US Geological Survey
Enhanced Water Use Information

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Water use 1950-2015

▶ Guidelines Open-file Report 2017-1029.pdf

▶ compiling and reviewing available data and making estimates to complete a national picture every 5-years

  ▶ Data/Information from state agencies/federal partners

    ▶ reported (<u>metered or measured</u>); estimated, or computed from an aggregate area;

    ▶ Estimated using coefficients, permitted volumes, data from prior years, or disaggregate
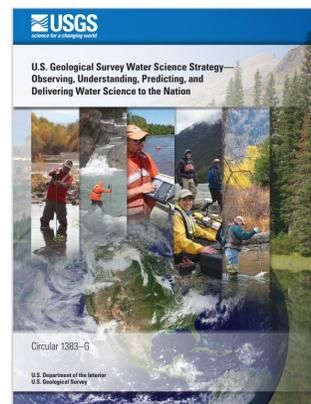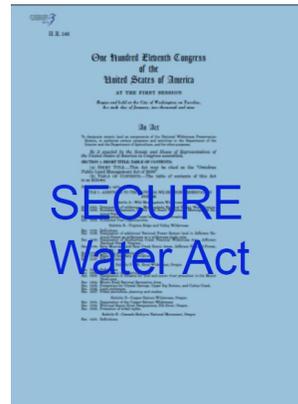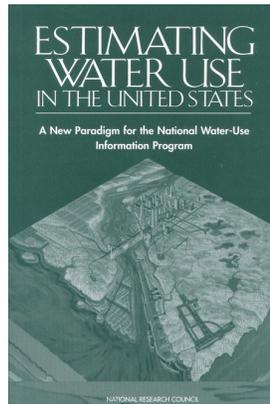
SECURE (Subtitle F- Sec 9508)

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- ▶ Carry out an ongoing assessment of water use in <u>hydrologic accounting units and major aquifers</u>

  - ▶ Maintenance of a comprehensive national water use inventory

  - ▶ Incorporation of water use science principles- applied research and statistical estimation techniques

  - ▶ Integration of ANY dataset maintained by any Federal or State agency into the dataset

  - ▶ Integration of any data water use, flow and quality to generate information on the impact of human activity on water and ecological resources

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Nex-Gen Water Use Information Should:

- ▶ Be reported consistently, comprehensively, and frequently
- ▶ Inform understanding of what influences the variation in time and space
- ▶ Be put in the context of water supply and impacts
- ▶ Drive future data collection and improvements to water use forecasts

- ▶ Support risk-informed management decisions
  - ▶ Will there be enough water for future needs?
  - ▶ Will there be enough water to support new populations and activities in a particular geography?
  - ▶ How might changes in climate, land use, and socioeconomic priorities impact changes in available water supplies of particular quantity?

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USGS Water Use Science Goals and Focus

Develop an operational system for estimating and forecasting water use and transfers nationally

Focusing in 4 critical areas:

1. Enhance the collection and completeness of water use information. Striving for automated transfer of necessary water use information, in coordination with partners

2. Build data driven and process driven models that establish nationally consistent estimation methodology and uncertainty in those estimates

3. Develop methods that quantify and trace the movement of water over the landscape

4. Integrate forecasting targets into models

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Categories of Use

Public Supply
- water withdrawn by public and private water suppliers that furnish water to at least 25 people or have a minimum of 15 connections. Public suppliers provide water for a variety of uses, such as domestic, commercial, industrial, thermoelectric-power, and public water use.

Thermoelectric
- water used in the process of generating electricity with steam-driven turbine generators.

Irrigation
- water that is applied by an irrigation system to assist crop and pasture growth, or to maintain vegetation on recreational lands such as parks and golf courses. Irrigation includes water that is applied for pre-irrigation, frost protection, chemical application, weed control, field preparation, harvesting, dust suppression, leaching of salts from the root zone. Irrigation water use estimates also include conveyance losses.

Industrial
- water used for fabrication, processing, washing, and cooling. Includes industries such as chemical and allied products, food, mining, paper and allied products, petroleum refining, and steel.

