

Lesson 1: Water Resources and Water Footprints



Adobe Stock: SNEHIT: Glacier National Park, Montana

SUMMARY

This lesson helps students understand why Earth is considered the “water planet.” Students analyze how much of Earth’s water is available for humans to use for life-sustaining purposes, and they explore the concept of water scarcity in both physical and economic terms. They look at the many ways that humans use water and investigate international trends in agricultural, industrial, and household water consumption. The lesson also sets up the focus of this course: the concept of water footprints. Students explore how water footprints are 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. Critical to this exploration is a visit to watercalculator.org, where students calculate their personal water usage, analyze the results, and set a base point for tracking and conserving their water use.

ESTIMATED TIME NEEDED

Two 55-minute sessions

KEY VOCABULARY

scarcity, freshwater, salt water, water conservation, water consumption, drought, climate change, direct water use, virtual water, water footprint, irrigation, water quality, sustainable production, sustainable consumption

OBJECTIVES

Students will be able to ...

- ✓ 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 or virtually).
- ✓ Explain how a water footprint can help contribute to the better management of our water resources.
- ✓ Evaluate their water footprint using GRACE Communication Foundation’s Water Footprint Calculator located at watercalculator.org.

Lesson 1: Water Resources and Water Footprints



INSTRUCTIONAL EMPHASIS

Instructional methods, key skills, and values/attitudes emphasized in this lesson include the following:

VALUES/ATTITUDES

- ☒ Leadership
- ☒ Resilience
- ☒ Mindfulness
- ☒ Optimism
- ☒ Empathy
- ☒ Curiosity
- ☒ Global Citizenry

SKILLS

- ☒ Critical Thinking
- ☒ Creative Problem Solving
- ☒ Collaborating
- ☒ Communicating
- ☒ Information Literacy
- ☒ Systems Thinking
- ☒ Adability

METHODS

- ☒ Problem-Based Learning
- ☒ Real-World Application
- ☐ Modeling
- ☒ Brain-Based Learning
- ☒ Multiple Intelligences
- ☒ Technology Integration
- ☒ Multi-Disciplinary

ATTACHMENTS

- Water Resources and Water Footprints Presentation
- Water Resources and Water Footprints Presentation Teacher's Notes
- My Water Footprint Stats Worksheet
- My Water Footprint Stats Sample Answers
- Basic Rubric
- Participation Checklist

MATERIALS

SESSION 1: HOW DO WE USE WATER?

- ☐ Audiovisual presentation equipment with access to the Internet
- ☐ Student access to computers, smart phones, and/or tablets, and the Internet

SESSION 2: HOW DO I USE WATER?

- ☐ Student access to computers, smart phones, and/or tablets, and the Internet

STANDARDS CORRELATIONS

This lesson, with all components included, is linked to the following standards:

COMMON CORE STATE STANDARDS (CCSS)

English Language Arts: RI.9-10.1-4; W.9-10.1.A-C, 2.A-B, 4-5, 7-10; SL.9-10.1.C-D, 2-4; L.9-10.1.B, 2.A-C, 3-6; RH.9-10.1-4, 7-10; RST.9-10.1-10; WHST.9-10.1 A-C, 2.A-B, 4-5, 7-10 Mathematics: HSN.Q.A.1-3

NEXT GENERATION SCIENCE STANDARDS (NGSS)

Earth's Systems: HS-ESS2-2, 4; HS-ESS3-1, 4-6

Ecosystems: Interactions, Energy, and Dynamics: HS-LS2-1-2, 6

Engineering Design: HS-ETS1-1

TEXAS ESSENTIAL KNOWLEDGE AND SKILLS (TEKS)

Biology: §112.34.c.2G-H; 3A-E; 12D-E

Earth and Space Science: §112.36.c.2.G-I; 3A-E; 12E; 13A

Environmental Systems: §112.37.c.2.E-F, I, J-K; 3.A-E; 5.B-E, J; 7A, C; 9F

CLOUD EDUCATION FOR SUSTAINABILITY (EFS)

STANDARDS & PERFORMANCE INDICATORS

Grades 3-12: A5; B4-5, B7-9; C1, C3-8, C13-14, C20, C22, C28-30, C34-35, C46, C48-52; D1-2, D5, D7; E2-4, E6-7; F1, F3, F5A-C, F6; G2, G4, G10, G22, G26, G34; H7-12; I28-30.

