

Effects of Corn Ethanol vs Switchgrass Based Biofuels in the Midwest

Silvia Secchi¹ , Phillip Gassman², Manoj Jha²,
Lyubov Kurkalova³, and Catherine L. Kling²

¹ Department of Agribusiness Economics, Southern Illinois University Carbondale

² Center for Agricultural and Rural Development, Iowa State University

³ Department of Economics, North Carolina Agricultural and Technical State University

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Recent increases in biofuels production

- 7 billion gal vs. < 2 billion gal in 2002
- 154 biorefineries operating + 49 under construction (as of June 2008)
- EISA 2007 (latest energy bill) mandates 36 billion gal of ethanol by 2022
 - 15 from corn
 - 21 from second generation technologies



Concerns for water quality

- Increasing ethanol production
- Increasing demand for corn
- Increasing corn acreage
- Concerns related to water quality in the Upper Mississippi River Basin (UMRB)
 - Nitrogen from corn contributes to Gulf of Mexico hypoxia and local water quality concerns throughout the Midwest



Research questions

- How much additional nutrients (N and P) are likely to end up in the rivers and streams of the UMRB as a result of the increase in the relative profitability of corn?
- How would those nutrient levels differ if switchgrass production in UMRB became widespread in lieu of total reliance on corn-based ethanol?

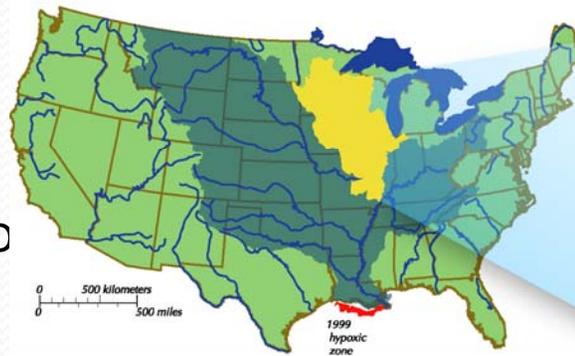


Scenarios considered

- Baseline
- Commodity prices as forecast by
 - FAPRI long term projections
 - \$3.9/bu for corn, ~ \$9.8/bu for soybeans
 - Year 2018
 - Futures markets (CBOT)
 - \$6.58/bu for corn, \$14.7/bu for soybeans
 - Futures contracts for 2010
- Switchgrass
 - 10% of UMRB's cropland converted away from row crops
 - Production restricted to the most erodible land.

Integrated economic and water quality modeling system

- National Resources Inventory (NRI) data
 - 110,000 NRI points UMRB
 - Weather, soil characteristics, crop choices, rotations
- Economic model
- Soil and Water Assessment Tool (SWAT)

