



How Does Food Production Affect the Planet?

Climate Change, Food Production,
and Food Security #2
6th-8th Grade Lesson
~60 minutes

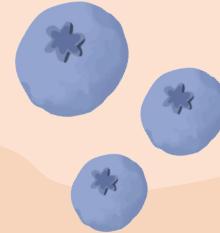


Standards

Primary Standards

Next Generation Science Standards (NGSS)

- MS-ESS3-4.** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems
- MS-ESS3-5.** Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.



Supporting Standard

Common Core English Language Arts Standards (CCSS.ELA)

- CCSS.ELA-LITERACY.RST.6-8.2** Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.



Essential Questions

01

What steps does food go through to get to my plate?

02

What contributes to a food's carbon footprint?

03

How do different foods vary in their carbon footprint?



Learning Outcomes

01

I can explain the different steps involved in food production, storage, and consumption.

02

I can analyze a food's carbon footprint.

03

I can explain how different stages of production impact a food's carbon footprint.

Agenda



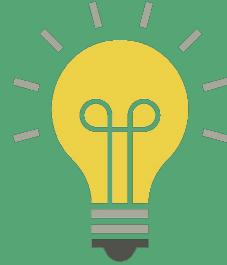
Inquire



Investigate



Inspire



Inquire

~15 minutes



Inquire

Turn and Talk

1. Choose a **food** or **ingredient** that you often eat.
2. What are the **steps** to get that food to your plate? Try to **trace back** as much as you can!
3. Which steps do you think have the **largest environmental impact**? Why?



Example: Chicken Nuggets



Inquire

How do we get from
here....

to here?



Example: Chicken Nuggets



Inquire

1. Production of feed for chickens by farmers



2. Production of chickens: grow out house, slaughterhouse, and processing plant



Example: Chicken Nuggets



Inquire

3. Distribution



4. Selling



5. Waste Disposal



Steps in Food Production

Did you know that the production of most foods requires this many steps?

- Growing/Producing on Farm
- Packaging/Processing
- Transportation
- Storage
- Selling in Grocery/Retail Stores
- Eating
- Disposing



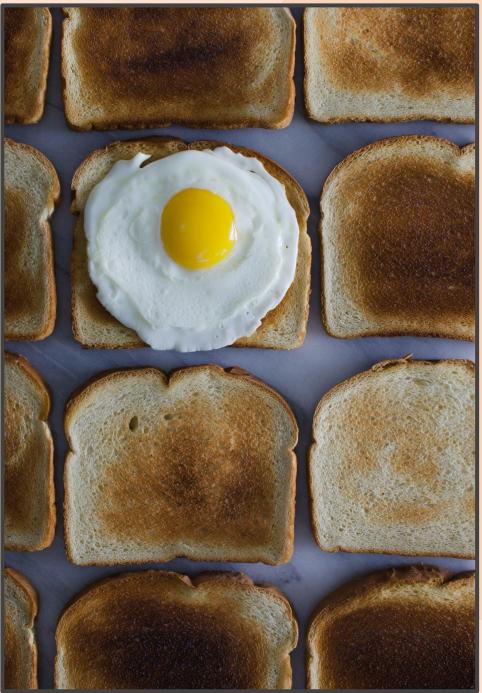
Image from Nourish

Class Discussion



Inquire

- Revise your answer from before. Now which steps do you think have the **largest environmental impact?** Why? How much do you think it might depend on the food?
- How does it feel to learn that almost all foods have an environmental impact? How can you address these feelings?
- How can conversations around food production and consumption make us feel disconnected to our historical and cultural ties? To our families?



Investigate

~30 minutes



Understanding the Carbon Footprint of Food



Different foods have different **carbon footprints**. Certain stages in a food's supply chain may play a bigger role than others.

Let's investigate a few foods to see how different stages of the supply chain contribute to their carbon footprints.

