

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

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Toward Sustainable Groundwater in Agriculture

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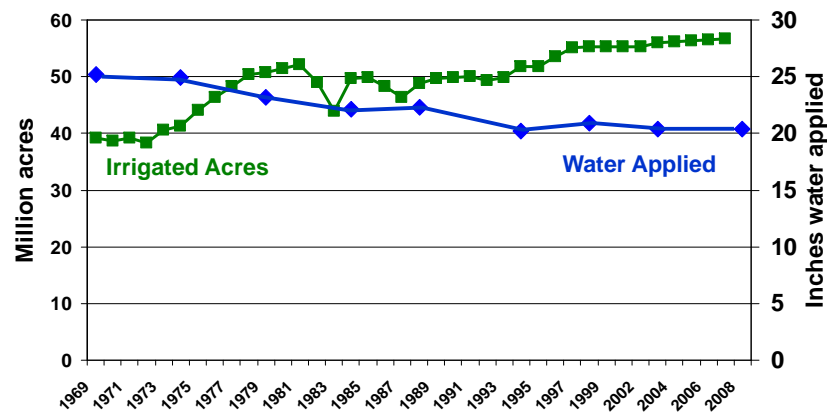


Goal of presentation

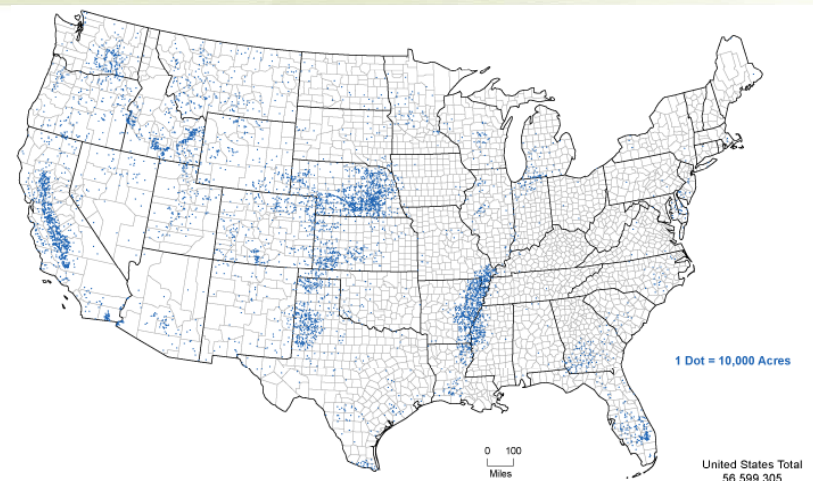
- Provide a National perspective on irrigated agriculture
 - Acres
 - Water use
 - Crops
- What do trends and current conditions tell us about the water and land potentially used for biofuel production?
- What are the groundwater implications?



U.S. irrigated acres & water applications



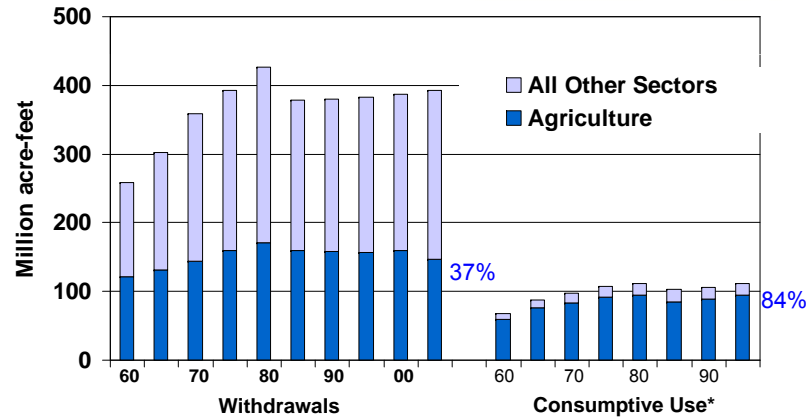
Irrigation overview: Acres location, 2007



Source: USDA, 2007 Census of Agriculture



Total and agricultural water withdrawals (1960-2005) and consumptive use estimates (1960-1995)



