ELEPHANT IN THE ROOM: LIVESTOCK'S ROLE IN CLIMATE AND ENVIRONMENTAL CHANGE

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I. INTRODUCTION

Climate change has "grave implications" for biodiversity and, consequently, for how ecosystems function and what ecosystem services they provide.[1] According to Thomas Lovejoy, "solutions and policies constructive for biodiversity are largely close at hand. What is missing . . . is greater public awareness and understanding of [biodiversity's importance] in a healthy world."[2]

Lovejoy opined that biodiversity "itself is our greatest ally" in promoting public awareness "because it is inherently fascinating."[3] But biodiversity is a crucial ally in a more fundamental way: biodiversity can help mitigate climate change and facilitate adaptation to climate change.

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1. *See* Thomas Lovejoy, *What Is Biodiversity, Why Do We Care, and What Is the Importance of Regional, State, Local, and Private Policies and Programs?*, *in* BIODIVERSITY CONSERVATION HANDBOOK: STATE, LOCAL, AND PRIVATE PROTECTION OF BIODIVERSITY 19, 20–22 (Robert B. McKinstry, Jr., et al. eds. 2006).

2. *Id*. at 21–22.

3. *Id.* at 22.

The challenge is to conserve biodiversity—to maintain "biologically functional landscapes everywhere"[4]—in the face of changes in climate and environmental conditions which are outside the evolutionary experience of species. The stakes are high. If we fail, "[n]ature won't come to an end, but it will look very different."[5]

In this essay I make an argument—a plea—that we take a clear-eyed look at a major cause of both climate change and biodiversity loss. I refer to livestock grazing—the most widespread, and widely ignored, land use on the planet.

To begin, however, I need to explain certain premises which provide the context for my remarks. These may seem unremarkable, but—as a set—they are not universally accepted.

First, climate change strategies should not be seen as "either-or" choices. We will not reverse climate trends solely by implementing what have been disparaged as "incremental" measures.[6] Every sector, every level of government, and every person must play a part. Given the global nature of the problem, policies that exempt or ignore any source category or population are simply irrational. Significant reductions must be accomplished swiftly to avert disaster, while we develop and implement new technologies that will be required for even greater emission reductions.[7] Thus, we must make changes now that can be effected without long planning or implementation phases.[8]

A second point, closely related to the first, is that because CO_2-equivalents are fungible, any reduction in greenhouse gas (GHG) emissions or any increase in sequestration of GHGs anywhere and by any source or sink contributes to a remedy. No individual reduction in atmospheric levels of GHGs, no matter how small, should be deemed negligible, as a matter of policy, especially if that action is easily

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4. *See id.* at 21.

5. David Quammen, *Planet of Weeds*, HARPER'S, Oct. 1998, at 57, 65.

6. Professor Alan Ramo, Golden Gate University School of Law, Email to Professors list serve, Sept. 24, 2007 ("[R]elying on incrementalism (as in many cap and trade proposals) may not only be ineffective in reversing global warming, but may implicitly undermine the message that needs to come across about the drastic reductions that are required and the long lead time necessary to reverse global warming.") (Email on file with author).

7. *See, e.g.*, Stephen Pacala & Robert Socolow, *Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies*, 305 SCI. 968, 968–69 (2004), *cited in* Vandenbergh & Steinemann, *infra* note 8, at 1686 n.51.

8. Michael P. Vandenbergh & Anne C. Steinemann, *The Carbon-Neutral Individual*, 82 N.Y.U. L. REV. 1673, 1678 (2007) (referring to "behaviors [that] can be easily modified to generate large emissions reductions in the short term" as "low-hanging fruit").

replicable and widely adopted. Consider that in the United States "individuals contribute roughly one-third of carbon dioxide emissions"—an amount greater "than the total emissions of any other country except China, and more than several continents"![9] Installing CFLs, turning down the heat, planting trees, minimizing waste, adjusting one's diet, controlling weeds, etc.—each has a small individual impact, but the potential aggregate effect is huge. The converse is also true: individual actions that cause small increases in GHG concentrations can, in the aggregate, be highly significant.[10]

Third, mitigation and adaptation policies must fit the particular circumstances of the source or sink, the place, and the people who are involved and will be affected.

And fourth, climate mitigation and adaptation measures that can simultaneously address other environmental or social problems should be preferred. Conversely, we should avoid climate change policies that exacerbate other problems or undermine other goals.

So, why focus on livestock production? In brief:

- Livestock production (LSP) is the most widespread land use.
- LSP is a significant driver of climate change.[11] Concomitantly, climate changes affect LSP; thus, the industry will be required to adapt.
- LSP is also a significant factor in many other environmental harms, including biodiversity loss.

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9. *See id.* at 1673 (adding that individual Americans account for about "8% of the world's total" Carbon Dioxide2 emissions).

10. Consider: "Beef consumption in China is currently about 10 pounds annually per capita but is projected to grow. According to USDA data, from 1995 through 1997 beef consumption in China increased by 2.2 pounds per capita. This small increase in beef consumption per person totals 2.64 billion pounds when multiplied across the population—more than the total of all 1999 U.S. beef exports." News Archive, *Yes Vote on China Trade Sets Stage for More Beef Exports*, NCBA NEWS, May 24, 2000, http://www.beefusa.org/NEWSYESVOTEONCHINA TRADESETSSTAGEFORMOREBEEFEXPORTS4259.aspx [hereinafter NCBA News Archive].

11. *See also* Thomas L. Thurow & Charles A. Taylor, Jr., *Viewpoint: The Role of Drought*, 52 J. RANGE MGMT. 413, 417 (1999) (citing J. Charney et al., *Drought in the Sahara: A Biophysical Feedback Mechanism*, 187 SCI. 434 (1975); J. Otterman, *Anthropogenic Impact on the Albedo of the Earth*, 1 CLIMATIC CHANGE 2 (1977)) (noting that livestock management practices can alter local climate).

– Excess consumption of meat, especially grain-fed beef, is implicated in several human health problems, including heart disease and some cancers.[12]

Reforming livestock production policies and practices will require significant action by individuals as well as governments, but this reform would have far-reaching health, environmental, and social benefits.

II. LIVESTOCK PRODUCTION AND CLIMATE CHANGE

No doubt you have heard the pundits' advice: "Give up Big Macs©, not your Hummer©!" I'm not advocating this strategy; the wiser course would be far less of both.[13] The point is that meat production is indeed a significant source of GHGs, including:

– carbon dioxide (CO_2),
– methane (CH_4),
– nitrous oxide (N_2O), and
– ammonia (NH_3).

In fact, livestock production accounts for 18 percent of global GHG emissions (in CO_2 equivalents)—more than the transport sector. Food production accounts for 20 percent of fossil fuel use in the United States;[14] livestock production alone accounts for "9 percent of [global]

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12. For a description of the diseases linked to "the western diet," see MICHAEL POLLAN, IN DEFENSE OF FOOD (2008).

13. A positive recent development was General Motors's announcement that it might stop manufacturing Hummers. *See, e.g.*, *Hummer's Heyday Could Be Out of Gas: GM Announces It Is Closing Four U.S. Truck and SUV Plants; May Discontinue Hummer*, CBS NEWS, June 3, 2008, http://www.cbsnews.com/stories/2008/06/03/business/main4148168.shtml?source=RSSattr=HOME_4148168.

14. Jennifer Wilkins, *Food Citizen: Fossil Fuels Consume Big Portion of Food Costs*, TIMES UNION (Albany), May 7, 2006, www.timesunion.com/AspStories/story.asp?storyID=479022; Danielle Murray, *Oil and Food: A Rising Security Challenge*, EARTH POLICY INSTITUTE, May 2005, www.earth-policy.org/updates/2005/Update48.htm. *See also* INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990-2005, Fig. 2-13 (reporting that U.S. agricultural production in 2005 emitted about 625 teragrams of CO2 equivalent, or about as much carbon dioxide as 141 million cars release each year). As another writer put it:

> America's biggest crop, grain corn, is completely unpalatable. It is raw material for an industry that manufactures food substitutes. Likewise, you can't eat unprocessed wheat. You certainly can't eat hay. You can eat unprocessed soybeans, but mostly we don't. These four crops cover 82 percent of American cropland. Agriculture in this country is not about food; it's about commodities that require the outlay of still more energy to become food.

