



# ISU Carbon modeling efforts

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# Overview

- Introduction, how we got started
- Indirect Land Use
- National Offset Policies/GreenAgSim
- Offsets in the ACES Act

# How we got started

- ISU and Missouri run the FAPRI modeling system
- We attempt to project prices and quantities for agricultural products in all key countries
- We then change a policy and describe the impacts
- Congress funds this work and sometimes uses the results
- We realized that corn would rise to its energy value and we predicted the impacts of \$4.05 corn
- The model showed that the world could easily handle a vary large increase in US ethanol production

# Corn price versus corn energy value



— Breakeven Corn using Ethanol

— Corn

— Breakeven Corn using 0.67\*ethanol

# GreenAgSim

- FAPRI/CARD Agricultural Outlook Model
  - Partial equilibrium agricultural model
  - Coverage: 35 countries/regions, 13 crops, and 3 major livestock categories
  - Area planted/harvested
  - Livestock (number of heads)
  - Yield
- Greenhouse Gases from Agriculture Simulation Model (GreenAgSiM)
  - Extension of the CARD Agricultural Outlook Model

# GreenAgSiM Components

- Three model components
  - International Agricultural Production
  - US Agricultural Production
  - Land-Use Change
- Agricultural Production includes:
  - Enteric Fermentation ( $\text{CH}_4$ )
  - Manure Management ( $\text{CH}_4, \text{N}_2\text{O}$ )
  - Agricultural Soil Management ( $\text{N}_2\text{O}$ )
- Land-Use Change
  - Biomass and Soil ( $\text{CO}_2$ )

# Results

	Searchinger Data			Fall 2008 CARD Data			
Model used	Searchinger et al.	GreenAgSiM					
US Deforestation	Yes	Yes	No	No	No	No	No
Comparison	Base 07/ HCO	Base 07/ HCO	Base 07/ HCO	Base 08/ HEP Yield	Base 08/ HEP	Base 08/ HEP	Base 08/ HEP
Agricultural Production	No	No	No	No	No	Yes	Yes
Ethanol increase in million liters	55,950	55,950	55,950	29,859	29,859	29,859	29,859
Difference in Area Harvested (in thousand ha)	10,817	10,817	10,817	(1,281)	6,076	6,076	6,076
Difference in Emissions (in million tons of CO <sub>2</sub> -equivalents)	3,801	4,179	3,218	403	1,425	1,514	1,514
Payback period (in years)	166.69	183.27	141.13	31.50	117.18	124.41	55.40

# National Policy Offsets

- Tillage types:
  - Conservation Tillage (CT)
  - Reduced Tillage (RT)
  - Intensive Tillage (IT)
- Conservation Technology Information Center (CTIC):
  - Tillage by crop in the Midwest
  - Logarithmic projection (crop specific)
- Data per county: global ecological zone, climate region, and soil carbon (GIS based)

# Scenario 1: Fertilizer Adjustment

- Policy regarding anhydrous ammonia
  - Share of anhydrous ammonia after 2011: 0%
- Proportional increase in nitrogen solutions and urea

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Baseline	71.7	71.9	72.3	72.8	72.8	72.9	73.3	73.4	73.2	73.0	72.7	72.3
Scenario	39.4	39.5	39.7	40.0	40.0	40.0	40.3	40.3	40.2	40.1	39.9	39.7
<b>Total</b>	<b>32.3</b>	<b>32.4</b>	<b>32.6</b>	<b>32.8</b>	<b>32.8</b>	<b>32.9</b>	<b>33</b>	<b>33.1</b>	<b>33</b>	<b>32.9</b>	<b>32.8</b>	<b>32.6</b>

# Scenario 2: Tillage

- Policy regarding intensive tillage
  - Share of intensive tillage after 2011: 0%
- Proportional increase in reduced tillage and conservation tillage

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Baseline	-53.0	-58.4	-65.2	-71.5	-72.9	-71.5	-66.4	-73.4	-78.6	-79.5	-79.6	-80.1
Scenario	-75.5	-78.5	-85.3	-91.3	-92.3	-90.8	-85.8	-92.3	-97.3	-97.9	-97.8	-98.1
Difference	22.5	20.1	20.1	19.8	19.5	19.3	19.4	19.0	18.7	18.5	18.2	17.9

