



A Bottom-Up Assessment of Land Use Related to Corn Ethanol Production

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Background

Scope

- The study attempts to determine if conversion of non-agricultural land to corn - **corn extensification** - occurred around a selected ethanol plant and if the ethanol plant is the likely cause
 - Secondly, the study attempts to determine if conversion of non-corn crop to corn - **corn intensification** - occurred and if the ethanol plant is the likely cause
 - Third, the study examines the land carbon balance from IRE corn ethanol production
 - Fourth, the study combines the land carbon balance with a full life cycle assessment of corn ethanol produced at IRE including GWi contributions from corn farming, the ethanol plant, and ethanol distribution
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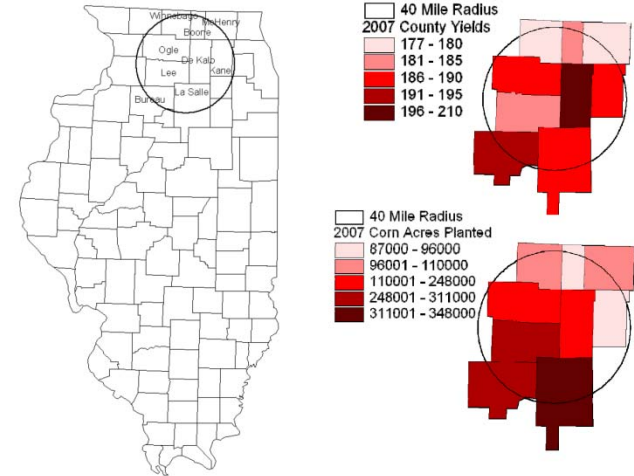
Corn Draw Area

- The first step in the process was to create a draw area boundary for the Rochelle ethanol plant.
- Two different methods were used:
 - Circle Method
 - ProExporter Polygon

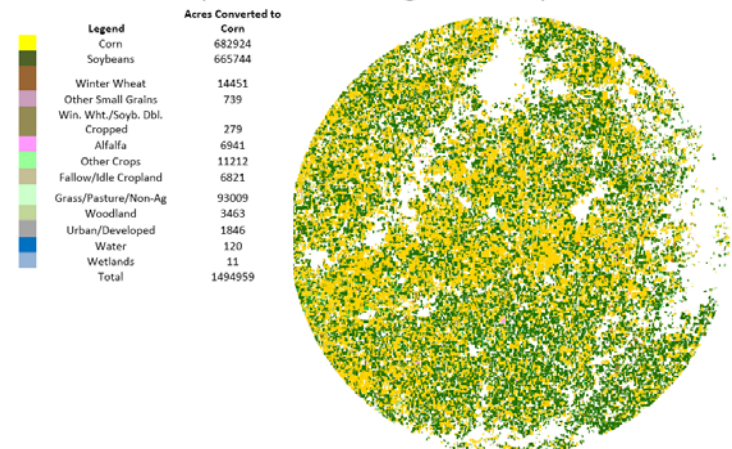
Circle Method

- The circle method uses the address of the ethanol plant as the center point and survey information on growers delivering from farthest away as the radius.
- The surveys showed that growers deliver from as far as 40 miles away to the plant.
- 40 mile radius was developed as a geographic information system (GIS) polygon file.
- Circle represents the approximate draw area for corn required for the production of ethanol by the plant.

Counties in the 40-mile Radius and USDA NASS Data



What Were 2007 Corn Acres in 2006 (Land Use Change to Corn)





Assessed Corn Acres

Land Use	2007 Crop Acres in 2006	
	NASS Unvetted Acres	NASS Vetted Acres
Corn	682,924	680,340
Soybeans	665,744	661,660
Winter Wheat	14,451	15,026
Other Small Grains	739	274
Win. Wht./Soyb. Dbl. Cropped	279	110
Alfalfa	6,941	3,060
Other Crops	11,212	9,428
Fallow/Idle Cropland	6,821	1,608
Grass/Pasture/Non-Ag	93,009	3,982
Woodland	3,463	122
Urban/Developed	1,846	5
Water	120	0
Wetlands	11	0
Ag 2005 to Non-Ag to Ag Land		26,616
Field and Roadway Fringes		85,329
Total Analyzed	1,487,560	1,487,560

Vetting Routines resulted in drop in non-ag to ag conversions

Non-ag to corn



Land Use Summary Table

	2007	2006	2005
Com Yield IRE Grower Survey (bu/acre)	196.1	186.1	167.4
Com Yield Increase 2007-2006	5.4%		
Com Yield Increase 2006-2005		11.2%	
IRE Delivered Corn (bu)	20,450,000		
IRE Required Acres	104,284		
IRE Acres as Percent of Corn Draw Area	7.0%		
Com Acres	1,487,560	1,225,986	1,158,809
	261,574		
Soy Acres	540,975	840,340	851,540
	-299,365		