Mining
- water used for the extraction of naturally occurring minerals including solids (such as coal, sand, gravel, and other ores), liquids (such as crude petroleum), and gases (such as natural gas). Also includes uses associated with quarrying, milling and other preparations customarily done at the mine site, injection of water for secondary oil recovery or for unconventional oil and gas recovery (such as hydraulic fracturing), and other operations associated with mining activity. Does not include water associated with dewatering of the aquifer that is not put to beneficial use. Also does not include water used in processing, such as smelting, refining petroleum, or slurry pipeline operations.

Livestock
- water used for livestock watering, feedlots, dairy operations, and other on-farm needs. Types of livestock include dairy cows and heifers, beef cattle and calves, sheep and lambs, goats, hogs and pigs, horses and poultry.

Aquaculture
- water use associated with the farming of finfish, shellfish, and other organisms that live in water, and offstream water use associated with fish hatcheries.

Self-supplied Domestic
- water withdrawn from a groundwater or surface-water source by a user rather than being obtained from a public supply.

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Data driven approaches
(with some physic-based methods)

System information

- Withdrawal volumes
- Connected systems
  - Deliveries for domestic and other users
  - System losses, purchases/sales/transfers of water
  - Conveyances/IBTs
- Electricity/fuel use data
- Industry type/crop grown/material mined
- Technology
- Water source (GW, SW, reuse, reclaimed): fresh/saline; aquifer, stream, reservoir

Geospatial

- Water distribution (age/ type/condition)- PipeID
- Water Service Area Boundaries
- Irrigated Acres- LANID
- Location of facility and water intakes
- Landuse (Urban, Rural)
- Crop
- Landsat
  - SSEBop (OpenET)
- National Hydrologic Model (NHM-PRMS)-

Socioeconomic

- Population (including transient/seasonal population) (education/income)
- Indoor/outdoor water features
- Housing
- Tax
- *Water prices*
- *Water management*
- *Triggers for change in water use*
- *Conservation plans*
- *Economic forecasts*
- *Population forecasts*
- *Land use forecasts*
- *Perception-institutional trust*
- *Political influence*

Climate

- Precipitation
- Temperature
- Solar Radiation
- Wet bulb/dry bulb temperature
- Windspeed
- ETo
- Humidity

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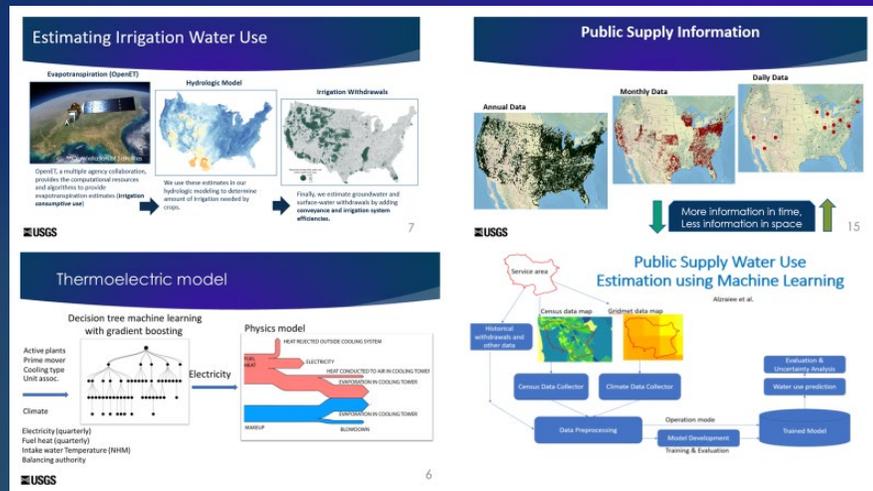
Models

▶ **Public Supply:** Statistical models, including machine learning; data intensive and rely heavily on State, Federal and local information; understanding of customer base.

▶ **Thermoelectric:** A hybrid physics-based and machine learning modeling approach; based on linked heat-and-water-budget understanding that are constrained by power plant fuel consumption, electricity generation, cooling-system technology and environmental variables (air and water temperatures, wind speed, and elevation).

