How can we reduce our environmental footprint one food at a time?

Authors:
Donald Rose, Amelia M. Willits-Smith, and Martin C. Heller
Associate Editors:
Miranda Wilson and Rachel Watson

Abstract

Have you ever wondered what you can do to help the environment and slow climate change? What about eating certain foods because they are better for the environment? Producing the food you eat uses a lot of water and releases gases that warm the planet. If you ate foods that had a smaller impact on the environment, you could help fight climate change.

But it's hard for most people to change their entire diet! So we wondered if replacing just one food could reduce a person's impact on the environment. We collected diet data from a national survey in the USA. We figured out which foods produced the most carbon emissions. Then we created new potential diets where we substituted foods that had a smaller impact. We found that replacing beef products reduced carbon emissions and water use the most. That means not eating beef can lower the impact of your diet on the environment.

Introduction

Do you know how big your **carbon footprint** is? Your carbon footprint accounts for the **greenhouse gases** produced by your daily habits and activities. For example, carbon dioxide is a greenhouse gas emitted by gasoline-powered cars and trucks. A common suggestion to reduce your carbon footprint is to walk or take public transportation instead of driving. But what about changing what you eat?

Food systems are responsible for a third of global greenhouse gas emissions. Also, growing food uses about 70% of global freshwater resources. And these impacts are different for different foods. This means that the choices you make at the grocery store can have a huge impact on the environment.

Particular types of food produce more greenhouse gases than others. Producing beef creates 8-10 times more greenhouse gas emissions than the same amount of chicken, and about 20 times more than nuts or seeds! Some foods
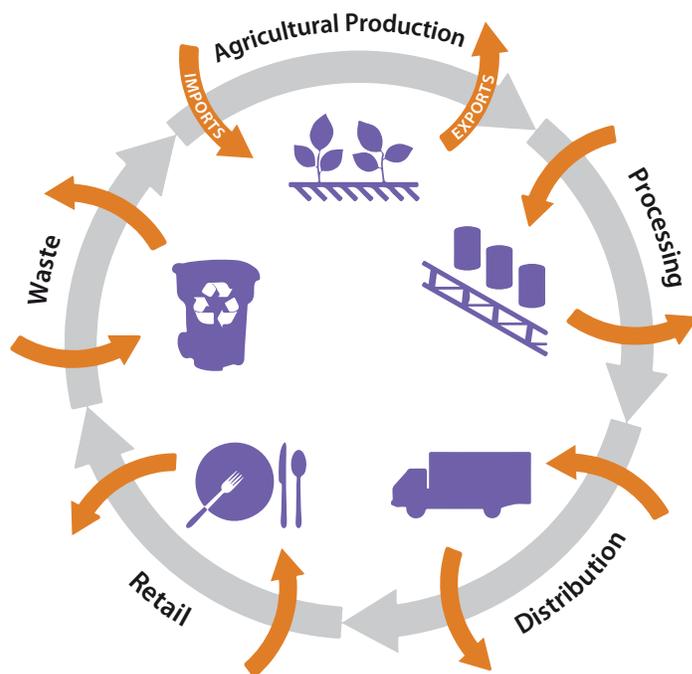
The parts of a food system include everything from producing food on a farm to what happens to your leftovers when you throw them away. Figure by Carsten Roden for **Spur.org**.

also need more water than others to grow. If people could reduce these foods in their diet, it would be better for the environment and for the climate.

It's not easy for everyone to change their entire diet to focus on foods with smaller environmental impacts. We thought it might be easier for people if they only had to change a single food item. We decided to see if changing a single food in a person's diet would have any impact on their **environmental footprint**.

Methods

We used diet information for a single day from the U.S. National Health and Nutrition Examination Survey in 2005-2010. It included a total of 16,800 adults. We identified all the foods in their diets. We then looked at the environmental literature on food production to:

1. Create a database of the carbon footprint for each food.

2. Estimate how much water went into producing each food, considering where foods were produced, and the availability, or scarcity, of water in those locations. We called this our **water scarcity footprint**.

We ranked foods based on their carbon footprint. All the top ten ranked foods were beef items! We identified all the people who reported they consumed beef on that survey day. For these people, we created a potential new diet that replaced the high ranked food for something with a smaller carbon footprint. The substitutions were similar in calories, cooking styles, taste, and how they were eaten. For example, we used ground turkey as a substitute for ground beef.

We calculated the carbon footprint and the water scarcity footprint for each person's original diet. We calculated these footprints for their potential new diet and then compared. We determined how healthy the original diet was and how healthy it would be with the substituted food. For comparison, we also looked at diets where we made substitutions for foods other than beef.

Results

The top ten ranked foods were all beef; for example, ground beef, beef steak, and beef roast. We found 3320 people (19.8% of our sample) who ate foods with those products.

When we replaced the data for beef with an appropriate meat substitute, it made a big difference.

• The carbon footprint decreased by 48.4% (Figure 1). That's almost half!

• The water scarcity footprint decreased 29.9%.

• People's diets became healthier. Why? The substitutions reduced the amount of saturated fats people consumed.

When we averaged our data across all the people in the survey (even the ones who didn't eat those beef products), we still found that the carbon footprint decreased 9.6%.

We also found that the water scarcity footprint decreased 5.9%.

We found that substituting foods in place of shrimp or dairy milk also decreased the carbon footprint for individuals, while substituting foods in place of asparagus or almonds decreased the water scarcity footprint (Table 1). However, in general, the impact was not as large as substituting alternatives to beef products.

