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Arizona Water Footprint

Those of us living in the desert should know better than anyone that water is life. Water is certainly the lifeblood of our existence in the desert. Despite this obvious fact, it is often difficult to comprehend the full extent of the importance of water in our daily lives.

A good place to start is with the recognition that 60-70% of our body weight is made up of water. We need plenty of water just to function properly and each person needs to directly consume approximately one gallon of water per day, as a basic metabolic minimum (Mayo Clinic, 2022).

Each person's water needs will vary depending on their diet, environmental conditions such as temperature and humidity, and a person's activity level among other factors. For example, someone hiking in the desert on a warm spring day will need to consume at least one quart of water per hour to maintain proper hydration.

It is commonly estimated that the average American needs about 102 gallons of water daily for personal use, which includes water to drink, bathing, cooking, toiletries, etc. (Kobir, 2024; and Philadelphia City Government, 2024). The United States Geological Survey (USGS) estimates that the average American needs 80-100 gallons per day for basic use and consumption, commonly referred to as indoor use (USGS, 2019). The Arizona Department of Water Resources (ADWR) estimates that Arizonans consume an average of 146 gallons of water per day (ADWR, 2024).

Fruits and vegetables contain large quantities of water in proportion to their weight. When these foods are eaten, the water can be absorbed by the body. Accordingly, diet is an important part of a person's direct daily water consumption (Table 1). Nutritionists and dieticians have often been the ones alerting people to how much water our food contains.

Fruits				Vegetables			
<i>Item</i>	<i>Food Weight (g)</i>	<i>Water Weight</i>	<i>Percent Water</i>	<i>Item</i>	<i>Food Weight (g)</i>	<i>Water Weight</i>	<i>Percent Water</i>
Apple	138	116	84	Broccoli	44	40	91
Apricot	106	92	86	Cabbage (green)	35	32	93
Banana	114	85	74	Cabbage (red)	35	32	92
Blueberries	145	123	85	Carrots	72	63	87
Cantaloupe	160	144	90	Cauliflower	50	46	92
Cherries	68	55	81	Celery	40	38	95
Cranberries	95	82	87	Cucumber	52	50	96
Grapes	92	75	81	Eggplant	41	38	92
Grapefruit	123	112	91	Lettuce (iceberg)	20	19	96
Orange	140	122	87	Peas (green)	72	57	79
Peach	87	76	88	Peppers (sweet)	50	46	92
Pear	166	139	84	Potato (white)	112	88	79
Pineapple	155	135	87	Radish	45	43	95
Plum	66	56	85	Spinach	28	26	92
Raspberries	123	106	87	Zucchini	65	62	95
Strawberries	149	136	92	Tomato (red)	123	115	94
Watermelon	160	146	92	Tomato (green)	123	114	93

Table 1. Water content of common fruits and vegetables.

Prepared by Sandra Bastin, Foods, and Nutrition Specialist and Kirn Henken, Extension Associate for ENRI. Information taken from Bowes & Church's Food Values. In: *Water Content of Fruits and Vegetables*. University of Kentucky Cooperative Extension. 1994.

Considering daily indoor use and diet, a person can develop estimates on their own personal daily water consumption and water footprint. There are numerous calculators available on-line (i.e., Water Footprint Calculator) where we can develop personalized estimates on our water footprint.

Each of us consumes a lot more water daily than our daily indoor or direct consumption. It takes water to produce all our food including fruits, vegetables, meat, bread, etc. This is true for food products that are fresh or processed. Most of the time we are oblivious to this aspect of water consumption through our food, often referred to as “virtual water”, but it represents a huge part of our personal water footprint.

It is commonly estimated that the daily diet of most people in the U.S. requires 800-1,500 gallons of water to produce (Anyabwile and Walker, 2019; Wheeler, 2022; Food Print, 2024; Michel, 2023; Smith, 2012). If this estimate is expanded to clothing, appliances, vehicles, and other items in our common daily use the average water footprint for Americans easily equals or exceeds 2,000 gallons of water per day (ASPE, 2022).

We can consider the annual Arizona population’s dietary consumptive use of water using a range of averages of 800; 1,000; and 1,500 gallons per day to support the food we eat (Table 2).

If we use an average of 1,000 gallons per day to produce the food that we eat and consider the 7.4 M Arizonans living in our state today, we can gain a good general estimate of the annual water consumption level necessary to support the population for the State of Arizona as approximately 8.3 million acre-feet (MAF).

