

Accounting for GHG Emissions from Agronomic Phase of Corn Ethanol

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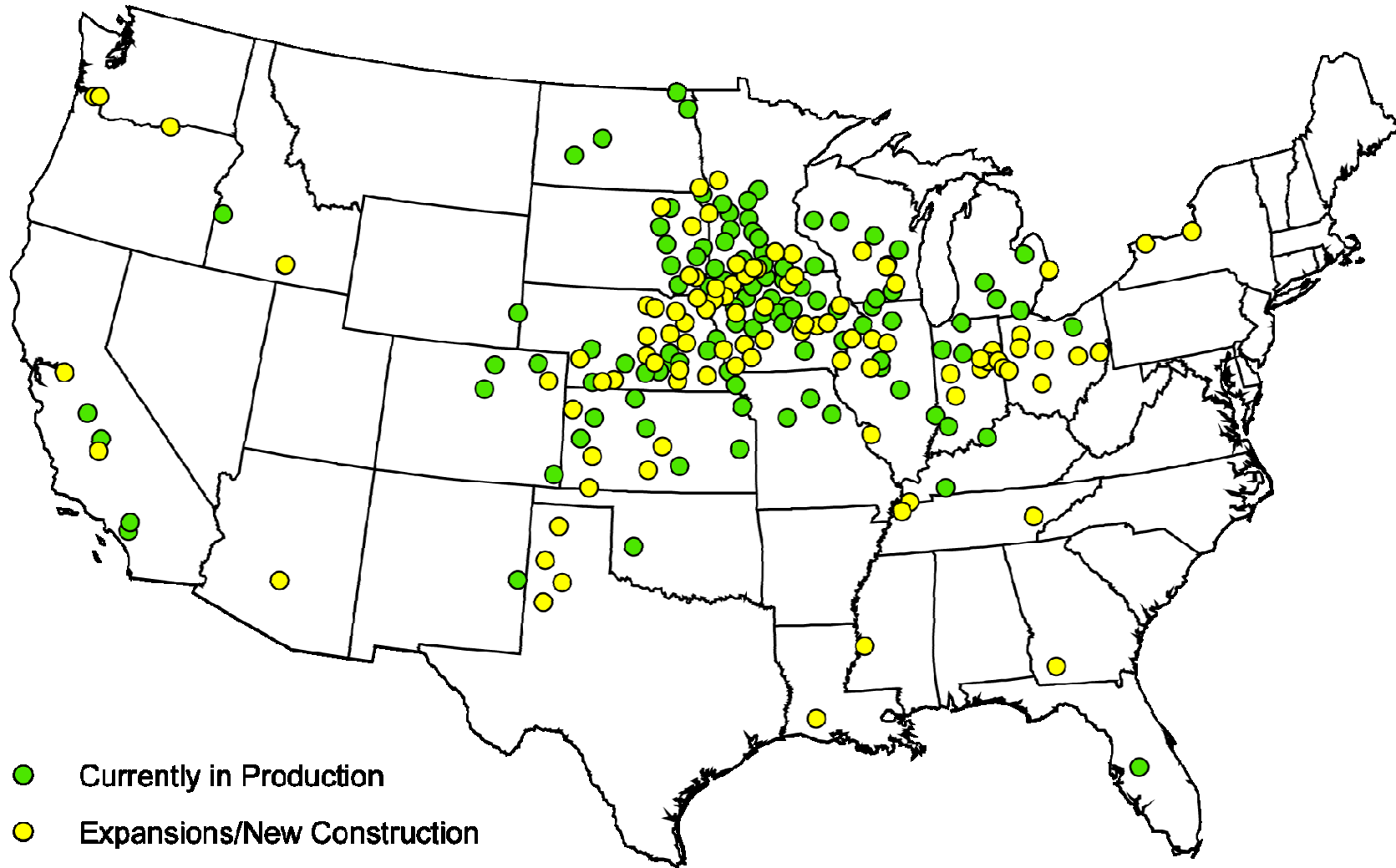
Center for Agricultural and Rural Development
www.card.iastate.edu

