Agriculture and Climate Change: An Agenda for Negotiation in Copenhagen

Mitigating Greenhouse Gas Emissions from Livestock Systems

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Livestock—poultry, small ruminants (such as goats and sheep), cattle, and pigs—provide many benefits for human well-being. Livestock production systems, especially in developing countries, are changing rapidly in response to population growth, urbanization, and growing demand for meat and milk. The need for action by all sectors to mitigate climate change adds additional complexity to the already considerable development challenges these systems face.

Some livestock production systems use large quantities of natural resources and also produce significant amounts of greenhouse gas emissions (GHGs). Since the demand for meat and milk is increasing, the question is whether cost-effective mitigation options exist to meet them within equitably negotiated and sustainable GHG emission targets. In fact, emissions from livestock systems can be reduced significantly through technologies, policies, and the provision of adequate incentives for their implementation. The objective of this policy brief is to highlight options to mitigate GHGs from livestock industries and to suggest key negotiating outcomes for including livestock in the Copenhagen meetings.

The global livestock industry

Livestock systems occupy 45 percent of the global surface area with a value of at least $1.4 trillion. Livestock industries are a significant source of livelihoods globally. They are organized in both short and long market chains that employ at least 1.3 billion people globally and directly support the livelihoods of 800 million poor smallholder farmers in the developing world.

Livestock are an important source of nourishment. Livestock products contribute 17 percent of calorie consumption and 33 percent of protein consumption globally. The level of consumption of milk and meat in the developed world is at least five times higher than in the developing world. However, in developing countries the demand for livestock products is rising rapidly, mainly as a consequence of increased human population and rapidly increasing incomes, primarily in Asia. Growth in milk and beef production is also becoming important in parts of Africa. It is projected that growth in poultry and pig production will be adequate to satisfy the demand.

For the poor, increased consumption of livestock products has positive effects on mortality and the cognitive development of children. At the same time, the sale of livestock products can increase smallholders' incomes.

Keeping livestock can be an important risk-reduction strategy for vulnerable communities. And livestock are important providers of nutrients and farm traction in smallholder systems.

Of the planet's 1.3 billion poor who live on less than a dollar a day, at least 90 percent are located in Asia and Sub-Saharan Africa, and 60 percent of those depend on livestock for some part of their livelihood. Climate change is likely to have major effects on poor livestock keepers and on the ecosystems on which they depend. These impacts will include changes in the productivity of rainfed crops and forage; reduced availability of water and widespread water shortages; and changes in the severity and distribution of important human, livestock, and crop diseases. Major changes can thus be anticipated in livestock systems, including the mix of species raised, crops grown, and feed resources and feeding strategies.

Livestock and GHG emissions

Livestock contribute 18 percent of global anthropogenic GHG emissions (FAO 2006). The main sources and types of GHGs from livestock systems are methane production from animals (25 percent), carbon dioxide (CO_2) from land use and its changes (32 percent), and nitrous oxide (N_2O) from manure and slurry management (31 percent).

The systems for producing different kinds of livestock are highly diverse, which results in large differences in the associated GHG emissions per kilogram produced in different regions. The impacts of livestock production on GHG emissions have been widely discussed, particularly those associated with rapidly expanding industrial livestock operations in Asia and those linked to deforestation in Latin America. Nevertheless, in smallholder crop-livestock, agropastoral, and pastoral-livestock systems, livestock are one of a limited number of broad-based options to increase incomes and sustain the livelihoods of people who have a limited environmental footprint. By diversifying risk and increasing assets, livestock increase the resilience of vulnerable poor people, who are subject to climatic, market, and disease shocks. Given that almost all human activity is associated with GHG emissions, those from livestock in these systems are relatively modest, compared with the contribution that livestock make to the livelihoods of a huge number of people. This complex balancing act of resource use, GHG emissions, and livelihoods must be clearly understood and taken into account when designing mitigation strategies to offset the effects of livestock on the environment. Farmers should be provided incentives or offset payments for adopting livestock systems that reduce emissions yet maintain their livelihoods.

GHGs emitted by livestock systems can be significantly reduced

GHG emissions in livestock systems can be reduced through technologies, policies, and incentives. The important ways are managing the demand for livestock products, intensifying the diets of ruminants, using more productive livestock breeds, or shifting species.

