BOVINES AND GLOBAL WARMING: HOW THE COWS ARE HEATING THINGS UP AND WHAT CAN BE DONE TO COOL THEM DOWN

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"If happiness truly consisted in physical ease and freedom from care, then the happiest individual would not be either a man or a woman. It would be, I think an American cow."[1]

INTRODUCTION

Cows generally lead very uninteresting lives, grazing day after day until they are fit for human consumption, but one lucky Black Angus named Lucy has been recruited to play an important role in the fight against global warming.[2] Chewing passively in her outdoor pen with a tube and canister securely fastened to her neck, she is the subject of an ongoing study to reduce livestock gas emissions.[3] Like Lucy, cows all over the world are tremendous sources of methane, a chief component of greenhouse gases.[4] Ruminant animals, such as cattle, sheep, buffalo, and goats, have special digestive systems, allowing them to convert most unusable plant material into a nourishing meal.[5] This beneficial digestive system, however, causes them to expel methane, a powerful greenhouse gas that contributes to global warming.[6]

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[1] William Lyon Phelps, Happiness (New York, 1927), *available at* http://www.twp-psychology.com/happiness.htm.

[2] Gary Polakovic, *Getting the Cows to Cool It*, L.A. TIMES, June 7, 2003, at A1, *available at* http://www.physsci.uci.edu/news/entries/2003067.html.

[3] *Id.*

[4] *Id.*

[5] *Id.*

[6] *Id.*

Livestock gas emissions pose a significant threat to the environment due to today's industry-like animal raising operations. After World War II, farm life shifted dramatically from quaint family-owned operations that raised modest amounts of crops and animals and recycled wastes back to the land.[7] Today, farms dominate 930 million acres in the United States,[8] which boasts a cow population equivalent to two cows for every five people.[9] Large-scale livestock production operations are responsible for twenty-five percent of methane emissions in the United States[10] and produce other greenhouse gases such as carbon dioxide and nitrous oxide.[11]

Carbon dioxide, the focus of the global warming debate, is emitted in considerably larger amounts than methane, but methane is nearly "fifty times more effective at warming the planet."[12] Compared to a reduction of carbon dioxide, efforts to reduce methane emissions can provide more immediate benefits because methane molecules break down faster than carbon dioxide molecules.[13] Although research efforts have yielded promising feed additives designed to reduce methane emissions, and studies show that alternative operating methods can also cut down on greenhouse gas production, farmers are unlikely to consider implementing such improvements unless given proper incentives to do so.[14]

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[7] Holly Cheever, DVM, *Concentrated Animal Feeding Operations: The Bigger Picture*, 5 ALB. L. ENVTL. OUTLOOK 43, 43 (2000).
[8] J.B. Ruhl, *Farms, Their Environmental Harms, and Environmental Law*, 27 ECOLOGY L.Q. 263, 273 (2000).
[9] Polakovic, *supra* note 2.
[10] *Id*; *see also Methane: Sources and Emissions*, U.S. Environmental Protection Agency, *at* http://www.epa.gov/methane/sources.html (last visited Apr. 4, 2005).
[11] *Ruminant Livestock*, U.S. Environmental Protection Agency, *at* http://www.epa.gov/rlep/index.html (last visited Apr. 2, 2005).
[12] *Greenhouse Gases: The Overlooked Sources*, Science Friday, (Dec. 5, 1997), *at* http://www.sciencefriday.com/pages/1997/Dec/hour1_120597.html.
[13] Seranne Howis, *Cow Flatulence: A Significant Contributor to Global Warming or Just a Lot of Hot Air?*, *available at* http://rucus.ru.ac.za/~wolfman/Essays/Cow.html (last visited Feb. 5, 2005).
[14] *See infra* Parts IV-V.

In addition to global warming, the livestock industry is a major contributor to the pollution and depletion of the planet's water supply, deforestation, soil erosion, and world hunger.[15] Astoundingly, despite the irreparable damage inflicted, the livestock industry has successfully escaped strict environmental regulation.[16] Although factory farms harm the environment in countless ways, the current regulatory model is very broad and seeks to control each aspect of pollution separately, allowing farmers to legally use outdated, harmful production methods.[17]

Part I of this Note addresses global climate change concerns and the significant contribution of the livestock industry to increased greenhouse gas emissions. Part II highlights the results of domestic and international research on curbing livestock methane emissions. Other considerable environmental damage, including soil erosion, deforestation, and depletion of water resources caused by the livestock industry are examined in Part III. Part IV focuses on the inefficiency of current federal regulations when applied to factory farm operations. Finally, Part V emphasizes the need for comprehensive, industry-specific regulations at both the federal and state level and the importance of incentives to encourage farmers to implement alternative methods to alleviate the harms associated with livestock production.

I. GLOBAL CLIMATE CHANGE AND THE LIVESTOCK INDUSTRY

A. What are the Dangers of Global Warming?

Greenhouse gases, such as carbon dioxide, methane, and nitrous oxide, have always existed in the Earth's atmosphere, allowing solar radiation to enter the atmosphere and be absorbed by the Earth's surface.[18] The solar energy is converted to heat, which rises from the surface and hits the gaseous molecules, reflecting some of the heat back toward the surface and warming

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[15] *See infra* Part III.
[16] Ruhl, *supra* note 8, at 267-68.
[17] *See infra* Part IV.
[18] JEREMY RIFKIN, BEYOND BEEF 223-24 (1992).

the planet.[19] The greenhouse effect is therefore essential to sustain life on the planet by ensuring a warm temperature.[20] Without greenhouse gases, the Earth would be approximately sixty degrees colder.[21]

Unfortunately, industrialization has caused the release of increased amounts of greenhouse gases into the atmosphere, blocking the release of heat from the Earth and resulting in global warming.[22] The Earth's mean temperature has remained fairly constant since the last Ice Age, varying only 3.6 degrees Fahrenheit over the last 18,000 years.[23] However, because of the release of enormous amounts of greenhouse gases today, scientists predict a four- to nine-degree temperature rise over the next fifty years.[24] "A temperature change of this magnitude is likely to plunge the world's ecosystems and human civilization into the throes of an unprecedented crisis."[25]

1. Health

The most direct effects of global warming on human health will stem from rising temperatures.[26] Studies show that most parts of the United States have already warmed, some by as much as four degrees Fahrenheit.[27] Heat waves boost death and illness rates, particularly among the elderly, infants, and individuals with

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[19] *Id.* at 224.
[20] *Id.*
[21] *Climate Change: The Greenhouse Effect*, U.S. Environmental Protection Agency, *at* http://yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/SHSU5BUMQ9/$File/greenhouseeffect.pdf (last visited Apr. 2, 2005).
[22] RIFKIN, *supra* note 18, at 224.
[23] *Id.* at 227.
[24] *Id.*
[25] *Id.*
[26] *Global Warming - Impacts: Health*, U.S. Environmental Protection Agency, *at* http://yosemite.epa.gov/oar/globalwarming.nsf/content/ImpactsHealth.html (last visited Apr. 2, 2005) [hereinafter *Health Impacts*].
[27] *The Consequences of Global Warming*, Natural Resources Defense Council, *at* http://www.nrdc.org/globalwarming/fcons.asp (last visited Apr. 2, 2005).

cardiovascular disorders.[28] The dangers associated with heat waves should not be taken lightly. A heat wave in Chicago killed more than 700 people in 1995, and research shows that a mere two-degree temperature increase in Atlanta may cause the number of heat-related deaths to rise from 78 per year to as many as 247 per year.[29]

Higher temperatures also increase the concentration of ground-level ozone, which, unlike the protective nature of atmospheric ozone, is a powerful pollutant.[30] Ozone causes lung damage and is particularly harmful to people with asthma and other respiratory conditions.[31] It can also cause nausea, chest pains, and pulmonary congestion in healthy individuals.[32] A temperature increase of four degrees Fahrenheit could elevate ozone concentrations by five percent.[33]

An increase of infectious diseases is another possible result of rising temperatures.[34] Scientists predict that diseases that currently exist only in warmer climates, such as malaria, dengue fever, yellow fever, and encephalitis, may become more prevalent.[35]

2. Decreasing Water Supply

Rising temperatures will affect both precipitation and evaporation throughout the United States.[36] Greater evaporation could cause a greater likelihood of drought and lower the water levels of rivers and lakes.[37] This "evaporation, particularly during

