

This presentation helps students appreciate the value of water on Earth, the many ways humans use water, how humans can conserve water, and how students' personal water habits matter in terms of a larger ecology. The presentation also sets up the focus of this course—water footprints. With this presentation, students begin to understand that a water footprint is an invaluable tool for identifying patterns of water use so that individuals, businesses, and even nations can more effectively manage their use of one of the most precious resources on Earth: water.

### **Presentation Objectives**

- Describe the availability of water on Earth.
- Describe several ways that people use water.
- Differentiate between direct and indirect (or virtual) water.
- Give examples of ways we can conserve water (directly and virtually).
- Explain how a water footprint can help contribute to the better management of our water resources.
- Explain how GRACE's Water Footprint Calculator can be used to measure one's water footprint.

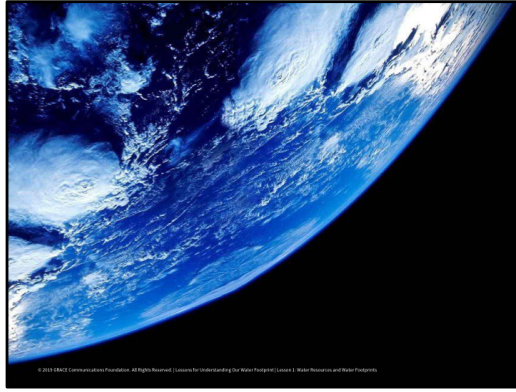
### **CREDITS**

#### *Resources:*

GRACE Communications Foundation. (n.d.). Find your water footprint and learn how to save water. Retrieved from <https://www.watercalculator.org/intro>

GRACE Communications Foundation. (2018). Water footprint calculator [Home page]. Retrieved from <https://www.watercalculator.org/>

*Image:* Adobe Stock: SNEHIT: Glacier National Park, Montana



## Objective

- Describe the availability of water on Earth.

## Suggested Teaching Strategy

Ask students: Why do you think Earth is often called the “water planet”? Explain that when viewing Earth from outer space, much of what we see is water. About 71 percent of Earth’s surface is covered with water. Ask: How much of that water is in the form of salt water? (*Most of it—about 97.5 percent*) Ask: How much is in the form of freshwater? (*Not very much—about 2.5 percent*) And of that freshwater, how much is accessible for human consumption? (*About one percent—the rest is frozen in glaciers and ice caps or locked underground.*) So where does that leave us?

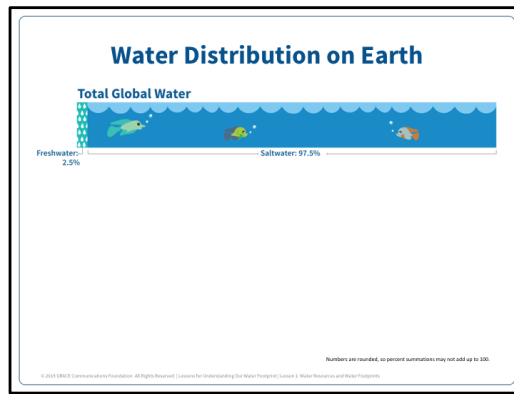
## CREDITS

### Resources:

USGS Water Science School. (2016, December 2). The world’s water. U.S. Geological Survey. Retrieved from <https://water.usgs.gov/edu/earthwherewater.html>

Van der Pluijm, Ben. (2018). World’s fresh water supply. Retrieved from <http://resilience.earth.lsa.umich.edu/units/freshwater/index.html>

*Image:* Scupham, B. (2012, July 28). Earth. Creative Commons. Attribution 2.0 Generic. Retrieved from <http://tinyurl.com/flickr-scupham-earth>



## Objective

- Describe the availability of water on Earth.

## Suggested Teaching Strategy

Use the next three pages to help students understand why so little water is available for human consumption. The graphic on this first page shows how little water is available as freshwater compared to oceans and other salt water. After students have had a moment to think about this, move to the next page.

## CREDITS

### Resources:

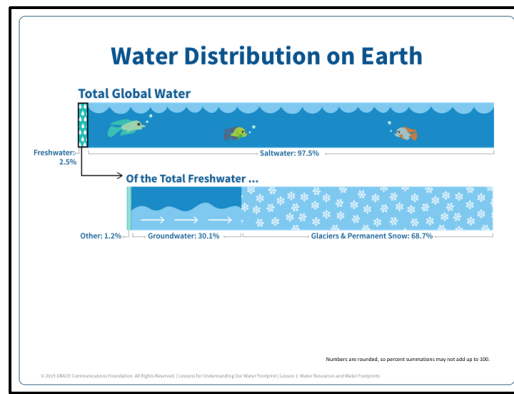
Shiklomanov, I. A. (1993) World fresh water resources. In P. H. Gleick (Ed.), *Water in crisis: A guide to the world's fresh water resources* (pp. 13-24). New York, NY: Oxford University Press.

United Nations Environment Programme. (2016). *Global environment outlook: 6 regional assessments*. Retrieved from <https://www.unenvironment.org/resources/global-environment-outlook-6-regional-assessments>

UN WWAP hosted by UNESCO. (2015, October 30). Where is water? – The water rooms #2 [Video file]. Retrieved from <https://www.youtube.com/watch?v=b1f-G6v3voA&feature=youtu.be>

USGS Water Science School. (2016, December 2). The world's water. U.S. Geological Survey. Retrieved from <https://water.usgs.gov/edu/earthwherewater.html>

Image: EcoRise. <http://ecorise.org>



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- Describe the availability of water on Earth.

