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Livestock's Hoof Print

The Challenge of Regulating Global Warming Emissions

Bruce Myers

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Bruce Myers

2000 L Street, N.W., Suite 620
Washington, D.C. 20036
Telephone: 202.939.3800 • Fax: 202.939.3868
E-mail: law@eli.org • Web: www.eli.org

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About the Author:

Bruce Myers is a senior attorney at the Environmental Law Institute. He co-directs ELI's Industrial Agriculture Law & Policy Center and regularly writes and speaks on issues at the intersection of environmental protection and animal welfare.

IN THE ABSENCE of a comprehensive federal law to mitigate greenhouse gas (GHG) emissions, an "all-of-the-above" approach is now taking shape. President Barack Obama's Climate Action Plan, announced last year, relies on a mix of regulations and incentives to cut carbon pollution from power plants, accelerate the shift to clean energy, reduce emissions from transportation, and improve energy efficiency in industry, businesses, and homes. And environmentalists—a group that includes environmental professionals *ex officio*—have long been active on each of these fronts. Beyond pressing for policy reform, environmentalists have led the charge to opt out of, or reduce their demand for, activities that generate GHGs. This has meant lowering personal energy use by choosing green power, using public transportation, driving more fuel-efficient vehicles, flying less, and making myriad other individual decisions that, in the aggregate, keep more carbon in the ground and out of the atmosphere.

But the national climate policy dialogue has mostly steered clear of a significant category of GHG emissions: those associated with the production of meat and other animal products by an ever more industrialized livestock sector. According to the United Nations Food and Agriculture Organization (FAO), 14.5 percent of all heat-trapping GHGs emitted into the atmosphere through human activity is attributable, directly or indirectly, to the livestock sector. By 2050, meat production is projected to double due to increasing population and growing per capita demand. And according to research published in the *Proceedings of the National Academy of Sciences* in 2010, the livestock sector alone could, by 2050, account for 70 percent of what the authors characterize as humanity's "suggested safe operating space" for anthropogenic GHGs. It is well past time to elevate the role of livestock, and especially the industrialized production of meat, as a matter of national climate policy.

Primary Causes

HOW DOES RAISING ANIMALS have such a serious climate impact? In broad strokes, the livestock sector (and in particular the industrial livestock sector) generates GHG emissions through the production of feed for animals, during animal rearing, and in connection with the processing of animal products. Transportation and energy emissions factor in at every phase of the process, generating the familiar gas CO_2. As in all economic sectors, industrial livestock production activities consume energy and so result in CO_2 emissions. Energy is used throughout the livestock production process, for example, in the manufacture of chemical inputs (such as fertilizer), in the operation of farm machinery and equipment, and in processing and transporting final products. But where livestock production really separates itself from most other sectors is through the emission of large amounts of the far more potent heat-trapping gases methane (CH_4) and nitrous oxide (N_2O). These two gases are responsible for nearly three-quarters of the global livestock sector's CO_2-equivalent emissions.

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CH_4 is a major culprit. It is the most abundant non-CO_2 GHG in the atmosphere, measured by concentration. Worldwide, agricultural activities are the primary source of anthropogenic CH_4 emissions—with livestock as the primary contributor. In the United States, the U.S. Environmental Protection Agency (EPA) assigns about one-third of anthropogenic CH_4 emissions to livestock production—placing it just ahead of attention-grabbing natural gas and petroleum systems as a source. As most people know, cows and other ruminants expel CH_4 as a byproduct of their digestive process: this is called "enteric fermentation." Earth is home to over 3.5 billion domestic ruminants, not counting wild populations. Cattle and

other ruminants are overwhelmingly responsible for livestock CH_4 emissions. And this isn't only about what comes out of the front end of the animal: CH_4, along with N_20, is also generated by the storage and processing of manure. Industrial livestock systems generate enormous amounts of waste, which is often stored in large lagoons.

