

How Do the Climate Crisis, Agriculture and the Food System Affect One Another?

Food Solution in the Era of Climate Crisis – Part 1

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The food system accounts for a quarter of global greenhouse gas emissions.

The summer of 2020 will be remembered in Korea as the time of the longest monsoon on record, which lasted for a total of 52 days in the central region of the country from June 24 to August 14. The average cumulative rainfall nationwide reached 780 millimeters, far greater than the 406 millimeters observed in 2013, when the summer monsoon season lasted for 49 days. The historic monsoon wreaked havoc across the nation, causing 1,584 landslides, immeasurable losses to various crops, fruits and livestock, and evacuation of thousands of people. As unprecedented rain, floods and hurricanes swept across Korea and elsewhere, other regions around the world suffered from record heatwaves, abnormal heights in temperatures, and massive wildfires.

According to *Report on the Impact of Climate Change on Korea 2020*, co-released by Korea's Ministry of Environment (ME) and the Korea Meteorological Administration (KMA),¹ the current pace of increases in greenhouse gas emissions and temperatures, if left unmitigated, would raise the sea level around the Korean Peninsula by one full meter by the end of this century, flooding 1.2 percent of the whole peninsula (roughly 300 times the area of today's Yeouido Island). This would mean the loss of at least 15 percent of the pine forests that make up much of mountains across the Korean Peninsula, and the northward migration of orchards for the region's main fruit crops, such as apples, pears, peaches, and persimmons. The rice crop output would also be slashed by more than 25 percent, while the quality of the rice would also suffer. The high temperatures at the end of this century would also drastically reduce soybean and corn outputs. Although a warmer climate could encourage cultivation of more tropical fruits and crops in Korea, it would also open the door to vermin and pests against which Koreans lack immunity. These projections highlight the urgent need for us to start researching and experimenting diverse ways now to adapt to climate change.

When we talk about agriculture and food in relation to climate change, the first thing we often think of is how climate change has been destroying crops and produce. Rarely does it occur to us, however, to think about how the modern systems of agriculture and food that we have invented, for our constant nourishment, affect climate. According to a study titled "Reducing food's environmental impacts through producers and consumers" that appeared in a 2018 issue of *Science*, modern agriculture—including production of food and non-food crops and the destruction of woodlands for enlarging arable land—generates 13.7 billion tons of carbon dioxide equivalent or 26 percent of total greenhouse gas emissions worldwide.² Livestock and fishery industries that produce meat and poultry, dairy products, eggs, and seafood together account for 31 percent of all greenhouse gas emissions generated by the food industry. Another 27 percent comes from cultivation of staples and vegetables, including 21 percent from crops for human consumption and another 6 percent from crops grown to produce animal feed. Land use itself accounts for 24 percent of total worldwide emissions, as vast areas of the savannah, jungles, and prairies are regularly scorched to create land for farming palm trees and crops for animal feed. Even organic farming involving the plowing of soil generates emissions. The food supply chain produces 18 percent of total worldwide emissions because enormous amounts of energy and resources are expended throughout the chain from farm to table, including food processing (four percent), transportation (six percent), packaging (five percent), and retail (three percent). A sizable portion of greenhouse gas emissions

¹ ME and KMA (2020). *Report on the Impact of Climate Change on Korea 2020*, <http://me.go.kr>.

² Poore, J. and Nemecke, T. (2018, June). Reducing food's environmental impacts through producers and consumers. *Science*, <https://science.sciencemag.org/content/360/6392/987>.

also comes from food wastes. The entire food system, encompassing production, the supply chain, transportation and distribution, and food wastes, thus make up a quarter of total greenhouse gas emissions generated worldwide.³

The livestock industry exerts a considerable impact on climate throughout its lifecycle.

