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Science & Technology

How Farm Animal Burps Are Fueling Global Warming

Columbia environmental scientist Catherine Ivanovich wants us to understand the impacts of the food we eat.

By
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|
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In the world of greenhouse gas (GHG) emissions, carbon dioxide gets the limelight, while methane always plays second fiddle. Everyone knows CO2, but who knows CH4? It's a CO2 world — carbon emissions, carbon capture, carbon sequestration — and methane is just wafting in it.

To be fair, CO2 accounts for 74 percent of all anthropogenic GHG emissions. But methane, the second-most prevalent GHG (17 percent of the whole pie), is a serious problem. Invisible, colorless, and odorless, CH4 is far more potent than CO2 in trapping heat in the atmosphere. This potency is even more alarming given that nearly half of all human-caused methane emissions come from the sector most critical for our survival: agriculture.

Catherine Ivanovich, a fifth year PhD candidate in Columbia's Department of Earth and Environmental Sciences, has long been fascinated by the complex interplay of GHG emissions, the food system, and the climate. "Our changing climate has an impact on what foods we're able to grow and how efficiently we can grow them, and affects the health of agricultural workers and farm animals," she says from her office at the Lamont-Doherty Earth Observatory. "In the other direction, the process of food production is contributing heavily to greenhouse gas emissions and

environmental degradation."

Ivanovich is the lead author of a study called "Future warming from global food consumption," recently published in the journal *Nature Climate Change*. The study looks at emissions in the global food system from the three big GHGs — carbon dioxide (transportation, machinery, and electricity use), methane (livestock), and nitrous oxide (fertilizer) — and calculates their impact on warming by the end of the century, under current dietary patterns and agricultural practices.

"It's difficult to accurately assess the impact of the agricultural sector in terms of emissions, because multiple climate pollutants are released throughout the agricultural production process, and they stay up in our atmosphere for different amounts of time," Ivanovich says. "We use a modeling technique that allows us to directly measure the impact of each individual GHG on global average temperature rise, rather than combining all three."

In the study, Ivanovich and her coauthors found that agriculture, primarily due to methane emissions, could produce a 1° Celsius rise in the average global temperature by the end of the century. How significant is that one degree? Consider the Paris Agreement of 2015, in which 196 parties (195 countries plus the EU) vowed to keep global temperature from rising more than 1.5° C (2.7° F) above "pre-industrial" levels (between 1850 and 1900), in hopes of preventing further intensification of the droughts, fires, biodiversity loss, and severe weather that we are already seeing. Ivanovich shows that food consumption alone could push us over the 1.5° C brink.

The bulk of agricultural methane emissions comes from ruminant meat and dairy. Ivanovich explains that ruminants — animals with multi-chambered stomachs, such as cows, goats, and sheep — undergo a digestive process called enteric fermentation, resulting in methane belches. There are more than 3.5 billion of these animals on the planet, and their emissions release hundreds of billions of tons of methane into the atmosphere each year (cattle release 231 billion pounds of methane annually, according to *Our World In Data*, an online publication based at the University of Oxford). Ruminant belching accounts for some 40 percent of all methane emissions from human activity.

Now maybe it's the amusing fact of animal flatulence that helps us dismiss these emissions as somehow unimportant. But it's also a matter of visualization, says

Ivanovich: “When you look at transportation, you can actually see the exhaust coming out of vehicles, and so you can picture the gases being released and understand that they are impacting our atmosphere. But when you look at a farm, you don’t see the methane being released.”

And it’s not just animal agriculture. Another big source of methane emissions — accounting for 10 to 12 percent of all anthropogenic methane — comes from a surprising place: the irrigated green grasses of the world’s rice fields. “Methane in rice production comes from a process called rice paddy methanogenesis, in which bacteria that exist in rice paddies produce methane,” explains Ivanovich. The problem, she says, is both the emissions and the scope of consumption: rice is a staple for billions of people around the world.

The good news is that methane, for all its heat-trapping prowess, is short-lived. While CO2 stays in the atmosphere for hundreds of years, methane sticks around for about ten — which presents an opportunity. “What it means,” says Ivanovich, “is that if we can take targeted measures and directly reduce those methane emissions, we’ll see the benefits very quickly.”

To achieve these benefits, Ivanovich and her coauthors offer several mitigation strategies. These include modifications to production practices (better manure management, methane-reducing food additives for livestock, changes to rice-paddy flooding methods), decreasing retail- and consumer-level food waste (on the theory that this will reduce demand), and healthful changes to diets, with an emphasis on reducing meat consumption. Last year, *Nature Food*, another academic journal, published a widely-discussed paper that linked a plant-based diet to dramatic declines in GHG emissions, land use, and water pollution.

Not that Ivanovich wants to tell anyone what to eat. She recognizes the emotional and cultural importance of food, and advocates that these factors be considered in any policymaking decisions aimed at GHG reductions. On the other hand, she views global warming as an all-hands-on-deck problem, and asserts that individual consumer behavior, however insignificant it might seem, matters: “If you make a healthful dietary choice, and you communicate that to your community, or you make it easier for people to do the same, it can have aggregate effects that are really meaningful,” she says. Basically, if you’ve discovered a fabulous veggie burger, don’t keep the news to yourself.

By targeting agricultural methane emissions with every tool available, Ivanovich believes that substantial reductions are within our grasp. And if her research pushes methane more into the spotlight as a major climate pollutant, it can also help ensure that CH4 never attains the notorious brand recognition of CO2.

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