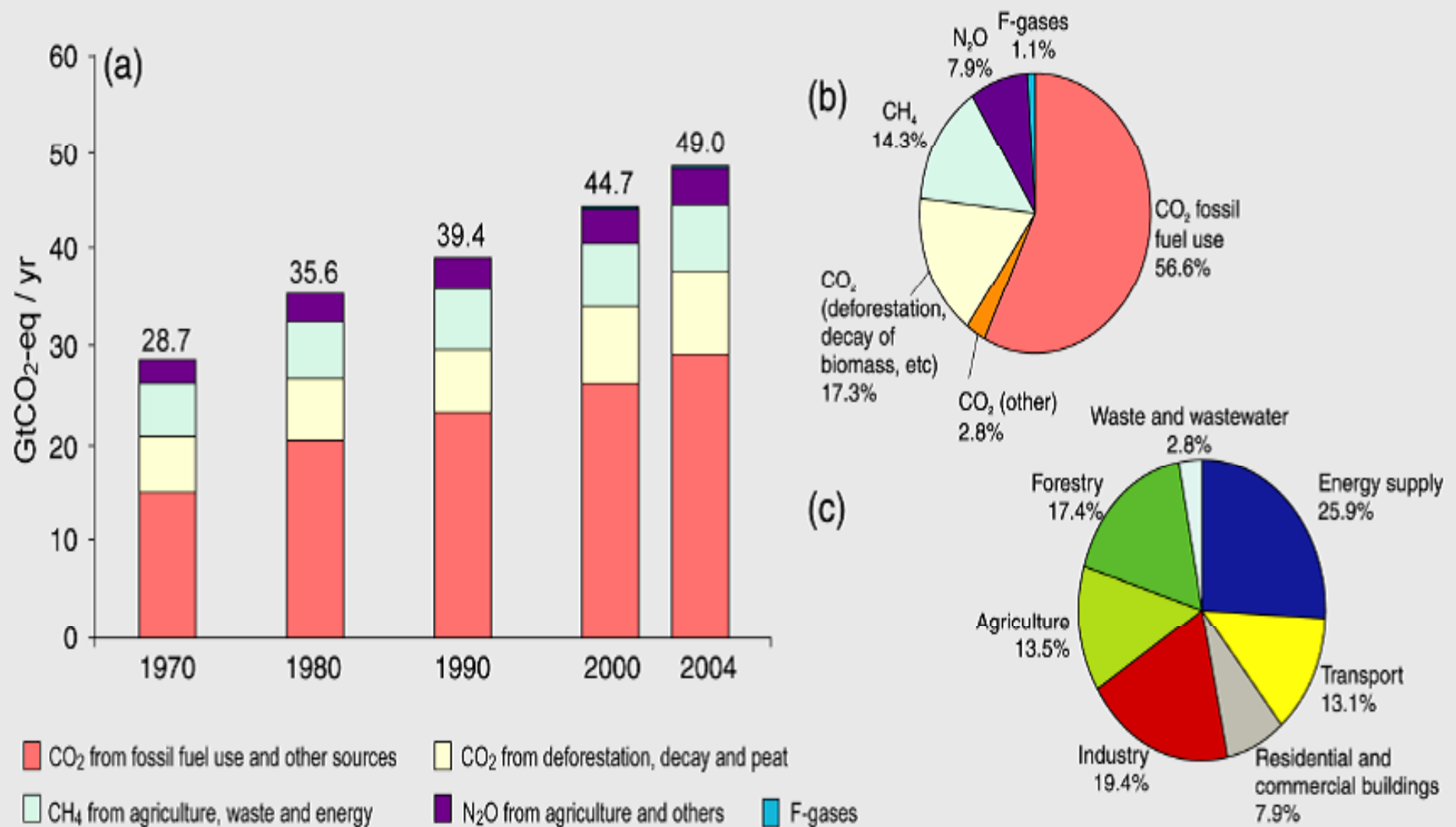
**Lead Author, IPCC AR4 WGIII**



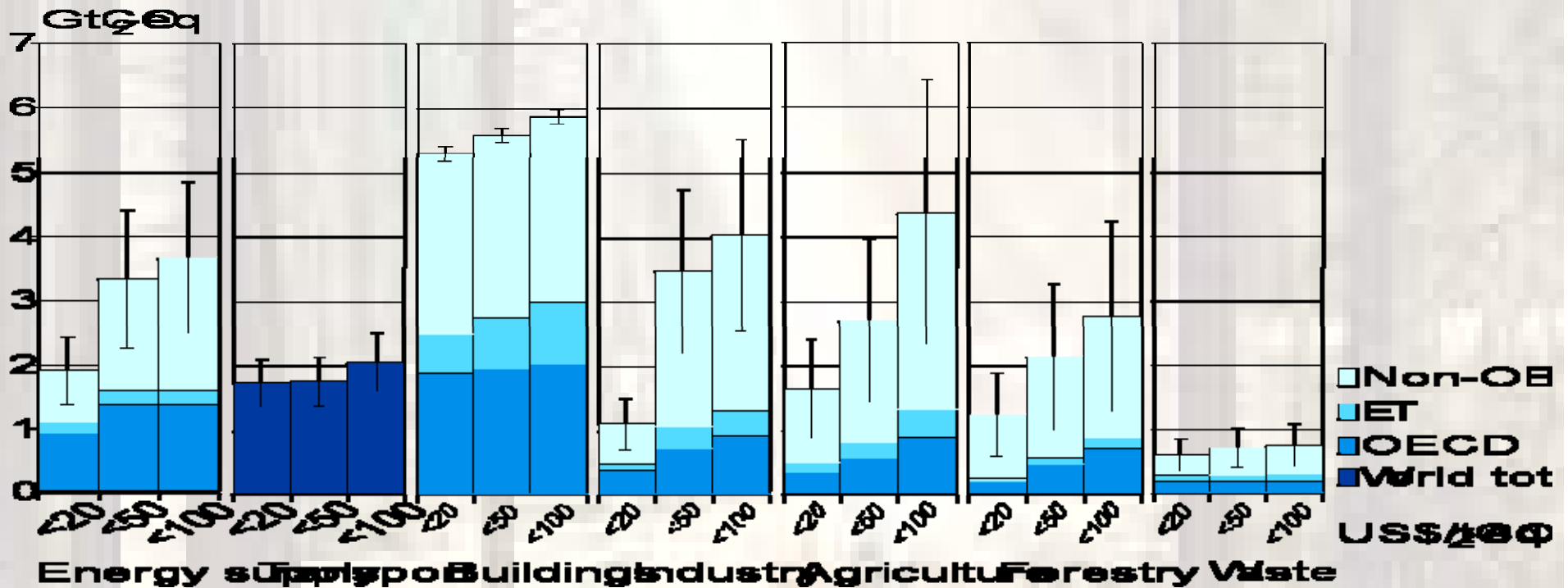
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**Figure SPM.3.** (a) Global annual emissions of anthropogenic GHGs from 1970 to 2004. (b) Share of different anthropogenic GHGs in total emissions in 2004 in terms of CO<sub>2</sub>-eq. (c) Share of different sectors in total anthropogenic GHG emissions in 2004 in terms of CO<sub>2</sub>-eq. (Forestry includes deforestation). {Figure 2.1}



# 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 increasing energy efficiency within agriculture
  - By contributing biomass feedstocks for energy use

# Consortium for Agricultural Soil Mitigation of Greenhouse Gases

- *To provide the tools and information to successfully implement soil carbon sequestration and reduce greenhouse gas emissions so that*
  - *the accumulation of greenhouse gases is lowered in the atmosphere,*
  - *while providing income and incentives to farmers and improving sustainability.*

