National Water Use Implications of Biofuel Feedstock Production

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Renewable Energy Biomass Field Days

November 18, 2010

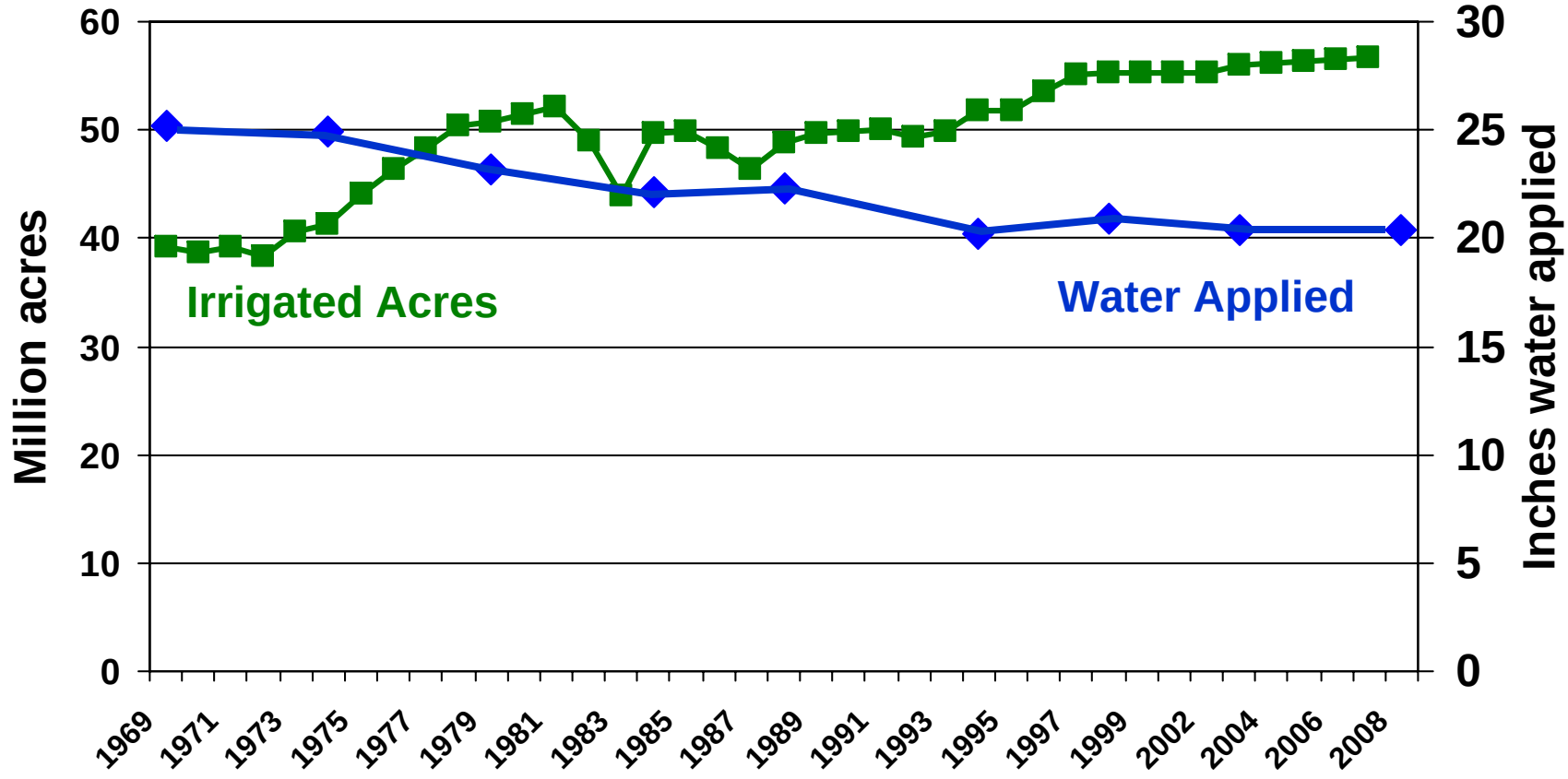
Knoxville, TN

NRCS

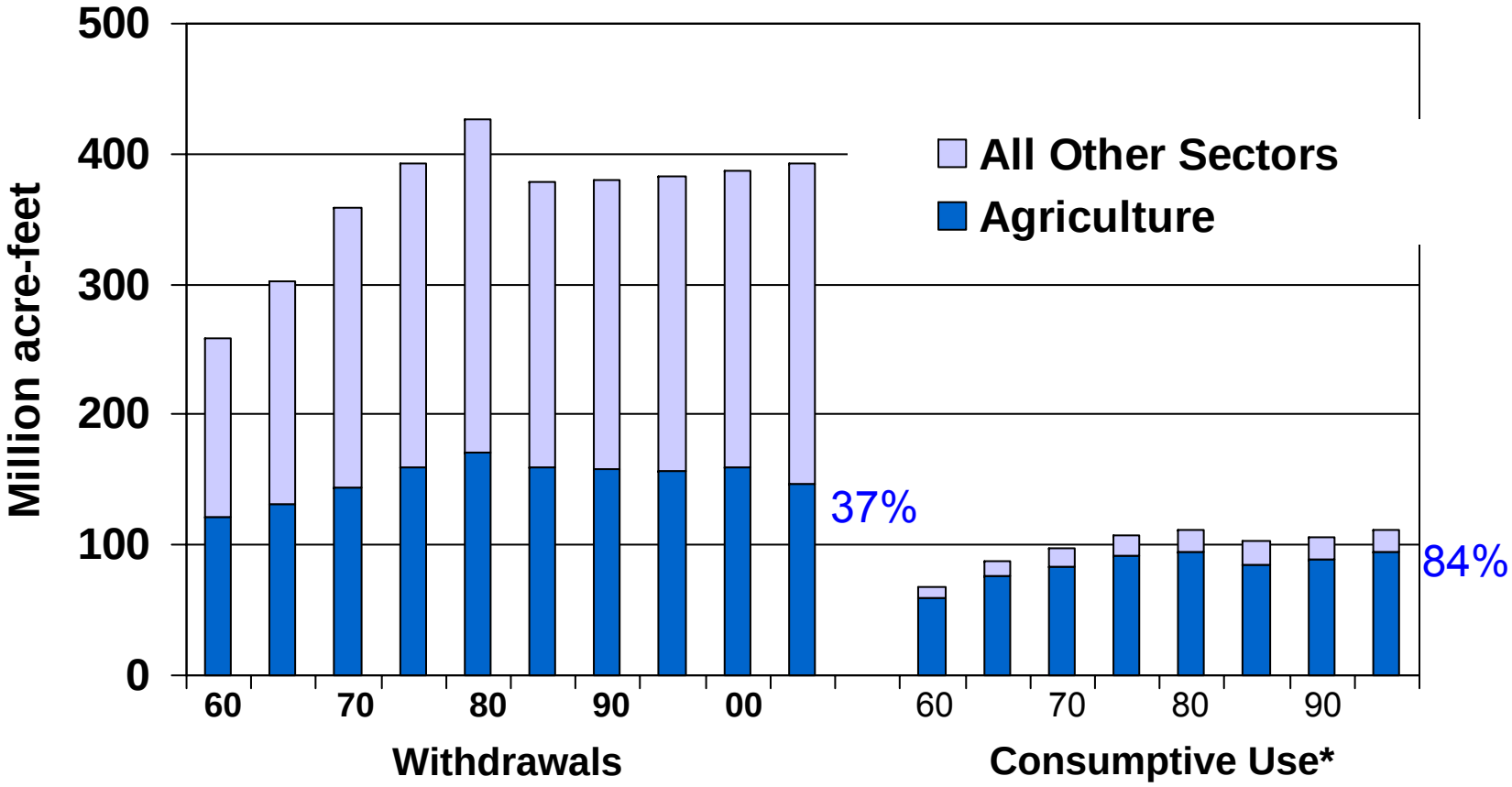
Goal of presentation

- Provide a National perspective on irrigated agriculture
  - Acres
  - Water use
  - Crops
- What do trends and current conditions tell us about the water currently used for biofuel production?
- What does tell us about the potential water use for biofuel production?

