The Ethics of Food, Fuel & Feed

Brian G. Henning

Abstract: As the collective impact of human activity approaches Earth's biophysical limits, the ethics of food become increasingly important. Hundreds of millions of people remain undernourished, yet only 60 percent of the global harvest is consumed by humans, while 35 percent is fed to livestock and 5 percent is used for biofuels and other industrial products. This essay considers the ethics of such use of edible nutrition for feedstock and biofuel. How humanity uses Earth's land is a reflection of its values. The current land-use arrangements, which divert 40 percent of all food to feed animals or create fuels, suggest that dietary and transportation preferences of wealthier individuals are considered more important than feeding undernourished people, or the stability of the wider biotic community.

As the collective impact of human activity approaches Earth's biophysical limits, the ethics of food become increasingly important. Human agriculture has a tremendous impact on global ecosystems. Worldwide agriculture has already "cleared or covered 70 percent of the grassland, 50 percent of the savanna, 45 percent of the temperate deciduous forest, and 27 percent of the tropical forest biome."[1] Despite the scale of global agricultural production, more than eight hundred and seventy million people remain undernourished.[2] It is striking, then, that only 60 percent of the global harvest is consumed by humans, while another 35 percent is fed to livestock and the remaining 5 percent is used for biofuels and other industrial products.[3]

This essay considers whether such use of edible nutrition for feedstock and biofuel production is ethically justified. The analysis will proceed in two parts: the first part builds on earlier work that examines the impact of using feedstock to create meat and other animal-based food products; the second part considers the ethics of biofuel production, which has been left out of earlier analysis.[4] I conclude that although there are important and morally relevant differences between various modes of agricultural production, given the present and projected size of the

BRIAN G. HENNING is Professor of Philosophy and Environmental Studies at Gonzaga University. His book *The Ethics of Creativity: Beauty, Morality, and Nature in a Processive Cosmos* (2005) won the John N. Findlay Book Prize from the Metaphysical Society of America. His most recent book is *Riders in the Storm: Ethics in An Age of Climate Change* (2015).

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human population, eating grain-fed animals and converting food to fuel are difficult to ethically justify.

How the human community chooses to use the land available to it is a reflection of its values. The current land-use arrangements, which divert 40 percent of all food to feed animals or create fuels, reflect values suggesting that the dietary and transportation preferences of wealthier individuals are more important than both feeding the malnourished and stabilizing the wider biotic community.

As the ethicist Paul Thompson has noted, the term ethics is sometimes misunderstood in scientific contexts, where its meaning is often limited to codes of conduct within a professional field.[5] In this context, to act ethically often means little more than to act in accordance with professional protocol. However, when philosophers use the term, it refers to fundamental conceptions of how moral agents ought to act within their world relative to competing conceptions of what is good or has value. Thus, as Thompson notes, "While philosophical ethics does not necessarily shy away from prescriptive statements that say what people should be doing, the point of a philosophical analysis is to illustrate and analyze the background assumptions and context in which the prescription is grounded."[6] In this sense, the present analysis is a work of philosophical ethics.

In a previous article, I systematically considered the impact of intensive, feedstock-based livestock production on human health and the environment.[7] I demonstrated that human health is greatly affected by both the overconsumption and production of animal products. Indeed, by contributing to the prevalence of chronic diseases and to the spread of both antibiotic resistant infections and infectious diseases, the mass production and overconsumption of meat constitutes one of the single greatest threats to public health.[8]

Grain-fed livestock production also has significant consequences for Earth's water, land, and air. Globally, livestock and their feed crops consume large quantities of freshwater and contribute to the pollution of waterways through agricultural runoff and untreated waste, along with the natural aftereffects of giving livestock access to waterways.[9] Also, by motivating significant land-use changes (LUC) for pasture and feed crops, livestock production is a leading cause of species extinction, deforestation, and soil erosion.[10] Finally, by contributing to deforestation and producing direct methane and indirect nitrous-oxide emissions, livestock are a significant source of the anthropogenic greenhouse gases (GHG) changing the climate.[11] Overall, agriculture is the single largest anthropogenic source of GHG, accounting for approximately 35 percent of all emissions.[12] This figure is more "than the emissions from worldwide transportation (including all cars, trucks, and planes) or electricity generation."[13] Livestock production represents nearly one-half of these agricultural GHG emissions (14.5 percent).[14] However, to properly understand the ecological impact of meat production, it is important to place the activity within the context of both expected population growth and projected rates of meat consumption.