In its 2006 report entitled “Livestock’s Long Shadow: Environmental Issues and Options,” the Food and Agriculture Organization (FAO), part of the United Nations, revealed the modern system of agriculture and food supply as one of the main culprits behind global warming, responsible for nearly a third of the effects of climate change we feel today. Livestock has grown into a major industry over the decades, accounting for 40 percent of the worldwide sum of gross domestic product (GDP) from agriculture. It also supplies a third of proteins consumed by humans. The global meat and poultry output are projected to more than double, from 229 million tons in 1999 to 465 million tons by 2050, as the growing western diet and populations of nations will likely fuel the demand. The global milk output, too, is projected to soar at a similar pace from 580 million tons to 1,043 million tons. More vast areas of wilderness will be reclaimed as pastures for cattle, while the shift to more efficient breeds will occur at an increasingly accelerated pace, as will the trends toward the centralization and industrialization of livestock farming. Small ranchers and farmers will become all the more marginalized in the process.

Over a quarter of unfrozen land on earth is already under use for grazing cattle, while a third of farmland is used to grow animal feed. The livestock industry is an unbeatable force in worldwide competition over scarce land, water, and other natural resources. In the meantime, the loss of wilderness due to the need for pastures and animal feed production, the use of wide-ranging materials for the processing and international transportation of livestock products, and the manure and other wastes generated by the industry continue to turn land arid, pollute air and water, deplete water sources, threaten biodiversity, and accelerate climate change.

Dr. Ahn Yeong-in, who also covers climate-related news for SBS, a major TV network in Korea, particularly blames methane from livestock. Methane is a greenhouse gas that is 20 to 80 times more damaging than carbon dioxide. Carbon dioxide buildup in atmosphere may alter climate over centuries, while the same extent of change can occur in just nine years for the same amount of methane. Ruminants therefore have been drawing much attention from the circles desperate to find ways to mitigate and delay the effects of climate change. As the table below shows, cows and sheep generate 30 times more greenhouse gas emissions per kilogram of meat than do pigs. Substituting beef altogether with soy proteins can reduce emissions by 99 percent.⁴

(Unit: kg CO₂eq./kg)

Ruminant		Other sources of proteins	
Beef (free-range)	12 to 129	Fish (farmed)	3 to 15
Lamb and mutton	10 to 150	Pork	4 to 11
Beef (rancher)	23 to 52	Eggs	2 to 6
Beef (mass-bred)	9 to 42	Soybeans (meat substitutes)	1 to 2

Greenhouse Gas Emissions Generated Per Kilogram of Proteins⁵

The livestock population raised in Korea for food grew approximately 140 percent from 77 million heads in 1990 to 182 million heads in 2017. As of 2019, 98.11 million chickens were raised

³ Ritchie, H. (2019). Food production is responsible for one-quarter of the world’s greenhouse gas emissions. *Our World in Data*. Oxford University, <https://ourworldindata.org/food-ghg-emissions>.

⁴ Ahn, Y. (2017). *Signals: Warnings from Climate*. 137-141. Enzyme Health Inc.

⁵ Nijdam, D., Rood, T. and Westhoek, H. (2012). The price of protein: Review of land use and carbon footprints from life cycle assessments of animal food products and their substitutes. *Food Policy* 37, 760-770.

per month on average, and a total of 1.06 billion chickens were slaughtered for food that year. That same year, Koreans produced 245,000 tons of beef, 970,000 tons of pork, and 640,000 tons of chicken, while importing 427,000 tons of beef, 420,000 tons of pork, and 180,000 tons of chicken as well.⁶ The amount of meat and poultry available for consumption per capita in Korea is already 60 kilograms per year, but the demand is rapidly rising thanks to the media and trends encouraging intakes of animal proteins. Even meat and poultry from livestock raised in Korea cannot be produced without animal feed imported from abroad.⁷ Koreans, in other words, are not free from the responsibility for the additions to greenhouse gas emissions from the international trade of meat, poultry and animal feed.