Lesson 1: Water Resources and Water Footprints



BACKGROUND INFORMATION

Water conservation encourages students to become more mindful of their daily direct water use, encouraging them not to waste water when brushing their teeth, washing dishes, showering, etc. These lessons go beyond those activities to encourage a greater global perspective and to cultivate students' awareness and understanding of indirect (virtual) water use. The lessons promote conversation about how food choices and shopping habits have a larger impact on water consumption than students may realize. They do this by introducing the concept of water footprints and helping students understand how they use water beyond the tap.

The goal of **Lesson 1** is to provide students with an in-depth understanding of key water issues. Students learn key facts about water resources and water footprints and then use a water calculator to identify and analyze their personal direct and virtual water consumption. The lesson gives students a foundation of knowledge and helps them understand why they should care about protecting water resources. Once students understand why the issue is important, it is easier for them to make a fundamental shift in attitude about their water use.

In **Lesson 2**, students learn how to articulate and share the concept of a water footprint. Then they investigate in greater detail the impact of their food consumption habits on their virtual water use and begin thinking about how their diet is influenced by systems outside of themselves, such as social groups, advertising, and structures in place at home and at school.

Lesson 3 empowers students to take action. First, they investigate how the products they buy impact their virtual water footprint. Then they devise a plan to reduce their personal water footprint. Next, they work together to evaluate the water footprint of their school campus. Finally, they create a Strategic Action Plan to reduce the school's water footprint and work in groups to get the necessary permissions to enact a water-saving plan for the campus.

The 5E Instructional Model

All three lesson plans are designed using the 5E instructional model, which leads students to Engage, Explore, Explain, Elaborate, and Evaluate the topic. The article [Lesson Planning: 5E Model + Technology](#) is one resource for learning more about the 5E model and 21st century learning.

A Cautionary Word ...

Be careful to avoid using words like “good” and “bad” when discussing the use of water and other products. Such words could leave students feeling shamed, which is not an effective motivator for change. For example, some students may be sensitive to the notion that a water habit they have, such as taking an occasional long shower, is “bad.” In addition, be careful to discuss the merits of sustainably produced foods and consumer goods (e.g., organic produce from a farmers' market) without heavily disparaging less sustainably produced items. Encourage students to come to their own conclusions and to gently help their families shift to more sustainable habits and purchasing practices. Farmers' market produce, for example, is sometimes more expensive than supermarket produce. You may want to encourage students to do research on inexpensive alternatives to current habits and purchasing practices that they can present to their families, rather than assuming families have the means to change all their habits and practices and replace them with new “good” ones.

Lesson 1: Water Resources and Water Footprints



IN ADVANCE

Review the lesson materials in advance. Note that pp. 7, 18, and 22 of the presentation/corresponding Teacher's Notes recommend links for students to follow. You may wish to have students connect to the Internet to access these links or project the websites to review the information together as a class; alternately, you could review the websites in advance and share details during class. (You can also skip these suggestions.) Plan to set up and test your audiovisual presentation equipment in advance and make a copy of the My Water Footprint Stats Worksheet for every student.



Adobe Stock: Buffy1982

PROBLEM-BASED LEARNING TIPS

This program contains three lessons on water conservation; each can stand alone, or all three can be completed together as a series. Consider conducting these three lessons together as a problem-based learning (PBL) experience for students. You could begin with this first lesson by encouraging students to come up with a central question they can explore together throughout the module. Effective PBL is student-led, so encourage students to come up with their own question. If students get stuck, you might share a few questions such as the following to get them thinking:

- Could global climate change impact our water consumption habits for the better?
- How could we rethink our water consumption habits to create a more sustainable future?
- How can we inspire members of our school community to adopt more sustainable water consumption habits??
- Why might our community need to be more open to the practice of water conservation?