Given the projected growth of the global middle class, the consumption of animals and animal-based products is expected to grow 73 percent between 2010 and 2050.[15] As the Food and Agriculture Organization (FAO) of the United Nations has noted, reducing the ecological impact of intensive livestock production is critically important. This reduction can be achieved by pricing water and the commons, decreasing or eliminating subsidies, and implementing manure management prac-

tices, among other techniques. Further, the FAO reports that deployment of current technologies and practices could reduce livestock-sector GHG emissions by up to one-third.[16]

However, ecologists Nathan Pelletier and Peter Tyedmers have demonstrated that these changes would not likely be sufficient – even if they were widely implemented – given the projected growth in meat consumption. Their analysis shows that if human activity is to remain within sustainable "environmental boundary conditions" for GHG emissions, reactive nitrogen mobilization, and anthropogenic biomass appropriation, agriculture will increasingly need to move away from the profligate use of edible nutrition to feed to livestock (and, as we will see, biofuels).[17] All human activity – including food production, energy production, and transportation – must fall within these limits if humanity is to avert "irreversible ecological change."[18]

While recognizing that their model embodies "considerable uncertainty," Pelletier and Tyedmers's conservative estimate is that "by 2050, the livestock sector alone may either occupy the majority of, or considerably overshoot, current best estimates of humanity's safe operating space in each of these domains."[19] Specifically, by 2050, in order to meet FAO projected demand for animal products, livestock production will require 70 percent of the sustainable boundary conditions for greenhouse gas emissions, 294 percent of sustainable reactive nitrogen mobilization, and 88 percent of sustainable biomass appropriation.[20] Again, these are the sustainable boundary thresholds for all human activity, not merely agriculture. As a point of comparison, Pelletier and Tyedmers noted that if humans derived their nutrition entirely from plant sources, agriculture could use only 1.1 percent of sustainable GHG emissions, 69 percent of sustainable reactive nitrogen mobilization, and 1.1 percent of sustainable biomass appropriation.[21] Pelletier and Tyedmers claim that as "the human species runs the final course of rapid population growth before beginning to level off midcentury, and food systems expand at commensurate pace, reining in the global livestock sector should be considered a key leverage point for averting irreversible ecological change and moving humanity toward a safe and sustainable operating space."[22]

The mass production and consumption of grain-fed animals is a significant source of human disease and is a leading cause behind the depletion and pollution of freshwater sources, the degradation and deforestation of land, the extinction of species, and the warming of the planet. Further, increasing demand to eat animals decreases the total nutrition available to humans, making the task of feeding eight hundred and seventy million malnourished people all the more difficult. As ecologist Jonathan Foley has stated, "Using highly productive croplands to produce animal feed, no matter how efficiently, represents a net drain on the world's potential food supply."[23] This use of edible nutrition reflects the human community's ethical values. Given the current and projected quantity of edible nutrition used to feed livestock, preserving the ability of wealthier individuals to consume animals appears to have far greater value than achieving the most sustainable means possible for feeding a growing world population. But what, then, are the values reflected in the diversion of edible nutrition to create biofuels?[24]

Though biofuel production diverts significantly less of the global harvest than livestock production (5 percent devoted to fuels compared to the 35 percent that is allocated to feed), the amount is not inconsequential.[25] For instance, in 2011, 40 percent of all corn grown in the United

States was turned into ethanol.[26] Further, biofuel production is often mandated by laws requiring the production of certain quantities of biofuel. For instance, in the European Union, biofuels must account for 10 percent of all fuel by 2020; in the United States, 36 billion gallons must be produced annually by 2022.[27] As the Nuffield Council on Bioethics notes in its report on biofuels, the motivations behind the creation of biofuel quotas are diverse and complex: "The expectation of some was that they [biofuels] would solve these great challenges all at once: i.e., provide a new source of income for farmers and revenue from 'clean' technology, as well as renewable – and therefore endless – sources of fuel, leading to far less greenhouse gas (GHG) emissions than fossil fuels."[28] But as we will see, all of these claims about biofuels have been brought into question. Let us first examine the claims that biofuels mitigate GHG emissions.

