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LESS BEEF, LESS CARBON:

AMERICANS SHRINK THEIR DIET-RELATED CARBON FOOTPRINT BY 10 PERCENT BETWEEN 2005 AND 2014

LESS BEEF = LESS CARBON

BETWEEN **2005 AND 2014**, AMERICANS CUT THEIR BEEF CONSUMPTION, AVOIDING THE EQUIVALENT OF THE ANNUALTAILPIPE EMISSIONS OF APPROXIMATELY

39 MILLION CARS

Between 2005 and 2014, Americans cut their per-capita diet-related climate-warming pollution by approximately 10 percent. Based on NRDC's calculations, these changes cumulatively avoided approximately 271 million metric tons (MMT) of climate-warming pollution. This was roughly equivalent to the annual pollution of 57 million car tailpipes, with most of these cuts in emissions due to reduced beef consumption.

The most impactful diet adjustments relate to the reduced consumption of specific products. For starters, Americans consumed 19 percent less beef, avoiding an estimated 185 MMT of climate-warming pollution or roughly the equivalent of the annual tailpipe pollution of 39 million cars. Americans' reduced consumption of other products—such as milk, pork, shellfish, and high fructose corn syrup—accounts for the remaining emissions cuts. Pollution could have been cut even deeper had Americans not simultaneously increased consumption of other carbon-intensive foods like cheese, yogurt, butter and other foods.

Despite a drop in consumption, beef still contributes more climate-warming pollution than any other food in the American diet. In fact, it comprised approximately 34 percent of total diet-related per capita climate-warming pollution in 2014, the last year for which data is available.

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LESS BEEF = LESS CARBON

PRODUCING **A KILOGRAM** OF BEEF EMITS **26 KILOGRAMS** OF CARBON DIOXIDE

1kg=26kg CO_2

DIFFERENT FOODS, DIFFERENT IMPACTS

As the threat of climate change looms larger and larger, agricultural global warming pollution is coming under increased scrutiny. Some foods are more greenhouse gas-intensive to produce due to greater inputs of land, fertilizer, and energy. For example, meat and dairy production requires large amounts of animal feed, which is comprised mainly of resource-intensive corn and soy. Through their digestive processes, ruminant animals, like cows, also emit large volumes of methane, a climate-changing pollutant 25 times more powerful than carbon dioxide.[1,2,3] Manufacturing and applying synthetic fertilizer, much of which is used to produce feed, and depositing manure on rangelands and pastures also releases nitrous oxide, a climate-warming pollutant 298 times more powerful than carbon dioxide.[4,5]

FIGURE 1: PER CAPITA GHG EMISSIONS FROM BEEF CONSUMPTION 2005–2014[12]

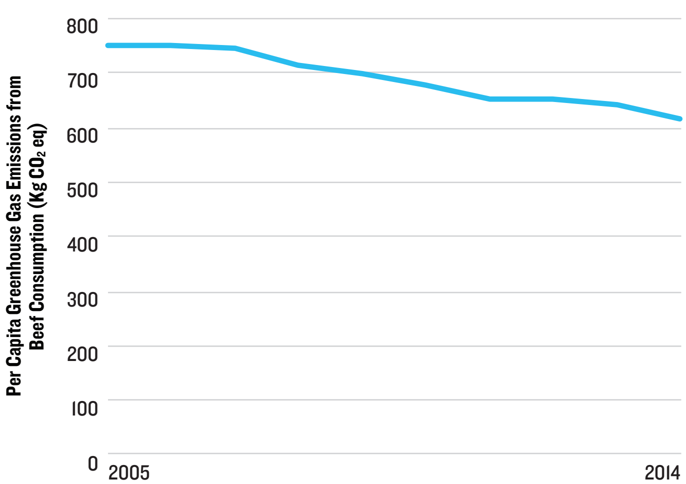
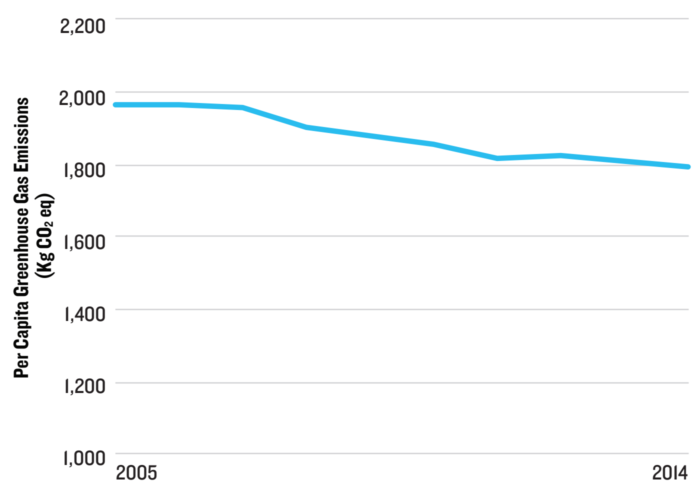