CO_2 emissions."[15] The sector's CH_4 and N_2O emissions warrant special attention because the global warming potential of these gases far exceeds that of CO_2 (by 23 and 296 times, respectively!). In addition, "methane cycles out of the atmosphere in just eight years," in contrast to CO_2, "which can remain in the air for more than a century." Thus, lower methane emissions more "quickly translate to cooling of the earth."[16]

Grazing on pastures and rangelands (referred to as extensive production systems) contributes to global warming in other ways, namely, by changing how those lands function physically, chemically, and ecologically. Use by livestock commonly causes carbon loss via mechanical disturbance of soils (e.g., breakdown of soil macro-aggregates and erosion) and alteration of vegetative composition and cover (leading to decomposition of soil organic matter and loss of below-ground sinks in roots and soil inorganic carbon). Reducing the carbon-storage capacity of the soil reduces the earth's potential to sequester carbon.[17] By several mechanisms, livestock grazing has affected the frequency and increased the severity of wild fires in parts of the western U.S.: removing herbaceous understory which would otherwise provide fine fuels for 'cool' surface fires, facilitating the encroachment of some woody species in non-forested and non-woodland areas, contributing to high stand density in some forest types, drying out surface soils, etc.[18] Unnaturally large, catastrophic fires release more carbon than do smaller, more frequent fires.[19]

Richard Manning, *The Oil We Eat: Following the Food Chain Back to Iraq,* HARPER'S, Feb. 2004.

15. U.N. FOOD & AGRICULTURE ORGANIZATION, LIVESTOCK'S LONG SHADOW: ENVIRONMENTAL ISSUES AND OPTIONS xxi (2006), *available at* http://www.fao.org/docrep/010/a0701e/a0701e00.htm [hereinafter FAO].

16. Brad Knickerbocker, *Humans' beef with livestock: a warmer planet*, CHRISTIAN SCIENCE MONITOR, Feb. 20, 2007, http://www.csmonitor.com/2007/0220/p03s01-ussc.htm.

17. *See, e.g.*, J.M Kimble et al., *Introduction: The Characteristics and Extent of U.S. Grazing Lands, in* THE POTENTIAL OF U.S. GRAZING LANDS TO SEQUESTER CARBON AND MITIGATE THE GREENHOUSE EFFECT 3, 13 (R.F. Follett et al., eds., 2001) [hereinafter POTENTIAL OF U.S. GRAZING LANDS] ("Overgrazing and poor management lead to a loss of system [carbon], and the overall productivity of the land decreases as a result.").

18. CENTER FOR BIOLOGICAL DIVERSITY, LIVESTOCK GRAZING, FIRE REGIMES, AND TREE DENSITIES (1996), *available at* http://www.biologicaldiversity.org/swcbd/PROGRAMS/grazing/FIRE.PDF; Kieran Suckling, *Fire & Forest, Ecosystem Health in the American Southwest*, SW. CTR. FOR BIOLOGICAL DIVERSITY (May 27, 1996), *available at* http://www.biologicaldiversity.org/ publications/papers/fire-prm.html; Aldo Leopold, *Grass, Brush, Timber and Fire in Southern Arizona*, 22 J. FORESTRY 1 (1924).

19. *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, LAND USE, LAND-USE CHANGE AND FORESTRY: A SPECIAL REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE

The increasing global demand for beef and for cattle feed crops is a major factor in tropical deforestation, especially in Latin America, West Africa, and Southeast Asia. Deforestation causes huge releases of carbon as well as a loss of carbon storage capacity.[20]

As one scientist put it, there is "no greater potential source for the sequestration [of] global carbon than the soil."[21] Furthermore, "more than adequate data [is] available to establish that it would cost much less to increase the soil store of carbon by promoting appropriate agricultural practices, than it would to reduce the use of fossil fuels."[22] While the amounts of carbon stored in rangelands are considered "modest" compared to forested lands, the vast extent of rangelands and pasturelands means that the cumulative potential for affecting soil carbon loss and storage capacity is significant.[23] According to one estimate, "[i]mproving management on 279 million acres of poorly managed . . . rangelands [in the U.S. alone] would sequester 11 million additional tons of carbon annually."[24]

In other words, livestock production is plainly part of the global warming problem. At the same time, it can also serve as part of the

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CHANGE 216 (Robert T. Watson et al, eds., 2000).

20. *See* Joseph Fargione et al., *Land Clearing and the Biofuel Carbon Debt*, 319 SCI. 1235 (2008); Timothy Searchinger et al., *Use of U.S. Croplands for Biofuels Increases Greenhouse Gases through Emissions from Land Use Change*, 319 SCI. 1238 (2008).

21. D.J. Greenland, *Carbon Sequestration in Soil: Knowledge Gaps Indicated by the Symposium Presentations*, *in* SOIL PROCESSES AND THE CARBON CYCLE 591 (Rattan Lal et al., eds., 1998).

22. *Id.* at 594; *see also* GLOBAL CLIMATE CHANGE AND U.S. LAW 696 (Michael B. Gerrard ed., 2007) (summarizing sources regarding costs of sequestering carbon through land use, land use change, and forestry, or LULUCF).

23. *See* R.F. Follett et al., *The Potential of U.S. Grazing Lands to Sequester Soil Carbon*, *in* POTENTIAL OF U.S. GRAZING LANDS, *supra* note 17, at 416; Justin D. Derner et al., *USDA-ARS Global Change Research on Rangelands and Pasturelands*, RANGELANDS, at 36, 39; James P. Bruce, et al., *Carbon Sequestration in Soils*, 54 J. SOIL & WATER CONS. 382, 384–85 (1999) (discussing potential for sequestration on pastures and rangelands). "Estimating [carbon] sequestration in soils of grazing lands with minimal management inputs is difficult." Follett et al., *supra* note 23, at 401, 417. The evidence for net carbon sequestration by rangelands is incomplete and somewhat inconsistent. Some studies indicate, for example, that carbon sequestration may be greater in shrub lands than in grasslands, while others have reached the opposite conclusion. *See, e.g.*, Keith L. Olenick et al., *Texas Landowner Perceptions Regarding Ecosystem Services and Cost-sharing Land Management Programs*, 53 ECOL. ECON. 247 (2005) (citing studies with contradictory findings and noting the lack of studies specific to Texas's Edwards Plateau); *cf.* S.B. Bird et al., *Exploiting Heterogeneity of Soil Organic Matter in Rangelands: Benefits for Carbon Sequestration*, *in* POTENTIAL OF U.S. GRAZING LANDS, *supra* note 17, at 121, 134 (also noting that the greater sequestration in shrub lands may be offset by greater soil erosion).

24. Derner et al., *supra* note 23, at 39.

solution. Reduced grazing intensity and/or improved pasture and range management hold tremendous potential for enhancing the removal of atmospheric carbon. I will come back to these ideas.[25]

III. OTHER ENVIRONMENTAL IMPACTS OF LIVESTOCK PRODUCTION

Few human activities or land uses rival the overall environmental impact of livestock production. It is "by far the single largest anthropogenic user of land"; it accounts for more than 8 percent of human water use; it is "probably the largest sectoral source of water pollution"; and it "may well be the leading player in the reduction of biodiversity."[26] According to the U.N. Food and Agriculture Organization (FAO), which released a major report in 2006, livestock production is a "major stressor on many ecosystems and the planet as a whole"—"one of the top two or three most significant contributors to the most significant environmental problems, at every scale from local to global."[27]

Livestock grazing is the "chief commercial use of rangelands" throughout most of the world;[28] it occurs on 70 percent of the land area of the western United States.[29] Rangelands have been degraded or desertified worldwide—in much of the steppe of North Africa, the Middle East and Central Asia, and in North America—and grazing has long been recognized as a chief cause.[30] Beef production is of particular concern.[31]

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25. *See infra* Part IV.

