



An HSUS Report: The Impact of Industrialized Animal Agriculture on World Hunger

Abstract

Of the world’s nearly 6.8 billion humans, almost 1 billion people are malnourished. Feeding half the world’s grain crop to animals raised for meat, eggs, and milk instead of directly to humans is a significant waste of natural resources, including fossil fuels, water, and land. Raising animals for food is also a major contributor to global warming, which is expected to further worsen food security globally. To meet the daily nutritional needs of a rapidly expanding population, the world’s human community, particularly in Western countries, must reduce its reliance on animal products and shift to a more plant-based diet.

Global Hunger

In 2008, the Food and Agriculture Organization of the United Nations (FAO) estimated that nearly 1 billion people worldwide were considered “hungry” or undernourished, not consuming enough calories daily to maintain good health.¹ This figure has risen since 2007, when approximately 850 million people were not getting enough to eat.² The United Nations Millennium Development Goals, which were established in 2000, call for hunger to be halved by 2015,³ but it is unlikely that this important aim will be achieved. High food prices throughout 2008 have left many of both the urban and rural poor without the economic ability to purchase staples such as rice or wheat, or to buy seeds to grow their own food.⁴ As a result, riots have occurred in many parts of the developing world.⁵

At the October 2008 Community Food Security Coalition conference, Eric Holt Gimenez, Executive Director of the Institute for Food and Development Policy/Food First, told participants that while record high food prices have been called a “Silent Tsunami” by the World Food Program,^{6,7} the United Nations agency that oversees international food aid,⁸ problems have been building over time. According to Gimenez, in addition to the global economic crisis and high prices for food, the effects of fluctuating weather patterns as a result of climate change,^{*} extremely low grain reserves, high oil prices, the surge in biofuels production,[†] and the “meatification” of the global diet have contributed to the increase in the number of hungry in recent years.⁹ More people, particularly the growing middle class in the developing world, are consuming greater quantities meat and other animal products than ever before¹⁰ with much of it coming from industrialized animal operations.¹¹

Global Meat and Dairy Production and Consumption

According to the FAO, the worldwide production of meat and dairy is projected to more than double by 2050:¹²

	1999/01	2050
Global meat production	229 million tonnes	465 million tonnes
Global dairy production	580 million tonnes	1,043 million tonnes

^{*} For additional information, see “The Impact of Animal Agriculture on Global Warming and Climate Change” at www.hsus.org/web-files/PDF/farm/hsus-the-impact-of-animal-agriculture-on-global-warming-and-climate-change.pdf.

[†] For additional information, see “The Implications of Farm Animal-Based Bioenergy Production” at www.hsus.org/web-files/PDF/farm/hsus-the-implications-of-farm-animal-based-bioenergy-production.pdf.

The most rapid growth in production has been in the developing world. In 1995, more meat and dairy products were produced in developing countries than in industrialized countries for the first time, and this trend has continued consistently.¹³ By 2006, nearly 60% of meat was produced in developing nations.¹⁴

In 2006, as much as 48 kg (106 lb) of meat from farmed animals, 102 kg (224 lb) of dairy, and 10 kg (22 lb) of eggs were produced per capita worldwide, but animal product consumption varies greatly by region and socioeconomic status.^{15,16} In the industrial world in 2003, consumers ate more than twice the global average—as much as 324 kg (713 lb) of farmed animal products—per person per year,¹⁷ but meat, egg, and dairy consumption is rising the fastest in the developing world, where people eat as much as 91 kg (200 lb) of farmed animal products per person year, more than doubling consumption since 1963.¹⁸ According to food and agricultural policy expert Christopher Delgado, formerly with the International Food Policy Research Institute (IFPRI) and currently with the World Bank, this increase in consumption of animal products is multifactorial, due to rising population growth, movement of more people to cities, and the subsequent need for urban residents to purchase rather than produce food, as well as their greater access to street foods and fast food.