Kansas State University

Iowa State University

Montana State University

Ohio State University

Texas A&M University

Pacific Northwest National Labs

Colorado State University

Michigan State University

University of Nebraska

Purdue University

Oregon State University

# CASMGS

- Improve understanding of basic processes and mechanisms.
- Evaluate 'best management practices' to reduce net greenhouse gas emissions.
- Provide decisions support tools and evaluate alternative national economic and policy strategies.
- Assess impacts of mitigation programs on crop production potential, food security and environmental quality.
- Provide information to: policy makers, agricultural sector, energy and transportation industries, the scientific community and the general public.
- Team: Agronomy, Crop Science, Ecology, Economics, Engineering, Remote Sensing, Sociology, Soil Science

**Climate**

**Soils**

**Management**

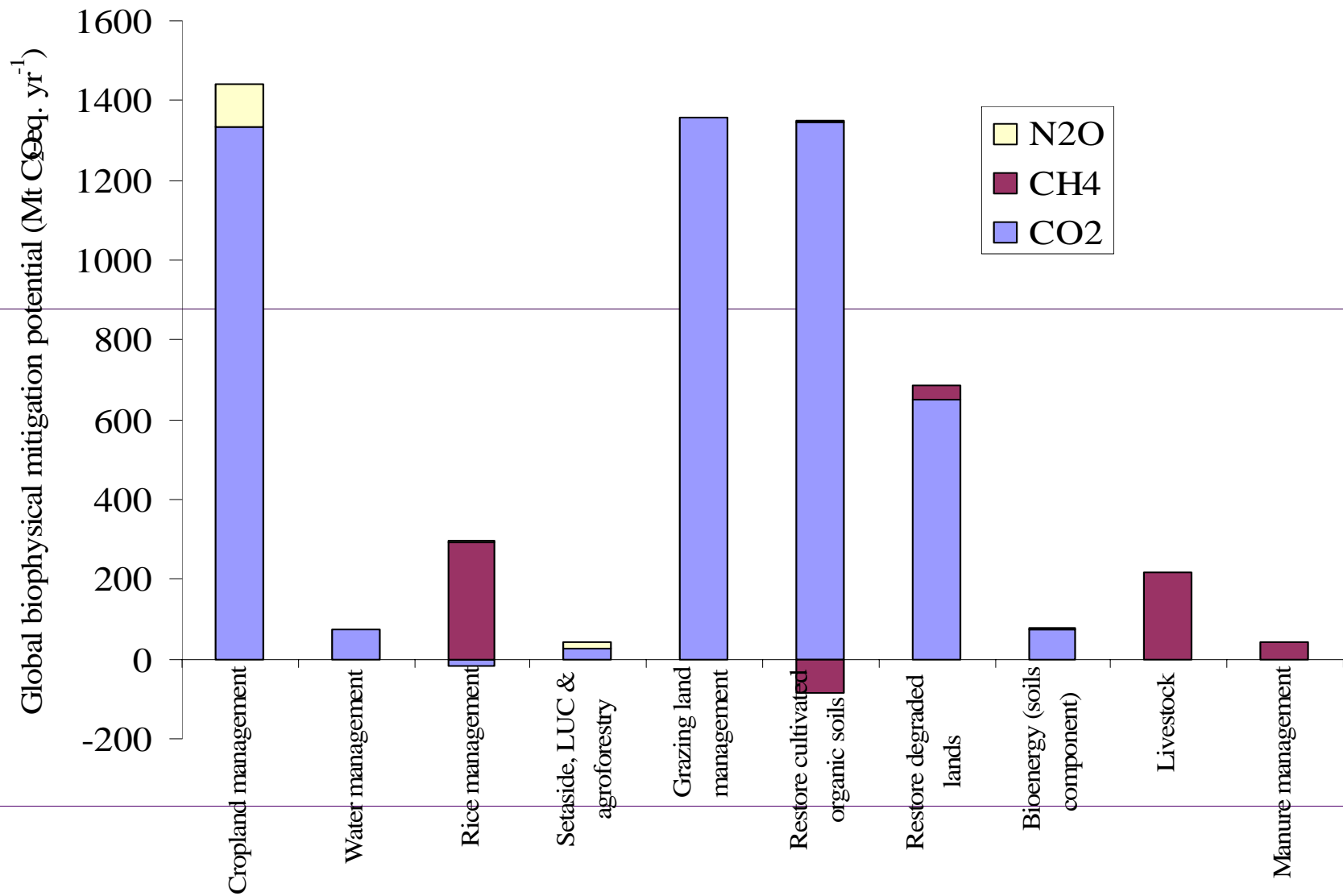
**Sunlight**

**CO<sub>2</sub>**

**Harvestable  
Yield**



# Global mitigation potential in agriculture

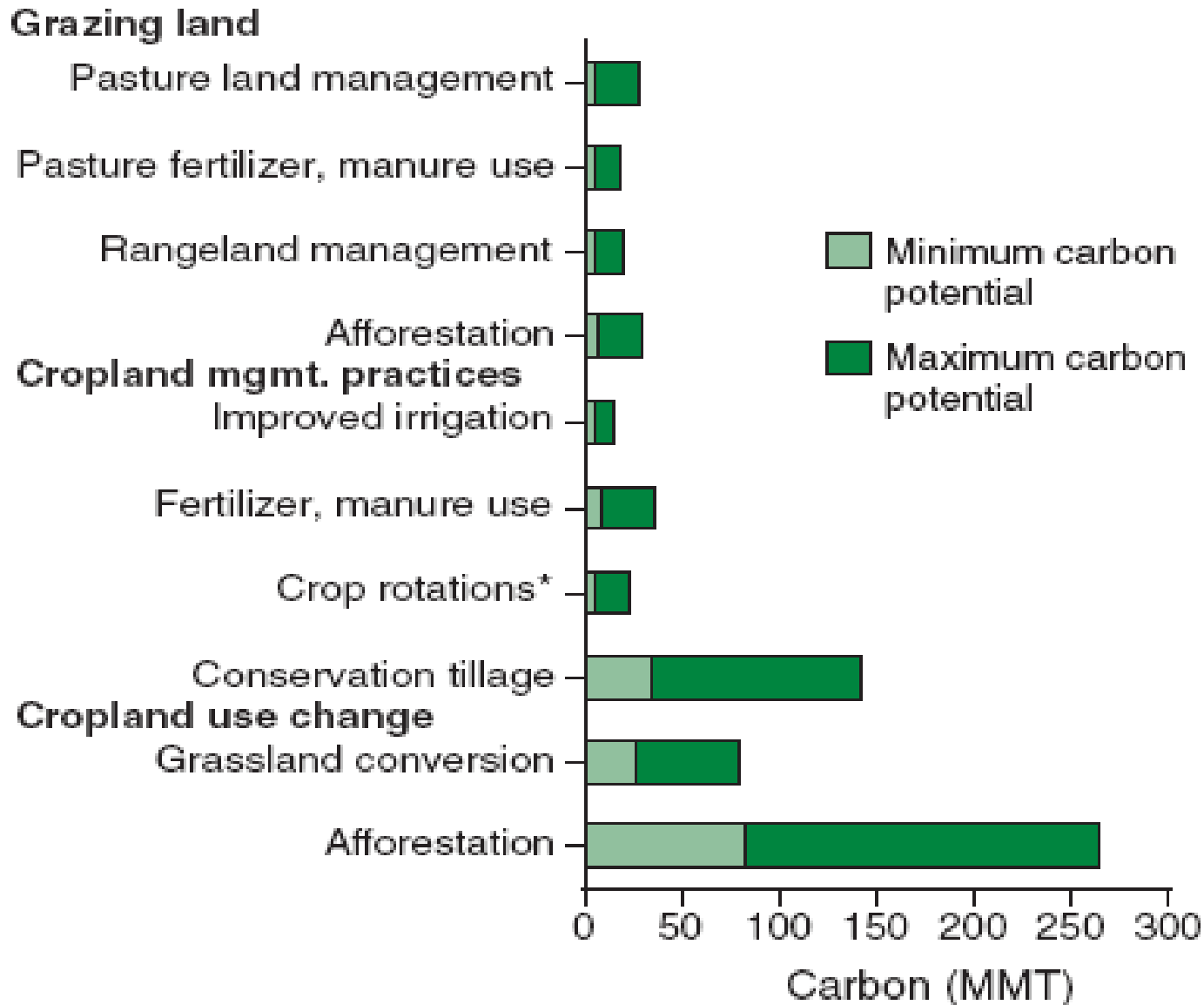


Mitigation measure

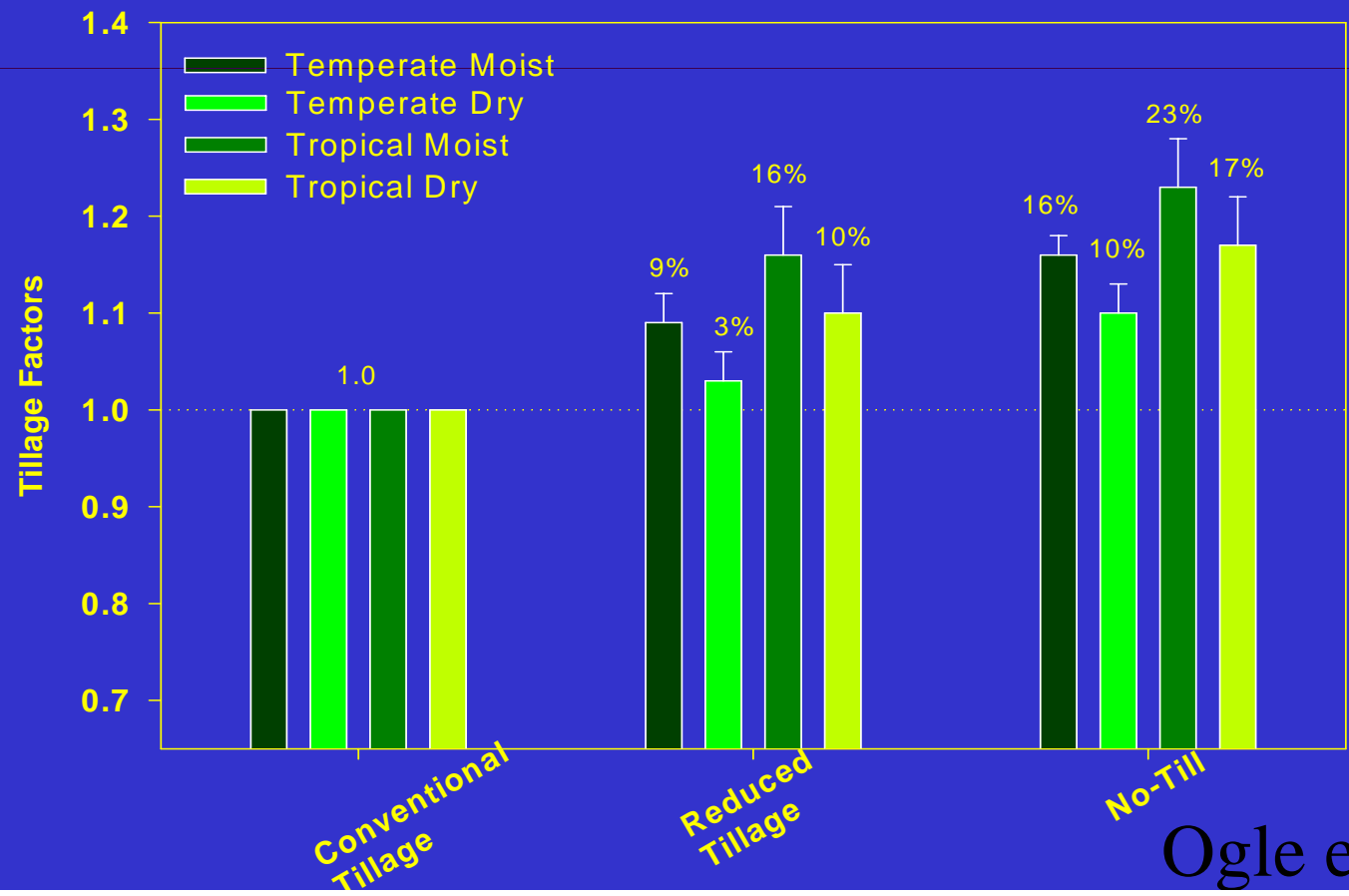
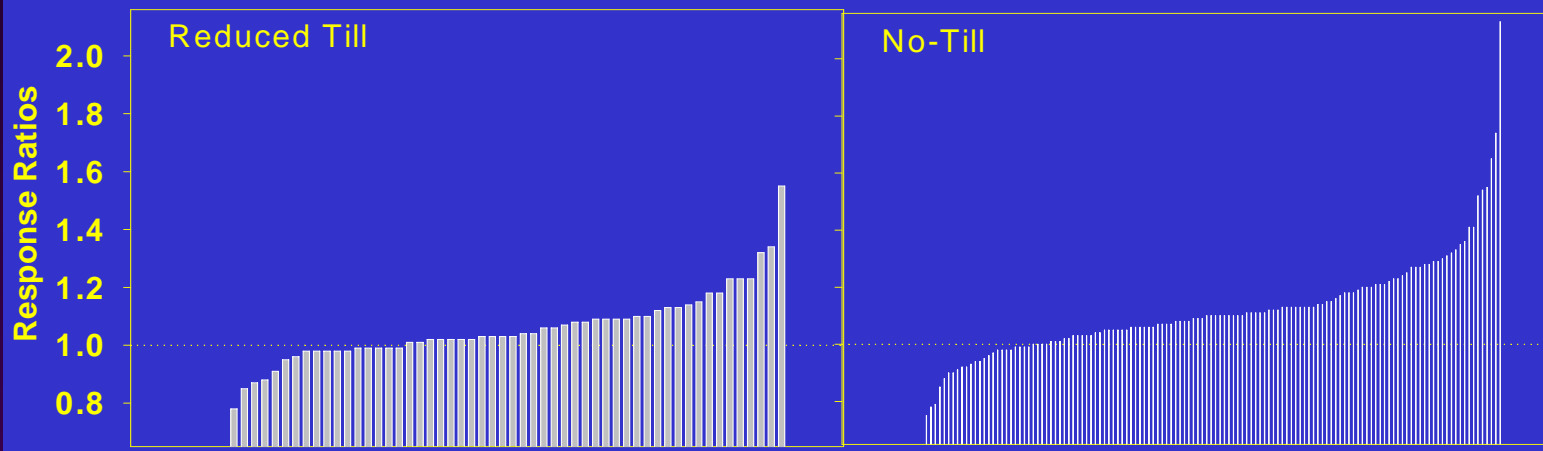
Smith et al. (2008)