After students have come up with a central question, write it on the board and refer back to it frequently. Also encourage students to keep it in mind as they move through the lessons. You may wish to suggest that they each create a Water Footprint Portfolio, which could be a folder, a notebook, or even an electronic portfolio to which they can add helpful links, completed worksheets, and other products, ideas, etc. This [Common Sense Education article](#) shares a few examples and descriptions of electronic portfolio tools.

Lesson 1: Water Resources and Water Footprints



ACTIVITY BREAKDOWN

SESSION 1: HOW DO WE USE WATER?

Time	Exercise	Description
5 min.	Engage	Students respond to a writing prompt and then view a short video.
40 min.	Explore	Share the Water Resources and Water Footprints Presentation with students and use the corresponding Teacher's Notes to generate discussion.
10 min.	Explain	Students revisit their answer to the earlier writing prompt, discuss it with a peer, and then share their thoughts with the class.
Homework		Suggest that students use the Water Footprint Calculator at watercalculator.org to assess their personal water footprint at home before working through it in class. The calculator will prompt them to answer questions for everyone who lives in their household, so reflecting with members of their households on some of the questions can help them arrive at more precise estimates.

SESSION 2: HOW DO I USE WATER?

Time	Exercise	Description
10 min.	Elaborate	Working in small groups, students brainstorm a list of habits they have, products they buy, or foods they eat that they think may require a lot of water and then rank those items according to which likely require the most water.
45 min.	Evaluate	Working independently, students use the Water Footprint Calculator at watercalculator.org to estimate their personal water footprint. Then they take the data gathered from the calculator to complete the My Water Footprint Stats Worksheet. Students participate in a final discussion and question/answer session.

Notes

Lesson 1: Water Resources and Water Footprints



IMPLEMENTATION INSTRUCTIONS

SESSION 1: HOW DO WE USE WATER?

Engage

1. Instruct students to take out a blank sheet of paper and respond in writing to the following prompt: What do you think the phrase “eat water” means? In what ways do you think you “eat” water every day? Allow students 2–3 minutes to record their thoughts.
2. Show students a short video, [Fresh water scarcity: An introduction to the problem](#), as a quick introduction and to jump-start their thinking.



WaterCalculator.org

Explore

3. Delve into the topic in greater detail with the Water Resources and Water Footprints Presentation. Use the discussion topics, activities, and technology links in the corresponding Teacher’s Notes to actively engage students and encourage thoughtful reflection.

Explain

4. Have students revisit their earlier response to the question: “How do you ‘eat’ water every day?” Give them a minute or two to record their thoughts.
5. Have students find a partner to discuss their updated responses to the writing prompt.
6. Conclude the session with a whole-class discussion, inviting volunteers to share how their thoughts have changed since before the presentation regarding the amount of water they “eat” every day. Give students the opportunity to ask questions or share insights on anything they have learned.

Homework

Tell students that in the next session, they will be analyzing their water footprint via [watercalculator.org](#). Explain that it may be helpful for them to work through the calculator with a family member at home before completing it in class. The Water Footprint Calculator will prompt them to answer questions for everyone who lives in their household, so reflecting with members of their households on some of the questions, such as “where does your electricity come from” and “how many miles do you drive each week” can help them arrive at more precise estimates. Advise students to write down any details they may forget so they can easily recall the information when using the calculator again in the next session.



Lesson 1: Water Resources and Water Footprints



IMPLEMENTATION INSTRUCTIONS, continued

SESSION 2: HOW DO I USE WATER?

Elaborate

1. Divide the class into groups of 3–4 students and have each group brainstorm a list of habits they have, products they buy, or foods they eat that they think may require a lot of water.
2. After five minutes or so, have groups rank the items, with 1 indicating the habit or product they think requires the greatest amount of water.
3. Encourage volunteers to share with the class the habits or products they think require the most water. Alternately, you could have them reflect on their lists in a journal entry.

Evaluate

4. Then tell students that you are going to give them an opportunity to evaluate their personal water footprint using the Water Footprint Calculator at watercalculator.org. Give each student a copy of the My Water Footprint Stats Worksheet.
5. Go over the instructions at the top of the worksheet together as a class and make sure students understand that to fill out the worksheet, they will need the final summary that appears below their final water footprint calculation, so caution them not to close out of the calculator too soon.
6. Tell students they will explore their results and learn more about water footprints in the next couple of classes. In the meantime, give them an opportunity to ask questions and/or share any immediate thoughts they have about what they learned in this lesson.
7. Use the Reflection Questions, which begin on the next page, to conduct a final, synthesizing discussion. Alternatively, you could assign the questions to students to complete as homework and then discuss their answers at the beginning of the next class period.

