U.S. Irrigated Agriculture: Trends and Challenges

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Presentation Objectives

● Current status of U.S. irrigated agriculture.
   — How important irrigation is to U.S. agriculture
   — Where does irrigation occur, what does it produce.

● Role of emerging demands and climate change on water supply and demand

● The challenge changing forces pose for agricultural water conservation.

● Sustainable irrigated agriculture — A broader ‘conservation’ perspective
   — Shifting from an onfarm technology “application” focus to:
     (1) an onfarm irrigation “production system” focus, and to a
     (2) farm/institutional conservation perspective [integrating farm
         and watershed-scale water-management initiatives].

Source:

The views expressed are those of the author(s) and should not be attributed to the Economic Research Service or USDA.

**Traditional Water Demands**
* (Agriculture vs. Non-Agricultural)

**Trends in total water withdrawals by major water-use category, 1950 -- 2005.**

How Important is Irrigation to U.S. Agriculture?

- Irrigated farms accounted for $152.4 billion in sales, or 39% of the market value of agricultural products sold in 2012.

- Average per-farm value of market sales (2012):
  - All farms: $187,097
  - Non-irrigated (dryland) farms: $133,603
  - Irrigated farms: $514,412

- Irrigation contributes to the value of livestock and poultry production through irrigated crop products used as animal forage and feed.

Where does crop irrigation occur? How has it changed over time?

State Shares of Total U.S. Irrigated Acres for 2012

- Nebraska, 14.86%
- California, 14.08%
- Arkansas, 8.61%
- Texas, 8.04%
- Idaho, 6.03%
- Kansas, 5.16%
- Colorado, 4.51%
- Montana, 3.41%
- Mississippi, 2.96%
- Washington, 2.93%
- Oregon, 2.92%
- Florida, 2.67%
- All Other States, 23.82%

Source: 2012 Census of Agriculture, National Agricultural Statistics Service (USDA, 2014)
What Does Irrigation Produce?
Distribution of Harvested Irrigated Acres by Major Crop Category, 2012

**17 Western States**
- **Corn (for grain)**: 24.5%
- **Sorghum (for grain)**: 7.1%
- **Soybeans**: 8.4%
- **Wheat (All)**: 6.3%
- **Rice**: 1.9%
- **Oats**: 0.1%
- **Cotton (All)**: 2.3%
- **Barley**: 2.3%
- **Forage (all hay, haylage, grass silage, & greenchop)**: 1.5%
- **Orchards**: 5.3%
- **Vegetables**: 9.8%
- **Sugarbeets (for sugar)**: 1.1%
- **Peanuts**: 0.4%
- **All Other Crops**: 9.8%

**31 Eastern States**
- **Corn (for grain)**: 24.3%
- **Sorghum (for grain)**: 0.5%
- **Soybeans**: 29.6%
- **Wheat (All)**: 1.8%
- **Rice**: 13.1%
- **Peanuts**: 2.5%
- **Cotton (All)**: 9.8%
- **Vegetables**: 12.5%
- **Orchards**: 4.1%
- **Forage (all hay, haylage, grass silage, & greenchop)**: 1.6%
- **Sugarbeets (for sugar)**: 1.1%
- **Oats**: 0.4%
- **All Other Crops**: 2.5%

Source: 2012 Census of Agriculture, National Agricultural Statistics Service (USDA, 2014)
Emerging Water Demand/Supply Conditions: Challenges for Irrigated Agriculture

- Growing competing water demands and increased scarcity
  (1) potential realization of Native American water-right claims;
  (2) an expanding instream (environmental) flow concept;
  (3) water for an expanding energy sector; and
  (4) the potential for supply and demand changes associated with expected climate change impacts.

1. Native American water-right claims
   — Estimated at: 46 million ac.ft. annually (Western States Water Council, 1984)

2. Instream (environmental) flows
   — Shift in concept of beneficial use of surface waters: [initially from an “out-of-stream development” to a “minimum instream flow” concept, and more recently to the broader “environmental/ecosystem flow” concept].
Emerging Water Demand/Supply Conditions: (Continued)

- Growing competing water demands and increased scarcity (Continued)

3. Water for energy expansion
   - an expanding biofuels sector, expanded use of evaporative cooling technology for the thermo-electric power sector, utility-scale solar power development, an expanding oil-shale sector, and expanded use of hydraulic fracking by the deep-shale natural gas sector.

4. Climate change (supply/demand) impacts
   - For the West, forecasts involve a gradual warming of temperatures
   - Shift traditional source of freshwater supplies from stored winter snowpack to more frequent and intensive early spring rainfall.
     - reduce irrigation water supplies by reducing the quantity and timing of streamflows, reduce aquifer recharge rates, and increase crop evapotranspiration requirements.
The Challenge for Agricultural Water Conservation — Part 1

Continue to enhance onfarm irrigation efficiency, but from a broader “efficiency/conservation” perspective.

- With rising temperatures, existing irrigation systems become even less efficient.
- Increased competition and climate change impacts underscore the importance of the “timing and quantity (or infield mgmt.) of irrigation applications.”
- Adaptability and sustainability of irrigated agriculture will depend on more extensive adoption of higher-efficient irrigation production systems — Systems that combine efficient irrigation application systems with more intensive infield water-management practices.
- Efficient irrigation ‘production systems’ improve the ability of producers to decide when to irrigate and how much water to apply by crop growth stage — applying a crop’s consumptive-use requirement, or “deficit irrigating”, while maximizing overall farm economic returns.
How Efficient is Irrigated Agriculture?

More efficient irrigation (as a Percent of Total Irrigated Acres),
By System Type, for the 17 Western States, 1994-2008

More efficient gravity irrigation includes furrow irrigated acres using above- or below-ground pipe or a lined open-ditch field water-delivery system, plus acres in flood irrigation (between borders or within basins) on farms using laser-leveling and pipe or lined open-ditch field water-delivery systems.

More efficient pressure-sprinkler irrigation includes acres using either drip/trickle systems or lower pressure-sprinkler systems [pressure per square-inch (PSI) < 30].

Traditional irrigation included all remaining irrigated acres.

Better integrate improved onfarm water conservation programs with institutional (watershed-level) water-management mechanisms.

- Agricultural water conservation is both a farm and a basin-level resource conservation issue.

- Integrate improved onfarm irrigation efficiency with State and Federal watershed water-management tools:
  - e.g., conserved water rights, drought water banks, option water markets, reservoir management, irrigated acreage and groundwater pumping restrictions, and irrigated acreage retirement.
The Challenge for Agricultural Water Conservation (Part 2) — Continued

● “Sustainable agriculture” as it applies to irrigated agriculture was initiated as a USDA goal with the Food, Agriculture, Conservation, and Trade Act of 1990, with the key objective to:
  — “protect and enhance America’s water resources”

● USDA’s Strategic Plan for FY’s 2010-15 highlights the importance of using farm-level, watershed, and institutional measures as strategic means to meet this goal (USDA, 2012).

● Current Status: USDA has participated in watershed-scale agricultural water conservation through Federal, State, and local stakeholder-based partnership agreements under its Agricultural Water Enhancement Program (AWEP).
  — From 2009-11, USDA entered into 101 AWEP partnership agreements.
  — The 2014 Farm Bill repealed AWEP (& other conservation programs) for a broader land- and water-based Regional Conservation Partnership Program.
    — one embodying a landscape/institutional-scale resource conservation perspective for both land and water.
Supporting Sources:


