Analysis of the Water Footprint
of Domestic Consumers in Iran

Green water — Rain water used

Blue water — Water used from surface and groundwater

Grey water — Freshwater used to dilllute pollution
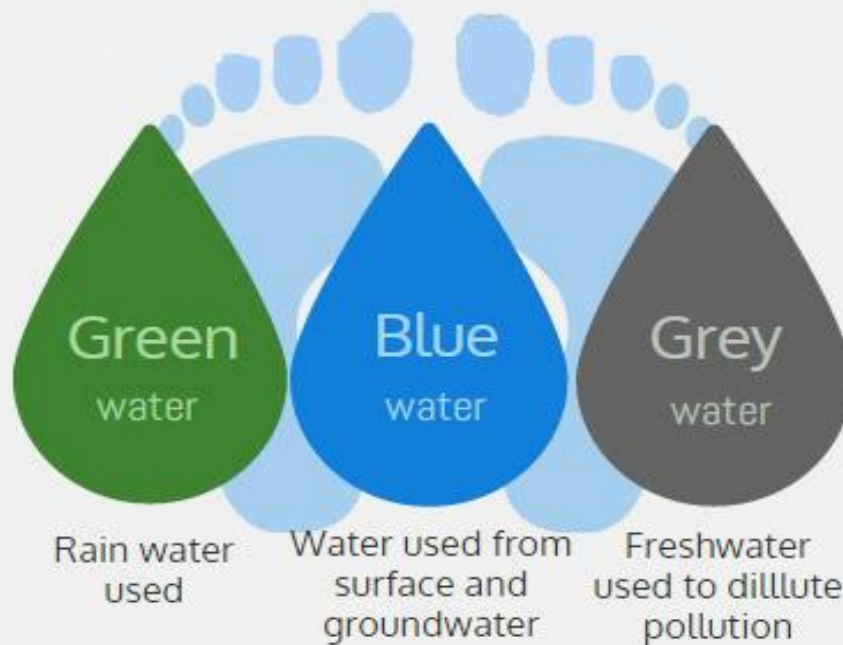
Water Footprint

The water footprint is a measure of humanity's appropriation of fresh water in volumes of water consumed and/or polluted. The water footprint measures the amount of water used to produce each of the goods and services we use. It can be measured for a single process, such as growing rice, for a product, such as a pair of jeans, for the fuel we put in our car, or for an entire multi-national company. The water footprint can also tell us how much water is being consumed by a particular country – or globally – in a specific river basin or from an aquifer (1)

The water footprint allows us to answer a broad range of questions for companies, governments and individuals. For example:

- Where is the water dependence in my company's operations or supply chain?

- How well are regulations protecting our water resources?

- How secure are our food or energy supplies?

- Can I do something to reduce my own water footprint and help us manage water for both people and nature?

Depending on the question you are asking, the water footprint can be measured in cubic metres per tonne of production, per hectare of cropland, per unit of currency and in other functional units. The water footprint helps us understand for what purposes our limited freshwater resources are being consumed and polluted. The impact it has depends on where the water is taken from and when. If it comes from a place where water is already scarce, the consequences can be significant and require action (2)

The water footprint is made up of three key components: green, blue, and grey. These components offer a detailed understanding of water usage by distinguishing between different sources—rainfall or soil moisture (green), surface or groundwater (blue), and polluted water caused by human activities, especially from industrial and agricultural processes (grey). Together, they provide a clear picture of how water is consumed, reused, and its environmental

impact. This breakdown helps identify opportunities for more efficient water use and better management of resources. The three types of water footprints are:

- **Blue:** Water that is either sourced from the ground or the surface. It's either evaporated, used to create a new product, or is taken from one body of water and used in another. It can be used right away in a different body of water or saved for another time.

- **Green:** A green water footprint focuses on rainwater. It's stored in the root systems of soil and is particularly useful for agricultural purposes.

- **Grey:** A grey water footprint deals with wastewater and pollution. It focuses on how much fresh water is needed in order to 'flush out' pollutants, on local and state levels (3)

Direct and indirect water use

The water footprint looks at both direct and indirect water use of a process, product, company or sector and includes water consumption and pollution throughout the full production cycle from the supply chain to the end-user.