26. FAO, *supra* note 15, at xxi–xxiii.

27. *Id.* at xx, 267. Speaking of agriculture generally, a World Bank report asserts: "It is the main user of land and water, a major source of greenhouse gas emissions, and the main cause of conversion of natural ecosystems and loss of biodiversity." WORLD BANK, WORLD DEVELOPMENT REPORT 2008: AGRICULTURE FOR DEVELOPMENT 199 (2007).

28. NATIONAL RESEARCH COUNCIL, COMMITTEE ON RANGELAND CLASSIFICATION, RANGELAND HEALTH: NEW METHODS TO CLASSIFY, INVENTORY AND MONITOR RANGELANDS 19 (1994).

29. Thomas L. Fleischner, *Ecological Costs of Livestock Grazing in Western North America*, 8 CONS. BIO. 629, 630 (1994). About one-third of the area of the United States, excluding Alaska, is "grazing land." *See* T.M. Sobecki et al., *A Broad-Scale Perspective on the Extent, Distribution, and Characteristics of U.S. Grazing Lands*, *in* THE POTENTIAL OF U.S. GRAZING LANDS, *supra* note 17, at 29.

30. *See* H E. Dregne, *Desertification of Arid Lands*, *in* PHYSICS OF DESERTIFICATION 4, 14-22 (F. El-Baz & M. H. A. Hassan eds., 1986), *available at* http://www.ciesin.org/docs/002-193/002-193.html. "Overgrazing and degradation of pastoral areas are widespread in much of the steppe of North Africa, the Middle East and Central Asia, and the Sahel." WORLD BANK,

Inevitably, production of livestock involves impacts on and tradeoffs with many, probably most, other ecosystem services.[32] Of the twenty-four ecosystem services studied in the Millennium Ecosystem Assessment (MA), only four—including food and livestock production—had "been enhanced in the past 50 years."[33] Increased food production and lower food prices have "been achieved at growing costs in the form of degradation of many ecosystem services [and] increased risks of nonlinear changes in ecosystems."[34] The MA noted specifically that "[e]xpansion of livestock production around the world has often led to overgrazing and dryland degradation, rangeland fragmentation, loss of wildlife habitat, dust formation, bush encroachment, deforestation, nutrient overload through disposal of manure, and greenhouse gas emissions."[35] There can be no serious doubt that the declines documented by the MA in fisheries, fresh water, fuel wood, wild foods, and climate are linked to agriculture and livestock production.[36] These and other impacts of livestock production have been widely chronicled in the scientific and legal literature.[37]

In addition, changes in ecology and climate can result in feedback loops. For instance, a warmer, drier climate can cause soil drying, as can grazing; as a result, the soil is more prone to erosion. Livestock hooves loosen dry soil, resulting in dust formation. Wind-borne dust can be deposited on the snow in mountains hundreds or even thousands of miles away. This causes premature melting of the snowpack, earlier

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supra note 27, at 191. About 76 percent of pastureland in Mongolia is overgrazed and desertified. *Id.* at 196. At least 750 million acres of North America have been desertified. *See* Dregne, *supra* note 30, at 22.

31. FAO, *supra* note 15, at 261 (reporting that beef production poses the "largest costs in terms of land and water requirements, as well as in terms of contribution to climate change"). Livestock drinking water requirements in Botswana comprise 23 percent of total water use! *Id.* at 273.

32. *See generally* MILLENNIUM ECOSYSTEM ASSESSMENT, ECOSYSTEMS AND HUMAN WELL-BEING: SYNTHESIS (Island Press 2005) [hereinafter MILLENNIUM ASSESSMENT]; *see also* FAO, *supra* note 15, at 50; WORLD BANK, *supra* note 27.

33. MILLENNIUM ASSESSMENT, *supra* note 32, at 6, 7. The other two services that had been enhanced were agriculture and aquaculture. *Id.*

34. *Id.* at 5. At the same time, "60 percent of the ecosystem services (closely linked to biodiversity) are being degraded or used unsustainably. These include the maintenance of fresh water; the survival of fishery stock; air and water purification; and the regulation of regional and local climate, natural hazards, and pests." *Id.*at 6.

35. *Id.* at 47.

36. *See id.*; *see also supra* note 31.

37. For a concise account concerning impacts in the U.S. West, see Fleischner, *supra* note 29.

(and faster) runoff, and longer dry periods at lower elevations during the summer, thus exacerbating the local effects of climate change.[38]

The environmental costs of LSP have not lessened the demand for meat. In fact, global demand has increased steadily, especially in developing countries. As a result, extensive grazing has spread to more and more unsuitable lands, only worsening the problems.[39]

The ecological impacts of domestic livestock production are explained in part by simple principles of competitive exclusion.[40] But the impacts are more severe than they need be. The fact is that, throughout the world, livestock production, and particularly extensive grazing, is largely un- or under-regulated.

The FAO attributes the lack of an "adequate institutional response" to "a lack of understanding about the nature and extent of livestock's impact on the environment," the lack of appropriate policy frameworks, and general "neglect."[41] It suggests that even in developed countries, and "even among the majority of environmentalists and environmental policy-makers, the truly enormous impact of the livestock sector on climate, biodiversity and water is not fully appreciated."[42]

Forty years into the environmental era, how could this be?

The FAO explains that, although it is "not a major global player" economically, "the livestock sector is socially and politically very significant."[43] Livestock "lobbies have been able to exert an over-proportional influence on public policies, to protect their interests," particularly in developed countries. This ability, the FAO says, can be attributed to the "legacy of the sector's past importance . . . [or] the cultural values embodied in livestock."[44] Even when countries reach "full industrialization," and "environmental and public health

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38. *See, e.g.*, Brian Maffly, *U. Researchers Find that Dust Is Melting the State's* '*Greatest Snow on Earth*,' SALT LAKE TRIB., (Jan. 22, 2008), *available at* http://www.sltrib.com/news/ci_8043046.

39. *See* FAO, *supra* note 15, at 4; WORLD BANK, *supra* note 27.

40. *See, e.g.*, Brian Czech, *Technological Progress and Biodiversity Conservation: a Dollar Spent, a Dollar Burned*, 17 CONS. BIO. 1455 (2003).

41. FAO, *supra* note 15, at 221–22 ("a lack of understanding about the nature and extent of livestock's impact on the environment, among producers, consumers and policy-makers alike"; lack of appropriate policy frameworks and policies that actually "exacerbate livestock's impact on the environment"; and "neglect," prompted by various causes, depending on the place and other circumstances).

42. *Id.* at 282.

43. *Id.* at xx.

44. *Id.* at 226.

objectives" become predominant over food supply and social/poverty concerns,[45] livestock "lobbies still wield widespread influence over policy-making."[46] Their influence is reflected in the persistence of subsidies—price supports, tax breaks, and other incentives—particularly for beef and dairy products.[47]

To put it bluntly, we—policy-makers and the public—turn our heads to the elephant in the room and hold our noses, even as the manure piles up.

Examples in the U.S. of the industry's lobbying prowess (and its success in deploying misinformation) are legion. Blocked endangered species listings, edited agency environmental reports, pest and predator eradication programs, impunity for water pollution, post-fire rehab concessions, archaic open range laws—the list is never-ending.

The FAO is not the first to call attention to the industry's political clout. Many (including myself) have documented the favorable treatment enjoyed by the livestock sector, and agriculture in general, at national, state and local levels.[48] J.B. Ruhl calls it the "anti-law" of agriculture.[49]

What is especially interesting about the FAO report is the revelation that this government solicitude is not restricted to the U.S., or even to developed countries; it manifests world-wide. As countries develop economically, policies toward livestock production tend to evolve toward greater emphasis on food safety and protection of the environment.[50] But even in most developed countries (i.e., OECD nations) livestock lobbies continue to exert substantial influence, as reflected by subsidies for livestock commodities.[51] Viewed in an optimistic light, however, this paradigm suggests that lessons learned in

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45. *Id.* at 225–26.

46. *Id.* at 226.

47. *Id.* at 222.

