Cattle Grazing on Federal Public Lands Contributes to Global Climate Change

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Animal agriculture has recently received much attention[1, 2] for its role in producing gases that contribute to global climate change. Prominent among those gases so produced is methane, which cattle emit as a consequence of their digestion.

Based on the estimate that the typical grass-fed cow produces 600–700 liters of methane per day,[3] we can calculate the amount of this gas annually produced by cattle that graze on 260 million acres of federal public lands managed by the U.S. Forest Service and the Bureau of Land Management in the forty-eight contiguous states.[4] In the interest of producing a conservative estimate, I will perform the calculation using the lower limit (i.e., 600 liters) of a cow's daily methane production.

The BLM[5] and U.S. Forest Service[6] report annual forage utilization from their lands by cattle of 7,862,879 and 6,025,788 AUMs[7] respectively, with the combined forage utilization being 13,888,667 AUMs.

As each AUM represents thirty-one days of a cow's forage consumption, it likewise represents thirty-one days of a cow's methane production. In other words, each AUM consumed produces (31 days x 600 liters/day) of methane. Or performing the calculation: 18,600 liters of methane.

Consequently, the annual volume of methane produce by public lands cattle is equal to (18,600 liters/AUM) x (13,888,667 AUMs/year), or 258,329,206,200 liters.

Since 1,000 liters is equivalent in volume to 1 cubic meter (m^3), public lands cattle produce 258,392,206 m^3 of methane per year.

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1. Henning Steinfeld, Pierre Gerber, Tom Wassenaar, Vincent Castel, Mauricio Rosales, and Cees de Haan. *Livestock's Long Shadow: Environmental Issues and Options* (Food and Agriculture Organization of the United Nations, 2006).
2. European Vegetarian Union, "Less Meat, Less Heat - IPCC Chairman Insists on Eating Less Meat," press release, August 31, 2008, http://www.euroveg.eu/lang/en/news/news.php?id=36895 (accessed October 31, 2008).
3. TheCattleSite, "Cutting Emissions: Less Grass, Less Gas," October 30, 2008, http://www.thecattlesite.com/news/24920/cutting-emissions-less-grass-less-gas (accessed October 31, 2008).
4. The U.S. Forest Service manages 97 million acres for livestock production; the Bureau of Land Management manages 163 million acres for this purpose. George Wuerthner and Mollie Matteson, eds. 2002. *Welfare Ranching: The Subsidized Destruction of the American West*. Washington, DC: Island Press, 5.
5. Bureau of Land Management, Department of the Interior, "Public Land Statistics 2007," Table 3-8c (Summary of Authorized Use of Grazing District Lands and Grazing Lease Lands, Fiscal Year 2007), http://www.blm.gov/public_land_statistics/pls07/pls3-8c_07.pdf (accessed October 31, 2008).
6. United States Department of Agriculture, Forest Service, Range Management, "Grazing Statistical Summary FY 2005," April 2006, p. 4, http://www.fs.fed.us/rangelands/ftp/docs/graz_stat_summary_2005.pdf (accessed October 31, 2008).
7. AUM: acronym for "animal unit month"—the amount of forage consumed by a cow over a period of 31 days.

The weight of this volume, based on methane's density of 0.68 kg/m^3 (under conditions of 1.013 bar and 15 °C (59 °F)),[8] is 175,663,860 kg.

What does this weight of methane represent in terms of CO_2 emissions? Well, I plugged the above value into the U.S. Environmental Protection Agency's online Greenhouse Gas Equivalencies Calculator.[9] And according to its analysis, the methane annually produced by cattle grazing on U.S. federal public lands is equivalent to any of the following:

- annual greenhouse gas emissions from 705,342 passenger vehicles
- CO_2 emissions from 414,954,000 gallons of gasoline consumed
- CO_2 emissions from 8,578,933 barrels of oil consumed
- CO_2 emissions from 49,258 tanker trucks' worth of gasoline
- CO_2 emissions from the electricity use of 447,687 homes for one year
- CO_2 emissions from the energy use of 313,952 homes for one year
- CO_2 emissions from burning 19,263 railcars' worth of coal
- CO_2 emissions from 153,705,878 propane cylinders used for home barbecues
- CO_2 emissions of 0.958 coal-fired power plants for one year
- carbon sequestered by 94,588,232 tree seedlings grown for 10 years
- carbon annually sequestered by 786,555 acres of pine or fir forests
- carbon annually sequestered by 35,006 acres of forest preserved from deforestation.

Having now determined the quantity of methane produced by cattle that graze on public lands, one might ask if by removing these cattle the net greenhouse gas contribution of those public lands would be reduced by that amount. The answer to that question is beyond the scope of this article. But I will mention a few of the factors that must be considered in performing the calculation that underlies the answer.

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8. Air Liquide, "Gas Encyclopaedia," http://encyclopedia.airliquide.com/Encyclopedia.asp?GasID=41 (accessed October 31, 2008).
9. U.S. Environmental Protection Agency, "Greenhouse Gas Equivalencies Calculator," http://www.epa.gov/rdee/energy-resources/calculator.html (accessed May 17, 2010). (Assumptions underlying the calculation of greenhouse gas equivalencies can be found on the website.)

Removal of cattle from public lands will allow several environmental entities to begin their recovery from more than a century of harmful impacts. In particular, vegetation that had been consumed by cattle will now be available for wildlife. Consequently, we can expect wildlife populations to increase. And among that wildlife we find native ruminant mammals, such as pronghorn and deer, which like cattle emit methane as a by-product of their digestion. But they produce the gas in much smaller quantities than cattle. An individual deer produces on average only 22 grams of methane per day.[10]—approximately 5 percent of that produced by a cow.

Cessation of cattle grazing will in many locations result in greater sequestration of greenhouse gasses in the soil. For example, one study of grasslands in China found that 20 years after the end of grazing, carbon storage in the top 40-cm of soil had increased by 35.7 percent.[11]

And then there are the microbiotic crusts[12] whose prevalence throughout western deserts has been greatly reduced by the trampling of cattle. One study notes that "[the crusts] can be dominant sources of productivity and carbon sequestration in extremely dry environments."[13] But since damaged crusts may require from 40 to 250 years to fully recover,[14] depending on environmental conditions, significant carbon sequestration by the crusts may similarly take many years.

Quantifying the biological and chemical processes of these and other greenhouse gas sources and sinks following the cessation of cattle grazing would be a daunting task—one made even more difficult by the need to account for impacts on vegetation and wildlife from future global climate change.

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10. *Country-Wide*, "Scientist to Investigate Methane From Deer," January 10, 2003, http://www.country-wide.co.nz/article/1077.html (accessed May 15, 2010).

11. L. Wu, H. He, Y. Wang, and X. Han, "Storage and Dynamics of Carbon and Nitrogen in Soil after Grazing Exclusion in *Leymus chinensis* Grasslands of Northern China," *Journal of Environmental Quality* 37 (2008): 666.

12. Roxanna Johnston, *Introduction to Microbiotic Crusts* (United States Department of Agriculture, July 1997), ftp://ftp-fc.sc.egov.usda.gov/GLTI/technical/publications/micro-crusts.pdf (accessed May 19, 2010).

13. Zoe G. Cardon, Dennis, W. Gray, and Louise A. Lewis, "The Green Algal Underground: Evolutionary Secrets of Desert Cells," *BioScience* 58(2) (2008): 120.

14. Jayne Belnap, "Recovery Rates of Cryptobiotic Crusts: Inoculant [sic] Use and Assessment Methods," *Great Basin Naturalist* 53(1) (1993): 94.