.... indirect .... direct ....> consumer
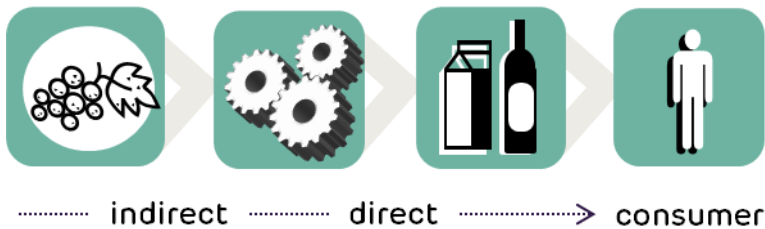
It is also possible to use the water footprint to measure the amount of water required to produce all the goods and services consumed by the individual or community, a nation or all of humanity. This also includes the direct water footprint, which is the water used directly by the individual(s) and the indirect water footprint – the summation of the water footprints of all the products consumed (2).

Why Are Water Footprints Important?

Billions of people go without fresh drinking water every single day. Unfortunately, if current trends continue that number will grow. What we don't often think about is how a shortage in water might affect other things. **It goes far beyond an individual level.**

For example, consider how much water it might take to create a product, or to grow crops to feed everyone. The less water that's available, the harder it will be for those products to be made or those crops to grow. That means the prices for those things will skyrocket. Less people will be able to afford them.

A shortage of water, as you can see, affects the entire economy. It also affects our energy storage, since it takes energy to pump out clean water and filter away pollutants. Time, money, and resources all come into play when it comes to **water conservation**. Understanding more about a water footprint on every level can help to ensure things like this don't happen. If they do, it could eventually be catastrophic for the whole world.

Water footprints affect **all of us on both an indirect and eventually a direct level.** T**he more we can strategize on how to conserve water** and be more efficient with our water use. Before you, as an individual, have a chance to see the negative direct effects, it's **important to get a firm grasp on how you can monitor your own water footprint** (3)

Some facts and figures

- The production of one kilogramme of beef requires approximately 15 thousand litres of water (93% green, 4% blue, 3% grey water footprint). There is a huge variation around this global average. The precise footprint of a piece of beef depends on factors such as the type of production system and the composition and origin of the feed of the cow.

- The water footprint of a 150-gramme soy burger produced in the Netherlands is about 160 litres. A beef burger from the same country costs on average about 1000 litres (4).

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How do we use the water footprint of products?

Knowing the water footprint of the products and goods we produce and consume, allows:

- Businesses can assess their water dependency and the risks of scarcity and pollution. Using water footprint benchmarks, they can improve resource efficiency, set reduction targets, and integrate these into their corporate water strategies. Water footprint assessments help evaluate product sustainability, engage stakeholders, and disclose information to consumers and governments. Sharing innovations promotes more sustainable water use, allowing companies to focus on efficient and environmentally sustainable practices across operations and supply chains.

- Governments can assess how different production types contribute to water scarcity and pollution. Using water footprint benchmarks, they can improve efficiency, support poor performers with best practices, and encourage transparency in business water use. Evaluating water's role in the economy aids policy-making while integrating water footprints into policies helps meet societal goals. This enables fair water allocation and supports effective governance in river basins globally

- Citizens can understand how much water is used to make everyday products and how their consumption choices impact global water scarcity and quality. By considering product water footprints, they can encourage responsible water use by companies, advocate for government action, and make informed decisions to reduce their water footprint, promoting sustainable and equitable water use (1)

Water foot print in iran

In iran the average water footprint for crops such as wheat, barley, corn, rice, potato, onion, apple, orange, and peas in Iran is 656 cubic meters per person per year. The external water footprint is smaller than the internal footprint, comprising 40% of the total blue water footprint and 29% of the total green water footprint. Additionally, 14,611 million cubic meters of water have been stored on average due to cereal imports, while 135 million cubic meters have been lost from fruit and legume exports. From 1997 to 2001, an average of 14,476 million cubic meters of water was stored in the country (5)

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In a study on estimation of household water footprint in Iran, it has found an average water footprint of 4420.14 ± 695.17 lpcd, with indirect use as the major component (6).