When burned, both petroleum-based and plant-based fuels release large quantities of carbon dioxide into the atmosphere. However, unlike fossil fuels, the plants used for biofuels remove carbon dioxide from the atmosphere during their growing phase. From this fact follows the widespread claim that biofuels can be used without significantly adding to the net release of carbon dioxide into the atmosphere. Indeed, the International Energy Agency estimates that biofuels could reduce current fossil fuel–related carbon dioxide emissions from cars by 20 – 50 percent.[29] However, several studies have questioned the potential for biofuels to mitigate GHG emissions.[30] In particular, research has shown that corn-based ethanol in the United States likely leads to a net increase in GHG.[31]

Proponents of biofuels contend that the problem is not with biofuels per se but with the crops being used. If, for instance, corn were replaced with a new, second generation of more efficient biofuels, such as miscanthus or jatropha, the GHG mitigation potential of biofuels could be achieved. The FAO estimates that if such second-generation biofuels are grown on 25 percent of all agricultural land, they could replace up to 14 percent of all transportation fuels.[32] Indeed, the Nuffield Council concludes that, since the demand for liquid transport fuels is not likely to decrease in the coming decades, there is a duty to support the development of second-generation biofuels.[33] Ideally, these biofuels would satisfy five ethical principles:

1) The development of biofuels should not come at the expense of essential human rights (including comprehensive health and work rights, access to sufficient food and water, and land entitlements).

2) Biofuels should be environmentally sustainable.

3) Biofuels should contribute to the net reduction of total GHG emissions; they should not exacerbate global climate change.

4) Biofuels should develop in accordance with trade principles that are fair and recognize the rights of people to just reward, including labor rights and intellectual property rights.

5) The costs and benefits of biofuels should be distributed in an equitable way.[34]

There is not enough space here to examine each of these principles. At present, the pressing question to answer is: can second-generation biofuels meet the principles set out by the Nuffield Council?

Although second-generation fuels are very likely to be more efficient than their predecessors, some studies have indicated that, if indirect land-use changes (iLUC) are considered, these gains may be absorbed, or even lost, if land that is currently a carbon sink is converted into a source.[35] When lands that could be used for growing food or feed crops are instead used to grow biofuels, this creates pres-

sures to convert marginal or forested land to agricultural production.[36] If one's analysis includes these iLUC, it is likely that even second-generation biofuels will lead to a net increase in GHG, violating the Nuffield Council's third principle.[37] Yet beyond the technical viability of second-generation biofuels to achieve much-needed GHG reductions, we must also ask whether it would be ethically defensible to divert 25 percent of all agricultural land – which is currently used to grow crops to feed humans – to replace 14 percent of transportation fuels.

Further, critics of biofuels claim that the diversion of edible food crops to biofuel production decreases the global supply of food commodities. This decrease in supply increases the price of food commodities, and such price increases disproportionately harm the poor. Thus, biofuels are criticized as unethical for exacerbating and contributing to worldwide hunger. Wealthy individuals are filling their vehicles with fuels created from crops that could have been used to feed the poor. This dimension of the debate over biofuel production first came to the fore in 2006, when biofuels were blamed for a dramatic spike in global food prices, which caused widespread suffering and instability in developing nations.[38] The food versus fuel debate reached its zenith in 2007, when Jean Ziegler, the United Nations' special rapporteur, condemned biofuels as "a crime against humanity."[39]

However, as Paul Thompson has demonstrated, this analysis of the ethics of biofuels is too facile. First, it is not clear that shifting biofuels from edible plants to nonedible and more efficient crops will mitigate biofuels' effect on food prices. In a global food commodity market, it is not possible to segregate food and fuel crops. For instance, if biofuel production is shifted from corn to miscanthus, this will still result in fewer acres of corn being planted, which will have the same economic effect on food prices as having diverted the corn to biofuel production.[40] Thus, Thompson concludes: "Over the long run, relying on the use of nonfood crops as fuel feedstocks will translate into land use decisions that preserve the same food vs. fuel tensions noted in the original critiques."[41]

