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The Hidden Water Costs of Your Morning Brew with your Smartphone: A Qualitative Study on Coffee's and Smartphone's Water Footprint

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ABSTRACT

Water footprinting is an essential concept for understanding the total amount of freshwater used to produce goods and services throughout their entire lifecycle. This measurement includes three primary components: green water (rainwater utilized by plants), blue water (surface and groundwater used in irrigation and processing), and grey water (water needed to dilute pollutants). By quantifying these aspects, water footprinting provides insights into the impact of various activities on freshwater resources and highlights opportunities for more sustainable water use. Despite its significance, awareness of water footprinting remains low among the general public, often due to the complexity of the concept and limited educational outreach. This lack of awareness can lead to unsustainable practices, inefficiencies, and increased environmental impacts. Addressing this issue through improved education, transparency, and community involvement is crucial for fostering informed decision-making and promoting responsible water use.

Keywords: Water footprinting, Freshwater usage,Green water, Blue water, Grey water, Lifecycle assessment, Sustainable water use,Environmental impact, Public awareness, Educational outreach

Introduction

Water is a fundamental resource that sustains life, ecosystems, and economies. However, with increasing global population, industrialization, and climate change, water resources are under unprecedented pressure. To address this challenge, the concept of "water footprinting" has emerged as a vital tool for understanding and managing water use across various sectors. In today's world, water scarcity is becoming a critical issue. Regions like the Middle East, parts of Africa, and South Asia face severe water stress, where the demand for water exceeds the available supply. Even in water-abundant areas, pollution from industrial waste, agricultural runoff, and untreated sewage has compromised water quality, making it unusable without significant treatment. At the same time, global trade and consumption patterns have led to a situation where water-rich regions are exporting "virtual water" (the water embedded in products) to water-scarce regions, further exacerbating local water shortages.

The term "water footprinting" was coined to bring attention to the hidden water costs associated with our daily lives. While concepts like carbon footprinting have become mainstream in discussions about climate change, the idea of a water footprint helps illuminate the often-overlooked issue of water consumption and its environmental impacts. Water footprinting is a crucial concept for navigating the complex challenges of water resource management in the 21st century. By measuring and analyzing our water use, we can make informed decisions that lead to more sustainable and equitable water use, ensuring that this vital resource is available for future generations.

What is Water Footprinting?

Water footprinting is a way to measure how much water is used to produce things we use every day. Think of it as a way to keep track of how much water goes into making everything from your morning coffee to the clothes you wear. Here's a simple breakdown:

1. What We Measure:

- Green Water: Rainwater that plants use to grow. For example, the rain that helps coffee beans or cotton crops grow.
- Blue Water: Water from rivers, lakes, and underground sources used for things like irrigation and industrial processes.
- Grey Water: Water needed to clean up pollution and waste. This is the water used to dilute pollutants so that they don't harm the environment.

2. Why It Matters:

- Understanding Impact: It helps us understand how much water is needed to make products and how our choices impact water resources.
- Saving Water: By knowing the water footprint, we can make better decisions to save water and use it more wisely.
- Protecting Resources: It helps protect our water sources by highlighting where we use the most water and where we can reduce usage.

Everyday Example: Let's say you love coffee. The water footprint of your cup of coffee includes:
- Water used to grow the coffee beans.
- Water used to process and roast the beans.
- Water used to brew the coffee.

By knowing these details, you can see how your coffee habit affects water resources and think about ways to reduce your impact. In short, water footprinting is like keeping track of your water use to make sure we're all using this precious resource wisely and sustainably.
Water footprinting provides a comprehensive assessment of the volume and impact of freshwater used throughout the lifecycle of a product or service. It serves as a critical tool for understanding and mitigating the pressures on global freshwater resources, which are increasingly strained by population growth, industrial activities, and climate change. The water footprint concept is integral to numerous significant extents:
1. Agricultural Products: Water footprinting helps assess the amount of water needed to grow crops, raise livestock, and process agricultural products. This is essential for identifying water-intensive practices and promoting more sustainable agricultural methods.
2. Industrial Processes: In manufacturing, water footprinting evaluates the water used for production processes, cooling, and cleaning. It also considers the impact of industrial pollutants on water quality.
3. Consumer Goods: For everyday products such as clothing, electronics, and packaged foods, water footprinting quantifies the water used in their entire supply chain, from raw material extraction to production and transportation.
4. Energy Production: The water footprint of energy sources, including fossil fuels, biofuels, and renewable energy, is crucial for understanding the water requirements for extraction, processing, and cooling in energy production.
5. Ecosystems: Water footprinting can also be applied to assess the impact of human activities on natural ecosystems and water bodies, helping to protect and restore freshwater habitats.