U.S. irrigated acres & water applications



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

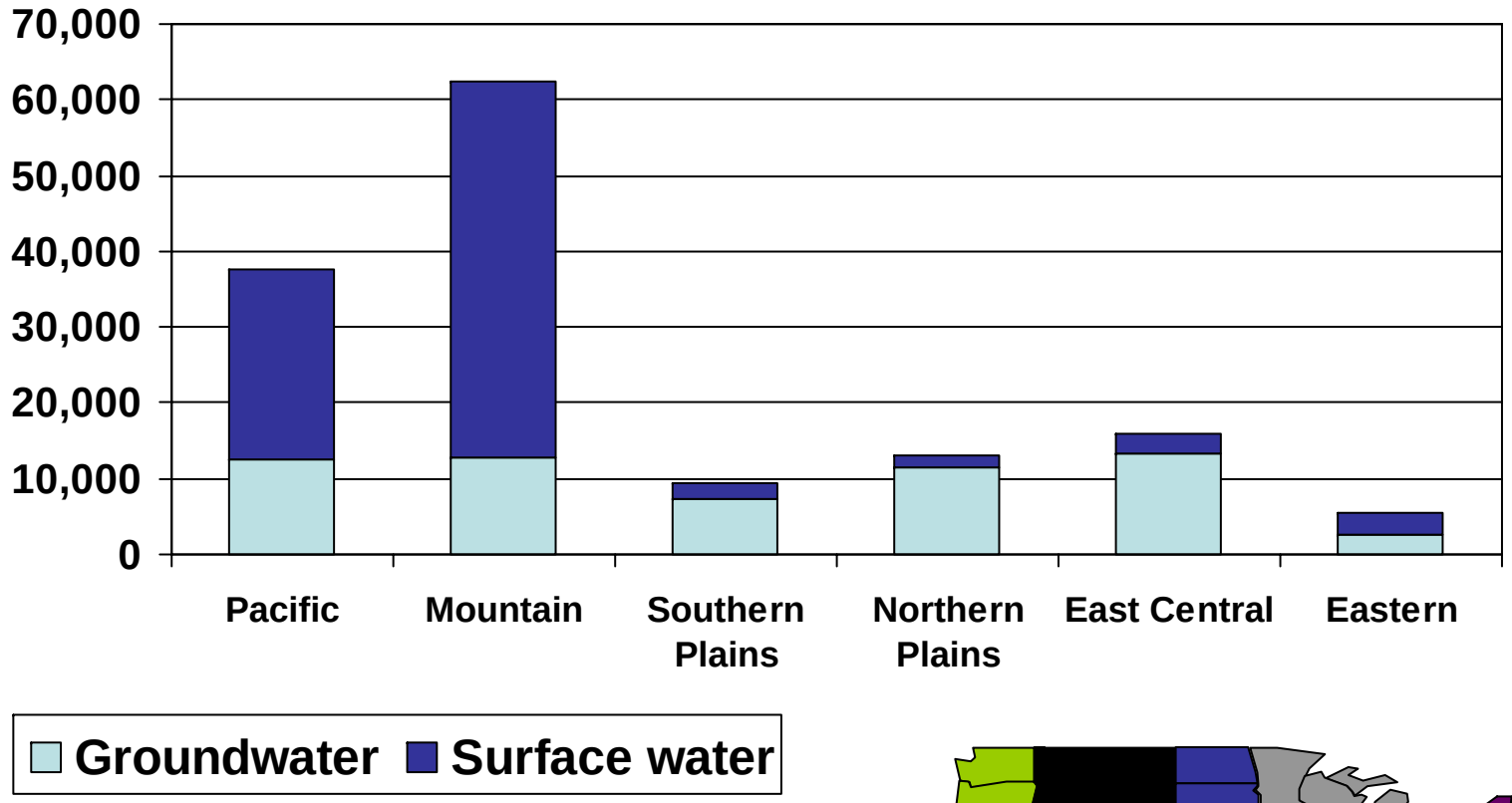


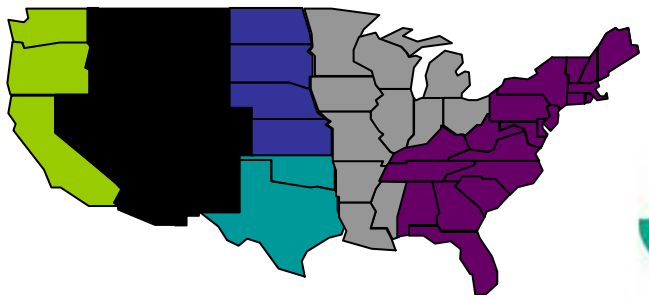
Source: USDA, NRCS, based on Kenny, et al, 2009

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

U.S. Irrigation water withdrawals, 2005

Acre-feet (1,000)