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[28] *Health Impacts*, *supra* note 26.
[29] *Id.*
[30] *Id.*
[31] *Id.*
[32] *Id.*
[33] *Id.*
[34] *Health Impacts*, *supra* note 26.
[35] *Id.*
[36] *Global Warming - Impacts: Water*, U.S. Environmental Protection Agency, *at* http://yosemite.epa.gov/oar/globalwarming.nsf/content/ImpactsWaterResources.html (last visited Feb. 5, 2003) [hereinafter *Water Impacts*].
[37] *The Consequences of Global Warming*, *supra* note 27; *see also Water Impacts*, *supra* note 36.

summer and fall, could exacerbate [existing] drought conditions and increase the risk of wildfires."[38] Some areas may even experience flooding during the winter and spring and drought in the summer months.[39]

Several warning signs suggest that this process has already begun.[40] Between 1999 and 2002, the United States experienced one of the most widespread droughts in forty years.[41] In 1998 and 1999, several states in the far north and far south experienced their driest summers in over one hundred years.[42] In addition, seven million acres in the western United States burned in 2002, marking that area's "second worst wildfire season in the last fifty years."[43] Other states had considerable dry seasons, resulting in severe dust storms and wildfires.[44]

3. Rising Sea Levels

Warmer temperatures are expected to raise sea levels as a result of expanding ocean waters and partial melting of glaciers and ice caps.[45] Rising sea levels can lead to intensified flooding, beach erosion, lowland and wetland submersion, and increased salinity of brackish and fresh water bodies, including groundwater tables.[46] According to the Environmental Protection Agency ("EPA"), "a two foot rise in sea level could eliminate 17-43 percent of US wetlands . . . with more than half of the loss taking place in

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[38] *The Consequences of Global Warming*, *supra* note 27; *see also Water Impacts*, *supra* note 36 (explaining that rainfall tends to be concentrated during heavy storms that occur when temperatures rise, thereby increasing flooding but not the available water supply).
[39] *Water Impacts*, *supra* note 36.
[40] *The Consequences of Global Warming*, *supra* note 27.
[41] *Id.*
[42] *Id.*
[43] *Id.*
[44] *Id.*
[45] *Id.*
[46] *Global Warming - Impacts: Coastal Zone*, U.S. Environmental Protection Agency, *at* http://yosemite.epa.gov/oar/globalwarming.nsf/content/ImpactsCoastalZones.html (last visited Apr. 2, 2005) [hereinafter *Coastal Zone Impacts*].

Louisiana alone."[47] Such a rise would also destroy roughly 10,000 square miles of land, which is equal to the areas of Massachusetts and Delaware combined.[48]

The effects of rising seas may be noticed more immediately at beaches, which are eroding at a rate of one to four feet per year.[49] Research suggests that at this rate, "about 25 percent of all buildings within 500 feet of the U.S. coastline will be taken by erosion in the next 60 years."[50]

Flooding of low lying coastal areas is likely to intensify dramatically with even a small sea-level increase.[51] A Federal Emergency Management Agency report estimated that with a mere one-foot rise, the 100-year flood plain would expand by 3500 square miles and flood damages would increase by as much as fifty-eight percent.[52] Scientists note that the sea-level is currently rising three times faster than in the past and will have risen between nineteen and thirty-seven inches by 2100.[53]

4. Ecosystems

Regional ecosystems will feel the largest impact.[54] Many forests are expected to die early in the twenty-first century because they "will not be able to migrate fast enough to keep up with the shift in their temperature range."[55] A similar problem exists in aquatic ecosystems because of species' sensitivity to floods, drought, and temperature.[56] Warmer waters will alter the geographic distribution of aquatic plants and animals and may lead

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[47] *Id.*
[48] *Id.*
[49] *Id.*
[50] *Id.*
[51] *Id.* This happens because "a higher sea level raises the flood level from a storm of a given severity." *Coastal Zone Impacts*, *supra* note 46.
[52] *Id.*
[53] *The Consequences of Global Warming*, *supra* note 27.
[54] RIFKIN, *supra* note 18, at 228.
[55] *Id.*
[56] Press Release, Pew Center, Climate Change Threatens Health of America's Lakes, Streams, Rivers and Wetlands (Jan. 29, 2002), *at* http://www.pewclimate.org/press_room/sub_press_room/2002_releases/pr_aquatic.cfm.

to a disruption of reproduction.[57] A five-degree temperature increase could devastate trout and salmon populations, which require cool water for survival.[58] Coral reefs are currently experiencing coral bleaching, whereby their complex biological system is broken down by heat absorbed from the warming water.[59] Twenty-seven percent of coral reefs have already died, and by 2020, the water may be warm enough to eliminate them entirely.[60]

B. Fun Flatulence Facts

The principal focus of the global warming fight has been the reduction of carbon dioxide, the most prevalent greenhouse gas.[61] Carbon dioxide is responsible for the greatest percentage of the global warming problem, but methane is much more effective at trapping heat, and thus presents more of a problem.[62] In addition, reducing methane emissions may have a more immediate impact on the greenhouse effect.[63] Atmospheric methane is able to break down within a decade, whereas carbon dioxide can linger for more than a century.[64]

Ruminant animals, such as cattle, sheep, buffalo, and goats, comprise a significant source of methane emissions throughout the world.[65] "Each animal has a four-chambered stomach, including a

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[57] *Id.*

[58] *Global Warming & Energy: Aquatic Ecosystems*, Sierra Club, *at* http://www.sierraclub. org/globalwarming/habitat/aquatic.asp (last visited Apr. 2, 2005).

[59] *Id.*

[60] *Id.*

[61] *Greenhouse Gases: The Overlooked Sources*, *supra* note 12.

[62] Howis, *supra* note 13; *see also Greenhouse Gases: The Overlooked Sources*, *supra* note 12 ("Two hundred times as much carbon dioxide as methane is emitted each year, but molecule for molecule, methane is about fifty times more effective at warming the planet.").

[63] Howis, *supra* note 13.

[64] *Id.*; *see also Breath Mints for Cows*, CBS NEWS, June 13, 2003, *available at* http://www.cbsnews.com/stories/2003/06/13/tech/main558572.shtml ("Methane's lifetime in the atmosphere is about 10 to 12 years, compared to 50 to 200 years for carbon dioxide. Focusing on reducing methane would provide quicker benefits to reducing the greenhouse gases.").

[65] Polakovic, *supra* note 2.

large forestomach called a rumen, where the hard work of digestion takes place."[66] Because of their special digestive systems, cows can digest fibrous plants, allowing them to find nourishment in many different environments and making them easy to raise.[67] Unfortunately, cows experience chronic indigestion—repeatedly regurgitating and re-chewing and swallowing their food.[68] During each trip to the rumen, the food absorbs fungi, protozoa, and bacteria.[69] Methanogenic bacteria,[70] which feed on hydrogen, cause methane to be expelled whenever the cow spits out its cud.[71] This process, known as enteric fermentation, produces a considerable amount of methane through exhalation.[72] An average cow produces about 600 liters of methane each day, which is enough to fill 400 party balloons.[73] This may not appear to be a significant amount by itself, but now that production of cattle has doubled in the last thirty years,[74] cow exhalations constitute twenty-five percent of U.S. methane emissions.[75] The number of cows in the United States has increased so much that there are now two animals for every five people.[76] Each of the 1.3 billion cows that roam American fields today[77] exhales roughly 219,000 liters of methane per year,[78] bringing the total cow emissions to over 300 trillion liters per year.[79] Breath mints, anyone?

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[66] *Id.*
[67] *Id.*
[68] *Id.*
[69] *Id.*
[70] PETER J. VAN SOEST, NUTRITIONAL ECOLOGY OF THE RUMINANT, 278-79 (2d ed. 1994).
[71] Polakovic, *supra* note 2.
[72] *Id.*
[73] David Adam, *How Much Brown Cow?*, NATURE, Sept. 5, 2000.
[74] Polakovic, *supra* note 2.
[75] *Methane: Sources and Emissions*, U.S. Environmental Protection Agency, *at* http://www.epa.gov/methane/sources.html (last visited Apr. 4, 2005) (illustrating that enteric fermentation accounts for nineteen percent of methane emissions and livestock manure constitutes six percent of such emissions).
[76] Polakovic, *supra* note 2.
[77] *Id.*
[78] 600 liters per day x 365 days a year = 219,000 liters per year.
[79] 1.3 billion cows x 219,000 liters per year = 300 trillion liters per year.