FIGURE 2: PER CAPITA GREENHOUSE GAS EMISSIONS FROM U.S. DIET 2005–2014[15]



OUR METHODS

NRDC calculated the emissions fluctuations associated with changes in per capita consumption of 197 foods tracked by USDA's Economic Research Service from 2005 to 2014.[6,7]

Greenhouse gas emissions factors are based on a compilation of average of lifecycle analysis values identified through a literature meta-analysis published by Heller et al.[8] A life cycle analysis approximates the climate-warming pollution associated with the production of a food item—from fertilizer and pesticides used to grow the crops to transportation and refrigeration. Multiple life cycle analyses for the same food can yield different values if the calculation includes varying growing conditions or different assumptions are made for what to include the measurement. NRDC used life cycle analysis data averaged from the results of multiple life cycle studies, published in the Journal of Industrial Ecology, a peer-reviewed scientific journal.

Finally, we used the U.S. Environmental Protection Agency's (EPA) emissions calculator to translate changes in climate-warming pollution due to shifts in food consumption into the equivalent number of passenger vehicles removed from the road over the period in question.[9] See appendix B for additional details on our methodology.

REDUCING BEEF CONSUMPTION PUT THE BIGGEST DENT IN OUR FOOTPRINT

Producing a kilogram of beef emits 26 kg of carbon dioxide, the highest of all the 197 foods we examined.[10] Furthermore, Americans generally eat a lot of beef, but reduced beef consumption during this time period. This dietary change resulted in the single biggest contributor to the cumulative total climate-warming pollution reductions between 2005 and 2014, as illustrated in Figure 3. As illustrated in Figure 1, the per capita climate-warming pollution associated with beef consumption dropped by approximately 19 percent between 2005 and 2014, avoiding 185 MMT of climate-warming pollution. That's the equivalent of the annual tailpipe emissions of approximately 39 million cars.[11] In addition, per capita reduced consumption of orange juice, pork, plain whole milk, and chicken further cut per capita climate-warming pollution—but not by nearly as much as reduced beef consumption. Figure 5 highlights the top 10 foods for which reduced consumption, in turn, reduced climate-warming pollution between 2005 and 2014.

AMERICANS CONTINUE TO EAT MORE BEEF THAN ALMOST ANY OTHER COUNTRY

Despite reduced beef consumption over the last decade, in 2014, beef was responsible for an outsized 34 percent of the average American's diet-related climate-warming pollution, as illustrated in Figure 4. According to the Organization for Economic Cooperation and Development (OECD), the United States was the world's third largest per capita consumer of beef and veal in 2011, behind just Argentina and Uruguay.[19] As such, eating even less beef offers the biggest opportunity to further reduce food-related pollution.