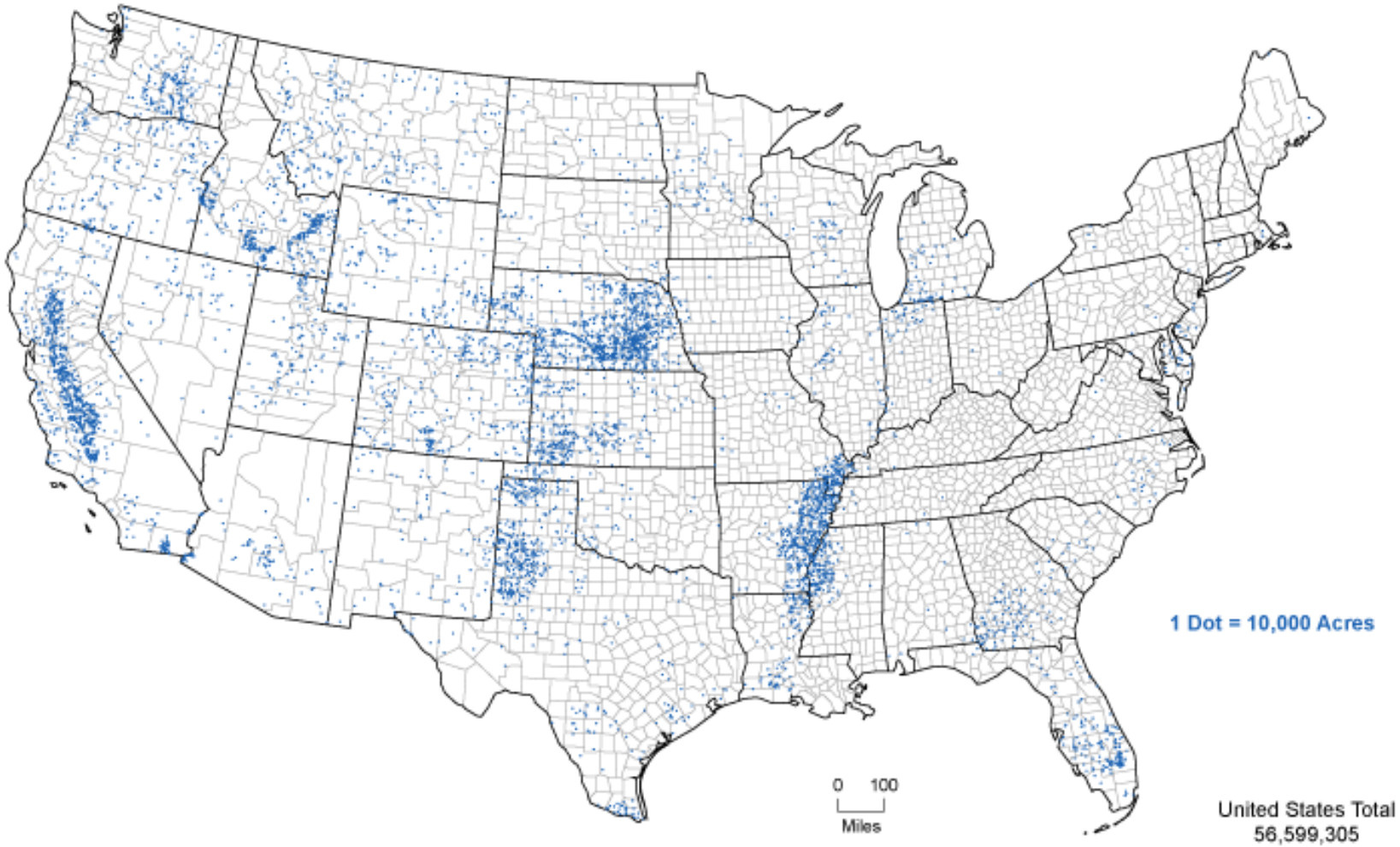




Source: NRCS analysis of USGS Water Use data

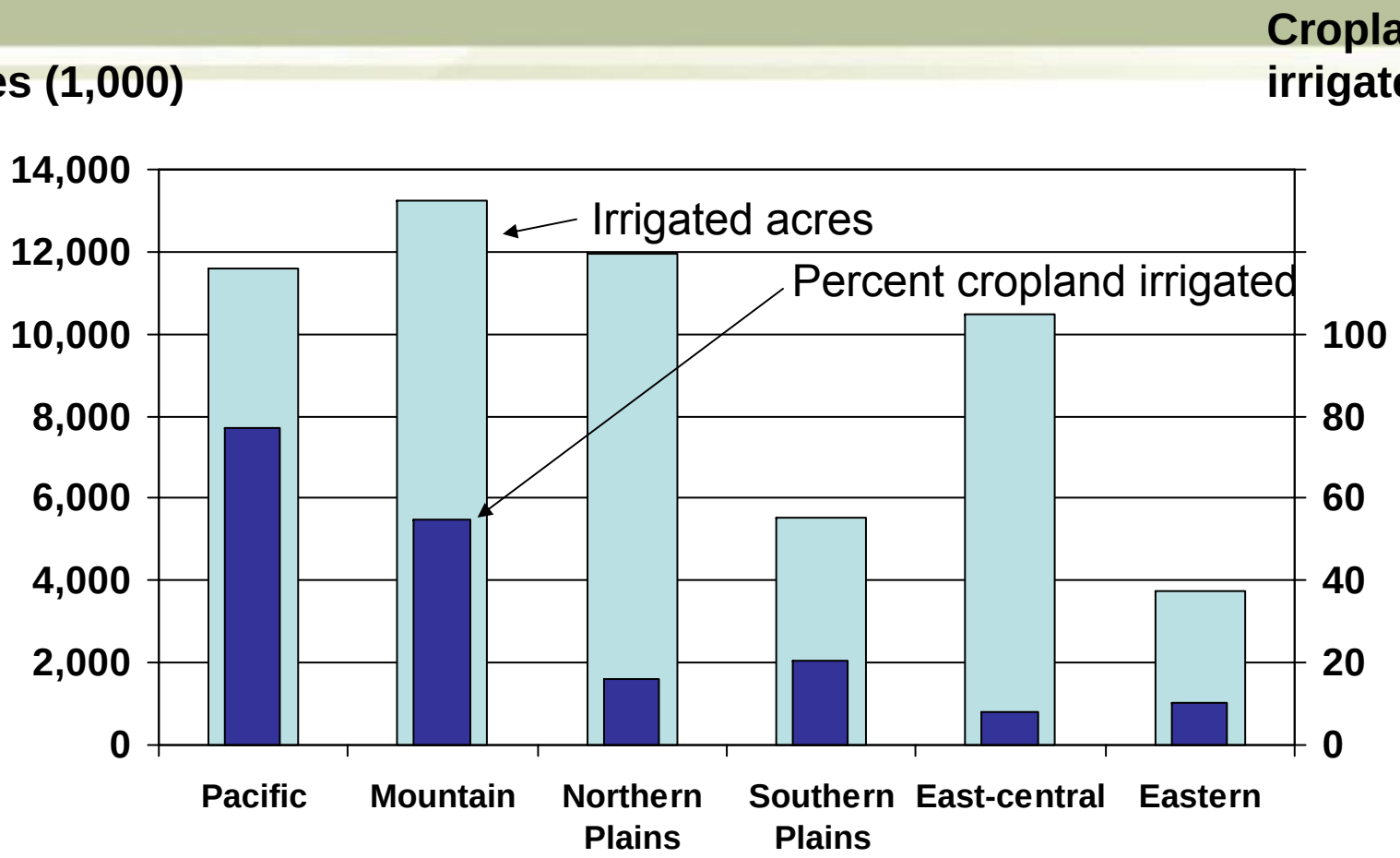
What is all that irrigation water used for?

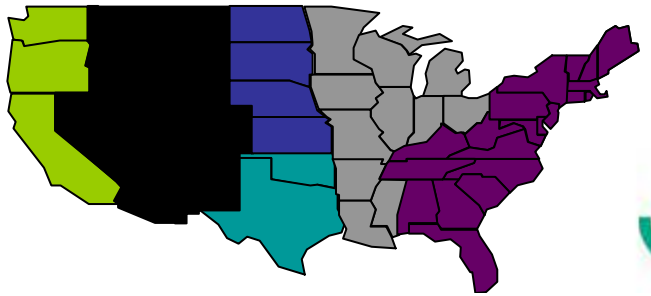
Irrigation overview: Acres location, 2007