Our World
in Data



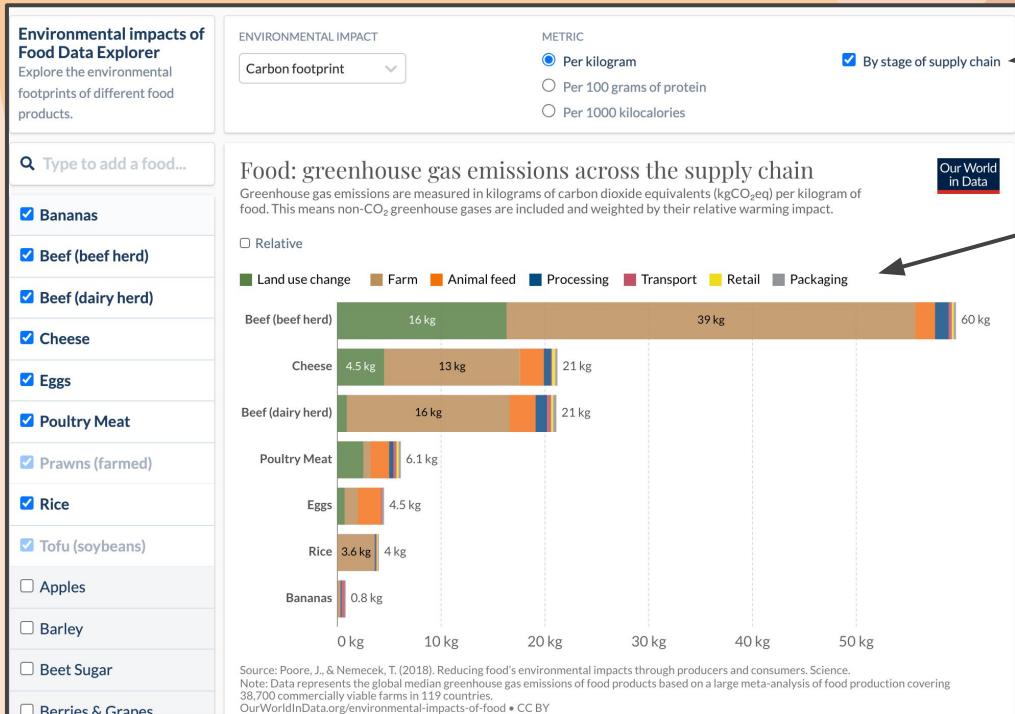
Carbon Footprint: the total amount of greenhouse gas generated by an action

Part 1: Data Explorer



Investigate

Directions: Learn how to use these important tools and set up the interactive.



Click here to break down the supply chain into steps

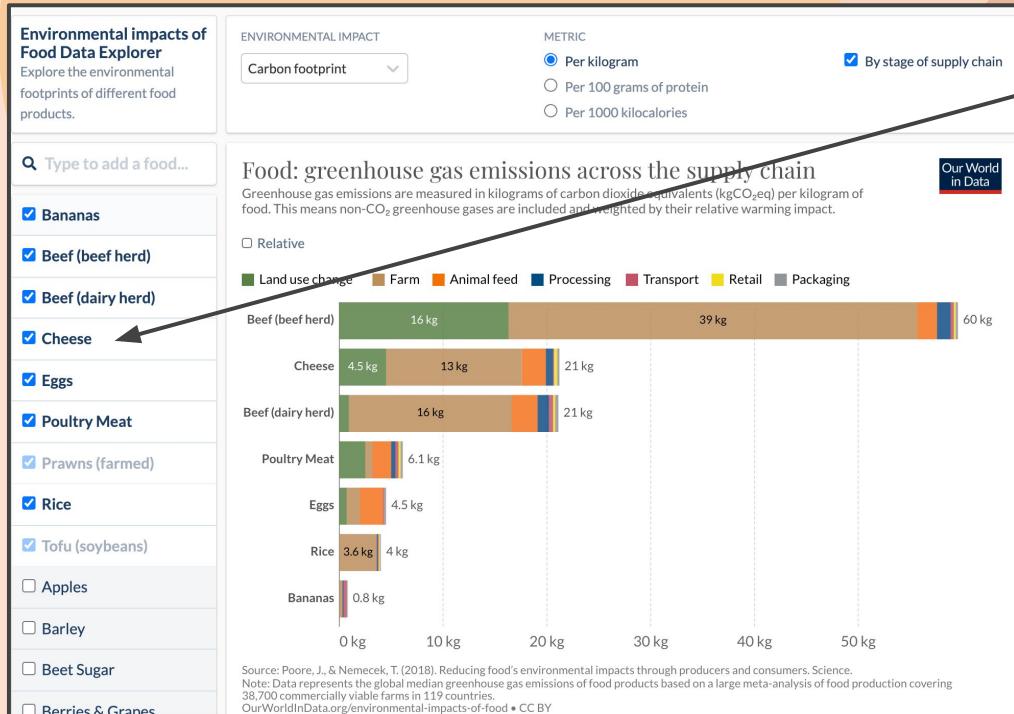
Now you can see the breakdown of the carbon footprint based on each stage of the supply chain (e.g., land use change, transport). Each color represents a different stage.