FIGURE 3: TOTAL GREENHOUSE GAS EMISSIONS FROM U.S. DIET 2005–2014[17]

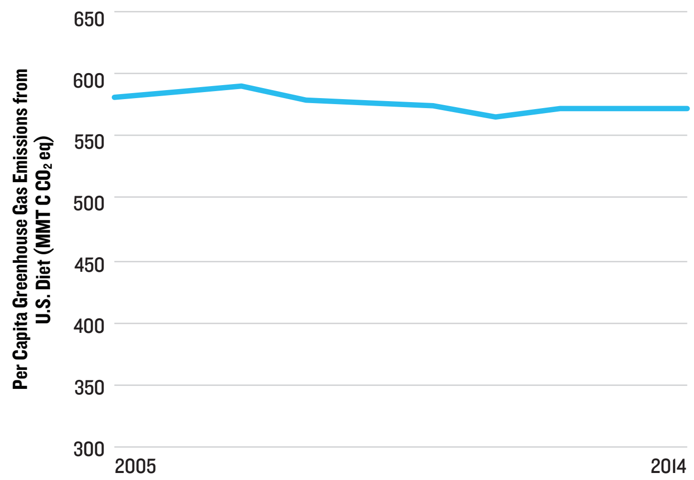
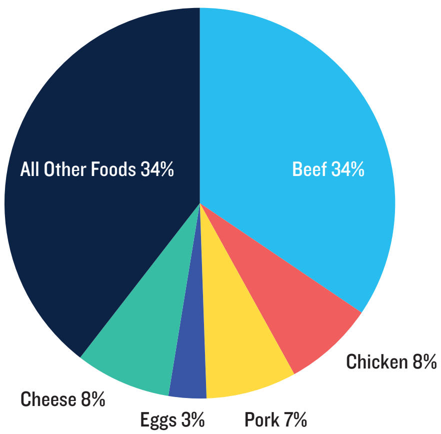


FIGURE 4: RELATIVE CONTRIBUTIONS OF TOP 5 GHG-INTENSIVE FOODS AND ALL OTHER FOODS TO TOTAL PER CAPITA FOOD-RELATED GHG EMISSIONS IN 2014[20]



THERE'S A BETTER WAY TO MANAGE BEEF PRODUCTION

Changes to beef industry management practices could reduce the lifecycle climate-change pollution impacts of beef. Most beef cattle in the United States today are finished on grain in confined animal feeding operations (CAFOs). Growing this cattle feed (primarily corn and soy) requires large amounts of pesticides and fertilizers, which, in turn, require significant inputs of fossil fuels. Alternative models of beef production, such as intensive rotational cattle grazing, can help sequester carbon in the soil and provide numerous other health and environmental benefits compared to CAFOs. Better storage and disposal of manure can also reduce methane emissions.

AMERICANS HAVE REDUCED DIET-RELATED CLIMATE-WARMING POLLUTION

Figure 2 illustrates this decrease in per capita climate-warming pollution. As mentioned earlier, between 2005 and 2014, per capita diet-related climate-warming pollution dropped by approximately 10 percent due to changes in the consumption of the 197 food items examined in this analysis.[13] We estimate that changes in the American diet avoided approximately 271 MMT of climate-warming pollution between 2005 and 2014—roughly equivalent to the pollution put out by 57 million car tailpipes for one year.[14]

As a result of this per capita reduction in food-related climate-warming pollution, overall U.S. food-related emissions dropped by approximately 3 percent, despite an 8 percent population growth between 2005 and 2014. Figure 3 illustrates this drop.[16]

AMERICANS INCREASED THEIR CONSUMPTION OF OTHER CARBON-INTENSIVE FOODS, PARTICULARLY DAIRY

While we reduced our consumption of beef and other carbon-intensive products, Americans ate significantly more dairy products such as cheese, yogurt, and butter between 2005 and 2014. Dairy products are sourced through the same or similar climate-change pollution-intensive supply chain as beef, resulting in relatively high emissions for these products. Americans also ate significantly more asparagus, a particularly climate-change pollution-intensive vegetable.