However, as Thompson has demonstrated, this analysis of the ethics of biofuels is still incomplete: it fails to recognize that food insecurity is highest among poor people who are themselves food producers.[42] Of the world's poor, it is primarily the 20 percent who live in urban areas and buy (rather than grow) food that are affected by the increase in food commodity prices caused by biofuel production. Thus, although biofuel production will increase food prices, harming the 20 percent of the world's urban poor, for the 80 percent of the world's poor who are food producers, increases in food commodity prices can in principle be economically beneficial.[43] Yet, as Thompson rightly notes, although there is the potential for commodity price increases to empower the food-producing poor, these theoretical benefits are unlikely to be realized in the absence of concerted implementation programs.

Although defenders of biofuels argue that they can benefit poor farmers, there is very little discussion of the peculiar vulnerabilities that poor farmers face in an era of rapid technological change. There is every reason to suspect that many of the scientists, public institutions, and private firms that are in the process of developing the next generation of biofuels operate from a position of naiveté about the most likely impact of the technology that they are developing.[44]

To summarize, there are serious technical and ethical concerns regarding the use of feedstock and biofuels. Though the technical advances in livestock and biofuel

production are likely to make them more efficient, this alone does not address the underlying ethical issues regarding land use and food security for the world's poor. The underlying ethical issue of the widespread use of both feedstock and biofuels is one of resource allocation and land use. Is it ethically defensible to use land to create feed for animals when doing so is often harmful for human health, uses large quantities of increasingly scarce freshwater, contributes significantly to water pollution, exacerbates LUC that cause species extinction, and significantly contributes to global climate change, all while reducing the total nutrition available for humans? Similarly, what values are reflected in the use of land to create crops (whether edible or not) that will be turned into biofuels so that wealthier individuals can drive vehicles with a potentially lower GHG footprint, when doing so increases the price of food for at least 20 percent of the urban poor, and is unlikely to benefit the remaining 80 percent of food-producing poor, who often do not have access to markets and technology that would allow them to benefit from higher food commodity prices?

The widespread and growing use of feedstock and biofuels reflects the human community's values. The current land use arrangements, which divert 40 percent of all food to feed animals or create fuels, reflect values that suggest that dietary and transportation preferences of wealthier individuals are more important than feeding people. If food were used to feed people directly, rather than to fatten cows or create fuel, it would increase the total supply of food. As Foley and his colleagues have noted, the wholesale shift to a plant-based diet would net up to three quadrillion calories annually, a 50 percent increase in the total supply of food.[45] They add: "Naturally, our current diets and uses of crops have many economic and social benefits, and our preferences are unlikely to change completely. Still, even small shifts in diet, say from grain-fed beef to poultry, pork or pasture-fed beef, can pay off handsomely."[46]

Thus, appropriately extended to include the present analysis of biofuels, the central claim of my earlier analysis remains true: although there are important and morally relevant differences in various modes of agricultural production, eating grain-fed animals and converting food to fuel are difficult to ethically justify when more than eight hundred and seventy million people are malnourished. Given the current and projected size of the human population, it will increasingly be necessary to modify not only how meat and biofuels are produced, but also dietary and transportation preferences themselves.

ENDNOTES

1 Jonathan A. Foley, Navin Ramankutty, Kate A. Brauman, et al., "Solutions for a Cultivated Planet," *Nature* 478 (7369) (2011): 338.

2 Food and Agriculture Organization of the United Nations, *The State of Food Insecurity in the World 2012 : Economic Growth is Necessary but Not Sufficient to Accelerate Reduction of Hunger and Malnutrition* (Rome: Food and Agriculture Organization of the United Nations, 2012), http://www.fao.org/docrep/016/i3027e/i3027e00.htm.

3 Jonathan A. Foley, "Can We Feed the World and Sustain the Planet?" *Scientific American* 305 (5) (2011): 62.

4 Brian G. Henning, "Standing in Livestock's 'Long Shadow': The Ethics of Eating Meat on a Small Planet," *Ethics & the Environment* 16 (2) (2011): 63 – 93.