Despite a much shorter atmospheric life-span when compared with CO_2 (12 years as compared with 50–200 years), CH_4 paints a troubling climate picture. First, CH_4's potency as a heat-trapper may have been seriously underestimated. Late last year, the Intergovernmental Panel on Climate Change (IPCC) said that CH_4's heat-trapping capacity (or global warming potential, GWP) over the relevant 20-year and 100-year time horizons is, respectively, 86 and 34 times that of CO_2. In contrast, FAO's most recent analysis uses a lower 100-year GWP factor of 25, and EPA's last GHG inventory relied on an even lower, and especially outdated, 100-year GWP of 21—though the Agency has just raised the figure to 25, effective in 2014. Whatever the proper 100-year GWP for CH_4, given the increasingly dire news on the state of climate change, it may well make more sense to assess CH_4's potency based on the higher GWP associated with a shorter, 20-year horizon. The IPCC has acknowledged that the choice of time horizon amounts to a "value judgment."

Second, there is probably already more CH_4 in the atmosphere than was previously estimated, according to new measurements. A 2013 Harvard study on CH_4 published in the *Proceedings of the National Academy of Sciences* included a finding that U.S. CH_4 emissions due to ruminants and manure are actually up to twice the magnitude shown in existing GHG inventories (and CH_4 attributable to fossil fuel extraction and processing could be multiples of existing estimates). EPA Administrator Gina McCarthy has promised that the Agency will "take a close look" at these latest CH_4 measurements. Bottom line: CH_4 is both worse and more prevalent than scientists knew until quite recently. And the livestock sector is a CH_4 machine.

Next, animal feed production is a significant but overlooked pathway for the emission of livestock GHGs. The majority of live-

stock production in the United States follows an industrial model where feed is grown elsewhere and transported to the animal facility. More corn is grown in the United States for animal feed than for any other purpose, including for ethanol production, and livestock consume 97 percent of soybean meal. That feed was almost certainly genetically modified and was produced through the application of fertilizer, pesticide, and herbicide—inputs that had to be manufactured and transported. Substantial amounts of CO_2 and N_2O are generated at this initial phase of livestock production. N_20 is over 300 times more potent as a heat-trapper than CO_2; agricultural soil management and the manufacture of chemical fertilizer are major sources of N_2O emissions. The more industrialized the system, the greater the need for chemicals, mechanical equipment, transportation, and processing. All of this contributes to a hefty climate hoof print.

Despite the links between industrialized animal production and GHG emissions, another study (again, from the *Proceedings of the National Academy of Sciences* and authored by an Australian scientist) concludes that smaller producers in the developing world actually account for the majority of global livestock GHG emissions. There are more total animals in developing nations, their livestock production systems are typically far less efficient than in developed countries, and the demand for meat in developing countries is growing rapidly. Land conversion to make room for feed crops and pasture is also a problem: in 2006, FAO grabbed headlines with its finding that one-third of global livestock GHG emissions were the result of deforestation in developing countries—though FAO has used new methodology to revise that figure down to nine percent, still a large number.

Nevertheless, the drive to consume ever more meat has its roots firmly in developed countries. Americans, for example, are among the top per capita consumers of meat in the world; we eat it at roughly three times the global average. Though U.S. meat consumption has dipped slightly in recent years, per capita consumption is up dramatically over the last half-century. Residents of developed nations eat vastly more meat per capita, even as they tend to have far

more dietary options. And industrialized nations are exporting their eating habits: a 2013 report issued by the U.N. Environment Program noted that citizens of the developed world are "setting a standard for food consumption patterns, especially of meat and dairy products, that is far from being sustainable, while at the same time leading to significant additional health risks through over consumption." Livestock-related GHG emissions are everyone's problem.

FAO's global work on livestock and climate change has, to date, been the most recognized and cited. FAO takes a broad life-cycle analysis approach to identifying livestock sources and estimating all direct and indirect emissions associated with the sector. EPA, by comparison, in its most recent GHG inventory, relies on IPCC methodology and reports only on direct livestock GHG emissions attributable to enteric fermentation and manure management. This approach has the effect of obscuring the full extent of the CO_2 emissions attributable to animal feed production.