Source: USDA, 2007 Census of Agriculture

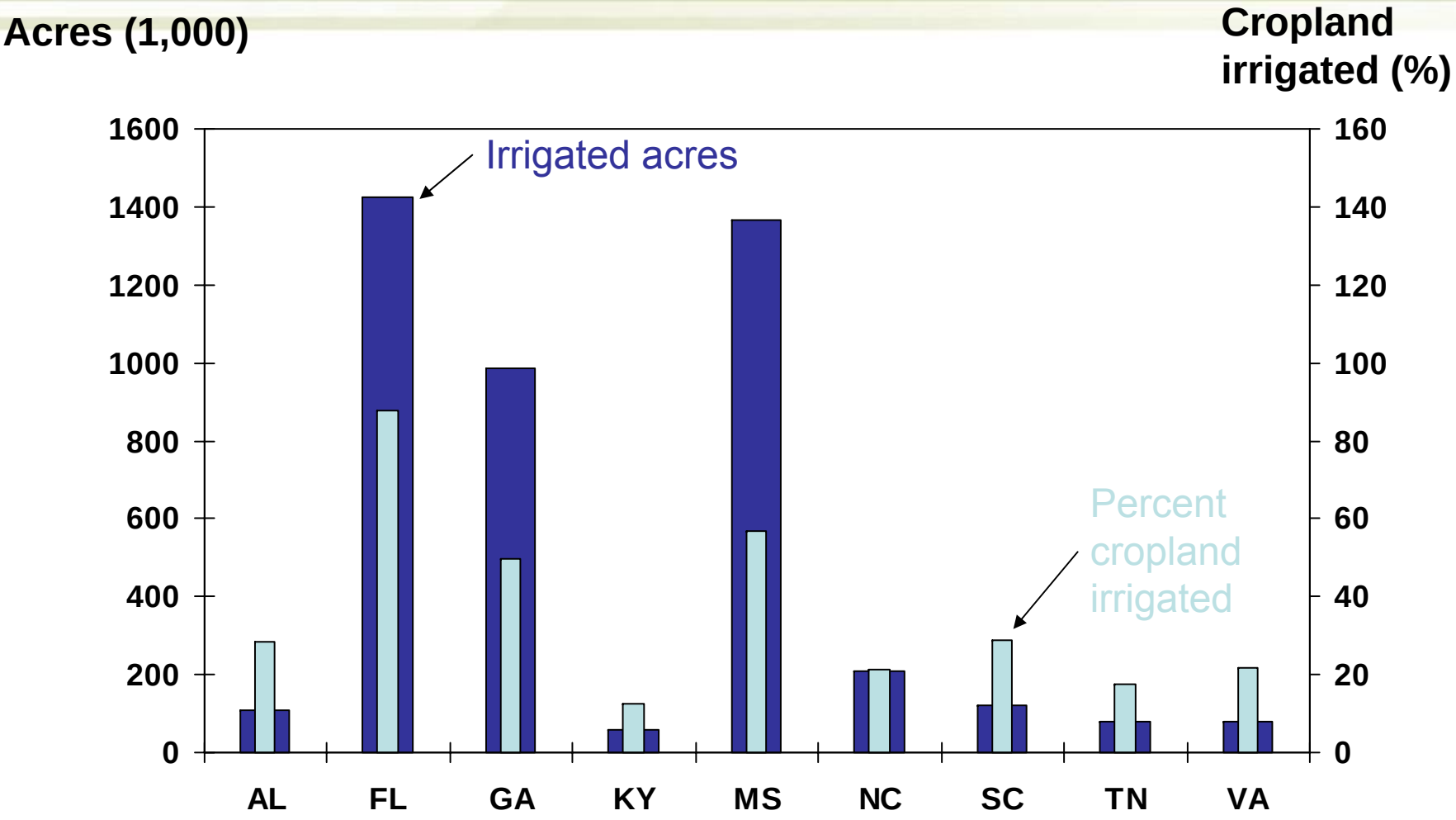
U.S. irrigated acreage, 2007





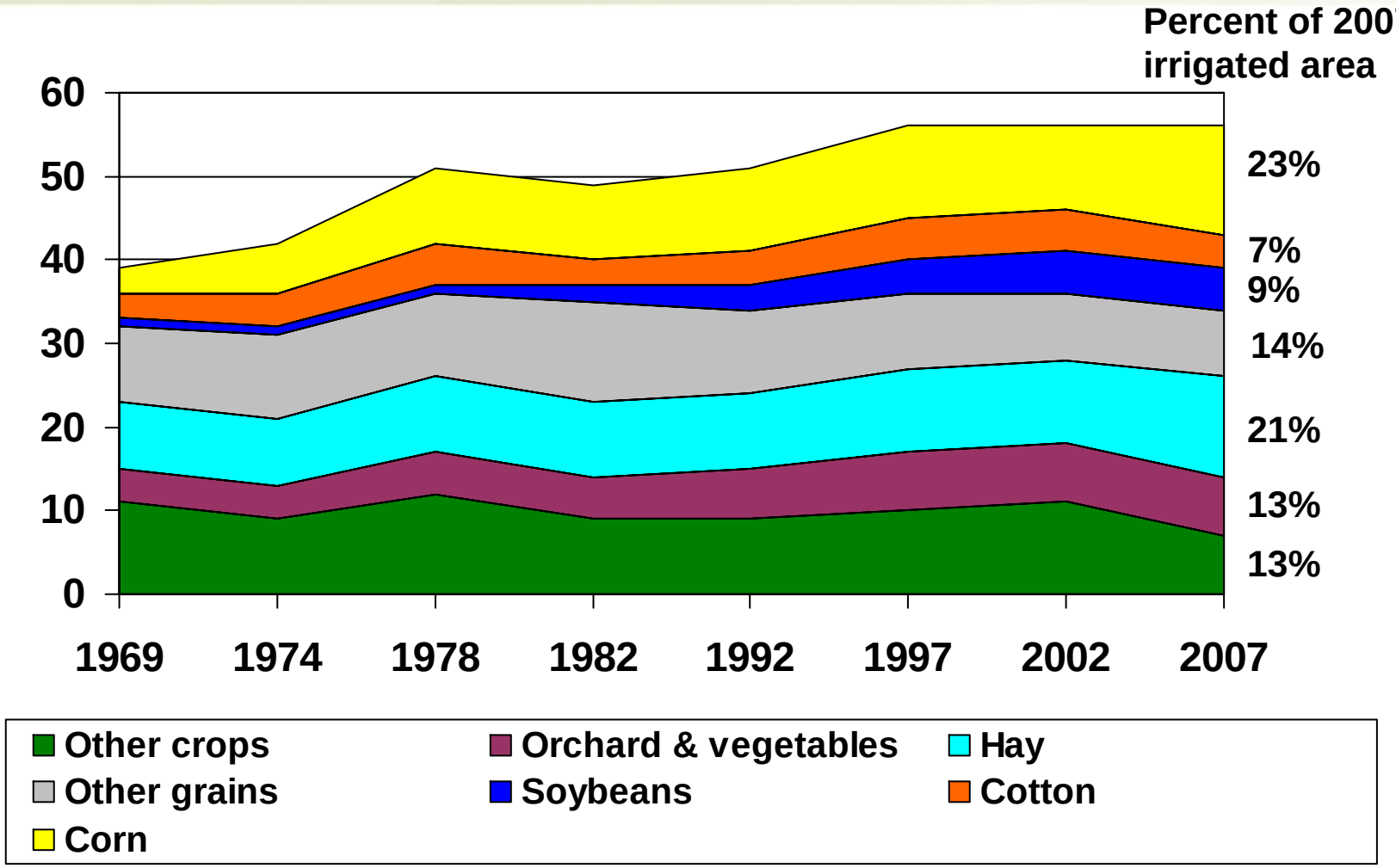
Source: NRCS analysis of Census of Agriculture Data

Southeast irrigated acreage, 2007



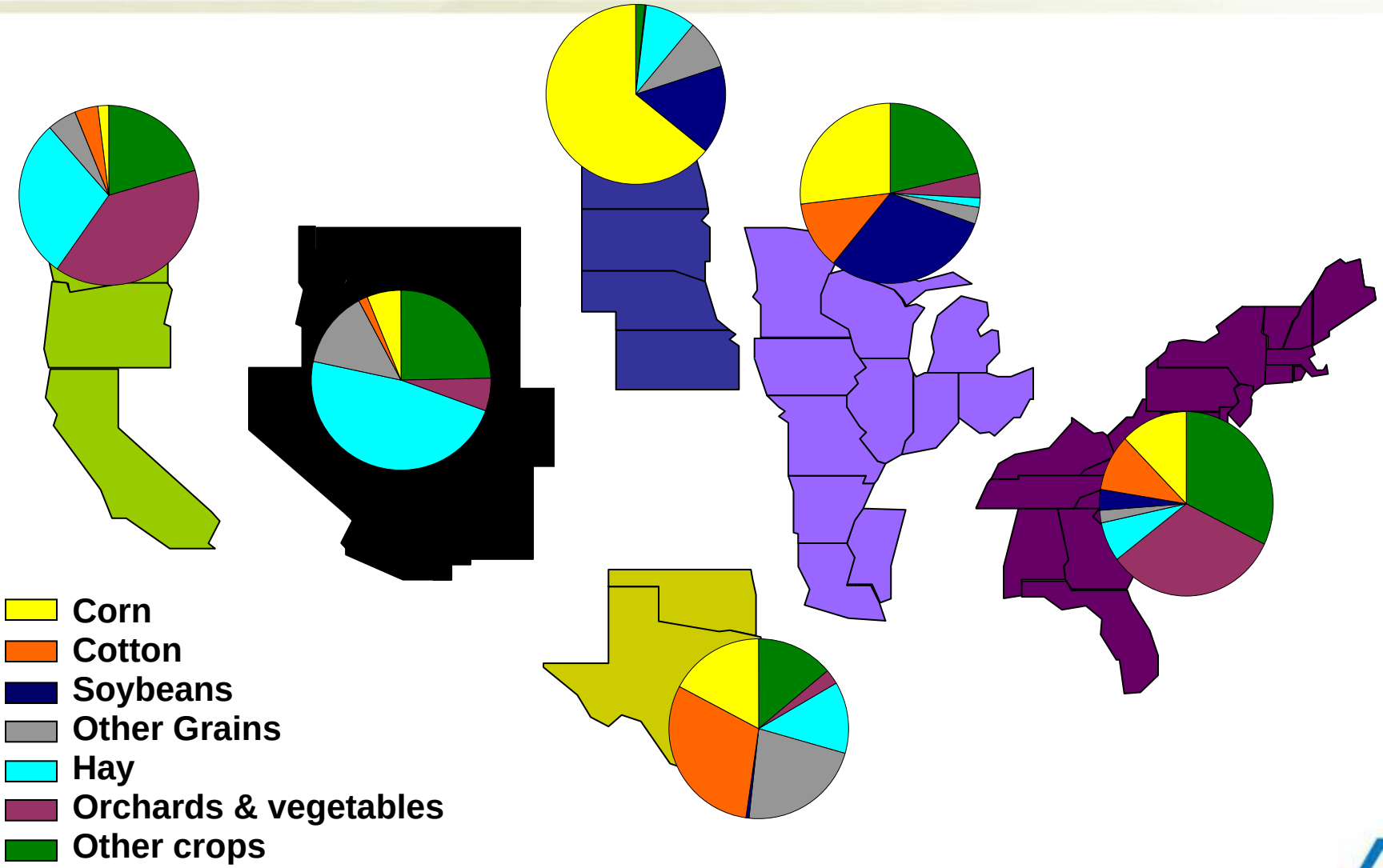
Source: NRCS analysis of Census of Agriculture Data

U.S. irrigated crops, 1969 - 2007



Source: NRCS analysis of Census of Agriculture Data

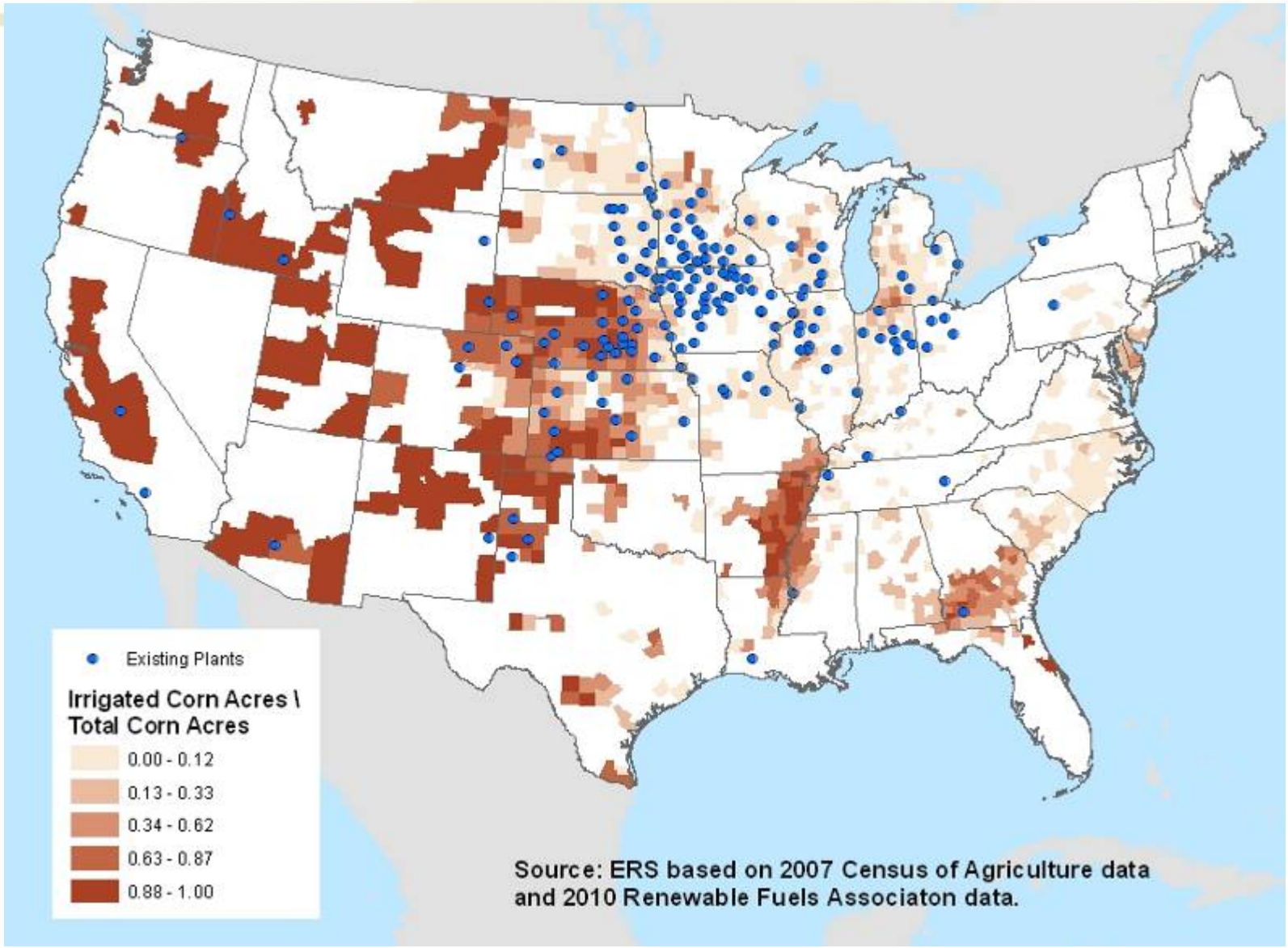
Regional Irrigated cropping patterns, 2007