# Number in Perspective

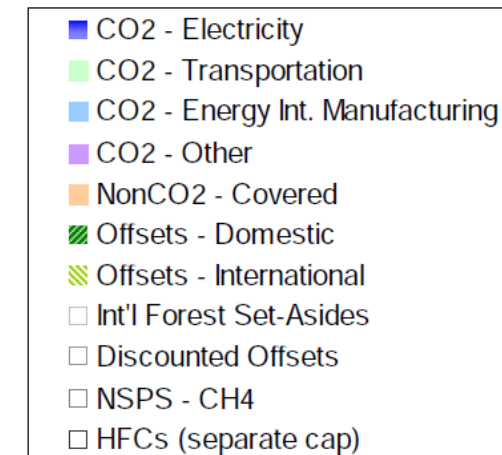
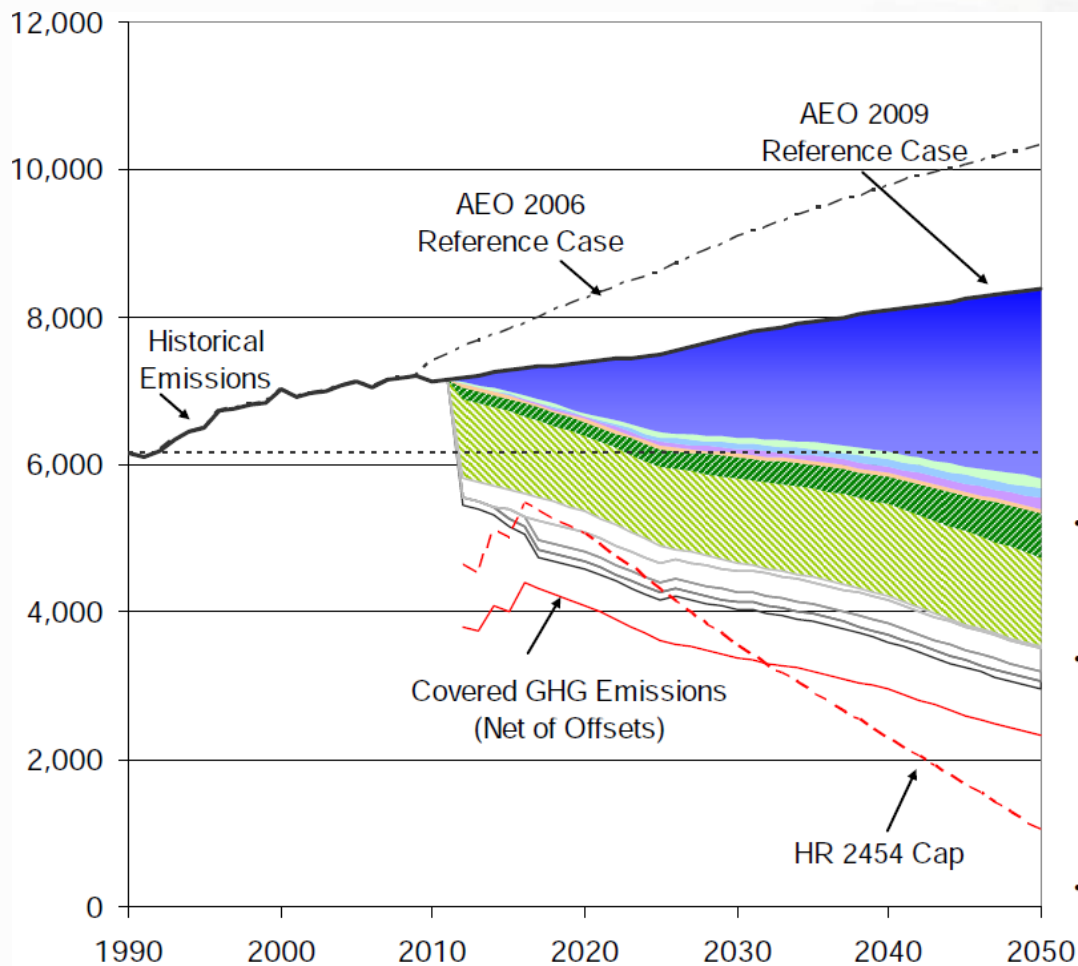
- Annual GHG emissions from US Agriculture:
  - 454.1 Mt of CO<sub>2</sub>-equivalent (2006)
- Fertilizer Policy
  - Savings of 7%
- Tillage
  - Savings of 4.2%



