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TRAMPLING THE PUBLIC TRUST

DEBRA L. DONAHUE*

Abstract: Livestock production is a chief contributor to many significant and intractable environmental problems. This Article examines the causal role of livestock (especially beef) production in global climate change, predator control in the western United States, and winter elk feeding in Wyoming. It argues that ending livestock grazing on western public lands is a cost effective first step for dealing with these problems and is readily achievable under existing law. Removing livestock would lead to improved watershed conditions and make reintroduction of predators politically feasible, which would promote further recovery of landscapes impacted by native ungulate populations. Ending public-land grazing would facilitate the closure of (arguably unlawful) elk feedgrounds, which contribute to unnaturally high elk populations and promote the spread of diseases. Closing the feedgrounds would improve conditions on these sites and slow the spread of disease. Collectively, these measures would promote ecosystem restoration, which would enhance prospects for coping with climate change.

INTRODUCTION

The “American public doesn’t seem to care much about what we call rangelands,” says Dr. Steven Herman, adding that “rangelands” is “a horrible term.”¹ Horrible because most people associate “rangelands” not with valuable watersheds or “extraordinary biodiversity and beauty,” but with livestock grazing.² And according to the aphorism, if land isn’t good for anything else, it’s still good for grazing.³

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¹ This statement is quoted in MIKE HUDAK, *WESTERN TURF WARS: THE POLITICS OF PUBLIC LANDS RANCHING* 269 (2007). Dr. Herman teaches ecology, natural history, and animal behavior at Evergreen State College in Washington.

² *See id.* Despite the paean to a “home on the range,” these lands have been treated generally with contempt. *See generally infra* notes 6–11 and accompanying text. The Society for Range Management defines rangelands as lands “characterized by native plant communities, which are often associated with grazing,” adding that “‘range’ can also include

Seldom do you hear that grazing is not necessarily good for the land. Livestock production is the most widespread land use in the United States and the world.⁴ Perhaps its ubiquity has inured us to the damage it causes.⁵ Livestock production is a “major stressor on many ecosystems and on the planet as a whole”—“*one of the top two or three most significant contributors to the most serious environmental problems, at every scale from local to global.*”⁶ While the harmful consequences of this sector are (at long last) drawing increasing attention from the popular press⁷

forestlands that have grazing resources, or seeded lands that are managed like rangeland.” Soc’y for Range Mgmt., Policy Statement: Rangeland and Rangeland Resources, http://www.rangelands.org/about_pos_rangeresources.shtml (last visited Apr. 16, 2010).

³ The corollary is that nearly *any* land can be used to produce livestock. See Debra L. Donahue, *Federal Rangeland Policy: Perverting Law and Jeopardizing Ecosystem Services*, 22 J. LAND USE & ENVTL. L. 299, 306 n.53 (2007) (suggesting, based on Bureau of Land Management (BLM) statistics, that “the only BLM lands that are *not* available for livestock grazing—19 of 262 million acres— ‘consist of barren mountains, mountaintops, glaciers, sand dunes, and playas’”); cf. U.N. FOOD & AGRIC. ORG. [FAO], LIVESTOCK’S LONG SHADOW 280 (2006) [hereinafter FAO] (“In the past, livestock occupied vast territories because there was no possible alternative use, i.e. the land had no opportunity costs; this made marginally productive activities, such as extensive grazing, profitable.”).

⁴ See, e.g., FAO, *supra* note 3, at xxi (“The total area occupied by grazing is equivalent to 26 percent of the ice-free terrestrial surface of the [earth].”); Thomas L. Fleischner, *Ecological Costs of Livestock Grazing in Western North America*, 8 CONSERVATION BIOLOGY 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 TO SEQUESTER CARBON AND MITIGATE THE GREENHOUSE EFFECT 21, 29 (R.F. Follett et al. eds., 2001); COMM. ON RANGELAND CLASSIFICATION, NAT’L RESEARCH COUNCIL, RANGELAND HEALTH: NEW METHODS TO CLASSIFY, INVENTORY, AND MONITOR RANGELANDS 19 (1994) [hereinafter RANGELAND HEALTH].

⁵ See Fleischner, *supra* note 4, at 629 (“The destruction caused by livestock grazing is so pervasive and has existed for so long that it frequently goes unnoticed.”).

⁶ See FAO, *supra* note 3, at xx, 267. Beef production poses the “largest costs in terms of land and water requirements . . . as well as in terms of contribution to climate change.” *Id.* at 261.

⁷ See, e.g., HUMANE SOC’Y INT’L, ANIMAL AGRICULTURE & CLIMATE CHANGE: AN HSUS FACT SHEET (2008); Daniele Fanelli, *Meat Is Murder on the Environment*, NEW SCIENTIST, July 21, 2007, at 15; Nathan Fiala, *The Greenhouse Hamburger*, SCI. AM., Feb. 2009, at 72; Mike Tidwell, *The Low-Carbon Diet*, AUDUBON, Jan.–Feb. 2009, at 46, available at <http://www.audubonmagazine.org/features0901/viewpoint.html>; Michaela Schiessl & Christian Schwägerl, *Meat’s Contribution to Global Warming: The Cow Is a Climate Bomb*, SPIEGEL ONLINE INT’L, Aug. 27, 2008, <http://www.spiegel.de/international/germany/0,1518,574754,00.html> (Christopher Sultan, trans.); George Wuerthner, *Global Warming, Western Ranching, and the Bovine Curtain*, NEWWEST, Oct. 6, 2007, http://www.newwest.net/topic/article/global_warming_western_ranching_and_the_bovine_curtain/C38/L38/; Posting of Azadeh Ensha to Green Inc. Blog, N.Y. TIMES, <http://greeninc.blogs.nytimes.com/2009/03/27/meat-vs-climate-the-debate-continues/> (Mar. 27, 2009, 13:26 EDT).

and from scientists,⁸ they continue to be largely dismissed by policy makers.⁹ As a society, we continue to ignore the elephant in the room.¹⁰

Producing meat for human consumption has far-reaching implications. Some are obvious and well known, for instance, pollution from unregulated cattle feedlots and the current H1N1, or swine flu, pandemic. But there are other, more insidious effects: streams dewatered to irrigate forage crops, native wildlife displaced, human diet-related and food-borne diseases, consumption of fossil fuels, efficient spread of invasive species, and effects on social and economic status, to name a few. It would be difficult to identify an environmental problem that isn't somehow connected to or aggravated by livestock production.¹¹

This Article seeks to substantiate this assertion by highlighting three seemingly unrelated issues—one global, the others local or regional—and exploring their common connection to livestock production. The issues are climate change, predator control, and winter elk feeding (the latter two, current controversies in the West). The use of land to produce livestock is a driving force behind each, and the environmental effects of each are intertwined with those caused by livestock

⁸ See, e.g., P.J. Gerber et al., *Issues and Options in Addressing the Environmental Consequences of Livestock Sector's Growth*, 84 MEAT SCIENCE 244 (2010); Gowri Koneswaran & Danielle Nierenberg, *Global Farm Animal Production and Global Warming: Impacting and Mitigating Climate Change*, 116 ENVTL. HEALTH PERSP. 578 (2008); Anthony J. McMichael et al., *Food, Livestock Production, Energy, Climate Change, and Health*, 370 LANCET 1253 (2007); Barry M. Popkin, *Reducing Meat Consumption Has Multiple Benefits for the World's Health*, 169 ARCHIVES INTERNAL MED. 543 (2009); X.P.C. Vergé et al., *Agricultural Production, Greenhouse Gas Emissions and Mitigation Potential*, 142 AGRIC. & FOREST METEOROLOGY 255 (2007). But see *infra* note 10 (noting that in some instances, scientists have failed to identify the harms associated with grazing).

⁹ See FAO, *supra* note 3, at 221–22. Recent action in the U.S. Congress, leading up to House passage of the Waxman-Markey climate change bill, is illustrative. See Steven Pearlstein, *For the Farm Lobby, Too Much Is Never Enough*, WASH. POST, June 26, 2009, at A18, available at <http://www.washingtonpost.com/wp-dyn/content/article/2009/06/25/AR2009062504133.html> (reporting that, despite numerous concessions to agriculture, the Farm Bureau Federation—“the world's most selfish lobby”—“urged all House members to vote against” the bill).

¹⁰ See generally Debra L. Donahue, *Elephant in the Room: Livestock's Role in Climate and Environmental Change*, 17 MICH. ST. J. INT'L L. 95 (2008) (discussing how policy makers ignore the grave environmental impacts of livestock production and grazing). Various scientific disciplines, including hydrology and forest ecology, also ignore or dismiss the elephant in the room. See, e.g., JACK E. WILLIAMS ET AL., *WATERSHED RESTORATION: PRINCIPLES AND PRACTICES* (1997) (containing only a few paragraphs about grazing even though it is a 500-page volume).

¹¹ This is my variation on John Muir's observation: “When we try to pick out anything by itself, we find it hitched to everything else in the universe.” JOHN MUIR, *MY FIRST SUMMER IN THE SIERRA* 211 (1911).

production. This Article's premise is that tackling this common cause would advance a common solution.¹²

It might strike readers as overreaching to attempt to treat in a single article climate change, which has been referred to as the most pressing challenge of our generation, along with local (some would say parochial) topics like predator control and elk feeding. Even granting a legitimate link among the three issues, a single article could barely scratch the surface of any one of them, each of which pits private against public interests, state against state, governments against citizen groups, and historical practices against new scientific understandings.

This Article's aims are relatively modest: to call further attention to the environmental scourge that is livestock (especially beef) production by identifying its connection to these three seemingly disparate issues, and thereby advance the case for reforming livestock production practices. In particular, this Article proposes the specific reform of removing livestock from public lands. Experts warn that comprehensive climate change policies *must* address the livestock sector.¹³ Predator control and supplemental elk feeding issues will never be resolved without changes in livestock production practices. Ending public-land

¹² The authors of a leading casebook had this to say about voluntary retirement of federal grazing permits:

[Grazing buyouts appear] to offer great benefits, environmental and otherwise. They lead to restoration of the health of riparian areas and wildlife populations. They give the government land managers more flexibility to cope with drought, fire, and insect outbreaks. They may achieve tangible, visible environmental improvements in a short time in a less contentious way than pitched battles over regulation. Economists have advocated grazing buyouts since the 1950s.

GEORGE C. COGGINS ET AL., *FEDERAL PUBLIC LAND AND RESOURCES LAW* 830–31 (7th ed. 2007); cf. John D. Leshy & Molly S. McUsic, *Where's the Beef? Facilitating Voluntary Retirement of Federal Lands from Livestock Grazing*, 17 N.Y.U. ENVTL. L.J. 368, 371 (2008) (asserting that retiring grazing permits "has the potential to resolve vexing conflicts of resources and values, and to restore environmental health to millions of acres of federal land").

