



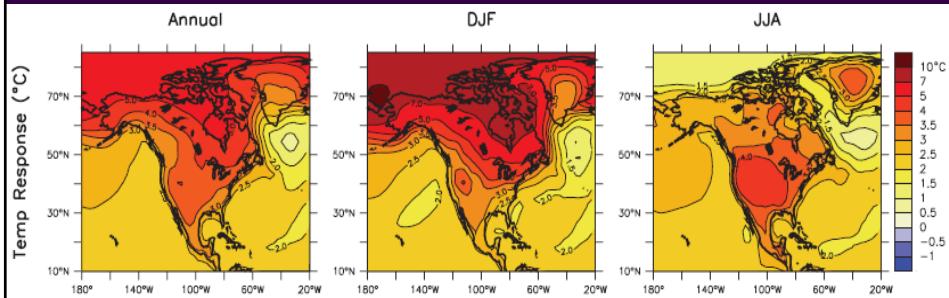
# *The Impact of Demands for Energy and Environmental Services on Kansas Agriculture*

Charles W. Rice  
Department of Agronomy



*K-State Research and Extension*

## Temperature

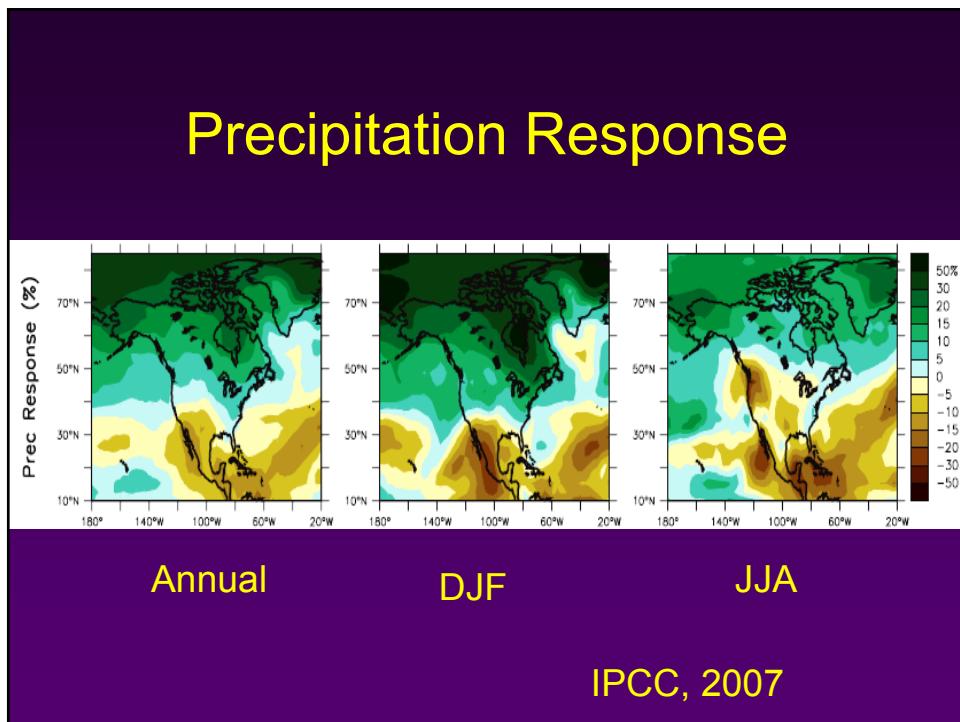


Annual

DJF

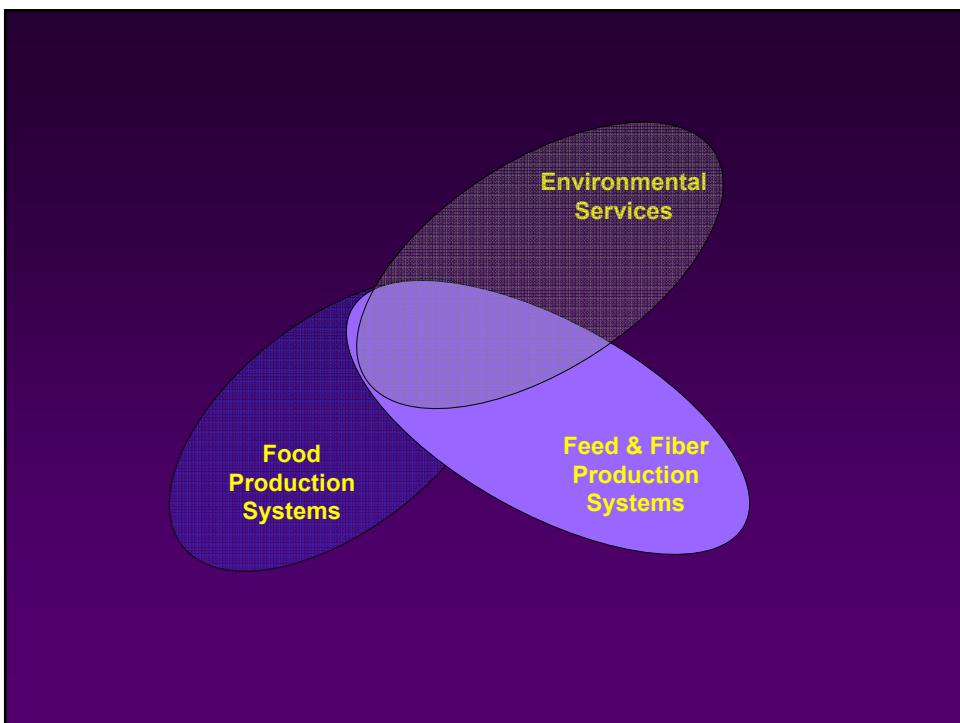
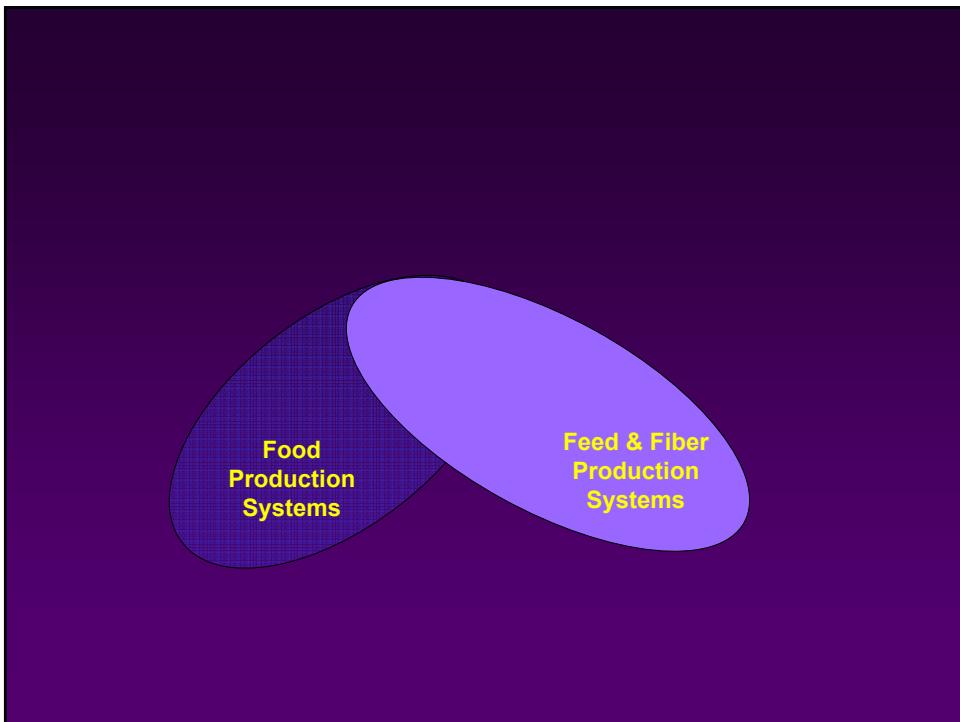
JJA