48. *See* DEBRA L. DONAHUE, THE WESTERN RANGE REVISITED: REMOVING LIVESTOCK FROM PUBLIC LANDS TO CONSERVE NATIVE BIODIVERSITY (Gordon Bakken ed., Univ. of Okla. Press 1999).

49. *See* J.B. Ruhl, *Farms, Their Environmental Harms, and Environmental Law*, 27 ECOLOGY L.Q. 263, 263 (2000) ("When combined, the active and passive safe harbors farms enjoy in most environmental laws amount to an 'anti-law' that finds no rational basis given the magnitude of harms farms cause.").

50. FAO, *supra* note 15, at 225-26.

51. *Id.* at 226; *see also id.* at 232 ("In all OECD countries, in 2004, subsidies to agricultural producers amounted to more than US$225 billion," or "31 percent of farm income.").

one country, from efforts to reform livestock production policies, could facilitate policy interventions elsewhere.

IV. EXTENSIVE LIVESTOCK PRODUCTION AND POLICY RESPONSES

The FAO's landmark report amply supports two conclusions: (1) extensive grazing is less efficient in producing livestock, and (2) extensive grazing on marginal lands has a proportionally greater impact on climate and the environment than do intensive production systems.

Marginal lands worldwide are often used for extensive livestock production. These "less-favored areas" have "low agricultural potential because of poor climate, soil, and topography"; many are "either hillside and mountain regions (uplands) or arid and semiarid zones (drylands)."[52] "Many are environmentally fragile, their soils, vegetation, and landscapes easily degraded" and susceptible to wind and water erosion.[53] Extensive agriculture, characteristic of these areas, is often accompanied by "resource degradation [and] poverty."[54] Land degradation and deforestation not only "reduce agricultural productivity" but also "cause the loss of other valuable ecosystem services."[55] In addition, these areas suffer from "[g]rowing population numbers, limited infrastructure and market access, [and] land tenure problems."[56]

"Intensification," the FAO concluded, is part of the solution. Increasing "productivity both in livestock production and in feedcrop agriculture" can "reduce greenhouse gas emissions from deforestation

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52. WORLD BANK, *supra* note 27, at 190; *see also* Lipper et al., *Less-Favoured Areas: Looking Beyond Agriculture Towards Ecosystem Services*, (Agric. & Dev. Econ. Div. of FAO, ESA Working paper 06-08 2006) ("Many dryland regions are considered less favoured areas as they face a variety of either biophysical or socio-economic constraints to agricultural production and sustaining livelihoods.").

53. WORLD BANK, *supra* note 27, at 191.

54. *Id.* at 190. According to the World Bank: "Less-favored areas account for 54 percent of the agricultural area and 31 percent of the rural population of developing countries . . . ." *Id.* "Less-favored areas . . . also cover areas that may have higher agricultural potential but are underexploited because of limited access to infrastructure and markets, low population density, or social and political marginalization." *Id. See also* Lipper et al., *supra* note 52.

55. WORLD BANK, *supra* note 27, at 191.

56. Lipper et al., *supra* note 52, at 1.

and pasture degradation."[57] Several factors contribute to this conclusion: "Grazing occupies 26 percent of the terrestrial surface," but extensive grazing systems "contribute less than 9 percent of total meat supply."[58] "Grazing animals emit more methane . . . than feedlot animals."[59] Methane and nitrous oxide emissions can be reduced through improved animal diets and manure management, both of which are more readily achieved in intensive management systems.[60] (Climate change may sharpen this difference, as it is likely to cause a decline in forage quality and quantity on semiarid rangelands.[61]) Intensifying LSP also would alleviate other environmental impacts associated with extensive grazing systems, in particular, impacts on the water cycle and on biodiversity; these improvements, in turn, could ameliorate climate change.[62]

"Intensification," as used in the FAO report, does not refer solely to feedlots. Rather, the authors explain, use of the "most suitable and productive areas need to be intensified and marginal areas retired into stable pastures or forest land."[63] Concentration of livestock in "areas with little or no agricultural land" should be avoided, as it "leads to high impacts on the environment . . . , mainly related to manure and waste water management."[64] Ideally, LSP should occur near the lands that produce feedcrops, which will reduce transportation costs, allow for optimal recycling of animal and crop wastes, and reduce the need for synthetic fertilizers.[65]

Of course, intensive LSP (and feedlots, in particular) also has environmental impacts—notably, air and water pollution and GHG emissions—and it raises ethical issues. Environmental impacts, however, are easier to regulate and control when the sources are more localized. (Intensive operations, in fact, are already subject to more

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57. FAO, *supra* note 15, at xxi-xxii.
58. *Id.* at 280.
59. Derner et al., *supra* note 23, at 40.
60. *See generally* FAO, *supra* note 15, chs. 4-5.
61. "[S]emiarid rangelands may be among the . . . more responsive ecosystems to rising CO2. However, CO2-enhanced productivity is accompanied by lower forage nitrogen concentration and reduced digestibility. Thus, even though plant production is stimulated . . . , the biomass produced is of poorer quality and is less desirable for livestock and wildlife." Derner et al., *supra* note 23, at 37.
62. *See generally* FAO, *supra* note 15, chs. 4 & 5.
63. *Id.* at 265.
64. *Id.* at 69.
65. *See id.*

stringent environmental regulation.) In addition, intensive systems are more efficient: they require less water, land, and other inputs to produce a given amount of meat (particularly beef). As long as humans require or desire meat protein—and as long as the human population continues to rise—we will need to produce meat, and we should do so in the most efficient, environmentally sound way. Ideal, of course, would be a decline in the demand for meat, which would enable significant reductions in the environmental impacts of LSP.

Extensive production systems vary widely, and great differences exist between developing and developed countries. Pastoralism in the developing world and commercial grazing on federal public lands in the western U.S.—the contexts of my two proposals—represent opposite ends of the spectrum in several respects. Environmental policy interventions must be tailored to the circumstances of the place and the people,[66] but one tool, payment for ecosystem services (PES), can apply to both.

A. Pastoralism in Developing Countries

Some of the world's poorest people depend on pastoralism for their livelihood and survival. In many "less-favored regions" where this land use is important, "population growth is placing enormous pressure on the natural resource base."[67] Farming is extending into fragile lands once used only by itinerant herders, and grazing lands are being stocked at higher levels or grazed longer or more often.[68] According to the World Bank:

> Pastoralism and agropastoralism are the main agricultural production systems in dryland areas, supporting the livelihoods of 100 to 200 million people worldwide. The number of extremely poor pastoralists and agropastoralists is estimated at 35 to 90 million. More than 40 percent of the pastoralists live in Sub-Saharan Africa, 25 percent in Middle East and North Africa, 16 percent in East Asia, 8 percent in South Asia, and 4 percent each in Latin America and in Europe and Central Asia.[69]

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66. *See* WORLD BANK, *supra* note 27, at 192 ("The form of policy interventions should depend on the type of less-favored region targeted and on the national economic context. The diversity on both counts is considerable.").

67. *See id.* at 191.

68. *See id.*

69. *Id.* at 89 (Box 3.6). These figures indicate that few, if any, persons in the U.S.,

These poor people are engaged in small-scale, extensive production, much of it involving itinerant herding, a practice that "has evolved over centuries and is well suited to sustaining life in areas where rainfall is unpredictable."[70] Over those centuries pastoralists have developed "strategies of herd diversity, flexibility, and mobility" to survive "in erratic environments."[71] Even so, their livelihoods are "closely linked to weather condition," and they are particularly vulnerable to climate change.[72]

Pastoralism in many of these areas is crucial to human survival. Herders depend on animals for milk, meat, and fiber; for transport and traction (e.g., tilling fields); and as a means of generating income. Plainly, the practice will and must continue. Yet the lands used for grazing are widely degraded. In some places current levels of use are not sustainable, and population pressures will soon cause use to exceed sustainable levels in other areas. In addition, global economic factors are causing encroachment onto even more marginal lands and deforestation for livestock and feed crop production.

To promote the welfare of pastoralists and environmental objectives, it will be necessary both to increase productivity and to provide alternatives to pastoralism.