¹³ See, e.g., FAO, *supra* note 3, at 275–76; U.N. FOUND. & SIGMA XI, *CONFRONTING CLIMATE CHANGE: AVOIDING THE UNMANAGEABLE AND MANAGING THE UNAVOIDABLE* 69–70 (2007) [hereinafter *CONFRONTING CLIMATE CHANGE*] ("The key to making the needed large reductions in CO₂ emissions is a multi-pronged strategy that addresses all of the major emission sources. . . . [This includes] possibilities for reducing the carbon emissions from land-use change by means of . . . improved soil-management practices in agriculture."); see also *infra* notes 163–71, 177–78 and accompanying text; cf. KEITH PAUSTIAN ET AL., *AGRICULTURE'S ROLE IN GREENHOUSE GAS MITIGATION*, at v (2006) ("[A]griculture has much to offer in helping to reduce net [greenhouse gas (GHG)] emissions to the atmosphere."); *id.* at 58 ("Agricultural activities have a broad and multi-faceted impact on all three of the main GHGs—carbon dioxide, methane, and nitrous oxide—and policies designed to mitigate GHGs must consider impacts on all three GHGs.").

grazing offers a more readily achievable and cost effective first step for dealing with each of these issues than any other measure yet suggested.

I. FOCUS: RIPARIAN AREAS

Riparian areas—“transitional [areas] between terrestrial and aquatic ecosystems,” which are adjacent to streams and other bodies of water¹⁴—are the focus of vital landscape processes, especially in the arid West. In several ways, they also provide a focus for this Article’s wide-ranging discussion.

Of the ecological harms wrought by livestock, the damage to streams and riparian areas is probably best known.¹⁵ These impacts have been recognized—and studied—for decades.¹⁶ In 1924 Aldo Leopold concluded that grazing was “the prime factor in destroying watershed values” in Arizona, and he wrote that, in the Southwest generally, “any grazing at all, no matter how moderate, is liable to overgraze and ruin the watercourses.”¹⁷ Seventy years later, the Federal Bureau of Land Management (BLM) predicted that “[w]atershed and water quality conditions would *improve to their maximum potential*” if livestock were *removed* from public lands.¹⁸

¹⁴ See NAT’L RES. COUNCIL, *RIPARIAN AREAS: FUNCTIONS AND STRATEGIES FOR MANAGEMENT* 3 (2002) [hereinafter NRC REPORT] (defining “riparian areas”).

¹⁵ See, e.g., A. Joy Belsky et al., *Survey of Livestock Influences on Stream and Riparian Ecosystems in the Western United States*, 54 J. SOIL & WATER CONSERVATION, 419, 419 (1999); Fleischer, *supra* note 4, at 634.

¹⁶ See A. Joy Belsky & Dana M. Blumenthal, *Effects of Livestock Grazing on Stand Dynamics and Soils in Upland Forests of the Interior West*, 11 CONSERVATION BIOLOGY 315, 321 (1997) (“The most thoroughly studied irregularity in livestock distribution is the heavy use by cattle of riparian areas.”).

¹⁷ ALDO LEOPOLD, *Some Fundamentals of Conservation in the Southwest*, 1 ENVTL. ETHICS 131, 137 (1979), reprinted in *THE RIVER OF THE MOTHER OF GOD AND OTHER ESSAYS* BY ALDO LEOPOLD 86, 92 (Susan L. Flader & J. Baird Callicott eds., 1991); see DEBRA L. DONAHUE, *THE WESTERN RANGE REVISITED: REMOVING LIVESTOCK FROM PUBLIC LANDS TO CONSERVE NATIVE BIODIVERSITY* 116 (1999); see also K.L. Cole et al., *Holocene Vegetation and Historic Grazing Impacts at Capitol Reef National Park Reconstructed Using Packrat Middens*, 57 GREAT BASIN NATURALIST 315, 315, 324 (1997) (concluding that the “most severe vegetation changes of the last 5400 years” on the Colorado Plateau resulted from livestock grazing during the last two centuries); Fleischer, *supra* note 4, at 634; Allison Jones, *Review and Analysis of Cattle Grazing Effects in the Arid West, with Implications for BLM Grazing Management in Southern Utah* (Feb. 2001), <http://rangenet.org/directory/jonesa/litrev.html> (a literature review submitted to the Southern Utah Landscape Restoration Project).

¹⁸ BUREAU OF LAND MGMT., DEP’T OF THE INTERIOR, & FOREST SERV., DEP’T OF AGRIC., *RANGELAND REFORM ’94: DRAFT ENVIRONMENTAL IMPACT STATEMENT* 44–45 (1994) [hereinafter *RANGELAND REFORM*] (emphasis added).

A National Research Council (NRC) committee¹⁹ provided support for the BLM's assessment when, in 2002, it reported that "[e]xcluding cattle from riparian areas is the most effective tool for restoring and maintaining water quality and hydrologic function, vegetative cover and composition, and native species habitats," and that in "riparian areas degraded by livestock," conditions "will not improve without changes in grazing management."²⁰ The committee also warned: "Even where grazing in riparian areas is excluded or properly managed, *grazing also must be managed on uplands to protect riparian areas.*"²¹ By all accounts, this advice has not been followed on public lands. In 1994 the BLM itself reported that riparian areas throughout the American West were in their worst condition in history and that conditions on dry uplands had not improved under BLM management.²²

To understand the magnitude of the problem and the NRC committee's advice, one must consider: First, grazing is *the most widespread and longest running land use* in the West. It occurs on about 260 million acres of *public* lands, an area 2½ to 3 times the size of California. Authorized use is more than 12 million AUMs—the equivalent of *4 million cows with calves* living off the public lands for three months each year.²³ Second, even though riparian areas are "the most productive habitats in North America,"²⁴ they comprise *less than one percent* of the land area of the West. More wildlife species depend on riparian areas than any other habitat.²⁵ They are hugely important for providing many other

¹⁹ National Research Council Committee on Riparian Zone Functioning and Strategies for Management. The author was a member of the committee.

²⁰ See NRC REPORT, *supra* note 14, at 393.

²¹ *Id.* (emphasis added).

²² RANGELAND REFORM, *supra* note 18, at 45.

²³ See, e.g., COGGINS ET AL., *supra* note 12, at 767–68. "AUM" refers to "animal unit month." Actual (or active) use is less, which is, in itself, suggestive of range condition. The agencies like to point out that the animal numbers are down since the 1950s. But the numbers and the impacts don't enjoy a straight-line relationship, in part because cattle weights, and thus their destructive capacity, have increased, see, for example, *Revisiting Long-Term Trends in Livestock Weights, Letter #33* (Livestock Marketing Info. Ctr.), Aug. 13, 2004, at 1–3, available at <http://www.ag.ndsu.nodak.edu/aginfo/lsmkt/docs/ac081304.pdf>, and in part because continued grazing can push (and *has* pushed) range conditions past ecological thresholds, with potentially irreversible results, see, for example, DONAHUE, *supra* note 17, at 146–51, 179, 316 n.96 (discussing the threshold concept and citing sources).

²⁴ See Fleischner, *supra* note 4, at 635.

²⁵ See, e.g., J. Boone Kauffman, *Lifeblood of the West: Riparian Zones, Biodiversity, and Degradation by Livestock*, in WELFARE RANCHING: THE SUBSIDIZED DESTRUCTION OF THE AMERICAN WEST 175, 175–76 (George Wuerthner & Mollie Matteson eds., 2002) [hereinafter WELFARE RANCHING]; Glenn Monahan, *Cows vs. Cottonwoods on Upper Missouri*, MISSOULIAN, Feb. 11, 2009, http://www.missoulian.com/news/opinion/editorial/article_def-9b8da-b17b-5e0fb645-d2802ea-d31ec.html?mode=story (quoting BLM website regarding riparian zones).

ecosystem services as well.²⁶ It is the water they harbor, and the associated willow, cottonwood, and other tree/shrub communities, which make riparian areas so valuable—and which lead cattle to congregate there.²⁷ Cattle impacts include soil erosion and streambank damage, loss of palatable plants, the spread of weedy plants, and changes in the age structure of riparian forests.²⁸ Grazing can “eliminate a willow stand within thirty years.”²⁹ Over longer periods it drastically reduces and can eliminate cottonwood recruitment.³⁰ The impacts on water quality and channel stability can be severe.³¹

Dismal riparian conditions reflect a failure of stewardship, *not* a lack of knowledge concerning either the value of these areas or the destructiveness of grazing. If further incentive to tend riparian areas carefully or more information about the consequences of poor management were needed, however, the last decade has provided both. For example, we understand that riparian areas become ever more valuable as the climate changes.³² We also know that how we choose to *adapt* to

²⁶ See generally NRC REPORT, *supra* note 14; Donahue, *supra* note 3.

²⁷ See Belsky & Blumenthal, *supra* note 16, at 321 (“The most thoroughly studied irregularity in livestock distribution is the heavy use by cattle of riparian areas.”).

²⁸ Fleischner, *supra* note 4, at 637.

²⁹ Bernard L. Kovalchik & Wayne Elmore, *Effects of Cattle Grazing Systems on Willow-Dominated Plant Associations in Central Oregon*, SYMPOSIUM ON ECOLOGY AND MANAGEMENT OF RIPARIAN SHRUB COMMUNITIES 111, 114 (1991).

³⁰ Robert L. Beschta & William J. Ripple, *Rapid Assessment of Riparian Cottonwood Recruitment: Middle Fork John Day River, Northeastern Oregon*, 23 *ECOLOGICAL RESTORATION* 150, 154 (2005) (determining that long-term grazing/browsing of cottonwood by cattle—the “principal land use along [these] riparian systems . . . since at least the late 1800s”—has caused a decline in or total lack of cottonwood recruitment); accord Fleischner, *supra* note 4, at 633–34; see also Robert L. Beschta & William J. Ripple, *Wolves, Trophic Cascades, and Rivers in the Olympic National Park, USA*, 1 *ECOHYDROLOGY* 118, 120–21 (2008) [hereinafter Beschta & Ripple, *Wolves, Trophic Cascades, and Rivers*] (citing sources regarding long-term deleterious effects of elk over-browsing on woody species growth and recruitment).

³¹ Photos dramatically illustrating these and other impacts can be found on the Internet. See, e.g., Mike Hudak, Mike Hudak’s Public Lands Ranching Photo, <http://www.mikehudak.com/PhotoEssays/LivestockGalleryVS/> (last visited Apr. 16, 2010); W. Watersheds Project, Research and Reports, <http://www.westernwatersheds.org/reports/research-reports> (last visited Apr. 16, 2010); WildEarth Guardians, Gila Riparian Recovery, <http://www.wildearthguardians.org/WildRivers/ProtectingRestoringWildRivers/RiverRestorationSites/tabid/61/Default.aspx> (last visited Apr. 13, 2010) (displaying photos documenting dramatic changes in riparian conditions observed within five years after a lawsuit ended grazing in several areas of the Gila River watershed in New Mexico). See generally WELFARE RANCHING, *supra* note 25.

³² See, e.g., PETER BACKLUND ET AL., U.S. CLIMATE CHANGE SCI. PROGRAM, SYNTHESIS AND ASSESSMENT PRODUCT 4.3, THE EFFECTS OF CLIMATE CHANGE ON AGRICULTURE, LAND RESOURCES, WATER RESOURCES, AND BIODIVERSITY 8 (2008) (“River and riparian ecosystems in arid lands will very likely be negatively impacted by decreased streamflow, increased water removal, and greater competition from nonnative species.”); DANIEL B. FAGRE ET AL., U.S.

climate change will determine the severity of many climate change impacts, especially on ecosystem services.³³ One adaptation strategy that holds great promise is to restore ecosystems.³⁴

Which brings us back to livestock grazing.

