Irrigation Resources to Grow Biofuel: A National Overview with Role of Groundwater

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Goal of presentation

• Provide a National perspective on irrigated agriculture
  ▪ Acres
  ▪ Water use
  ▪ Crops
• What do trends and current conditions tell us about the water and land potentially used for biofuel production?
• What are the groundwater implications?
U.S. irrigated acres & water applications

Source: NRCS, based on Census of Agriculture Data and Farm and Ranch Irrigation Survey Data

Irrigation overview: Acres location, 2007

Source: USDA, 2007 Census of Agriculture
Total and agricultural water withdrawals (1960-2005) and consumptive use estimates (1960-1995)

Source: USDA, NRCS, based on Kenny, et al, 2009

* Data limitations do not allow estimation of consumptive use in 2000.

U.S. Irrigation water withdrawals, 2005

Acre-feet (1,000)

Source: NRCS analysis of USGS Water Use data
What is all that irrigation water used for?

U.S. irrigated acreage, 2007

Source: NRCS analysis of Census of Agriculture Data
What does this mean for irrigation water demands?

Irrigated corn share and current ethanol plant locations

Source: ERS based on 2007 Census of Agriculture data and 2010 Renewable Fuels Association data.
How much water for an “average” corn field?

- 130 acre center-pivot field
- 12 inch application in 2008 (reduction from 14 in 2003)
- 42,357,120 gallons applied per year per field (27,152 * 12 * 130)
- States with >100,000 acres range from 21 to 85 million gallons per field
- 1,800 gallons /bu (based on average irrigated corn yield in 2008 of 181 bu/acre)

Source: USDA, NASS, Farm and Ranch Irrigation Survey

Gallons of irrigation water per bushel of irrigated corn, 2008

Source: NRCS based on Farm and Ranch Irrigation Survey Data
Gallons of irrigation water per gallon of corn-based ethanol, 2008

Assuming all feedstock irrigated converting at 2.7 gallons per bushel.

Source: NRCS based on Farm and Ranch Irrigation Survey Data

High Plains Aquifer remaining and current & planned ethanol plant locations

Source: NRCS based on 1999 USGS Digital map data and 2010 Renewable Fuels Association data.
Average irrigation water applications levels for selected crops, U.S., 2008

Source: ERS based on 2003 Farm and Ranch Irrigation Survey data.

Average irrigation water applications levels for selected crops, Nebraska, 2008

Source: ERS based on 2003 Farm and Ranch Irrigation Survey data.
Average irrigation water applications levels for selected crops, California, 2008

Source: ERS based on 2003 Farm and Ranch Irrigation Survey data

Average irrigation water applications levels for selected crops, Kansas, 2008

Source: ERS based on 2003 Farm and Ranch Irrigation Survey data
Regional crop shifts from 2002 to 2007, selected crops

- Pacific
- Mountain
- Southern Plains
- Northern Plains
- East Central
- Eastern

Source: NRCS, based on Census of Agriculture data

Groundwater use: Irrigation, and Estimated Ethanol Shares

Source: NRCS analysis of RFS, FRIS, and USGS water use data
### Resource requirements for Biofuel production

**Shifting** irrigated acres to biofuel production
- Land—one for one primary shift (secondary impacts are likely as crop prices rise)
  - Nitrogen fertilizer needs.
  - Pesticide needs.
  - Erosion levels.
- Irrigation water—depends on the specific crop shift and where it occurs
  - Have not observed significant changes to date, potential exists
  - Soybeans to corn Northern Plains: ▲ irrigation water application
  - Potatoes to corn in Pacific: ▼ irrigation water application

**Develop** new irrigated acres for biofuel production?
- Land—irrigable acres available, but …
- Irrigation water—location specific availability
  - Water use is controlled by State laws
  - Many States are now using a local planning process to establish management goals
  - Declines in water availability in some locations to meet environmental and water quality concerns
  - Irrigated field-crop returns relative to non-irrigated
Summary

• In the short run, increased agricultural production for biofuels will not alter the national view of water use

• Growing crops for next generation of biofuel production will have a more significant regional and local impact
  ▪ In some cases an increase in water use
  ▪ In other cases a decrease, depending on the crops being grown now and the biofuel crops produced
  ▪ In some cases an impact on groundwater by driving demand for irrigation water

Thank you!

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