Intensifying production depends on improving feed availability and quality. Methods include "integrated agroforestry-livestock production systems," "improving pasture management (area rotation, silvopastoral systems), producing leguminous fodder crops, . . . using crop residues and [local] industrial subproducts [as soil amendments, or fertilizer]," and planting "[h]igh quality fodder shrubs."[73] Some countries have been promoting policy reforms aimed at legally recognizing the rights of pastoralists and improving the management of rangeland resources.[74]

The "challenge" in intensifying production will be to do it "profitably while ensuring the sustainable use of resources at local levels and avoiding negative environmental externalities at higher scales."[75] One

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Canada, or Australia depend on pastoralism.

70. *Id.*

71. *Id.*

72. *See id.* at 192–93.

73. *See id.* at 194.

74. *See id.* at 89 (citing the Sahelian countries, Burkina Faso, Mali, Mauritania, and Niger). The report notes that "recent efforts to set aside extensive areas of marginal lands as national parks and biodiversity reserves, particularly in Africa, pose new challenges to pastoralism." *Id.*

75. *Id.* at 192–93.

strategy holds great promise: paying pastoralists to maintain or enhance ecosystem services could enable them to increase their income while reducing livestock production, and it would alleviate environmental impacts.[76] I'll take up PES in more detail shortly.

One alternative to pastoralism is outmigration. But although it eases population pressures on the land, it can have undesirable social and cultural impacts.[77] Another alternative, economic diversification, is generally not an option in poor countries with agriculture-based economies. Often, urban areas are lacking or too distant.[78]

Whatever strategy is pursued, social safety nets will be needed. Establishing safety nets should be seen as an international obligation, argues the FAO, "especially in countries where the economic potential for other sectors is also limited, and where global assets such as biodiversity or climate are concerned."[79] Again, PES can play a role.

B. Extensive Production in Developed Countries

Dramatically different considerations apply to high-income, industrialized countries, especially "where there is widespread degradation of state-owned land leased out to individual farmers."[80] The FAO highlighted the western U.S. and western Australia as two such areas, noting the lands' "small contribution . . . to overall livestock supply" and the "growing demands for other uses such as recreation or [other] environmental services."[81] These rangelands are predominantly arid or semiarid, and thus are easily degraded. Indeed, most have been degraded.[82]

Producers in these areas are very unlikely to depend on livestock for their survival or subsistence, and much less likely than poor farmers and herders in developing countries to depend on livestock even for their

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76. *See generally id.* at 197–99.

77. *See generally id.* at 72–95.

78. *See id.* at 191–92, 215.

79. *See* FAO, *supra* note 15, at 281.

80. *See id.* at 261 (suggesting that converting them "back to their original state" is a "real possibility").

81. *Id.*

82. *See id.*; *see also* Debra L. Donahue, *Federal Rangeland Policy: Perverting Law and Jeopardizing Ecosystem Services*, 22 J. LAND USE & ENVTL. L. 299, 301–03 (2007). (An estimated 70 percent of the dry areas of the world are degraded). *See* FAO, *supra* note 15, at 30; *see also* WORLD BANK, *supra* note 27, at 190.

livelihood.[83] Most U.S. public-land operations are marginally (or not) profitable. Most producers say they stay in the business for the way of life. (For others, an unprofitable ranch operation has tax advantages.) They are an aging group, and for the most part their children do not remain in the ranching business. Opportunities for economic (non-agricultural) diversification are more readily available than in developing countries. In fact, most public-land ranchers already depend on non-farm income—as do the majority of U.S. farmers.[84]

The FAO concluded that taking "marginal" lands like these out of livestock production is a "real possibility."[85] I have argued at length that removing livestock from arid and semiarid public lands would do much to conserve native biodiversity, that it would make economic and ecological sense, and that it could be done under existing law.[86] Removing livestock from public lands would enhance the provision of other ecosystem services, including mitigating climate change by reducing GHG emissions and promoting increased carbon sequestration. And, because livestock are a source of disturbance, or stress, in these ecosystems, removing that stress would greatly help the lands cope with the impacts of climate change.[87] In other words, ending extensive livestock production on these lands would mitigate climate change and facilitate adaptation to changes that are inevitable.

Even though public-land grazing permits are not a property right,[88] many people believe it would be inequitable simply to terminate grazing on public lands. The National Public Lands Grazing campaign has made a persuasive case for voluntary buyouts with generous compensation to the permit holders.[89] A few bills in Congress have promoted voluntary buyouts, but none has yet received committee approval, in part because livestock trade groups like the National

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83. *See generally* THOMAS MICHAEL POWER, LOST LANDSCAPES, FAILED ECONOMIES: THE SEARCH FOR A VALUE OF PLACE 182-86 (1996) (writing about the "dependency" of livestock producers on public lands).

84. *See generally* DONAHUE, *supra* note 48.

85. *See* FAO, *supra* note 15, at 261.

86. *See generally* DONAHUE, *supra* note 48.

87. *Cf.* AUGUSTIN COLETTE, CASE STUDIES ON CLIMATE CHANGE AND WORLD HERITAGE (UNESCO 2007); GAO, CLIMATE CHANGE: AGENCIES SHOULD DEVELOP GUIDANCE FOR ADDRESSING THE EFFECTS ON FEDERAL LAND AND WATER RESOURCE, GAO-07-863, at 44 (Aug. 2007).

88. *See* 43 U.S.C. §§ 315b, 1752(h) (2000).

89. *See* National Public Lands Grazing, *available at* http://www.publiclandsranching.org/.

Cattlemen's Beef Association (NCBA) oppose any restraints on the industry.[90]

Western ranchers and range scientists have long defended their industry by manipulating, disregarding, or simply rejecting science. For instance, they argue that livestock grazing stimulates plant growth and enhances wildlife habitat, ignoring evolutionary ecology and substantial research supporting the opposite conclusion.[91] Now they have a new argument: that well managed rangelands can help sequester GHGs. As previously discussed, this is true—for some, but not all, range- and pasturelands. (And, of course, it disregards the many other environmental impacts of extensive grazing on these lands.) Unfortunately, it will be difficult in the political arena to sort out the claims from the science. For example, despite the fact that the beef industry's impact on climate change (and on the environment generally) is the largest of any LSP sector,[92] cattle producers, led by the NCBA, have publicly rejected the FAO's (and by inference the IPCC's) figures for the livestock industry's GHG contributions.[93] Relying on unspecified EPA data, they claim much lower emissions, concealing the fact that EPA's numbers for the agriculture sector exclude all CO_2 emissions.[94] Building on this canard, Wyoming stockgrowers urge that

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90. *See* Press Release, NCBA and the Public Lands Council Oppose Grazing Buyout Programs, http://www.beefusa.org/goveGrazingPermitBuyouts.aspx (last visited, Aug. 26, 2008).

91. The latest example can be found in D.D. Briske et al., *Rotational Grazing on Rangelands: Reconciliation of Perception and Experimental Evidence*, 61 RANGELAND ECOLOGY & MGMT. 3, 11 (Jan. 2008).

92. *See* FAO, *supra* note 15, at 261 (Beef "carr[ies] the largest costs in terms of land and water requirements for its production, as well as in terms of contribution to climate change.").

93. *See* Email by Ron Hays, *Beef Industry Fires Back on Global Warming—Saying It's the Cars Not the Cows*, Feb. 26, 2007, http://www.oklahomafarmreport.com/Oklahoma_s_Farm_News_Update_0226.htm; *NCBA Reviews the Highs and Lows of 2007*, AG WEEKLY, http://agweekly.com/articles/2008/01/04/commodities/livestock/lvstk27.txt ("NCBA also remains steadfast in its effort to defend the beef industry against anti-meat, anti-agriculture activists. Their latest tactic has been to target the livestock industry as a major contributor of greenhouse gases and global warming despite EPA data to the contrary.") (last visited Oct. 17, 2008).