II. TROPHIC CASCADES AND PREDATOR CONTROL

New research provides striking, if indirect, evidence that removing livestock could restore rangeland ecosystems. Studies in national parks in *six different North American ecosystems*—Yellowstone, Yosemite, Wind Cave, Zion, and Olympic National Parks in the United States, and Jasper National Park in Canada—have shown that ecosystems unravel when “keystone” predators are removed.³⁵

CLIMATE CHANGE SCI. PROGRAM, SYNTHESIS AND ASSESSMENT PRODUCT 4.2, THRESHOLDS OF CLIMATE CHANGE IN ECOSYSTEMS 84 (2009) (stating that riparian ecosystems are “vulnerable to drought-related thresholds”); WORKING GROUP II OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE [IPCC], CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY 234 (Martin Parry et al. eds., 2007) [hereinafter IMPACTS, ADAPTATION AND VULNERABILITY]; AMY K. SNOVER ET AL., PREPARING FOR CLIMATE CHANGE: A GUIDEBOOK FOR LOCAL, REGIONAL, AND STATE GOVERNMENTS 111 (2007); Steven R. Archer & Katharine I. Predick, *Climate Change and Ecosystems of the Southwestern United States*, RANGELANDS, June 2008, at 23, 25; Jeanne C. Chambers & Mike Pellant, *Climate Change Impacts on Northwestern and Intermountain United States Rangelands*, RANGELANDS, June 2008, at 29, 29.

³³ See U.S. CLIMATE CHANGE SCI. PROGRAM, CLIMATE CHANGE AND ECOSYSTEMS SUMMARY OF RECENT FINDINGS 1–4 (2008), available at <http://www.climatechange.gov/Library/sap/sap44/final-report/sap44-brochure-FAQ.pdf> (reporting that stream temperatures are likely to increase as the climate warms, which is very likely to have effects on aquatic ecosystems and water quality; climate change in arid lands will very likely create physical conditions conducive to wildfire, and the proliferation of exotic grasses will very likely provide fuel, thus causing fire frequencies to increase in a self-reinforcing fashion; and river ecosystems in arid lands will very likely be negatively impacted by decreased streamflow, increased water removal, and greater competition from non-native species).

³⁴ See *infra* note 174 and accompanying text.

³⁵ See, e.g., Beschta & Ripple, *Wolves, Trophic Cascades, and Rivers*, *supra* note 30, at 118, 126; Robert L. Beschta & William J. Ripple, *Wolves, Elk, and Aspen in the Winter Range of Jasper National Park, Canada*, 37 CAN. J. FOREST RES. 1873, 1873 (2007); William J. Ripple & Robert L. Beschta, *Trophic Cascades Involving Cougar, Mule Deer, and Black Oaks in Yosemite National Park*, 141 BIOLOGICAL CONSERVATION 1249, 1249 (2008); William J. Ripple & Robert L. Beschta, *Hardwood Tree Decline Following Large Carnivore Loss on the Great Plains, USA*, 5 FRONTIERS ECOLOGY & ENV'T 241, 241 (2007) (reporting research in Wind Cave National Park); William J. Ripple & Robert L. Beschta, *Linking a Cougar Decline, Trophic Cascade, and Catastrophic Regime Shift in Zion National Park*, 33 BIOLOGICAL CONSERVATION 397, 397 (2006); William J. Ripple & Robert L. Beschta, *Restoring Yellowstone's Aspen with Wolves*, 138 BIOLOGICAL CONSERVATION 514, 514 (2007); William J. Ripple et al., *Trophic Cascades Among Wolves, Elk and Aspen on Yellowstone National Park's Northern Range*, 102 BIOLOGICAL CONSERVATION 227, 227 (2001); Robert L. Beschta & William J. Ripple, *Recovering Riparian Plant Communities with Wolves in Northern Yellowstone*, 6–10 RESTORATION ECOLOGY (2008), <http://www3.interscience.wiley.com/cgi-bin/fulltext/121430130/PDFSTART> [hereinafter Beschta & Ripple, *Recover-*

In each study area the absence of top predators—primarily wolves and/or cougars—resulted in a similar “cascade” of effects:³⁶

- Populations of native ungulates, chiefly elk (where wolves were the apex predator) or deer (where cougars were the apex predator), increased significantly and foraging behavior changed.³⁷
- The ungulates spent more time in riparian areas, and they overbrowsed preferred plants, especially cottonwood, aspen, willow, oaks, maples, and berry-producing shrubs.
- “Recruitment” of cottonwood and aspen—the growth of seedling/sprouts into tall saplings and trees—was drastically reduced, and uncommon plants became rare or disappeared.
- Loss of streamside vegetation caused major changes in channel stability and floodplain function.
- Loss of young aspens and cottonwoods and berry-producing shrubs led to decreases in the diversity and abundance—and sometimes outright loss—of other species, including beaver, amphibians, and songbirds.³⁸
- Furthermore, the loss of top predators triggered an explosion of “mesopredators,” such as coyotes, which led to further cascading effects.³⁹

In all six national parks, the researchers were able to exclude other environmental factors, including long-term variations in winter weather or snowpack and fire, as significant causes of the changes they observed.⁴⁰

ing]; Trophic Cascade Program, Oregon State University, Scientific Articles, <http://www.cof.orst.edu/cascades/articles.php> (last visited Apr. 15 2010) (listing OSU research and providing links to text of most articles); see also Robert L. Beschta & William J. Ripple, *Large Predators and Trophic Cascades in Terrestrial Ecosystems of the Western United States*, 142 BIOLOGICAL CONSERVATION 2401, *passim* (2009) [hereinafter Beschta & Ripple, *Large Predators*] (synthesizing the results of many of the foregoing studies).

³⁶ “Trophic cascade” has been defined as the “progression of indirect effects by predators across successively lower trophic levels.” William J. Ripple & Robert L. Beschta, *Wolves and the Ecology of Fear: Can Predation Risk Structure Ecosystems?*, 54 BIOSCIENCE 755, 756 (2004) [hereinafter Ripple & Beschta, *Ecology of Fear*] (quoting J.A. Estes et al., *Predators, Ecological Role of*, in 4 ENCYCLOPEDIA OF BIODIVERSITY 280–81 (2001)).

³⁷ An ungulate is a hoofed mammal.

³⁸ Other researchers also have reported that “[l]oss of beaver produces cascading effects on other biota.” BRUCE L. SMITH ET AL., IMPERFECT PASTURE: A CENTURY OF CHANGE AT THE NATIONAL ELK REFUGE IN JACKSON HOLE, WYOMING 130 (2004).

³⁹ Cf. Laura R. Prugh et al., *The Rise of the Mesopredator*, 59 BIOSCIENCE 779, 780–81 (2009) (describing the phenomenon and implications of “mesopredator release” following collapse of top predator populations throughout the world).

⁴⁰ See Beschta & Ripple, *Large Predators*, *supra* note 35, at 2407–09. Some of these studies involved before- and after-predator-removal comparisons; others (like Zion) relied on

What is exciting about this research is that the damage seems to be reversible. In the Yellowstone area, for instance, the return of wolves has led to renewed recruitment of cottonwood, aspen, and willow,⁴¹ and it holds “great [] promise for . . . the eventual recovery of riparian plant communities.”⁴² Moreover, based on the initial recovery of vegetation and beavers⁴³ along the upper Gallatin River in the northwestern corner of the park, Robert Beschta, a forest hydrologist and one of the principal researchers, believes that the river channel itself is on the road to restoration.⁴⁴

The Yellowstone experience also undermines the notion that simply reducing ungulate populations—for example, by hunting—can achieve the same results.⁴⁵ The Park Service reduced elk numbers ag-

comparisons between areas with and without predators. The Greater Yellowstone study areas allowed comparison of historical, no-wolf conditions with conditions following reintroduction of wolves in 1995. In most cases the researchers also used historical photos and accounts as well as aerial photos. Similarly, Smith et al. concluded that “factors other than climate change are responsible for the decline in woody vegetation on the National Elk Refuge.” SMITH ET AL., *supra* note 38, at 98, 100 (“[C]hanges in snow pack are an unlikely cause of the decline in wet meadow willow communities [on the National Elk Refuge].”).

⁴¹ See, e.g., Joshua Halofsky & William Ripple, *Linkages Between Wolf Presence and Aspen Recruitment in the Gallatin Elk Winter Range of Southwestern Montana, USA*, 81 FORESTRY 195, 204 (2008); Beschta & Ripple, *Recovering*, *supra* note 35, at 1. Indeed, “the presence of wolves may be integral to the long-term recruitment” of aspen. Beschta & Ripple, *Recovering*, *supra* note 35, at 1.

⁴² Robert L. Beschta, *Reduced Cottonwood Recruitment Following Extirpation of Wolves in Yellowstone’s Northern Range*, 86 ECOLOGY 391, 402 (2005).

⁴³ See Beschta & Ripple, *Recovering*, *supra* note 35, at 8 (reporting on the “recent return of beaver colonies to the northern range,” and citing D.W. Smith et al., *Yellowstone After Wolves*, 53 BIOSCIENCE 330, 336–37 (2003)).

⁴⁴ Telephone interview with Robert L. Beschta, Emeritus Professor, Watershed Processes & Hydrology, Or. State Univ., in Corvallis, Or. (Oct. 5, 2009). Beschta also notes “improvements in plant communities along various tributaries of the Lamar River [in the northeastern corner of the park] and a portion of the Lamar River above the confluence with Soda Butte Creek. But, below Soda Butte Creek, the Lamar River continues to be ‘hammered,’ now by an increasing bison herd in the last five years.” Email from Robert L. Beschta to author (Oct. 7, 2009, 14:24 PDT) (on file with author) [hereinafter Beschta email]. He concludes that the recovery that might otherwise have occurred in the Lamar “has been obscured by bison impacts which now are a major factor along [the Lamar] floodplains, as well as those of other major rivers in the park.” *Id.*; see also Beschta & Ripple, *Recovering*, *supra* note 35, at 7. Beschta commented, wryly, that he had spent a day in the field recently with Park Service officials, and “incredibly, they see no problems along the Lamar River. Like elk of yesteryear (that are now being taken care of by wolves), they simply love their bison.” Beschta email, *supra*; see also Virginia Morell, *Aspens Return to Yellowstone, with Help from Some Wolves*, 317 SCIENCE 348, 349 (2007).