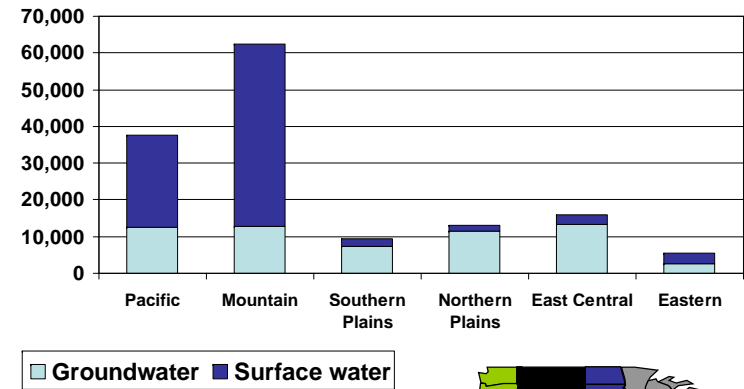
Source: USDA, NRCS, based on Kenny, et al, 2009

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

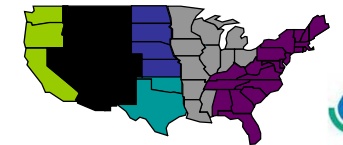


U.S. Irrigation water withdrawals, 2005

Acre-feet (1,000)



Groundwater Surface water



Source: NRCS analysis of USGS Water Use data



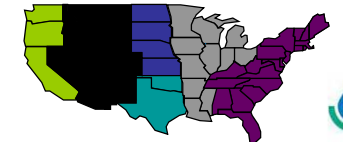
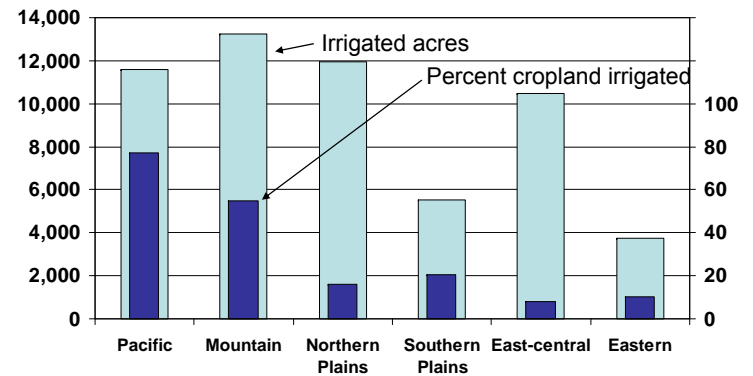
What is all that irrigation water used for?



U.S. irrigated acreage, 2007

Acres (1,000)

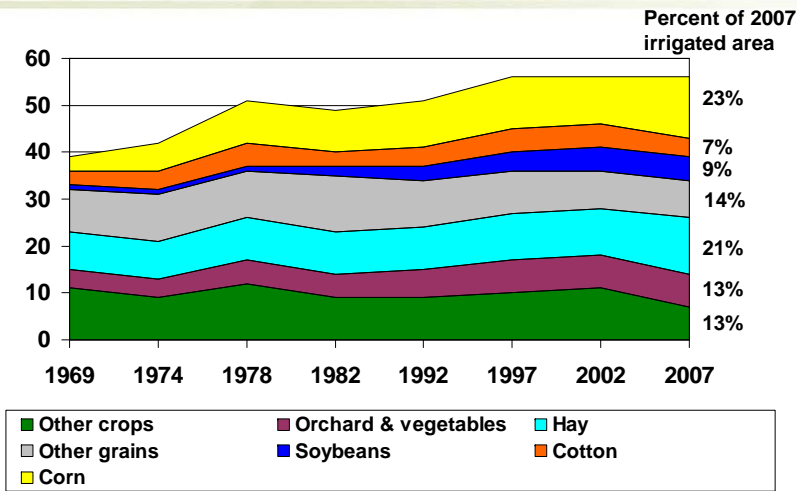
Cropland irrigated (%)