Part 1: Data Explorer



Investigate

Directions: Learn how to use these important tools and set up the interactive.



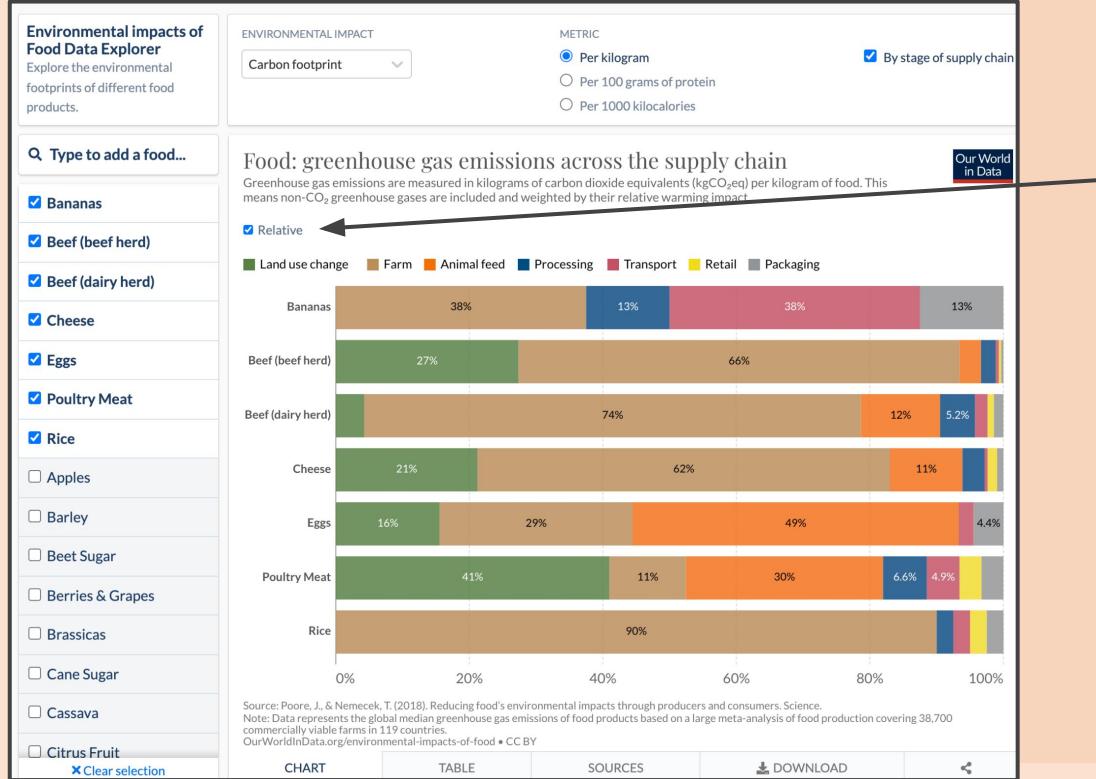
Select foods by clicking the checkbox.

Choose the following foods to start:

- Bananas
- Beef (beef herd)
- Eggs
- Poultry Meat
- Rice

Part 1: Data Explorer

Investigate



Check off “relative” to look more closely at the supply chain for each ingredient.