⁴⁵ Year-round hunting, however, might come closer to simulating predation. Beschta and Ripple cited Alverson et al.’s finding that “year-round hunting sufficiently influenced ungulate browsing such that recruitment of palatable tree species continued to occur, whereas tree recruitment on adjacent National Forest lands, with more limited hunting,

gressively until 1968, but the degradation of riparian communities on the park's northern ranges continued.⁴⁶ After elk culling stopped, the impacts became more severe as the northern range elk herd grew from about 4000 animals to nearly 19,000 within two decades.⁴⁷ Since the introduction of wolves in the mid-1990s, however, conditions have been improving. Trophic cascades theory offers a cogent explanation: Wolf predation reduces elk numbers, yes, but the presence of wolves also affects *where* elk feed and *how long* they spend there. In other words, wolves have brought about changes in elk densities and foraging behavior—a so-called “ecology of fear.”⁴⁸

We do not yet understand exactly how these top-down processes work.⁴⁹ But it is undeniable that the absence of keystone predators affects ungulate behavior and population dynamics, which in turn disrupts ecosystem processes, with consequences for the ecosystem as a whole.⁵⁰ As Leopold observed: “Yellowstone has lost its wolves and cou-

was adversely affected by ungulate browsing.” Beschta & Ripple, *Wolves, Trophic Cascades, and Rivers*, *supra* note 30, at 125 (citing William S. Alverson et al., *Forests Too Deer: Edge Effects in Northern Wisconsin*, 2 CONSERVATION BIOLOGY 348, 351–52 (1988)).

⁴⁶ See Beschta, *supra* note 42, at 394; Beschta & Ripple, *Recovering*, *supra* note 35, at 2. In addition, the NPS captured elk and shipped them to many locations in the United States and Canada, and elk that crossed the park boundary into Montana were subject to hunting. See Beschta email, *supra* note 44.

⁴⁷ See Beschta & Ripple, *Recovering*, *supra* note 35, at 2.

⁴⁸ See Joel S. Brown et al., *The Ecology of Fear: Optimal Foraging, Game Theory, and Trophic Interactions*, 80 J. MAMMALOGY 385, 385 (1999); Ripple & Beschta, *Ecology of Fear*, *supra* note 36, at 756. The work of Drs. Ripple and Beschta, and the role of large predators in maintaining and restoring ecosystem health, is featured in a documentary film. LORDS OF NATURE: LIFE IN A LAND OF GREAT PREDATORS (Green Fire Productions 2009); see Press Release, Or. State Univ., “Ecology of Fear,” Role of Large Predators Explored in New Documentary Film (Apr. 27, 2009), available at <http://oregonstate.edu/ua/ncs/archives/2009/apr/%E2%80%9Cecology-fear%E2%80%9D-role-large-predators-explored-new-documentary-film>.

⁴⁹ For example, other researchers have recently suggested that something else may be going on, too. Matthew J. Kauffman and his colleagues think

it is unlikely to be optimal for elk to simply avoid these resources [areas with preferred woody browse], because many of them provide forage during the critical winter months This need for winter forage most likely explains why elk have not made broad-scale changes in winter habitat selection as a means of avoiding encounters with wolves How elk perceive and manage the trade-off between food and safety will ultimately determine the existence and strength of a behaviourally mediated trophic cascade in [the Yellowstone northern range].

Matthew J. Kauffman et al., *Landscape Heterogeneity Shapes Predation in a Newly Restored Predator–Prey System*, 10 ECOLOGY LETTERS 690, 698 (2007).

⁵⁰ See Norman L. Christensen et al., *The Report of the Ecological Society of America Committee on the Scientific Basis for Ecosystem Management*, 6 ECOLOGICAL APPLICATIONS 665, 672 (1996). Trophic cascades theory is consistent with Aldo Leopold’s understanding of “land

gars, with the result that elk are ruining the flora, particularly on the winter range.”⁵¹ The recent research on trophic cascades, and the Yellowstone experience in particular, provides compelling evidence that reestablishing predators could help restore riparian and stream communities and ultimately entire landscapes.⁵²

Aldo Leopold was among the first to understand that annihilating large predators led to “irruptions” in populations of native ungulates, with serious consequences for their habitat.⁵³ Having witnessed firsthand the extermination of wolves and resultant onslaught of deer in the Southwest in the 1920s and 1930s, he wrote:

I have lived to see state after state extirpate its wolves. I have watched the face of many a newly wolfless mountain, and seen the south-facing slopes wrinkle with a maze of new deer trails. I have seen every edible bush and seedling browsed, first to anemic desuetude, and then to death.⁵⁴

Elk and cattle are hardly ecological equivalents, but it’s no stretch to infer that similar mechanisms are behind the damage that this and other *non-native ungulates* have caused across the West. Imagine the impacts of turning out millions of *non-native* cattle and sheep, whose numbers were and are largely unaffected by natural controls, such as predators, disease, and competition for food and water.⁵⁵ Leopold put the matter this

health” as “the capacity of the land for self-renewal.” As Leopold explained, the capacity for self-renewal depends on the presence of an intact “land community,” which includes top predators. See *infra* notes 267–69 and accompanying text; see also JULIANNE LUTZ NEWTON, ALDO LEOPOLD’S ODYSSEY 339–41 (2008). See generally William J. Ripple & Robert L. Beschta, *Linking Wolves and Plants: Aldo Leopold on Trophic Cascades*, 55 *BIOSCIENCE* 613 (2005) [hereinafter Ripple & Beschta, *Linking Wolves and Plants*].

⁵¹ ALDO LEOPOLD, *A SAND COUNTY ALMANAC* 196 (1987).

⁵² See, e.g., Halofsky & Ripple, *supra* note 41, at 203 (“[T]wo browse species in different winter ranges [Yellowstone’s northern range and the Gallatin range] and growing under different conditions (*riparian* cottonwood *vs.* *upland* aspen) concurrently declined during the time of wolf extirpation.” (emphasis added)).

⁵³ See LEOPOLD, *supra* note 51, at 130–33. A 1930 report by the U.S. Forest Service Inspector of Grazing attributed the “problem” to overgrazing by livestock, but noted that the problem was “complicated by the increasingly important deer management problem.” Large predators had been virtually eliminated from much of this area by the 1920s. Memorandum from R.R. Hill, U.S. Forest Service Grazing Inspector, Browse Problem in the Southern Forests of Region 3, at 1 (May 29, 1930), available at http://www.foresthistory.org/ASPNET/Policy/Grazing/Grazing_Inspection.pdf.

⁵⁴ See Ripple & Beschta, *Linking Wolves and Plants*, *supra* note 50, at 619 (quoting LEOPOLD, *supra* note 51, at 130).

⁵⁵ See Christensen et al., *supra* note 50, at 675 (“Human-generated changes must be constrained because nature has functional, historical, and evolutionary limits.” (quoting S.T.A. Pickett et al., *The New Paradigm in Ecology*, in *CONSERVATION BIOLOGY: THE THEORY*

way: “The cowman who cleans his range of wolves does not realize that he is taking over the wolf’s job of trimming the herds to fit the range. He has not learned to think like a mountain. Hence we have dustbowls, and rivers washing the future into the sea.”⁵⁶ Environmental historian Donald Worster compared the consequences of introducing livestock in the West to the “explosive, shattering effect of all-out war.”⁵⁷

Conversely, just as the release from elk-browsing pressure seems to be fostering recovery of Yellowstone’s northern range, removing livestock is known to improve riparian conditions and ecosystem function.⁵⁸ Thus, two strategies for restoring ecosystems are to remove livestock and to reintroduce predators.⁵⁹

But just as livestock production contributes to the problem, it also frustrates solutions. Not only have public-land ranchers and their allies strenuously opposed reductions in grazing use and other policy re-

AND PRACTICE OF NATURE CONSERVATION, PRESERVATION, AND MANAGEMENT 65 (P.L. Fiedler & S.K. Jain eds., 1992)). One commentator recently described the annihilation of bison in the 19th century and their replacement by cattle on the Great Plains thus:

Between 1870 and 1880, at least 10 million buffalo, and possibly as many as 20 million, were killed

Thereafter the northern plains would be cattle country. Between 1866 and 1884, at least 5 million longhorns were driven north out of Texas. The number of cattle in Wyoming rose from 90,000 in 1874 to 500,000 by 1880; and by 1883 in Montana, where ten years earlier there were practically no cows, half a million now grazed on grasses untouched by their rivals. “For every single buffalo that roamed the Plains in 1871,” wrote [Army] Colonel [Richard] Dodge, “there are in 1881 not less than two, and more probably four or five, of the descendants of the longhorned cattle of Texas.”

Christopher Ketcham, *They Shoot Buffalo, Don’t They?*, HARPER’S, June 2008, at 66, 68–69.

⁵⁶ LEOPOLD, *supra* note 51, at 130–33.

⁵⁷ DONALD WORSTER, UNDER WESTERN SKIES: NATURE AND HISTORY IN THE AMERICAN WEST 45 (1992).

⁵⁸ See *supra* note 20 and accompanying text. Removing livestock or fencing them out of riparian areas is widely recommended by government agencies as a “best management practice” for protecting water quality and reducing erosion. A recent five-year study of nearly a dozen streams by the Wyoming Game and Fish Department (WGFD) concluded that “[r]educd or no livestock grazing of riparian buffer strips had a positive affect [sic] on water quality, stream channel morphology, hydrology, riparian zone soils, instream and streambank vegetation and aquatic and riparian wildlife.” BERT JELLISON ET AL., WYO. GAME & FISH DEP’T, RESPONSE OF PRAIRIE STREAM RIPARIAN BUFFERS TO LIVESTOCK EXCLUSION AND SHORT-DURATION GRAZING IN NORTHEAST WYOMING—A PRE- AND POST-PHOTOGRAPHIC COMPARISON 2 (2007), available at http://gf.state.wy.us/habitat/Riparian/RiparianBuffer_Rept_Final.pdf.

⁵⁹ Both strategies will be required. As the research in the national parks demonstrates, native ungulates (in the absence of predators and livestock) can cause severe impacts on riparian and upland vegetation, soils, etc. See generally Beschta & Ripple, *Large Predators*, *supra* note 35.

forms, but the livestock industry is the major impediment to reestablishing top predators. Donald Worster described cattle- and sheepmen's hatred of wolves and coyotes as "almost metaphysical."⁶⁰ Since the founding of this nation, wolves, coyotes, cougars, and bears have been shot, poisoned, and trapped.⁶¹ Wolves and coyotes have been run down and mutilated. Wolves have been intentionally infected with mange.⁶² Coyote pups are still pulled from their dens and killed. For more than a century, these activities have been undertaken by government at the behest of ranchers and farmers.⁶³ In the twenty-first century, "efforts to wage war on wildlife predators are increasing."⁶⁴

Federal assistance directed at predator control began in 1907. Responding to pressure by the western range livestock industry, the Bureau of Biological Survey and the Department of Agriculture "conducted field studies of wolf and coyote populations and published bulletins on methods of their control."⁶⁵ Part of the impetus was the fact that the new Forest Service had begun charging grazing fees. "[I]t was felt that there was an obligation to offer some protection for live-

⁶⁰ DONALD WORSTER, *NATURE'S ECONOMY: A HISTORY OF ECOLOGICAL IDEAS* 264 (1994). See generally BARRY HOLSTUN LOPEZ, *OF WOLVES AND MEN* (1978) (exploring the precarious relationship between humans and wolves).