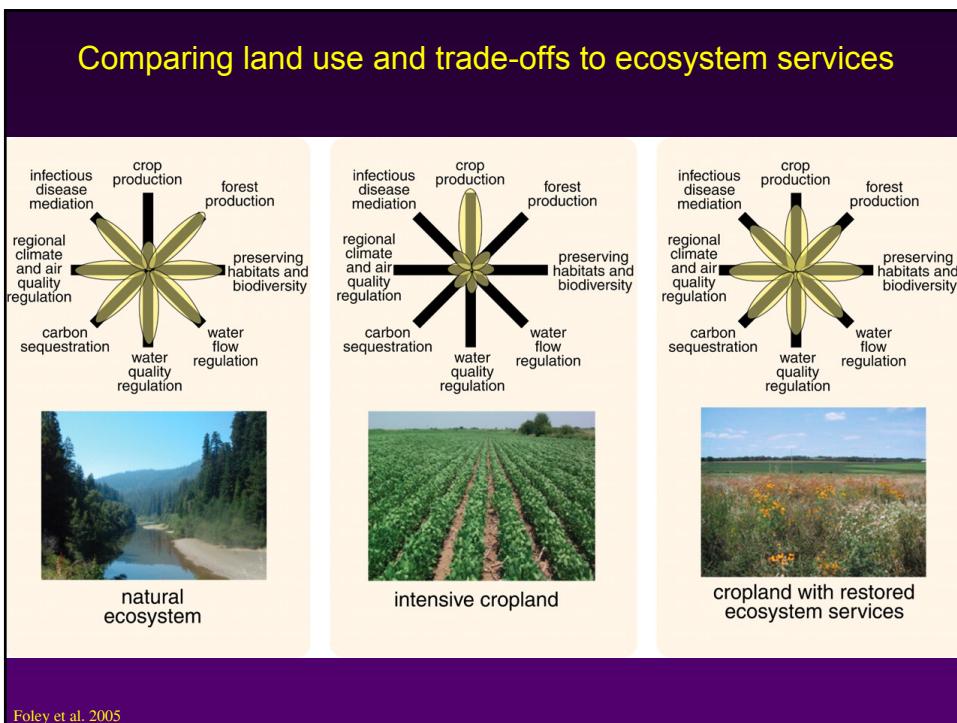
IPCC, 2007