FIGURE 5: TOP 10 FOODS FOR WHICH DROPS IN CONSUMPTION CONTRIBUTED TO GHG REDUCTIONS 2005–2014

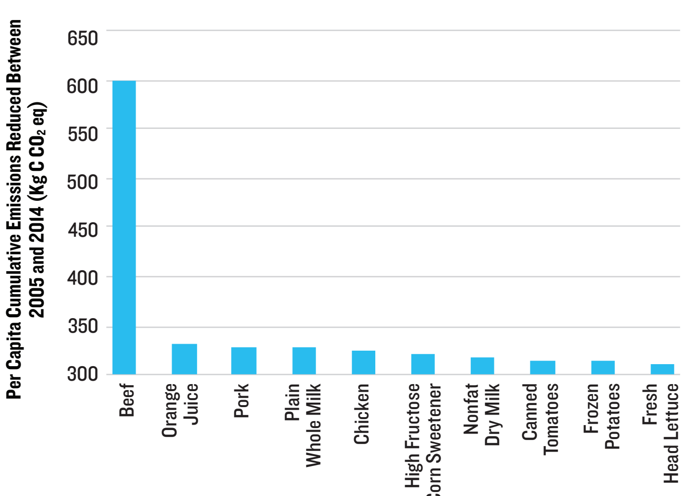


FIGURE 6: TOP 10 FOODS THAT INCREASED CONTRIBUTIONS OF GHG EMISSIONS 2005–2014[21]

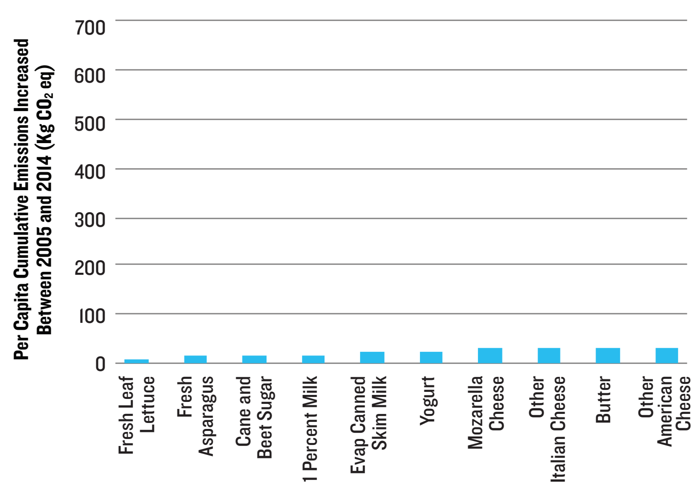


TABLE 1: GREENHOUSE GAS EMISSIONS FACTORS OF TOP 10 FOODS FOR WHICH DROPS IN CONSUMPTION CONTRIBUTED TO GHG REDUCTIONS 2005–2014[18]	
Food	**Emissions Factor (kg CO_2 eq/kg)**
Beef	26.45
Orange Juice	1.03
Pork	6.87
Plain Whole Milk	1.34
Chicken	5.05
High-Fructose Corn Syrup	0.96
Nonfat Dry Milk	10.40
Canned Tomatoes	1.10
Frozen Potatoes	1.44
Fresh Head Lettuce	1.08

TABLE 2: GREENHOUSE GAS EMISSIONS FACTORS OF TOP 10 FOODS THAT CONTRIBUTED MORE GHG EMISSIONS 2005–2014[22]	
Food	**Emissions Factor (kg CO_2 eq/kg)**
Other American Cheese	9.78
Butter	11.92
Mozzarella Cheese	9.78
Other Italian Cheese	9.78
Yogurt	2.02
Evaporated Canned Skim Milk	3.10
1 Percent Milk	1.34
Cane and Beet Sugar	0.96
Fresh Asparagus	8.87
Fresh Leaf Lettuce	1.08