▶ **Irrigation:** Satellite-based surface energy balance models and a hydrologic soil-water balance model are coupled to calculate crop water consumption and applied irrigation; water withdrawn relies on an understanding of irrigation system type and water conveyance efficiencies

Enhanced Understanding
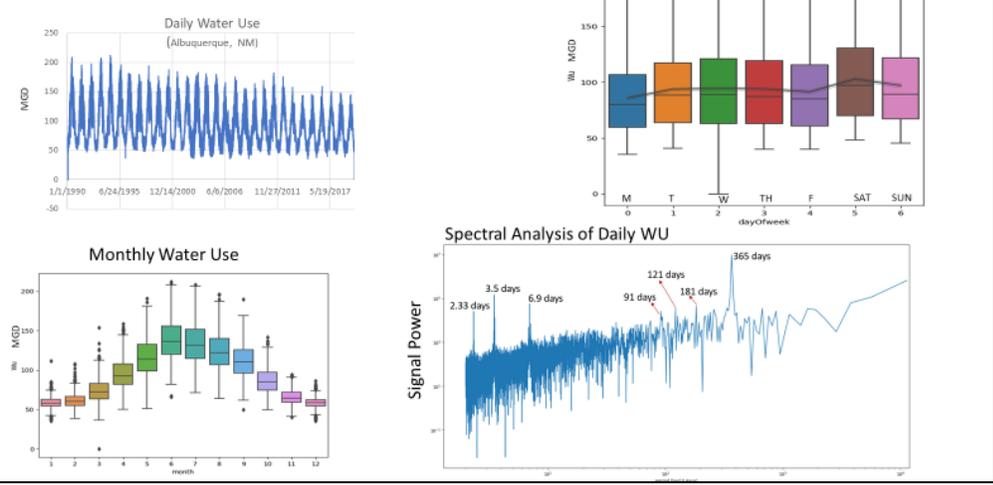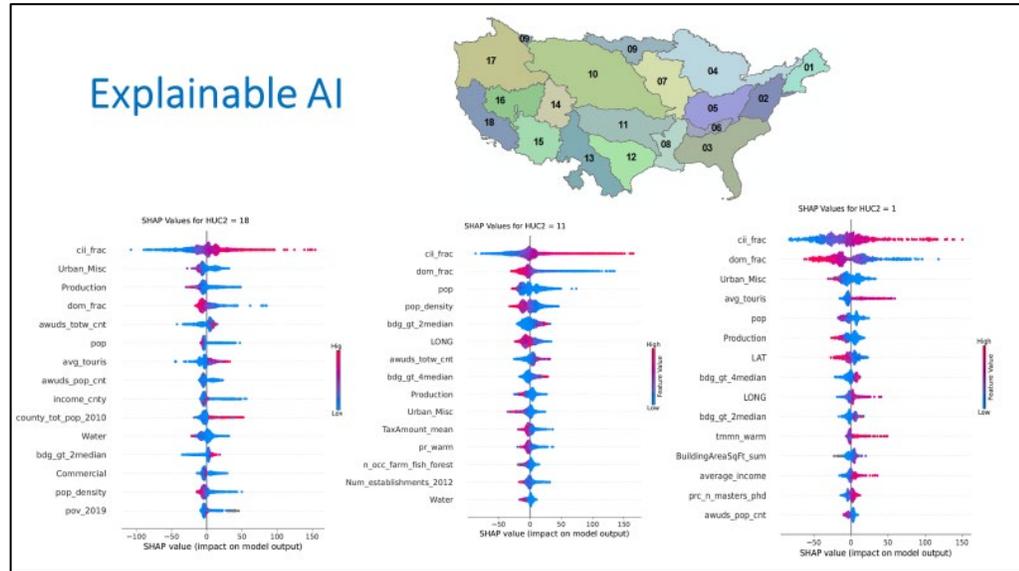
What's next….