The world's urban population has grown more than the rural population over the last 20 years, and, according to the United Nations (UN), 61% of the world's populace will live in urban areas by 2040. Demographic data from the UN Population Division indicate that in 2008, for the first time in human history, more people resided in urban, rather than rural, areas.¹⁹ As urbanization increases, economists and demographers predict an increase in demand for meat. In some parts of Asia, consumption of beef, pork, and/or poultry products could increase by 100% by 2025.²⁰

High economic growth rates in the developing world are also contributing to the increase in meat consumption. According to a 2007 report by IFPRI, even countries with a high incidence and prevalence of hunger reported strong economic growth rates over the past five years. In the world's 34 most food-insecure countries, 22 had average economic growth rates, from 5-16% annually between 2004 and 2006, and developing-country growth was expected to average 6% in 2008.²¹ This growth is a “central force of change,” according to IFPRI's analysis, and has led to changes in demand for certain types of food, including meat, milk, and eggs.²² Meat and other animal products are often considered both nutritionally superior and a symbol of wealth and social status. As a result, there is a greater demand for more meat, eggs, and dairy products, as well as Western fast food.

Much of the growing demand for animal products is being met by industrial animal operations—large-scale production facilities that are spreading around the world, including Brazil, China, India, Mexico, Thailand, and Vietnam.²³ On a global scale as of 2001-2003, these operations produced 67% of the world's farmed chickens, 50% of eggs, and 42% of farmed pigs.²⁴

Industrial animal agriculture facilities intensively confine animals by the thousands and even hundreds of thousands, preventing them from engaging in much of their natural behavioral repertoire, and produce massive amounts of waste.[‡] Confined animal feeding operations in the United States produce more than 500 million tons of waste annually,²⁵ polluting the air, soil, and water. Large-scale facilities can also exacerbate the emergence and spread of foodborne pathogens and zoonotic diseases, such as pathogenic *E. coli* and avian influenza.²⁶

The Inefficiencies of Grain-Based Animal Agriculture

According to recent research by IFPRI, the global meat industry “may find itself in a position of competing with poor people for cereals”²⁷ and other grains used as feed stocks for farmed animals. As much as 80% of the global soybean crop and 40-50% of the annual corn crop are fed to cattle, pigs, chickens, and other animals used in agriculture,²⁸ in large part due to grain consumption facilitating rapid weight gain,²⁹ which allows industries to slaughter animals in less time.

[‡] For more information, see www.hsus.org/farm/resources/research/.

The use of grain for animal feed is an extremely inefficient use of food. Typically, 3 kg (6.6 lb) of grain is needed to produce just 1 kg (2.2 lb) of meat.³⁰ Protein conversion inefficiencies compiled by Distinguished Professor Vaclav Smil in the Faculty of Environment at the University of Manitoba clearly show that depending on animal products for protein is not the most efficient use of resources.³¹ According to his research, chickens fed a diet of corn and soybeans can only utilize 20% of the protein present in those grains, meaning that 80% is simply wasted; for pigs, 90% of the protein they are fed in grain is lost.³² Most of the energy farm animals consume from grains and other sources of food is used for metabolic processes or for forming bones, cartilage, and other non-edible parts (offal), as well as feces.³³

According to the UN Environment Programme, “stabilizing the current meat production per capita by reducing meat consumption in the industrialized world and restraining it worldwide to 2000 level of 37.4/kg/capita in 2050 would free estimated 400 million tons of cereal per year for human consumption.”³⁴ That is enough food to satisfy the annual caloric needs for more than 1 billion people.³⁵

It is not only food resources that are depleted to produce meat, eggs, and dairy. Water is, perhaps, the most important ingredient in agriculture—both for food crops and meat, egg, and dairy production.³⁶ As the effects of climate change increase, however, water resources will be jeopardized. Raising animals for food requires substantially greater quantities of water than raising plants for human consumption. It can take 5 times as much water to supply 10 grams of protein from beef than from rice and 20 times more water to supply 500 calories from beef than from rice.³⁷ According to the International Water Management Institute and the Stockholm International Water Institute, an average of 6 m³/kg of water is required to produce 1 kg (2.2 lb) of chicken, whereas 0.4-3 m³/kg of water is needed to produce 1 kg (2.2 lb) of cereals.³⁸

Additionally, water is needed for hydrating farm animals and an increasing amount is required—particularly at industrial operations—to clean enclosures (e.g., cages, stalls, pens) and sheds, to dispose of waste, and for cooling animals via misters or sprays during periods of high temperatures.³⁹