0% Awareness in Common People

The notion of "0% awareness" highlights a critical gap in public understanding and engagement with water footprinting. This lack of awareness can be dissected into several dimensions:
- Curriculum Integration: Water footprinting is often not included in standard educational curricula, leading to a lack of foundational knowledge about water use and sustainability from an early age.
- Public Information Campaigns: There is a scarcity of effective campaigns that translate the complex concept of water footprinting into accessible and engaging information for the general public.
- Focus on Immediate Issues: Media coverage often prioritizes immediate and visible water-related issues, such as droughts and water scarcity, over more abstract concepts like water footprinting.
- Complex Terminology: Reports and articles that discuss water footprinting may use technical language that is difficult for the average person to understand.
- Lack of Transparency: Consumers often lack access to information about the water footprint of the products they buy. Without this transparency, it is challenging for individuals to make informed choices about their consumption.
- Prioritization of Other Environmental Issues: Consumers may prioritize other environmental concerns, such as carbon footprints or waste management, over water footprints, due to greater familiarity or perceived urgency.
- Cultural Norms: In many cultures, water use is perceived as an abundant resource, leading to a lower perceived urgency for managing water footprints.
- Behavioral Resistance: People may be resistant to changing their behaviors or consumption patterns due to lack of awareness or perceived inconvenience.

Implications of Low Awareness

• Unsustainable Practices: Low awareness can lead to continued engagement in water-intensive and unsustainable practices, exacerbating issues like water scarcity and pollution.
• Ecosystem Degradation: Without understanding the broader impact of water use, ecosystems may suffer from over-extraction and pollution, affecting biodiversity and ecosystem services.
• Weak Policy Support: Policymakers may find it challenging to garner support for water management policies if the public does not recognize the importance of water footprinting.
• Inadequate Regulations: The lack of public pressure can result in insufficient regulations and enforcement related to water use and conservation.
• Increased Costs: Unsustainable water practices can lead to higher costs for water treatment and management, impacting both businesses and consumers.
• Resource Scarcity: Overuse and pollution of water resources can result in resource scarcity, affecting agricultural yields, industrial productivity, and overall economic stability.
• Water Quality Issues: Polluted water sources due to inefficient practices can lead to health problems, particularly in vulnerable communities.
• Social Inequality: The impacts of water mismanagement can disproportionately affect marginalized communities, exacerbating social inequalities.

Moving Forward: To address the awareness gap in water footprinting, several strategies can be employed:
1. Educational Initiatives: Integrating water footprinting concepts into educational programs and public awareness campaigns can help build a foundational understanding of water use and sustainability.
2. Enhanced Transparency: Providing clear and accessible information about the water footprint of products and services can empower consumers to make more informed choices.
3. Media Engagement: Using engaging and relatable media formats to explain water footprinting and its implications can help reach a broader audience.
4. Community Involvement: Encouraging community-based initiatives and local action groups can promote awareness and practical solutions for managing water resources.

Unveiling the Water Footprint of Coffee: A Study on the Water Use from Farm to Mug:

Measuring the water footprint of a cup of coffee involves evaluating the total amount of water used in its production from start to finish. This includes not just the water directly used to brew the coffee but also the water used in the entire supply chain. Here's a step-by-step approach to measure it:

1. Identify the Components of the Water Footprint:
- Green Water: Rainwater used by the coffee plant.
- Blue Water: Surface and groundwater used in irrigation and processing.
- Grey Water: Water required to dilute pollutants (e.g., water used in cleaning and processing).

2. Calculate Water Use in Coffee Production:
a. Water Used for Growing Coffee Beans: Determine the average water requirement per kilogram of coffee beans. This varies by region, coffee variety, and growing practices. For instance, it takes approximately 1,200 to 2,400 liters of water to produce 1 kilogram of green coffee beans.
b. Water Used in Processing: Include water used for washing and processing the coffee beans after harvesting. This can be significant, especially in wet processing methods.
c. Water Used in Roasting and Grinding: Typically, this is a minor component but still worth including if data is available.