APPENDIX A

FOODS INCLUDED IN ANALYSIS OF PER CAPITA GREENHOUSE GAS EMISSION FROM U.S. DIET

1 Percent Milk
2 Percent Milk
Almonds
Apple Juice
Barley Products
Beef
Blue Cheese
Brick Cheese
Butter
Buttermilk
Cane and Beet Sugar
Canned Apples
Canned Apricots
Canned Asparagus
Canned Cabbage
Canned Carrots
Canned Chile Peppers
Canned Cucumbers
Canned Green Peas
Canned Mushrooms
Canned Olives
Canned Peaches
Canned Pears
Canned Pineapple
Canned Plums
Canned Potatoes
Canned Salmon
Canned Sardines
Canned Shellfish
Canned Snap Beans
Canned Sweet Cherries
Canned Sweet Corn
Canned Tart Cherries
Canned Tomatoes
Canned Tuna
Cheddar Cheese
Chicken
Collard Greens
Corn Flour and Meal
Corn Hominy and Grits
Corn Starch
Cranberry Juice
Cream Cheese
Cured Fish
Dehydrated Onions
Dehydrated Potatoes
Dextrose
Dried Apples
Dried Apricots
Dried Dates
Dried Figs
Dried Peaches
Dried Plums
Dry Black Beans
Dry Buttermilk
Dry Great Northern Beans
Dry Lima Beans
Dry Navy Beans
Dry Peas and Lentils
Dry Pinto Beans
Dry Red Kidney Beans
Dry Whole Milk
Edible Syrups
Egg Nog
Eggs
Evap Cond Bulk Whole Milk
Evap Cond Skim Milk
Evap Condensed Canned Whole Milk
Fresh and Frozen Fish
Fresh and Frozen Shellfish
Fresh Apples
Fresh Apricots
Fresh Artichokes
Fresh Asparagus
Fresh Avocados
Fresh Bananas
Fresh Bell Peppers
Fresh Blueberries
Fresh Broccoli
Fresh Brussel Sprouts
Fresh Cabbage
Fresh Cantaloupe
Fresh Carrots
Fresh Cauliflower
Fresh Celery
Fresh Cherries
Fresh Cranberries
Fresh Cucumbers
Fresh Eggplant
Fresh Escarole
Fresh Garlic
Fresh Grapefruit
Fresh Grapes
Fresh Head Lettuce
Fresh Honeydew
Fresh Kale
Fresh Kiwi
Fresh Leaf Lettuce
Fresh Lemons
Fresh Lima Beans
Fresh Limes
Fresh Mangoes
Fresh Mushrooms
Fresh Mustard Greens
Fresh Okra
Fresh Onions
Fresh Oranges
Fresh Papaya
Fresh Peaches
Fresh Pears
Fresh Pineapple

a U.S. Department of Agriculture, Economic Research Service, Food Availability (Per Capita) Data System, *Loss-Adjusted Food Availability Data*, http://www.ers.usda.gov/data-products/food-availability-(per-capita)-data-system/.aspx (accessed September 29, 2016).

Fresh Plums
Fresh Potatoes
Fresh Pumpkin
Fresh Radishes
Fresh Raspberries
Fresh Snap Beans
Fresh Spinach
Fresh Squash
Fresh Strawberries
Fresh Sweet Corn
Fresh Sweet Potatoes
Fresh Tangerines
Fresh Tomatoes
Fresh Turnip Greens
Fresh Watermelon
Frozen Apples
Frozen Apricots
Frozen Asparagus
Frozen Blackberries
Frozen Blueberries
Frozen Broccoli
Frozen Carrots
Frozen Cauliflower
Frozen Green Peas
Frozen Lima Beans
Frozen Other Berries
Frozen Peaches
Frozen Plums
Frozen Potatoes
Frozen Raspberries
Frozen Snap Beans
Frozen Spinach
Frozen Strawberries
Frozen Sweet Cherries
Frozen Sweet Corn
Frozen Tart Cherries
Glucose
Grape Juice
Grapefruit Juice
Hazelnuts
High Fructose Corn Syrup
Honey
Ice Cream
Ice Milk
Lamb
Lemon Juice
Light Cream
Lime Juice
Low fat Cottage Cheese
low fat Flavored Milk
Macadamia
Miscellaneous. Frozen Vegetables
Mozzarella Cheese
Muenster Cheese
Nonfat Dry Milk
Oat Products
Orange Juice
Other American Cheese
Other Canned Fish
Other Canned Vegetables
Other Dry Beans
Other Frozen
Other Italian Cheese
Other Miscellaneous Cheese
Other Processed Vegetables
Other Tree Nuts
Parmesan Cheese
Peanuts
Pecans
Pineapple Juice
Pistachios
Plain Whole Milk
Pork
Provolone Cheese
Prune Juice
Raisins
Regular Cottage Cheese
Ricotta Cheese
Romano Cheese
Rye Flour
Skim Milk
Sour Cream
Swiss Cheese
Turkey
Veal
Walnuts
White and Whole Wheat Flour
Whole Flavored Milk
Yogurt