## Suggested Teaching Strategy

Point out that this page shows an addition to the graphic students saw on the previous page. Ask students to explain what this new element of the graphic shows. (*The second bar takes from the first bar the small portion that indicates freshwater and enlarges it to demonstrate how much freshwater is locked up in unusable places.*) After students have had a chance to think about this for a moment, move to the next page.

## CREDITS

### Resources:

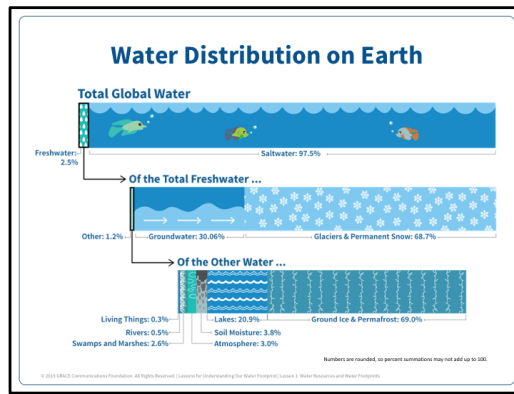
Shiklomanov, I. A. (1993) World fresh water resources. In P. H. Gleick (Ed.), *Water in crisis: A guide to the world's fresh water resources* (pp. 13-24). New York, NY: Oxford University Press.

United Nations Environment Programme. (2016). *Global environment outlook: 6 regional assessments*. Retrieved from <https://www.unenvironment.org/resources/global-environment-outlook-6-regional-assessments>

UN WWAP hosted by UNESCO. (2015, October 30). Where is water? – The water rooms #2 [Video file]. Retrieved from <https://www.youtube.com/watch?v=b1f-G6v3voA&feature=youtu.be>

USGS Water Science School. (2016, December 2). The world's water. U.S. Geological Survey. Retrieved from <https://water.usgs.gov/edu/earthwherewater.html>

Image: EcoRise. <http://ecorise.org>



## Objective

- Describe the availability of water on Earth.

## Suggested Teaching Strategy

Share with students that this page adds a third bar to the graphic shown on the previous two pages. Explain that this bar shows the amount of water that humans can actually use—but even that water is limited. To give them a better look, flip to the next page.

## CREDITS

### Resources:

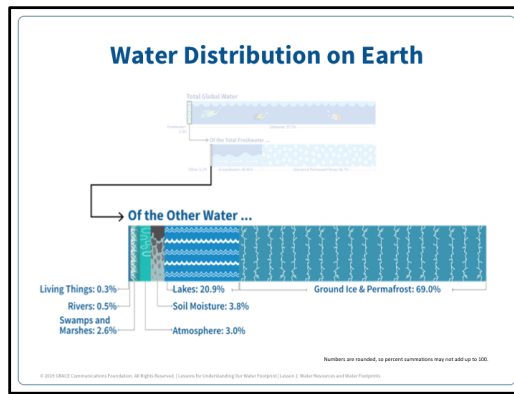
Shiklomanov, I. A. (1993) World fresh water resources. In P. H. Gleick (Ed.), *Water in crisis: A guide to the world's fresh water resources* (pp. 13-24). New York, NY: Oxford University Press.

United Nations Environment Programme. (2016). *Global environment outlook: 6 regional assessments*. Retrieved from <https://www.unenvironment.org/resources/global-environment-outlook-6-regional-assessments>

UN WWAP hosted by UNESCO. (2015, October 30). Where is water? – The water rooms #2 [Video file]. Retrieved from <https://www.youtube.com/watch?v=b1f-G6v3voA&feature=youtu.be>

U.S. Geological Survey. (n.d.). Water use in the United States. Retrieved from <http://water.usgs.gov/watuse/>

Image: EcoRise. <http://ecorise.org>



## Objective

- Describe the availability of water on Earth.

## Suggested Teaching Strategy

Ask students: Of the types of water shown in this final bar, how much can we actually use? (*Not much! Most of the water used for human consumption comes from lakes and rivers, as well as a smaller amount from groundwater.*) So that means that about one percent of all the water on Earth is available for us to use. Let students think about that for a moment.

Explain to students that the water we use has been around in one form or another for billions of years—since long before dinosaurs roamed the earth! Ask: What has changed during that time? (*Humans have evolved, and the human population has exploded and continues to grow rapidly.*)

Ask: What have you learned from these graphics about the amount of freshwater that is available to humans for drinking, cooking, bathing, recreation, growing food, and keeping ourselves healthy? (*It has remained essentially the same even though the human population keeps growing. We can't drink salt water, and most of the freshwater on Earth is trapped in ice and snow or polluted or contaminated, so we can't consume it. About one percent of Earth's water resources are available to meet the needs of billions of people.*) Explain that Earth's water supply is fixed, but human demand for water resources grows stronger and stronger each year.

## CREDITS

### Resources:

Shiklomanov, I. A. (1993) World fresh water resources. In P. H. Gleick (Ed.), *Water in crisis: A guide to the world's fresh water resources* (pp. 13-24). New York, NY: Oxford University Press.

United Nations Environment Programme. (2016). *Global environment outlook: 6 regional assessments*. Retrieved from <https://www.unenvironment.org/resources/global-environment-outlook-6-regional-assessments>

UN WWAP hosted by UNESCO. (2015, October 30). Where is water? – The water rooms #2 [Video file]. Retrieved from <https://www.youtube.com/watch?v=b1f-G6v3voA&feature=youtu.be>

USGS Water Science School. (2016, December 2). The world's water. U.S. Geological Survey. Retrieved from <https://water.usgs.gov/edu/earthwherewater.html>

Image: EcoRise. <http://ecorise.org>



## Objective

- Describe the availability of water on Earth.