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Even so, FAO has detractors. A 2009 Worldwatch Institute report made a splash with findings by two World Bank experts who argue that livestock's global GHG contribution is a whopping 51 percent—multiples of FAO's estimate. The researchers claim that FAO overlooked, underestimated, and misallocated a variety of GHG contributions associated with the sector.

Others take on FAO from a different direction. Farmer and author Eliot Coleman, for example, argues that the problem isn't meat at all, but rather industrial agriculture. Industrialized meat production depends on the burning of fossil fuels, the manufacture and heavy use of chemical fertilizer for feed crops, and the need to contend with vast amounts of manure. By contrast, long-term pasture used for grass-fed beef can actually sequester carbon, and healthy, well-managed grasslands are home to CH_4-chomping microbes that can potentially counterbalance the CH_4 emissions of the ruminants grazing there. Proponents of grass-fed beef argue that in comparing

its GHG impacts to those of industrial meat (which actually tends to have lower CH_4 emissions from enteric fermentation), it is important to examine all of the environmental impacts of each production system—including the full range of GHG sources and sinks associated with each.

Responding to the Arguments

THERE IS AMPLE EVIDENCE to support the need for action on livestock's GHG emissions. Nevertheless, arguments for inaction will be advanced. Let us look at some of the most likely:

American farmers are already bogged down by environmental regulation, and efforts to regulate cow belches and bovine flatulence are a bridge too far. The premise that U.S. agriculture is overregulated for its environmental impacts simply lacks support. Most major federal environmental laws largely exempt agricultural activities. EPA has encountered industry resistance, and suffered significant legal defeats, in the face of even modest attempts to regulate discharges from concentrated animal feeding operations (CAFOs) under the Clean Water Act. And many state legislatures protect agricultural operations from lawsuits (e.g., through right-to-farm laws) and, in some instances, insulate them from public scrutiny (e.g., through "ag gag" laws that criminalize the recording of activities at agricultural facilities without the owner's permission). Far from piling on, any new environmental regulation of livestock-related GHGs would be novel.

Farmers have a charge to feed the world. With the earth's population at over 7 billion now and racing toward 9 to 10 billion by 2050, we need to produce meat and other animal products as efficiently and inexpensively as technology will allow. This means generating GHGs. The "feed the world" argument misses the fact that, all things being equal, meat and other animal products are an ecologically inefficient way for people to obtain their protein, fiber,

and calories, compared to a plant-based diet. Plants convert energy from sunlight, a fraction of which is available to the livestock that consume the plant matter, and a further fraction of which is obtained by people that consume the animal products derived from livestock. The great majority of energy is lost at each step of the food chain, despite, ironically, the application of massive inputs of energy to create animal products in the first place.

Worse, resource-intensive meat production competes for land with plant-based foods grown for people. Obviously, there are communities and places where a vegetable-centric diet is impractical or even impossible (e.g., think Inuit populations in the far North), or simply inconsistent with tradition. And not all pasture land or other land used to grow feed crops is suitable for producing human food. But much of it is. With well over 800 million undernourished people in the world, it is curious that we dedicate to livestock production such vast expanses of land—an estimated 30 percent of the planet's land surface and nearly three-quarters of all agricultural land.

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To be sure, producing and transporting any food, including grains and vegetables, or any of the meat substitutes now hitting the shelves, imposes a climate cost. Nevertheless—on average—the carbon cost of eating meat, and especially the meat of ruminants, is far higher than that of eating plants. A call to reduce the GHG emissions attributable to livestock production is not an argument against eating, any more than calls to reduce GHGs from coal-fired power plants or from automobiles are arguments against using electricity or riding in a car. The point is that feeding the world's growing population does not necessarily require feeding it meat, certainly not at the unsustainable rate at which Westerners eat it.

There is no practical way to address the vast, diffuse number of emissions sources associated with the livestock sector. The sources of GHG emissions that define the livestock sector are indeed var-

ied and scattered. Just aggregating and estimating GHG emissions from so many diffuse source types—from the huge, industrial animal facilities in the United States to one-half billion small holdings in developing nations—is already a formidable task. Every credible report on the subject acknowledges the difficulties and uncertainties involved. So, any meaningful attempt at reining in these emissions will face obstacles—technical, economic, and political. But the same kinds of objections have been raised in response to tackling any source of GHG emissions. Difficult does not mean impossible.