APPENDIX B

METHODOLOGY NOTES

The USDA's Food Availability data set includes estimates of the amount of food produced for domestic consumption (i.e., food availability) for more than 200 basic commodities at the farm or in early stages of processing. Ingredients in highly processed foods are included as their primary components—for example, as flour, sugar and beef.

This data set is the federal government's best assessment of our diet, although imperfect. It is important to note, for instance, that this data set does not include *all* food commodities ingested by all Americans. It does include major food items that USDA has been able to secure data for, and has been considered sufficiently comprehensive by USDA to use in assessments of whether Americans are adhering to federal dietary pattern recommendations, and in other analyses of U.S. consumption patterns. Other papers have examined additional potential limitations of the data set.[b]

We used values listed in the 'retail weight' category for red meat and poultry, and the primary weight at farm gate of all other food commodities as a proxy for consumption. Of the commodities that USDA tracked, we included only foods for which data over the period 2005-2014 existed in order to avoid skewing year-to-year comparisons in consumption and GHG emissions. Appendix A includes a list of these foods.

It is important to underscore that these life cycle assessments are estimates and can have a significant range due to differences in geography assumptions, inputs and available data. The average life cycle analyses compiled by *Heller et al* also include life cycle analyses from production outside the United States, and do not specifically represent domestic production systems. They do, however, align with similar estimates made by other researchers. The GHG emissions factor for beef calculated by the Environmental Working Group in a separate life cycle analysis at farm gate, for instance, was 20.44 kg CO_2 eq/kg, compared to the average factor of 26.45 kg CO_2/kg derived by Heller.[c] For a complete list of the range of emissions factors identified in this review and the averages used in this analysis, please refer to *Heller et al*.

b Fehrenbach KS, Righter AC, Santo RE, A critical examination of the available data sources for estimating meat and protein consumption in the USA, Public Health Nutrition (2016) 19(8): 1358-1367.

c Hamerschlag, K., and Venkat, K., "Meat Eater's Guide to Climate Change and Health," Lifecycle Assessments: Methodology & Results, 2011.

SAMPLE CALCULATIONS

A. *Per Capita Emissions for a Food Item in One Year —example Beef*

Per Capita Consumption of Beef in 2005 (lbs/year) – 62.5 lbs/year

Per Capita Consumption of Beef in 2005 (kg/year) – 62.5 lbs/year * 0.45 kg/lb = 28.35 kg

Per Capita Emissions due to consumption of Beef in 2005 (kg CO_2 eq) - 28.35 kg * 26.45 kg CO_2 eq/kg = 749.84 kg CO_2 eq

For this analysis, we performed the same calculation for all foods in one year to determine the total food-related per capita emissions for one year.

B. *Average Percent Reduction in all per capita food-related emissions each year between 2005 and 2014*

Year	Overall Annual Food-Related Per Capita Emissions	Percentage Difference (year-to-year % change)
2005	1,932	
2006	1,933	0.06
2007	1,926	–0.3
2008	1,871	–2.9
2009	1,849	–1.2
2010	1,826	–1.2
2011	1,784	–2.3
2012	1,795	–0.61
2013	1,781	0.73
2014	1,762	–1.1
Average Percentage Change Per Year		–1.0

C. *Overall percentage change in per capita and overall emissions from U.S. diet*

We used the trendline equation, y=-21.64x+1994.90, from the per capita emissions graph (Figure 1) to calculate the starting per capita emissions in 2005 and the ending per capita emissions in 2014. When X=1: y=1973.27 and when X=10;y=1777.92. The percentage difference between these two values is approximately 10 percent. Similarly, we used the trendline equation y= -1.9x+588.09 from Figure 2 to calculate the starting overall emissions in 2005 and the ending per capita emissions in 2014. When x=1: y=586.19 and when X=10; y=569.09. The percentage difference between these two values is approximately 3 percent.