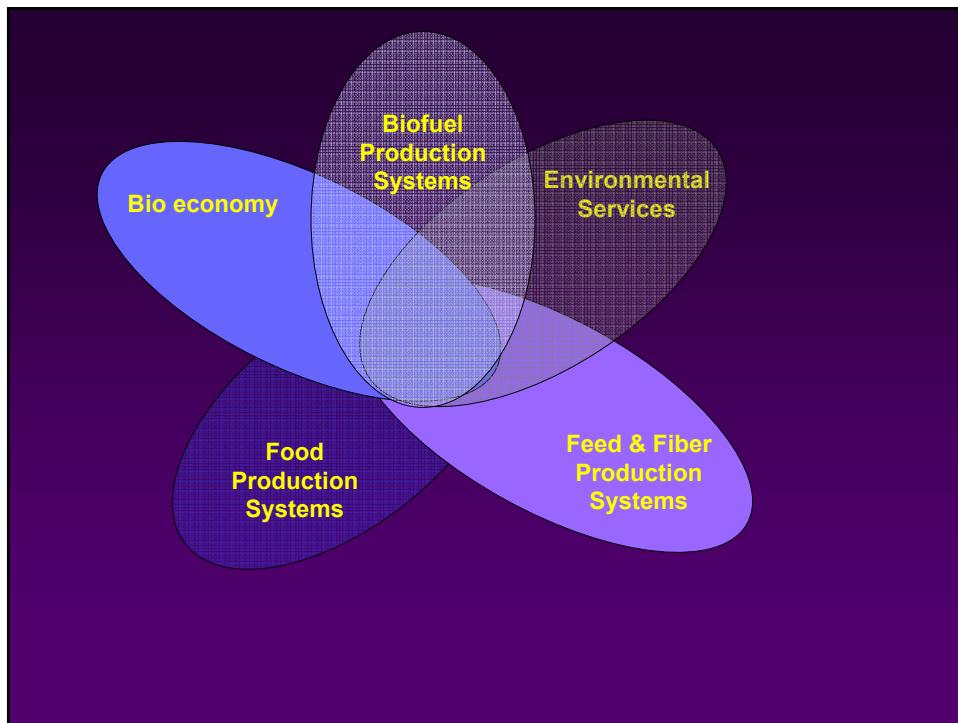
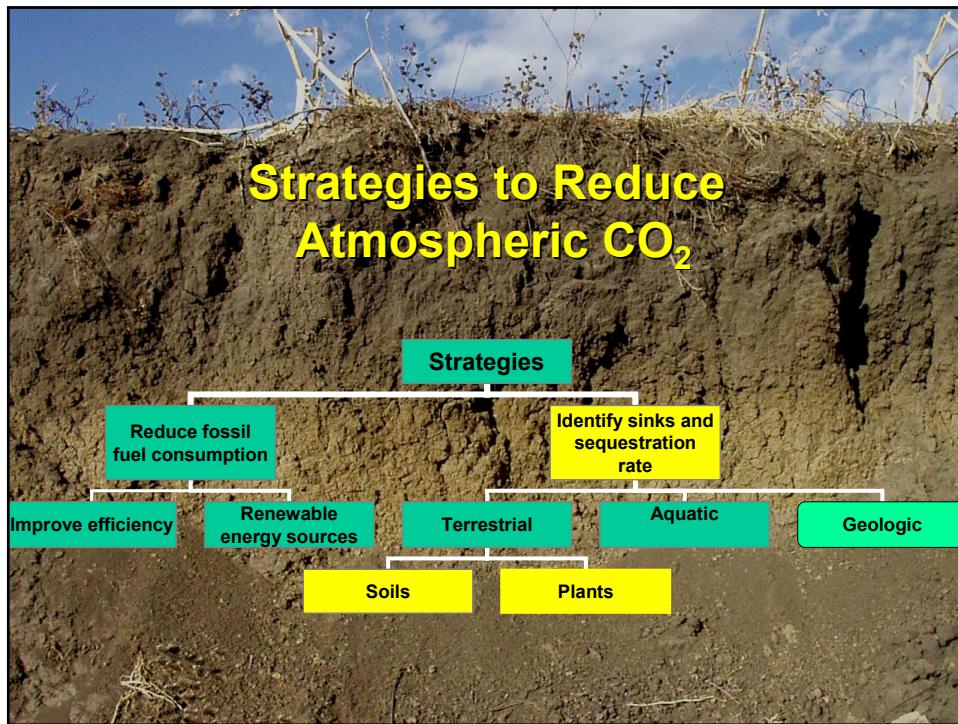