3. Convert to a Single Cup: Estimate the amount of green coffee beans needed for one cup. A standard cup of coffee generally uses about 10-12 grams of coffee beans. Calculate the total water footprint of these 10-12 grams based on the data from the previous steps.

4. Include Brewing Water: Measure the amount of water used to brew one cup of coffee. This is usually about 180-240 milliliters (ml) per cup.

5. Sum Up the Water Footprint: Combine the water used in growing, processing, roasting, grinding, and brewing.

Example Calculation for Bean to Brew:

1. **Water to Grow Beans:** Average: 1,500 liters/kg of beans. For 10 grams (0.01 kg): 15 liters.
2. **Water for Processing:** Estimate around 0.5 liters of water per gram of beans. For 10 grams: 5 liters.
3. **Water for Roasting and Grinding:** Estimate: 0.1 liters for simplicity.
4. **Brewing Water:** 0.24 liters.
5. **Total Water Footprint per Cup:** Total = 15 liters (growing) + 5 liters (processing) + 0.1 liters (roasting) + 0.24 liters (brewing) = 20.34 liters.

The water footprint of a cup of coffee can be quite high when considering the entire supply chain. The water footprint of a single cup of coffee can range from 30 to over 100 liters, depending on the methods and efficiencies in each stage of production. This figure emphasizes the need for sustainable practices in coffee farming and processing to reduce the overall water impact. This calculation can vary based on specific practices, coffee type, and location.

The Hidden Water Cost of a Smartphone

Every smartphone in our hands comes with a hidden water cost known as "virtual water." Virtual water refers to the amount of water embedded in the production and supply chain of a product. For a smartphone, this cost is substantial, as water is used at nearly every stage of its creation, from mining raw materials to manufacturing, assembling, and transporting the final product.

1. **Raw Material Extraction:** The journey of a smartphone begins with the extraction of raw materials like metals and minerals, such as lithium, cobalt, and gold. Mining operations require large amounts of water for cooling, dust suppression, and processing ores. The environmental impact is compounded by the fact that these operations often occur in regions already facing water scarcity.
2. **Manufacturing and Assembly:** Once the raw materials are extracted, they are processed and refined, a step that consumes even more water. The manufacturing process, which includes the production of microchips, circuit boards, and batteries, is incredibly water-intensive. For instance, producing the silicon wafers used in microchips requires ultra-pure water, which is essential for cleaning and maintaining the high precision needed in electronics manufacturing.
3. **Energy Use:** The energy consumed during the manufacturing and assembly stages also carries a virtual water cost. Powering factories, particularly in regions where energy is generated from fossil fuels or hydropower, involves significant water usage, adding to the total virtual water footprint of the device.
4. **Transportation and Packaging:** After manufacturing, smartphones are transported globally, requiring additional resources and energy, which in turn adds to their virtual water footprint. Packaging, often involving plastics and cardboard, also has its own water cost associated with the production of these materials.
5. **End of Life and Recycling:** Even after a smartphone's useful life ends, its impact on water resources continues. If not properly recycled, toxic materials can leach into groundwater, further exacerbating water pollution issues. On the other hand, recycling can help mitigate some of the water costs by reducing the need for new raw materials and the associated water usage.

Calculate the virtual water cost of a smartphone

Calculating the exact virtual water cost of a smartphone can be complex, as it depends on various factors like the model of the smartphone, the production processes used, the geographical location of production facilities, and the sources of energy. However, general estimates and studies provide a broad understanding of the water footprint involved.

Breakdown of Virtual Water Cost

1. **Raw Material Extraction:** Mining for materials such as cobalt, lithium, gold, and rare earth elements is water-intensive. Estimated water use: 10,000 to 20,000 liters.
2. **Manufacturing and Assembly:** This stage includes the production of components like microchips, circuit boards, batteries, and screens. Manufacturing microchips alone is highly water-intensive due to the need for ultra-pure water. Estimated water use: 15,000 to 30,000 liters.
3. **Energy Use:** Energy consumption during manufacturing also carries a water cost. If the energy is generated using hydropower or water-cooled power plants, this adds to the water footprint. Estimated water use: 5,000 to 10,000 liters.
4. **Transportation and Packaging:** Transporting the finished smartphone to global markets involves additional water usage, albeit relatively smaller compared to other stages. Estimated water use: 1,000 to 3,000 liters.
5. **Total Virtual Water Cost Estimate:** Adding these estimates together, the virtual water cost of producing a single smartphone can range between: 31,000 to 63,000 liters of water.