C. *How is Methane from Cows Measured?*

The rate of methane expulsion from a cow is measured by a sulfur hexafluoride ("SF6")trace technique.[80] A permeation device that releases SF6 is placed in the cow's rumen and a sampling device collects air from the cow's nose and mouth over an extended period of time.[81] The device consists of a halter fitted across the head, a PVC yoke around the neck, a capillary tube for air transfer, and a gas dilution system.[82] The SF6 accounts for the dilution of expelled gases when they mix with outside air.[83] Once the device is removed from the cow, the device is connected to the dilution system where pressure is recorded and the dilution factor is calculated.[84] Assuming that SF6 and methane are emitted at the same rate, their dilution rates are identical[85] and the concentration of each is measured using gas chromotography.[86] The methane emission rate is then calculated from the measured concentrations and the known release rate of SF6.[87]

This method can also be used to measure the methane rates for an entire barn full of cows without the complex fitting devices.

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[80] *Methane Measurements from Ruminants: The SF6 Technique*, U.S. Environmental Protection Agency, slide 2, *at* http://www.epa.gov/rlep/presentation/sld002.htm (last visited Feb. 5, 2003) [hereinafter *Methane Measurements*].

[81] *Id.* at slide 3.

[82] *Id.*

[83] *Id.* at slide 26.

[84] *Id.* at slide 24.

[85] *Id.* at slide 26.

[86] *Methane Measurements*, *supra* note 80, at slide 25. Gas chromatography is a technique used to separate volatile gases to determine the amount of each gas in the sample. A carrier gas is introduced into the system along with a sample of the gases to be separated. Each gas in the mixture is transported by the carrier gas through the column at a rate determined by its physical properties. As each gas exits the column, it enters a heated detector which produces an electric signal upon interaction with the gas. This signal is plotted against the elapsed time to produce a chromatogram. The amount of each gas is identified by the size of the peak on the chromatogram. *What is Gas Chromatography?*, Agilent Technologies, *at* http://www.chem.agilent.com/cag/cabu/whatisgc.htm (last visited Apr. 3, 2005).

[87] *Methane Measurements*, *supra* note 80, at slide 26.

One such test was conducted by releasing SF6 into a barn with ninety cows and measuring the methane content thirty meters downwind from the barn.[88] However, cows produce one fifth more methane when grazing outdoors,[89] therefore making the individual fitting device measurement a more accurate indicator of the adverse effects that 1.3 billion outdoor grazing cows will have on the environment.

II. DOMESTIC AND INTERNATIONAL METHANE RESEARCH

A. Methane Reducing Research in the United States

In 2000, University of Nebraska researchers decided to try to reduce methane by blocking enzymes in the cow's rumen that produce the harmful gas.[90] The researchers patented a process by which an enzyme-blocking compound would be added to cattle feed.[91] Over 200 compounds were tested in order to find a formula that would block the methane without harming the "beneficial microbes in the cow's rumen."[92] Of the 200 studied, ten compounds proved successful enough to undergo further testing on actual rumen fluid.[93] Stephen Ragsdale, a biochemistry professor at the University of Nebraska noted that "[o]f those [10 compounds], about 20 to 30 percent are indeed doing what we expect them to do. We're honing in on what would be perfect."[94]

The compounds have not been tested in live animals, but Ragsdale noted that when testing occurs, it will likely take place "in an animal much smaller than a cow."[95] The team goal is to

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[88] Adam, *supra* note 73.
[89] *Id.* (explaining that an indoor cow produces about 542 liters of methane per day, whereas an outdoor cow produces 600 liters).
[90] *Breath Mints for Cows*, *supra* note 64.
[91] *Id.*
[92] *Id.*
[93] *Id.*
[94] *Id.* "We'd probably go to sheep before cattle, and before sheep we may go to a termite. They make a lot of methane." *Id.* (quoting Stephen Ragsdale).
[95] *Breath Mints for Cows*, *supra* note 64.

reduce methane emissions by about four percent, which would help restore the balance between methane production and attenuation.[96]

An additional benefit may stem from curtailing cattle methane production.[97] The Nebraska researchers believe that methane does not benefit the cows, and as much as sixteen percent of feed is actually wasted because it is converted to methane.[98] Therefore, by reducing methane production, cattle could be fed less because they could devote more of their energy to producing proteins, amino acids and fat—"[a]ll the things that the livestock producer values in their beef."[99]

B. International Livestock Facts and Solutions

1. Brazil

Brazil holds the second largest number of cattle in the world, boasting more than 160 million cows.[100] The number of cows is equivalent to its human population and, if the Brazilian cattle industry's productivity were not so low, would be "enough to inundate the international market with beef and milk."[101] The country's portion of methane emissions could be reduced, given that its large cattle population is not necessary to maintain current levels of food production.[102] For example, it is estimated that one-fifth of the world's current herd could sustain the current demand for milk.[103] Paulo Machado, professor at the University of Sao Paulo's School of Agronomy, notes that this would be possible if Brazil could achieve the productivity levels of Australia and

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[96] *Id.*
[97] *Id.*
[98] *Id.*
[99] *Id.* (quoting Stephen Ragsdale).
[100] Mario Osava, *Cattle Contribute to Global Warming*, TIERRAMÉRICA, Nov. 26, 2000, *at* http://www.tierramerica.net/2000/1126/acent.html.
[101] *Id.*
[102] *Id.*
[103] *Id.*

New Zealand.[104] Armed with efficient breeds found in the United States, "which produce seven tons of milk per animal per year," Brazil could survive with a dairy herd one-tenth its current size.[105] Because the cattle population needs to be reduced, research on feed additives that reduce pollution and improve the efficiency of cattle production seems imperative for Brazil's agricultural future.

2. India

India, with the world's largest livestock population, faces a similar problem.[106] The nation's "National Dairy Development Board has estimated that with better feed, the cattle population in India could be reduced from 300 million to 120 million without affecting production."[107] India's experimentation with new feed supplements, the India Dairy Project, has determined that low-cost molasses-urea products ("MUPs") are effective in reducing methane emissions as well as increasing dairy production.[108] Studies showed that introducing the MUPs into a cow's diet resulted in higher levels of milk and butterfat production[109] and reduced methane emissions by "70 percent per unit product."[110] Additional research notes that consumption of MUPs can facilitate increased weight gain, reduced fodder waste, enhanced reproduction, and improved overall animal health.[111]

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[104] *Id.*
[105] *Id.*
[106] Osava, *supra* note 100.
[107] *Greenhouse Gases: The Overlooked Sources*, *supra* note 12.
[108] *Programs and Strategy: India Dairy Project*, EnterpriseWorks, *at* http://www.enterpriseworks.org/prog_profile_dairy_india.asp (last visited Apr. 3, 2005) [hereinafter *India Dairy Project*].
[109] *Id.*
[110] *Project Highlights: India Dairy Project*, Global Livestock Group, *at* http://web.archive.org/web/20030204073044/theglg.com/inb619~1.htm (last visited Apr. 4, 2005).
[111] *See id.*; *India Dairy Project*, *supra* note 108.

3. New Zealand

New Zealand's 45 million sheep and 10 million cattle pose a significant problem for the country's fight against global warming.[112] This enormous livestock population constitutes fifty percent of the country's total greenhouse gas emissions and ninety percent of its methane emissions.[113] Such a dramatic environmental effect has caused the government to do what farmers consider the unthinkable—impose a livestock levy.[114] The levy, affectionately referred to as the "fart tax,"[115] charges farmers 72 cents per dairy cow, 54 cents per beef cow, and 9 cents per sheep in order to fund research ($4.9 million worth) to identify methane reducing methods.[116] The Federated Farmers of New Zealand introduced their new campaign, cleverly known as the Fight Against Ridiculous Taxes ("FART").[117] Farmers are currently gathering signatures to eliminate the tax, which they contend is unconstitutional because it taxes only one group while the results benefit the entire country.[118]

Fortunately for the government, the tax seems to have yielded fruitful research. Researchers were aware that some plants reduce the amount of methane an animal produces, but were not sure of the source of the reduction.[119] After collecting methane emissions from Myrtle the cow, they were able to analyze the different effects produced by various types of food.[120] Results indicate that plants

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[112] John Roach, *New Zealand Tries to Cap Gaseous Sheep Burps*, NATIONAL GEOGRAPHIC NEWS, May 13, 2002, *available at* http://news.nationalgeographic.com/news/2002/05/0509_020509_belch.html.

[113] *Id.*

[114] Ray Cooklis, *New Zealand: Big Stink over Gas Tax*, CINCINNATI ENQUIRER, Aug. 22, 2003, *available at* http://www.enquirer.com/editions/2003/08/22/editorial_memo22ray.html.

[115] *New Zealand Farmers Raise Stink Over "Fart Tax,"* CBC NEWS, Sept. 8, 2003, *available at* http://www.cbc.ca/stories/2003/09/05/fart_tax030905 [hereinafter *Fart Tax*].

[116] Cooklis, *supra* note 114.

[117] *Fart Tax*, *supra* note 115.

[118] Cooklis, *supra* note 114.