Source: NRCS analysis of Census of Agriculture Data

How does biofuel feedstock production impact irrigation water demands?

Irrigated corn share and current ethanol plant locations

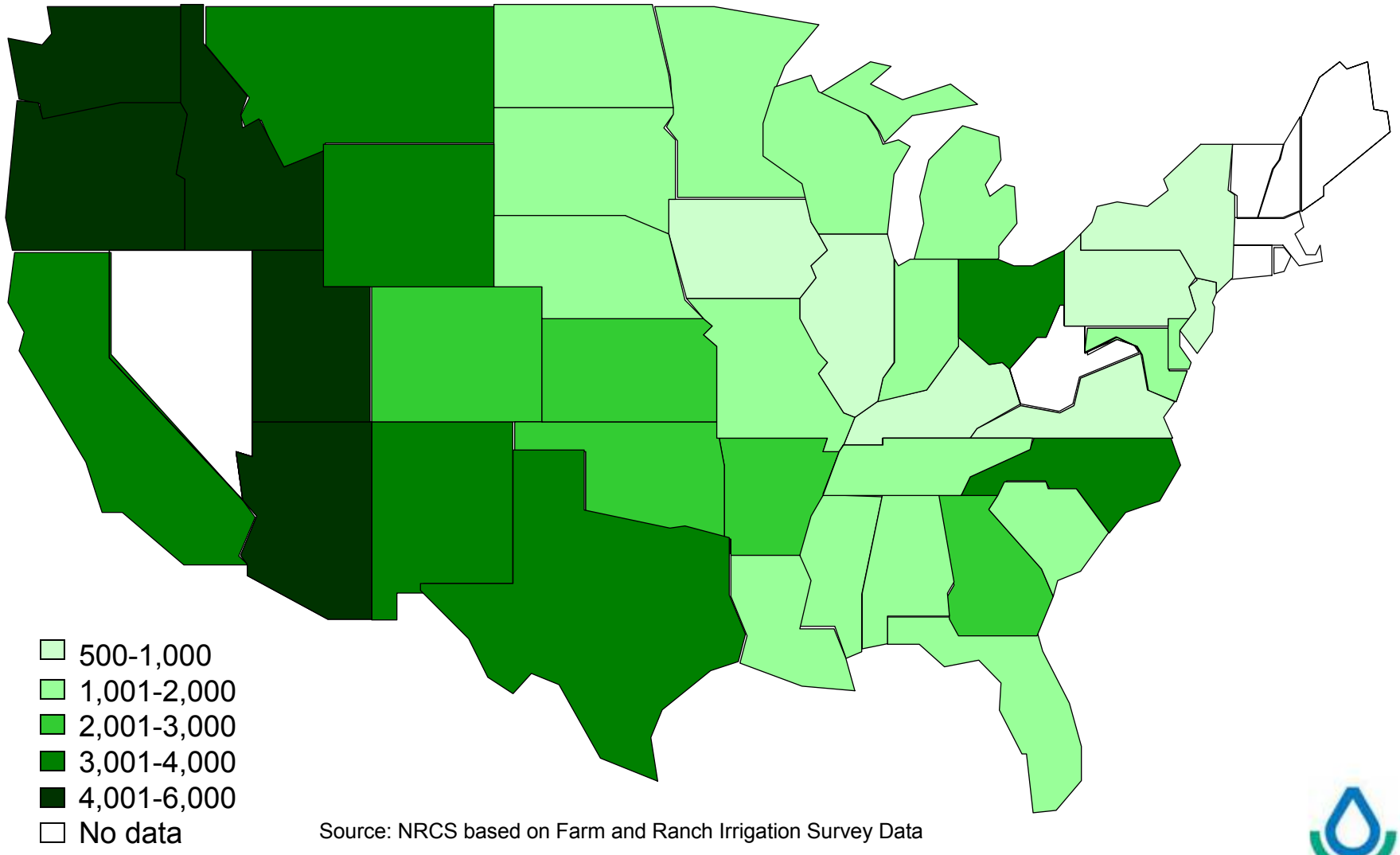


How much water for an “average” corn field?

- 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)

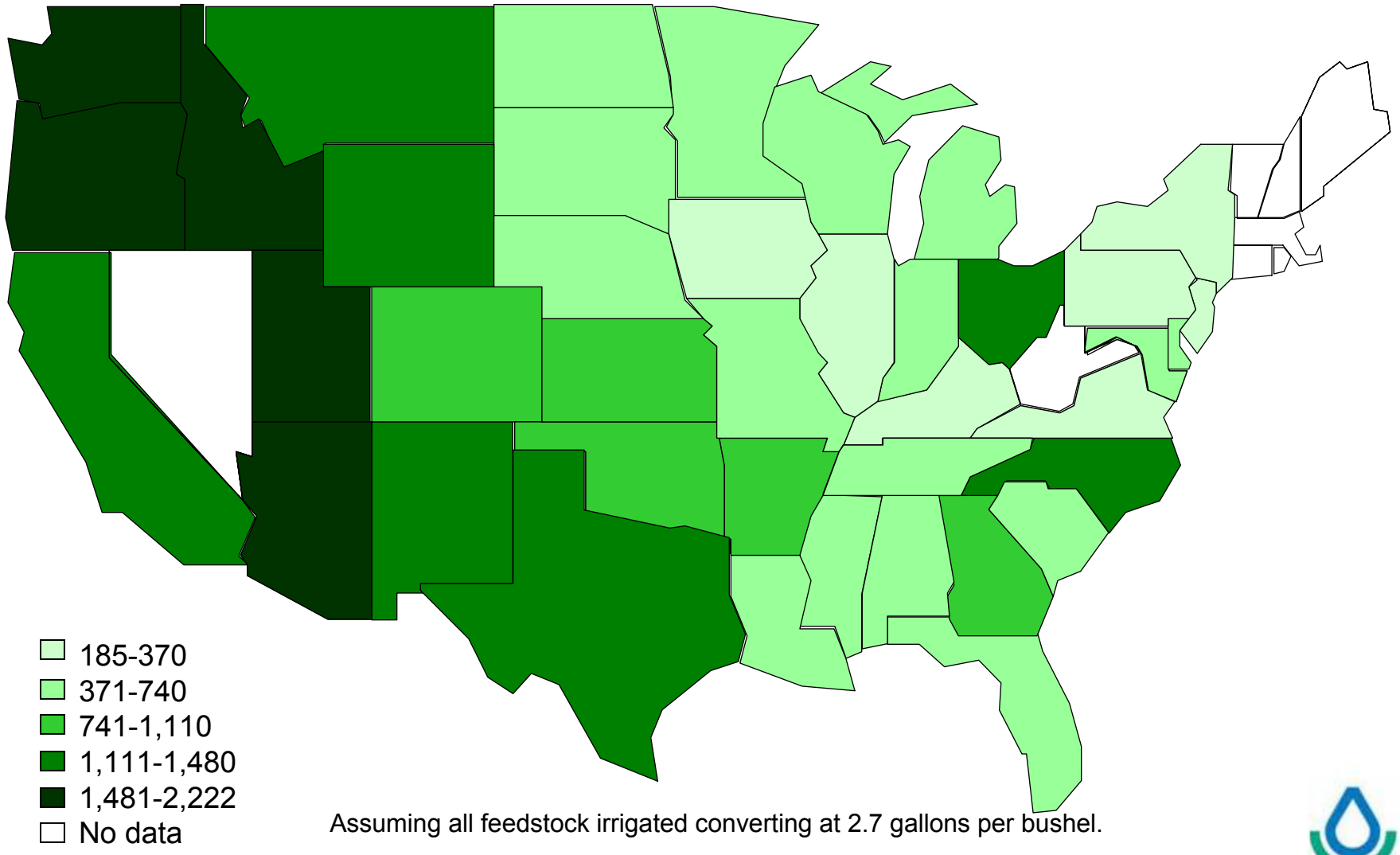
Source: USDA, NASS, Farm and Ranch Irrigation Survey