## Suggested Teaching Strategy

Ask: What happens when the demand for water exceeds water supplies? (*Water shortages might occur.*) Explain that a drought is an extended period in which a region receives less-than-expected precipitation (rain or snow) over a certain period of time. During a drought, water supplies from surface water or groundwater could be reduced because of extended dry climate conditions, because of excessive human consumption, or because of some combination of both. Droughts can last for months or years; if conditions are serious enough, a drought may even be declared after a few weeks.

Ask: What might be some of the consequences of a serious drought? (*Students will likely have a wide range of answers. You may wish to organize them on the board according to categories such as the following: Environmental, Agricultural, Health, Economic, and Social.*) Ask: Do you think some groups of people are more vulnerable than others to the effects of drought? (*Yes. Farm workers, for example, may lose their source of income during times of drought. In addition, people who rely on crops that are grown in drought-prone areas as a major food source are highly vulnerable to famine.*) How might drought affect almost everyone—even people far from the drought? (*A variety of costs could go up across an extended region—such as the cost of fruits, vegetables, and grains or the costs of water and electricity.*)

Explain that a drought can also reduce the quality of water, because lower water flows reduce the pollutant dilution and increase the contamination of remaining water sources.

Do research in advance or have students do research to determine if drought is now or ever has been a problem in your region. If it is a problem, how does it compare to droughts in the past? Is it more serious? Are there more frequent droughts? What do experts think might be the cause of droughts in your area? The [United States Drought Monitor](https://droughtmonitor.unl.edu/) is a great resource for checking to see if your region is currently experiencing a drought.

## CREDITS

### Resources:

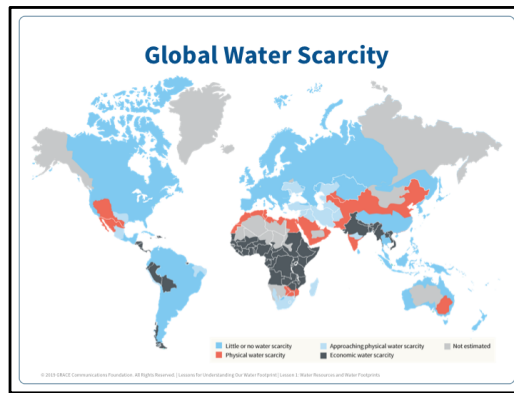
GRACE Communications Foundation. (2018, October 10). Drought or deluge: Different threats, same problems. <https://www.watercalculator.org/water-use/drought-deluge-threats-problems/>

GRACE Communications Foundation. (2018, October 11). The impact of climate change on water resources. Retrieved from <https://www.watercalculator.org/water-use/climate-change-water-resources/>

National Drought Mitigation Center. (n.d.) United States drought monitor. Retrieved from <https://droughtmonitor.unl.edu/CurrentMap.aspx>

National Drought Mitigation Center. (n.d.) What is drought? Retrieved from <https://drought.unl.edu/Education/DroughtforKids/WhatisDrought.aspx>

Image: Adobe Stock: wokr10



## Objective

- Describe the availability of water on Earth.

## Suggested Teaching Strategy

Explain that water scarcity is a growing problem. As the human population grows, we put ever-increasing demands on limited supplies. This means that the cost and effort to build or even maintain access to water will increase. In addition, water's importance to political and social stability will increase.

Ask: What do you think of when you hear the term “water scarcity”? Explain that most people probably think the term refers to not having enough water. It can refer to a lack of a sufficient *quantity* of water to serve a given population. In addition, the phrase can refer to a lack of *water quality*, or a shortage of clean, drinkable water.

In areas that have dry climates or are drought stricken, lack of water is a huge problem. There simply isn't enough to serve the people who need it. This condition is known as *physical scarcity*.

Where finding a reliable source of safe water is time consuming and expensive, economic scarcity results. With *economic scarcity*, plenty of water may be available, but getting rid of contaminants in the water and transporting it to where it is needed most is too expensive to be practical.

## Group Activity

Have students analyze and discuss the world map and what it shows. Then discuss with the class whether they feel concerned and why, based on what the map reveals. If your area does not show water scarcity, ask if students think water scarcity in other areas of the country or the world might affect them. Also encourage them to consider that global water demand is growing at a significant rate, so this map could show even more red and black areas in a decade or two.

## CREDITS

Resources:

UNESCO. (2014). *The United Nations world water development report 2014*. Retrieved from <http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/2014-water-and-energy/>

UNESCO. (2018). *The United Nations world water development report 2018*. Retrieved from <http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/2018-nature-based-solutions/>

UN Water. (n.d.). Water scarcity. United Nations. Retrieved from <http://www.unwater.org/water-facts/scarcity/>

Image: Design City Media & Advertising Lab. [www.designcity.com.mx](http://www.designcity.com.mx)





## Objective

- Describe the availability of water on Earth.

## Suggested Discussion Topic

The world's population is expected to reach 8.6 billion by 2030. Our use of water worldwide is growing even faster. In 2025, people in developed countries are projected to withdraw about 18 percent more water than they do now. In developing countries, people are expected to withdraw around 50 percent more water than they do now. Because economic and societal development depends on greater use of clean water, every sector from domestic to agriculture to manufacturing to energy requires improved water access, which leads to an increase in withdrawals. This is a serious concern.