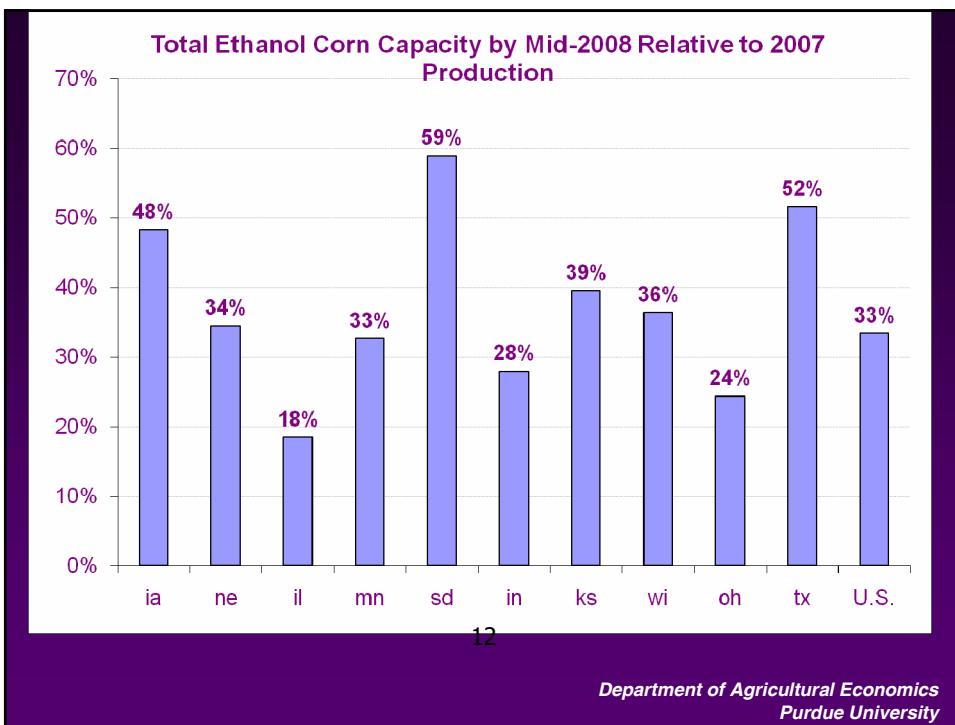
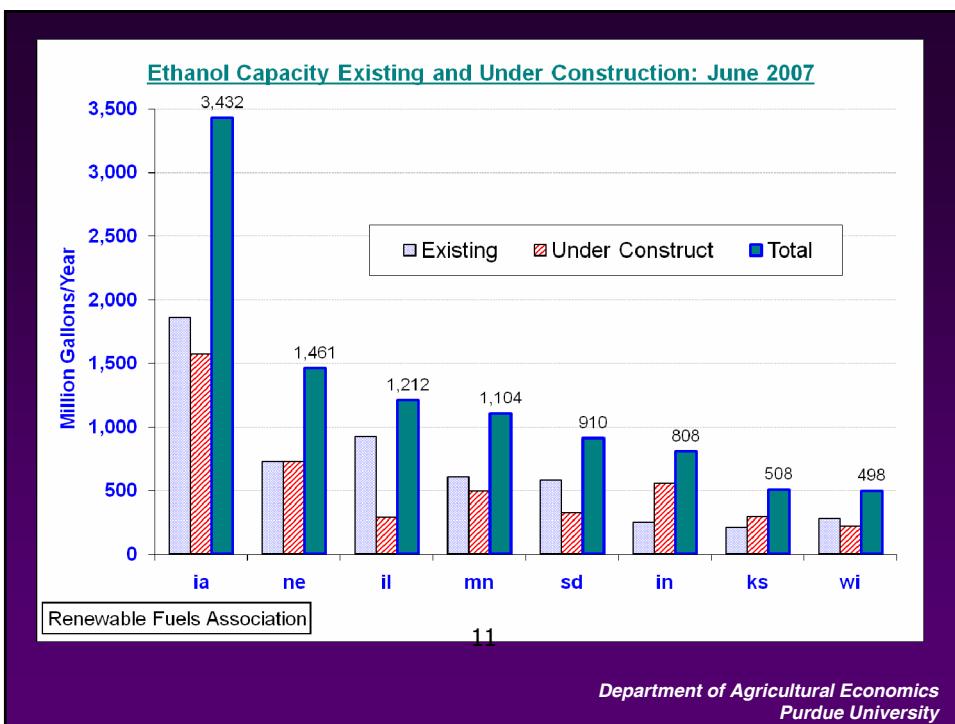
## Consequences of Climate Change on Kansas Agriculture

- Increased productivity potential
  - WATER AVAILABILITY
    - Drought
    - Erosion
  - Nitrogen availability
    - Impacts forage quality
    - Grain quality
  - Hasten maturity
  - Shorten growing season
  - Increased pests