Fig. 1 shows the largest component of the water footprint is IWF, followed with a significate distance by the DWFin and the DWFout footprints. This means that the most water is used to produce goods and services that are consumed in Iran.
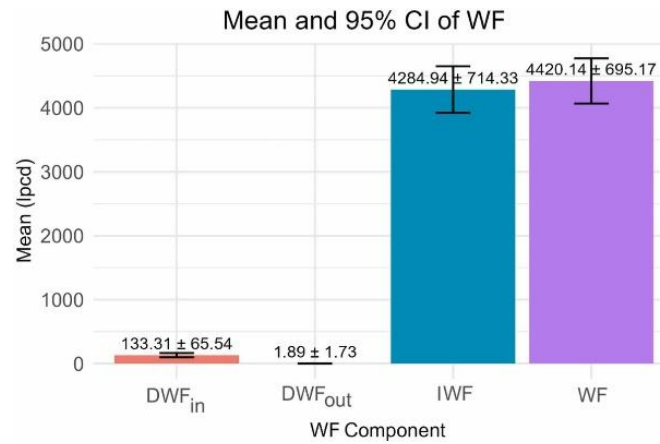

Fig. 1 is compared with data from the United States (7)

Where the average DWF_{in} is 87.0645 lpcd and the average DWF_{out} is 355.828 lpcd, it becomes evident that Iran's DWF_{in} is higher. Additionally, the US figures for average IWF and total WF are 7495.766 lpcd and 6821.312 lpcd, respectively, indicating a different pattern of water usageaccording to this study the per capita household water footprint in Iran estimated to be 4138.15 ± 90.92 lpcd (6).

Fig 2. Shows The largest source of water consumption in the household is dietary regimen, which accounts for 2493 lpcd. This is followed by purchasing, which accounts for 1767 lpcd. This includes the water that is used to produce the food, goods, and services that we buy. Other significant sources of water consumption include showers (45 lpcd), kitchen sink use (36 lpcd), and dishwashing (12 lpcd). The figure also shows that there are a number of ways to reduce water consumption in the household. Recycling can save up to 94 lpcd, while graywater use can save up to 5 lpcd. Rain barrels can also

help to reduce water consumption by collecting rainwater that can be used for watering plants or washing cars (6).
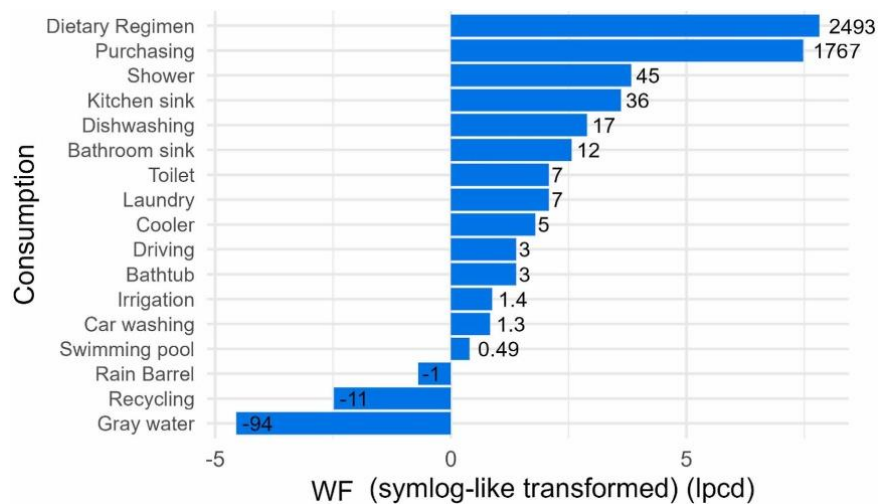

Fig. 2. The water footprint within various consumption categories.