ADDITIONAL TEACHING TIP

If you have students whose native language is Spanish, they might prefer using the Spanish version of the [Water Footprint Calculator](#) and [website](#).



Pexels.com: rawpixel

Lesson 1: Water Resources and Water Footprints



REFLECTION QUESTIONS

Use the following questions to prompt critical thinking and guide students to reflect on the lesson:

- Are you surprised at how much or how little water you use compared to people in other parts of the world? *(Sample answer: I am not surprised that people in the United States consume so much water. I am surprised by how little water people in some other parts of the world consume.)*
- How do the foods you eat and the products you buy affect freshwater resources in a way you never considered before? *(Sample answer: I guess I thought I had no responsibility for the water needed to produce the food I eat and the stuff I buy—that responsibility belongs to the farmers and the manufacturers. It never occurred to me that I can actually make a difference by cutting back or rethinking what I eat and what I buy.)*
- What actions can you take to help conserve freshwater resources directly? *(Sample answer: I love our large, green yard, but it needs a lot of water and care. I think one of the biggest steps I could take would be to do research on other options for our huge yard—maybe we can convert it into a really beautiful xeriscape.)*
- What actions can you take to help conserve freshwater resources virtually? *(Sample answer: I’m not sure yet. Maybe I could do research to find out how much water my favorite foods require. I think eating less meat would be a good way for me to conserve freshwater resources virtually.)*
- How might your attitude toward freshwater resources affect people in other countries? *(Sample answer: I think, as someone who lives in an industrialized nation, I take freshwater resources for granted. If I continue to use so much water directly and virtually, it may have a real impact on people in my community or even in other countries who already have very little to spare.)*
- Are you concerned about water scarcity now or for the future? *(Sample answer: Yes. It seems like more and more places around the country are facing droughts, and people are being asked to make big sacrifices to conserve water. I think it is a real issue for all of us today, not just for people in other countries.)*
- What do you think are the best ways to prepare for or cope with water scarcity? *(Sample answer: I think spreading awareness is the best way. I learned things today that I honestly had never, ever thought about. I think it would be helpful if everyone had the opportunity to think carefully about the issue and educate themselves.)*

ASSESSMENT OPPORTUNITIES

Allow students to choose a way to share what they’ve learned from this lesson, either by selecting one of the ideas listed on the pages that follow or via a method of their own choosing. Then use the Basic Rubric or create a tailored rubric to assess how well students understood the information in the lesson and how well they were able to express their understanding. Share the rubric with students in advance so they have a clear understanding of expectations. The Reflection Questions above also provide an excellent opportunity for checking students’ understanding of key topics. In addition, see the Additional Activities and Extensions section, beginning on the next page, to further check student comprehension as well as to reteach and extend key ideas from the lesson.

Lesson 1: Water Resources and Water Footprints



DIFFERENTIATION

- For students whose native language is Spanish, you could suggest that they use the Spanish version of the Water Footprint Calculator: calculadoradeagua.org. Also point out that the Water Footprint Calculator site includes [water saving tips in Spanish](#).
- Give students who may struggle with the content of this lesson an overview of the material in advance so they can mentally prepare for the tasks ahead.
- The video [Where Is Water? – The Water Rooms #2](#) (also referenced in the Using Technology section) is another great option for preparing students for the content in advance or reinforcing content after the lesson.



watercalculator.org

CULTURAL ADAPTATION NOTE

As mentioned in the Background Information, it is important to avoid using words like good and bad when discussing the use of water and other products. Such words could leave students feeling shamed, which is not an effective motivator for change. For example, some students may be sensitive to the notion that a water habit they have, such as taking an occasional long shower, is “bad.” In addition, be careful to discuss the merits of sustainably produced foods and consumer goods, such as organic produce from a farmers’ market, without heavily disparaging less sustainably produced items. Encourage students to come to their own conclusions and to gently help their families shift to more sustainable habits and purchasing practices. Farmers’ market produce, for example, is sometimes more expensive than supermarket produce. You may want to encourage students to do research on inexpensive alternatives to current habits and purchasing practices that they can present to their families, rather than assuming families have the means to change all their habits and practices and replace them with new “good” ones.