Iowa State University

CARD

- Oldest (est. 1958) agricultural policy research center
- Mission: Understand where agriculture is going and the impacts of alternative policies
- Main client: Congressional ag committees
- One output: FAPRI's 10 year, multi-country, multi-commodity (including biofuels) projections of prices, quantities, and trade flows

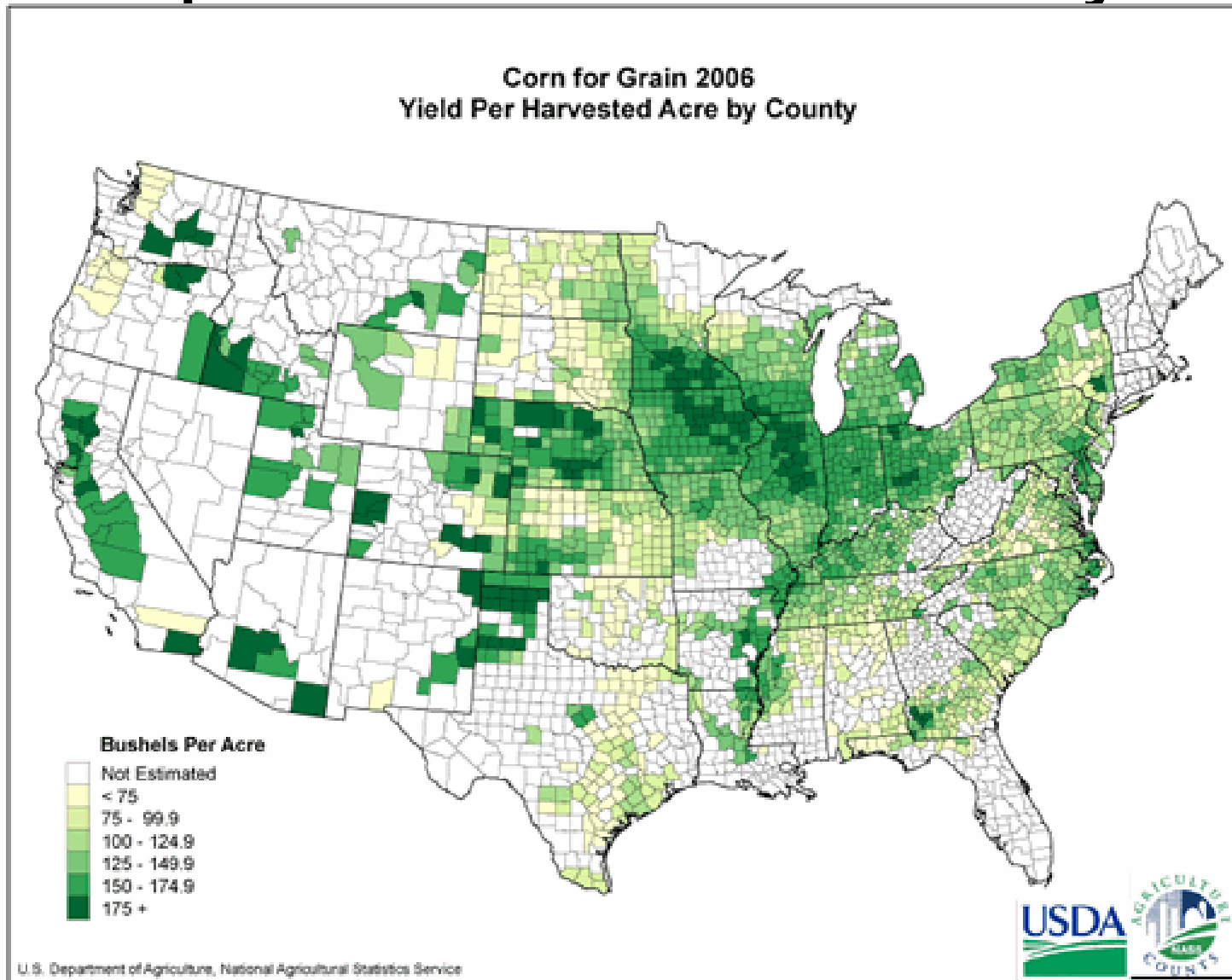
U.S. Ethanol Industry



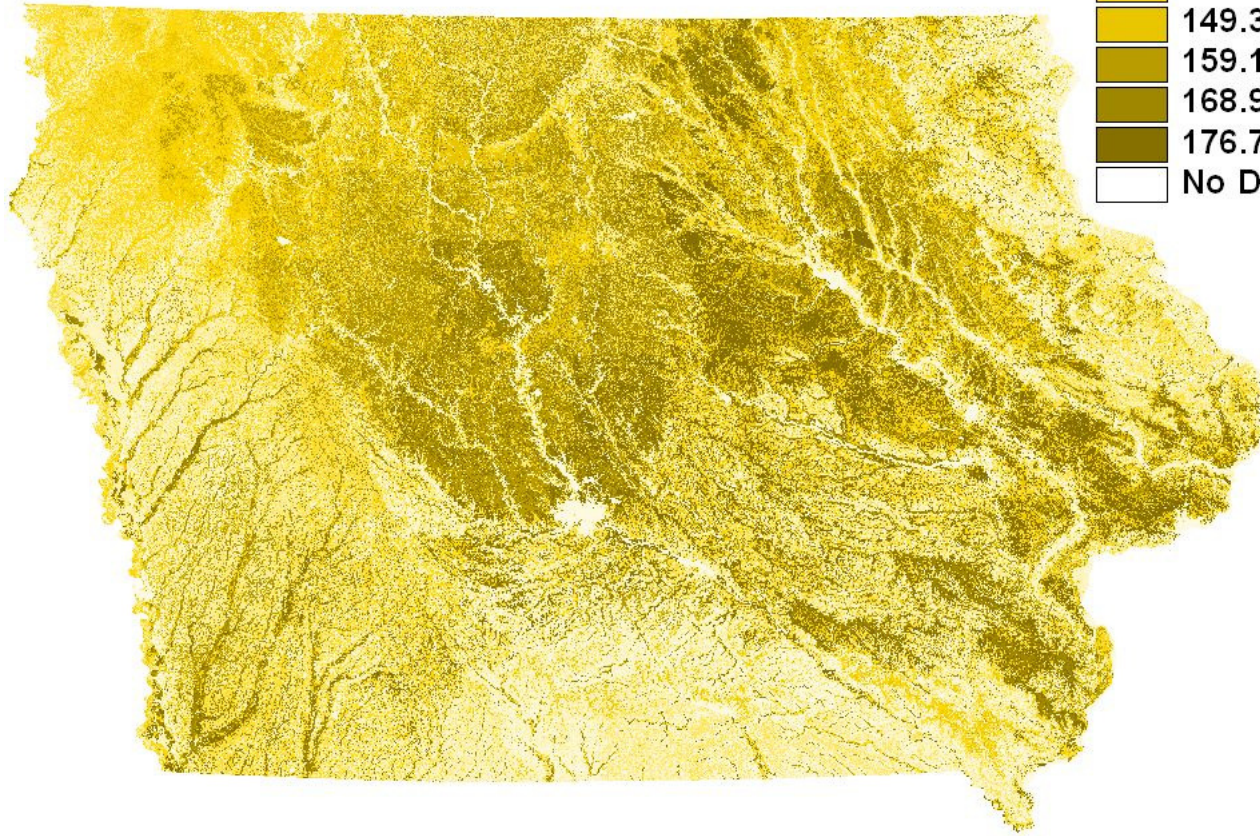
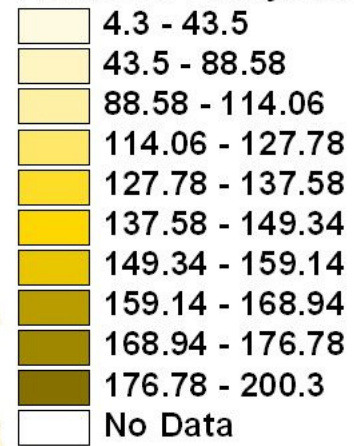
Importance of Accounting for Changes in Land Use