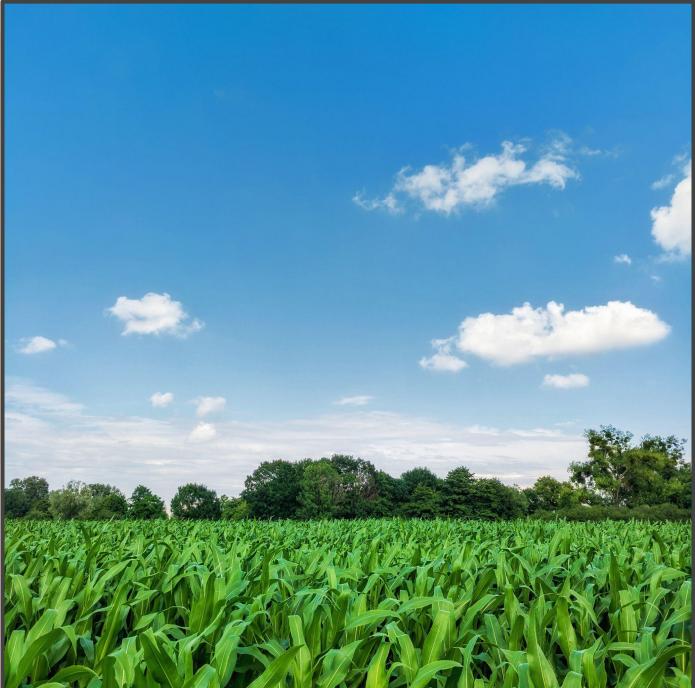
This shows each stage as a percentage of a total.

Part 1: Data Explorer



Investigate

NOW YOU'RE READY! Now that you know how to use the interactive, let's analyze.



Open-Ended Version

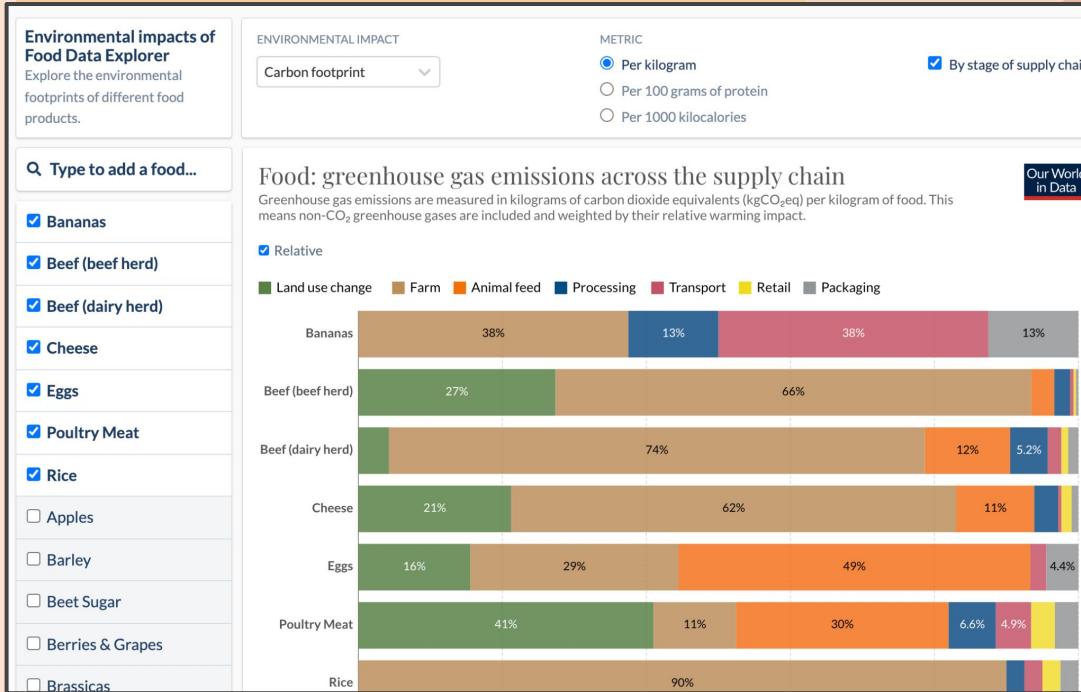
This version has questions that are more broad.

Guided Version

This version has specific questions to help students identify trends.

