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# **Nitrogen Cycling and Economic Viability of Corn Residue for Energy**

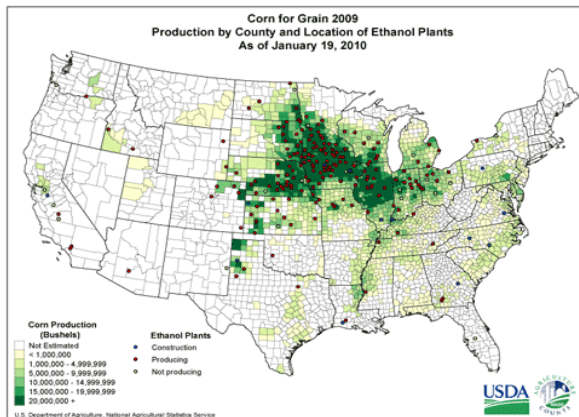
Juan Sesmero and Ben Gramig

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## Background

- RFS requires 36 billion gallon ethanol equivalent mandate of renewable transportation fuels per year by 2022.
- Corn residue was identified by EPA and USDA as the third feedstock in importance to meet the annual mandate.
- Due to high density and yields the bulk of corn residue is expected to come from the Corn Belt.



## Limitations of Current Knowledge

- Previous literature assumes replacement of nutrients removed with residue ( $\cong 20\%$  of harvesting cost) and exogenous crop rotation choice.
- Evidence suggests improvement in N cycling after harvest may reduce need for nutrient replacement.
- Positive net revenue from corn residue may affect optimal rotation choice triggering land cover changes.

## Model

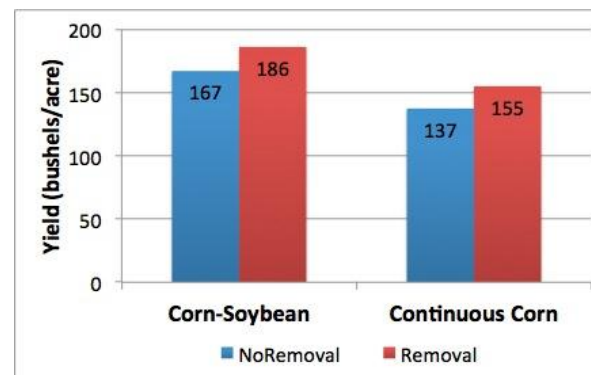
- Farmers choose rotation and stover harvest rate to maximize profits.
- Farmers choice is a function of prices (corn, soybean, and nitrogen) and agronomic parameters.
- Agronomic parameters capture yield and nutrient effects of rotation and harvest choice.
- Profit conditions determine price and agronomic thresholds triggering management practices.
- We construct profit conditions comparing four different management practices with the baseline (corn-soybean rotation without stover harvest):

$$V(CRCR) \geq V(CNS) \quad V(CRS) \geq V(CNS)$$

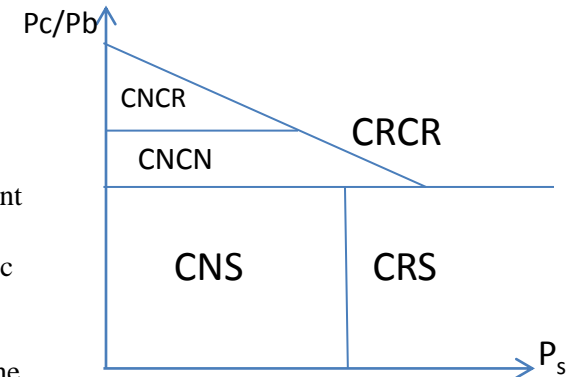
$$V(CNCN) \geq V(CRCR) \quad V(CNCR) \geq V(CNCN)$$

$$V(CNCR) \geq V(CRCR)$$

## Results (agronomic effects)



## Prices and management



## Conclusions

- Nitrogen replacement and hence cost of harvesting stover may be overestimated.
- Increases in stover price may trigger changes in land cover (rotation and residue coverage).
- We find lower cost of harvesting stover. This is because:
  - 1) Stover removal enhances N-cycling
  - 2) High stover price increases corn planting density and stover harvesting density.

## Data Sources

- Own simulations with Daycent
- Coulter and Nafziger, Pantoja et al., Maskina et al., Power et al., Coulter et al. 2010

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