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water: [herbert-goetsch/unsplash](#); footprint: [will-walker/unsplash](#); composing Christina Hof/Science in Schools

Do you know your water footprint?

Sinead Kelly

Fresh water is a scarce resource on our planet – but how many of us are aware of how much water is needed to make the foods we eat every day?

You are probably aware that the choices we make as consumers affect how much carbon dioxide is produced on our behalf – and thus how we can try to decrease our ‘carbon footprint’.

But have you ever thought about how much water is consumed in making the items we use daily? Fresh water is a limited resource on our planet – in fact, a shortage of fresh water is one of the most urgent global problems. So it’s important that we all become more aware of our ‘water footprint’, which measures the amount of water used to produce each of the goods and services we use.

Although people are becoming aware of the large volumes of water needed to produce some of the items we wear (such as jeans or cotton T-shirts), there is perhaps less awareness of the huge contribution that food makes to our personal water footprint. In fact, it’s by far the most important single factor:

almost 80% of an individual’s water footprint is linked to the food they eat. As a science teacher, I was inspired by this amazing fact to raise awareness among my students of the amount of water used in producing foods – and of the need to conserve water in our food choices and, of course, to avoid food waste wherever possible.



Lake Powell reservoir, Arizona, USA, providing the precious resource of fresh water

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The activities described in this article allow students to explore the wide variation in water footprints associated with different foods, and then to apply this knowledge to finding out the water footprint of various ready-made 'lunch boxes'. Structured discussions after the activities can further encourage students to apply what they have learned in class to their own real-life dietary choices at school and at home. The calculations involved in evaluating the lunch boxes also require some careful arithmetic.



One average hamburger has a very large water footprint: about 2400 litres.

Drozhhina Elena/Shutterstock.com

Activity 1: Guess the water footprint

In this activity, students guess the water footprint of some common foods, before finding out the answers from their teacher. This can be done with or without internet research, as the answers are provided within the activity. Students can work individually or in groups, remotely or in class.

Materials

- List of food items (see table 1)
- Optional: use of the internet to research water footprint values

Item	Amount	Water footprint?
Chocolate	1 bar (100 g)	
Bread	100 g	
Pasta (uncooked)	100 g	
Chicken (cooked)	100 g	
Beef (cooked)	100 g	
Hamburger	120 g patty with bun and garnish	
Apple	1 average (150 g)	
Milk	1 glass (300 ml)	
Beer	1 large glass (500 ml)	
Tea (without milk or sugar)	1 large cup (250 ml)	
Coffee (without milk or sugar)	1 small cup (125 ml)	

Table 1: Some common foods. Can you guess the approximate water footprint of each one?

Procedure

1. Ask the students to read the descriptions of each item and guess what the water footprint could be – that is, how much water is needed to produce the item. Students should choose from the following categories, entering the chosen letter in the third column of table 1:

A: 1–50 litres

B: 50–100 litres

C: 100–200 litres

D: 200–500 litres

E: 500–1000 litres

F: 1000–2000 litres

G: over 2000 litres

2. Once students have submitted their guesses, provide feedback via the answers in table 2.

Item	Amount	Water footprint (litres)
Chocolate	1 bar (100 g)	F (1700)
Bread	100 g	C (130)
Pasta (uncooked)	100 g	C (141)
Chicken (cooked)	100 g	D (433)
Beef (cooked)	100 g	F (1540)
Hamburger	120 g patty with bun and garnish	G (2400)
Apple	1 average (150 g)	C (123)
Milk	1 glass (300 ml)	D (306)
Beer	1 large glass (500 ml)	C (148)
Tea (without milk or sugar)	1 large cup (250 ml)	A (30)
Coffee (without milk or sugar)	1 small cup (125 ml)	C (130)

Table 2: Some common foods with their approximate water footprint



A small cup of black coffee has a water footprint of about 130 litres – more than four times the value for a cup of tea.

Marco Verch/Flickr.com, [CC BY 2.0](https://creativecommons.org/licenses/by/2.0/)

It's important to emphasise that these figures are approximate and can vary greatly for different foods of the same type, depending on how that food and the ingredients it contains are produced.