Carbon Balance of IRE Supplied Corn

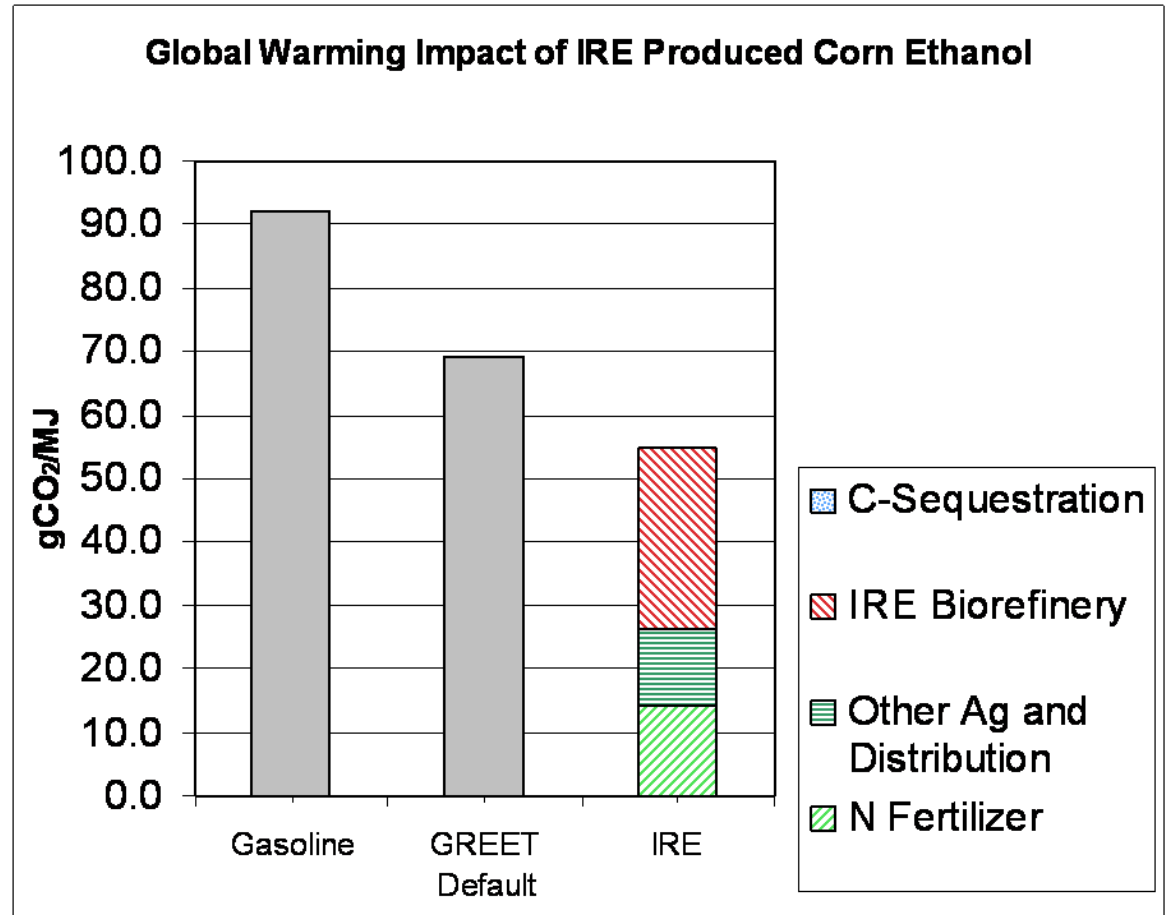
N₂O Emissions and Sequestration Values

Metric Tons Sequestered on IRE Acres	CO₂e for IRE Supply Acres (tonnes/y)	IRE Ethanol GWI Contribution (g/MJ LHV)*
N ₂ O: Mummey Factors	91,403	19.6
N ₂ O: GREET Default	70,822	15.2
N ₂ O: GREET IRE Customized	64,164	13.8
N ₂ O: GREET N-Application Optimized	55,085	11.8
N ₂ O: IL Measured	7,113	1.5
Sequestr.: UIUC Factors, 13% no till	-5,300	-1.1
Sequestr.: CCX CMO, 13% no till	-8,134	-1.7
Sequestr.: UIES, 13% no till	-22,645	-4.9
Sequestr.: UIUC Factors, 100% no till	-30,830	-5.8
Sequestr.: UIUC Factors, 100% no till, Winter Cover	-61,640	-11.7
Sequestr.: CCX CMO, 100% no till	-62,570	-13.4
Sequestr.: UIES, 100% no till	-174,432	-37.5
Whole Draw Area: CCX CMO 13% no till	-116,030	-25
Whole Draw Area: UIES 13% no till	-321,308	-69.1



