

Environmental footprint calculators have one big flaw we need to talk about

February 17 2022, by Aaron Simmons and Annette Cowie



Credit: AI-generated image ([disclaimer](#))

Are you one of the increasingly large number of people seeking to minimise the environmental damage wrought when producing the food you eat? If so, you might use the common "environmental footprint" method to decide what to buy.

[Environmental footprints](#) measure the [environmental damage](#) caused by a product throughout its life. For food, this includes the impacts of growing crops and livestock, and manufacturing the inputs required such as fertilisers. It can also include packaging and transport.

But unfortunately, environmental footprints often don't tell the full story. When consumers switch to a food seen as more environmentally friendly, its production expands at the expense of other products. This has consequences that environmental footprints don't take into account.

Environmental footprint calculators may promise to help consumers lead a greener life. But they may in fact encourage choices that don't benefit—and may even harm—the environment.

A problematic assumption

We are experts in assessing the effectiveness of climate change mitigation for agricultural systems. We regularly provide policy advice to governments, United Nations bodies and other organisations.

The design of environmental footprint calculators is guided by international [standards organisations](#) and policymakers, including the [European Union](#). The tool is commonly found on the websites of environmental groups, government agencies, companies and other organisations.

The calculators aim to guide consumer choice, by assessing the impacts of current production on the environment. But this is a problem.

It assumes the footprint of a product calculated today remains constant as production is scaled up or down, but this often doesn't hold true. When demand for a product changes, this has knock-on effects on nature. It might mean more [agricultural land](#) is required, or [river water](#) is

used to irrigate different crops.

Below, we examine three ways environmental footprints can provide a misleading picture of a product's true impacts.

1. Land use

Agriculture makes a large contribution to [greenhouse gas emissions](#)—primarily due to animal belches but also the production and use of synthetic fertilisers.

Organic farming can help reduce agriculture emissions, primarily because it doesn't use synthetic fertiliser. But some research suggests converting to [organic farming](#) production could also exacerbate greenhouse gas emissions.

One [study](#) in England and Wales examined what would happen if all food production was converted to organic. It found [global greenhouse gas emissions](#) from food production could increase by [about 60%](#).

This was because organic systems produce lower yields, meaning more crop and livestock production would be needed overseas to make up the shortfall. Creating this agricultural land would mean clearing vegetation, which emits [carbon dioxide](#) when it decomposes.

And when grasslands are converted to cropland, soil organic carbon is also lost. Enhanced soil carbon storage from organic farming offsets only a small part of the higher overseas emissions.

When considering the consequences of switching from one food to another, the type of agricultural land used is also important.

In Australia, about 325 million hectares of land is used to [raise cattle](#) to

produce [red meat](#). This land often [can't be used](#) to grow crops because it's too dry, steep, vegetated or rocky.

If consumers switch from red meat to plant-based diets, more land suitable for growing crops would be needed, either in Australia or overseas, to produce alternative proteins such as legumes or plant-based meats.

In Australia, existing arable land is already being used to supply crops to domestic and global markets. So new land would have to be made suitable for [crops](#), either by cultivating grazing land or clearing forest. Alternatively, crop production could be increased by using more fertiliser or other inputs.

The emissions associated with these shifts are not included in carbon footprints of plant-based protein production.

2. Water

It's commonly [assumed](#) that choosing a product with a smaller [water](#) footprint will increase the water in rivers and lakes which replenishes the environment. However, in Australia, policy and markets determine how water is used.

Irrigation water can be traded between users. If a water-intensive crop such as rice is no longer grown, the farmer will almost always either use the water to grow a different crop or trade it with another farmer. In such a scenario, no water is returned to the environment.

Similarly, a fall in red meat production may not necessarily increase water for the environment.

Farmers whose land adjoins a river or other water body are [allowed to](#)

[take](#) water for livestock to drink. Fewer livestock would leave more water available in rivers, but [research](#) in Australia suggests this water would be extracted for domestic uses, especially in dry years.

3. Goods produced together

Many agricultural products are produced in conjunction with others. For example, a cow slaughtered for red meat will also produce hide, meat meal and tallow. Likewise, a sheep can produce wool when alive, then other products when slaughtered.

So if consumers eschewed red meat due to its high carbon footprint, the associated products would also need to be replaced—and this would have environmental impacts.

If synthetic materials replace wool or hides, for example, demand for oil will likely increase. Or if wool is replaced with bio-based products such as cotton or hemp, demand for cropland will increase.

Increasing milk production per cow—and thus keeping fewer cows—has been considered as a way to reduce livestock emissions. But [research](#) suggests it may not have the intended result.

Fewer cows would produce fewer calves, which are used to produce veal. The research found less veal would require more red meat to be produced elsewhere, meaning no overall reduction in emissions.

It is realistic to assume that more red meat would be required. While per capita beef consumption is declining in some [Western countries](#), global demand for beef is projected to increase to [2030](#) as wealth in developing countries increases and global population grows.

Towards a healthier planet

We and other experts are increasingly trying to [raise awareness](#) of the [simplistic](#) nature of environmental footprints.

It's important to recognise the limitations of current methods and create tools that fully assess the consequences of consumers' decisions.

Developing these tools will be [challenging](#), due to the many uncertainties involved, and will require substantial research investment.

But it will lead to better environmental policy, fewer unintended consequences and a healthier planet.

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Provided by The Conversation

Citation: Environmental footprint calculators have one big flaw we need to talk about (2022, February 17) retrieved 21 June 2024 from <https://phys.org/news/2022-02-environmental-footprint-big-flaw.html>

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