[119] Roach, *supra* note 112.

[120] *Id.*

high in condensed tannins (the chemicals that give red wine its flavor) can reduce livestock emissions by sixteen percent.[121] Besides reducing methane emissions, condensed tannins prove beneficial to livestock in many other ways, including increased weight gain, improved milk production, and decreased internal parasites and bloat.[122]

4. Australia

Australia's 140 million sheep and cattle also produce high levels of methane, constituting roughly one-seventh of the country's total greenhouse gas emissions.[123] Interestingly, the focus of Australian research has not centered on SF6 tracing methods or new feed additives, but on kangaroos.[124] "Down under" cows and kangaroos dine on the same grass, but while farm animals generate fifteen percent of Australia's greenhouse gases, kangaroos produce no methane.[125] Kangaroo stomachs contain a different type of bacteria that does not convert the hydrogen into methane.[126] Unsure of exactly what kangaroo stomachs do with the hydrogen, scientists have isolated forty types of bacteria in order to determine how each works in processing food.[127] Once the type responsible for methane suppression is identified, the goal is to place the bacteria in cow rumens to yield non-polluting cattle.[128] "As well as being more climate-friendly, the kangaroo bacteria could be good news for farmers too by raising yields of . . . milk and meat."[129]

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[121] *Id.*
[122] *Id.*
[123] Howis, *supra* note 13.
[124] Richard Black, *Kangaroos Offer Clue to Global Warming*, BBC NEWS, June 3, 2002, *available at* http://news.bbc.co.uk/1/hi/world/asia-pacific/2023371.stm.
[125] *Id.*
[126] *Id.* (explaining that a possible reason for the difference is that, unlike cattle, which only arrived from Europe two centuries ago, kangaroo have bacteria that has evolved over millions of years and may be more efficient at processing Australian grasses).
[127] *Id.*
[128] *Id.*
[129] *Id.*

5. Conclusion

Through extensive research, many countries with large cow populations have identified effective methods to reduce methane productions. The most promising appears to be the new types of feed additives, because poor diet is one cause of increased methane production.[130] Problems arise, however, because cows in different parts of the world have diverse nutritional deficiencies.[131] Each country should therefore conduct its own research to develop methane reducing additives and curb gas emissions from their unique cow populations.

III. OTHER WAYS LIVESTOCK THREATEN THE ENVIRONMENT

The farming business has undergone dramatic changes since the traditional days of small, family-owned farms that raised a variety of animals and crops.[132] Countries which became wealthier after World War II demanded more meat, and the race was on to deliver the most meat for the greatest profit.[133] Beef became the center of the American diet in the early 1950s, outselling pork for the first time.[134] To meet the growing population's desire for meat, agriculture became industrialized and many small farmers were forced to quit or learn to specialize in single animal operations.[135]

Traditionally dominated by small businesses, farming has developed into a large industry, occupying more than 930 million acres of the United States.[136] The new farming "industry" focuses on the production of one crop by utilizing assembly-line techniques

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[130] *See supra* notes 90-129.
[131] *Greenhouse Gases: The Overlooked Sources*, *supra* note 12.
[132] Cheever, *supra* note 7, at 43-44.
[133] C. DAVID COATS, OLD MACDONALD'S FACTORY FARM 19 (1991).
[134] *Id.*
[135] *Id.*
[136] Ruhl, *supra* note 8, at 272.

in order to increase profit margins.[137] It was actually the slaughterhouse, not Henry Ford, that first implemented the assembly line, allowing workers to prepare an animal for food production as it moved along a conveyor belt.[138]

Today's factory farms are favored by agricultural businessmen because they greatly reduce expenditures on land and labor, two of the largest agricultural expenses.[139] The lives of the animals in the factories, however, are far different from the happy cows and chickens roaming the fields that are depicted in most children's books.[140] The animals no longer roam free, nor are they sustained by land they occupy.[141] Instead, "they are kept in large numbers in the smallest possible space, producing volumes of wastes calculated in the billions of tons and requiring specialized holding systems that can be overwhelmed."[142] Most dairy cows are never allowed outside of their concrete confines and only see a grassy field once—on the way to the slaughterhouse.[143]

The cattle population today is so extraordinary that one biologist stated, "'an alien ecologist . . . might conclude that cattle is the dominant animal species in our biosphere.'"[144] Together with other ruminant livestock, cattle "graze one-half of the planet's total land area."[145] Unlike the traditional small family farming methods which allowed the environment to prosper, today's agricultural production leads to drastic environmental consequences.

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[137] Cheever, *supra* note 7, at 44.
[138] RIFKIN, *supra* note 18, at 119.
[139] COATS, *supra* note 133, at 20.
[140] *Id.* at 19.
[141] Cheever, *supra* note 7, at 43-44.
[142] *Id.* at 44.
[143] COATS, *supra* note 133, at 54.
[144] ALAN B. DURNING & HOLLY B. BROUGH, TAKING STOCK: ANIMAL FARMING AND THE ENVIRONMENT 6 (1991) (quoting University of Georgia biologist David Hamilton Wright) (citation omitted).
[145] *Id.* at 15.

A. *Water Resource Pollution and Depletion*

Livestock production poses a considerable threat to the pollution and depletion of water reserves.[146] Organic waste, one of the principal sources of water pollution, is produced by cattle at an alarming rate.[147] U.S. livestock produce one million pounds of excrement every four seconds and nearly two billion tons of manure each year.[148] These enormous piles of excrement create disastrous consequences for lakes and rivers located near feedlots because the runoff is "'ten to several hundred times more concentrated than raw domestic sewage.'"[149] In addition to animal waste, farm runoff carries fertilizers, pesticides, sediments, and bacteria into the water supply.[150]

Besides contaminating the nation's lakes and streams, the livestock industry is also draining water supplies "at a rate far above sustainability."[151] The industry commands over half of the total amount of water consumed in the country in order to provide food and water to the animals.[152] Some estimates suggest that the amount of "water used to produce a pound of beef can be more than a single person may use in taking showers for an entire year."[153]

B. *Human Starvation*

Two hundred years ago, Thomas Malthus wrote: "'the power of population is indefinitely greater than the power of the earth to produce subsistence for man.'"[154] In his view, war, disease, and starvation are inevitable events to ensure a balance between the

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[146] Robert H. Smith, *Livestock Production: The Unsustainable Environmental and Economic Effects of an Industry Out of Control*, 4 BUFF. ENVTL. L.J. 45, 48 (1996).
[147] *Id.* at 52.
[148] *Id.* at 52-53.
[149] *Id.* at 53 (quoting Dr. Harold Bernard, an agricultural expert for the Environmental Protection Agency) (citation omitted).
[150] Ruhl, *supra* note 8, at 288.
[151] Smith, *supra* note 146, at 48.
[152] *Id.* at 49.
[153] *Id.*
[154] RIFKIN, *supra* note 18, at 157.

population and the ability of the land to sustain it.[155] The population today is estimated to double within the next sixty years and there are great concerns about the availability of resources to feed the human race.[156] According to the World Health Organization, 1.3 billion people currently suffer from chronic hunger.[157]

The modern farming industry is one of the major contributing factors to world hunger.[158] Over seventy percent of the grain produced in the United States is used to feed livestock.[159] Cows waste most of the feed, however, because of their inefficiency in converting the grain into beef.[160] In addition, most of the beef that is produced from the grain-fed animals goes to feed the wealthy, robbing the poor of grain that is essential to their survival.[161] Today, 157 million tons of grain and other crops are fed to livestock, which yield only 28 million tons of meat, poultry, and eggs.[162] 129 million tons of grain and soybeans are therefore wasted and unavailable for human consumption.[163] One food economist estimates that if converted into cash, the wasted grain "would be worth approximately $20 billion and if converted to human use could provide 'the equivalent of one cup of grain for every single human being on earth every day for a year.'"[164]

C. *Loss of Rainforests and Deforestation*

Cattle production is also a leading cause of deforestation.[165] Rainforests, which "act as the lungs of Earth," are constantly

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[155] *Id.*
[156] *Id.* at 158-59.
[157] *Id.* at 177.
[158] *Id.* at 159.
[159] *Id.* at 160.
[160] RIFKIN, *supra* note 18, at 160 (noting that only eleven percent of feed is actually used to produce beef and the rest is used to maintain normal bodily functions or is burned off as energy).
[161] *Id.* at 159.
[162] *Id.* at 161.
[163] *Id.*
[164] *Id.* (quoting food economist Frances Moore Lappé) (citation omitted).
[165] Smith, *supra* note 146, at 53.

