USDA Economic Research Service
U.S. DEPARTMENT OF AGRICULTURE

A report summary from the Economic Research Service *December 2021*

Trends in U.S. Irrigated Agriculture: Increasing Resilience Under Water Supply Scarcity

R. Aaron Hrozencik and Marcel Aillery

What Is the Issue?

Growing urban populations and economic development intensify competition for the Nation's water resources. With surface water supplies largely allocated in most river basins of the Western United States and some river basins in the Eastern United States, emerging water demands from non-agricultural sectors must be met in many cases through a reallocation of water initially allocated to agriculture. Meanwhile, changing climate regimes—through increased evaporative losses, seasonal shifts in precipitation patterns, reduced snowpack and snowmelt runoff, and higher frequency and severity of droughts—have reduced water supplies during the crop growing season. At the same time, groundwater pumping in excess of natural recharge has substantially diminished aquifer resources critical to agriculture in regions where, and when, surface water is less abundant. Increasing competition for water, coupled with increasingly constrained water supply trends, have important implications for the viability and resiliency of the irrigated agricultural sector. How the sector adapts to these trends will shape the future of irrigated agriculture and the value it creates for the greater agricultural economy.

What Did the Study Find?

Irrigated agriculture—a critically important component of the U.S. farm economy—expanded significantly over the last century, as public reclamation policy initiatives and technological innovations opened new lands to irrigated production.

- Irrigated agriculture generates substantial value for the broader U.S. agricultural economy. In 2017, irrigated farms accounted for more than 54 percent of the total value of U.S. crop sales, while irrigated cropland constituted less than 17 percent of total harvested cropland.
- Irrigated acreage has expanded rapidly since the onset of the Federal reclamation era, which began with the passage of the Reclamation Act (P.L. 57-161) in 1902. Nationwide, irrigated acreage grew from less than 3 million acres in 1890 to more than 58 million acres in 2017.
- Between 1949 and 2017, the share of U.S. irrigated cropland located within the Mountain and Pacific regions decreased from 77 percent to 44 percent, while the share of irrigated cropland in the Mississippi Delta and Northern Plains regions increased from 8 percent to 34 percent.
- Total U.S. water withdrawals for irrigation decreased by 21 percent between 1980 and 2015, with slightly lesser declines (19 percent) in average withdrawals per acre irrigated. In 2015, irrigation accounted for approximately

64 percent of total U.S. water withdrawals, including both freshwater and treated wastewater and excluding withdrawals for thermoelectric power.

- Since the mid–1900s, the relative predominance of surface and groundwater withdrawals for irrigation shifted. In the Pacific and Mountain regions, more than 60 percent and 72 percent, respectively, of irrigated cropland acres rely on surface water flows. However, reliance on surface water for irrigation is decreasing nationwide. Between 1950 and 2015, the share of irrigated acreage using surface water fell from 77 percent to 52 percent.
- Of crops irrigated in 2017, the largest allocation of irrigated acreage was in corn, with nearly 14 million irrigated acres harvested, or more than 25 percent of irrigated cropland harvested.
- While corn accounted for the largest acreage among irrigated crops during the 2017 growing season, these acres constitute less than 15 percent of total harvested corn acreage. Irrigation is more prevalent among other crops. In 2017, a majority of land planted in vegetables and orchards was irrigated, while 100 percent of land planted in rice was irrigated.
- Use of pressurized irrigation application systems, which are generally more water-use efficient than gravity-flow systems in most field settings, increased significantly in recent decades. Of the total U.S. cropland acres irrigated in 2018, 36 percent used gravity systems, while 67 percent used pressurized systems—including sprinklers and low-flow micro systems. Those systems account for 57 percent and 10 percent, respectively, of total irrigated acreage (approximately 3 percent of acres used some combination of gravity and pressurized systems).
- In the Pacific, Mountain, and Northern and Southern Plains regions,[1] the share of irrigated acres using pressurized systems rose from 37 percent in 1984 to 72 percent in 2018—with innovations focused on improved precision of applied water, reduced pressurization requirements, and system automation.
- Improved irrigation water management practices (e.g., soil moisture sensors, weather tracking, irrigation scheduling tools, flow meters, plant condition monitoring technology, etc.) are essential in achieving maximum water-use efficiency. However, survey data of irrigated producers indicate relatively low adoption rates and potential for further expansion of these improved irrigation water management practices. Both surface water supply shortfalls under multi-year drought and a growing concern for groundwater depletion across major U.S. agricultural regions focus policy attention on vulnerabilities of the irrigation sector. Various Federal efforts have sought to strengthen the resilience of irrigated agriculture to water scarcity and the long-term sustainability of the sector.

How Was the Study Conducted?

This study draws on several Federal data sources to describe historical and emerging trends in irrigation use in the U.S. agricultural sector. Land and water resource use trends were assessed based on: the Censuses of Agriculture, the Irrigation and Water Management Survey (IWMS), and the U.S. Geological Survey's (USGS) water use summaries.[2] IWMS and Farm and Ranch Irrigation Survey (FRIS) data are further leveraged to analyze technology use in irrigated agriculture and highlight recent trends. Federal policy initiatives supporting the resiliency of the irrigated sector are addressed in the closing section.

---

[1]In this report, regions refers to USDA Farm Production Regions: Pacific (Oregon, Washington, California), Mountain (Colorado, Utah, Arizona, New Mexico, Nevada, Idaho, Wyoming, Montana), Northern Plains (Kansas, Nebraska, South Dakota, North Dakota), Southern Plains (Texas, Oklahoma), Mississippi Delta (Louisiana, Arkansas, Mississippi), Southeast (Florida, Alabama, Georgia, South Carolina), Appalachia (North Carolina, Tennessee, Kentucky, Virginia, West Virginia), Corn Belt (Missouri, Iowa, Illinois, Ohio, Indiana), Lake (Michigan, Wisconsin, Minnesota), and Northeast (Delaware, Maryland, New Jersey, Pennsylvania, New York, Connecticut, Rhode Island, Massachusetts, New Hampshire, Vermont, Maine). Throughout the report, the West or the Western United States refers to the Pacific, Mountain, and Northern and Southern Plains region, while the East or Eastern United States refers to the Mississippi Delta, Southeast, Appalachia, Corn Belt, Lake, and Northeast regions. See figure 1 for a map of the USDA Farm Production Regions.

[2]The *Censuses of Agriculture* were compiled by the U.S. Bureau of the Census (1890–1992) and USDA's National Agricultural Statistics Service (USDA, NASS) (1997–2017). The Irrigation and Water Management Survey (IWMS) (formerly the Farm and Ranch Irrigation Survey (FRIS) prior to 2018) was compiled by the U.S. Bureau of the Census (1979–1994) and USDA, NASS (1998–2018). The U.S. Geological Survey's (USGS) water use summaries are reported at 5-year intervals between 1950 and 2015. The *Census of Agriculture* is generally collected every 5 years. Between the 1992 and 1997 Censuses, data collection responsibilities were transferred from the U.S. Bureau of the Census to the USDA, National Agricultural Statistics Service. Accordingly, 1992 data were collected by the U.S. Bureau of the Census, and 1997 data were collected by the USDA, National Agricultural Statistics Service.