Gallons of irrigation water per bushel of irrigated corn, 2008



Source: NRCS based on Farm and Ranch Irrigation Survey Data

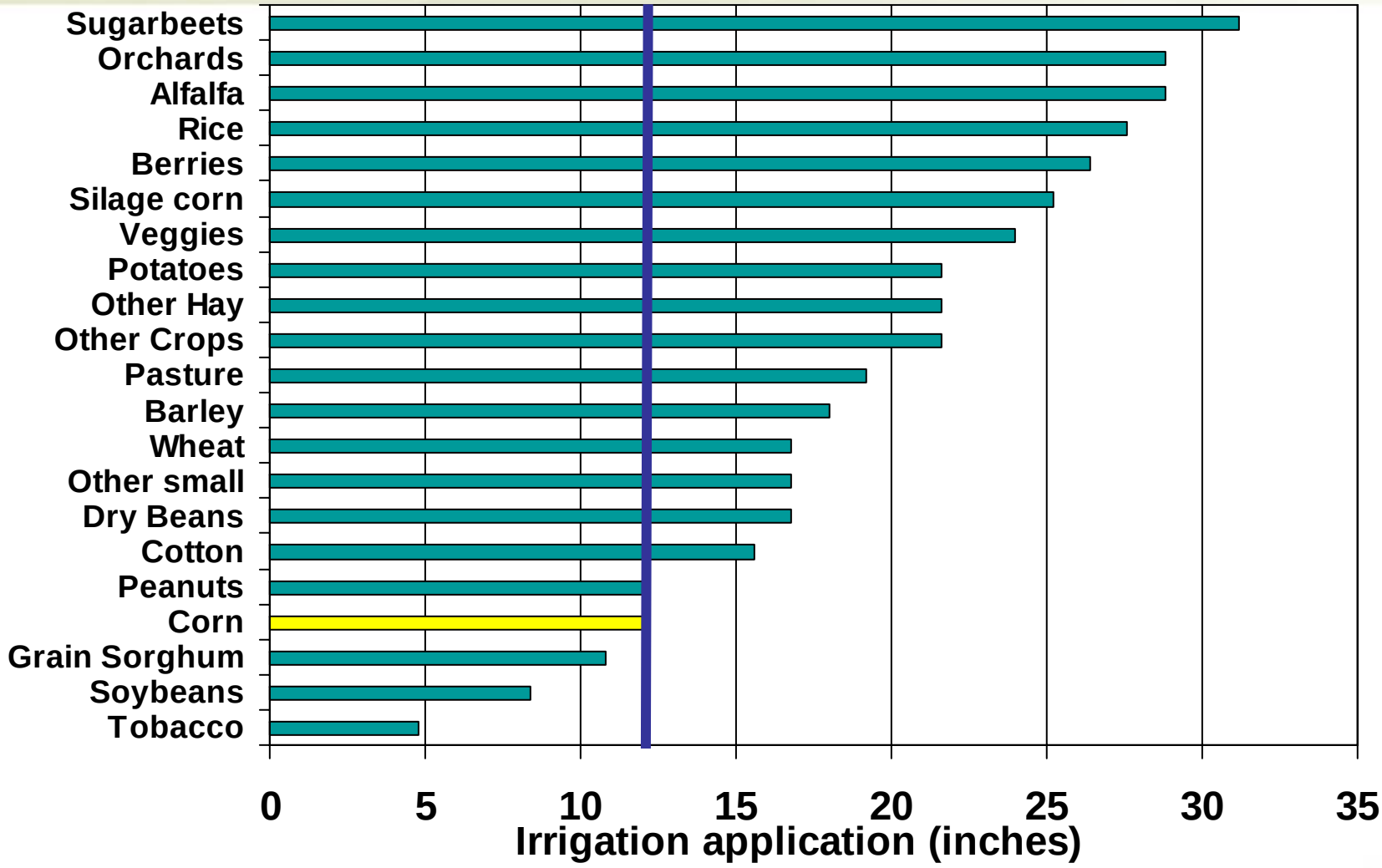
Gallons of irrigation water per gallon of corn-based ethanol, 2008



Assuming all feedstock irrigated converting at 2.7 gallons per bushel.

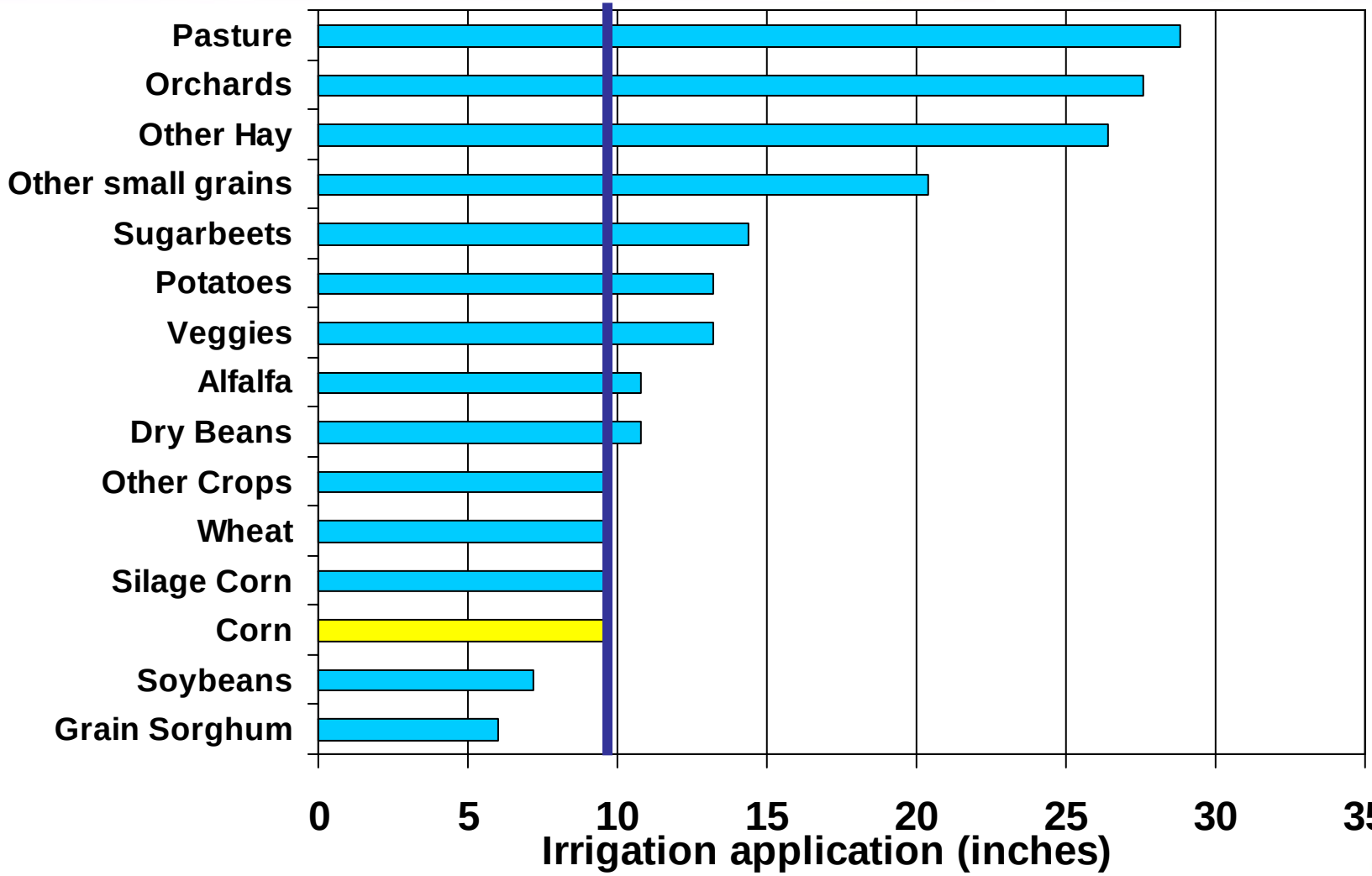
Source: NRCS based on Farm and Ranch Irrigation Survey Data

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



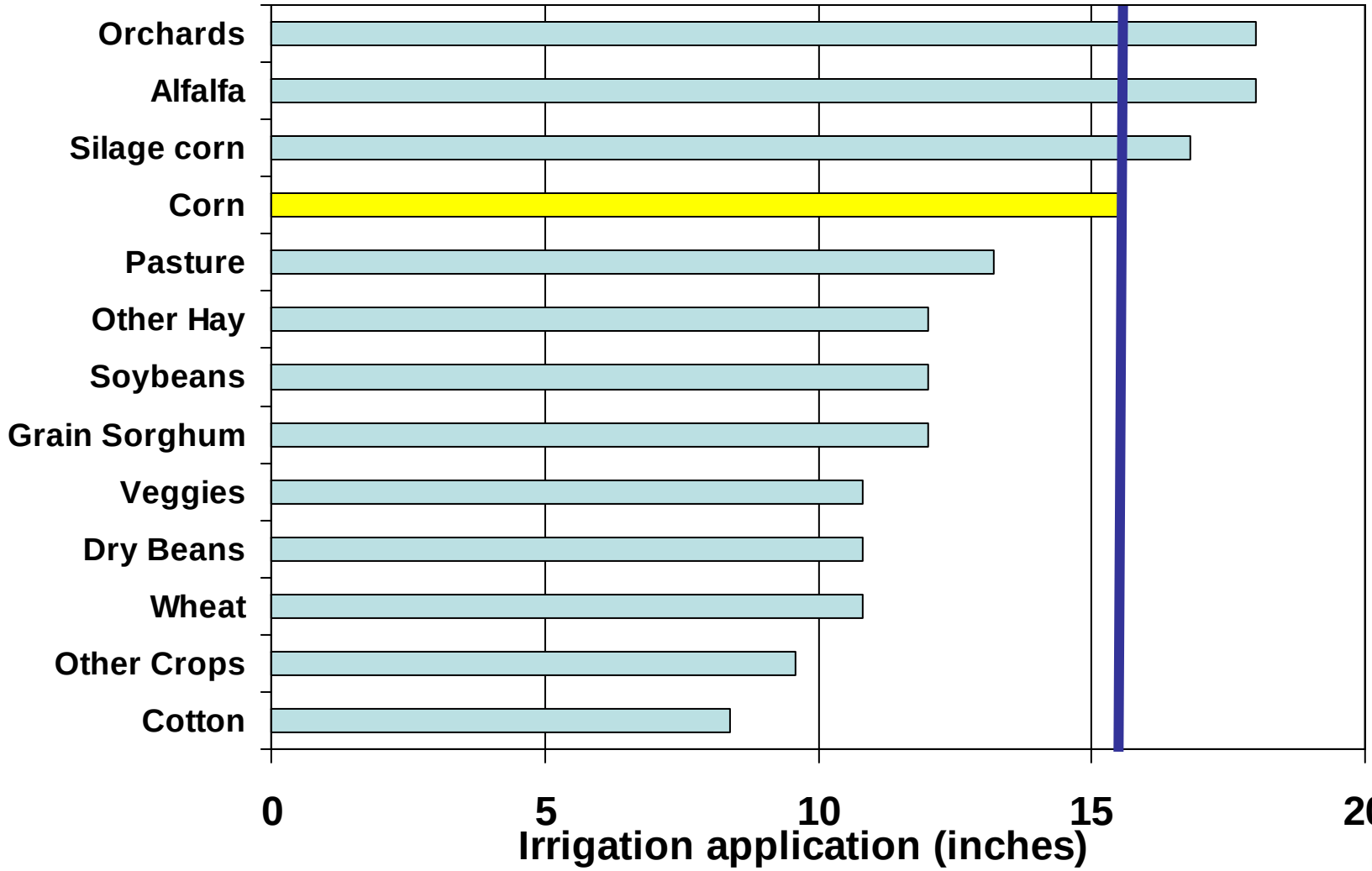
Source: ERS based on 2008 Farm and Ranch Irrigation Survey data.

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



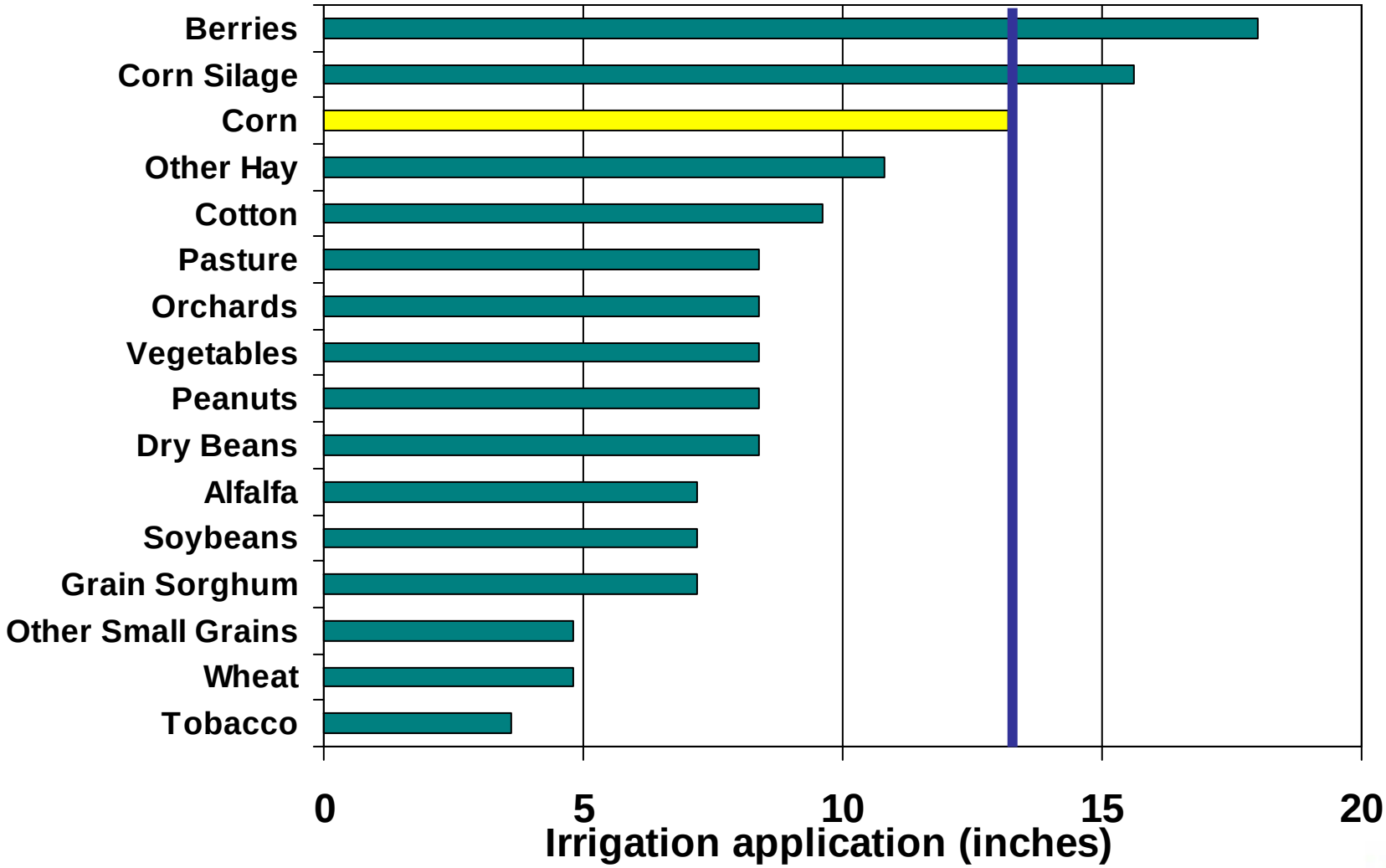
Source: ERS based on 2008 Farm and Ranch Irrigation Survey data