Source: NRCS analysis of Census of Agriculture Data



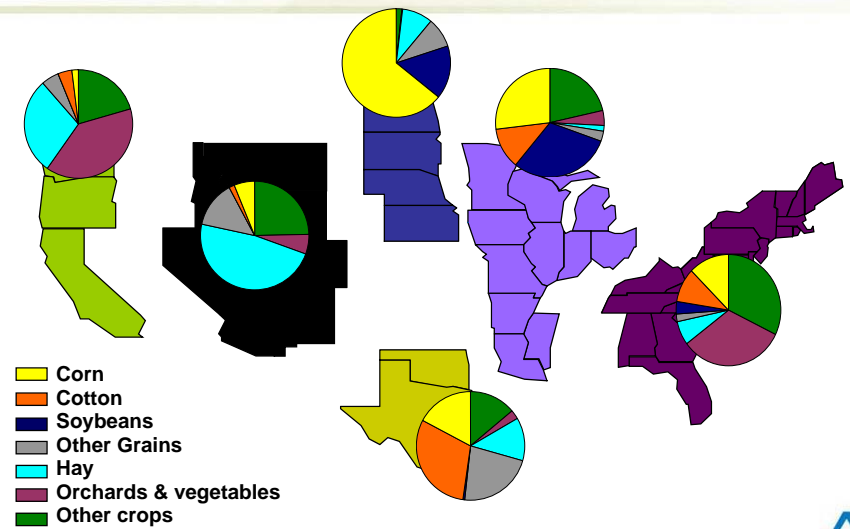
U.S. irrigated crops, 1969 - 2007



Source: NRCS analysis of Census of Agriculture Data



Regional Irrigated cropping patterns, 2007



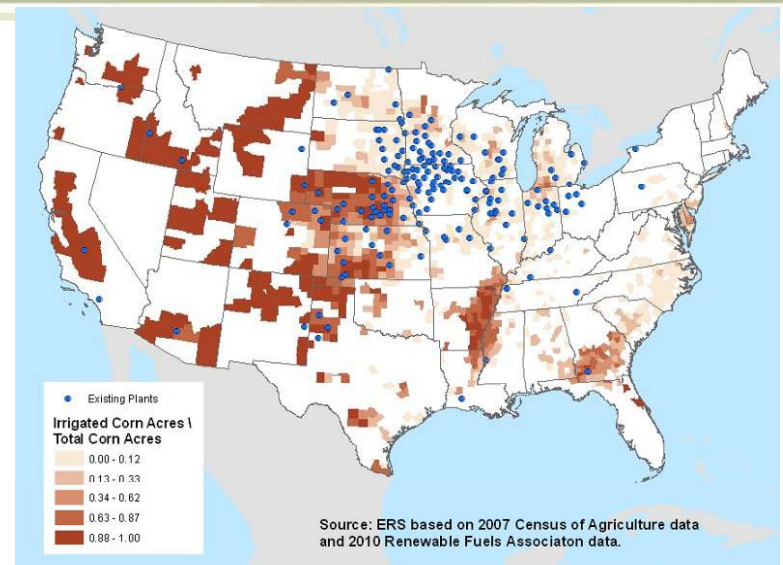
Source: NRCS analysis of Census of Agriculture Data



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?

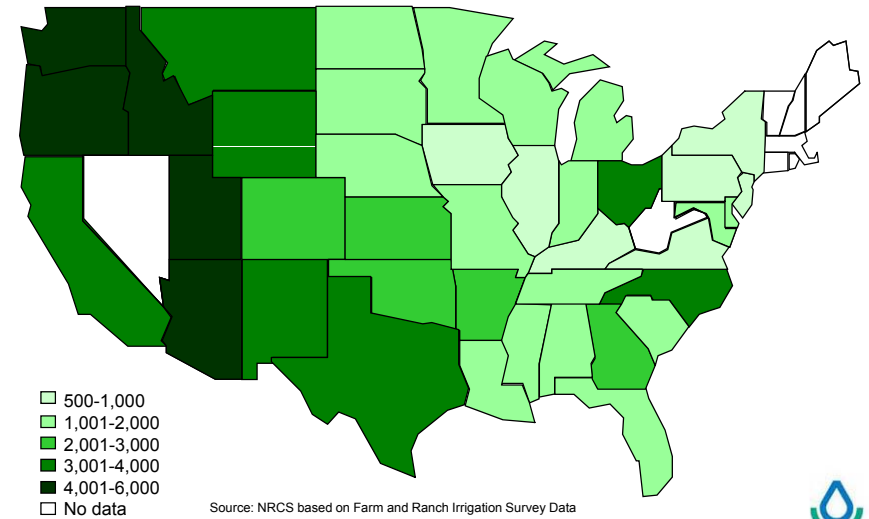


- 130 acre center-pivot field
- 12 inch application in 2008 (reduction from 14 in 2003)
- 42,357,120 gallons applied per year per field ($27,152 * 12 * 130$)
- States with >100,000 acres range from 21 to 85 million gallons per field
- 1,800 gallons /bu (based on average irrigated corn yield in 2008 of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