5 Paul B. Thompson, "The Agricultural Ethics of Biofuels: The Food *vs.* Fuel Debate," *Agriculture* 2 (4) (2012): 340.

6 Ibid.

7 Henning, "Standing in Livestock's 'Long Shadow.'"

8 Ibid., 66.

9 Ibid., 70. As the Nuffield Council notes in its report, biofuels are also a very large source of freshwater use and pollution. See Nuffield Council on Bioethics, *Biofuels: Ethical Issues* (London: Nuffield Council on Bioethics, 2011), 33; and Henning, "Standing in Livestock's 'Long Shadow,'" 69 – 71.

10 Henning, "Standing in Livestock's 'Long Shadow,'" 72 – 73.

11 Food and Agriculture Organization of the United Nations, *Tackling Climate Change through Livestock: A Global Assessment of Emissions and Mitigation Opportunities* (Rome: Food and Agriculture Organization, 2013), xii, 15, http://www.fao.org/docrep/018/i3437e/i3437e.pdf.

12 Foley, "Can We Feed the World and Sustain the Planet?" 63.

13 Ibid.

14 "Total GHG emissions from livestock supply chains are estimated at 7.1 gigatonnes CO_2-eq per annum for the 2005 reference period. They represent 14.5 percent of all human-induced emissions using the most recent IPCC estimates for total anthropogenic emissions." See Food and Agriculture Organization of the United Nations, *Tackling Climate Change through Livestock*, 15.

15 "Driven by strong demand from an emerging global middle class, diets will become richer and increasingly diversified, and growth in animal-source foods will be particularly strong; the demand for meat and milk in 2050 is projected to grow by 73 and 58 percent, respectively, from their levels in 2010. . . . With demand for livestock products projected to grow by 70 percent by 2050, concerns about the unbalanced nature of this growth and its attendant environmental and socio-economic consequences are increasing. To date, most of the increase in demand has been met by rapidly growing, modern forms of production while hundreds of millions of pastoralists and small-holders, who depend on livestock for survival and income, have little access to emerging opportunities for growth." See ibid., 1, 83.

16 Ibid., xiii, 83.

17 Nathan Pelletier and Peter Tyedmers, "Forecasting Potential Global Environmental Costs of Livestock Production 2000 – 2050," *Proceedings of the National Academy of Sciences* 10 (1073) (2010): 1 – 4; and Nathan Pelletier and Peter Tyedmers, "Supporting Information," *Proceedings of the National Academy of Sciences* 10 (1073) (2010): 1 – 4.

18 Pelletier and Tyedmers, "Forecasting Potential Global Environmental Costs of Livestock Production 2000 – 2050," 3.

19 Ibid., 2.

20 Ibid. Given that their analysis is limited to *direct* emissions and biomass appropriation, Pelletier and Tyedmers's analysis is, if anything, overly conservative. For more on this, see Henning, "Standing in Livestock's 'Long Shadow,'" 84.

21 Pelletier and Tyedmers, "Supporting Information," 3.

22 Pelletier and Tyedmers, "Forecasting Potential Global Environmental Costs of Livestock Production 2000 – 2050," 3. As David Tilman rightly brought to my attention, Pelletier and Tyedmers's claim that food systems will grow at a "commensurate pace" is not quite accurate. Tilman notes that food systems have been expanding at a pace about double the rate of

population growth because of the income-dependence of dietary choices, especially per capita consumption rates for various meats and animal products.

23 Foley et al., "Solutions for a Cultivated Planet," 2.

24 The term *biofuels* will be used broadly to refer to technologies used to create liquid transportation fuels such as ethanol and biodiesel.

25 My analysis here is greatly indebted to the work of Paul B. Thompson, who is the global expert in the ethics of biofuels. See Paul B. Thompson, "The Agricultural Ethics of Biofuels: Climate Ethics and Mitigation Arguments," *Poiesis & Praxis* 8 (4) (2012): 169 – 189; and Thompson, "The Agricultural Ethics of Biofuels: The Food *vs.* Fuel Debate."