destroyed in order to provide additional land for cattle production.[166] Twenty-five percent of Central America's rainforest and 40,000 square miles of the Amazon rain forest have been cleared since the 1960s to make room for more cattle.[167] In Panama and Costa Rica, where pasture now constitutes seventy percent of the deforested land, ranchers employ backhanded methods to acquire additional farm land.[168] Peasants in Panama are paid to clear forests and ranchers in Costa Rica engage in "fence creeping," extending their fences further and further into national parks.[169]

Deforestation is yet another method by which cows contribute to the global warming problem.[170] Removing and burning trees to make room for pastureland releases both carbon dioxide and methane into the atmosphere and leaves fewer trees to convert the carbon dioxide back into oxygen.[171]

Destruction of rainforests is not only harmful to the atmosphere; it also threatens the extinction of many endangered species.[172] "The tropical forests cover only 7% of the Earth's land area, yet it is quite possible that they contain perhaps half of the Earth's species."[173] In addition to a diverse population of mammals, birds, reptiles, and insects, an average 100 acre area in the Amazon contains approximately 300 to 500 plant species and thousands of micro-organisms yet to be discovered.[174]

D. Desertification

Cattle grazing also damages U.S. rangelands by turning productive areas into deserts.[175] The livestock industry is the primary cause of desertification, which is becoming more prevalent

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[166] *Id.* at 53-56.
[167] *Id.* at 54-56.
[168] DURNING & BROUGH, *supra* note 144, at 25.
[169] *Id.*
[170] Cheever, *supra* note 7, at 44.
[171] *Id.*
[172] Smith, *supra* note 146, at 54.
[173] *Id.*
[174] DURNING & BROUGH, *supra* note 144, at 26.
[175] Smith, *supra* note 146, at 58-59.

throughout the world.[176] A single cow consumes 900 pounds of vegetation per month while simultaneously compacting the soil with twenty-four pounds of pressure per square inch.[177] The relentless hoof-pounding leaves the land unable to absorb water and increases susceptibility to wind and rain erosion.[178] "Each year 52 million acres of land, an area equivalent to the size of Kansas, are eroded so severely by desertification that they are rendered unproductive for virtually any use."[179] In the western United States, approximately 430 million acres of land have experienced a twenty-five to fifty percent drop in productivity.[180] Six of the seven billion tons of soil eroded each year may be attributed to the livestock industry.[181] This creates a serious problem because of slow soil regrowth—it takes between 200 and 1000 years for an inch of topsoil to accumulate.[182] Furthermore, every inch lost reduces grain production by six percent.[183] It is estimated that soil erosion and runoff cost the United States more than $44 billion a year, an environmental debt which future generations must bear.[184]

E. Depletion of Fossil Fuels

Nearly half of America's agricultural energy is consumed by the livestock industry.[185] The equivalent of one gallon of fuel is expended to produce one pound of beef and more than 260 gallons are needed to provide beef for an average family of four.[186] This sizable use of fuel discharges 2.86 tons of carbon dioxide—more

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[176] *Id.* at 59.
[177] RIFKIN, *supra* note 18, at 204.
[178] *Id.*
[179] Smith, *supra* note 146, at 59.
[180] *Id.*
[181] *Id.* at 60.
[182] RIFKIN, *supra* note 18, at 202.
[183] *Id.*
[184] *Id.* at 203.
[185] Smith, *supra* note 146, at 61.
[186] *Id.* at 61-62.

than an average car emits in a six month period.[187] "As fossil fuel reserves continue to decline, it is inevitable that the actual cost of livestock production will continue to climb both in terms of economic inputs and environmental damage."[188]

IV. THE INEFFICIENCY OF CURRENT FEDERAL AND STATE REGULATIONS—WHAT NEEDS TO BE DONE?

A. Increased Efficiency of the Cattle Industry

As research in both the United States and in other countries suggests, improvements in feeding not only yield substantial methane reductions, but also higher levels of animal productivity.[189] Furthermore, taking advantage of better feed alternatives is economically beneficial to farmers due to the low-cost of feed supplements and the increased net profit per cow.[190] Cows lose up to six percent of the food they eat through producing and expelling methane.[191] Utilizing methods to keep this weight on the cow rather than in the air we breathe will lead to increased production as well as a cleaner environment.[192] EPA notes that increasing the efficiency of livestock production over a thirty year period has reduced methane emissions by 170,000 tons while producing ten million more tons of milk.[193]

Cattle ranchers and farmers have admitted that they pay little attention to problems associated with methane emissions.[194] Currently, no regulations or industry practices exist that require or provide incentives for livestock producers to engage in environmentally friendly practices.[195] Perhaps educating farmers about

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[187] *Id.* at 62.
[188] *Id.*
[189] *See supra* Part II.
[190] *Id.*
[191] Polakovic, *supra* note 2.
[192] *Id.*
[193] CHRISTINA WOOD & CALLIE K. KNIPMEYER, GLOBAL CLIMATE CHANGE AND ENVIRONMENTAL STEWARDSHIP BY RUMINANT LIVESTOCK PRODUCERS 10 (1998), *available at* http://www.epa.gov/methane/pdfs/ffa.pdf.
[194] Polakovic, *supra* note 2.
[195] *Id.*

the economic benefits of methane-reducing feed alternatives and improved livestock managing practices would encourage them to join the fight against global warming and promote a cleaner Earth for everyone.

B. The Need for Better Regulations

Although the livestock industry is one of the biggest threats to the environment, it has continually escaped environmental regulation.[196] Instead, Western nations spend billions of dollars to support the industry, providing livestock producers with subsidies and special favors[197] that allow their large industries to expand.[198] Although these support programs "are designed to promote self-sufficiency in food production, to raise farmers' incomes, and to aid rural communities," they have actually led to an increase in "intensive forms of livestock production."[199] Animal and feed farmers are highly favored by the agricultural support programs and they benefit more from using pasture land to grow harvested feed than from using it for grazing.[200] These flawed programs appear to encourage environmentally harmful practices in the livestock industry. If livestock support plans are not remedied, farmers will continue to reap the most benefits at the expense of the broader population by intensifying production methods and destroying the environment.

The current federal and local regulations also need significant changes in order to accurately address the unique aspects of the farming industry. Focusing on only one source of industry pollution, the traditional regulatory methods used today fail to completely remedy the widespread environmental damage caused

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[196] Ruhl, *supra* note 8, at 268.
[197] DURNING & BROUGH, *supra* note 144, at 34-35. Livestock "producers benefit from a variety of measures such as guaranteed minimum prices, government storage of surpluses, feed subsidies, import levies, and product insurance." *Id.* at 35.
[198] *Id.* at 34-35.
[199] *Id.* at 35.
[200] *Id.*

by large farming operations.[201] Current legislation attempts to regulate water pollution, soil damage, and odor concerns independently rather than employ new methods to control the problems collectively.[202] Many technological advances have made it possible to reduce livestock pollution while providing economic benefits to farmers, but are being ignored by existing regulations.[203]

C. Existing Regulations

1. Clean Water Act

The Clean Water Act ("CWA")[204] amended the Federal Water Pollution Act in 1977 to "'restore and maintain the chemical, physical, and biological integrity of the Nation's waters by 1985.'"[205] This impressive goal has yet to be met, however, primarily because of the difficulty in "control[ling] agricultural . . . and other pollution caused by water runoff."[206]

CWA employs a two-tiered approach for pollution prevention based on water quality standards and effluent limitations.[207] First, each state submits to EPA a Total Maximum Daily Load plan, a water quality plan designed to achieve relevant use standards for particular bodies of water.[208] Second, EPA sets effluent limitations by regulating pollutant discharge through the National Pollutant Discharge Elimination System ("NPDES"), which requires that "point sources" obtain a permit in order to continue their operation.[209]

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[201] Nicholas M. White, *Industry-Based Solutions to Industry-Specific Pollution: Finding Sustainable Solutions to Pollution from Livestock Waste*, 15 COLO. J. INT'L ENVTL. L. & POL'Y 153, 158 (2004).
[202] *Id.* at 159.
[203] *Id.* at 153.
[204] 33 U.S.C. §§ 1251 et. seq. (1977).
[205] Erika N. Hartliep, *Federal and Pacific Northwest State Water Laws Pertaining to Dairies*, 37 IDAHO L. REV. 681, 686 (2001) (quoting 33 U.S.C. § 1251(a)(1) (2000)).
[206] *Id.*
[207] *Id.*
[208] *Id.*
[209] *Id.*