Consumption of livestock products per capita has increased over the last few decades in the developed world, and recent evidence suggests that this level of consumption in some countries increases the risk of health problems. In these countries demand is met by local production in intensive systems or by direct imports of livestock products. In both cases, this demand affects land-use practices and use of resources in the developing world that are associated with significant GHG emissions. Reducing demand for livestock products in the developed world could lead to healthier people and also reduce pressures on land and natural resources in developing countries. This could lead to significant reductions in CO_2 and methane emissions.

The amount of methane produced per unit of animal product can be reduced by feeding better quality diets to ruminants. This increased efficiency could be achieved through improved land-use management with practices such as improved fodder technologies (development of fodder banks, improved pasture species, use of legumes, and others) and supplementation with crop by-products. These practices, which are cost effective and available in developing

countries, can increase milk production, improve the efficiency of methane production, and, together with reductions in the number of animals, help mitigate methane emissions from ruminant systems. Other options include manipulation of rumen microflora and use of feed additives, as practiced in some parts of the developed world, although reductions are only likely to be on the order of 10 percent at best. In the developing world, many low-producing animals could be replaced with fewer but better-fed animals, thus reducing total emissions while maintaining or increasing the supply of livestock products. This will require changing breeds or implementing cross-breeding schemes. Switching livestock species to better suit particular environments is a strategy that could yield higher productivity per animal for the resources available. Also, switching from cows, sheep, and goats to pigs and poultry could lead to reduced methane emissions, although it could also increase the demand for grains. More research is required to understand the effects of these trade-offs between species.

Regulations are required to reduce N_2O emissions from manures. They are of particular importance for managing excreta in the developing world and for slurry and manure applications from cattle in the developed world. In the developing world, regulatory frameworks for manure management in poultry and pig industrial units are necessary to reduce emissions.

Grazing systems can enhance the removal of CO_2 from the environment

Carbon can be sequestered (or, captured) from the atmosphere via improved management. Any practice that increases the photosynthetic uptake of carbon or slows the return of stored carbon to CO_2 via respiration, fire, or erosion will increase carbon reserves, thereby sequestering carbon. Significant amounts of soil carbon could be stored in rangelands or in silvopastoral systems through practices suited to local conditions. This would not only improve carbon sequestration but could also turn into an important diversification option for sustaining livelihoods of smallholders and pastoralists through collection of payments for ecosystem services.

Finally, livestock is integrally linked to crop production in the developing world. Crops and residues from agricultural lands are used to feed livestock, and manure is a crucial source of nutrients for crop growth and as fuel in crop–livestock systems. Crop residues can also be used as a source of fuel, either directly or after conversion to fuels such as ethanol or diesel. While these bioenergy feedstocks still release CO_2 upon combustion, the carbon is of recent atmospheric origin (via photosynthesis), rather than from fossil carbon. The net benefit of these bioenergy sources to the atmosphere is equal to the fossil-derived emissions displaced, less any emissions from producing, transporting, and processing. CO_2 emissions can also be avoided through agricultural management practices that forestall the cultivation of new lands now under forest, grassland, or other nonagricultural vegetation.

Suggested negotiating outcomes:

- Fund the implementation of effective strategies to mitigate the impacts of livestock in the developing world, while balancing the need to produce food (in the form of livestock products) in non-arable areas and to enable the vulnerable poor to continue to earn a living from livestock keeping.
- Fund mechanisms for developing countries to improve ruminant feeding and research for better understanding of the trade-offs between improved feeding practices and reduced animal numbers in different parts of the world.
- Fund research to elucidate the effects of changing breeds or species on the supply of animal products, smallholder incomes, and the best use of land for food production, while still meeting carbon targets and not compromising smallholder livelihoods.
- Fund the implementation of mitigation techniques from manure management in industrial pig and poultry systems in developing countries to reduce N_2O emissions from livestock systems.
- Fund the implementation of schemes to collect payments for agro-ecosystem services in selected rangeland systems to increase their contribution as a carbon sink and to provide income diversification options for pastoralists in developing countries. ■

For Further Reading: M. Herrero et al. "Drivers of change in crop–livestock systems and their potential impacts on agro-ecosystems services and human well-being to 2030" (Nairobi: International Livestock Research Institute, 2009); P. K. Thornton et al. "Mapping climate vulnerability and poverty in Africa," http://www.dfid.gov.uk/research/climate-change.asp (2006); H. Steinfeld et al. *Livestock's long shadow: Environmental issues and options* (Rome: Food and Agriculture Organization of the United Nations, 2006).

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