94. *See* EPA, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990-2005 Ch. 6 (Apr. 15, 2007), *available at* http://www.epa.gov/climatechange/emissions/downloads06/07CR.pdf ("This chapter provides an assessment of *non-carbon-dioxide* emissions from . . . enteric fermentation in domestic livestock, livestock manure management, rice cultivation, agricultural soil management, and field burning of agricultural residues" (emphasis added)); *but cf. id.*, Ch. 3 (Energy), at 10 ("The industrial end-use sector [which "includes

maintaining stock "driveways" will help mitigate climate change, since "trailing" cattle onto and off of public-land summer ranges produces less GHG emissions than trucking them.[95] This frivolous proposal ignores the many ways in which extensive livestock grazing contributes to climate change, as well as its pervasive ecological impacts. The fact that an agency official[96] is touting this recommendation is a painful reminder that the sector is lobbying as strenuously—and as effectively—as ever.[97]

C. Need for Well-Planned Interventions Based on Sound Information—Not Perfect Science

How we choose to adapt to climate change will determine the "ultimate severity of many climate change impacts," especially on ecosystem services.[98] Devising mitigation projects and adaptation measures will require looking at the big picture. At the national level, policy makers must be alert to potential leakage and spillover effects[99] and keep in mind that markets are global.[100] Poorly planned schemes

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activities such as manufacturing, construction, mining, and agriculture"] accounted for 27 percent of CO2 emissions from fossil fuel combustion."). For a view that contrasts starkly with NCBA's, see Manning, *supra* note 14 ("Agriculture in this country is not about food; it's about commodities that require the outlay of still more energy to become food."); *id.* (noting that it "takes thirty-five calories of fossil fuel to make a calorie of beef").

95. Personal communication from Temple Stevenson, University of Wyoming College of Law student and aide to Wyoming Governor Dave Freudenthal (describing telephone conversation with Grant Stumbaugh in January 2008).

96. Grant Stumbaugh, formerly with the Wyoming Department of Agriculture, is now employed by the federal Natural Resources Conservation Service.

97. *See* FAO, *supra* notes 43-51.

98. *See* PETER BACKLUND ET AL., U.S. DEP'T AGRIC., THE EFFECTS OF CLIMATE CHANGE ON AGRICULTURE, LAND RESOURCES, WATER RESOURCES, AND BIODIVERSITY, REPORT BY THE U.S. CLIMATE CHANGE SCIENCE PROGRAM AND THE SUBCOMMITTEE ON GLOBAL CHANGE RESEARCH, EXECUTIVE SUMMARY 1 (2008), *available at* http://www.usda.gov/oce/global_change/files/ SAP4_3/ExecSummary.pdf.

99. *See* MICHAEL B. GERRARD ED., GLOBAL CLIMATE CHANGE AND U.S. LAW 699 (2007) (offering an example of "leakage").

100. *See, e.g., China: Rising Beef Consumption*, CATTLE NETWORK, Oct. 23, 2007, http://www.cattlenetwork.com/Content.asp?ContentID=165470 ("Australia has increased exports of grain fed high quality beef to China to fill the gap left by the United States and Canada after the market was closed for BSE-related reasons in 2003 . . . . At the same time, Australians have been increasing production of grain-fed beef that competes more effectively compared to grass-fed."); William F. Laurance, *Letter*, 318 SCI. 1721 (2007) (noting the connection between U.S. farmers switching from soybeans to corn to meet increased demand for ethanol production, which increased world soy price, leading to deforestation in Brazil for soybean production and cattle ranching).

could easily have "win-lose" or even "lose-lose" consequences. Some projects might achieve reductions in GHG emissions or atmospheric concentrations, but reduce biodiversity or deplete scarce water supplies. Others might fail all around, like the livestock driveway proposal described above. Another better-known example in this category is biofuels production, which, it seems, can actually increase atmospheric carbon while also impacting biodiversity and consuming water.[101] As these examples demonstrate, policy makers must be alert to the spurious claims of special interest groups. Just as the prospects for ending public land livestock grazing depend on overcoming the entrenched positions of the livestock lobby, rescinding subsidies for biofuels production will require deflecting industrial agriculture's advocates.

Whenever possible, policy interventions should be designed to meet multiple environmental and/or social objectives. Reducing livestock production or otherwise reforming production practices could yield win–win outcomes for GHG control and conservation of water, soil, and biodiversity. Well designed and implemented projects could promote compliance with multiple international conventions—the UN Framework Convention on Climate Change, Kyoto Protocol, Convention on Biological Diversity, Convention on Desertification—as well as domestic laws.[102] Similar benefits are possible at the local and individual levels. For example, landowners who control weeds on their property by reestablishing native vegetation (whether voluntarily or because the state or county requires it) will not only increase the soil's carbon sequestration capacity, but likely garner other benefits, such as improved livestock forage (and increased profits), reduced fire danger, greater biodiversity, and a more aesthetically pleasing landscape.[103]

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101. *See supra* note 20; *see also* WORLD BANK, *supra* note 27, at 201 ("Much depends on the total GHG emissions through the entire [bio-energy] production cycle from the cultivation of feedstock crops to final use—which can negate much of the carbon sequestration from producing biofuels."). The Kyoto Protocol admonishes Annex I parties to "strive to implement [domestic] policies and measures . . . in such a way as to minimize adverse effects, including . . . social, environmental and economic impacts on other Parties, especially developing country Parties." *See* Andrew Green, *Climate Change Regulatory Policy and the WTO*, 8 J. INT'L ECON. L. 143, 146 (2005).

102. *Cf.* WORLD BANK, *supra* note 27, at 201.

103. *See, e.g.*, Donahue, *supra* note 82.

D. A Solution with Potentially Universal Application

By now it should be clear that range- and pasturelands—even marginal ones—are capable of producing many environmental goods and services. Those of utility to the livestock producer include forage quality and quantity, soil quality, and pollination services. Many others, however—notably carbon sequestration, water quality and flow regulation, and biodiversity conservation[104]—benefit chiefly persons downstream or at some distance, society as a whole, and future generations. And that's the rub: land owners and managers "receive no compensation for providing these services," so "they tend to be under-produced."[105] In promoting "agriculture for development," the World Bank counsels: "[I]f society wants farmers to undertake natural resource management practices that have benefits outside the farm, society needs to compensate them."[106]

The "emerging approach of payment for environmental services (PES)" is designed to do just that.[107] PES is "based on the twin principles that those who benefit from environmental services (such as users of clean water) should pay for them, and those who generate these services should be compensated for providing them."[108] Like "stewardship" payments, which Professor David Farrier proposed, PES would be preferable to compensating landowners for land use restrictions.[109] The World Bank seems to agree:

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104. *See* WORLD BANK, *supra* note 27, at 197.

105. *Id.*

106. *Id.*

107. *Id.* at 197. See *id.* at 197–99, ch. 11 and JEFFREY MCNEELY & SARAH J. SCHERR, ECOAGRICULTURE 224–30 (2003) for a general discussion of PES.

108. WORLD BANK, *supra* note 27, at 197–98.

109. *See* David Farrier, *Conserving Biodiversity on Private Land: Incentives for Management or Compensation for Lost Expectations?*, 19 HARV. ENVTL. L. REV. 303, 309 (1995) ("[I]ncentives should be delivered to landholders in the form of stewardship payments for *positive* land management that [is] sensitive to the conservation of biodiversity, rather than traditional compensation payments for the imposition of land-use *restrictions*." (emphasis added)). The "symbolism inherent in the language is crucial." *Id.* at 400; *cf.* Cass Sunstein, *Expressive Function of Law*, at 2021, 2025-26 (noting that laws not only regulate conduct but express and reinforce societal values). *See also* FWS, Endangered Species Recovery Program Fact Sheet ("The FWS also offers millions of dollars annually in grants for endangered species conservation and recovery. Private Stewardship grants are offered directly to private landowners."), http://www.fws.gov/ endangered/factsheets/recovery.pdf (last visited September 7, 2008).