In total, estimates suggest that the production of a single smartphone could require tens of thousands of liters of water. Understanding the concept of virtual water emphasizes the importance of mindful consumption and responsible disposal of electronic devices. Reducing the frequency of smartphone upgrades, opting for devices with longer lifespans, and supporting sustainable manufacturing practices can all contribute to lessening the water footprint associated with our tech-driven lives.

The Hidden Water Cost of Energy

Energy consumption is a fundamental part of modern life, but what often goes unnoticed is the significant amount of water required to produce that energy. This hidden water cost is a crucial factor in understanding the broader environmental impact of our energy choices.

- **Water in Power Generation:** A substantial portion of the water used in energy production goes into cooling steam electric power plants, which are fuelled by coal, oil, natural gas, and nuclear power. These plants rely on water to cool down the steam generated during electricity production, which then gets recycled back into the system. In addition, hydropower plants, which generate electricity by harnessing the energy of flowing water, depend entirely on large volumes of water to operate.

- **Water in Fuel Extraction and Production:** The extraction, refining, and production of fuels like coal, oil, and natural gas are also water-intensive processes. Water is used in fracking to extract natural gas, in mining operations to separate minerals from ores, and in refining oil into usable fuels. These processes not only consume large quantities of water but can also lead to water contamination if not managed properly.
- **Energy Efficiency Equals Water Efficiency:** Given this close relationship between energy and water, wasting energy indirectly results in wasting water. For instance, leaving lights on in an empty room or using inefficient appliances increases energy demand, which in turn requires more water for power generation.

Over the past five decades, the average electricity consumption per person has quintupled. This surge in energy use is not without consequence, as it takes a vast amount of water to produce the electricity that powers our daily lives. Water plays a critical role in cooling steam electric power plants, which rely on coal, oil, natural gas, and nuclear power. Additionally, water is essential for generating hydropower and is heavily utilized during the processes of fuel extraction, refining, and production. This means that when we waste energy, we are also wasting water.

The Bigger Picture:

Zero Water Footprint: Why It's Not Possible

It's important to realize that no one can eliminate their water footprint entirely, as water is essential in the production of nearly everything we consume. However, individual actions can collectively make a significant difference. By choosing energy-efficient appliances, turning off devices when not in use, and supporting renewable energy sources, we can reduce our energy consumption and, by extension, the hidden water cost associated with it. No one can have a water footprint of zero. Water is a fundamental resource required in the creation of almost everything we buy, eat, use, and eventually discard. While individual decisions about energy use may seem minor, their cumulative effect is significant. Small, mindful choices, such as turning off lights when not in use or opting for energy-efficient appliances, can collectively lead to meaningful reductions in water consumption and help mitigate the hidden water cost embedded in our energy use.

The concept of a "zero water footprint" suggests an ideal scenario where no water is consumed or impacted by human activities. However, in reality, achieving a zero water footprint is impossible due to the essential role that water plays in nearly every aspect of life and the economy.