As author Katy Keiffer points out, 80 percent of American beef cattle are owned by four corporate food giants, i.e., Cargill, Tyson Foods, JBS USA, and National Beef. These corporations have been reaping record-high profits since achieving breakthroughs in beef production by mass-breeding cows in factory-like, heavily clustered conditions. In the meantime, they have been getting more and more skilled in transferring the costs of their operations—soil and water pollution, greenhouse gas and other pollutant emissions accelerating global warming, the abrupt fall in the wage of livestock workers, and violation of workers' basic rights—onto consumers and the rest of society.⁸ The environmental impact of the livestock industry throughout its lifecycle can no longer be overlooked.

The dawn of agriculture 12,000 years ago began to alter climate on earth.

William F. Ruddiman, a paleoclimatologist, argues that plow, plagues, and petroleum have been the chief instruments with which humankind has been altering and disrupting climate over the past 12,000 years.⁹ Nature has been the main force of control on climate for much of the time humans and their primate ancestors lived on this planet. Humans, however, arose victorious and began to control, albeit unwittingly then, climate when they began to cultivate foods for themselves 12,000 years ago. As humans settled and began to raise livestock and crops in growing quantities, they multiplied rapidly in numbers thanks to better nourishment. The ever-growing human population has meant ever-growing demand for foodstuff, resulting in the scorching of land in the interest of farming and destruction of pristine forests in search for firewood necessary for cooking and heating. Humans began to irrigate lowland areas as early as 5,000 years ago. Rice paddies—a rudimentary form of manmade wetlands—proliferated across China and Southeast Asia. The amounts of methane released into atmosphere kept growing at astonishing speeds from the heaps of manure humans kept for farming, the burping and farting of the cattle humans raised, and the decomposition of plants dying on manmade wetlands.

During the latest interglacials the amount of carbon dioxide had been going down naturally. Humans, however, released over 300 billion tons of carbon dioxide even before the start of the Industrial Revolution in the mid-18th century throughout the preceding eight millennia. Agriculture, born in the so-called Fertile Crescent on the east side of the Mediterranean Sea, soon made its way across Europe, with humans chopping trees down and scorching land to gain ever more of cultivable land. Destroying one square kilometer of forests increases the amount of carbon dioxide in the air by roughly 1,000 to 3,000 tons. Agriculture, in other words, drastically increased the amounts of methane and carbon dioxide in the air that could have been reduced significantly by the workings of nature. The resulting phenomenon known as global warming has inhibited the natural growth of sea ice in Antarctica and the formation of new ice in the Arctic. In addition to the millennia-long delays in the natural reduction of carbon dioxide in the air, the arrival of the Industrial Revolution has had a

⁶ Korea Rural Economics Institute (2020). *Agriculture Outlook 2020 – Volume 2*, 737-818.

⁷ Greenhouse Gas Inventory and Research Center (2019). *National Greenhouse Gas Inventory Report*, 73.

⁸ Keiffer, K. (2017). *What's the Matter with Meat?* (Kang, Y. Trans.). Ruach Publishing.

⁹ Ruddiman, W. F. (2017). *Plow, Plagues, and Petroleum: How Humans Took Control of Climate* (Kim, H. Trans.). eco-livres.

cataclysmic effect in increasing greenhouse gas emissions over the last two centuries through the use of fossil fuels. Ruddiman estimates that the next ice age would already have begun had it not been for the 2°C rise in global temperature from pre-Industrial Revolution agriculturalization. In other words, he believes that human-generated greenhouse gas emissions are what have halted the natural cycle of ice ages.¹⁰

Our agriculture and food system today deplete all the resources on earth to satiate our desires. On the other hand, policymakers and the media often treat climate change as if it were the apocalypse. With the world's human population projected to reach 10 billion by the end of the 21st century, what changes should occur in agriculture and food system? We live in an age of unmatched scientific discoveries and technological innovations. We have the reasons and means to stop prioritizing profit above all else, and, instead, to make efforts in search for more eco-friendly models of agriculture that respect biodiversity and promote the wellbeing of humans, animals and the natural environment. Now that more and more people in Europe and North America—long known for their meat-heavy diets—are turning to vegan ways of life, Koreans, too, should take a step back from the meat-glorying culture of our day and begin to look for a new approach to our way of life.

¹⁰ Ruddiman, 2017, 169-199.