Concentrated animal feeding operations ("CAFOs"), facilities housing more than 1000 animals, are considered point sources by EPA.[210] Other animal feeding operations ("AFOs") may also be labeled CAFOs (and therefore point sources) if they are found to be "a significant contributor of pollution into waters of the United States."[211] EPA defines point source discharge as "'any discernible, confined and discrete conveyance . . . from which pollutants are or may be discharged.'"[212] Point sources are required to obtain an NPDES permit.[213] The permit limits allowable discharge and requires significant monitoring and reporting to ensure that the discharge does not harm the water supply or human health.[214] Although CWA successfully eliminates some of the water pollution, significant livestock pollution still remains.[215] Mid-size and remote operations have generally been successful at escaping regulations.[216] To avoid obtaining an NPDES permit, many AFOs install huge lagoons to contain waste runoff so that it does not reach waterways.[217] Although legal, the lagoons pose a substantial risk to the environment because the pollutants could seep into shallow groundwater tables, affecting the health of humans, wildlife, and other livestock.[218] By focusing solely on controlling water pollution, CWA does little to reduce the industry's pollution as a whole, neglecting significant damage caused by soil and air pollution.[219] The CAFO rule was amended in 2002 to designate a greater number of AFOs as point sources under CWA and require more NPDES permits to be obtained.[220] Under the new

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[210] White, *supra* note 201, at 161.
[211] *Id.*
[212] Hartliep, *supra* note 205, at 687 (quoting 33 U.S.C. § 1362(14) (2000).
[213] White, *supra* note 201, at 161.
[214] *National Pollutant Discharge Elimination System: NPDES Program Basics, Frequently Asked Questions*, U.S. Environmental Protection Agency, *at* http://cfpub2.epa.gov/npdes/faqs.cfm?program_id=45#107 (last visited Apr. 5, 2005).
[215] White, *supra* note 201, at 162-63.
[216] *Id.* at 162.
[217] *Id.* at 161-62.
[218] *Id.* at 162-63.
[219] *Id.* at 163.
[220] *Id.* at 164.

rule, agricultural producers must implement a Comprehensive Nutrient Management Plan that identifies the type and amount of each nutrient produced to determine the proper way to apply the waste to the farmland.[221] The new rule left the basic CAFO framework in place, but imposed stricter requirements and greater costs on agricultural producers, who were less than thrilled with the modification.[222] In its 108 page comment on the new plan, the National Cattlemen's Beef Association argued that the rules were "broad and confusing" and "impractical for the diverse U.S. cattle industry."[223] Because the concerns surrounding livestock waste vary among different locations, state and local governments should have the authority to regulate agricultural operations.[224] Moreover, many states enforce their own AFO regulations, requiring livestock producers to pay considerable compliance costs.[225] The new federal rule disparately impacts the most environmentally compliant producers by forcing them to pay extra costs to comply with a regulation that may be impractical in their region.[226] State governments that have been proactive in controlling livestock pollution have expressed concern that the new regulations may harm their agricultural producers.[227]

2. Clean Air Act

The Clean Air Act ("CAA") was first enforced against the livestock industry by the Clinton Administration.[228] CAA allows EPA to collect toxic emission information from large-scale feedlots and under President Clinton, such testing was required at select

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[221] White, *supra* note 201, at 164.
[222] *Id.*
[223] Clint Peck, *Proposed Federal Environmental Regulations Confusing for Cattle Industry*, BEEF MAGAZINE, Oct. 1, 2001, *available at* http://beef-mag.com/ar/beef_proposed_federal_environmental.
[224] White, *supra* note 201, at 166; *see also* Peck, *supra* note 223.
[225] White, *supra* note 201, at 166.
[226] *Id.*
[227] *Id.*
[228] Elizabeth Shrognen, *EPA Plans Farm Pollution Amnesty*, L.A. TIMES, Sept. 25, 2003, *available at* http://www.fass.org/fasstrack/news_item.asp?news_id=1548.

locations.[229] The Bush administration, however, has not required such testing.[230] In contrast, secret negotiations between EPA and CAFO operators have led to a deal that provides amnesty to polluters in exchange for providing emission information that EPA has the authority to collect.[231] Feedlots can avoid being sued for CAA violations by paying $500 in penalties and contributing $2500 for the development of an emission monitoring program.[232] Considering that the cost of testing one facility can run as high as $200,000, it seems that only a handful could actually be tested pursuant to a program funded by a mere $2500 contribution of each participating operation.[233]

3. Kyoto Protocol

Another non-environmentally friendly action taken by the Bush administration was the rejection of the Kyoto Protocol, an international initiative to curb the emission of harmful greenhouse gases that contribute to climate change.[234] The agreement requires industrialized countries to reduce net emissions of six greenhouse gases and remain within assigned quotas until 2012.[235] In order to take effect, the agreement must be signed by

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[229] Press Release, Senate Committee on Homeland Security and Governmental Affairs, Administration Preparing to Let Air Polluters Off Hook: Lieberman Questions Animal Feedlot Pollution Enforcement, (Oct. 2, 2003), *available at* http://www.senate.gov/~gov_affairs/index.cfm?Fuseaction=PressReleases.View&PressRelease_id=502&Affiliation=R.

[230] *Id.*

[231] *Id.*

[232] *Id.*

[233] Letter from Joseph Lieberman, to The Honorable Marianne Lamont Horinko, Acting Administrator, U.S. Environmental Protection Agency (Oct. 2, 2003), *available at* http://www.senate.gov/~gov_affairs/index.cfm?Fuseaction=PressReleases.View&PressRelease_id=502&Affiliation=R.

[234] *Bush Administration Errs on Kyoto Global Warming Agreement*, Natural Resources Defense Council, *at* http://www.nrdc.org/globalWarming/akyotoqa.asp (last visited Mar. 18, 2004) [hereinafter *Bush Administration Errs*].

[235] *A Primer on the Kyoto Protocol—The Climate's Changing, Now What?*, *at* http://environment.about.com/library/weekly/aa090402a.htm (last visited Apr. 3, 2005) [hereinafter *Kyoto Primer*].

at least fifty-five nations and "must include enough Annex I Parties (industrialized nations) to account for at least 55 percent of total CO2 emissions from industrialized countries in 1990."[236] Although the United States, which is responsible for twenty-five percent of emissions from industrialized nations,[237] refused the agreement, the rest of the world has almost met the ratification requirement.[238] President Bush "oppose[d] the Kyoto Protocol because it exempts 80 percent of the world . . . and would cause serious harm to the U.S. economy."[239] According to the Natural Resources Defense Council, however, the President's conclusions on the economy were misplaced.[240] The Energy Information Administration report, upon which Bush relied when rejecting the carbon dioxide reductions, "failed to consider the inexpensive greenhouse pollution reductions that can be achieved through energy efficiency."[241] President Bush also disregarded the results of the studies by the Clinton administration's White House Council of Economic Advisors and the Department of Energy laboratories, which stated that the costs associated with the Kyoto Protocol would be modest; by adopting policies to increase energy efficiency, the United States would come closer to Protocol

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[236] *Id.*

[237] Greg Kahn, *The Fate of the Kyoto Protocol under the Bush Administration*, 21 BERKELEY J. INT'L L. 548, 550 (2003).

[238] *Kyoto Primer*, *supra* note 235 ("As of April 15, 2004, 122 countries had ratified or acceded to the Kyoto Protocol . . . those countries represent . . . 44.2 [percent] of the total . . . emissions from industrialized countries in 1990.").

[239] Letter from President Bush, to Senators Hagel, Helms, Craig, and Roberts (Mar. 13, 2001), *available at* http://www.whitehouse.gov/news/releases/2001/03/20010314.html. Bush also wrote that he "do[es] not believe . . . that the government should impose on power plants mandatory emissions reductions for carbon dioxide, which is not a 'pollutant' under the Clean Air Act." *Id.* (citing a Department of Energy report which concluded that "caps on carbon dioxide . . . would lead to . . . significantly higher electricity prices"). Embarrassingly, this remark contradicted his pledge campaign as well as the statement made days before by EPA Christine Whitman "that the Bush administration was considering mandatory limits." Kahn, *supra* note 237, at 551.

[240] *Bush Administration Errs*, *supra* note 234.