According to UN Water, an agency at the United Nations that focuses on freshwater issues, by 2025, 1.8 *billion* people will be living in countries or regions with absolute water scarcity (the extremely low amount of 500 m<sup>3</sup> per person per year), and two-thirds of the world population could be living under water-stressed conditions. (Water stress occurs when the demand for water exceeds the amount of appropriate quality water that is available during a certain period.) Encourage students to think about that for a minute.

## CREDITS

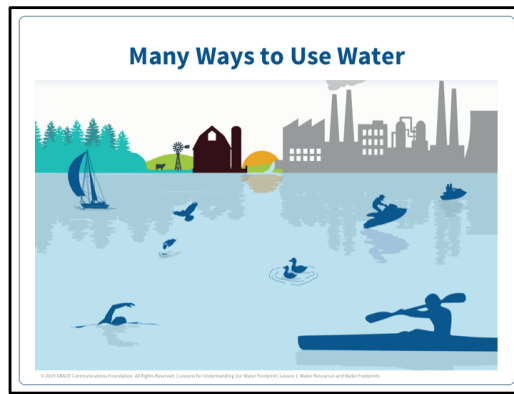
### Resources:

Food and Agriculture Organization of the United Nations (FAO). (n.d.) Absolute water scarcity. Retrieved from <http://www.fao.org/nr/water/aquastat/data/glossary/search.html?termId=7566&submitBtn=s&cls=yes>

United Nations Development Programme. (2006). *Human development report 2006*. Retrieved from <http://tinyurl.com/y4sbo9t8>

UN Water. (n.d.). Water scarcity. United Nations. Retrieved from <http://www.unwater.org/water-facts/scarcity/>

*Image:* Adobe Stock: marchello74: Chicago skyline aerial view



## Objective

- Describe several ways that people use water.

## Suggested Teaching Strategy

Explain that people use water in many different ways. Tell students to suppose that this illustration shows a lake. Ask them to describe some of the different ways this one water source is being used. *(The water is being used by humans for recreation. For the fish and ducks, the lake is where they live and feed. The farm is withdrawing water to nourish crops and cattle and process grain. The factory is likely withdrawing water at the beginning of the industrial process and then releasing waste water at the end of the process.)* So this illustration shows many—but by no means all—ways that humans use water.

Water has always influenced where human development occurs. Humans need water for so many purposes that it influences how an area develops in a tangible way. Ideally, people would move into areas with adequate water supplies, but that's not always the case. Ask: Why might some people live in areas without adequate water supplies? *(Sample answer: Perhaps they moved to an area that was developed when water resources were more available or when water could be easily obtained for the area. But that might not have been sustainable in the long term.)* Ask: What do you think happens when water resources are limited? *(If the water demand grows so great that it exceeds the available supply, people must change or reduce the way they use those resources.)*

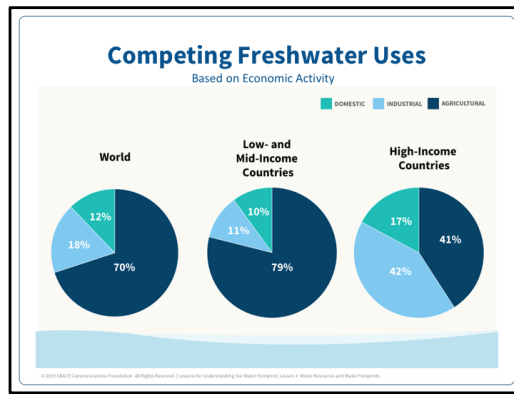
## CREDITS

Resources:

U.S. Geological Survey. (n.d.). Water use in the United States. Retrieved from <http://water.usgs.gov/watuse/>

USGS Water Science School. (n.d.). Total water use in the United States, 2010. U.S. Geological Survey. Retrieved from <https://water.usgs.gov/edu/wateruse-total.html>

Image: EcoRise. <http://ecorise.org>



## Objective

- Describe several ways that people use water.

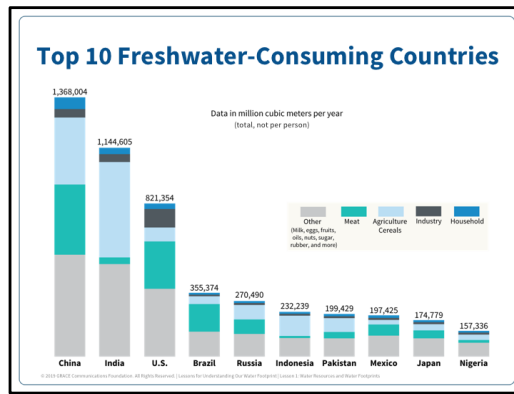
## Suggested Teaching Strategy

Point out that when comparing how we use resources across nations, it is helpful to use the three general categories of Domestic, Industrial, and Agricultural. Have students analyze this graphic to explain what it shows. *(It shows that high-income countries split most of their water resources between agricultural and industrial purposes, but low- and mid-income countries use most of their water resources solely for agricultural purposes.)*

## CREDITS

*Resource:* World Bank. (2012). World development indicators 2012 (p. 156). Washington, D.C: International Bank for Reconstruction and Redevelopment. Retrieved from <https://openknowledge.worldbank.org/handle/10986/2315>

*Image:* EcoRise. <http://ecorise.org>



## Objective

- Describe several ways that people use water.