ADDITIONAL ACTIVITIES AND EXTENSIONS

COMMUNITY CONNECTIONS

- Suggest that students look into efforts in the community to save water. For example, local restaurants might be serving water only on request. They can also look for models of large businesses trying to save water, such as campaigns that are promoted in local stores and other businesses or attached to specific products. Encourage students to share examples they find with the class.
- Fresh, green lawns are popular across the United States in many different forms, from small apartment courtyard lawns, to large front and back yards at single homes, to expansive parks and golf courses. Lawns are wonderful for many purposes, but they usually require a great deal of water for proper growth. Encourage students to pay attention as they are moving through their community to the various types of grass lawns as well as to lawn alternatives, and to take photos of different options. Then encourage them to learn about xeriscaping and other alternatives to grass lawns, such as by reading [The Seven Principles of Xeriscape](#). Then they could summarize their findings by writing their own “Get Along with Less Lawn” article to share with the school community.

Lesson 1: Water Resources and Water Footprints



ADDITIONAL ACTIVITIES AND EXTENSIONS, continued

CROSS-DISCIPLINARY CONNECTION: MATH

Remind students that the Water Resources and Water Footprints Presentation includes many statistics. Stimulate a discussion with students about the value of statistics. Explain that gathering statistics on worldwide environmental topics is often difficult because the topic is so large, data can be difficult to get and standardize, and because the people compiling the numbers often want to use the statistics to push a particular agenda. Emphasize the importance of knowing where facts are coming from, making sure they come from reputable sources, and verifying data. Encourage students to find out more about the calculations and assumptions behind the water calculator by referring to the [Water Footprint Calculator Methodology](#).

CROSS-DISCIPLINARY CONNECTION: SOCIAL STUDIES

- Have students read the article [How will the Great Lakes Compact hold up in a thirsty world?](#) (or another article about the legal battle for water rights that is especially pertinent to your area). Then encourage discussion. Ask: How do you think the agreement will hold up? Do you think broader legislation, such as water-use laws for the entire nation, should be enacted? If so, what might that legislation look like? Then have students write a short essay or article about why water-use legislation is so difficult.
- Have students compare the water use of the United States to the water use in another high-income nation as well as to that in lower-income nations. Direct them to research what factors might be influencing the different patterns of water use in each country. Alternatively, students could research, analyze, and compare two developing countries with different average individual water consumption patterns. Encourage them to report their findings to the class.

USING TECHNOLOGY

- An excellent video to help give students perspective is [Where Is Water? – The Water Rooms #2](#) from UNESCO WWAP (United Nations Educational, Scientific and Cultural Organization’s World Water Assessment Programme). You may wish to assign this video for all students to view at home before class or for students who seem to struggle to understand key points during class to view as a recap or reinforcement of key ideas covered in this lesson.
- Encourage students to work alone or in pairs to explore the interactive article: [476 gallons of water were used to make this plate](#). Then regroup as a class and ask students to share what they learned about their preferred foods and whether this sort of technology is useful.

CAREER INSPIRATION

Have students review the article [Get to Work! Jobs in Water Protection](#) from the Water Footprint Calculator site. Instruct them to pick one career, find out more about it, and then write a brief synopsis of the career—including educational background requirements, universities offering relevant programs, and local or regional employers offering relevant opportunities—on a large index card. Then have students post their cards around the classroom and host a Water Protection Careers Gallery Walk where they can take a look at each card.