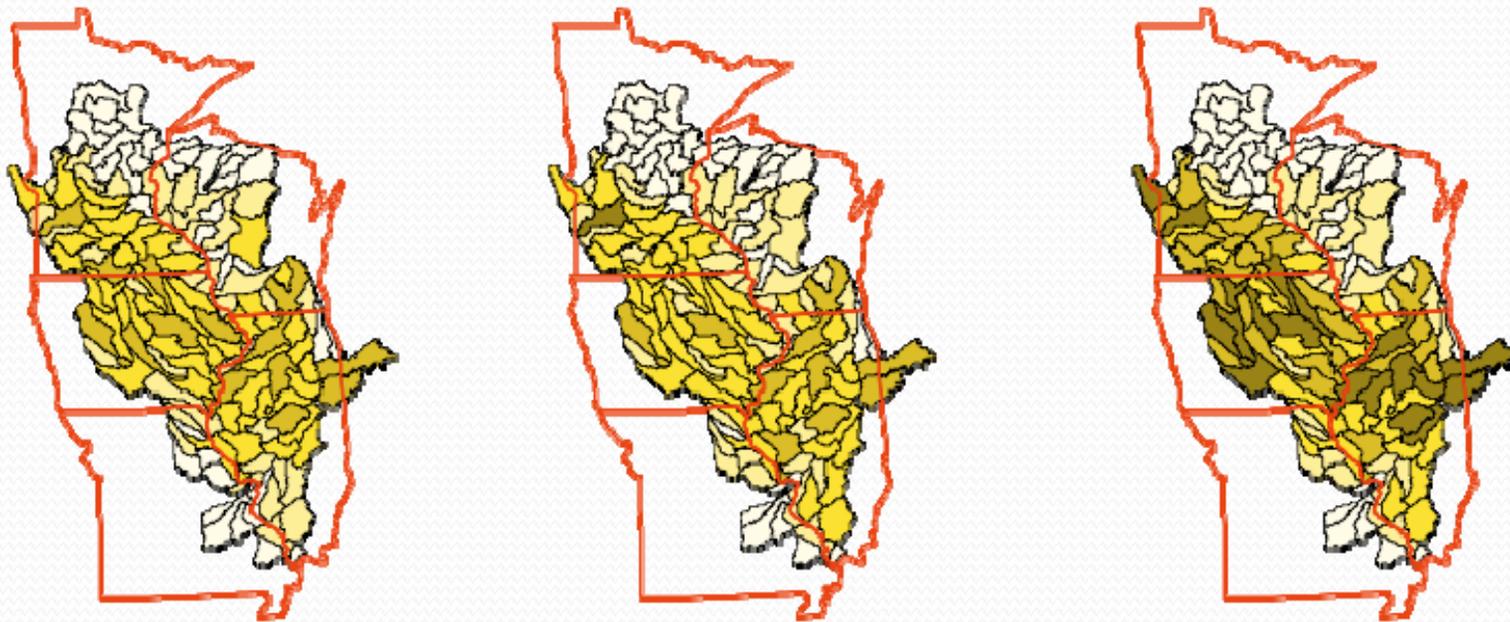




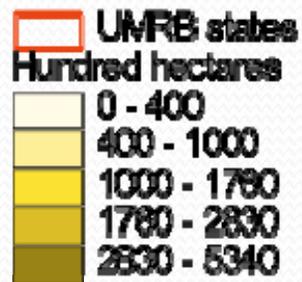
Economic model

- Assumes farmers choose the crop and associated rotation to maximize net returns
 - Profitability depends on soil type, climate, other physical characteristics of land
 - Commodity prices
- Cost of production are based on Iowa costs of production for 2008 (ISU Extension)
- Rates of fertilizer application are based on historical, state-specific averages (USDA-ERS)