## Suggested Teaching Strategy

Share with students that this graphic shows how much freshwater consumption varies in different parts of the world. Ask: Why do you think China and India might be among the largest consumers of freshwater (in total, not per person)? (*Sample answer: They have very large human populations, so even if each individual uses only a small amount of water, all together they consume a great deal.*)

Ask: Why do you think the United States is near the top of the list? (*Because United States residents have easy access to water and high average per-person use.*) Explain that the United States is a developed nation, which from the early to mid-20th century made public policy decisions and financial investments that supported reliable access to clean water for most Americans. This infrastructure is now aging, however, and in need of upgrades and reinvestment.

## CREDITS

### Resources:

Fischetti, M. (2012, June 1). Which nations consume the most water? *Scientific American*, p. 306. Retrieved from <http://www.scientificamerican.com/article/water-in-water-out/>

Hoekstra, A. Y., & Mekonnen, M. M. (2012, February 28). The water footprint of humanity. *Proceedings of the National Academy of Sciences of the United States of America*, 109(9): 3232–3237. Retrieved from <https://waterfootprint.org/media/downloads/Hoekstra-Mekonnen-2012-WaterFootprint-of-Humanity.pdf>

Image: Design City Media & Advertising Lab: [www.designcity.com.mx](http://www.designcity.com.mx)



## Objective

- Describe several ways that people use water.

## Suggested Teaching Strategy

Explain that this slide shows the primary categories of human water use in the United States according to the United States Geological Survey (USGS). Encourage students to discuss each category, providing additional examples as relevant. You can share these percentages of Water Use (withdrawals) in the United States per the USGS: Public Supply: 12%; Domestic (self supply): 3%; Irrigation: 37%; Thermoelectric power: 41%; Industrial: 5%; Mining: 1%; Livestock: 1%; and Aquaculture: 2%.

If your class is not in the United States, or if you have students who have lived in other countries, encourage them to discuss what they believe to be the primary categories in that country/those countries. You could also suggest that students do research to find the primary categories of water use in their home country. Alternatively, if you are not in the United States, you might prefer to replace this slide with one that reflects your country's major categories.

## Activity

Encourage students to combine these eight categories into just three: Agricultural, Industrial, and Domestic. (*Agricultural: Livestock, Aquaculture, and Irrigation; Industrial: Thermoelectric power, Industrial, and Mining; Domestic: Public Supply, Domestic.*)

## CREDITS

*Resource:* U.S. Geological Survey. (n.d.). Water use in the United States. Retrieved from <http://water.usgs.gov/watuse/>

### *Images:*

Top row, left to right: Adobe Stock: Bogdan Wankowicz; Pexels.com: rawpixel; Adobe Stock: Herr Loeffler; Adobe Stock: Alfredo

Bottom row, left to right: Adobe Stock: romaset; Adobe Stock: Pixaterra; Adobe Stock: Buffy1982; Adobe Stock: Spiritofamerica



### **Objective**

- Describe several ways that people use water.
- Differentiate between direct and indirect (or virtual) water.

### **Suggested Teaching Strategy**

Share with students that it is helpful to think of how we use water in terms of whether we use it directly or indirectly. Direct water use is when water is used directly, such as by turning on a tap, flushing a toilet, running a washing machine, or using a water hose. Explain that when we start thinking about conserving water, we tend to think first about reducing our direct water consumption. Explain that washing dishes by hand is an example of using water directly.

### **CREDITS**

*Resource:* GRACE Communications Foundation. (2017, May 13). What is a water footprint? Retrieved from <https://www.watercalculator.org/footprints/what-is-a-water-footprint/>

*Image:* Adobe Stock: Marjan Veljanoski



### **Objective**

- Describe several ways that people use water.
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### **Suggested Teaching Strategy**

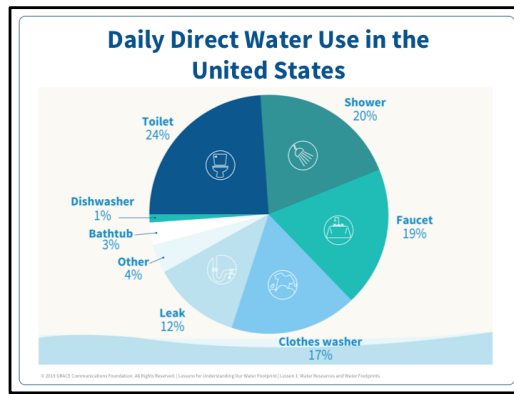
Point out that indirect water use is also known as virtual water use. Ask students: What might make the image on the previous page an example of direct water use and the image here an example of virtual water use? *(The person on the previous page is using water directly to wash cutlery. The cows here are eating feed that requires a lot of water and those cows could one day become food that people eat or leather for products people use. So when we use those products that came from cows, we are consuming water virtually (i.e., indirectly) because those cows required a lot of water to produce.)*

Explain that when we start thinking about conserving water, we tend to think first about reducing our direct water consumption, but virtual water is the largest portion of a person's water use because globally, water for food makes up the largest part of the water most people use.

### **CREDITS**

*Resource:* GRACE Communications Foundation. (2017, May 13). What is a water footprint? Retrieved from <https://www.watercalculator.org/footprints/what-is-a-water-footprint/>

*Image:* Adobe Stock: SGr



## Objective

- Describe several ways that people use water.
- Differentiate between direct and indirect (or virtual) water.

## Suggested Teaching Strategy

Share with students that according to the U.S. Environmental Protection Agency (USEPA), each individual in the United States uses an estimated 303–379 L (80–100 gal.) of water per day of direct water use. Tell students: You might think this average only relates to people with huge, green lawns, but consider that roughly 70 percent of water use consumption in the United States occurs indoors.