Generally, industrial production systems are more water intensive than extensive, pasture-based farming. Pig production requires the greatest water use, particularly those operations that employ “flushing systems”—production facilities that use a large volume of water to carry manure to a storage lagoon or tank.⁴⁰ Industrial milk and egg operations also likely require greater quantities of water compared to animals raised on pasture.⁴¹

Processing animal products also requires large volumes of water and can result in significant amounts of wastewater.⁴² At cattle slaughter plants, 44-60% of total water used for processing is utilized during slaughter, evisceration, and de-boning. Processing of chickens, however, is usually more water intensive per kilogram of weight than the processing of cattle. A “conservative” estimate by FAO in 2005 found that processing chickens for meat uses 1.9 km³ (0.45 mi³), which represents 0.05% of all water used globally.⁴³

In a growing world in which nearly 1 billion people are already hungry, animal products represent an extremely wasteful choice of nourishment.

Alleviating Hunger

It is likely that the diet of consumers, particularly in the industrial world, will look very different in 50 years. The human community may increasingly begin using food choices as tools, similar to changing their light bulbs and driving less, in the fight against climate change and as a way to reduce global hunger and to protect their own health.

In October 2008, food writer Michael Pollan published an open letter to the next President of the United States, calling for the Chief Executive to start looking at developing better food policy.⁴⁴ Pollan noted that until recently, presidents have not had to think much about food in the United States or around the world, but that is changing due to the obesity epidemic and other health challenges, rising food prices, and the impending threat of

climate change. Among Pollan's suggestions were advocating for more local and regional production of food and eating lower on the food chain as a way to reduce our dependence on fossil fuel and curb global warming.⁴⁵

Although projections from IFPRI indicate that animal product consumption is expected to continue to increase,⁴⁶ it is unrealistic to assume that demand for meat, eggs, and milk will be able to be satisfied. Industrial farm animal operations are inherently unsustainable, environmentally and economically, and such a fossil fuel-dependent method of food production cannot continue at even its present scale.

To address human health issues, in addition to environmental concerns, trending towards greater consumption of plant-based foods must be implemented. Indeed, public health advocates, medical professionals, and other policy leaders have increasingly published recommendations for eating habits that are beneficial for both planetary and personal health. A 2007 article in the *European Journal of Clinical Nutrition*, for example, suggests that plant-based diets “could play an important role in preserving environmental resources and reducing hunger and malnutrition in poorer nations.”⁴⁷ The authors noted that vegetarian and vegan diets have a much lower impact on water resources and contribute less pollution than diets that include beef, eggs, chicken, and dairy.⁴⁸ Similarly, a 2007 position paper by the American Dietetic Association states that dieticians “can encourage eating that is both healthful and conserving of soil, water, and energy by emphasizing plant sources of protein and foods that have been produced with fewer agricultural inputs.”⁴⁹ That same year, *The Lancet*, one of the world's leading medical journals, published an article that suggests that consumers in wealthier countries should limit their meat consumption to 90 grams per day, which is about one-half of a chicken's breast, to help reduce greenhouse gas emissions from industrial animal agriculture. The authors also noted that a reduction in the consumption of animal products could also decrease the incidence of cardiovascular disease, certain cancers, and obesity.⁵⁰

Dr. Rajendra Pachauri, chair of the Nobel prize-winning Intergovernmental Panel on Climate Change, has been very vocal in encouraging individuals to shop less, drive less, and eat less meat to combat climate change,⁵¹ and has also encouraged viewing reduction of greenhouse gas emissions as an opportunity both to benefit the planet and help struggling economies. According to Pachauri, utilizing more sustainable forms of energy, transit, and agriculture that do not rely as heavily on petroleum-based fuel sources will provide more jobs and better livelihoods.⁵²

Innovative substitutes to traditional animal products may also contribute to combating climate change and alleviating hunger. At Vrije University in Amsterdam, researchers are developing what they consider more sustainable forms of protein, including highly nutritious and inexpensive legume-based foods. As consumers learn more about the ethical and ecological impacts of how meat, eggs, and milk is produced, plant-based alternatives are becoming more popular.⁵³

There is also potential for even more novel meat substitutes to replace factory-farmed products. Researchers in the United States and The Netherlands are investigating ways to use modern tissue engineering techniques to produce animal tissue *in vitro*. Such “cultured meat” would look, taste, and smell like meat, but would not require animals to be bred, raised, and slaughtered. Additionally, *in vitro* meat can be produced to have higher nutritional content than conventionally-raised meat products.