[241] *Id.*

compliance, and domestic compliance measures could "improve economic performance over the long run."[242]

The Kyoto Protocol contains many ambiguities and uncertainties,[243] but it is at least a step in the right direction to combat global climate change. The United States has yet to develop a viable alternative plan to target global greenhouse gas emissions.[244] In February 2002, President Bush announced an "extremely vague" plan to reduce "emissions per unit of [gross domestic product]," which is likely to result in greater net emissions because the gross domestic product is estimated to rise at least thirty percent in the same time period.[245] The proposal was sharply criticized by the international community for lack of substance.[246] Critics argued that the proposal was "all hat and no cattle"[247] and "a sham."[248]

V. WHAT SHOULD FUTURE REGULATIONS ENTAIL?

In order to provide the greatest benefit to governments, farmers, and the environment, a new regulatory model should be created and applied to the livestock industry. Traditional, single-factor regulations result in unfair economic competition for agricultural producers.[249] The costs of complying with environmental regulations cause industry leaders to raise prices of their products. Governments that impose harsh restrictions on their farmers therefore place them at a disadvantage to farmers who operate under fewer restrictions.[250]

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[242] *Id. But see* Kahn, *supra* note 237, at 557 (noting that evidence exists that the economic consequences of compliance would be drastic).
[243] Brian C. O'Neill & Michael Oppenheimer, *Dangerous Climate Impacts and the Kyoto Protocol*, 296 SCIENCE, June 14, 2002, *available at* http://www.mindfully.org/Air/2002/Dangerous-Climate-Impacts-Kyoto14jun02.htm.
[244] *Bush Administration Errs*, *supra* note 234.
[245] Kahn, *supra* note 237, at 567.
[246] *Id.*
[247] *Id.* (quoting Eileen Claussen of the Pew Centre) (citation omitted).
[248] *Id.* (quoting *The Economist*) (citation omitted).
[249] White, *supra* note 201, at 158.
[250] *Id.*

The new model should focus on promoting technology and sustainability and addressing environmental concerns collectively while protecting the interests of everyone.[251] Other countries, as well as other industries, offer some guidance on ways to incorporate technology into EPA and other regulations.[252]

Southeast Asia's Environmental Center for Livestock Waste Management was created in 1998 for the development of new technologies designed to reduce damage from livestock pollution and for the creation of benefits for agricultural producers.[253] The facility highlights the importance of "[c]ooperation between researchers, local governments, and [livestock] producers," as well as sharing information with other industries to provide "the best opportunity to generate sustainable solutions in this area of environmental regulation."[254]

Similar facilities could be established in the United States, allowing producers to work with a state regulatory commission to effectively manage waste.[255] Research facilities could be funded by state and local governments, as well as private donors, and could receive equipment donated from manufacturers, who would benefit if other producers chose to implement processing facilities on their own farms.[256] Universities should also be involved in the research and testing processes, using the facility as a laboratory for multiple academic departments.[257] Farmers, researchers, students, and governments could collaborate to develop the most sustainable and economically beneficial alternatives to managing livestock operations.[258]

Another lesson can be learned from the pulp and paper industry's Voluntary Advanced Technology Incentives Program ("VATIP"), which allows extended compliance periods "for mills

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[251] *Id.* at 169.
[252] *Id.*
[253] *Id.* at 169-70.
[254] *Id.* at 171-72.
[255] White, *supra* note 201, at 176.
[256] *Id.*
[257] *Id.*
[258] *Id.*

that commit to greater levels of environmental protection."[259] The program utilizes a three-tier design and each tier has a six, eleven, or sixteen year compliance period.[260] The longer the period, the stricter the compliance standard.[261]

The need to explore technologies arose in the early 1990s when the industry was threatened with numerous civil lawsuits.[262] Although many AFOs are protected from liability by right to farm statutes, the "statutes could be modified or amended to limit immunity from suit to those operations who have taken steps to minimize odors or pollution, perhaps through the application of available technologies."[263]

Additionally, EPA applied the "cluster rule"[264] to the pulp and paper industry, developing industry-specific regulations to address the environmental problems holistically.[265] Considering the multiple harms associated with agricultural waste, similar regulation methods would prove beneficial to the livestock industry as well.[266] The fact that waste can be used as a resource lends additional support for the creation of an industry-specific regulation for livestock production.[267]

Considerable progress has already been made in the search for new technologies to promote the sustainability of large-scale farm operations, however, farmers are unlikely to take advantage of recent developments without proper incentives.[268]

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[259] *Id.* at 174.
[260] White, *supra* note 201, at 174.
[261] *Id.*
[262] *Id.* at 173.
[263] *Id.* at 175.
[264] *Id.* at 173.
[265] *Id.*
[266] White, *supra* note 201, at 166.
[267] *Id.*
[268] *Id.* at 177.

A. Proper Feed

Proper feeding techniques not only benefit farmers by saving them money and increasing profits, but they also improve the overall health of the animals.[269] Poor quality feed increases methane emissions, which is a disadvantage for not only the environment, but for the producers as well.[270] Sixteen percent of what a cow eats is wasted in the methane conversion process.[271] This is energy that should be used to facilitate beef and milk production.[272] Because of their low-protein diet, beef cattle are perhaps the most responsive ruminants to dietary improvements aimed at reducing methane production.[273] Livestock producers need to be educated about the benefits associated with implementing new feed alternatives and given incentives to make use of them in their own operations.[274]

B. Improved Range Management

Another way to increase efficiency and reduce greenhouse gas emissions in a livestock operation is to utilize range management practices.[275] Methods that have proven particularly effective include improving grazing procedures, testing soil to determine appropriate fertilizers, establishing a preventive herd health program, protecting water quality, and increasing reproductive efficiency.[276]

"Overgrazing exposes soils, increases erosion, encourages invasion by undesirable plants, destroys fish habitat, and reduces the filtration of sediment necessary for building stream banks, wet

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[269] *See supra* Part II.
[270] *Breath Mints for Cows*, *supra* note 64.
[271] *Id.*
[272] *Id.*
[273] VAN SOEST, *supra* note 70, at 280.
[274] White, *supra* note 201, at 177.
[275] *Pasture, Rangeland and Grazing Operations - Best Management Practices (BMPs)*, U.S. Environmental Protection Agency, *at* http://www.epa.gov/agriculture/anprgbmp.html (last modified May 19, 2004) [hereinafter *Best Management Practices*].
[276] *Id.*

meadows, and floodplains."[277] Controlled grazing is one of the more effective methods of increasing forage and obtaining the greatest amount of benefits from the land.[278] This procedure requires retaining cattle on one area of land while allowing other areas to regrow and the cattle to consume the most nutritious forage possible.[279] The most basic controlled grazing method utilizes electric fences to train the animals to graze in one area at a time whereas more intensive methods require additional fencing and watering systems to provide greater benefits.[280]

Livestock disease is a formidable profit-reducing risk encountered by many cattle operations, but can be overcome by developing a preventive herd health program.[281] These programs should be customized to fit each individual operation, but should also include procedures to prevent exposure to diseases by decreasing cattle confinement, maintaining a high resistance to disease by supplying adequate nutrition and vaccination and keeping stress at a minimum, and finally, immediately segregating animals upon positive diagnosis.[282]

> The particular practices a livestock producer utilizes to improve production will depend on the circumstances of his or her operation, including the goals to be achieved and the natural, financial, and labor resources available. By producing meat and milk with the most efficient U.S. herd possible, the global environment as well as our own economy will benefit. The bottom line [is that] improved livestock management[] is good for the environment and makes dollars and sense.[283]

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[277] *Id.*
[278] *Id.*
[279] *Id.*
[280] *Best Management Practices*, *supra* note 275.
[281] W. Dee Whittier & John Currin, *Beef Cow / Calf Herd Health Program and Calendar*, Virginia Cooperative Extension, Veterinary Medicine, Pub. 400-007, 1999, *available at* http://www.ext.vt.edu/pubs/beef/400-007/400-007.html.
[282] *Id.*
[283] *Best Management Practices*, *supra* note 275.

C. *Methane Digesters*

In addition to the enormous amounts of methane that cows expel through belching and flatulence, decomposing animal waste emits thirty-five million tons of the harmful greenhouse gas annually.[284] This additional methane, however, can be converted into electricity, creating benefits to both the economy and the environment.[285] By implementing anaerobic digesters, livestock producers can use the abundance of animal waste to provide enough energy to power their entire farms.[286] In 1999, the Government's AgSTAR program[287] established one of thirteen anaerobic digesters on a 1000 acre farm owned by Dennis Haubenschild in Minnesota.[288] Haubenschild's dairy cows produce roughly 22,000 gallons of manure daily, which can be converted into 3000 kilowatt hours of electricity.[289] The anaerobic digestion process seems quite simple:

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[284] Smith, *supra* note 146, at 63-64; *see also* DURNING & BROUGH, *supra* note 144, at 27.

[285] E.M. Morrison, *Farming for Energy: Anaerobic Digesters*, 10 AG INNOVATION NEWS (2001), *available at* http://www.auri.org/news/ainjul01/05page.htm.

[286] *Id.*; *see also Prize Wining Anaerobic Digester Generates Interest in Biogas*, 22 WESTERN AREA POWER ADMINISTRATION, ENERGY SERVICES BULLETIN, Feb. 2003, *available at* http://www.wapa.gov/es/pubs/esb/2003/03Feb/esb029.htm [hereinafter *Prize Winning Digester*].