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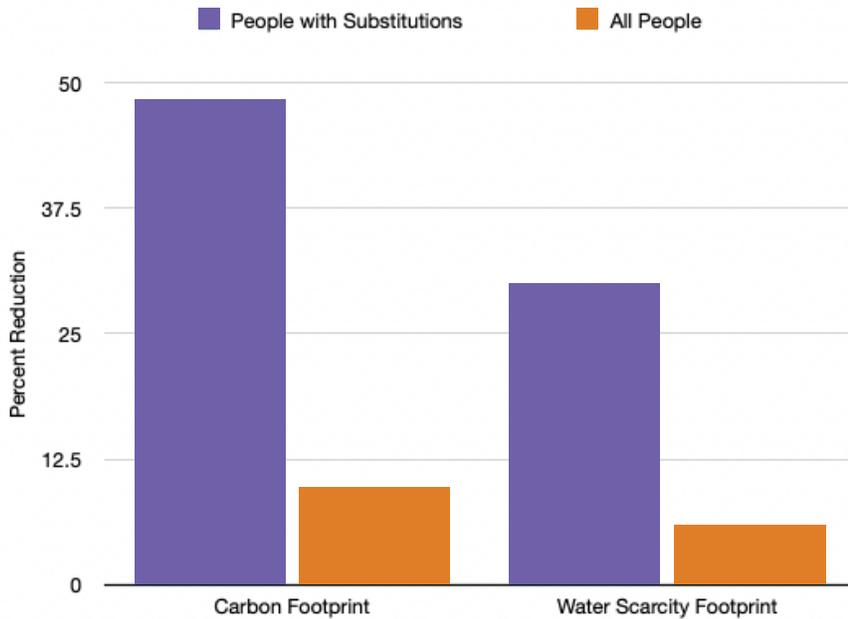
Figure 1:
How much environmental impact decreased (on average) when we substituted a single food. The foods that we replaced were all ranked in the top 10 highest carbon footprints and were all some type of beef.

What impact did substituting a single food have on the carbon emissions and water scarcity footprint of a person's diet?

Original Food	Substituted Food	Carbon Footprint Reduction	Water Scarcity Footprint Reduction
Beef	*Chicken/pork/turkey*	*48.4%*	*29.9%*
Shrimp	Cod	34.1%	6.1%
Dairy Milk	Soymilk	8.1%	5%
Asparagus	Peas	6.5%	48.2%
Almonds	Peanuts	2.5%	30.4%

Table 1: Additional substitutions that were not in the top 10 foods for highest carbon emissions. (Beef included for comparison.) These percentages are only for individuals who ate the foods we substituted, not averaged across all the people in the survey.

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JULY 2022

Discussion

Substituting single foods can reduce the environmental footprint of a person's diet. Removing beef from a person's diet had the largest impact, even averaged across everyone in the survey. Other foods had smaller but still significant impacts. Replacing high impact products could help reduce greenhouse gas emissions and water use.

Future studies should also incorporate plant-based **meat analogues** as substitutions. (Think about burgers or sausages that use soy, wheat, and/or vegetables instead of meat.) Plant-based products have a much lower carbon footprint than ground beef. These options are easier to find in stores today. So, people might be more willing to replace beef in their diet now!

Conclusion

The climate is changing rapidly and it can be hard to know how to help. It is clear we need to reduce greenhouse gas emissions. Government should play a role and industry needs to do its part, but individuals can also have an impact. Here are some ways you can help:

- Eat less beef! Choose chicken or meat analogues instead.

- Try eating vegetarian at least one day a week. Join the Meatless Monday campaign and introduce the idea to your friends or your school.

- Eat organic foods. The creation of fertilizers and pesticides produces lots of greenhouse gas emissions.

- Plant your own garden so you can buy less produce at the store.

Glossary of Key Terms

Carbon footprint – the total amount of greenhouse gases (like carbon dioxide and methane) produced to support human activities and habits. This amount is given as equivalent units of carbon dioxide. Carbon footprints are one way to measure the environmental impact of a person, household, or region.

Environmental footprint – a measurement of how many natural resources it takes to support your lifestyle. It includes things like how much energy you use, how much land it takes to grow the food you eat, and the resources it takes to produce the goods you use. People with smaller environmental footprints have less of an impact on the environment.

Food system – all the interactions that are involved in producing, transporting, consuming, and disposing of the food we eat. This includes processes like making fertilizers and pesticides, things that happen on a farm while food is grown, and what happens to discarded food in landfills.

Greenhouse gases – gases that trap heat in the atmosphere and contribute to global warming. Examples of these gases include carbon dioxide, nitrous oxide, methane, water vapor, and CFCs.

Meat analogue – a product that resembles meat in taste and texture, but is made from vegetarian or vegan ingredients. They generally have a smaller environmental footprint than real meat products.

Water scarcity footprint – a measurement we made of how much water was used to produce a food, adjusted by the scarcity of water in the locations where it was produced. Water scarcity describes not having enough water. For example, using water to irrigate tomatoes somewhere like California (where water is relatively scarce) has a bigger impact than using the same amount of water in Louisiana (where freshwater is plentiful).

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Check your understanding

1 What is a person's environmental footprint, and what parts of that footprint did we look at in our study?

2 What was the most common food substitution in people's diets, and why did people's diets become healthier with the substitution?

3 Other than beef, which food substitution reduced carbon emissions the most? The water scarcity footprint?

4 Do you already make any food choices that lower your impact on the environment? Looking at the substitutions we suggested, which ones do you think would be easy for you to do? Which one would be the hardest? Why?

5 Our food systems account for about 30% of greenhouse gas emissions worldwide. Using the different parts of the food system described and shown in the introduction, figure out which parts generate the most greenhouse gas emissions. Pick 3 different parts and make a suggestion to reduce emissions for each part.

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