Commenting on current and future meat production and consumption, Institute for Molecular and Cell Biology animal scientist Anna Olsson wrote:

[I]n a world where food and land are in short supply, livestock production is a hugely inefficient use of grain...Most analyses—including *New Scientist*'s—place blame with the changing dietary patterns in developing countries, which are resulting in a greater demand for meat. That's certainly a problem, but so is the fact that the west is not reducing its own meat consumption...[I]n terms of people ultimately fed, using land to grow animal feed is still inefficient compared with growing food crops for humans. And efficiency gains with livestock have come at a cost to animal welfare and the environment—problems that current animal science

will at best mitigate, not solve...So is using animals still the best approach to producing the meat that humans increasingly want to consume? If we are to invest resources in developing more efficient meat production, why not bypass animals altogether and grow it in vitro?...[I]f the end product is to be the white meat of a month-old broiler chicken or the minced meat of a hamburger, prepared without care and eaten absent-mindedly, why make the detour through a sentient vertebrate which needs kilos of grain just to keep upright and has a brain that may feel fear and frustration?...The way we produce livestock is not sustainable. If we're not willing to reduce consumption, isn't it time to bring non-animal alternatives into a serious discussion of how to produce the meat we eat?⁵⁴

Conclusion

Industrial animal agriculture is not a sustainable option in a carbon constrained world, where nearly 1 billion people do not get enough food. Phasing out industrial confinement facilities in favor of extensive farming systems will be necessary as agriculture moves to less fossil fuel-intensive methods of production.⁵⁵ In addition, consumers will need to reduce their reliance on meat, eggs, and milk, and replace them with plant-based sources of protein and other nutrients. Governments and policymakers, however, also need to play a role in creating a global diet that can feed everyone and protect the environment. The failures of industrial animal agriculture, including its contribution to hunger and greenhouse gas emissions, may have been unintentional, but that does not negate the hasty need for moving to more environmentally sustainable and healthier methods of food production.

¹ Food and Agriculture Organization of the United Nations. 2008. *The State of Food Insecurity in the World 2008* (Rome: FAO, p. 6).

² Food and Agriculture Organization of the United Nations. 2008. *The State of Food Insecurity in the World 2008* (Rome: FAO, p. 6).

³ Millennium Development Goals. 2000. www.un.org/millenniumgoals/poverty.shtml. Accessed July 7, 2009.

⁴ Food and Agriculture Organization of the United Nations. 2008. *The State of Food Insecurity in the World 2008* (Rome: FAO, p. 4).

⁵ Food and Agriculture Organization of the United Nations. 2008. *The State of Food Insecurity in the World 2008* (Rome: FAO, p. 4).

⁶ Holt-Gimenez E. 2008. Community Food Security Coalition Conference keynote speech, October.

⁷ United Nations World Food Programme. 2008. WFP says high food prices a silent tsunami affecting every continent. April 22.

⁸ United Nations World Food Programme. No date. www.wfp.org/about. Accessed July 7, 2009.

⁹ Holt-Gimenez E. 2008. *The world food crisis? What's behind it and what we can do about it?* Institute for Food and Development Policy Food First Policy Brief No. 16, October.

¹⁰ Food and Agriculture Organization of the United Nations. 2008. *The State of Food Insecurity in the World 2008* (Rome: FAO, p. 11).

¹¹ Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, and de Haan C. 2006. *Livestock's long shadow: environmental issues and options*. Food and Agriculture Organization of the United Nations.

¹² Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, and de Haan C. 2006. *Livestock's long shadow: environmental issues and options*. Food and Agriculture Organization of the United Nations, p. xx.

¹³ Steinfeld H and Chilonda P. 2006. *Old players, new players*. Livestock Report 2006 (Rome: FAO, p. 3).