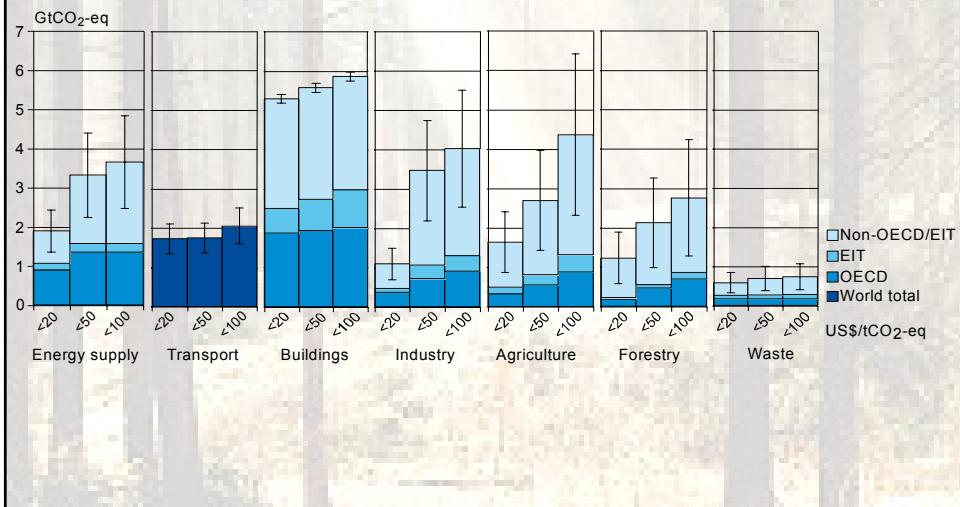


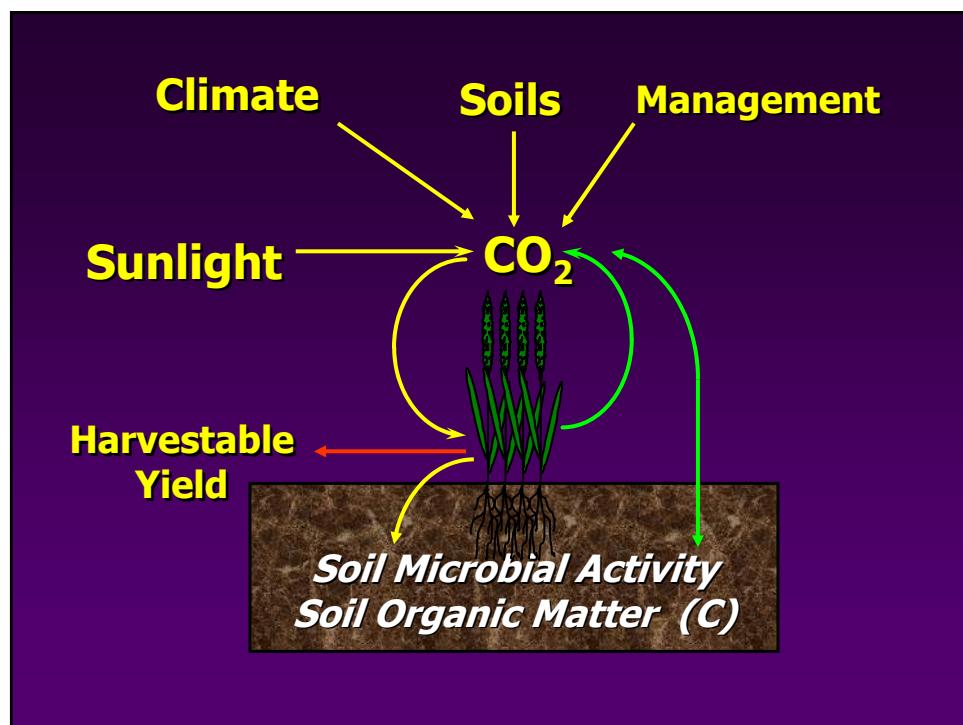
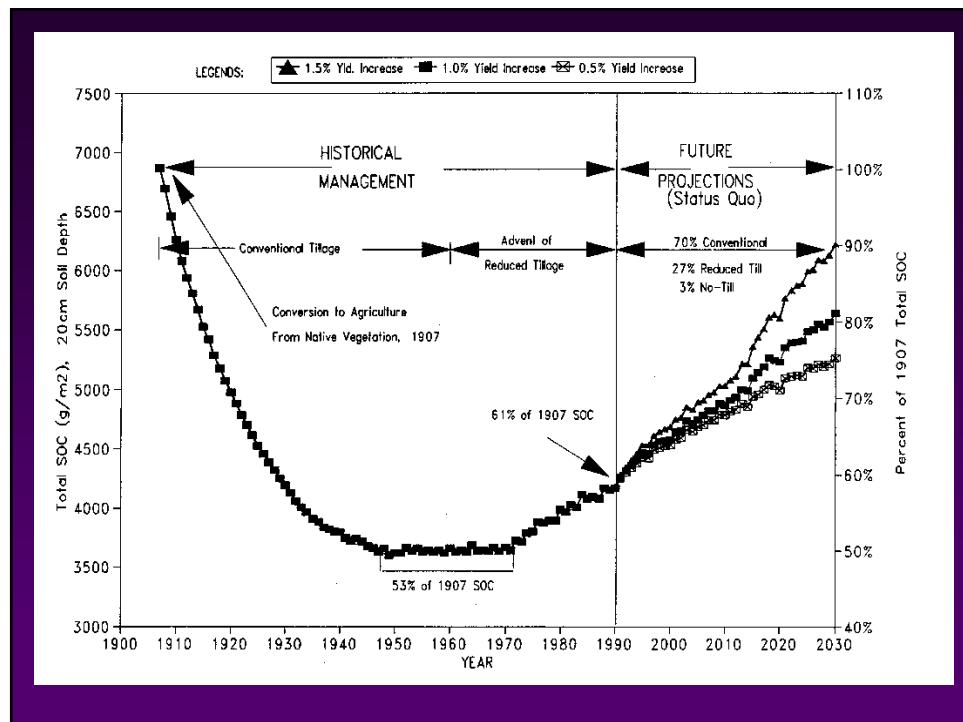