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



Source: ERS based on 2008 Farm and Ranch Irrigation Survey data

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



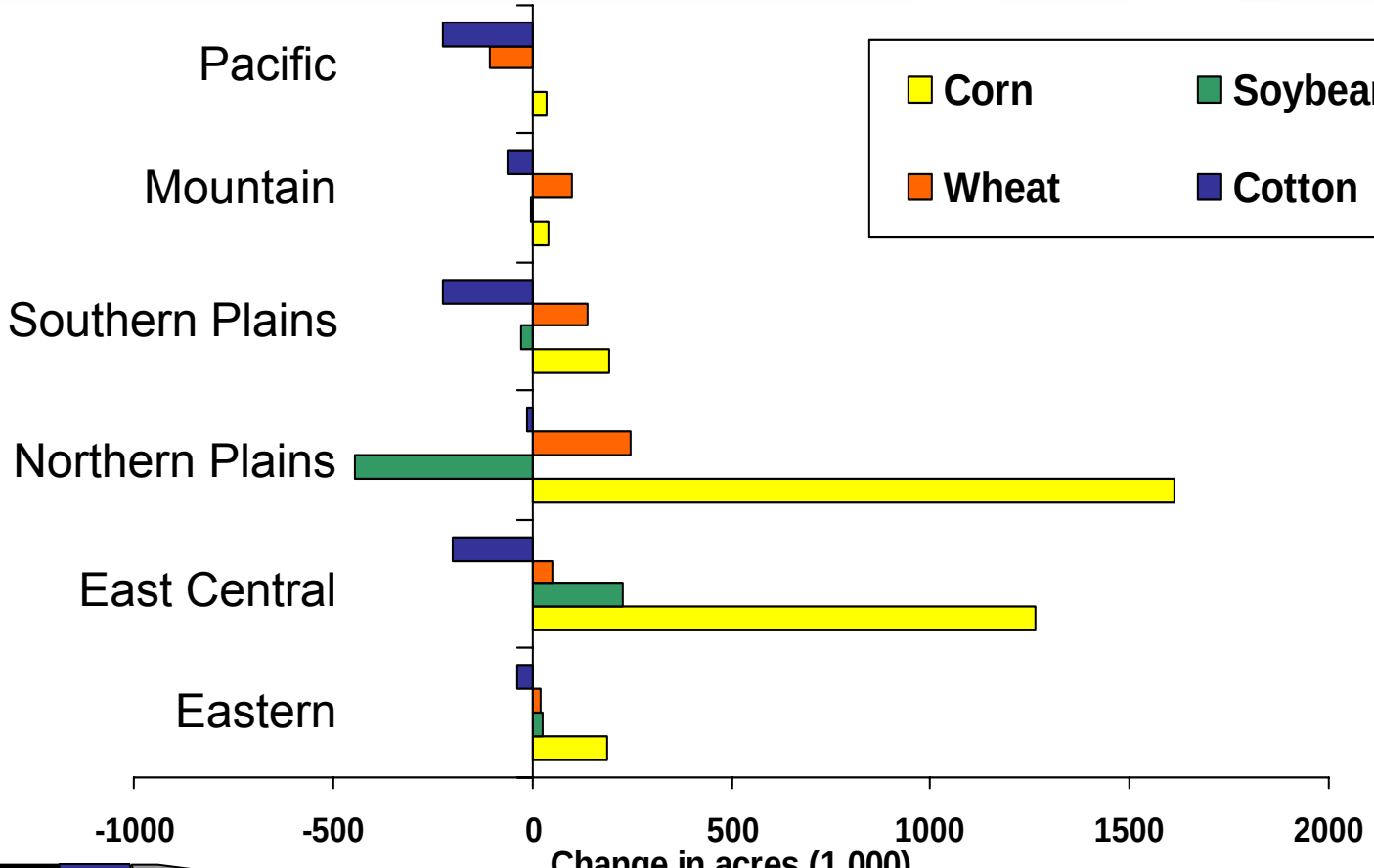
Source: ERS based on 2008 Farm and Ranch Irrigation Survey data

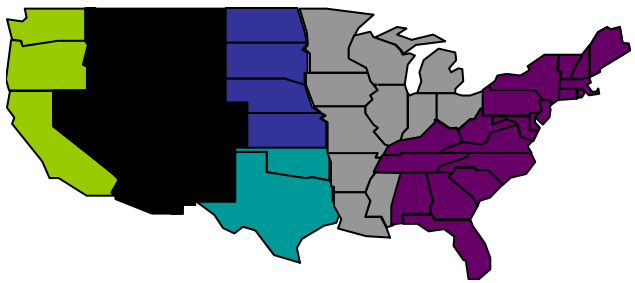
Did irrigation water use change with the growth in biofuel feedstock production?

Corn for Grain 2002 to 2007

- Corn harvested for grain peaked in 2007, when compared to 2002:
  - Planted corn acres increased by 19 million acres (about 25%);
  - Harvested corn acres increased by 17 million acres (about 25%);
  - Irrigated corn acres harvested increased by 3.4 million acres (about 35%);
  - Corn production increased by 3 billion bushels (about 33%);
  - Corn exported increased by 1 billion bushels (about 50%);
  - Corn used as an ethanol feedstock increased by 2 billion bushels (about 200%); and
  - Corn prices per bushel increased by $1.88 (about 80%).

Regional irrigated crop acreage changes from 2002 to 2007, selected crops

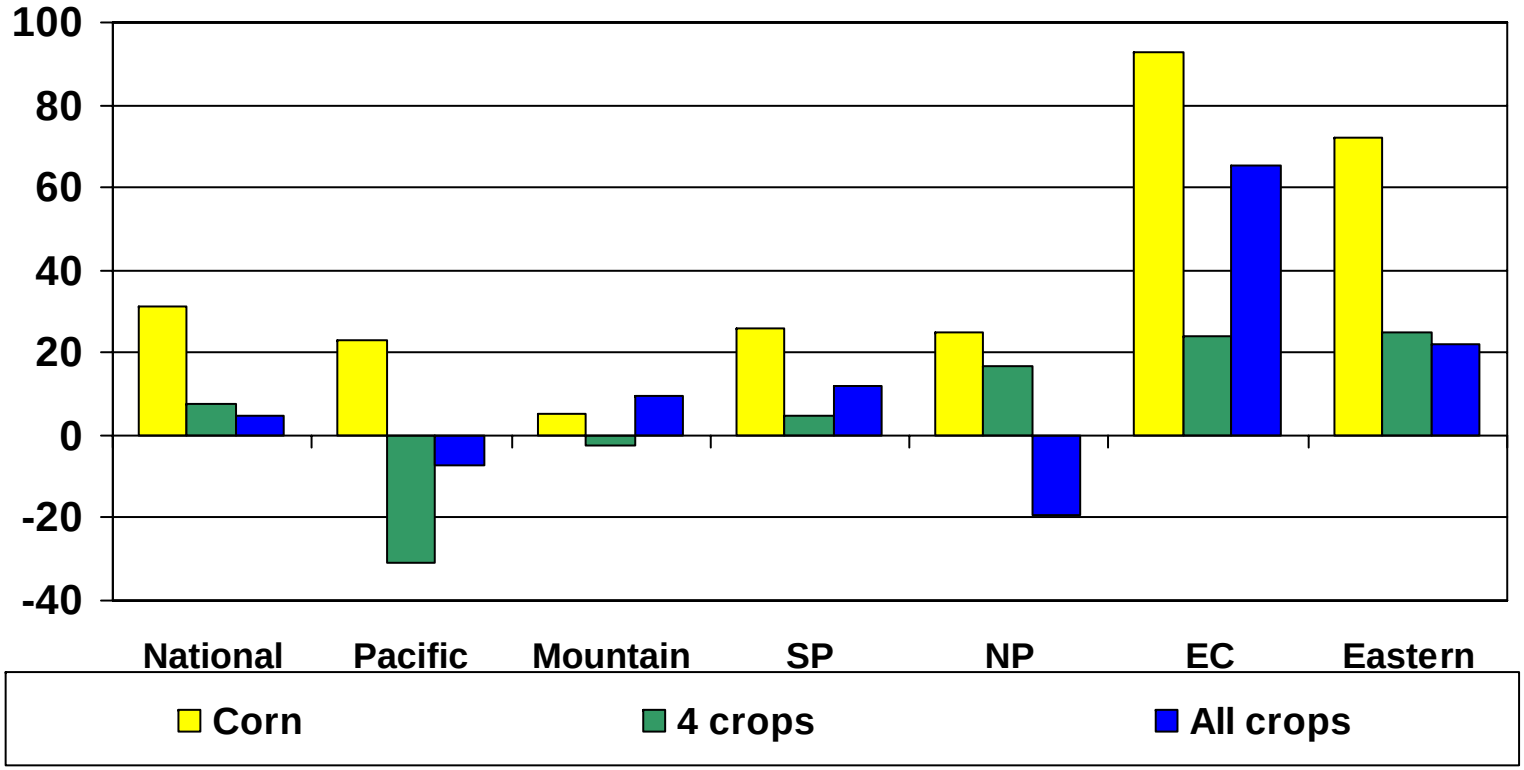


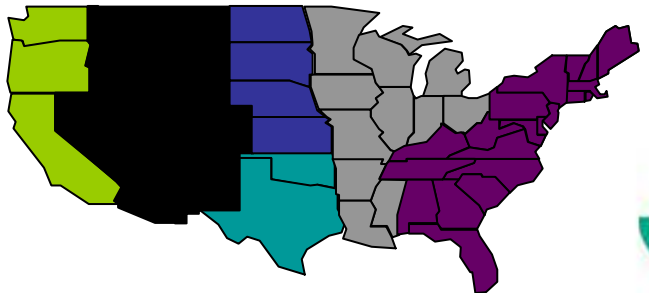


Source: NRCS, based on Census of Agriculture data

Change in Irrigation Water Applications, 2002-07

Percent change





Source: NRCS analysis of 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
    - 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

- Short run: increased agricultural production for biofuels will not alter the national water use picture
- Longer run: Feedstocks for the next generation of biofuels could 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
  - New irrigation will depend on the profitability of irrigation
    - Yield response to applied water
    - Risk considerations
    - How important is a stable feedstock supply?

Thank you!

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