[287] *AgSTAR Program*, U.S. Environmental Protection Agency, *at* http://www.epa.gov/agstar/index.htm (last modified Oct. 20, 2004).

> The Agstar Program is a voluntary effort jointly sponsored by the U.S. Environmental Protection Agency (EPA), the U.S. Department of Agriculture, and the U.S. Department of Energy. The program encourages the use of methane recovery (biogas) technologies at the confined animal feeding operations that manage manure as liquids or slurries. The technologies reduce methane emissions while achieving other environmental benefits.

Id.

[288] Morrison, *supra* note 285.

[289] *Id.*

> Cow manure, together with recycled newspaper bedding, is scraped from the freestall barn three times a day, mixed to a smooth consistency, then pumped into a 350,000-gallon covered digester tank, which looks like a long white sausage. There, the manure is heated to about 100 degrees F[ahrenheit], speeding the action of beneficial bacteria in the tank. As bacteria break the manure down, they give off gas—mostly methane, which collects under the tank cover. After three weeks in the digester, the manure—now a lot less smelly—empties into a storage lagoon for later application to the farm's 1,000 acres of cropland. Captured methane is burned in a retrofitted natural gas engine, which drives a 150-kilowatt electrical generator. Recovered heat from the engine warms the digester and the barn floors.[290]

The Haubenschild digester converts enough methane to fully power his farm, as well as seventy-eight other homes, rendering the process extremely profitable.[291] Instead of paying utility bills, he actually receives money from the power company for the surplus energy.[292] Although constructing a digester can be costly, Haubenschild is confident that the digester will pay for itself within five years because of the money saved and earned.[293]

This so-called "cow power"[294] is also environmentally friendly.[295] The digesting process reduces odor, pathogens, and greenhouse gas emissions and creates a nitrogen-rich fertilizer.[296]

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[290] *Id.*

[291] *Prize Winning Digester*, *supra* note 286.

[292] *Id.* Creating electricity from manure saves the family approximately $2,000 on monthly electric bills and they receive an additional $4,000 per month from the sale of the excess electricity. *Id.*

[293] *Id.*

[294] Morrison, *supra* note 285.

[295] *Id.*

[296] *Id; see also Alternative Energy Lights up Haubenschild Farms*, Minnesota Office of Environmental Assistance, *at* http://www.moea.state.mn.us/resource/haubenschild.cfm (last visited Apr. 5, 2005).

Odor reduction is perhaps the most noticeable benefit associated with anaerobic digesters.[297] The putrid smell of undigested manure can drift up to three miles away from the field on which it is spread and can linger for days.[298] After digestion, however, the nitrogen-rich manure remains have a considerably milder smell that disappears overnight.[299]

These remains are used as a fertilizer, which contains more usable nutrients and may be more effective than regular manure and commercial fertilizers.[300] Using the digested remains to fertilize the soil saves the thirty-four gallons of propane per acre required to produce the ammonia contained in petroleum-based fertilizers.[301]

Anaerobic digesters also substantially reduce greenhouse gas emissions.[302] Studies estimate that for every 125,000 cows living on farms with anaerobic digesters, 100 million fewer pounds of methane enters the atmosphere.[303]

Implementing anaerobic digesters can also provide farmers with a way to comply with CWA standards.[304] Because animal waste is a principal source of water pollution, farmers are required to find other alternatives for using and storing manure.[305] Methane digestion has been "approved as an acceptable nutrient management practice" under CWA.[306] Digesters therefore allow farmers to

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[297] *Prize Winning Digester*, *supra* note 286.
[298] *Id.*
[299] *Id.*
[300] Morrison, *supra* note 285 (highlighting the University of Minnesota's ongoing field study to compare the performances of digested manure, raw manure, and commercial fertilizers).
[301] *Prize Winning Digester*, *supra* note 286.
[302] *Id.*
[303] Ericka Pizzillo, *Manure Project Volunteer Wanted*, BELLINGHAM HERALD, Feb. 2, 2004.
[304] David Riggle, *Anaerobic Digestion Gets New Life on Farms*, U.S. Environmental Protection Agency, *at* http://www.epa.gov/agstar/resources/biocycle3.html (last modified June 30, 2004).
[305] *See supra* Part IV.C.1.
[306] Riggle, *supra* note 304.

kill two birds with one stone; they save farmers money on their energy bills and provide an efficient way to comply with environmental regulations.

Anaerobic digestion is not a recent technological advancement.[307] The 1970s spike in oil prices made livestock-produced methane an attractive alternative energy source.[308] Farmers and environmental organizations made considerable progress in biogas development, and 140 digesters were put to work in both commercial and research settings.[309] In the 1980s, however, "[t]he reduction of programs for sustainable energy projects . . . and reduced energy prices under PURPA (a program that required utilities to purchase power from independent renewable energy sources) put the nascent on-farm anaerobic digestion industry into a state of free fall."[310] In addition, improperly designated grant money, poor design, and inadequate repair services led to several failed projects.[311] "[T]he failures contributed to the current poor technical perception of anaerobic digestion held by the livestock industry and have resulted in very limited biogas development since."[312] Even though at least two to four thousand farms could benefit from anaerobic digestion, only twenty-five commercial systems were in operation in 1994.[313] Despite the previous setbacks in anaerobic digestion implementation, project interests may increase if farmers are offered incentives to install digestion systems.[314]

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[307] *Id.*
[308] *Id.*
[309] *Id.*
[310] *Id.*
[311] *Id.*
[312] Riggle, *supra* note 304.
[313] *Id.*
[314] *Methane Digesters*, Sustainable Conservation, *at* http://www.suscon.org/dairies/methanedigesters.asp (last visited Feb. 15, 2004).

D. Incentives to Promote Technology and Efficiency in Livestock Operations

Instead of imposing stricter regulations for each separate aspect of livestock pollution, future EPA regulations should seek to collectively address environmental concerns, such as soil, air, and water quality.[315] These "cluster rule" regulations will provide incentives for farmers to contemplate management practices that solve pollution problems holistically.[316]

Both EPA and farmers would also benefit from applying the VATIP plan to CAFO regulations.[317] Farmers would be more likely to establish alternative treatment techniques if they were given extended periods of time to do so.[318] Producers spending great amounts of money to incorporate technology would avoid additional EPA compliance costs.[319]

In addition to implementing a new, industry-specific federal regulatory scheme for the livestock industry, states should give farmers incentives to implement modern methods that attack agricultural environmental damage as a whole. Producers are unlikely to implement new technology to manage their operations because current techniques are "cheap and labor efficient."[320] Therefore, education and demonstration of benefits should be the first step in promoting the use of technology.[321] Innovators such as "cow power" user Dennis Haubenschild could offer statistics and demonstrations of his methane digester to encourage efficiency at other facilities.

Right to farm statutes, which protect farmers from civil liability for adversely affecting neighboring properties, should also be modified to end protection of producers who refuse to implement

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[315] White, *supra* note 201, at 178.
[316] *Id.*
[317] *Id.*
[318] *Id.*
[319] *Id.*
[320] *Id.* at 177.
[321] White, *supra* note 201, at 177.

environmental technology.[322] The statutes have recently been criticized on Fifth Amendment grounds, but could possibly be saved by offering immunity for environmentally sound farmers and imposing liability on those who continue to pollute neighboring land without compensating the landowner for the harm caused by livestock waste.[323]

State and local regulations are important to the livestock industry because "they give state governments the flexibility to devote attention to unique challenges in their geographic area, as well as within the particular market forces of the individual states."[324]

CONCLUSION

After examining the disastrous effects that livestock production imposes on the environment, it is shocking that the industry has persisted for so long with such minimal and inefficient regulation. As the human population and the demand for animal products continue to grow, factory farms will likely expand and intensify their operations in order to meet consumption needs at minimal cost. Although it would be easy to simply incorporate stricter provisions into existing regulations, this solution is not market-friendly. The costs of complying with harsh regulations places producers at a disadvantage to those who are able to continue their harmful, yet inexpensive, production methods. Toying with existing regulations also does nothing to address the unique qualities of the livestock industry. Agricultural production is responsible for many different types of pollution that should be regulated collectively. Moreover, manure, the industry's largest waste source, is a valuable resource that can be used as both electricity and a beneficial fertilizer for overworked farmland. Future regulations should therefore be designed specifically for the livestock industry in order to promote the most efficient, as well as environmentally friendly, production techniques.

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[322] *Id.*
[323] *Id.*
[324] *Id.* at 178.