Discussion

Water footprints tell us how much of Earth's limited water supplies we are using, so we can ask: how could each of us save water by making small changes to the items we consume?

Suggested follow-up questions to ask after this activity include:

- Which water footprint values did you find most surprising? Did any shock you?
- What types of food do you think typically have high water footprints, and why?
- What factors do you think might contribute to the water footprint of a food?

- Why might the water footprints of similar items (e.g. coffee and tea) be very different?
- Look at the image of the available water on Earth. What does this tell you about the need to conserve water on Earth?
- If you were required to reduce your water footprint, what effect would this have on you and your family?
- One-third of the world's food production ends up as waste. How do you think we should reduce our food waste to decrease the amount of water wasted?

Students can use the internet to investigate these questions. Useful websites to use for water footprint values, and also for explanations regarding why these vary, are shown in the resources section at the end of this article.

Activity 2: Lunch box water footprints

In this activity, students use their own research to work out the approximate water footprints of six ready-made lunch boxes. They can use this information to think about – and maybe change – what they choose to put in their own packed lunches. Again, students can work individually or in groups, remotely or in class.

A teacher resource with values for each item and calculations for each lunch box is provided, but please note that these values are not precise: they are based on approximate weights, and items grown in different countries will use different amounts of water depending on the raw materials needed to grow and harvest the item. There is thus wide variation in values for the same foodstuff between different sources.



Figure 1: Some sample lunch boxes: can students work out the water footprint of each? [Click on the image to enlarge.](#)

Sinead Kelly/Nicola Graf



Materials

- Student resource: labelled lunch box photos (see figure 1 and additional materials section)
- Teacher resource: calculations of approximate water footprint of lunch box contents (see additional materials section)
- Internet access to research water footprint values (see resources section)

Procedure

1. Students view the labelled lunch box photos (either in class or remotely).
2. Each student (or group) chooses three or more lunch boxes (ideally all of them), for which to calculate the water footprint.
3. Using the internet and the links in the resources section, students find out the relevant values per kilogram (or similar) for each of the foods shown in the lunch box photos.
4. Using this information, students then calculate the water footprint for the amount of food shown in each lunch box and find the overall total for the complete box.
5. Teachers can provide feedback to students at this stage using the supporting resource sheet 'Lunch box calculations' (see additional materials section), which provides water footprint values for each of the foods.
6. Students can then compare and share their findings with others and consider the discussion questions below.

Discussion

Suggested follow-up questions for after this activity include:

- Which lunch box had the highest water footprint? Which had the lowest?
- Which items do you think represent the best 'value' in terms of their water footprint, and which the worst?
- Choose an item from the lunch boxes and decide whether you think that item's water footprint is sustainable over years to come. Give your reasons.

- Think about the items you would normally choose to put in your own lunch box. What might the overall water footprint be for your normal lunch box?
- What items in your normal lunch box have the highest water footprint? How might you replace these with better options?
- What other ways can you think of to reduce your food water footprint? (For example, change from coffee to tea, and from beef to chicken.)
- Can you design a lunch box you would like that has a water footprint of no more than 300 litres?

The last question could be used as the basis for a student competition, with students voting for the best lunch box: the most tempting items combined with a low water footprint. <<

Resources

- Use the product gallery on the [Water Footprint Network website](#) to obtain water footprint values for many items of food and drink, and some other consumables.
- Find out more about all aspects of water footprints from the [Water Footprint Network website](#).
- Read this article on the [FuturEnviro website](#) about the large contribution our diet makes to our water footprint.
- Explore water footprint values for some food items in this pictorial article from [The Guardian newspaper](#).
- Read about the water footprints of many different types of consumer product in this book: Leahy S (2014) [Your Water Footprint: The Shocking Facts About How Much Water We Use to Make Everyday Products](#). Richmond, ON, Canada: Firefly Books. ISBN: 9781770852952

AUTHOR BIOGRAPHY

Sinead Kelly is a teacher of science, biology and physical education at St Oliver's Community College in Drogheda, Ireland. Sinead has been teaching for 19 years, in Ireland, England and Zambia. She was a member of the Irish Science on Stage team in 2019, and she is also one of the authors of an educational science book, *Investigating Science* (2016, Gill Education).

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