¹⁴ Food and Agriculture Organization of the United Nations. 2006. *Meat and meat products*. Food Outlook, No. 1, June. www.fao.org/docrep/009/j7927e/j7927e08.htm. Accessed July 7, 2009.

¹⁵ Food and Agriculture Organization of the United Nations. 2006. FAOSTAT Statistical Database. <http://faostat.fao.org/default.aspx>. Accessed July 7, 2009.

¹⁶ Food and Agriculture Organization of the United Nations. 2009. *The State of World Fisheries and Aquaculture* (Rome: FAO).

¹⁷ Food and Agriculture Organization of the United Nations. 2003. FAOSTAT Statistical Database. <http://faostat.fao.org/default.aspx>. Accessed July 7, 2009.

-
- ¹⁸ Food and Agriculture Organization of the United Nations. 1963. FAOSTAT Statistical Database. <http://faostat.fao.org/default.aspx>. Accessed July 7, 2009.
- ¹⁹ United Nations Population Division. 2008. World Population Prospects (New York: United Nations Population Division).
- ²⁰ Von Braun J. 2007. The world food situation: new driving forces and required actions. International Food Policy Research Institute Food Policy Paper No. 18. (Washington, DC: IFPRI).
- ²¹ Von Braun J. 2007. The world food situation: new driving forces and required actions. International Food Policy Research Institute Food Policy Paper No. 18. (Washington, DC: IFPRI).
- ²² Von Braun J. 2007. The world food situation: new driving forces and required actions. International Food Policy Research Institute Food Policy Paper No. 18. (Washington, DC: IFPRI).
- ²³ Food and Agriculture Organization of the United Nations, Commission on Genetic Resources for Food and Agriculture. 2007. The state of the world's animal genetic resources for food and agriculture. www.fao.org/docrep/010/a1250e/a1250e00.htm.
- ²⁴ Food and Agriculture Organization of the United Nations, Commission on Genetic Resources for Food and Agriculture. 2007. The state of the world's animal genetic resources for food and agriculture. www.fao.org/docrep/010/a1250e/a1250e00.htm.
- ²⁵ U.S. Environmental Protection Agency. 2003. Concentrated animal feeding operations, final rule, chapter 1, background information. Federal Register, February 12.
- ²⁶ Greger M. 2007. Human/animal interface: emergence and resurgence of zoonotic infectious diseases. *Critical Reviews in Microbiology* 33(4):243-99.
- ²⁷ Bjerklie S. 2008. Meat: unobtainable for, and in competition with, the world's poor. meatpoultry.com, January 28. http://meatprocessingglobal.com/news/headline_stories_print.asp?ArticleID=90875. Accessed July 7, 2009.
- ²⁸ Personal correspondence with Vaclav Smil, University of Manitoba, February 9, 2008.
- ²⁹ Gillespie JR. 2004. *Modern Livestock & Poultry Production* (Florence, KY: Cengage Learning).
- ³⁰ Nellemann C, MacDevette M, Manders T, et al., (eds.) 2009. *The Environmental Food Crisis* (Nairobi: United Nations Environment Programme, p. 26).
- ³¹ Smil V. 2000. *Enriching the Earth: Fritz Haber, Carl Bosch, and the Transformation of World Food Production* (Cambridge, MA: MIT Press, p. x).
- ³² Smil V. 2000. *Enriching the Earth: Fritz Haber, Carl Bosch, and the Transformation of World Food Production* (Cambridge, MA: MIT Press, p. x).
- ³³ Baroni L, Cenci L, Tettamanti M, and Berati M. 2007. Evaluating the environmental impact of various dietary patterns combined with different food production systems. *European Journal of Clinical Nutrition* 61:279-86, citing Moriconi E. 1997. *Nutrisi tutti, inquinando meno (Food for everyone, with less pollution)*. Regione Piemonte, Assessorato Tutela Ambientale.
- ³⁴ Nellemann C, MacDevette M, Manders T, et al., (eds.) 2009. *The Environmental Food Crisis* (Nairobi: United Nations Environment Programme, p. 26).
- ³⁵ Nellemann C, MacDevette M, Manders T, et al., (eds.) 2009. *The Environmental Food Crisis* (Nairobi: United Nations Environment Programme, p. 26).
- ³⁶ World Wildlife Fund. 2008. *Living Planet Report 2008* (London: World Wildlife Fund).
- ³⁷ Postel S. 2006. Safeguarding freshwater ecosystems. In: Worldwatch Institute. 2006. *State of the World 2006* (New York: W.W. Norton, p. 54).
- ³⁸ Stockholm International Water Institute and the International Water Management Institute. 2004. *Water—more nutrition per drop: towards sustainable food production and consumption patterns in a rapidly changing world*. Stockholm International Water Institute. Stockholm, p. 21. www.siwi.org/documents/Resources/Policy_Briefs/CSD_More_nutrition_per_drop_2004.pdf. Accessed July 7, 2009.
- ³⁹ Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, and de Haan C. 2006. *Livestock's long shadow: environmental issues and options*. Food and Agriculture Organization of the United Nations, pp. 128-129.
- ⁴⁰ Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, and de Haan C. 2006. *Livestock's long shadow: environmental issues and options*. Food and Agriculture Organization of the United Nations, pp. 129-130.
- ⁴¹ Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, and de Haan C. 2006. *Livestock's long shadow: environmental issues and options*. Food and Agriculture Organization of the United Nations, p. 130.