- U.S corn emissions depend on where it is produced and how it is produced
- Where:
 - Different regions have different corn yields
- How:
 - Corn grown after corn has higher N fertilizer use and lower yields than corn after soybeans
 - Corn grown on idle land has even higher emissions because of depletion of current stock of soil carbon and possible loss of future buildup of soil carbon

Spatial Yield Variability



Predicted corn yields (bushels/acre)



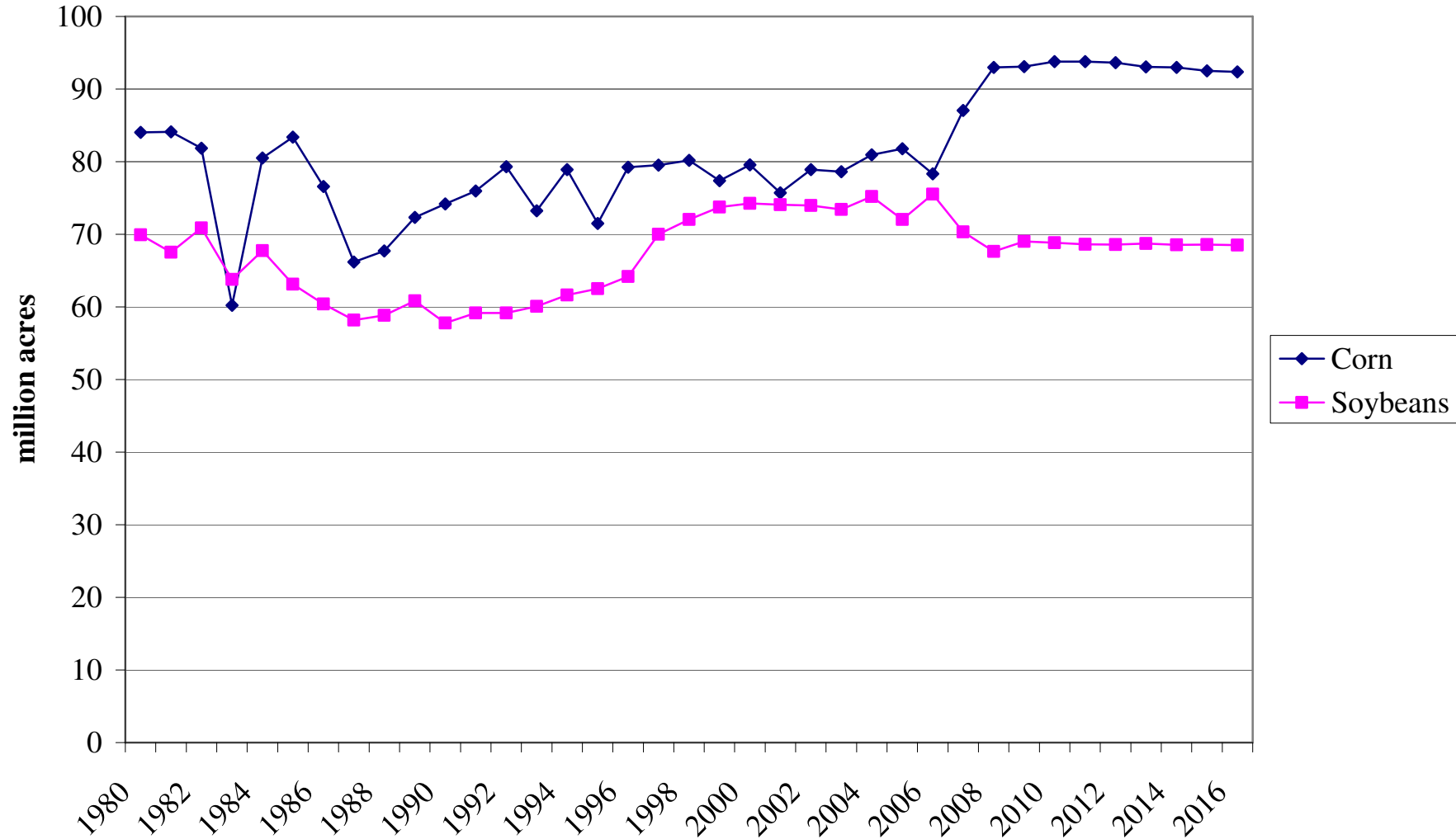
Impact of Crop Rotation

**Table 1: Average Yields Based on Rotation and Nitrogen Level,
Northeast Research and demonstration Farm, IA, 2000-2005**

Rotation	Nitrogen Rate (lb/acre for corn only)			
	<u>0</u>	<u>80</u>	<u>160</u>	<u>240</u>
CS (corn bu/acre)	105	163	181	191
CC (corn bu/acre)	49	122	150	154

Source: Duffy and Correll, ISU Extension, 2006.

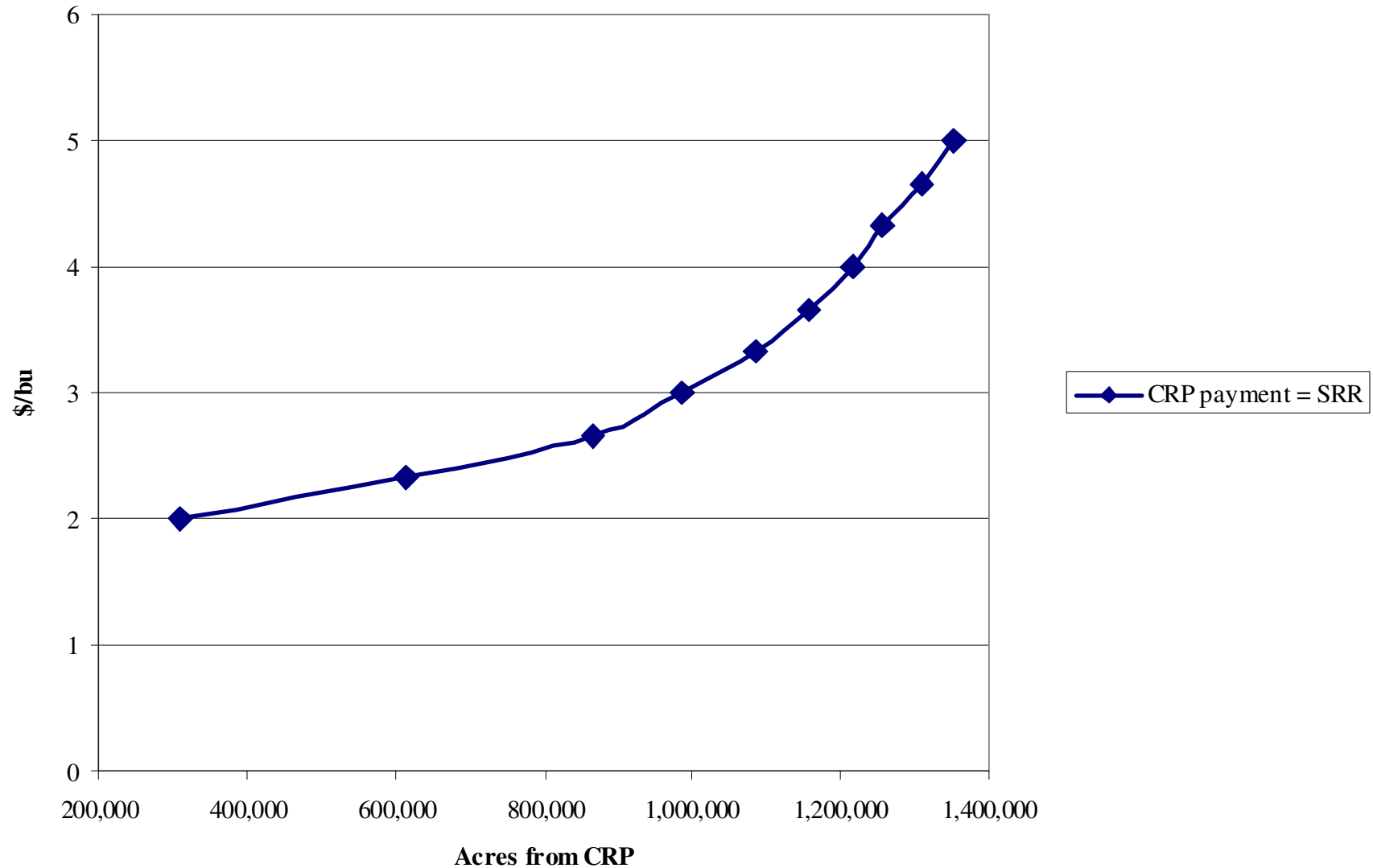
Historical and Projected (Jan 2007) Planted Acreage