Part 1: Data Explorer

Investigate



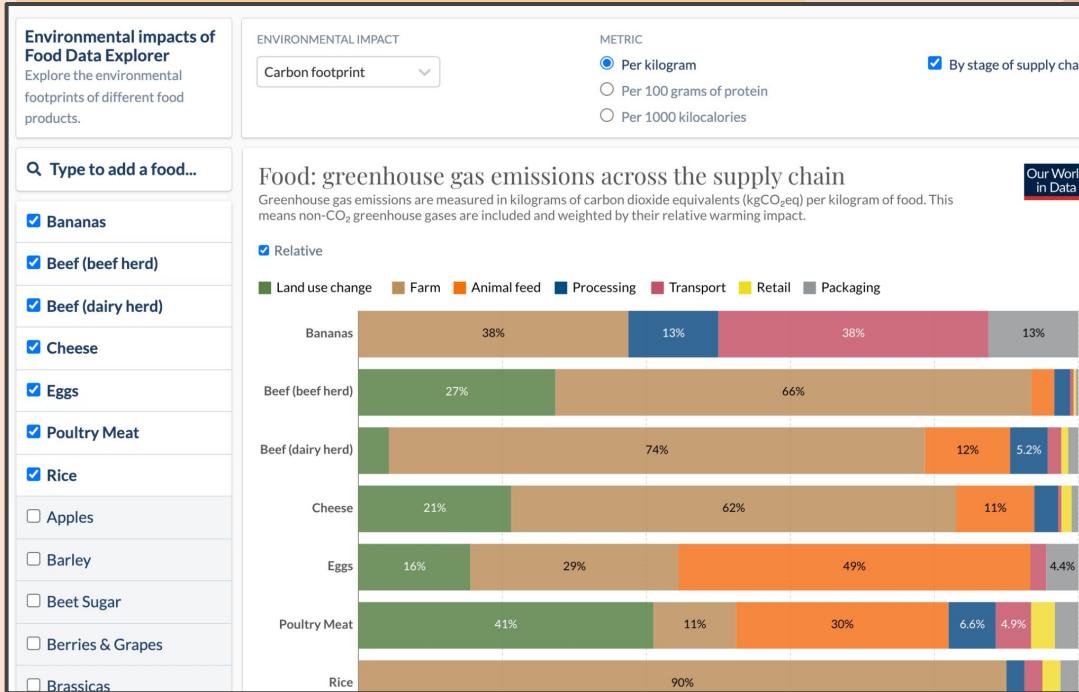
Open-Ended Version

Let's analyze!

1. What **trends** do you notice?
2. Which foods have **similar** trends?
3. Which foods have **different** trends?

Part 1: Data Explorer

Investigate



Guided Version

Let's analyze!

1. Which foods require land use change?
2. What makes bananas so different compared to other foods?
3. What do you notice about animal products compared to plant products?

Part 2: In-Depth Carbon Footprint

Choose one of the four foods and read more about its carbon footprint.



Investigate

bananas

beef

chicken

rice

What to do:

1. Click on the food you choose. *Each person in your group should choose a different food.*
2. Read the slides.
3. Write down notes on what you've learned.
4. Share with your group.
5. Compare similarities and differences.

bananas



Investigate

bananas



Investigate

Farming

There are some general factors that contribute to carbon emissions in building and maintaining a banana farm. The tools, plastics, and machines to plant and harvest crops, as well as pesticide use, contribute to greenhouse gas emissions. Pesticides and fertilizer are the biggest problems when looking at emissions.

Transportation

However, transportation and shipping are the biggest culprits in emitting greenhouse gases. Transporting bananas across roads or even seas requires a lot of energy. Often times, ships may use fuel that is cheaper and that is also less environmentally friendly. And it's not just the fuel needed for trucks or ships. Bananas also need to be refrigerated, which requires additional energy and also refrigerants, which also produce greenhouse gases. Transportation accounts for 62-67% of bananas' carbon footprint.



bananas



Investigate

Distribution

Once bananas get closer to where they are actually sold in grocery stores, they are taken to ripening and distribution centers. At these centers, bananas become more ripe by closely controlling temperature and using chemicals (ethylene). These steps require even more energy and account for 10% of bananas' carbon footprint.