-
- ⁴² Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, and de Haan C. 2006. Livestock's long shadow: environmental issues and options. Food and Agriculture Organization of the United Nations, p. 130.
- ⁴³ Steinfeld H, Gerber P, Wassenaar T, Castel V, Rosales M, and de Haan C. 2006. Livestock's long shadow: environmental issues and options. Food and Agriculture Organization of the United Nations, p. 132.
- ⁴⁴ Pollan M. 2008. Farmer in chief. The New York Times, October 12.
- ⁴⁵ Pollan M. 2008. Farmer in chief. The New York Times, October 12.
- ⁴⁶ Von Braun J. 2007. The world food situation: new driving forces and required actions. International Food Policy Research Institute Food Policy Paper No. 18. (Washington, DC: IFPRI).
- ⁴⁷ Baroni L, Cenci L, Tettamanti M, and Berati M. 2007. Evaluating the environmental impact of various dietary patterns combined with different food production systems. *European Journal of Clinical Nutrition* 61:279-86.
- ⁴⁸ Baroni L, Cenci L, Tettamanti M, and Berati M. 2007. Evaluating the environmental impact of various dietary patterns combined with different food production systems. *European Journal of Clinical Nutrition* 61:279-86.
- ⁴⁹ American Dietetic Association. 2007. Position of the American Dietetic Association: food and nutrition professionals can implement practices to conserve natural resources and support ecological sustainability. *Journal of the American Dietetic Association* 107:1033-43.
- ⁵⁰ McMichael AJ, Powles JW, Butler CD, and Uauy R. 2007. Food, livestock production, energy, climate change, and health. *The Lancet Energy and Health Series. The Lancet* 370(9594):1253-63.
- ⁵¹ Jowit J. 2008. UN says eat less meat to curb global warming. *The Observer*, September 7. www.guardian.co.uk/environment/2008/sep/07/food.foodanddrink. Accessed July 20, 2009.
- ⁵² Pachauri R. 2009. State of the World 2009 Briefing. Worldwatch Institute.
- ⁵³ Aiking H, Boer J, and Vereijken J. 2006. Sustainable Protein Production and Consumption: Pigs or Peas?
- ⁵⁴ Olsson A. 2008. Lab-grown meat could ease food shortage. *New Scientist*, July 9. www.newscientist.com/article/mg19926635.600-comment-growing-m. Accessed July 7, 2009.
- ⁵⁵ Scherr S. and Sthapit S. 2009. Farming and land use to cool the planet. In: Worldwatch Institute. 2009. State of the World 2009 (New York: W.W. Norton).

The Humane Society of the United States is the nation's largest animal protection organization—backed by 11 million Americans, or one of every 28. For more than a half-century, The HSUS has been fighting for the protection of all animals through advocacy, education, and hands-on programs. Celebrating animals and confronting cruelty. On the Web at humanesociety.org.