Agricultural Water Use

This EnviroAtlas national map estimates the total gallons of water in millions of gallons per day used for agricultural irrigation in each 12-digit hydrologic unit (HUC) in the contiguous United States. Estimates include self-supplied surface and groundwater, as well as water supplied by irrigation water providers, which may include governments, corporations, or other organizations.

Why is agricultural water use important?

According to United States Geological Survey (USGS) water use data, agricultural irrigation accounts for approximately one-third of all water withdrawn in the U.S. on a daily basis. As a major consumer of water, agricultural practices impact the availability and cleanliness of regional water supplies and the ecosystems, towns, and individuals that depend on them. Evaluating the demand for water resources can provide valuable insight into the delicate balance between water availability and use.

Agricultural irrigation includes water used before, during, and after growing seasons to suppress dust, prepare fields, apply chemicals, control weeds, remove salt from root zones, protect crops from frost and heat, and harvest crops. Water use for agricultural practices varies throughout the year and depends on many factors, such as weather patterns, other land uses within the watershed, crop type, evolving technologies and practices, and cost. The variability of agricultural water use may continue as weather and climate patterns shift, thus changing water availability and demand in some areas.

Production of the national food supply represents one critical use for water in the U.S. However, agriculture is not the only important water consumer within a watershed. Individuals and communities depend on water resources for other uses, such as drinking, household use, recreation, industry, power generation, and transportation. Plants and animals also depend on a clean and plentiful water supply. Though water appears to be everywhere, it is a finite resource. Overuse within a watershed can lead to unintended consequences, such as water shortages, the need for additional treatment, and higher expenses for storage and distribution. Maintaining appropriate natural resource usage can help ensure the availability of a stable water supply.

In addition to the economic impacts of treating or delivering water, water resource overuse can impact ecosystems, such as forests and wetlands, and the ecosystem services or natural benefits that they provide. Natural ecosystems such as wetlands, forests, and water bodies help protect the supply and quality of water resources. By storing and filtering rainwater, regulating the speed and volume of water flows, and preventing sediment and contaminants from entering waterways, natural resources ensure that clean and plentiful water is available. Understanding the demand placed on these ecosystems will help ensure their continued ability to provide such services.


Photo: Eric Vance, EPA

How can I use this information?

The map, Agricultural Water Use, can be used to help evaluate the demand for clean and plentiful water within a 12-digit HUC. Understanding water uses is a critical step to identifying potential imbalances and trends in supply and demand. Within EnviroAtlas, this map can be used in combination with maps on domestic, industrial, and thermoelectric water use to visualize which watersheds have relatively high demands placed on their water resources.

These data can also be used in conjunction with maps and data that illustrate water availability within 12-digit HUCs. Together, these data suggest where demand for water may outpace availability at the watershed scale. It also highlights where the ecosystems that protect water resources may experience strain, require protection, or benefit from restoration. In areas with a significant imbalance or a problematic trend, additional research and action can help alleviate pressure on the water supply.

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How were the data for this map created?

This map was initially based solely on irrigation water use estimates per county. Finer resolution spatial data, including modeled remotely-sensed irrigation, land cover, and crop type, were used to develop an agricultural water use map as a 30-meter grid across the contiguous United States. These data were then summarized by 12-digit HUC for representation in EnviroAtlas.

What are the limitations of these data?

With regard to the county-level data, estimated irrigation water use covers a variety of uses in addition to agriculture, such as for golf courses, parks, nurseries, turf farms, and cemeteries. Where detailed estimates were available, golf course irrigation was removed in the development of this map.

Remotely-sensed irrigation and the re-aggregation of water use also have limitations. Vacillating weather patterns influence the irrigation demand and, therefore, satellite imagery over time. Irrigation water withdrawals, such as the county-level estimates, are calculated in the county in which they occur. This water, however, may be delivered across county (or even watershed) boundaries before it is applied, resulting in differences between the county-level data and the remotely-sensed data. Considerable efforts have been made to report the most accurate estimates across these data.

How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. The original 2010 county-level water use estimates are available via the USGS Water Use website.[1,2] The 2007 and 2012 modeled remotely-sensed irrigation data, which is based on irrigation statistics and satellite imagery, is available via the USGS MIrAD-US website.[3] The 2011 land cover can be downloaded through the NLCD website.[4] The 2011 crop type data can be accessed and downloaded through the USDA Cropland Data Layer (CDL) website.[5]

Where can I get more information?

There are numerous resources on agricultural water use and demand; a small selection of these resources is listed below. EPA, USGS, and USDA also have additional resources on their respective websites. For additional information on how this data layer was created, access the metadata for the data layer from the drop down menu on the interactive map table of contents and click again on metadata at the bottom of the metadata summary page for more details. To ask specific questions about this map contact the EnviroAtlas Team.

Acknowledgments

EnviroAtlas is a collaborative effort by EPA, its contractors, and project partners. Megan Mehaffey and Anne Neale, EPA, and Elena Horvath, EPA ORISE Participant, developed the map. Elena Horvath and Jessica Jahre, EPA Student Services Contractor, created the fact sheet.

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