> The PES approach is attractive in that it (1) generates new financing, which would not otherwise be available for conservation; (2) can be sustainable, as it depends on the mutual self-interest of service users and providers and not on the whims of government or donor funding; and (3) is efficient if it generates services whose benefits exceed the cost of providing them.[110]

An additional attribute, pointed out by Jeffrey McNeely and Sarah Scherr, is that, "unlike traditional payments to leave land out of production," payments for environmental services are "a form of transfer to farmers that is likely to be approved by the World Trade Organization."[111]

A growing literature on PES describes its potential advantages, prerequisites for and impediments to implementation, and the experiences of actual programs.[112] PES holds promise in both developed and developing countries, even though governance and fiscal institutions and capacities vary greatly between the two groups. My purpose here is not to propose specific PES programs, but simply to encourage attention to the potential benefits of PES in livestock production systems.

PES would be a logical complement to reducing extensive LSP in developing countries and would provide a means for improving the practices (and conditions) of poor pastoralists. Poor people engaged in small-scale extensive production could be compensated for planting trees or shrubs, establishing shelter belts, collecting seed, and protecting steep slopes, areas with fragile soils, and water sources. By increasing their income, PES could enable pastoralists to shift from "extractive" livestock production practices[113] to sustainable grazing. Improved practices could increase livestock productivity as well as alleviate environmental impacts and generate ecosystem services.[114] Actual

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110. WORLD BANK, *supra* note 27, at 198. The World Bank report contrasts this approach with prior, small-scale efforts, such as "providing concessionary loans for investments, using food-for-work programs for conservation activities such as tree planting, and supplying key inputs like seedlings without charge," which have usually been short-term. *See id.* at 197. "Getting the incentives right is the first step towards sustainability." *Id.* at 199.

111. Jan Sendzimir & Zsuzsanna Flachner, *Exploiting Ecological Disturbance*, *in* FARMING WITH NATURE: THE SCIENCE AND PRACTICE OF ECOAGRICULTURE 228 (Sarah J. Sherr & Jeffrey A. McNeely eds., 2007).

112. *See generally id.*; WORLD BANK, *supra* note 27; FAO, *supra* note 15; Lipper et al., *supra* note 52.

113. FAO, *supra* note 15, at 281 (describing the "mining of marginal grazing lands").

114. Note that sustainable use of biodiversity is one objective of the Convention on Biological Diversity. Convention on Biological Diversity, art. 1, Jun. 5, 1992, 1760 U.N.T.S.

livestock production might be reduced or increased, depending on the capacity and condition of the rangeland and on site-specific goals.

In developed countries, PES could substitute for—perhaps even exceed—the relatively paltry income now obtained from LSP on marginal lands, while promoting the production of more valuable goods and services. In other words, grazing permittees could be compensated for managing their own and federal lands so as to sequester carbon and produce other ecosystem services. Paying western ranchers to produce native seed and plants for desperately needed range rehabilitation projects, for example, would be far more sensible than subsidizing public land grazing, given its minor contribution to meat production and substantial environmental externalities.[115] Public-land livestock producers—and federal agencies—might be more inclined to retire grazing permits if that step were part of a broader conservation program, which included PES.

Other PES programs could be tailored for private lands (those of both current public-land ranchers and others). Landowners could be compensated for eradicating and controlling weeds, establishing and maintaining perennial vegetation, slowing soil erosion, and protecting riparian areas. The benefits of such efforts would inure to persons downstream, to other landowners in the immediate area, to those who value the environment for itself or for recreation, and to future generations.[116] Some landowners are already undertaking steps like these on their own because they realize that the value and income-generating potential of their lands for wildlife observation, hunting, fishing, and other recreational activities exceed its value for livestock production.

Programs targeted at conserving biodiversity could be especially effective in achieving multiple objectives. To illustrate: Payment for establishing and maintaining perennial vegetation, without regard to the species, could be expected to enhance carbon sequestration and likely would benefit some species, but it might have unintended negative consequences, such as impacts on nesting birds or increased water consumption. Prescribing native perennials, however, would make the PES program more likely to enhance habitat for indigenous fauna and

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79, *available at* http://www.biodiv.org/doc/legal/cbd-un-en.pdf.

115. *See* Donahue, *supra* note 82.

116. *See, e.g.*, *id.*, at 319–20.

secure pollination services, in addition to achieving the other benefits noted.

The amount of payments should reflect the services produced. The development of markets—e.g., for carbon permits under the Kyoto Protocol or its successor, by local water districts, or NGO-sponsored biodiversity markets—can provide a means for valuing services. In some cases, it might be possible to use proxies—for instance, the presence of a certain animal species, persistence of trees, or lack of sheet or rill erosion—to indicate that a service is being provided. At least minimal performance standards and monitoring will be necessary to ensure that practices are being carried out and are effective.

The configuration and funding mechanisms of PES programs will depend on the nature of the service.

> One important criterion for assessing potential sources of demand is the scale at which benefits are realized . . . . Climate change mitigation through carbon sequestration and biodiversity conservation (including agricultural biodiversity conservation) are the two main services which fall into the [global] category. In both cases the environmental service has potential benefits for the entire global population as well as future generations. In contrast the benefits from environmental services for watershed management such as improvements in water flow, soil erosion and water quality are usually realized, and better accounted for, at the local level.[117]

"Special nature districts," for instance, offer a means of implementing PES programs at local and regional scales.[118] This model, advanced by Professor Christopher Elmendorf, could accommodate PES and other incentive measures, as well as provide a framework for taxes and regulation.

Financing mechanisms could and should be broader and more flexible than the quid pro quo system suggested by the World Bank. The emerging carbon market is an obvious example, although the limited scope of the Kyoto Clean Development Mechanism (CDM) prevents realization of its full potential.[119] Extending the CDM's application

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117. *See* Lipper et al., *supra* note 52, at 13; *see also id.* at 16 ("Some of the most effective ES funds are managed by NGOs that represent groups with specific environmental interests." (e.g., The Nature Conservancy, World Wildlife Fund, and Conservation International)).

118. Christopher S. Elmendorf, *Ideas, Incentives, Gifts, and Governance: Toward Conservation Stewardship of Private Land, in Cultural and Psychological Perspective*, 2003 U. ILL. L. REV. 423, 474–76 (2003).

119. *See* WORLD BANK, *supra* note 27, at 201; *see also* KARAN CAPOOR & PHILIPPE

beyond afforestation and reforestation to include conservation of existing forests, range-, and pasturelands would be an improvement,[120] and should be addressed in the post-2012 international climate convention.[121] Other funding sources include a carbon tax, taxes on certain land uses, and government subsidies.

Indeed, the primary focus should be on reallocating the substantial funds that now go to export subsidies and domestic support of agricultural products, including livestock.[122] According to the FAO, subsidies to agricultural producers in all OECD countries in 2004 totaled "more than US$225 billion a year, equivalent to 31 percent of farm income."[123] By 2000, subsidies accounted for nearly half of net income of U.S. Farmers.[124] Subsidies are "not neutral in terms of environmental impact."[125] (Indeed, the permissive environmental regulation that agriculture enjoys is itself a subsidy.) As a general rule, agricultural subsidies tend to provide an incentive to increase production of specific commodities, which promotes monocultures, brings more "marginal (environmentally sensitive) land into production," and puts more "pressure on the environment."[126] Furthermore, in spite of national policies ostensibly favoring family

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AMBROSI, STATE AND TRENDS OF THE CARBON MARKET 2007 (May 2007).

120. According to the World Bank, "opportunities for this reduction through carbon trading are in principle quite large because of generally low returns from forest conversion to agricultural uses." WORLD BANK, *supra* note 27, at 201; *see also* Andrew Balmford et al., *Economic Reasons for Conserving Wild Nature*, 297 SCI. 950 (2002).

121. *See, e.g.*, WORLD BANK, *supra* note 27, at 201.

122. *See id*. at 97, tbl. 4.1 (discussing the main kinds of instruments that distort trade in agricultural products). *Cf.* Farrier, *supra* note 109, at 402 (arguing in favor of "'decoupling' farmer income support from production of agricultural commodities, while 'recoupling' it to a 'green' commodity that is in increasingly short supply but that the market offers little incentive to produce"); Balmford et al., *supra* note 120.