⁶¹ While large predators were the focus of this campaign, control operations have also caused considerable "collateral damage" to many non-target animals, including threatened or endangered species. See PREDATOR CONTROL—1971. REPORT TO THE PRESIDENT'S COUNCIL ON ENVIRONMENTAL QUALITY AND THE DEPARTMENT OF THE INTERIOR BY THE ADVISORY COMMITTEE ON PREDATOR CONTROL 1 (1972) [hereinafter PREDATOR CONTROL]; see also Animal & Plant Health Inspection Serv., U.S. Dep't of Agric., *Wildlife Damage Management; Program Data Reports*, http://www.aphis.usda.gov/wildlife_damage/prog_data/prog_data_report_FY1996.shtml (last visited Apr. 15, 2010) (presenting tabular statistics for fiscal years 1996–2006 and graphical information for 2007 with links to state data); WENDY KEEFOVER-RING, *WILDEARTH GUARDIANS, WAR ON WILDLIFE: THE U.S. DEPARTMENT OF AGRICULTURE'S "WILDLIFE SERVICES"* (2009) [hereinafter WAR ON WILDLIFE] (describing more recent operations of the Federal Wildlife Services as "a 'sledgehammer approach' to wildlife management because of the breadth of extermination"); *infra* notes 77–78 and accompanying text.

⁶² Franz Camenzind, *Bio-Warfare on Wildlife*, JACKSON HOLE NEWS & GUIDE, Mar. 4, 2009, <http://www.jhalliance.org/Library/Perspectives/2009/Wolves&Mange.3-09.pdf> ("The 1905 rancher-dominated Montana Legislature passed 'an Act to provide for the extermination of wolves and coyotes by inoculating the same with mange.'). In an advance notice of proposed rulemaking the U.S. Fish and Wildlife Service (USFWS) discussed the debilitating effect of mange on wolves. See Final Rule to Identify the Northern Rocky Mountain Population of Gray Wolf as a Distinct Population Segment and to Revise the List of Endangered and Threatened Wildlife, 74 Fed. Reg. 15,123, 15,163–64 (Apr. 2, 2009).

⁶³ See generally MICHAEL J. ROBINSON, *PREDATORY BUREAUCRACY: THE EXTERMINATION OF WOLVES AND THE TRANSFORMATION OF THE WEST* (2005) (revealing the relationship between policymaking and wolves).

⁶⁴ Brad Knickerbocker, *With Predator Populations Rising, More Calls for Control*, CHRISTIAN SCI. MONITOR, Jan. 18, 2008, at 2.

⁶⁵ PREDATOR CONTROL, *supra* note 61, at 1.

stock.”⁶⁶ The first appropriation for direct predator-control efforts—\$125,000 to the Bureau of Biological Survey—came in 1915.⁶⁷ Soon “the government found itself saddled with an obligation that continues to this day.”⁶⁸

While federal predator control efforts eventually supplanted or absorbed state programs,⁶⁹ predator control involved cooperation among local, state, and federal government and livestock producers. Livestock associations and some individual ranchers helped fund predator control activities. A federal advisory committee, which studied the predator control program in 1971,⁷⁰ opined that the confluence of various factors—including longstanding federal involvement, government “trappers” who made a career of killing predators, and commingled funds—had established “a continuity of purpose in promoting the private interest of livestock growers, especially in the western rangeland states” and produced a “high degree of built-in resistance to change” in predator policies.⁷¹ But the committee noted that, while “the program is popular with ranchers, many of whom urge even more intensive efforts, it has become increasingly objectionable to the public at large.”⁷² The “federal-state predator control program must be effectively changed,” the panel concluded. “It must take full account of the whole spectrum of public interests and values, not only in predators but in all wildlife.”⁷³

In 1971, this predator control program cost \$8 million.⁷⁴ By 2001, federal expenditures of taxpayer dollars for all animal damage control activities, including predator control, were \$23.3 million.⁷⁵ The killing is carried out by the U.S. Department of Agriculture’s ironically named “Wildlife Services.”⁷⁶ In 2006 the tally included more than 117,000 na-

⁶⁶ *Id.*

⁶⁷ *Id.*

⁶⁸ *Id.* While these words were written in 1972, they remain true today.

⁶⁹ As western states began to help finance federal control efforts, they largely phased out their own programs. *See id.*

⁷⁰ CEQ chairman Russell Train referred to the seven scientists who produced the report *Predator Control—1971* as “distinguished consultants.” *Id.* at preface.

⁷¹ PREDATOR CONTROL, *supra* note 61, at 2.

⁷² *Id.*

⁷³ *Id.*

⁷⁴ *Id.* at 1.

⁷⁵ U.S. GEN. ACCOUNTING OFFICE, WILDLIFE SERVICES PROGRAM: INFORMATION ON ACTIVITIES TO MANAGE WILDLIFE DAMAGE 3 (2001) (“The Wildlife Services program spent nearly \$60 million on such damage control activities in fiscal year 2000; the program provided about \$23.3 million of these funds, and its clients provided the remaining \$36.4 million.”).

⁷⁶ In 2008, Wildlife Services’ total operations budget was more than \$120 million, about half of which was paid by cooperators. WILDLIFE SERV., THE FACTS ABOUT WILDLIFE

tive carnivores, including coyotes, bobcats, foxes, bears, and wolves.⁷⁷ In 2008 the numbers of animals (chiefly coyotes and wolves) killed from low-flying aircraft *increased by forty percent* from the prior year.⁷⁸ All this despite the small numbers of livestock lost to predators and a lack of correlation between numbers of predators killed and stock lost.⁷⁹

SERVICES WILDLIFE DAMAGE MANAGEMENT, FY 2008 at 1 [n.d.], *available at* http://www.aphis.usda.gov/wildlife_damage/state_report_pdfs/FY_2008_State_Reports/2-facts_management%20information_assistance-1a.pdf. Operations include the use of “nonlethal and lethal [management] methods.” *Id.* According to the Natural Resources Defense Council, “The actual annual price tag on predator control is not clear. The structure of Wildlife Services’ budget tends to obscure the full cost of specific predator control methods to taxpayers.” Posting of Andrew Wetzler, to Switchboard, http://switchboard.nrdc.org/blogs/awetzler/wildlife_services_the_most_imp.html (Dec. 2, 2009).

⁷⁷ In 2006, Wildlife Services killed 1.6 million animals, including 117,113 mammalian carnivores, of which 34,056 were shot from aircraft in western states. The regional aerial gunning toll included 25,349 coyotes, 449 bobcats, 56 wolves, and 81 red foxes. *See* AGRO: A National Coalition to End Aerial Gunning of Wildlife, <http://www.goagro.org/index> (locate the kill statistics by clicking “Wildlife Killed”) (last visited Apr. 15, 2010). Wildlife Services’ kill statistics for 1996–2007 are available at http://www.aphis.usda.gov/wildlife_damage/prog_data/prog_data_report_FY1996.shtml. *See supra* note 61. According to one study by federal researchers, the cost of killing a coyote is between \$185 and \$805 *per individual*. *See* Kimberly Wagner & Michael Conover, *Effect of Preventive Coyote Hunting on Sheep Losses to Coyote Predation*, 63 J. WILDLIFE MGMT. 606, 609 (1999) (estimating for portions of Utah and Idaho that “aerial hunting removed 2.3 coyotes/hr at a cost of \$185/coyote, while corrective control removed 0.03 coyotes/hr . . . at a cost of \$805/coyote”); *see also* Brian Mitchell et al., *Coyote Depredation Management: Current Methods and Research Needs*, 32 WILDLIFE SOC’Y BULL. 1209, 1213-14 (2004). In 2008, Wildlife Services “exterminated nearly five million wild animals and pets . . . —a record number and a 125% increase from the 2.2 million animals killed in 2007.” Press Release, WildEarth Guardians, Wildlife Services Exterminates 125% More Animals in 2008 (June 17, 2009), *available at* <http://wildearthguardians.org/library/paper.asp?nLibraryID=765> [hereinafter WildEarth Guardians Press Release]. Wildlife Services claims that the dramatic increase in kill numbers from 2007 to 2008 is due in part to its use of “modeling to better calculate bird mortalities from the avian pesticide, DRC-1339,” which is “mainly used in feedlots and experimentally near sunflower plantations in North Dakota and South Dakota.” *Id.* *See generally* WAR ON WILDLIFE, *supra* note 61 (explaining the role of Wildlife Services in predator control programs).

⁷⁸ *See* WildEarth Guardians Press Release, *supra* note 77.

⁷⁹ “Of the 104.5 million cattle that were produced [in the U.S.] in 2005, 190,000 (or 0.18%) died as the result of predation from coyotes, domestic dogs, and other carnivores. In comparison, livestock producers lost 3.9 million head of cattle (3.69%) to all sorts of maladies, weather, or theft.” AGRO: A National Coalition to End Aerial Gunning of Wildlife, http://www.goagro.org/wildlife_and_agriculture.htm (last visited Apr. 15, 2010). The numbers of predators killed to protect livestock is highly disproportionate—one study showed that 1.5 to 9.7 million animals were killed for the benefit of agricultural interests “without cause,” or indiscriminately, by federal agents during the period 1996 to 2001. *See* Adrian Treves & K. Ullas Karanth, *Human-Carnivore Conflict and Perspectives on Carnivore Management Worldwide*, 17 CONSERVATION BIOLOGY 1491, 1494 (2003). Studies show no correlation between the number of coyotes killed and the number of lambs lost. *See, e.g.*, Frederick F. Knowlton et al., *Coyote Depredation Control: An Interface Between Biology and Management*, 52 J. RANGE MGMT. 398, 407 (1999); Mitchell et al., *supra* note 77, at 1213; *see also*

Western “range” states remain unabashedly solicitous of livestock interests, and Wyoming arguably heads up that list. Wyoming’s wolf management plan, for instance—which refers to wolves’ “notorious reputation as livestock killers”⁸⁰—is plainly a sop to the livestock industry and a handful of hunters and outfitters. The plan (to date, rejected by the U.S. Fish and Wildlife Service) classifies wolves as “predatory animals” in about ninety percent of the state. This subjects them to being shot on sight and to regulation (or not) by the state Department of Agriculture.⁸¹ One high-ranking Wyoming Game and Fish Department (WGFD or the Department) official stated publicly that the Department plans to “maintain a higher number of wolves than the minimum required,” *but only to* “allow us some flexibility in dealing with wolves that are impacting livestock or wildlife and need to be removed.”⁸²

WYO. GAME & FISH COMM’N, FINAL GRAY WOLF MANAGEMENT PLAN 8 (Nov. 16, 2007) [hereinafter WYOMING WOLF MANAGEMENT PLAN] (conceding that “livestock losses to wolves are minimal industry-wide”).

⁸⁰ WYOMING WOLF MANAGEMENT PLAN, *supra* note 79, at 8. The plan concedes: “Wolf depredation on livestock undoubtedly intensified [in the early 1900s] due to the depletion of natural prey and expanding livestock presence.” *Id.*

⁸¹ *See id.* at 4 (“Prior to 2003, the gray wolf was classified by [W.S. 23-1-101(a)(viii)] as a predatory animal. This classification was changed in the 2003 legislative session to a dual status, following delisting by the USFWS, of ‘trophy game animal’ or ‘predatory animal’ depending on the area they occupy.”); *see also* WYO. STAT. ANN. §§ 23-1-101(a)(xii)(B), -101(b), -108, -304(a) (2009) (classifying wolves as either a trophy game animal or predatory animal upon delisting). The “trophy game animal” status, which applies only to wolves in the northwestern corner of the state, allows wolves to be hunted during designated seasons by those authorized to do so by the State. Outside that area wolves would have no protection under state law. They would not even be managed by the WGFD. *See* WYOMING WOLF MANAGEMENT PLAN, *supra* note 79, at 4 (“Outside of the aforementioned area, wolves will be classified as predatory animals. The Department will collect certain management data in this area but will not manage nuisance conflicts. Predatory animals are regulated under Title 11, Chapter 6 of the Wyoming Statutes, by the Department of Agriculture.”); *see also id.* at 10, 15 (“In areas of Wyoming where the wolf is classified as a predatory animal, take will not be regulated.”). The plan summarizes “Legal Wolf Mortality” thus:

Upon delisting, legal wolf mortality will result from such things as agency removals, public take (i.e., hunting and trapping), or in defense of life or private property. The Department or its authorized agent may lethally remove wolves, when deemed necessary, to mitigate wolf conflicts with wildlife, livestock, or humans (see “Nuisance Wolf Management” section of this plan). Taking wolves in areas where they are designated as predatory animal also will be legal.