# National and International Offsets

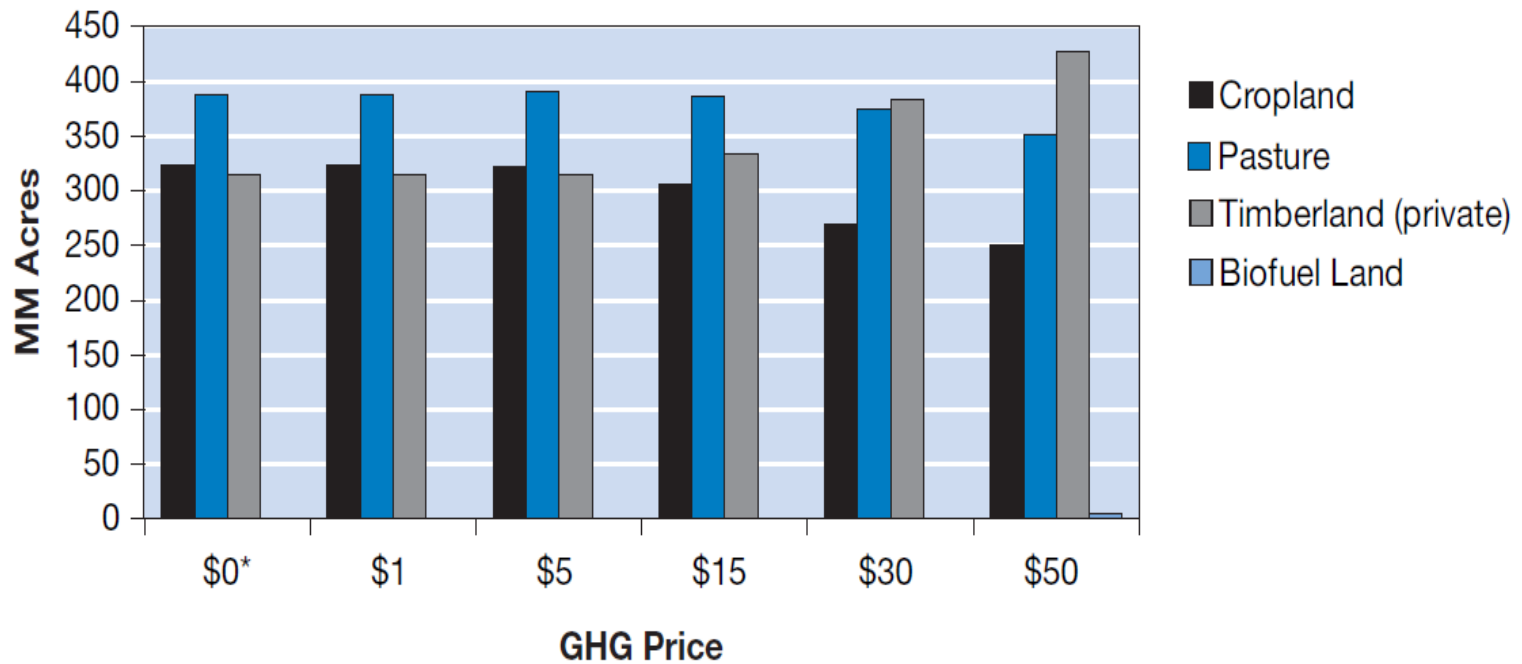
- Most to the reduced carbon flows come from a dramatic increase in nuclear power and enormous amounts of offset credits
- Most of the offset credits are from forestation
- Given a price of \$30 per ton of CO<sub>2</sub>:
  - Corn Belt: \$121.11 per acre per year
  - Delta States: \$189.81
  - Lake States: \$146.54
  - Southeast: \$173
- What impact does this have on US agricultural exports and farm income

# Impact of domestic offsets



- The updated reference case for this analysis is based on AEO 2009, and the old reference case from EPA's S. 2191 analysis was based on AEO 2006.
- Cumulative 2012-2050 GHG emissions are 14% (51 bmt) lower in the AEO 09 baseline compared to the AEO 06 baseline in ADAGE due to the inclusion of EISA, lower initial (2010) GDP (\$13.2 trillion in AEO 09 vs \$14.6 trillion in AEO 06), and a lower projected GDP growth rate (2.5% in AEO 09 vs 3.0% in AEO 06).
- International forest set-asides, discounted offsets, NSPS provisions for landfill and coal mine methane, and the HFC cap all provide additional abatement that does not help to meet the main cap.

**Figure 4 2: Land Use in 2025 at Different GHG Price Levels**



\*Baseline

Notes: \$ represent price per tonne, CO<sub>2</sub> Eq.

Quantities are in million acres.



# Questions and Comments