Then ask students to guess how much *virtual* water they think the average person in the United States might use, keeping in mind that the U.S. is one of the biggest water consuming nations on the planet. (*The average person in the U.S. uses 2,207 L (583 gal.) of water per day to buy, use, and throw away consumer goods, such as clothing, electronics, and other household goods. And that doesn't include food, which we will discuss shortly.*)

## CREDITS

### Resources:

Chapagain, A. K., & Hoekstra, A. Y. (2004, November). *Water footprints of nations: Volume 1: Main report*. UNESCO-IHE. Retrieved from <https://waterfootprint.org/media/downloads/Report16Vol1.pdf>

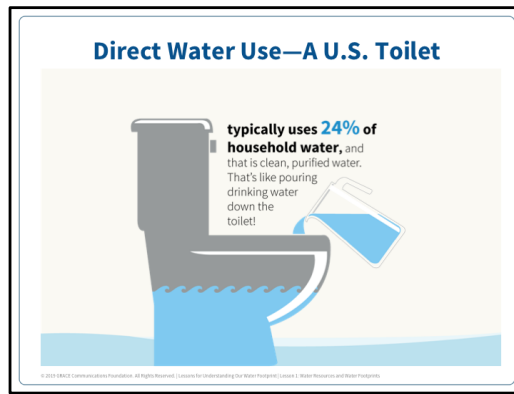
GRACE Communications Foundation. (2018, October 12). How the United States uses water. Retrieved from <https://www.watercalculator.org/footprints/how-united-states-uses-water/>

U.S. Environmental Protection Agency. (n.d.). How we use water: Water in daily life. Retrieved from <https://www.epa.gov/watersense/how-we-use-water#Daily%20Life>

Water Research Foundation. (2016, April). *Residential end uses of water, version 2: Executive report*. Retrieved from [www.waterrf.org/4309](http://www.waterrf.org/4309)

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## Objective

- Describe several ways that people use water.
- Differentiate between direct and indirect (or virtual) water.

## Suggested Teaching Strategy

Ask students: Does this illustration show an example of direct or virtual water use? (*direct*) Why? (*because we are using water directly when we flush the toilet*) Explain that direct water use is water use that we see and/or feel. What might be an example of virtual water use associated with a toilet? (*the water needed to make the toilet; the water a local utility uses to process water after it has been flushed*)

Encourage students to share their ideas about what they think the image might mean. Explain that in many industrialized countries like the United States, our water systems often use clean, safe drinking water for sewage disposal. It's not like that in other parts of the world. Nearly 2.1 billion people in the world lack access to safe, readily available water at home. That's 3 out of every 10 people. Another 4.5 billion do not have access to safely managed human waste. That's 6 out of every 10 people. In some countries, people defecate in open fields or near the same rivers they drink from and wash in. Exposure to soil and water contaminated with human feces can lead to life threatening diarrhea and serious illnesses, such as cholera, typhoid, and intestinal hookworms. Approximately 3.3 million people around the world (mostly children under the age of five) die each year due to complications from poor water and sewage systems.

## CREDITS

Resources:

Rosenberg, T. (2010, April 1). The burden of thirst. *National Geographic*. Retrieved <https://www.nationalgeographic.com/magazine/2010/04/our-thirsty-world/>

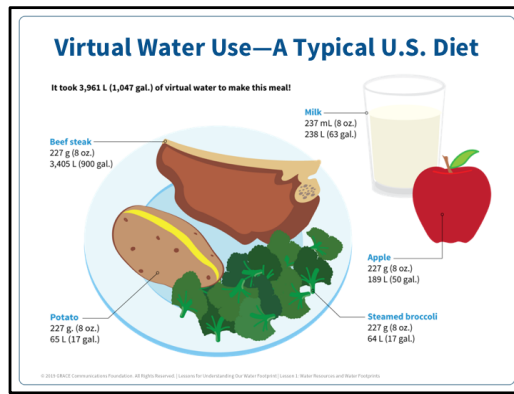
UNICEF USA. (n.d.). Child survival: Water and sanitation. Retrieved from <https://www.unicefusa.org/mission/survival/water>

UN Water. (n.d.). Water, sanitation and hygiene. United Nations. Retrieved from <http://www.unwater.org/water-facts/water-sanitation-and-hygiene/>

U.S. Environmental Protection Agency. (n.d.). How we use water: Water in daily life. Retrieved from <https://www.epa.gov/watersense/how-we-use-water#Daily%20Life>

World Health Organization. (2017, July 12). 2.1 billion people lack safe drinking water at home, more than twice as many lack safe sanitation. Retrieved from <https://www.who.int/news-room/detail/12-07-2017-2-1-billion-people-lack-safe-drinking-water-at-home-more-than-twice-as-many-lack-safe-sanitation>

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## Objectives

- Differentiate between direct and indirect (or virtual) water.
- Give examples of ways we can conserve water (directly and virtually).

## Suggested Teaching Strategy

Explain that this image shows the amount of virtual water needed to make the food on this plate using conventional agricultural production practices (See FoodPrint for more information.) Ask students: How much water was needed to make the entire plate of food? (1,047 gallons/3,961 L) How much for the steak alone? (900 gal./3,405 L)

Stimulate a discussion about how water-conservation efforts often focus on more *sustainable production*, or finding ways to decrease the amount of water we use to produce goods and services. Why might it also be important to consider more *sustainable consumption*, or the number and type of products we consume and where and how they're produced? For example, this is why some water advocates encourage people to eat less meat or switch to a vegetarian diet. (*Changing many of our habits, such as eating fewer animal products, can significantly help water conservation efforts and improve animal welfare.*)

For an activity, you could direct students to explore additional meals and the virtual water they require using this interactive tool: <http://graphics.latimes.com/food-water-footprint/>. (Note: Although the water footprint numbers from this interactive tool are similar because they are all based on the same source, we use global averages as opposed to U.S. averages, so our numbers might be slightly higher.)

