Sources of Greenhouse Gases Handout

Part 1

Match the greenhouse gases (GHGs) with their sources within the food system. One source can produce more than one GHG. The first source is completed for you.

Greenhouse Gases: Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O)

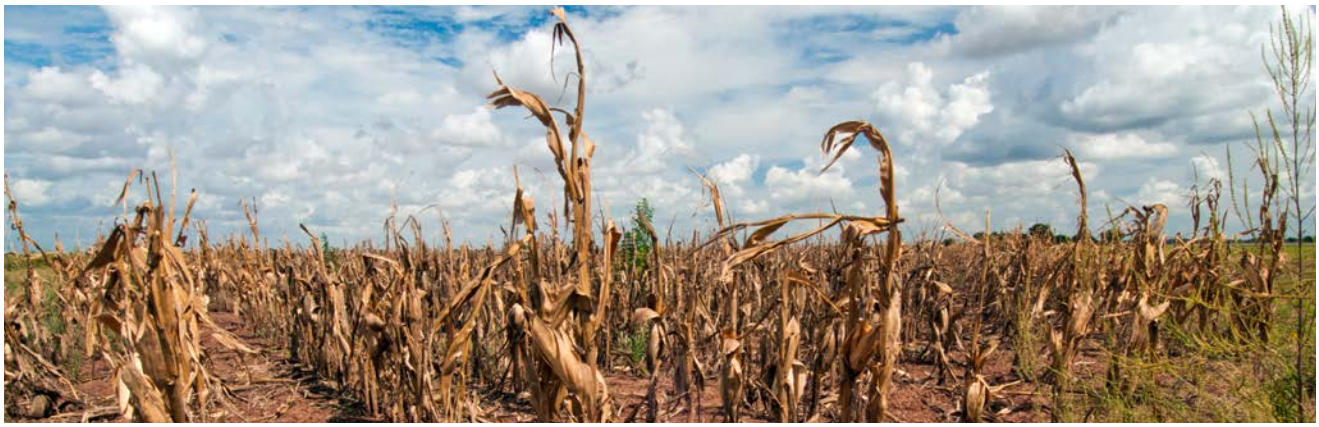
Food System Source	Greenhouse Gas(es)
Decomposition of food waste in landfills	Methane, nitrous oxide
Use of nitrogen-based fertilizer on crops	
Transporting food products	
Bacterial decomposition in rice paddies	
Livestock manure	
Clearing forests for farmland	
Cattle belching	
Running agricultural machinery	

Part 2

List different sources of GHG emissions from the food system, rank them in order of importance, and propose interventions that could reduce emissions from each source. An example is provided.

Source of GHG Emissions	Rank	Intervention to Reduce GHG Emissions
Transporting Products		Transport products by rail or ship, instead of by truck or plane

Climate Change Impacts Teacher Guide



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Loss of topsoil

- Extreme heat: Heat dries out soil, making it more vulnerable to wind erosion.
- Extreme weather events: Hurricanes and flooding can damage crops and wash away soil.
- Changing rainfall patterns: Periods without rainfall can dry out soil, making it more vulnerable to wind erosion. Heavy rainfall can wash soil away.
- Rising sea level: Rising tides along coastal waterways can wash soil away.

Fungus invasion in corn crop

- Changing rainfall patterns: Long periods of heavy rain create ideal circumstances for fungal diseases to flourish and damage crops.

Saltwater contamination of freshwater supply

- Rising sea level: A higher ocean tidal range can introduce saltwater into groundwater supplies.

Increased cost to fight weeds

- Extreme heat: Temperatures rise and hardier weeds can outcompete more sensitive crops.

Increase in a crop's water needs

- Extreme heat: Heat dries out soil.
- Changing rainfall patterns: Periods with low rainfall can dry out soil.

Higher food prices

Explain to students that reduced crop yields often lead to higher food prices.

- Extreme heat: Damage from heat-tolerant weed species can lead to crop losses.
- Extreme weather events: Droughts, hurricanes, and flooding can erode soil and damage crops.
- Changing rainfall patterns: Dry periods and heavy rains can erode soil and damage crops.
- Rising sea level: Rising tides can erode soil and higher salinity can damage crops.

Depletion of freshwater sources for irrigation

- Extreme heat: Higher temperatures increase the evaporation rate. Freshwater in rivers, lakes, and groundwater may become depleted if it evaporates faster than it is replenished.
- Changing rainfall patterns: Periods with low rainfall can cause freshwater sources to dry up.

Food System Greenhouse Gas Emissions Handout

Greenhouse gas emissions by food type

Red meat (beef, pork, and lamb) and dairy production together account for nearly half of the greenhouse gas emissions associated with producing, processing, distributing, and selling food in the U.S.[1, 2]

Red meat (beef, pork & lamb)	Beverages, sweets, oil & other	Dairy	Cereals & Carbs	Fruits & Vegs	Chicken, fish & eggs
30%	21%	18%	11%	11%	10%

Greenhouse gas emissions by supply chain stage

GHG emissions associated with United States food supply chains are predominantly from food production (83 percent) with much smaller contributions from transporting food and food ingredients (11 percent) and food retail (5 percent). Transporting food from stores to homes, home refrigeration, cooking, and emissions from food waste were not included in these estimates, but are also significant contributors of emissions.

Production:	Transport:	Retail:
83%	11%	6%

1. Weber CL ; Matthews HS. Food-Miles and the Relative Climate Impacts of Food Choices in the United States. *Environ. Sci. Technol.* 2008, 42 (10), 3508–3513.

2. Engelhaupt E. Do food miles matter? *Environ. Sci. Technol.* 2008; 42 (10): 3482.