D. *Percentage of Beef's Contribution to overall emissions in 2014*

Food	Per Capita Emissions in 2014 (kg CO_2 eq)
Beef	618
Chicken	134
Pork	134
Eggs	56
Mozzarella Cheese	49
Other Italian Cheese	49
Cheddar Cheese	43
Total Wheat Flour	35
2 Percent Milk	34
Canned Tomatoes	33
All Other Foods	593

Percentage Calculation: Per Capita Beef Emissions in 2014/ Total Per Capita Emissions in 2014 *100%

= 618 kg CO_2 eq/1778 kg CO_2 eq *100%

= 34%

E. *Total Cumulative Emissions Avoided Between 2005 and 2014 due to Change in Consumption—example Beef*

To calculate the cumulative GHG emissions change between 2005 and 2014 due to the change in food availability each year, we calculated the difference in per capita emissions for each food, between each year from 2006 to 2014 and the year 2005. We then multiplied the difference in per capita GHG emissions between each of those years and 2005 by the population of that year to determine the overall GHG emissions gained or avoided in that year. We totaled all these changes in per capita GHG emissions to determine the total emissions avoided or gained over the ten year period.

In the example shown, calculations estimate the cumulative CO_2 emissions that were avoided from declining consumption of beef over the period 2005 to 2014, relative to a 2005 baseline, by estimating the difference between observed patterns and what emissions would have been if 2005 consumption levels had remained constant.

Per Capita Emissions from Beef in 2005: 750 kg CO_2 eq

Per Capita Emissions from Beef in 2006: 753 kg CO_2 eq

Difference in Per Capita Emissions from beef between 2005 and 2006: -3 kg CO_2 eq

Total Avoided Emissions due to change in per capita consumption of beef between 2006 and 2005:

-3 kg CO_2 eq * 294,914,085 (2005 U.S. population) = 884 million kg CO_2 eq

Performed same calculation for beef, comparing 2007 per capita consumption to 2005; 2008 to 2005; 2009 to 2005; 2010 to 2005; 2011 to 2005; 2012 to 2005; 2013 to 2005; 2014 to 2005

Added all these differences to calculate the total cumulative CO_2 emissions avoided by a change in per capita consumption of beef between 2005 and 2014

Performed same calculations for all food items to determine the top 10 foods that contributed avoided emissions during this period and the top 10 foods that contributed added emissions due to change in their consumption during this period.

ENDNOTES

1 U.S. Environmental Protection Agency, Source of Greenhouse Gas Emissions: Agriculture Sector Emissions, downloaded from http://www3.epa.gov/climatechange/ghgemissions/sources/agriculture.html.

2 Pimientel, D. 1997. Livestock production: Energy inputs and the environment. Canadian Society of Animal Science, Proceedings. Canadian Society of Animal Science, Montreal Quebec.

3 Manitoba Eco-Network (2016), Climate Change Connection, downloaded from: http://climatechangeconnection.org/emissions/co2-equivalents.

4 *Ibid*.

5 U.S. Environmental Protection Agency, Source of Greenhouse Gas Emissions: Agriculture Sector Emissions, downloaded from http://www3.epa.gov/climatechange/ghgemissions/sources/agriculture.html.

6 United States Department of Agriculture, Economic Research Service, Food Availability (Per Capita) Data System (2015), downloaded from http://www.ers.usda.gov/data-products/food-availability-(per-capita)-data-system.aspx .