Id. at 14.

⁸² *See* Eric Keszler, *Next Step for Wolves*, WYO. WILDLIFE, May 2008, at 6, 8 *available at* http://gf.state.wy.us/downloads/pdf/wolfreport/Next_Step_For_Wolves.pdf (quoting Bill Rudd, assistant wildlife chief for the WGFD). Keszler is WGFD Assistant Services Division Chief.

The plan itself states that the “Department is determined to keep economic [that is, livestock] losses from a recovered wolf population to a minimum.”⁸³ The Wyoming Range and the southern Wind River Range, largely unsettled and undeveloped, are deemed “unsuitable” for wolves *solely* because sheep grazing is permitted in national forests there.⁸⁴ The plan acknowledges that “wolf predation may have a negative effect on some [big game] herds and, thus, hunter harvest.” But it reassures hunters (and outfitters) that “impacts to big game are expected to be tolerable” since “most of the packs that reside outside [Yellowstone National Park] and the [National Elk Refuge (NER)] are subject to take under the dual status classification,” i.e., classified as “predatory animals” and subject to being shot on sight.⁸⁵ “Removal,” the

⁸³ WYOMING WOLF MANAGEMENT PLAN, *supra* note 79, at 32; *see also id.* at 2 (“Nuisance wolves will be managed . . . to minimize conflicts between wolves and humans. The Department will enter into a cooperative agreement with Wildlife Services (WS), which will assist the Department in managing conflicts between wolves and livestock.”). The plan even refers to the need to “minimize wildlife or livestock conflicts” in the northwestern portion of the state where wolves supposedly will be protected. *Id.* at 11. It provides that after delisting, wolves may be lethally removed when the Department deems it “necessary, to mitigate wolf *conflicts with wildlife, livestock, or humans.*” *Id.* at 14 (emphasis added). Further, the Department promises to “pursue all possible funding sources for the livestock compensation program, including Federal or State appropriations, public/private foundations, and other sources.” *Id.* at 20.

⁸⁴ *Id.* at 11. Reflecting that “suitability” is a determination made by the agency, *not* the wolves, the plan continues: “Several individual and pairs of wolves have attempted to use the lower portion of the Wyoming Range in the last few years. Almost all of them have been removed from the population due to livestock depredations.” *Id.* The plan further notes that, during the 1974–1980 recovery planning process, one of the criteria used to identify recovery areas was “the absence, if possible, of livestock grazing.” *Id.* at 9.

⁸⁵ *See id.* at 27; *see also supra* note 81 and accompanying text. Elk numbers in Wyoming actually *exceeded* the Department’s “objective,” or target population—by 14% statewide in 2007. In fact, the “elk population, number of elk harvested, and elk hunter success rates have steadily increased [over the past 30 years] both before and after wolf reintroduction.” *See* Tory Taylor & Meredith Taylor, *Barstool Mountain Myths: Wolves & Elk Numbers Strong Despite Dire Predictions*, WYOFILE, Apr. 6, 2009, <http://wyofile.com/2009/04/barstool-mountain-myths-wolves-elk-numbers-strong-despite-dire-predictions/>; *see also* SMITH ET AL., *supra* note 38, at 19–20 (reporting Jackson area elk population trends in the 20th century); *cf.* Press Release, Wyo. Game & Fish Dep’t, Game and Fish Department Comments on Federal Elk and Bison Management Plan (Nov. 4, 2005), *available at* http://gf.state.wy.us/services/news/press-releases/05/10/14/051014_1.asp (“The entire Jackson Elk Herd, which includes animals on the National Elk Refuge [(NER)] and Grand Teton National Park, is estimated at 13,000 animals. The Game and Fish Department’s population objective for that herd is 11,029 animals.”). Smith et al. observe that, despite conflicts over forage between cattle and elk, Jackson Hole stockmen in the late 1800s and early 1900s did not kill elk as did “frontiersmen” elsewhere. Instead, “stockmen’s associations . . . were formed to exterminate wolves.” SMITH ET AL., *supra* note 38, at 16.

plan states matter-of-factly, “is often the most effective management option for wolves that kill livestock.”⁸⁶

Montana pays comparable heed to the views of ranchers and vocal big-game hunters in its plans for managing wolves and elk.⁸⁷ Its elk plan mentions wolves in two contexts: hunters’ concerns about wolves, and the possible need to reduce wolf numbers if elk calf recruitment declines.⁸⁸ The plan observes that the “restoration of wolves to western Montana is an emerging factor in elk population management,”⁸⁹ which plainly refers to hunter harvest levels.⁹⁰ Nowhere does the plan suggest that wolves might have a salutary effect on the health of wild ungulate populations or their habitat.⁹¹

⁸⁶ WYOMING WOLF MANAGEMENT PLAN, *supra* note 79, at 21.

⁸⁷ See generally MONT. DEP’T OF FISH, WILDLIFE & PARKS, MONTANA STATEWIDE ELK MANAGEMENT PLAN (2004). See also *id.* at 158 (“Ranchers and some hunters have expressed concern about the presence of wolves.”); *id.* at 166 (describing establishment of working groups whose objectives include “explor[ing] innovative ways to minimize elk damage to agricultural producers” and “discuss[ing] the potential impact of predators (including wolves) on elk populations”); *id.* at 264 (“[S]ome hunters and landowners believe wolves have changed the behavior and distribution of elk, making it more difficult to harvest elk.”); *id.* at 267 (“People are very concerned about the possible impacts of increasing predator populations on elk, particularly the impacts of wolves and grizzly bears. There is a perception that wolves have already made it more difficult for hunters to harvest elk.”); *id.* at 285 (“There is a perception among hunters and landowners that wolves have changed the behavior and distribution of elk, making it more difficult to harvest elk. Further, the changes in distribution appear to be resulting in elk spending more time occupying areas in or near agricultural croplands, thereby increasing damage complaints.”). One of my favorite observations: “Landowners who have complained of too many elk in the past, are now concerned about the presence of wolves.” *Id.* at 198.

⁸⁸ See *id.* at 47 (“The effects of wolves and other predators on elk populations was [sic] one of the top issues of concern to the public in our scoping for issues relative to this Elk Management Plan revision.”); *id.* at 47–48 (“In 2002, 81.1% of [interviewees] listed wolves as one of the top 3 issues mentioned by hunters compared to 3.8% in 1996.”); *id.* at 48 (noting that after delisting, “[i]f there are more than 15 breeding pairs [in Montana], FWP [Montana Department of Fish, Wildlife and Parks] will reduce pack size through liberal management tools, which could include regulated hunting or trapping. Wolf management actions would be paired with other corrective measures to reduce ungulate mortality or enhance recruitment”); see also *id.* at 36 (discussing potential reasons for changes in elk calf recruitment rates).

⁸⁹ *Id.* at 132.

⁹⁰ This comment occurs repeatedly: “The degree of impact wolves have on elk populations is unknown at this time, but will be a consideration in future management decisions.” See *id.* at 236.

⁹¹ Instead, the plan states: “When wolves are delisted and Montana assumes management authority for wolf populations, FWP will attempt to balance the needs of both wolf and elk populations with the interests of hunters, non-hunters, and landowners.” *Id.* at 275. The Department found one good thing to say about wolves in its 2004 report on feedgrounds: “During spring, wolves may improve management by moving elk away from feed-

In fact, nothing is said in any of these Montana or Wyoming documents about the relationship between wolves and elk and the condition of willow and aspen communities. The potential ecological benefits from wolf reestablishment receive no attention.⁹² Incredibly, the plans are *devoid of any discussion of ecology*, much less trophic cascades research.

Livestock producers comprise a tiny fraction of the population; public-land ranchers are an even smaller group.⁹³ The hunters who oppose wolf reintroduction are a minority of all big game hunters.⁹⁴ But the stubbornness of these few has a powerful impact.

Their intransigence, and the agencies' bias, is even more blatant in winter elk feeding policies.

grounds to spring transitional ranges." WYO. GAME & FISH DEP'T, ELK FEEDGROUNDS IN WYOMING 19 (2004).

⁹² See WYO. GAME & FISH DEP'T, STRATEGIC HABITAT PLAN 12 (2009) ("Promot[ing] habitat management that enhances cottonwood and willow galleries, aspen stands, woody draw complexes and healthy shrub communities that benefit wildlife" is one of the strategies the Department has identified for achieving its first habitat-related goal, namely: "Conserve and manage wildlife habitats that are crucial for maintaining terrestrial and aquatic wildlife populations for the present and future."). While the plan contains no mention of wolves, predators, or trophic cascades, it refers several times to livestock grazing. The Department proposes that it will "[w]ork with landowners, land managers, partners and the public to manage wildlife and livestock numbers that maintain vigorous, healthy and sustainable shrub communities." *Id.* at 17. WGFD will also "[w]ork with landowners [and others] on grazing management programs that enhance sustainability of rangelands and wildlife habitat." *Id.*

⁹³ According to Jim Magagna, former president of the Wyoming Stock Growers Association (WSGA), WSGA membership totals 1096. There are only 232 WSGA members in the six counties where cattle are considered by the WSGA to be susceptible to brucellosis infection from elk. See Wyoming Stock Growers Association's Memorandum in Support of Motion to Intervene, Greater Yellowstone Coalition v. Bosworth, Civil Action No. 06-CV-37-B, 2006 WL 1505681 (D. Wyo., Apr. 10, 2006) [hereinafter WSGA Motion to Intervene]; see also A. Marm Kilpatrick et al., *Wildlife-Livestock Conflict: The Risk of Pathogen Transmission from Bison to Cattle Outside Yellowstone National Park*, 46 J. APPLIED ECOLOGY 476, 478-79, 481 fig.1 (2009) (citing the small number of livestock operators in Yellowstone area and mapping locations and sizes of cattle herds). By comparison tourism accounts for "3870 jobs and nearly \$67 million in earnings" in Park County (Yellowstone) alone. See Ruffin Prevost, *Wildlife, Natural Resources Top Tourism Priorities*, BILLINGS GAZETTE, Oct. 10, 2006, http://billingsgazette.com/news/state-and-regional/wyoming/article_a2d067b9-fb52-5943-b06a-ccc3d32a0ec5.html.