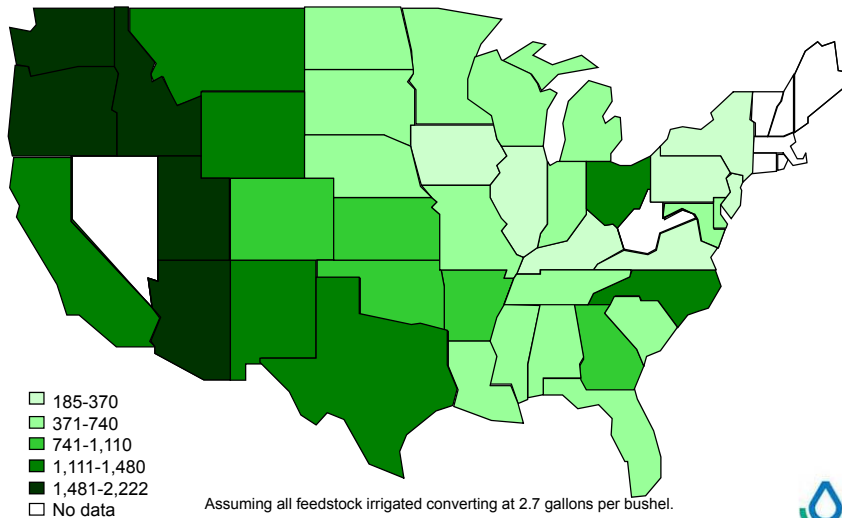
Source: USDA, NASS, Farm and Ranch Irrigation Survey



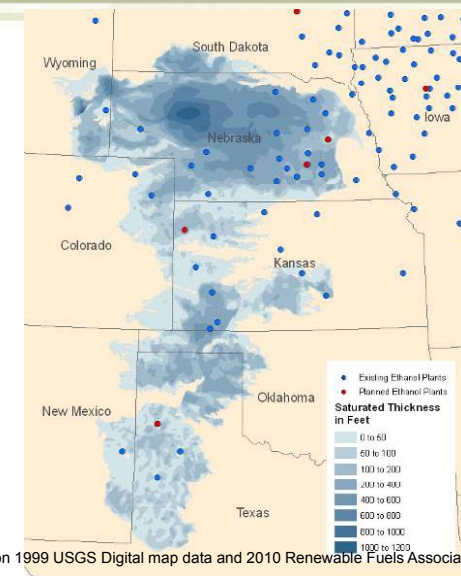
Gallons of irrigation water per bushel of irrigated corn, 2008



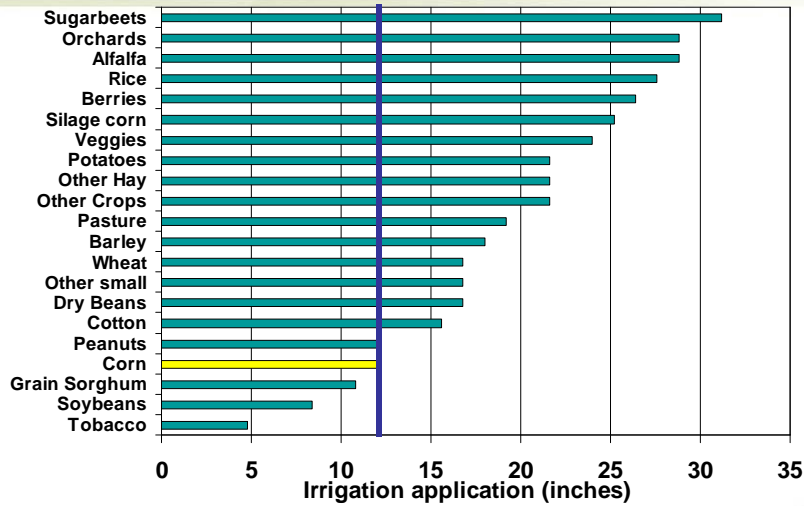
Gallons of irrigation water per gallon of corn-based ethanol, 2008