1. **Water as a Fundamental Resource:** Water is indispensable for sustaining life. It is required for drinking, agriculture, sanitation, and countless other daily activities. Every living organism, from plants to animals to humans, relies on water for survival. Even the most basic human activities, like eating and staying hydrated, involve water use. Therefore, it's impossible to eliminate water use entirely.
2. **Embedded Water in Products:** Every product we use has a "virtual water" cost associated with it, meaning water is used at various stages of production. For instance, growing crops requires water, manufacturing goods involves water for cooling and processing, and even energy production—whether from fossil fuels or renewables—requires water. From food to clothing to electronics, everything has a water footprint. Thus, completely eliminating water use in production and consumption is not feasible.
3. **Water in Energy Production:** Water is crucial in the energy sector. Power plants, especially those that rely on steam to generate electricity (like coal, nuclear, and natural gas plants), use vast amounts of water for cooling. Even renewable energy sources like hydropower depend on water. Given that energy is fundamental to modern life, a zero water footprint would mean a complete cessation of energy production—a clearly impractical scenario.
4. **Agriculture and Food Production:** Agriculture, which provides food for the global population, is the largest consumer of water worldwide. Crops and livestock require water to grow, and this water use is essential for feeding billions of people. Even with the most efficient irrigation systems and water-saving technologies, water use in agriculture cannot be reduced to zero.
5. **Water for Sanitation and Health:** Clean water is essential for sanitation and public health. Water is needed for bathing, cleaning, and ensuring hygiene. Reducing water use in these areas to zero would lead to severe health crises, as access to clean water is fundamental for preventing disease and maintaining public health.
6. **Environmental Water Needs:** Natural ecosystems require water to thrive. Rivers, lakes, wetlands, and forests depend on adequate water supplies to support biodiversity and maintain ecological balance. A zero water footprint would imply no water left for ecosystems, leading to the collapse of natural habitats and a loss of biodiversity.
7. **Unavoidable Water Losses:** In many processes, some water is inevitably lost through evaporation, absorption, or contamination. For example, water used in irrigation often evaporates before it reaches the crops, and water used in industrial processes may become polluted and unusable. These losses are unavoidable, further underscoring why a zero water footprint is unattainable.

While the goal of reducing our water footprint is crucial for sustainability, a zero water footprint is an impractical ideal. Water is an essential resource that permeates every aspect of life, from personal needs to industrial processes and environmental sustainability. The focus, therefore, should be on minimizing our water footprint as much as possible by using water more efficiently, reducing waste, and protecting water sources, rather than aiming for the impossible goal of eliminating water use entirely.

Strategies for Reducing Water Footprint

Reducing your water footprint involves making mindful choices in various aspects of daily life, from personal habits to consumer decisions. some effective strategies are explained below:

- Fix Leaks: A dripping faucet or leaking toilet can waste a significant amount of water over time. Regularly check and repair leaks.
- Install Water-Saving Devices: Use low-flow showerheads, faucets, and dual-flush toilets to reduce water consumption without compromising on functionality.
- Shorten Showers: Reducing shower time by even a minute can save gallons of water each day.
- Use a Dishwasher: Running a full load in a modern dishwasher typically uses less water than washing dishes by hand.
- Choose Native Plants: Plant native or drought-resistant plants that require less water to thrive in your region.
- Water Wisely: Water your garden in the early morning or late evening to minimize evaporation. Use drip irrigation systems to target water directly to the plant roots.
- Mulching: Apply mulch to garden beds to retain soil moisture and reduce the need for frequent watering.
- Reduce Meat Consumption: Meat production, especially beef, has a high water footprint. Consider reducing meat consumption or opting for plant-based meals more often.
- Eat Seasonal and Local: Buying seasonal and locally-produced food reduces the water footprint associated with transporting and growing food in less suitable climates.
- Minimize Food Waste: Plan meals and store food properly to avoid wastage. Remember, wasted food represents wasted water.
- Buy Less, Choose Wisely: Reduce overall consumption by buying fewer, higher-quality items that last longer. This reduces the water footprint associated with manufacturing and waste.
- Opt for Recycled Products: Choose products made from recycled materials, as they typically require less water to produce than those made from virgin resources.
- Support Water-Efficient Brands: Research and support companies that use water-efficient practices in their production processes.
- Use Energy-Efficient Appliances: Energy production often involves significant water use. By using energy-efficient appliances, you reduce both energy and water consumption.
- Turn Off Lights and Electronics: Reducing energy use indirectly reduces the water footprint associated with energy production.
- Consider Renewable Energy: Solar and wind energy have lower water footprints compared to fossil fuel-based energy sources.
- Drive Less, Walk or Bike More: The production and refinement of fuel involve substantial water use. By driving less, you reduce your indirect water footprint.
- Choose Fuel-Efficient Vehicles: If driving is necessary, opt for fuel-efficient or electric vehicles to minimize water-intensive fuel consumption.
- Raise Awareness: Educate others about the importance of reducing water footprints and share tips for water conservation.
- Support Water-Smart Policies: Advocate for policies and initiatives that promote water conservation, such as regulations on industrial water use or incentives for water-saving technologies.
- Turn Off Taps: Avoid leaving the tap running while brushing teeth, shaving, or washing dishes.
- Full Loads Only: Run washing machines and dishwashers only when they have full loads to maximize water efficiency.
- Reuse Water: Collect and reuse greywater (e.g., water from washing vegetables) for watering plants or other non-drinking purposes.
- Encourage Sustainable Practices: Support businesses that implement sustainable water management practices, such as recycling water or reducing water usage in their supply chains.
- Corporate Water Audits: Companies can conduct water audits to identify areas where water use can be reduced, such as in cooling systems or during manufacturing processes.
- Invest in Water-Saving Technologies: Support or adopt new technologies that reduce water use, such as advanced irrigation systems, water-efficient appliances, and greywater recycling systems.
- Smart Metering: Use smart water meters to track water usage in real-time and identify areas where water can be conserved.