Gallons/Day	800	1,000	1,500
Arizona Annual Water Consumption by Food (MAF)	6.6	8.3	12.4

Table 2. Arizona annual water consumption from food considering four average daily water consumption rates per person. MAF = million acre-ft.; 325,851 gallons/acre-ft.

Arizona’s statewide total direct wet water use is estimated to be about 7.1 MAF (ADWR, 2019). Considering an average of 8.3 MAF as the water requirement to produce the food to support Arizona’s population, the State is in a deficit of 3.3 MAF beyond the amount of water used by the Arizona agricultural industry, which is approximately 5 MAF (approximately 70% of the total Arizona water use).

If we consider that 2,000 gallons of water are required to support every Arizonan daily, which includes non-edible items (clothing, appliances, vehicles, etc.), Arizonans are responsible for the consumption of approximately 16.6 MAF per year.

Then of course we must also remember that the average person is directly responsible for the use of approximately 146 gallons of water per day for direct indoor use. That comes to a total of approximately 1.2 MAF per year for the Arizona population. That is much less than the reality of the total water required to produce the food we eat and support us in many facets of our life.

The main point from this discussion is that all of us in Arizona and across the nation use a lot more water than is commonly realized. Many of the food products we consume come from out of state, which is interesting in relation to the concerns being voiced regarding the use of Arizona water to produce agricultural products that are being transported to other states or nations.

We are all clearly the net beneficiaries of not only the agricultural production in this state but also from many places and other water sources beyond the boundaries of Arizona.

References:

Anyabwile, A. and S. Walker. 2019. 5 Ways to put food on a water diet. World Resources Institute. <https://www.wri.org/insights/5-ways-put-food-water-diet>

Arizona Department of Water Resources (ADWR). 2019. Water Your Facts. Arizona Water Facts. <https://www.arizonawaterfacts.com/water-your-facts>

Arizona Department of Water Resources (ADWR). 2024. Conservation. <https://www.azwater.gov/conservation/public-resources>

ASPE. 2022. New research shows most Americans are unaware of their daily water consumption. ASPE Pipeline. <https://aspe.org/pipeline/new-research-shows-most-americans-are-unaware-of-their-daily-water-consumption/#:~:text=Most%20believe%20they%20use%20less%20than%20100%20gallons,indirectly%20%28e.g.%2C%20the%20water%20required%20to%20produce%20food%29.>

Bastin, S. and K. Henken. 1994. Water Content of Fruits and Vegetables. University of Kentucky Cooperative Extension. 1994.

Food Print. 2024. The Water Footprint of Food. <https://foodprint.org/issues/the-water-footprint-of-food/>

Kobir. 2024. How many gallons of fresh water do we use per day. <https://medium.com/rocklinca/how-many-gallons-of-freshwater-do-we-use-per-day-7987edf6b1bb>

Mayo Clinic. 2022. Water: How much should you drink every day? <https://www.mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/in-depth/water/art-20044256>

Michel, D. 2023. Water and Food: How, When, and Why Water Imperils Global Food Security. Center for Strategic and International Studies. <https://www.csis.org/analysis/water-and-food-how-when-and-why-water-imperils-global-food-security>

Philadelphia City Government. 2024. Gallons Used Per Person Per Day. <https://water.phila.gov/pool/files/home-water-use-ig5.pdf>

Smith, T. 2012. World Water Day: How much water do you use in a day? Climate Home News. <https://www.climatechangenews.com/2012/03/22/world-water-day-how-much-water-do-you-use-in-a-day/>

United States Geological Survey (USGS). 2019. How much water do I use at home each day? <https://www.usgs.gov/special-topics/water-science-school/science/water-qa-how-much-water-do-i-use-home-each-day>

Wade, M. 2024. Where does our water wind up? Ag Alert, California Farm Bureau. 7 February 2024.

Water Footprint Food Guide and Calculator. 2024. <https://watercalculator.org/water-footprint-of-food-guide/>

Wheeler, M. 2022. Did You Know' Series: How Much Water Are We Actually Using?

Virginia Water Resources Research Center, Virginia Tech University.

<https://www.vwrrc.vt.edu/2022/03/31/did-you-know-series-how-much-water-are-we-actually-using/>