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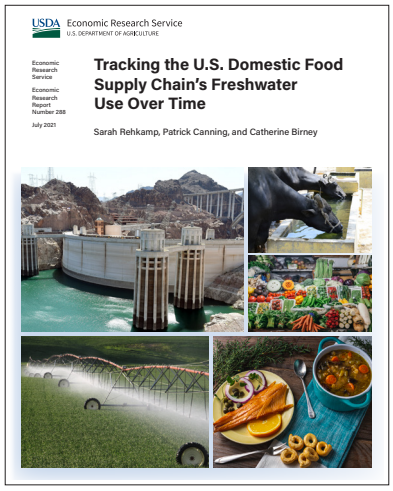
Tracking the U.S. Domestic Food Supply Chain's Freshwater Use Over Time

Sarah Rehkamp, Patrick Canning, and Catherine Birney



What Is the Issue?

Although water is one of the Earth's most abundant resources, only 2.5 percent is freshwater—water that is not seawater or brackish such as rainfall or lake water. Of this 2.5 percent, more than two-thirds is not readily available for human use since it may be frozen or underground, or in other forms (DOI-USGS, 2016). Not only is freshwater a scarce resource, but it also plays a key role in food production. Water is used on-farm for irrigation and later in the supply chain to process food, clean processing plants, generate electricity, and operate home kitchens. Very little is known about these freshwater withdrawals, also called blue water, in the U.S. food system beyond what is used in agriculture, in part, because it is mostly self-supplied (DOI-USGS, 2018c).

Annual food and beverage spending in the United States surpassed $2 trillion in 2019 (USDA-ERS, 2020b) and the majority of these foods and beverages are domestically produced. This research evaluates the blue water resources used throughout the U.S. food system to meet the domestic demand for foods and beverages overtime. Therefore, this analysis excludes water used to produce food for export or to produce non-food commodities, such as fiber or ethanol; the analysis also excludes water used in the production of food and ingredients imported for U.S. domestic use.

The results will help inform how much blue water might be needed for future food demand and how our food system might adapt its use of blue water. This information could be especially helpful in discussions around food system sustainability given competing realities such as a growing population, climate change, and changing consumer preferences.

What Did the Study Find?

- Over the years studied, blue water use in the U.S. food system was highest in 2002 at 43 trillion gallons, or 34 percent of total water withdrawals in the United States that year. In 2012, the most recent year included in the study, the U.S. food system required 34 trillion gallons of water for the production of U.S. food and beverages purchased (plus home kitchen operations). This would be enough water to cover the State of California at a depth of 1 foot.
- One of the primary uses for blue water in the U.S. domestic food system is for agricultural production (crops and livestock), but supply chain stages other than agriculture also use a considerable amount of blue water. In 2012, crop and livestock production used 68 percent of food-system blue water, while later stages of food production used 32 percent.
- Energy industries such as electric power and numerous petroleum products used substantial amounts of water in the supply chain. Water for energy contributed 13 percent of food-system water, emphasizing the food-energy-water nexus.
- Water used by the food system had an inverse relationship with precipitation in the four years studied. As precipitation increased, blue water withdrawals decreased, signaling that these water types may be substitutes for each other on-farm.
- Among all food-at-home (FAH) purchases in 2012, fresh vegetables accounted for the greatest water use at 5 trillion gallons of blue water, an amount sufficient to cover West Virginia in 1-foot of water, and the most blue water use by a FAH expenditure category.

How Was the Study Conducted?

This study was conducted by using an environmental input-output (EIO) model. This is a national economy-wide model in which we can track resources used throughout different industries. This modeling approach allowed us to measure embodied water, or direct and indirect water use throughout the production process through points of purchase. We employed the EIO model to measure water withdrawals linked to all domestic foods and beverage expenditures, including FAH and food away from home (FAFH). We used county-level blue water data from the U.S. Geological Survey over 4 time periods (1995, 2000, 2005, 2010) as the primary data source for this research. These 4 time periods of water data correspond with the most recent 4 time periods of benchmark input-output data. We allocated the blue water use data to the industries in the benchmark input-output data published by the Bureau of Economic Analysis (1997, 2002, 2007, 2012), using allocation metrics based on numerous other data sources.