Solutions

There are many practices and steps we can take to reduce bananas' carbon footprint. Farms can reduce the use of fertilizer by using organic or regenerative farming practices like crop rotation, which helps make soil more fertile. When transporting and ripening bananas, we can use more efficient technology to reduce the energy needed to transport, refrigerate, and ripen the bananas.



beef



Investigate



beef



Investigate

Overview

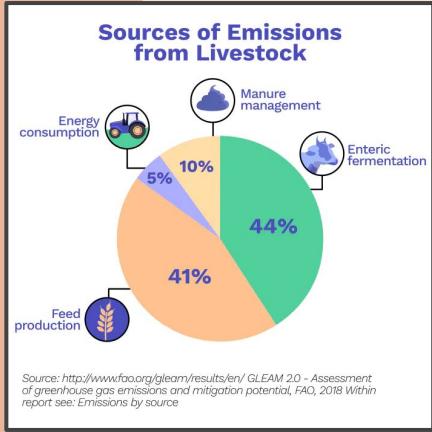
14.5% of all greenhouse gas emissions are caused by livestock farming, which includes production of beef, milk, pork, chicken, and eggs. Beef is the biggest culprit of all.

Enteric Fermentation

Cows produce methane, a type of greenhouse gas, when they burp and poop. Technically speaking, this is due to a process called enteric fermentation. Just like humans, cows have healthy bacteria in their stomachs that help them break down food. When the bacteria break down the grass and hay, they release methane, which is burped out by the cow. Animal manure also produces methane and another greenhouse gas called nitrous oxide. Both methane and nitrous oxide are stronger greenhouse gases than carbon dioxide because they trap more heat.

Land Use

Another factor contributing to beef's carbon footprint is land use. Many forests, which play an important role in helping our planet, are cleared and removed to make space for cattle farms. Beef production accounts for almost half of all deforestation in the world. Additionally, more land is needed to grow food for the cows. Almost half of beef's carbon footprint comes from feed production.



beef



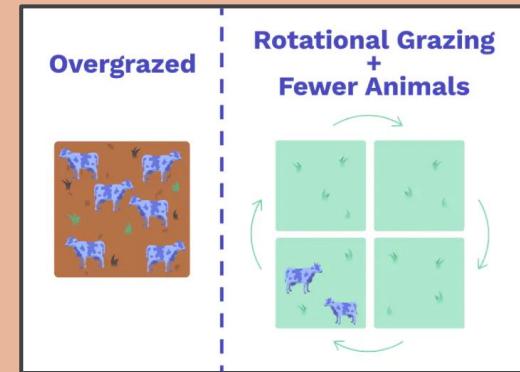
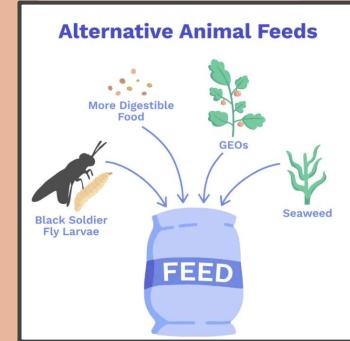
Investigate

Solutions

One way to reduce beef's carbon footprint is to feed cows more easily digestible food. This would limit the amount of methane being produced during enteric fermentation (the burping, remember?). Scientists are currently exploring other sources of food for cows, like seaweed.

Another potential solution to help reduce the carbon footprint is to find ways that farms can remove carbon dioxide from the atmosphere. If managed properly, farms could more closely mimic natural grasslands that absorb carbon. To do this, farmers can adopt practices to prevent overgrazing and improve soil quality.

The simplest way to reduce emissions? Eat less meat. Studies have found that we could reduce the agricultural carbon footprint by almost 50% if we didn't consume animal products.



chicken



Investigate



chicken



Investigate

Overview

Compared to other animal products like beef, lamb, milk, and pork, chicken has a lower carbon footprint. Poultry and eggs have similar carbon footprints.

Feed

Over half of chicken's total carbon footprint is from feed production. This is because land is needed to produce feed. Forests, which help absorb carbon dioxide from the atmosphere and help our planet, are usually cleared to make space for these farms.

Manure

The management and storage of chicken manure (poop) releases greenhouse gases like methane and nitrous oxide. Compared to carbon dioxide, these greenhouse gases are stronger and hold more heat in the atmosphere.