## Biofuel Production Concerns

- *Changes in land use, and potential conversion of conservation lands to biomass production.*
- *Changes in water needs, availability, and water quality impacts.*
- *Competition for grains and oilseeds and impacts on food and feed availability and prices.*
- *Lifecycle analyses and GHG/C accounting for biofuels production.*
- *Assessing co-benefits of biofuel production, such as soil quality, reduced erosion from marginal crop lands, and enhanced wildlife benefits.*

Global economic mitigation potential for different sectors at different carbon prices



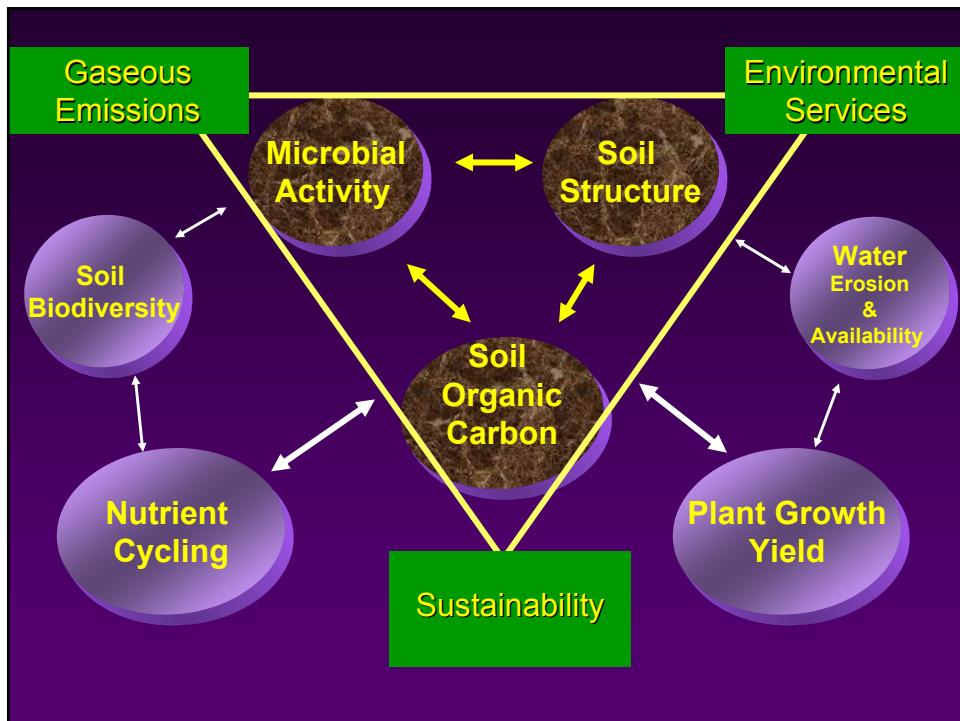


# No-Tillage Cropping Systems



Photo courtesy of R. Lal

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



**A FARM OF THE FUTURE**

Ecosystem services previously taken for free could generate perhaps half the income of a farm, if markets for various kinds of environmental credits take off as hoped. Farmlands in the future may have a diverse portfolio of ecosystem services to offer to a wide range of customers.