Adobe Stock: auremar: Oyster Farming

Lesson 1: Water Resources and Water Footprints



ADDITIONAL ACTIVITIES AND EXTENSIONS, continued

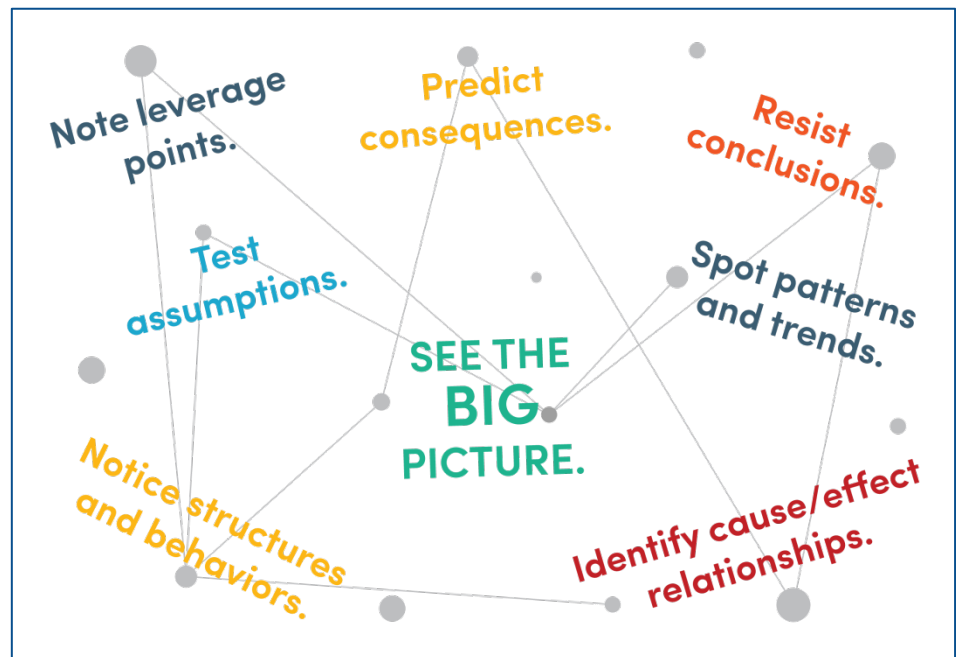
SYSTEMS THINKING

Share with students that systems thinking is a way to examine complex problems and come up with creative solutions. Tell students: Suppose you aren't doing so well in a class. If you are *not* a systems thinker, you might ask your teacher to cut you some slack so you can get back on track. If you *are* a systems thinker, you might:

- List all the factors that have caused you to fall behind in the class.
- Group similar factors.
- Identify cause-and-effect relationships among the factors.
- Brainstorm actions you can take to get caught up.
- Meet with your teacher to share your ideas and come up with a plan together.

You could ask: What are some patterns of behavior that a systems thinker has that a non-systems thinker does not have? He or she:

- Looks at the big picture.
- Searches for patterns and trends.
- Analyzes how a system's structure influences behavior.
- Identifies cause-and-effect relationships.
- Lists and tests assumptions.
- Identifies potential consequences.
- Finds leverage points to improve the system.
- Resists jumping to conclusions.



ecorise.org

Also encourage students to talk about possible results for the two different scenarios. Both approaches could result in the same thing (for example, the teacher cuts the student slack), but the second scenario has broader application (for example, the student has a better understanding of the problem, which leads to less likelihood of repeating the original problem behavior in this and other classes; planning together with the teacher leads to more respect from the teacher, etc.). In other words, instead of making an isolated change, the student has actually made a systemic change.

Now apply that to water use. Discuss how public policies related to water can drive water consumption up or down. For example, in the American West, the “use it or lose it” laws can encourage landowners to overuse water. Explain that water footprints are designed to lead people to make systemic changes. Encourage students to discuss how that might be true. *(Sample answer: Water footprints encourage us to see the big picture, spot patterns and trends, and identify cause and effect relationships that can lead us to make truly impactful progress in water conservation.)* Encourage students to further reflect on the topic by writing a short paragraph about how their work in this lesson is an example of systems thinking. You could then extend the topic by having students read the [What Is the Water-Energy-Food Nexus?](#) article and then discuss the article as a class.