Location of corn area – no switchgrass scenarios



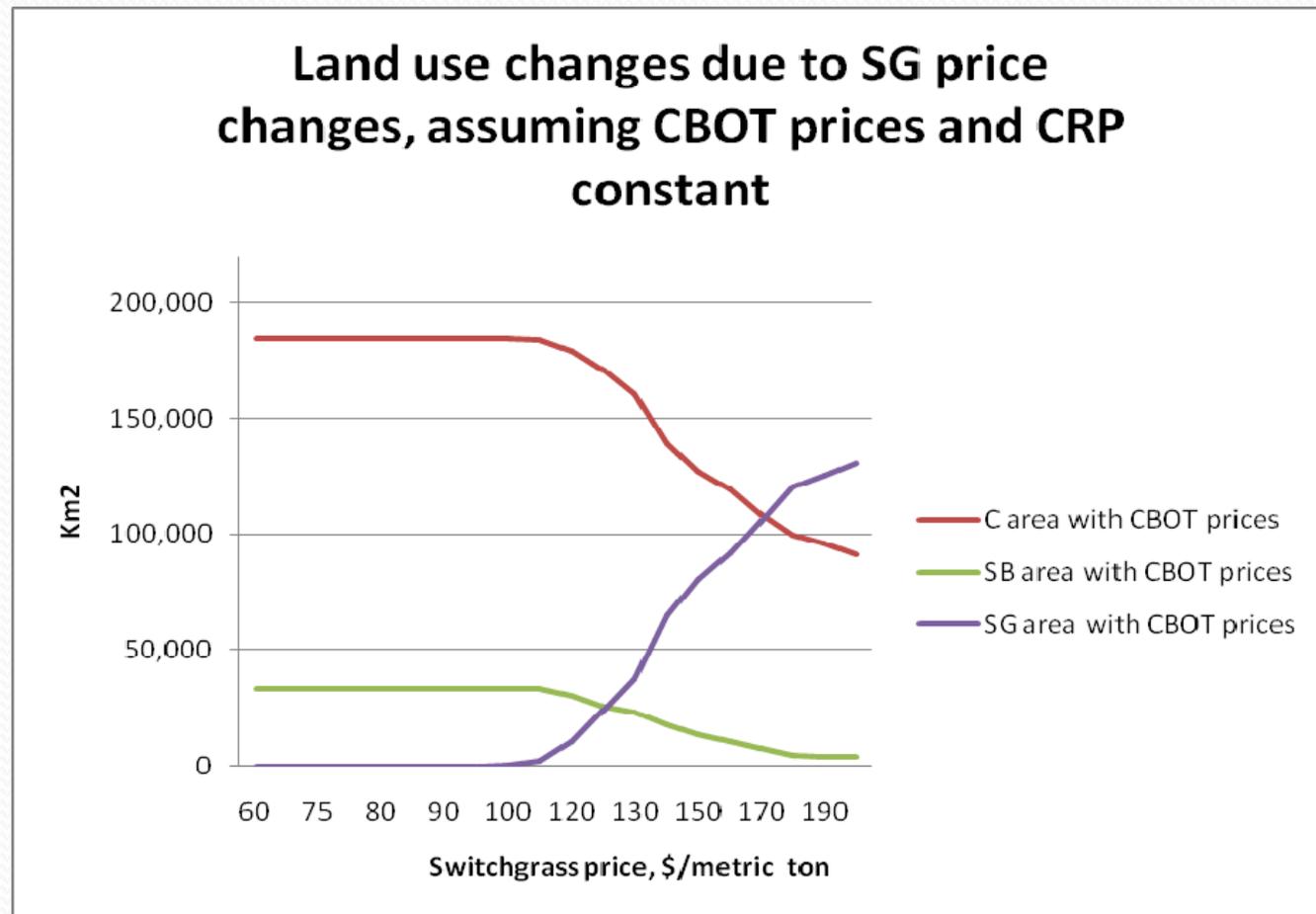
Baseline



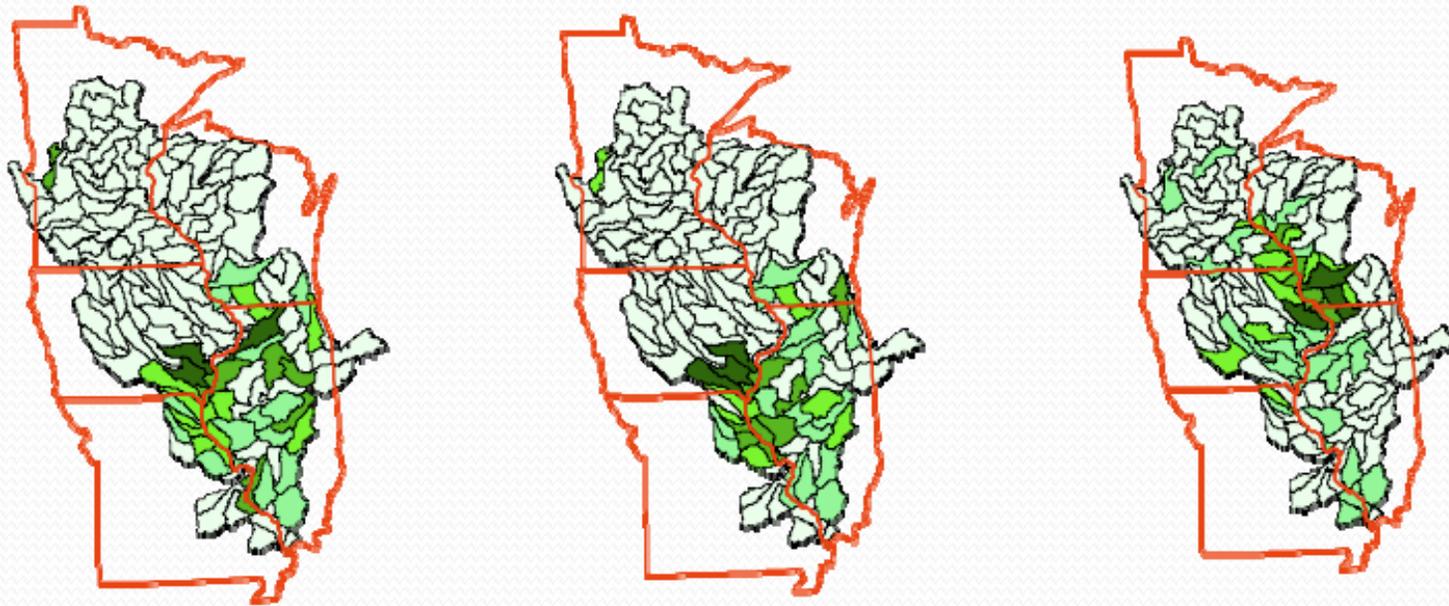
FAPRI prices

CBOT prices

Acreage Response of Corn, Soybean, and Switchgrass to Switchgrass Prices



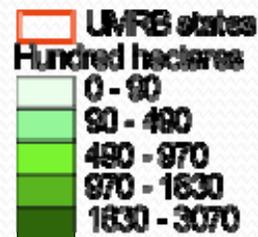
Location of switchgrass area



SG with FAPRI prices

SG with CBOT prices

SG with targeting



SWAT results

	Avg Sediment Out ,000 Metric tons	Avg NO3 Out ,000 Kgs	Avg P Out Kgs
Baseline	23,975	329,377	25,045
FAPRI prices – W/ CRP No switchgrass	25,412	357,808	24,912
FAPRI prices – W/ CRP With switchgrass	22,321	363,888	22,321
FAPRI prices – W/ CRP With targeted	21,825	411,371	22,758
CBOT prices – W/ CRP No switchgrass	24,541	346,083	27,238
CBOT prices – W/ CRP With switchgrass	20,482	353,125	24,503
CBOT prices – W/ CRP With targeted switchgrass	20,264	401,183	25,009



Implications for EISA 2007

- The unrestricted switchgrass production levels are around 37-41 million tons.
- The targeted scenarios have a much lower switchgrass production scenarios production level – 18 million tons.
- With an ethanol conversion efficiency of 0.3 liters/kg (realistic), this would mean that our scenarios show that the UMRB could supply between 7 to over 15% of the 21 billion gallon cellulosic ethanol EISA numbers.



Policy implications

- The 25 by 25 study estimated biomass prices of \$ 44-88/metric ton. The RAND report re-released this year has prices of \$81-181 metric ton – delivered at the plant.
- Our prices are \$78 and \$125/metric ton at the farm gate.
- To produce switchgrass levels in the UMRB, substantial subsidies may be needed.
 - The Farm bill subsidies are in the range.