Reducing your water footprint requires a combination of personal responsibility, smart consumer choices, and support for sustainable practices in industries. By adopting these strategies, you contribute to the conservation of one of our most vital resources, ensuring that water remains available for future generations.

Save With the Three Rs:

The principle of "Reduce, Reuse, Recycle" is essential in the fight to conserve water, a precious resource that is increasingly under pressure. This adage holds particular relevance when considering the vast amounts of water required to produce the consumer goods we use daily. Many of these products are designed for single use, contributing to the growing problem of waste, which often ends up in landfills, oceans, or scattered across our landscapes.

• **Reduce:** The first and most impactful step is to reduce our consumption. By buying fewer products, we directly decrease the demand for their production, which in turn reduces the water used in manufacturing. This approach also helps combat the culture of overconsumption, where items are quickly discarded and replaced. By choosing quality over quantity and focusing on necessities, we can significantly lessen our water footprint.

• **Reuse:** The next step is to maximize the use of the products we already own. Reusing items whenever possible extends their life and delays the need for new products. Simple actions like using a reusable water bottle instead of buying single-use plastic bottles, or repurposing old containers for storage, can make a considerable difference. Reuse not only conserves water but also reduces waste and the energy required to produce new goods.

• **Recycle:** Recycling is the third pillar, and it plays a crucial role in water conservation. Recycling materials like paper, plastic, and metals reduces the need for raw materials and the water-intensive processes required to produce them. For example, recycling just one pound of paper saves 3.5 gallons of water. While recycling is important, it should be viewed as a last resort after reducing and reusing, as the recycling process itself still consumes water and energy.

Small changes in our daily habits, such as reducing our consumption, reusing items, and recycling whenever possible, collectively make a significant impact on conserving water. By embracing the Three Rs, we contribute to a more sustainable future where water resources are preserved for generations to come. The principle of "reduce, reuse, recycle" is more crucial than ever in light of the significant water and other resources required to produce the vast array of consumer goods. Many of these products are designed for single use, leading to an accumulation of waste in landfills, pollution in oceans, and litter across landscapes. By purchasing fewer items, we directly decrease the demand for product manufacturing, which in turn reduces the amount of water consumed by the factories that produce them. Additionally, recycling plays a vital role in conserving water. For instance, in 2012, the United States discarded over 24 million tons of paper and nearly 29 million tons of plastic—both of which require substantial amounts of water to produce but can be effectively reused or recycled. Recycling just one pound of paper, equivalent to a typical daily newspaper, saves approximately 3.5 gallons of water.

Everyday actions, such as recycling at home, reusing items whenever possible, and minimizing the use of plastic bags and paper towels, may seem small but collectively contribute to significant water savings. The most impactful strategy, however, is to curb overconsumption by reducing the need for new products. Avoiding disposable, low-quality items destined for the trash makes a substantial difference. Opting for used or thrifted items, especially clothing, or choosing high-quality, durable products that are reusable and recyclable when new purchases are necessary, are the most sustainable choices we can make to conserve water.

Conclusion

Water footprinting offers a valuable framework for assessing the comprehensive water use associated with the production of goods and services. By incorporating green, blue, and grey water measurements, it provides a holistic view of how human activities impact freshwater resources. However, the effectiveness of water footprinting in driving change is hindered by widespread lack of awareness among the public. To overcome this challenge, it is essential to enhance educational efforts, increase transparency about water use, and engage communities in water conservation practices. As awareness grows and more people understand the significance of their water footprint, it becomes possible to make more informed choices, adopt sustainable practices, and ultimately contribute to the preservation of vital water resources.

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