## Estimated potential carbon sequestration



\* Includes winter cover crops and elimination of summer fallow.



# Soil C sequestration rates for 15 years (Mg C/ha/y)

Depth	Fertilizer N Tilled	Fertilizer N No-till		Manure N Tilled	Manure N No-till
cm					
0-5	0.161	0.351		0.393	1.182
0-15	0.254	0.497		0.792	1.402
0-30	0.336	0.717		0.839	1.387
0-60	0.146	1.325		0.733	1.141

# Conservation Agriculture



- Restores soil carbon
- Conserves moisture
- Saves fuel
- Saves labor
- Lowers machinery costs
- Reduces erosion
- Improved soil fertility
- Controls weed
- Planting on the best date
- Improves wildlife habitat

# Issues

- Capacity
- Understand variability
- Measurement, Monitoring and Verification

# Conclusions

- Agriculture has a significant role to play in climate mitigation
- Agriculture is cost competitive with mitigation options in other sectors
- Bio-energy crops and improved energy efficiency in agriculture can contribute to further climate mitigation, but the savings are usually counted in other sectors
- Agricultural mitigation should be part of a portfolio of mitigation measures to reduce emissions / increase sinks while new, low carbon energy technologies are developed.

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- Websites

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[www.casmgs.colostate.edu/](http://www.casmgs.colostate.edu/)



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