Emissions for manure play a bigger role in egg-laying chickens than in chickens used for meat. 20% of emissions in egg production are due to manure (compared to 6% in poultry production). This is due to differences in how the manure is stored.



rice



Investigate



rice



Investigate

Overview

Rice has one of the lowest carbon footprints when compared to foods like meat. But because rice is a staple for many people in the world, even a small difference in its carbon footprint can have a big impact. The majority of rice in the world is grown in Asia. China and India grow about half of the world's rice.

Fertilizer and Energy

According to some studies, about a third of rice's carbon footprint comes from fertilizer. Fertilizer releases nitrous oxide and methane into the atmosphere. Energy needed to supply machines and irrigation also contribute to rice's carbon footprint.

Microbes and Methane

Some of rice's carbon footprint is actually due to small bacteria that naturally exist in the water in rice fields. These bacteria are beneficial because they eat leftover organic matter, but they also release methane.



rice



Investigate

Climate Change's Impact on Rice

While rice does not produce a significant amount of emissions, it is being impacted by the effects of climate change. Scientists have found that higher amounts of carbon dioxide in the air have resulted in higher rice yields, while increasing temperatures lowers the yield. Additionally, the increase in droughts and extreme weather events, like cyclones, has made it more difficult to grow rice. Many communities rely on rice and other agriculture to make money.

Solutions

There are a few methods farmers can adopt to reduce their carbon footprint. Farmers can reduce the amount of methane produced by bacteria by almost 70% by draining rice fields so the bacteria don't have a place to live. This also helps conserve more water. This has become a common practice in China, but not everywhere.

When it comes to rice, most scientists and farmers are also focused on exploring ways to make rice more adaptable to climate change. These include harvesting rainwater and building barriers for flood protection.



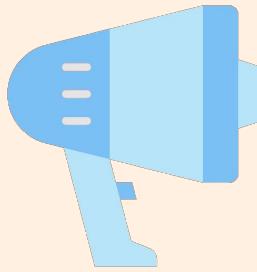
Reflection Questions



Investigate

Answer the following questions in your Student Document:

1. Summarize the passage you read. *In summary, this text is about...*
2. What elements of food production are contributing to higher carbon dioxide levels?
3. What are the consequences of higher carbon dioxide levels?
4. Higher temperatures result in less rice production. What questions do you have about this?



Inspire

~15 minutes

The Carbon Footprint of Food



Inspire

Part 1

1. Look at the **Food Tracker** that you've been working on.
2. Using the data explorer, can you identify the three foods on your Food Tracker that have **the largest carbon footprint?**



Our World
in Data



The Carbon Footprint of Food



Inspire

Part 2:

Use your Food Tracker to identify 2 foods you ate the most. **For each food...**

1. Calculate the **amount of greenhouse gas emissions released annually** (in kg, kilograms) using this [carbon footprint calculator](#). You can estimate how often you eat this food.
2. Choose one of the analogies to understand the impact that the food has on the environment.
3. Look at how the food compares to similar foods.
4. There are nearly 8 billion people on Earth. What are the impacts of a growing population as it relates to the carbon footprint of the food we eat?

Which food would you like?

How often do you have it?



1 apple per serving

Over an entire year your consumption of apples is contributing **2kg** to your annual greenhouse gas emissions.

That's the equivalent of driving a regular petrol car **7 miles (11km)**.



the same as heating the average UK home for **0.4 days**.

OR

Your consumption of apples also uses



1,124 litres of water, equal to **17 showers** lasting eight minutes.



SUBJECT to
CLIMATE

What can you do about it?



Inspire

Part 3:

- How did it feel to learn about the carbon footprint of the foods you eat most?
- Does everyone have the same access to food? Should people who don't have just access to food be responsible for monitoring their carbon footprint?
- How can you use what you learned in this lesson to lower your carbon footprint?
- Who can you share your learning with to encourage more people to lower their carbon footprint?
- How can you monitor your positive actions and measure your impact?

Glossary

Carbon Footprint: The total amount of greenhouse gas generated by a specific action



Emissions: A general term used to describe pollutants in the air



Irrigation: A method to water plants that is commonly done at a large scale in agriculture



Methane: A type of greenhouse gas that traps more heat than carbon dioxide

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