⁹⁴ Cf. Taylor & Taylor, *supra* note 85. The Taylors are long-time outfitters in northwestern Wyoming. Tory Taylor was appointed to the Brucellosis Task Force by Wyoming Governor Mike Sullivan in 1999 to represent the Wyoming Wildlife Federation and sportsmen. See Tom Thorne, *Historic Review and Update on Previous Committees*, Apr. 8, 2004 (listing members of the Task Force).

III. ELK FEEDGROUNDS AND WILDLIFE DISEASE

The undesirable consequences of supplemental feeding have been recognized for a century. One of Wyoming's first game wardens urged in 1909, not long after extensive elk feeding began, that elk should not be "semidomesticated" by feeding, as it "would soon take them out of the category of wild animals and put them in a class with the elk of eastern game parks."⁹⁵ In 1912 Teddy Roosevelt advised against maintaining unnaturally high populations of elk by feeding.⁹⁶ Biologist John Craighead warned in 1950 that "drastic corrective measures" were needed to prevent the "eventual extermination" of "preferred browse species" on the National Elk Refuge (NER) by elk concentrated by artificial feeding.⁹⁷ NER managers and biologists continue to chronicle progressive habitat deterioration: winter browse is increasingly scarce, "favored forage plants" are "universally hedged" or absent, aspen recruitment is nonexistent, and "cascading effects" on bird and small mammal communities have been documented.⁹⁸ In fact, in 2007 refuge managers concluded: "All of the biological issues identified [on the NER] stem from the winter feeding program."⁹⁹

⁹⁵ See Cory Hatch, *Is a Wild Animal Wild When It Can't Roam?*, JACKSON HOLE NEWS & GUIDE, June 17, 2009, <http://www.greateryellowstone.org/news/index.php?id=66> (quoting Daniel C. Nowlin). In fact, elk fed and managed like cattle "begin to act very much like cattle A common name for elk, not widely used but appropriate, is the 'forest cow.'" Beschta email, *supra* note 44. Conversely, I have heard wildlife biologists refer to cattle as "slow elk." Rather than feeding elk, Warden Nowlin had proposed in 1906 that a refuge for elk and other wildlife be established in the Gros Ventre Valley; the Wyoming Legislature passed a memorial requesting a grant "comprising six townships of public land" for that purpose. But the idea was opposed by resident stockmen, and the "proposal died." See SMITH ET AL., *supra* note 38, at 18. Two years later Nowlin and E.A. Preble, a Bureau of Biological Survey scientist, wrote a report recommending the "reservation of a permanent winter range in Jackson Hole, calling it 'essential for the proper protection of the elk.'" Bruce L. Smith, *Winter Feeding of Elk in Western North America*, 65 J. WILDLIFE MGMT. 173, 174 (2001) [hereinafter Smith, *Winter Feeding*] (quoting E.A. Preble, *Report on Condition of Elk in Jackson Hole, Wyoming in 1911*, 40 U.S. DEP'T OF AGRIC. BIOLOGICAL SURVEY BULL. 1 (1911)).

⁹⁶ See SMITH ET AL., *supra* note 38, at 132 (quoting Roosevelt's *1912 Comments on Yellowstone Elk*).

⁹⁷ See *id.* at vii.

⁹⁸ See, e.g., *id.* at 133, 134.

⁹⁹ U.S. FISH & WILDLIFE SERV., & NAT'L PARK SERV., BISON AND ELK MANAGEMENT PLAN NATIONAL ELK REFUGE, GRAND TETON NATIONAL PARK, at vi (2007) [hereinafter BISON AND ELK PLAN] (emphasis added), available at <http://www.fws.gov/bisonandelkplan/Final%20Plan/Bison%20and%20Elk%20Management%20Plan%20FINAL%20PLAN.htm>. The problems identified were high levels of brucellosis and increased risk of other major diseases in elk and bison, serious habitat damage, and impacts on other refuge wildlife, particularly scavengers. See *id.* Furthermore, feeding increases elk and bison populations, which "add[s] to the overall problem." See *id.*

Nevertheless, every winter some 20,000 elk are fed hay and alfalfa pellets on the NER and on twenty-two state-operated feedgrounds in northwest Wyoming.¹⁰⁰ Why? To put it simply—and delicately, as the Wyoming Game and Fish Department (WGFD or Department) does on its website—“Elk feedgrounds are a way to reduce the damage problems while maintaining the number of elk the public prefers.”¹⁰¹ The Department deemed it unnecessary to explain “the damage problems,” but if you suspect a connection with the ranching industry, you are on the right track.¹⁰² By feeding, WGFD aims to avoid even the *potential* for damage to private ranchlands or commingling of elk and cattle.¹⁰³ Motivations for feeding on the NER are similar.¹⁰⁴

¹⁰⁰ See Wyo. Game & Fish Dep’t, Elk Special Management Permit Information, <http://gf.state.wy.us/services/education/feedground.asp> (last visited Apr. 15, 2010) [hereinafter Elk Permit Information] (reporting that there are twenty-three feedgrounds in Wyoming, including the NER, and that “about 22,000” of the “[a]pproximately 30,000 elk [that] live in the Jackson-Pinedale region . . . use feedgrounds during the winter”); see also WYO. GAME & FISH DEP’T, *supra* note 91, at 4. Twenty-eight “elk hunt areas are associated with Wyoming’s 23 elk feedgrounds.” Elk Permit Information, *supra*.

¹⁰¹ Elk Permit Information, *supra* note 100.

¹⁰² According to the Wyoming Game and Fish Department, feedgrounds are necessary to protect livestock from wildlife diseases. See WYO. GAME & FISH DEP’T, *supra* note 91, at 10 (“[F]eedgrounds provide the only opportunity to effectively vaccinate elk [against brucellosis] . . .”); *id.* at 10–11 (“[F]eedgrounds . . . are one of the best methods to prevent co-mingling of elk and livestock during winter months.”); *id.* at 7 (“Nearly all of the 22 state-operated feedgrounds were established to prevent elk damage to stored hay crops and prevent co-mingling with livestock on private lands.”); *id.* at 15 (“Presence of elk on feedgrounds provides accessibility to elk to vaccinate them against brucellosis, thus reducing transmission of brucellosis among elk and the risk of transmission to cattle.”). Curiously, however, WGFD has *no legislative mandate* to protect domestic livestock. The WSGA intervened in litigation aimed at closing elk feedgrounds, and Jim Magagna, WSGA executive vice president, has publicly stated that “the association has many common interests with the state Game and Fish Department on the feedgrounds issue.” *Judge Allows Wyoming Stock Growers into Elk Feeding Lawsuit*, BILLINGS GAZETTE, June 6, 2006, <http://billingsgazette.com/articles/2006/06/06/news/wyoming/21-brucellosis.txt>.

¹⁰³ WYO. GAME & FISH DEP’T, *supra* note 91, at 22 (“If the potential for damage on private lands exists, elk are either moved to adjacent feedgrounds and/or feeding is initiated early to attract elk away from potential damage/co-mingling conflicts.”); *id.* at 7 (“Nearly all of the 22 state-operated feedgrounds were established to prevent elk damage to stored hay crops and prevent co-mingling with livestock on private lands.”); *id.* at 14 (“Because of the reservoir of brucellosis in elk and bison of the [greater Yellowstone area], producers in Wyoming, Idaho, and Montana will continue to have to vaccinate their cattle and participate in surveillance programs indefinitely. These activities are expensive for producers . . .”); see also U.S. FOREST SERV., U.S. DEP’T OF AGRIC., DRAFT ENVIRONMENTAL IMPACT STATEMENT, LONG TERM SPECIAL USE AUTHORIZATION FOR WYOMING GAME AND FISH COMMISSION TO USE NATIONAL FOREST SYSTEM LAND FOR THEIR WINTER ELK MANAGEMENT ACTIVITIES 7–8 (2008) [hereinafter DEIS LONG TERM SPECIAL USE AUTHORIZATION] (“A major role of elk feedgrounds today is to reduce the commingling of elk and cattle for concerns over elk-to-cattle brucellosis transmission. Thus, elk feedgrounds are . . . main-

Winter feeding of elk typifies the long discredited “agricultural paradigm” of wildlife management, which treats game species as crops, “employ[ing] simplified concepts of ecosystems in an attempt to increase yields.”¹⁰⁵ Olaus and Mardy Murie, biologists and long-time Jackson, Wyoming, residents, wrote:

People do not want to provide enough natural range for wildlife. Sportsmen demand bigger and bigger game herds but do not trouble to provide living space for them in the way nature intended. They want to simply stuff the animals with hay, the easy way—and that is supposed to settle all problems. *That’s* what’s the trouble with the elk!¹⁰⁶

This “production-consumption” approach to wildlife management “is *not* based on scientific principle [or] sustainable resource management policy.”¹⁰⁷ In the case of the feedgrounds, it is dictated by sociopolitical considerations. The Department rationalizes the feedgrounds as “a complex

taining the disease in elk while limiting elk-to-cattle transmissions at the same time.”); *infra* discussion at notes 104, 118–119.

¹⁰⁴ In 2007 the USFWS and National Park Service (the Services) completed a joint plan for managing bison and elk in the NER and Grand Teton National Park. See generally BISON AND ELK PLAN, *supra* note 99. In spite of all the biological problems caused by feeding, alternatives that would have phased out the feedgrounds were rejected, largely because of anticipated conflicts with private property, chiefly ranching. See *id.* at vi. Benefits of feeding cited in the plan and EIS include “protecting local ranchers’ haystacks and livestock pastures . . . from depredation by foraging elk,” and further reducing the “low risk of brucellosis transmission from elk or bison to cattle [and its] minimal economic impacts.” *Id.* at vi, 510. The EIS also pointed out that without feeding elk would “venture[] further from the refuge in search of native forage,” and “management action by WGFD personnel could be required” to prevent damage to private property. See *id.* at 273 (noting that such action “could include depredation hunts, agency removal, or relocation of elk”). Similarly, “free-ranging bison would likely not be allowed [in most areas outside the Park]. They would be hunted or removed by the state because of threats to public safety, property, or the health of domestic livestock.” *Id.* at 325. The plan pledges that the Services will “[w]ork cooperatively with the state of Wyoming and others to reduce the prevalence of brucellosis in the elk and bison populations in order to protect the economic interest and viability of the livestock industry.” See *id.* at ix.

¹⁰⁵ See Richard A. Lancia et al., *ARM! For the Future: Adaptive Resource Management in the Wildlife Profession*, 24 WILDLIFE SOC’Y BULL. 436, 438 (1996).

¹⁰⁶ MARGARET MURIE & OLAUS MURIE, WAPITI WILDERNESS 176–77 (1966). Indeed, in Wyoming the agricultural paradigm manifests in yet another way: bison is classified as livestock, not wildlife—unless the Wyoming Livestock Board approves a redesignation! See *infra* note 161; see also Dean Lueck, *The Extermination and Conservation of the American Bison*, 31 J. LEGAL STUD., S609, S646 (2002) (reporting that “nearly all states govern bison under the law of livestock”).