Lesson 1: Water Resources and Water Footprints



RESOURCES/LINKS FOR THIS LESSON

The following resources were cited in this lesson or relate specifically to this lesson:

- 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>
- Common Sense Education. (n.d.). Student portfolio apps and websites. Retrieved from <https://www.commonsense.org/education/top-picks/student-portfolio-apps-and-websites>
- Fischetti, M. (2012, June 1). Which nations consume the most water? *Scientific American*. Retrieved from <http://www.scientificamerican.com/article/water-in-water-out/>
- 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>
- 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. (n.d.). Cómo ahorrar agua. Retrieved from <https://www.watercalculator.org/como-ahorrar-agua/>
- GRACE Communications Foundation. (2019). ¿Cuál es su huella hídrica? Retrieved from <https://www.watercalculator.org/wfc2/esp/>
- 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. (n.d.). Find your water footprint and learn how to save water. Retrieved from <https://www.watercalculator.org/intro/>
- 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, September 21). Get to work! Jobs in water protection. Retrieved from <https://www.watercalculator.org/education/jobs-in-water-protection/>
- GRACE Communications Foundation. (2018, October 12). How the United States uses water. Retrieved from <https://www.watercalculator.org/footprints/how-united-states-uses-water/>

Lesson 1: Water Resources and Water Footprints



RESOURCES/LINKS FOR THIS LESSON, continued

- 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/>
- GRACE Communications Foundation. (2019). The latest water news & events. Retrieved from <https://www.watercalculator.org/category/water-news-events/>
- GRACE Communications Foundation. (2018). Water footprint calculator [Home page]. Retrieved from <https://www.watercalculator.org>
- GRACE Communications Foundation. (2017, May 27). Water footprint calculator methodology. Retrieved from <https://www.watercalculator.org/footprints/water-footprint-calculator-methodology/>
- GRACE Communications Foundation. (2017, June 1). Water resources for educators. Retrieved from <https://www.watercalculator.org/education/water-resources-for-educators/>
- GRACE Communications Foundation. (2017, May 13). What is a water footprint? Retrieved from <https://www.watercalculator.org/footprints/what-is-a-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/>
- Guhlin, M. (2016, April 27). Lesson planning: 5E model + technology. TechNotes. Retrieved from <https://blog.tcea.org/lesson-planning-5e-model/>
- 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>
- InfoDesignLab. (n.d.). The water we eat. Retrieved from <http://thewaterweeat.com>
- Kim, K., Schleuss, 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://waterfootprint.org/media/downloads/Report-48-WaterFootprint-AnimalProducts-Vol1_1.pdf
- 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://waterfootprint.org/media/downloads/Report47-WaterFootprintCrops-Vol1_1.pdf

Lesson 1: Water Resources and Water Footprints



RESOURCES/LINKS FOR THIS LESSON, continued

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>

Rodonsky-Bish, B. (2015, October 20). The seven principles of xeriscape. Habitat Network. Retrieved from <http://content.yardmap.org/learn/the-seven-principles-of-xeriscape/>

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

Seely, Ron. (2018, August 22). How will the Great Lakes Compact hold up in a thirsty world? Retrieved from <https://www.chicagobusiness.com/government/how-will-great-lakes-compact-hold-thirsty-world>

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.

TED-Ed. (n.d.). Fresh water scarcity: An introduction to the problem – Christiana Z. Peppard [Video file]. Retrieved from <https://ed.ted.com/lessons/fresh-water-scarcity-an-introduction-to-the-problem-christiana-z-peppard>

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/>

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

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

United Nations Development Programme. (2006). *Human development report 2006*. Retrieved from <http://www.undp.org/content/dam/undp/library/corporate/HDR/2006%20Global%20HDR/HDR-2006-Beyond%20scarcity-Power-poverty-and-the-global-water-crisis.pdf>

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

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

Lesson 1: Water Resources and Water Footprints



RESOURCES/LINKS FOR THIS LESSON, CONTINUED

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. 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>

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

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

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>

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

Water Footprint Network. (n.d.). [Home page]. Retrieved from <https://waterfootprint.org/en/>

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

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

World Bank. (2012). 2001: World development indicators 2012 (p. 156). Washington, D.C: International Bank for Reconstruction and Redevelopment. Retrieved from <https://openknowledge.worldbank.org/handle/10986/2315>

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://tinyurl.com/y4xub98>



Adobe Stock: Phant