IRE GWI: Results

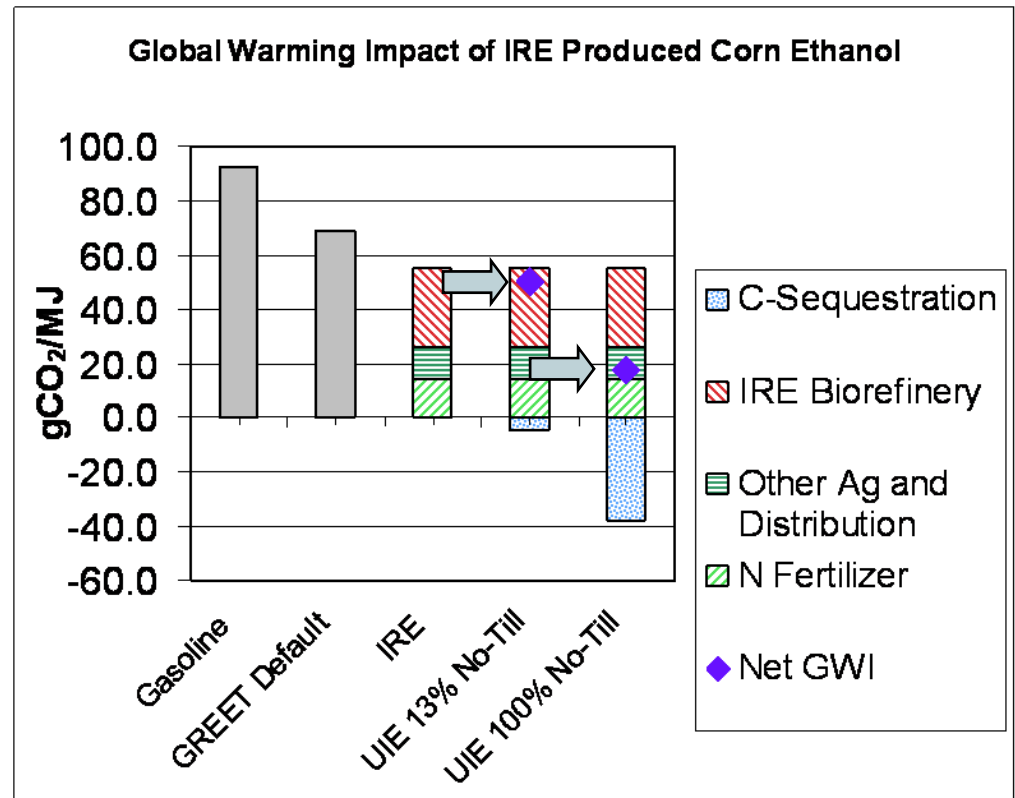
- Gasoline:
92.1 gCO₂e/MJ
- GREET Default
for Natural Gas
Dry Mill Corn
Ethanol Plant:
69.1 gCO₂e/MJ
- IRE Ethanol with
surveyed values:
54.8 gCO₂e/MJ





IRE Ethanol Plant GWI

- Gasoline:
92 gCO₂e/MJ
- Average Corn Ethanol:
69 gCO₂e/MJ
- Ethanol from IRE Plant:
54.8 gCO₂e/MJ
- Ethanol from IRE Plant & Accounting for 13% no-till:
49.9 gCO₂e/MJ*
- Ethanol from IRE Plant with incentive to supply 100% no-till corn (or 50% no-till & 50% winter cover crop):
17.3 gCO₂e/MJ*



*No-till sequestration based on long term Univ. of IL Extension Study



Conclusions

- Study provides a comprehensive and current analysis of corn ethanol GWI at a specific facility
 - There is no evidence that the studied ethanol production pathway promoted conversion of non-ag land to corn or was the cause of corn intensification.
 - Therefore, effects from international land adjustments (indirect effects) were not considered in the study
 - N₂O emissions and carbon sequestration effects vary widely by the employed methodology
 - Advanced agricultural practices including no-till and winter cover crops on acres supplying corn to an ethanol plant can significantly lower the GWI of the produced biofuel
 - These practices should be encouraged
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