**BIODIVERSITY CREDITS**  
Conservation organizations are leasing development rights from the owners of undisturbed forests and other habitats that host threatened endemic species and fast-vanishing ecosystems.

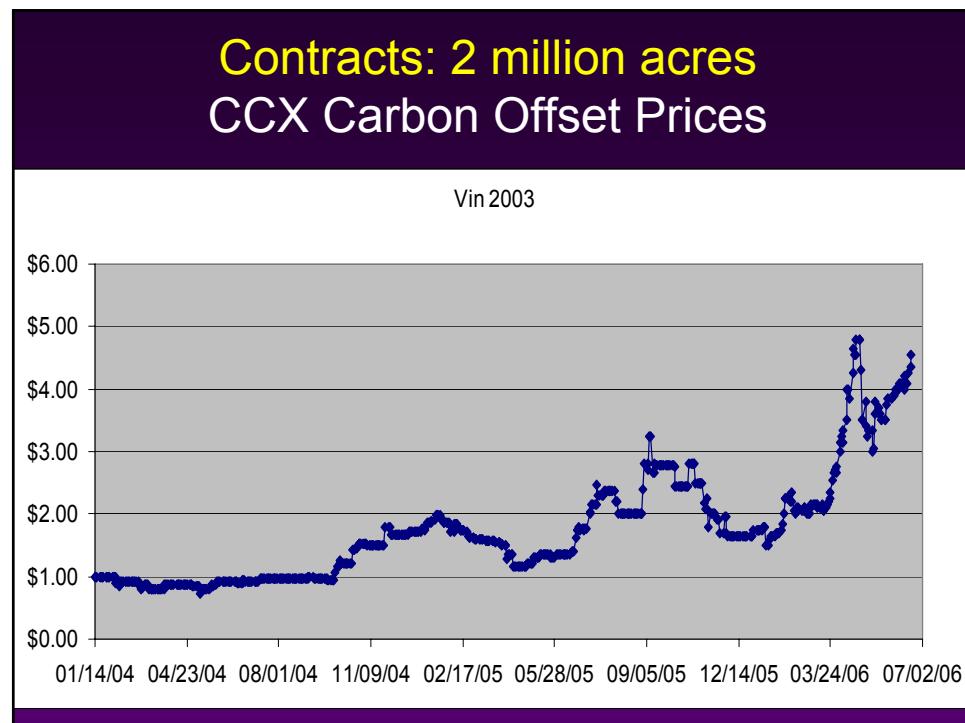
**CO<sub>2</sub> OFFSET CREDITS**  
When landowners plant new forests and promise never to cut or burn the trees, they can receive carbon dioxide offset credits. Industries will beg to help them comply with restrictions on greenhouse gas emissions.

**RENEWABLE ELECTRICITY**  
Wind farms generate nonpolluting electricity that commands premium prices in deregulated power markets. The turbines can also garner tax credits that subsidize their capital and operating costs.

**CERTIFIED SUSTAINABLE TIMBER**  
Sustainably harvested timber is now one of numerous "eco-labeled" products that are certified as ecologically sound and sold at a premium in specialty markets.

COMMODITY	PERCENT OF FARM'S INCOME	CUSTOMER
Biodiversity credits	5	Conservation trust
CO <sub>2</sub> offset credits	10	Steelmaker
Renewable electricity	15	Power market
Certified sustainable timber	20	Specialty market
Water credits	20	Urban water market
Wheat	15	World market
Wool	15	World market

**SCIENTIFIC AMERICAN**  
*Crossroads for Planet Earth*  
By Richard L. Waite, Michael R. Conard, and David L. Gash  
September 2005



## Summary

- Agricultural soil C sequestration
  - Keeps land in production
  - 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

## Summary

- Design Agricultural Systems
  - Improved energy output per water/energy input
  - Long term sustainability life cycle based
  - Maintain soil carbon
  - Balance nutrients, pesticides
  - Lower net Carbon emissions

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- Websites

[www.oznet.ksu.edu/kccm](http://www.oznet.ksu.edu/kccm)

[www.soilcarboncenter.k-state.edu/](http://www.soilcarboncenter.k-state.edu/)

[www.oznet.ksu.edu/ctec](http://www.oznet.ksu.edu/ctec)

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



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