### CREDITS

#### Resources:

FoodPrint. (n.d.) Factory Farming and Animal Life Cycles. Retrieved from <https://foodprint.org/issues/factory-farming-and-animal-life-cycles/>

GRACE Communications Foundation. (2011, August 1). Beef: The “king” of the big water footprints. Retrieved from <https://www.watercalculator.org/footprints/beef-king-big-water-footprints/>

GRACE Communications Foundation. (2017, July 1). Food's big water footprint. Retrieved from <https://www.watercalculator.org/water-use/foods-big-water-footprint/>

GRACE Communications Foundation. (2018, October 2). What is the water-energy-food nexus? Retrieved from <https://www.watercalculator.org/footprints/water-energy-food-nexus/>

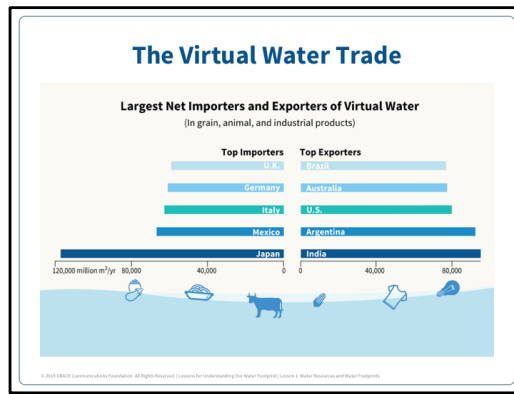
InfoDesignLab. (n.d.). The water we eat. Retrieved from <http://thewaterweeat.com>

Kim, K., Schluess, J., & Krishnakumar, P. (2015, April 7). 808 gallons of water were used to make this plate. Retrieved from <http://graphics.latimes.com/food-water-footprint/>

Mekonnen, M. M., & Hoekstra, A. Y. (2010 December). *The green, blue and grey water footprint of animals and farm products: Volume 1: Main report*. Value of Water Research Report Series No. 48, UNESCO-IHE. Retrieved from <https://tinyurl.com/wfovl1>

Mekonnen, M. M., & Hoekstra, A. Y. (2010 December). *The green, blue and grey water footprint of crops and derived crop products: Volume 1: Main report*. Value of Water Research Report Series No. 47, UNESCO-IHE. Retrieved from <https://tinyurl.com/UNESCO47>

Image: Design City Media & Advertising Lab: [www.designcity.com.mx](http://www.designcity.com.mx)



## Objective

- Differentiate between direct and indirect (or virtual) water.

## Suggested Teaching Strategy

Ask students to recall what virtual water use refers to. (*It refers to the amount of freshwater that is used to make or grow products and therefore the water we indirectly use when we consume products.*) Encourage students to review and discuss the top importers and exporters of virtual water. Ask: What do you think it means to import virtual water? (*It means to bring products in that required water to create.*) What do you think it means to export virtual water? (*It means that it took water to create and export goods.*)

Point out that the data on this page comes from 2012. Ask: How do you think the data may have changed since 2012? (*Sample answer: Many countries are probably using more water because human populations are growing in the countries around the globe that are withdrawing and consuming the most water.*) Share that this is actually not a simple question to answer. Water use for different countries can't be oversimplified because a variety of factors, such as climate, predominate industries, and population growth or decline, can impact the reasons that countries import and export certain goods, which can impact water use. For example, the populations of Japan and Italy have been declining for years, which can impact water use. Developed countries like the United States are actually using less water over time due to the increased availability of water-efficient fixtures and the promotion of water-saving measures. Many companies around the world are trying to reduce their water use to be better stewards of the Earth and to reduce costs.

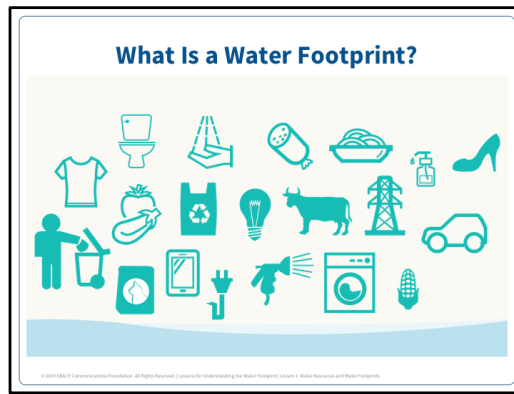
## CREDITS

### Resources:

Fischetti, M. (2012, June 1). Which nations consume the most water? *Scientific American*. Retrieved from <http://www.scientificamerican.com/article/water-in-water-out/>

Hoekstra, A. Y., & Mekonnen, M. M. (2012, February 28). The water footprint of humanity. *Proceedings of the National Academy of Sciences of the United States of America*, 109(9): 3232–3237. Retrieved from <https://waterfootprint.org/media/downloads/Hoekstra-Mekonnen-2012-WaterFootprint-of-Humanity.pdf>

Image: Design City Media & Advertising Lab: [www.designcity.com.mx](http://www.designcity.com.mx)



## Objectives

- Give examples of ways we can conserve water (directly and virtually).
- Explain how a water footprint can help contribute to the better management of our water resources.