7 This analysis relies on USDA Economic Research Service Food Availability (Per Capita) Data System food waste assumptions at the production, retail and consumer level, embedded in the Loss-Adjusted Food Availability data provided at http://www.ers.usda.gov/data-products/food-availability-(per-capita)-data-system.aspx. The data series measures the volume of food available for consumption at the farm level or in the early stages of processing. USDA calculates this availability after subtracting uses that fall outside the U.S. food supply such as farm inputs, exports, ending stocks and industrial uses. As such, this data series is a useful proxy for actual food intake. http://www.ers.usda.gov/data-products/food-availability-(per-capita)-data-system/food-availability-documentation.aspx.

8 Heller MC, Keoleian. Greenhouse gas emission estimates of U.S. dietary choices and food loss. *Journal of Industrial Ecology: Supporting Information* (2014).

9 Greenhouse gas emissions auto equivalent calculated using U.S. Environmental Protection Agency Greenhouse Gas Equivalencies Calculator, https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator, accessed on March 30 2016. Calculator uses the following conversion factor: 1 kg CO_2 eq = emissions from 0.0002 passenger vehicle for one year.

10 Heller, M.C. and G.A. Keoleian. 2014. Greenhouse gas emission estimates of U.S. dietary choices and food loss. *Journal of Industrial Ecology: Supporting Information.*

11 See Methodology, APPENDIX B, section D 'Converting Per Capita Change to Greenhouse Gas Emissions Gained or Lost – Calculation Breakdown Example of Beef'.

12 NRDC analysis of U.S. Department of Agriculture Economic Research Service Food Availability (Per Capita) Data System, Loss-Adjusted Food Availability Data, downloaded from http://www.ers.usda.gov/data-products/food-availability-(per-capita)-data-system/.aspx September 29 2016.

13 See Methodology 'Calculating the Per Capita Reduction in Diet-Related Greenhouse Gases between 1970 and 2013'.

14 Greenhouse gas emissions auto equivalent calculated using U.S. Environmental Protection Agency Greenhouse Gas Equivalencies Calculator, https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator, accessed on March 30 2016. Calculator uses the following conversion factor: 1 kg CO_2 eq = emissions from 0.0002 passenger vehicle for one year.

15 NRDC analysis of U.S. Department of Agriculture Economic Research Service Food Availability (Per Capita) Data System, Loss-Adjusted Food Availability Data, downloaded from http://www.ers.usda.gov/data-products/food-availability-(per-capita)-data-system/.aspx September 29 2016.

16 Source of U.S.yearly population estimates numbers: US Department of Agriculture, downloaded from Red Meat Food Availability Dataset http://www.ers.usda.gov/data-products/food-availability-(per-capita)-data-system/.aspx.

17 NRDC analysis of U.S. Department of Agriculture Economic Research Service Food Availability (Per Capita) Data System, Loss-Adjusted Food Availability Data, downloaded from http://www.ers.usda.gov/data-products/food-availability-(per-capita)-data-system/.aspx September 29 2016.

18 Heller, M.C. and G.A. Keoleian. 2014. Greenhouse gas emission estimates of U.S. dietary choices and food loss. *Journal of Industrial Ecology: Supporting Information.*

19 https://data.oecd.org/agroutput/meat-consumption.htm.

20 NRDC analysis of U.S. Department of Agriculture Economic Research Service Food Availability (Per Capita) Data System, Loss-Adjusted Food Availability Data, downloaded from http://www.ers.usda.gov/data-products/food-availability-(per-capita)-data-system/.aspx September 29 2016.

21 NRDC analysis of U.S. Department of Agriculture Economic Research Service Food Availability (Per Capita) Data System, Loss-Adjusted Food Availability Data, downloaded from http://www.ers.usda.gov/data-products/food-availability-(per-capita)-data-system/.aspx September 29 2016.

22 Heller, M.C. and G.A. Keoleian. 2014. Greenhouse gas emission estimates of U.S. dietary choices and food loss. *Journal of Industrial Ecology: Supporting Information.*