High Plains Aquifer remaining and current & planned ethanol plant locations



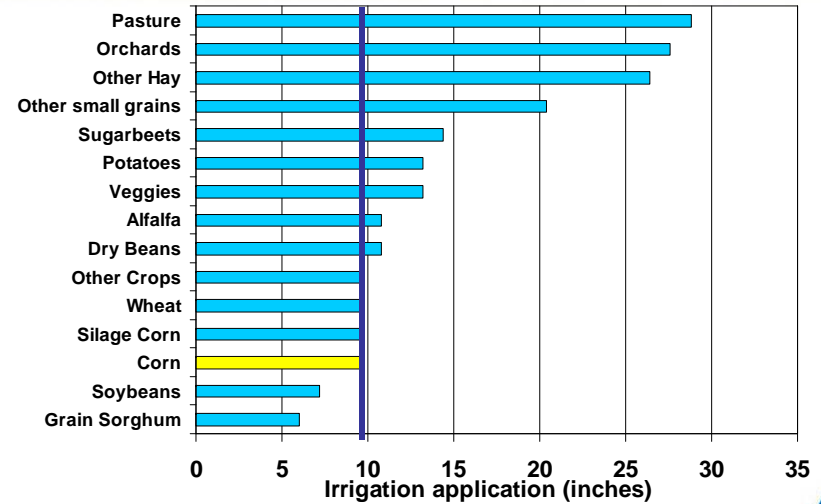
Average irrigation water applications levels for selected crops, U.S., 2008



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



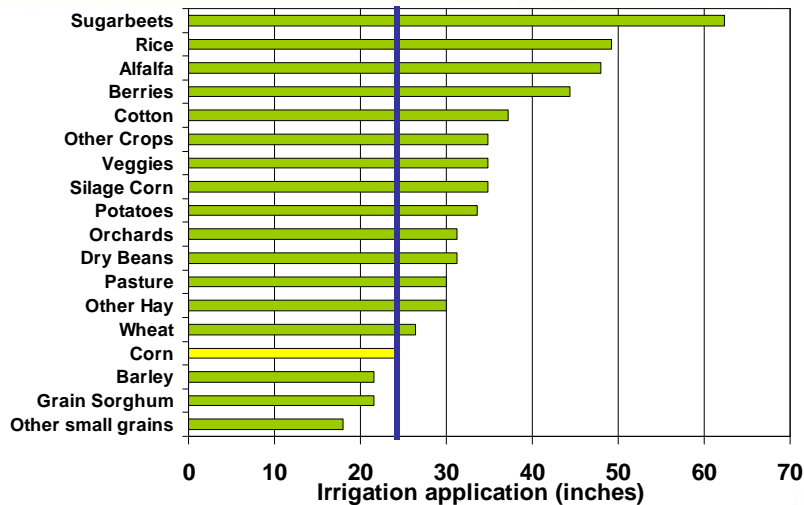
Average irrigation water applications levels for selected crops, Nebraska, 2008



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



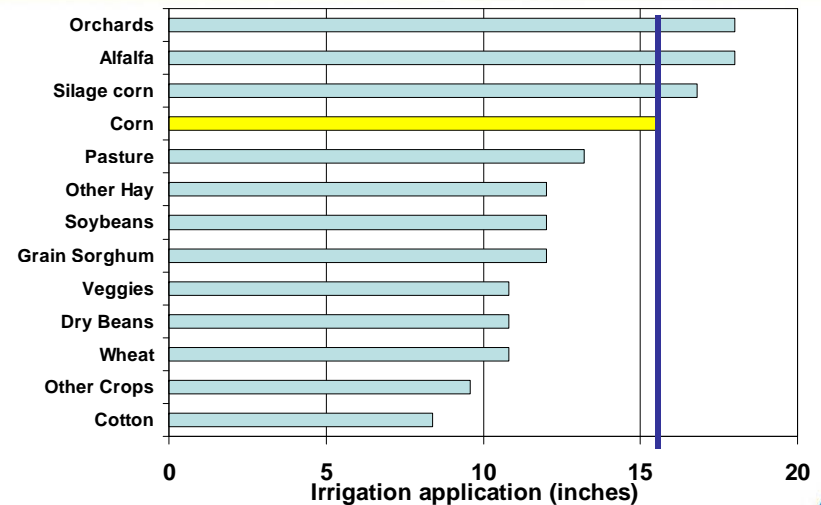
Average irrigation water applications levels for selected crops, California, 2008