26 Madhu Khanna and Xiaoguang Chen, "Economic, Energy Security, and Greenhouse Gas Effects of Biofuels: Implications for Policy," *American Journal of Agricultural Economics* 95 (5) (2013): 1325.

27 Alena Buyx and Joyce Tait, "Ethical Framework for Biofuels," *Science* 332 (6029) (2011): 540.

28 Nuffield Council on Bioethics, "About," http://www.nuffieldbioethics.org/about; and Nuffield Council on Bioethics, *Biofuels: Ethical Issues*.

29 "Bioenergy is unique in being the only form of renewable energy that can at the same time be used for heating, electricity, and transport. Looking at transport, it is estimated by the International Energy Agency that biofuels should be able to reduce current fossil-fuel related carbon dioxide emissions from cars by 20 – 50 percent." See C. Gamborg, K. Millar, O. Shortall, and P. Sandøe, "Bioenergy and Land Use: Framing the Ethical Debate," *Journal of Agricultural and Environmental Ethics* 25 (6) (2012): 912.

30 Jason Hill, Erik Nelson, David Tilman, et al., "Environmental, Economic, and Energetic Costs and Benefits of Biodiesel and Ethanol Biofuels," *Proceedings of the National Academy of Sciences* 103 (30) (2006): 11206 – 11210; Joseph Fargione, Jason Hill, David Tilman, et al., "Land Clearing and the Biofuel Carbon Debt," *Science* 319 (1235) (2008): 1235 – 1238; and Timothy Searchinger, Ralph Heimlich, R. A. Houghton, et al., "Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change," *Science* 319 (5867) (2008): 1238 – 1240.

31 Searchinger et al., "Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change," 1238 – 1240.

32 Cited in Gamborg, et al., "Bioenergy and Land Use," 917.

33 "If the first five Principles are respected and if biofuels can play a crucial role in mitigating dangerous climate change then, depending on additional key considerations, there is a duty to develop such biofuels." From Nuffield Council on Bioethics, *Biofuels: Ethical Issues*, 77.

34 Ibid.

35 "Thus although second-generation biofuel production is claimed to deliver greater savings in GHG emissions than first-generation biofuel production, these savings could be absorbed, or lost, in an indirect LUC, if production of the necessary biomass simply results in the displacement of cropland on to land that presently acts as a carbon sink, such as forest and pasture." From Gamborg et al., "Bioenergy and Land Use," 920.

36 Ibid., 913.

37 The Nuffield Council notes in *Biofuels: Ethical Issues* that iLUC are quite controversial and difficult to calculate.

38 Thompson's "Food *vs.* Fuel Debate" provides not only a history of the food versus fuel debate but also a careful ethical analysis. See also Nuffield Council on Bioethics, *Biofuels: Ethical Issues*, 30.

39 Grant Ferrett, "Biofuels 'Crime Against Humanity,'" *BBCNews*, October 27, 2007, http://news.bbc.co.uk/1/hi/world/americas/7065061.stm. See also George Monbiot, "An Agricultural

Crime Against Humanity," *The Guardian*, November 6, 2007, http://www.monbiot.com/2007/11/06/an-agricultural-crime-against-humanity/.

40 Thompson, "Food *vs.* Fuel Debate," 347.

41 Ibid.

42 Ibid., 341.

43 Ibid., 341, 351–352. "De Schutter estimates that about 50 percent of those in extreme poverty are agricultural producers, while another 20 percent are landless laborers. The remaining 10 percent are scavengers who derive a living from accessing common pool resources available in forests and fisheries. As such, they too depend at least partially on a production-based food entitlement. Thus the presumption that rising food prices are unilaterally disastrous to the world's poorest people is based on a faulty understanding of the ethics of hunger."

44 Ibid., 355. "The empirical argument for concluding that the theoretical potential of benefit to the rural poor fails to satisfy the requirements of ethics is that such theoretical benefits are frequently unrealized in reality. . . . For reasons such as this, there is a [sic] now a broad skepticism about the ability of innovations in agricultural technology to actual [sic] benefit the poor. The skepticisms [sic] is widely in evidence in writings on biofuels." Ibid., 352.

45 Foley, "Can We Feed the World and Sustain the Planet?" 65.

46 Ibid.