- Almost published:
  - Reanalysis of years 2000-2020 monthly withdrawals by HUC12 for TE, PS; withdrawals for IR coming a bit later.
  - Applied Irrigation total for IR and consumptive use for TE (2000-2020)
- Derivative and supporting Products
  - Water service areas spatial datasets, Data Release
  - LANID- irrigated lands dataset: Collaboration with the University of Wisconsin and University of North Texas
  - Per Capita use estimates
  - Water loss estimates: Collaboration with Virginia Tech
- Model development for other categories of use starting NOW!
- National Water Census; National Water Availability Reports
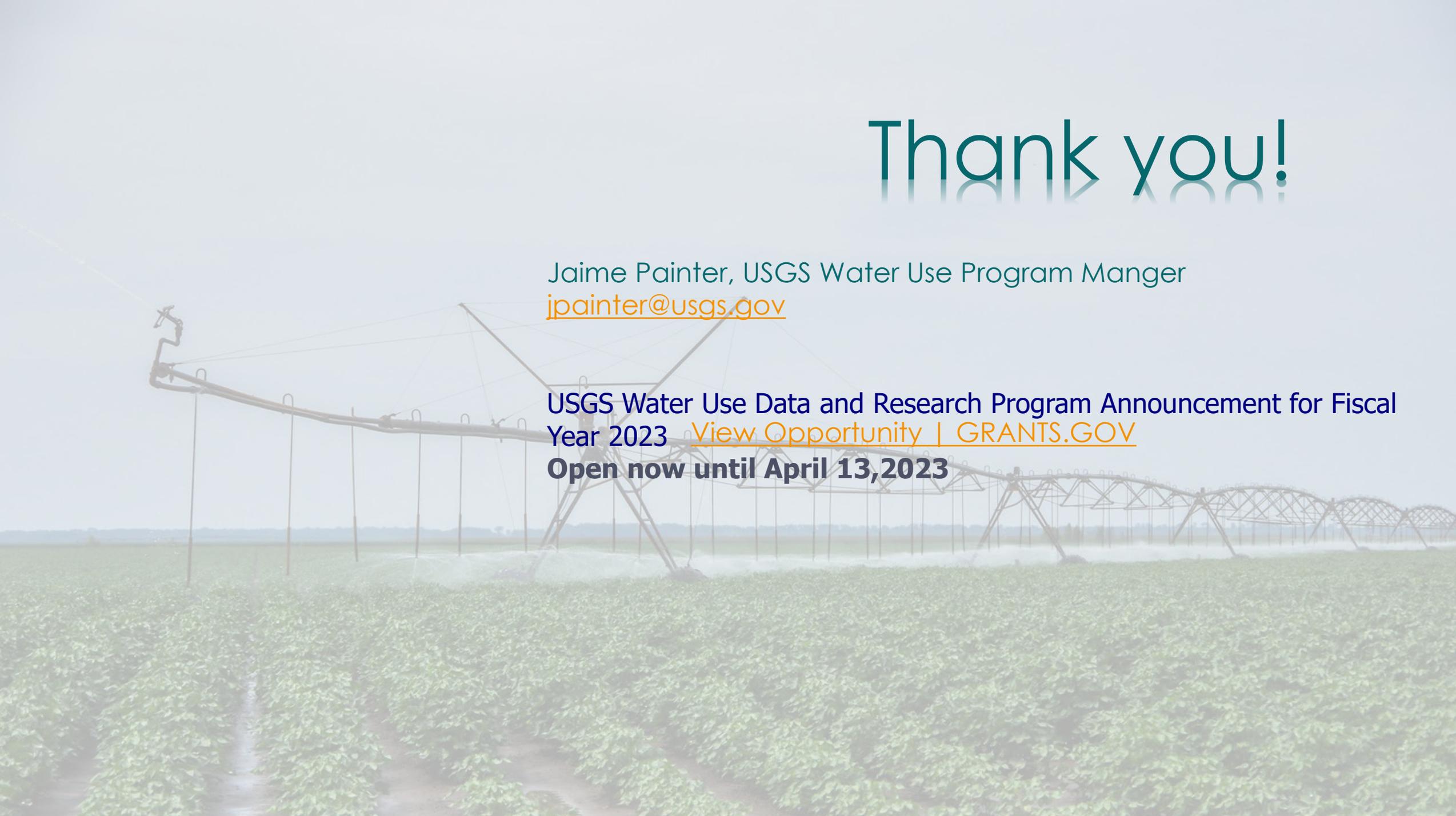
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Thank you!

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USGS Water Use Data and Research Program Announcement for Fiscal Year 2023 View Opportunity | GRANTS.GOV
Open now until April 13,2023