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



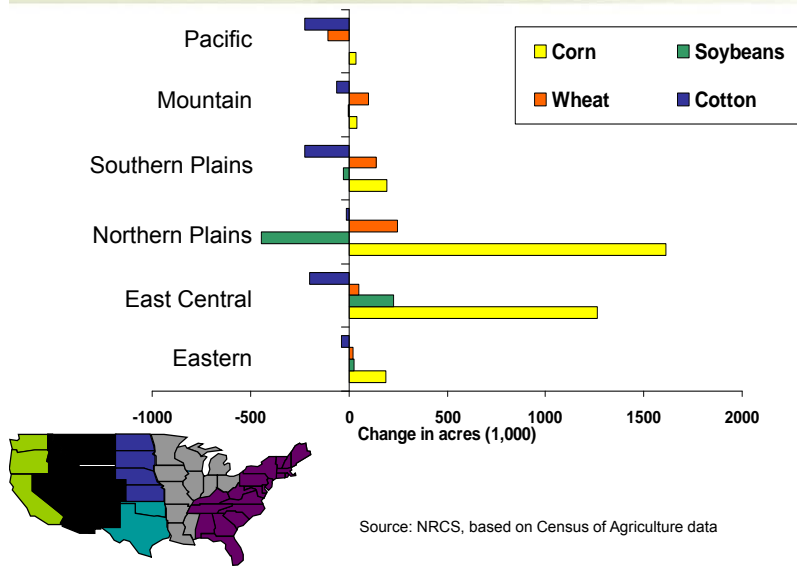
Average irrigation water applications levels for selected crops, Kansas, 2008



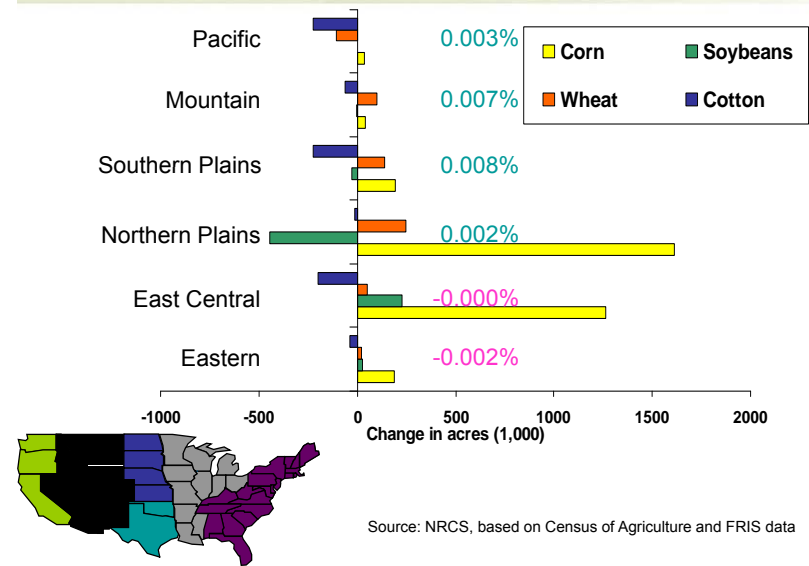
Source: ERS based on 2003 Farm and Ranch Irrigation Survey data



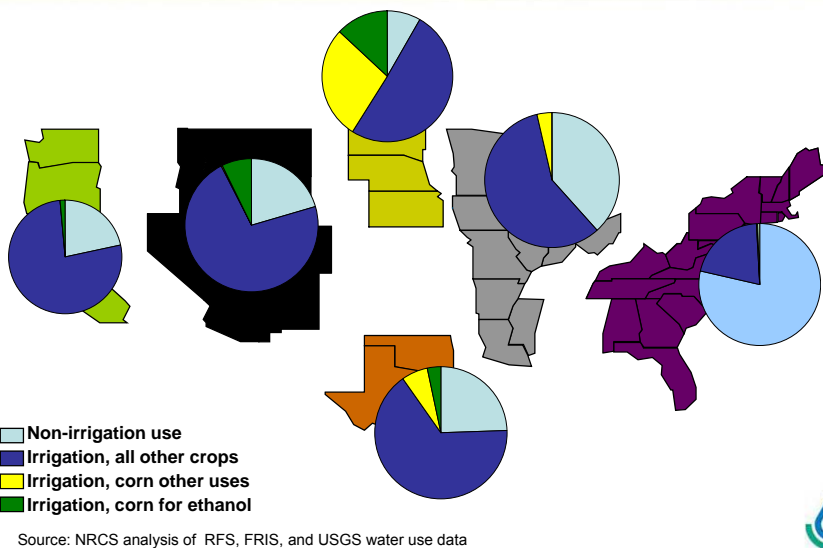
Regional crop shifts from 2002 to 2007, selected crops



Regional crop shifts from 2002 to 2007, selected crops with estimated change in water applied



Groundwater use: Irrigation, and Estimated Ethanol Shares



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

Resource requirements for Biofuel production

- **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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