Moving Ahead

THE GHG EMISSIONS associated with livestock production can be reduced by making meat in a way that produces less pollution, or by making fewer animal products overall—or both. The devil will be in the details.

For starters, livestock operations can pursue technical options to lower the GHG emissions associated with their existing processes. Manure management, animal husbandry, feeding practices, and grazing land management all offer opportunities for mitigation. More effective rotational grazing, in particular, has been held out as a major opportunity for restoring degraded landscapes. FAO asserts that technical mitigation options are available across all climates, regions, and livestock production systems, and estimates that as much as a 30 percent overall reduction in sectoral GHG emissions is possible through the adoption of practices already in use.

A big concern with technical mitigation options is who foots the bill. Producers won't make the leap to more climate-friendly practices voluntarily if it hurts their bottom line. Take the example of anaerobic digesters, the equipment and processes used to convert organic material in manure into CH_4, which can be used to generate electricity. The U.S. Department of Agriculture's (USDA's) Economic Research Service has determined that while digester adoption can provide environmental benefits, agricultural operators may not

find it profitable to incorporate a digester absent taxpayer assistance. And indeed, despite being promoted as a climate solution, digesters have not been widely adopted in the United States.

Digesters also illustrate the conflicting policy preferences that can come into play with GHG mitigation options. Digesters can provide a climate benefit by eliminating CH_4, a potent heat-trapper. Yet, environmental and animal welfare advocates have sharply criticized the wisdom of promoting GHG emission reductions through any form of taxpayer subsidy that has the effect of supporting the otherwise unsustainable CAFO model of animal production.

Regardless of who pays, technical mitigation options must eventually be paired with an overall decrease in meat consumption. In a study published several years ago in the journal *Global Environmental Change*, the authors modeled various scenarios of future adoption of mitigation options and changes in meat consumption and, unsurprisingly, found that the best reduction potentials for non-CO_2 agricultural GHGs resulted from a combination of the two approaches.

Better decisions by individual and institutional consumers are a direct path to mitigating GHG emissions associated with livestock. This can mean becoming vegetarian or vegan; cutting back on the consumption of animal products; choosing the most sustainably produced products; choosing a diet that minimizes the consumption of ruminant meat relative to other sources of protein; eliminating the waste of animal food products; or a combination of these. Of course, seeking behavioral change, especially on so personal and visceral a matter as one's food choices, is a big ask. A growing body of social science literature is examining how best to accomplish such changes, in the climate context and otherwise.

And yet major, beneficial shifts in diet and other relevant behaviors have occurred over the last several decades (e.g., recycling is commonplace, seatbelt use is up, and smoking is down), and there is no reason to believe that informed changes cannot also occur in the area of meat consumption. The Meatless Mondays campaign, for example, is a global effort to encourage people to skip meat one

day per week, for health and environmental reasons. Norway's military garnered press in November when it announced its adoption of a weekly meatless day for the express purpose of combatting climate change. The Cool Foods Campaign, run by the Center for Food Safety, encourages people to make climate-friendly food choices: eschewing meat and dairy that result from intensive confinement of animals and seeking locally grown, organic, and seasonal foods. And the Environmental Working Group has a Meat Eater's Guide that compares the carbon footprints of various kinds of meat and other food options.

Over and above voluntary actions by producers and consumers, what role should law and policy play? We are starting from a mostly blank slate. No EPA regulations are in the works to tackle livestock-related GHGs, and the Obama Climate Action Plan says little on the subject (USDA is participating in an interagency CH_4 strategy). EPA has legal authority under several Clean Air Act mechanisms to regulate GHG emissions from CAFOs. But the Agency raised the emissions thresholds under the Title V operating permits program so that only the largest emitters of GHGs are required to have permits, and few livestock producers would qualify. Regardless, the U.S. Congress has prohibited EPA from using its funds to issue or implement any rule that would require livestock producers to secure a Title V permit for GHG emissions, sometimes referred to as the "cow tax." EPA does require mandatory GHG reporting, and its rules cover manure management at certain kinds of large-emitting facilities—a very small subset of all CAFOs. But again, Congress has, through the appropriations process, barred the Agency from spending funds for implementation.