123. FAO, *supra* note 15, at 232. Two-thirds of OECD subsidies are market price supports. *Id.* at 233. These subsidies were included in the "amber box" category of support "that should be reduced or removed" and which were discussed in the Doha Round. *Id.*

124. John M. Anderlik et al., FDIC Outlook, Fall 2005, http://www.fdic.gov/bank/analytical/regional/ro20053q/na/2005fall_04.html (citing Economic Research Service statistics); *see also* Wastebasket, *Farm Subsidies Top $28 Billion*, TAXPAYERS FOR COMMON SENSE, Jan. 9, 2001, http://www.taxpayer.net/resources.php?category=&type=Project&proj_id=1178&action=Wastebasket (reporting $28 billion in direct federal payments to farmers in 2000, or nearly half of farm income; "In eight states, government assistance made up 100 percent of total farm income . . . ."); *see also* Marian L. Tupy, Op-Ed., *Who Pays for Farm Subsidies?*, WASH. TIMES, Nov. 25, 2005, at A23.

125. FAO, *supra* note 15, at 232.

126. *See id.* at 233.

farms, a "large share of farm subsidies tend to benefit larger farms and impoverish smaller ones and drive them out of business."[127]

A few years ago, several scientists calculated that, "[g]lobally, the subset of subsidies which are both economically and ecologically perverse totals between $950 billion and $1950 billion [nearly $2 trillion] each year."[128] (The uncertainty stems from "whether the hidden subsidies of external costs are also factored in."[129]) "Identifying and then working to remove these distortions," they concluded, "would simultaneously reduce rates of habitat loss, free up public funds for investing in sustainable resource use, and save money."[130]

Simply throwing money at problems is no solution. But a trillion dollars or so, wisely spent, could go a long way toward alleviating not only many environmental problems but poverty as well. PES is a sensible, effective means of investing in sustainable ecosystems and in the people who live and work there.

IV. SOME CONCLUDING THOUGHTS

Attempts to implement the land use changes and develop the institutions suggested here will confront multifarious obstacles. In the U.S., the "cowboy lobby" is alive and well and at work in Congress and every state legislature. In developing countries, societies are plagued by poverty and corruption. What can be done in the face of attitudes and forces like these?

Contracting with farmers, ranchers, and pastoralists to produce ecosystem services can play an important role. But the urgency and ubiquity of the problems we face counsel broad and immediate measures.

The World Bank criticizes environmental policies that are "based on demonstrating to farmers the 'right thing to do'—forgetting that it is the 'right thing' for others and not necessarily for the farmers."[131] The Bank also disparages attempts "to regulate what farmers can and cannot do."[132] In my view, we cannot afford to discard either of these tools.

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127. *See id.* (referring to those "based on production totals" and citing OECD 2006).
128. Balmford et al., *supra* note 120, at 952.
129. *Id*.
130. *Id.* (citations omitted).
131. WORLD BANK, *supra* note 27, at 197.
132. *Id.*

Information and education—backed up with technical and financial assistance, where appropriate, to motivate behavior—must be prominent in climate change mitigation efforts. Regulation has been an effective tactic in addressing many environmental problems; there is no reason to think that it cannot or should not play a role in the climate crisis.[133]

To tackle climate change and our other environmental problems concurrently, we need a full tool box. We must be open to radical ideas, like taking livestock off, and putting top predators back on,[134] public lands, and ensuring that pastoralists have secure legal rights to traditional grazing lands. We should encourage the kind of creative thinking that leads to grand new schemes, such as the Earth Atmospheric Trust.[135] Moreover, every individual can take simple measures, like conscientious choices about foods and energy use. At the same time, we cannot afford to overlook tried-and-true regulatory and market-based instruments that can be adapted for new applications.[136] As I said at the outset of this essay, action is needed at all levels, by all players, and with respect to all sources.

Finally, we critically need leaders and role models.

Daniel Abbasi wrote: "While no single individual or domain can plausibly be expected to take solitary charge on this encompassing problem [climate change], many who could assume leadership appear to think it is someone else's prerogative, or obligation, to do so. The result: a leadership vacuum."[137]

In the United States, the agencies that manage 600 million acres of federal lands should assume a leadership role. None of them has made climate change a "high priority," but each recognizes that it possesses authority "to address changes in resource conditions resulting from

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133. A recent poll revealed that a significant majority of Americans would, in fact, prefer regulation of the energy industry to a carbon tax or cap-and-trade scheme. Nathan Burchfiel**,** *Americans Would Prefer Gov't Regulation to CO2 Tax or Trading, Poll Finds*, THE NATION, June 21, 2007, http://www.cnsnews.com/Nation/Archive/200706/NAT20070621a.html.

134. Recent scientific research on trophic cascades shows that restoring top predators, such as wolves or mountain lions, can have broad ecological and hydrological benefits. *See, e.g.*, Oregon State University, Trophic Cascades Program, http://www.cof.orst.edu/leopold/cougars/index.php (last visited Oct. 17, 2008).

135. P. Barnes et al., *Creating an Earth Atmospheric Trust*, 319 SCI. 724 (2008).

136. These include tradable permits and licenses, transferable development rights, tax incentives, user fees and charges, performance bonds, easements and covenants, and certification systems.

137. DANIEL ABBASI, AMERICANS AND CLIMATE CHANGE 10 (2006).

climate change."[138] They must acknowledge, first, that their land management can exacerbate the "stresses caused by climate change,"[139] and second, that the severity of many climate change impacts, especially on ecosystem services, will depend largely on how they choose to manage their lands.[140] These facts, plus the long-term consequences of failing to act, gives rise to a strong, if implicit, mandate to take aggressive measures to conserve the nation's resources.

Removing livestock from 260 million acres of public lands could be a seminal first step. Carefully explained, it would send a clear message that the U.S. government is committed to managing this nation's public lands sustainably, for the benefit of all Americans, present and future.

Establishing global leadership, however, will require more. The U.S. bears considerable responsibility for livestock production's causal role in "the most significant environmental problems, at every scale from local to global."[141] The U.S. is the world's most affluent country; it is the largest importer and exporter of beef. Americans eat more beef than people in any other country.[142] The U.S. has a moral duty to protect resources, such as climate and biodiversity, which are threatened (at home and abroad) by its consumption and production patterns. Among the many paths available to it are: suspending efforts to increase U.S. beef exports to the Far East,[143] negotiating trade agreements to reduce global beef production and consumption, cooperating with other countries to help prevent deforestation, passing tough domestic climate change legislation, participating in a post-Kyoto international climate agreement, and ratifying the Convention on Biological Diversity.

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138. U.S. GEN. ACCOUNTABILITY OFFICE, *supra* note 87, at 44.

139. *Id.* at 1 (citing IPCC, April 2007).

140. *See* U.S. DEP'T AGRIC., *supra* note 98 and accompanying text.

141. FAO, *supra* note 15, at xx. *See also supra* note 27 and accompanying text.

142. AMERICAN MEAT INST., U.S. MEAT AND POULTRY PRODUCTION & CONSUMPTION: AN OVERVIEW (Mar. 2007), http://www.meatami.com/ht/a/GetDocumentAction/i/1239 ("In 2005, per capita beef consumption [in U.S.] was 66.5 pounds."); *United States Leads World Meat Stampede*, WORLDWATCH INSTITUTE, July 2, 1998, http://www.worldwatch.org/node/1626#1; *see also* Knickerbocker, *supra* note 16 ("[T]he average American diet—including all food processing steps—results in the annual production of an extra 1.5 tons of CO2-equivalent (in the form of all greenhouse gases) compared to a no-meat diet.").

143. *See Bush: Import US Beef, Quicken Yuan Revaluation*, CHINA DAILY, May 25, 2007, http://www.chinadaily.com.cn/world/2007-05/25/content_880315.htm ("One area where I have been disappointed is beef," President George W. Bush said to reporters after meeting with Wu. "They [the Chinese] need to be eating US beef. It's good for them," he said. "They'll like it."); *see also* NCBA News Archive, *supra* note 10.

If we "value the survival of future generations of our own species,"[144] business as usual is no longer an option. The ultimate question is, not whether we are willing to bear the costs and inconveniences that will be required, but can we "afford not to experiment with a radically different approach"?[145]

144. *See* Farrier, *supra* note 109, at 408.
145. *Cf. id.* at 407.