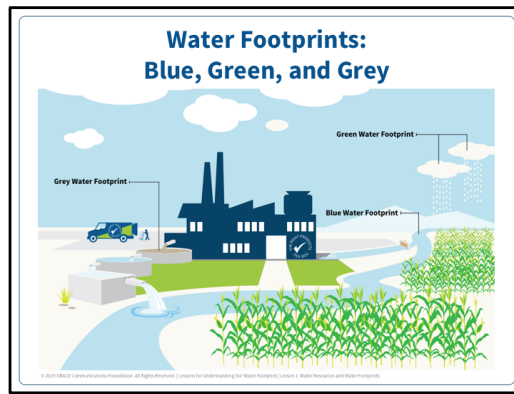
## Suggested Teaching Strategy

Explain to students that given global concerns about water scarcity, more and more people are becoming aware of and wishing to curb their water consumption. A great tool for understanding the full scope of our water use—including our direct and virtual water consumption—is a water footprint. Ask students: What do you think a water footprint might be? (*A water footprint shows us our water-use patterns.*) Why is it important? (*It can help individuals, governments, and businesses figure out how to manage their use of water to help conserve it for the future.*) Explain that water footprints include not only the water we use directly but also the virtual water that is used to produce our food, the consumer products we buy, and the energy we use. A water footprint is measured in terms of the volume of water consumed, evaporated, and polluted, and it can be calculated for individuals, households, businesses, and countries.

## CREDITS

*Resource:* GRACE Communications Foundation. (2017, May 13). What is a water footprint? Retrieved from <https://www.watercalculator.org/footprints/what-is-a-water-footprint/>

*Image:* GRACE Communications Foundation. (2017, May 27). Water Footprint Calculator Methodology. Retrieved from <https://www.watercalculator.org/footprints/water-footprint-calculator-methodology/>



**Objective**

- Explain how a water footprint can help contribute to the better management of our water resources.

**Suggested Teaching Strategy**

Share with students that a water footprint can be split into three categories:

*Blue Water Footprint:* The amount of surface water and groundwater required (evaporated or used directly) to produce an item.

*Green Water Footprint:* The amount of rainwater required to make an item—this is primarily rainwater (evaporated or used directly) that is used to grow food and fiber crops.

*Grey Water Footprint:* The amount of freshwater required to dilute the wastewater generated in manufacturing in order to maintain water quality, as determined by state and local standards.

Direct students to look at the image and differentiate between the three different types of water footprints.

**CREDITS**

*Resources:*

GRACE Communications Foundation. (2017, May 13). What is a water footprint? Retrieved from <https://www.watercalculator.org/footprints/what-is-a-water-footprint/>

Water Footprint Network. (n.d.). What is a water footprint? Retrieved from <https://waterfootprint.org/en/water-footprint/what-is-water-footprint/>

*Image:* Design City Media & Advertising Lab: [www.designcity.com.mx](http://www.designcity.com.mx)



## Objectives

- Give examples of ways we can conserve water (directly and virtually).
- Explain how the Water Footprint Calculator at [watercalculator.org](http://watercalculator.org) can be used to measure one's water footprint.

## Suggested Teaching Strategy

Reiterate to students that most water conservation efforts focus on our direct water use and consumption. Those are valuable water conservation tips. However, most people don't understand that water is crucial to produce almost every good and service that we use every day. The water required at every step of production is often "hidden" to consumers. Understanding this virtual water concept is a critical way for us to understand our *total* water consumption as well as to understand more impactful ways to conserve water.

Tell students that the image above is from a Water Footprint Calculator designed by the GRACE Communications Foundation. Ask students to recall what a water footprint is. *(It's a way of determining how much water a particular person consumes; a tool that a person can use to assess their personal water consumption.)*

Direct students' attention to the icons at the bottom of the page. Ask: What do these icons tell you about this calculator? *(It assesses an individual's direct indoor and outdoor water use as well as water used to make the food they eat, produce the energy they use, and products they buy.)* Tell students that they will be using this calculator later to determine how much direct and virtual water they use, and then they will use that data to develop truly meaningful water conservation habits.

## CREDITS

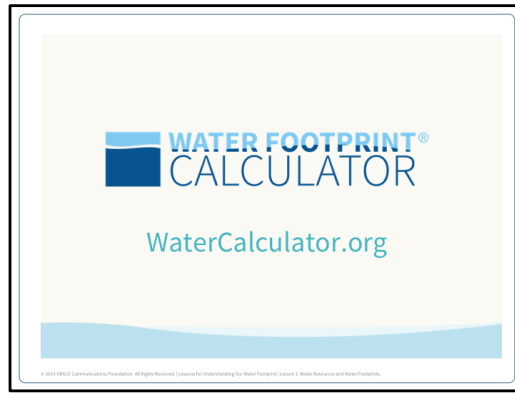
*Resources and image:*

GRACE Communications Foundation. (n.d.). Find your water footprint and learn how to save water. Retrieved from <https://www.watercalculator.org/intro/>

*Additional resources:*

GRACE Communications Foundation. (2018). Water footprint calculator [Home page]. Retrieved from <https://www.watercalculator.org>

GRACE Communications Foundation. (2017, May 13). What is a water footprint? Retrieved from <https://www.watercalculator.org/footprints/what-is-a-water-footprint/>



**CREDIT**

GRACE Communications Foundation. (2018). Water footprint calculator [Home page]. Retrieved from

<https://www.watercalculator.org>