Fig. 3 indicates Mazandaran and Yazd stand out with the highest water footprints. In contrast, Bushehr and Fars were at the bottom of the order, with the lowest water footprints (6).
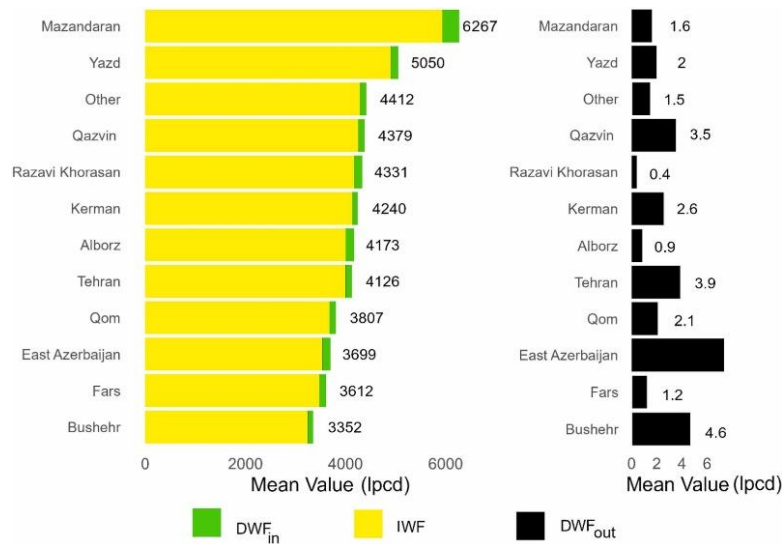
Fig. 3. Distribution of water footprints components by provinces (provinces with fewer than 2 observations pooled together as "other").

How we can help to reduce water foot print?

Taking certain actions will help us achieve this goal:

To replace outdated faucets with smart, water-saving models and to promote their widespread adoption. Using water-saving devices like low-flow showerheads to reduce consumption. Encouraging the use of dishwashers and washing machines at full capacity is recommended to optimize water efficiency during dishwashing and laundry. The collection of rainwater in barrels for irrigation of plants, gardens, and other applicable areas could prove advantageous. Additionally, it is advised to promote washing cars with buckets or cloths rather than using a garden hose, which often leads to excess water usage. Initiatives aimed at recycling materials such as paper, plastic bottles, cans, and clothing should be supported to reduce the water footprint associated with their production. Launching comprehensive advertising campaigns to elevate awareness and spread information throughout all segments of society can help alter consumption habits and introduce water-saving measures (6)

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Increased awareness and sensitivity among Iranian families regarding water consumption may led to positive outcomes in water conservation. Numerous households have adopted effective methods to curtail water usage, such as using standard faucets and water-saving devices like low-flow showerheads and faucets. Additionally, the proper use of modern electrical appliances like washing machines and dishwashers for cleaning has contributed significantly to water conservation within households. Awareness campaigns organized by relevant organizations could also play a crucial role in promoting water conservation practices. These campaigns, along with the dissemination of knowledge and information to the public, can result in a noticeable reduction in water consumption across sectors such as swimming pools, recycling, and shopping. By increasing awareness among diverse segments of the population and providing households with relevant information, it can become possible to emphasize the importance of water conservation and encourage optimal of water resources consumption. This, in turn, helps prevent unnecessary water wastage within the household sector.

As previously stated, the indirect water footprint of a consumer or producer pertains to the freshwater consumption and pollution associated with the products being consumed or produced. It is equivalent to the sum of the water footprints of all products consumed by the consumer or all (non-water) inputs used by the producer (6, 8)

Indirect water, although not apparent to the consumer or producer, is essential to produce all the goods used in daily life. This includes items such as cars, plastics (used in toys and food packaging), electronics, household goods (like furniture and textiles), clothing, and the associated packaging and shipping for these items. Therefore, everyone in Iranian's households can offset this amount by decreasing their consumption, reusing, and repurposing existing items, and recycling or donating (where appropriate) items that might otherwise end up in the trash. Recycling materials like paper, plastic, bottles, and cans can be particularly impactful, as recycled materials generally require less water and energy for processing compared to the production of raw materials. Choosing to reuse what everyone already possesses and purchasing fewer new items is a significant step in lowering the water footprint. Donating and recycling clothes, sheets, towels,

etc., helps keep fabrics and other materials out of the waste stream, contributing to a reduction in the overall water footprint (6, 7)

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