Loss of Carbon

- Conversion of cropland to Conservation Reserve Program sequesters 13000 kg CO₂ over ten years (Brenner et al. 2001)
- Tilling CRP mines this buildup and eliminates the possibility of continuing the buildup
- Brenner, J., K. Paustian, G. Bluhm, J. Cipra, M. Easter, E.T. Elliott, T. Kautza, K.Killian, J. Schuler and S. Williams. 2001. Quantifying the change in greenhouse gas emissions due to natural resource conservation practice application in Iowa. Final report to the Iowa Conservation Partnership. Colorado State University Natural Resource Ecology Laboratory and USDA Natural Resources Conservation Service, Fort Collins, CO, USA.

Likely Loss of CRP Land in Iowa

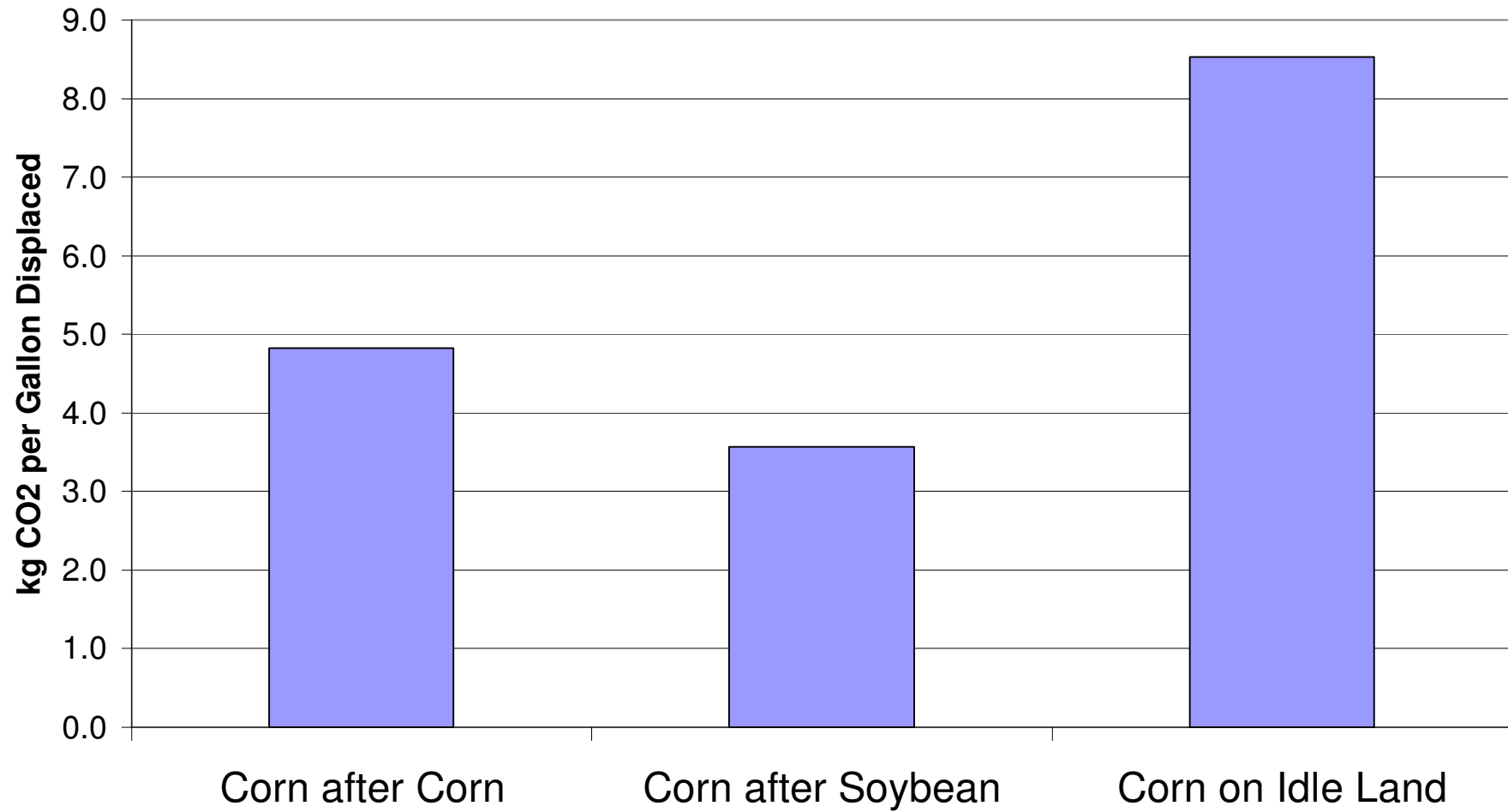


Assumptions

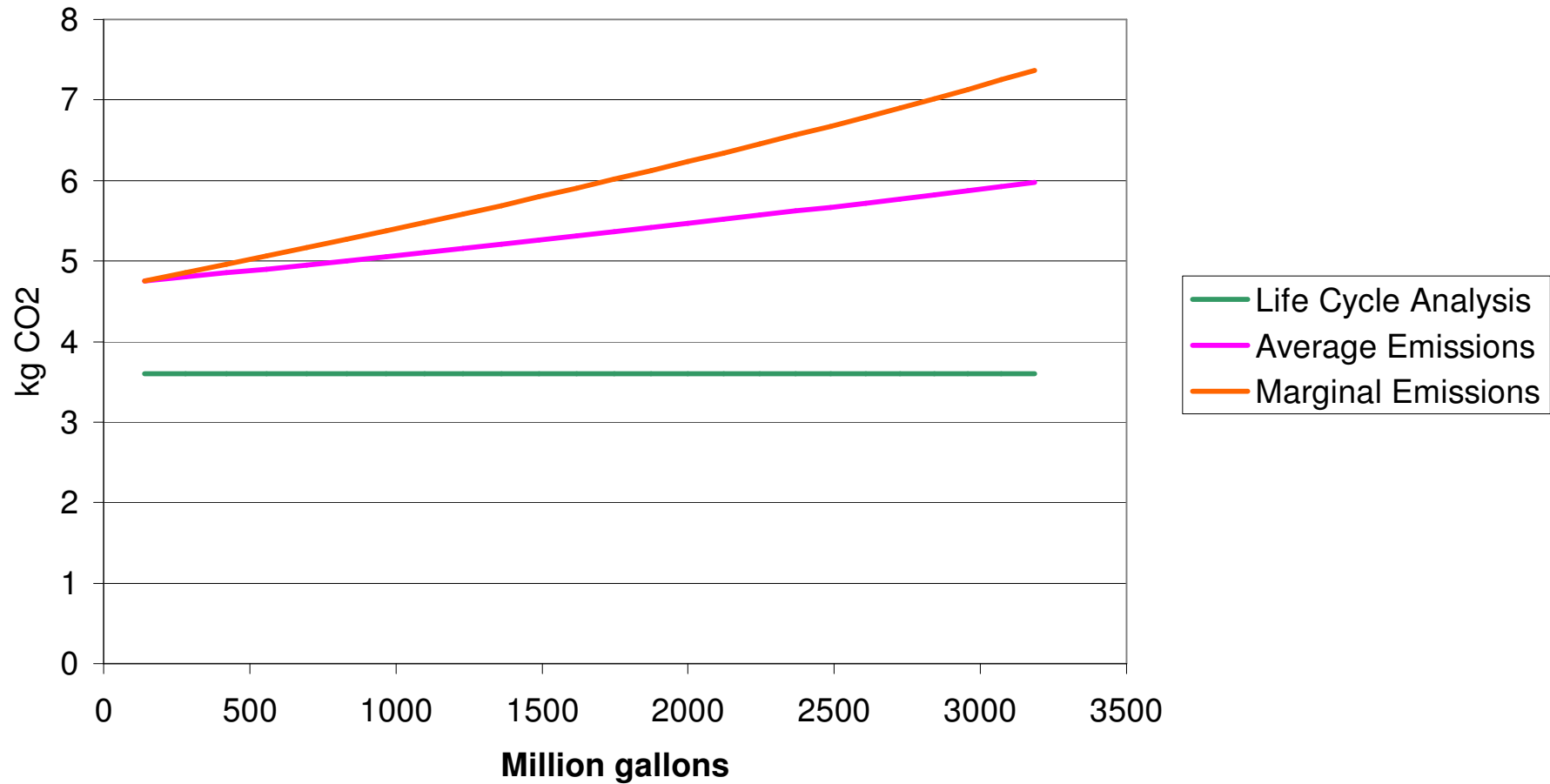
Table 3. Iowa's trend corn yields by counties 2007, inferred distribution and inputs.

Yield Classes	Lower	Middle	Upper
Total Share % (Iowa's acres planted corn)	20.02	38.36	41.62
<u>Corn-Soybean</u>			
Yields (bu/acre)	154.1	167.9	177.8
N fixed (lbs/acre)	130	130	130
N varied (lbs/acre)	115	130	145
P (lbs/acre)	55	60	70
K (lbs/acre)	40	50	55
<u>Corn-Corn</u>			
Yields (bu/acre)	138.7	151.1	160.0
N fixed (lbs/acre)	180	180	180
N varied (lbs/acre)	165	180	195
P (lbs/acre)	44	55	60
K (lbs/acre)	40	45	50
Limestone (lbs/acre)	577.6	577.6	577.6
Weighted Mean Yields (bu/acre)	149.6	163.0	172.6
Weighted Mean N rates (lb/acre)	129.5	144.5	159.5

Impact of Crop Rotation on GHG Emissions in Agronomic Phase



Agronomic Emissions of CO2 per Gallon of Gasoline Displaced from Corn Ethanol: Iowa Conditions Accounting for Crop Rotation and CRP Land Removal



International Response

- What land use changes occur in other countries because of U.S. biofuels policies?
- Would they have occurred anyways sometime in the future?
- Will they be reversed in the future?
- How should they be accounted for?