None of this is surprising. Attempts to regulate the environmental impacts of agriculture are always on difficult political ground, as evidenced by preemptive attacks on EPA by agricultural interests in recent years aimed at blocking any new regulation of so-called "farm dust" (a vaguely defined category of particulate matter (PM) focusing on PM_{10} but with implications for $PM_{2.5}$, measures of damaging

inhaled particulates) or "cow farts" (ruminant CH_4 emissions). In response to questioning at a U.S. House of Representatives Science Committee hearing in November, EPA Administrator McCarthy denied that the Agency was considering regulating CH_4 from cows; and back in 2011, then-Assistant Administrator McCarthy testified before the House Subcommittee on Energy and Power that any notion of EPA tightening regulation of "farm dust" was a myth.

Still, now is the time to lay the policy groundwork for how best to take on GHG emissions from livestock production. Should they be addressed through the Clean Air Act or other state and regional mechanisms, like California's AB 32 scheme or New England's Regional Greenhouse Gas Initiative? What role is to be played by international processes like the U.N. Framework Convention on Climate Change (to which the United States is a Party)? Do we need an entirely new mechanism? A group of scientists in the January 2014 issue of the journal *Nature Climate Change*, noting the significance of GHG emissions from ruminant meat production and the urgency of the climate crisis, called for an overall decrease in the global number of ruminants—which they believe will likely require a new tax or regulatory regime.

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Whatever policy course is selected, CAFOs are probably the place to start. They dominate the U.S. livestock landscape, they contain (by definition) large numbers of animals, they implicate a greater use of fossil fuels than other production systems, and an industrialized livestock facility is at least a decent analogue of the factories that U.S. environmental law already addresses in other contexts. Even setting aside climate concerns, the industrialized model of livestock production is far from environmentally friendly. It has severe negative consequences for water and air resources, contributes to the growing problem of antibiotic resistance in people, and has proven detrimental time and again to animal welfare.

Any new path that is forged will almost certainly face industry resistance. The Waxman-Markey cap-and-trade climate legislation that passed the House but failed in the U.S. Senate in 2010 not only exempted agriculture from emissions reductions, but also provided for agricultural offsets. Even with these concessions to agriculture, the American Farm Bureau and other major agricultural interests opposed the bill.

ENVIRONMENTALISTS CAN BEGIN to roll back livestock GHG emissions by helping to lead the shift to a reduced-meat or meat-free diet, or one that prioritizes climate-friendly meat options. This is a work in progress. A recent study appearing in the interdisciplinary journal *Climatic Change* examined the activities of U.S., Canadian, and Swedish nongovernmental organizations at the intersection of meat consumption and climate change. The authors characterized the environmental action they identified in this area as "quite limited."

Many people have deeply held concerns about the highly industrialized direction of the U.S. food system and the very meat-centric trajectory that China and other developing nations are now following. Health professionals are concerned about obesity, cancer risks, and antibiotic drug resistance; animal welfare advocates care about the harm suffered by farm animals; and a growing number of farmers and rural communities want alternatives to industrial food production. Working across constituencies to craft policy solutions to the climate problem, it turns out, may also point to solutions to other problems arising out of the prevailing food system.

In 2013, the atmospheric concentration of CO_2 surpassed 400 parts per million for the first time in recorded history, and likely in millions of years. The urgency to act is clear. But climate change is not only about power plants, planes, and cars, and we should no longer give a pass to any large-scale human activities that are drivers of climate change. When it comes to comprehensive climate policy, it is time to put animal products on the table.■

2000 L Street NW, Suite 620
Washington, DC 20036
Tel: (202)-939-3800
Fax: (202)-939-3868
www.eli.org