¹⁰⁷ Smith, *Winter Feeding*, *supra* note 95, at 185 (emphasis added).

biological, social, economic and political issue.”¹⁰⁸ “What started as a logical solution to some very real problems [for example, elk die-offs and damage to stored hay] has become one of the most complex and controversial wildlife management challenges of the 21st century.”¹⁰⁹

Today, primarily because of new knowledge about disease risks, supplemental feeding is criticized nearly universally by biologists.¹¹⁰ The feedlots are like huge petri dishes, providing ideal conditions for propagating disease.¹¹¹ Six viral, bacterial, and parasite-borne diseases—that we know of—occur in the NER in northwestern Wyoming.¹¹² According

¹⁰⁸ WYO. GAME & FISH DEP’T, CHRONIC WASTING DISEASE MANAGEMENT PLAN 5 (2006), available at <http://gf.state.wy.us/downloads/pdf/CWDPlanapprovedbycommission2-17-06.pdf> [hereinafter CWD PLAN]; cf. BISON AND ELK MANAGEMENT PLAN, *supra* note 99, at 126 (citing “social” and “political” barriers to phasing out supplemental feeding on the NER).

¹⁰⁹ WYO. GAME & FISH DEP’T, *supra* note 91, at 2.

¹¹⁰ See, e.g., MARKUS J. PETERSON, CHRONIC WASTING DISEASE AND THE GREATER YELLOWSTONE AREA 15 (2005) [hereinafter PETERSON, GREATER YELLOWSTONE AREA]; MARKUS J. PETERSON, DEP’T OF THE INTERIOR, INFECTIOUS AGENTS OF CONCERN FOR THE JACKSON HOLE ELK AND BISON HERDS: AN ECOLOGICAL PERSPECTIVE 31 (2003) [hereinafter PETERSON, INFECTIOUS AGENTS]. Dr. Peterson, a wildlife disease specialist and associate professor in the Department of Wildlife and Fisheries Sciences at Texas A&M University, was hired by Greater Yellowstone Coalition to prepare a detailed report on disease risks to the NER for the Elk and Bison EIS. See PETERSON, GREATER YELLOWSTONE AREA, *supra*, at i, 1. Dr. Tom Roffe, regional chief of wildlife health for U.S. Fish and Wildlife Service, asserted that he was unable to “find a single wildlife health professional outside of the [WGFD] who advocates the feeding of wildlife.” Memorandum in Support of Plaintiffs’ Motion for Summary Judgment at 6-7, *Defenders of Wildlife v. Salazar*, No. 08-cv-00945 (RJL) (D.D.C. Feb. 18, 2009) [hereinafter *Defenders of Wildlife v. Salazar Memo*] available at http://www.defenders.org/resources/publications/programs_and_policy/in_the_courts/elk_refuge_opening_brief.pdf (citing and quoting a May 15, 2006 memo by Dr. Roffe). The USFWS publicly acknowledged that the high levels of brucellosis in refuge elk and bison, as well as the increased risk of other major diseases, such as CWD, are due to winter feeding. See *supra* note 99 and accompanying text. The lead author on a recent study, which documented that CWD prions are spread in feces, stated that the evidence “likely has important implications for feedgrounds ‘If you think of areas where these animals congregate, you would find higher concentrations of feces in those areas,’ he said. ‘Feedgrounds would be a very good way of spreading this disease.’” Cory Hatch, *Feces on Feedgrounds Could Spread Wasting Disease; Officials Call for Phaseout of Feeding Elk Herds*, JACKSON HOLE NEWS & GUIDE, Sept. 16, 2009, http://www.jhnewsandguide.com/article.php?art_id=5068 (quoting Erdem Tamgüney, assistant professor of neurodegenerative diseases at University of California-San Francisco); see also Gültekin Tamgüney et al., *Asymptomatic Deer Excrete Infectious Prions in Faeces*, 461 NATURE 529, 529–31 (2009); *infra* note 127.

¹¹¹ See Chris Merrill, *Wildlife Disease Debate Heats Up*, CASPER STAR TRIB., Oct. 20, 2008, http://trib.com/news/state-and-regional/article_9eccc191-9df1-5ad9-9ffe-b81d836cc781.html (quoting Jackson Hole Conservation Alliance director Franz Camenzind as likening a feedground to a “walk-in, walk-out petri dish”).

¹¹² See BISON AND ELK PLAN, *supra* note 99, at 129–34. The plan also discusses several other diseases and parasites that are “undocumented” but which could be present or appear in the future. See *id.* at 134–39.

to Dr. Tom Roffe, regional chief of wildlife health for U.S. Fish and Wildlife Service: “feeding elk is *not* management based on sound science related to biology and ecology.”¹¹³ In fact, “crowding of animals is at the heart of the transmission–infection–disease perpetuation cycle.”¹¹⁴ “If you tried to design a system that would magnify wildlife diseases, you couldn’t do much better than what we’re doing now.”¹¹⁵

One of these diseases is brucellosis. Scientists have recognized for at least thirty years that “artificial concentration of elk during winter and early spring perpetuates the disease brucellosis.”¹¹⁶ This bacterial disease was introduced to elk (and bison) *from cattle*,¹¹⁷ and stock owners fear that these wild ungulates will transmit the disease back to cattle herds, from which it was eradicated at great cost.

The irony here is thick: The effects of brucellosis in elk are relatively benign, and *only* elk that frequent feedgrounds carry the disease. Also, no case of Yellowstone National Park bison transmitting the disease to cattle has ever been documented.¹¹⁸ But the chosen “solution”

¹¹³ See *Defenders of Wildlife v. Salazar Memo*, *supra* note 110, at 6 (emphasis added) (quoting Roffe memo of May 15, 2006).

¹¹⁴ BRUCE L. SMITH, DISEASE AND WINTER FEEDING OF ELK AND BISON: A REVIEW AND RECOMMENDATIONS PERTINENT TO THE JACKSON BISON AND ELK MANAGEMENT PLAN AND ENVIRONMENTAL IMPACT STATEMENT 7 (2005).

¹¹⁵ Kirk Johnson, *Wyoming Thinks Twice About Feeding the Elk*, N.Y. TIMES, Feb. 18, 2009, at A14 (quoting Dr. Thomas J. Roffe).

¹¹⁶ DEIS LONG TERM SPECIAL USE AUTHORIZATION, *supra* note 103, at 7 (citing E.T. Thorne et al., *Brucellosis in Elk. II. Clinical Effects and Means of Transmission as Determined Through Artificial Infections*, 14 J. WILDLIFE DISEASES 280 (1978)).

¹¹⁷ See Mary Meagher & Margaret E. Meyer, *On the Origin of Brucellosis in Bison of Yellowstone National Park: A Review*, 8 CONSERVATION BIOLOGY 645, 645 (1994).

¹¹⁸ See Kilpatrick et al., *supra* note 93, at 477. There seem few limits to the State of Wyoming’s willingness to subsidize the livestock industry. As part of the State’s continuing surveillance of brucellosis in Wyoming elk, WGFD sends hunters a blood vial and postage-free mailer, along with a letter asking them to take a blood sample from any elk harvested and send it to the Department for testing. Having drawn an elk tag for the 2009 season, I received one of these packets even though my hunt area is in *southeastern* Wyoming, at least 250 miles (straight-line distance) from the nearest known incidence of brucellosis in elk! Worried that wolves carrying brucellosis could “shut [the Wyoming cattle industry] all down,” the Wyoming Senate passed a bill in 2009 to appropriate \$45,000 to sample and test animals for the disease. See Matt Joyce, *Lawmakers Want to Test Wolves for Brucellosis*, CASPER STAR. TRIB., Feb. 24, 2009, http://trib.com/news/state-and-regional/article_9b4fbc60-6795-52ef-92d9-6f870ff4fcde.html (quoting Sen. Kit Jennings, one of the sponsors of Senate File 87); Angus M. Thuermer Jr., *Wolves Brucellosis-Free*, JACKSON HOLE NEWS & GUIDE, Mar. 14, 2009, http://www.jhnewsandguide.com/article.php?art_id=4357. Most biologists and veterinarians, however, “consider canids to be largely immune from contracting or spreading the [*Brucella*] bacteria.” Thuermer, *supra*. In 2009, the University of Wyoming Trustees approved a budget increase for brucellosis research. Press Release, University of Wyoming, University of Wyoming Trustees Approve Spending Plan (May 30, 2009), available at <http://www.wyoming.edu/news/showrelease.asp?id=31701>. Within days of this announcement, the University of

for avoiding even the slight possibility of infection is to maintain the feedgrounds, which both increase the prevalence of brucellosis in elk, thus increasing the possibility of transmission,¹¹⁹ and make elk more prone to other, fatal diseases.¹²⁰ And there's more: feedgrounds are far from the most cost effective solution to the brucellosis problem.¹²¹

Wyoming also announced "cuts in spending in support budgets across the university, a hiring squeeze, staff layoffs and elimination or deferrals of some initiatives" designed to "achieve the 10 percent budget cut announced by Gov. Freudenthal for Fiscal Year 2010." Press Release, University of Wyoming, University Response to State Budget Reductions (June 4, 2009), available at <http://www.uwyo.edu/news/showrelease.asp?id=31864>; see also Press Release, University of Wyoming, UW Trustees Approve Biennium Budget Request (Aug. 27, 2009), available at <http://wyoming.edu/news/showrelease.asp?id=34202> (reporting that the 2009–2010 UW budget request, which continues the "budget reductions enacted in June [2009]," "includes only two requests," one of which is for "\$814,000 . . . to develop a more effective vaccine and more reliable diagnostic test for brucellosis").

¹¹⁹ The WGFD's reasoning is truly circular: the agency concedes that "data support the contention that feedgrounds increase the probability of disease transmission," but it argues that "[p]resence of elk on feedgrounds provides accessibility to elk to vaccinate them against brucellosis, thus reducing transmission of brucellosis among elk"! See WYO. GAME & FISH DEP'T, *supra* note 91, at 10, 15.

¹²⁰ Bruce Smith explains: "The conditions of animal crowding, shared feedsites, bedsites, water sources, and accumulated excreta on feedgrounds promote relatively unsanitary conditions that benefit many pathogens and promote transmission of diseases which have a density dependent component. This explains why brucellosis is maintained in feedground elk, but not those unassociated with feedgrounds . . ." SMITH, *supra* note 114, at 15. See generally Smith, *Winter Feeding*, *supra* note 95. According to WGFD:

Seroprevalence data [for brucellosis] collected from 12 feedgrounds where elk have been vaccinated averaged 23.6% (range: 13–30%); the average seroprevalence of elk from the unvaccinated Dell Creek feedground has been 32%. The seroprevalence of elk not frequenting feedgrounds has averaged 2.3%. These data support the contention that feedgrounds increase the probability of disease transmission.

WYO. GAME & FISH DEP'T, *supra* note 91, at 10; accord BISON AND ELK PLAN, *supra* note 99, at 70 ("In areas where both elk and bison are present, and there is no supplemental feeding program, interspecies transmission [of brucellosis] is low."); Matthew J. Ferrari & Robert A. Garrott, *Bison and Elk: Brucellosis Seroprevalence on a Shared Winter Range*, 66 J. WILDLIFE MGMT. 1246, 1252 (2002). Vaccinating elk against brucellosis is controversial. See, e.g., WYO. GAME & FISH DEP'T, *supra* note 91, at 17 (reporting that "data indicate strain 19 vaccination may have influenced declines in seroprevalence on several feedgrounds," but warning that the data should "be interpreted with caution"); Thomas J. Roffe et al., *Efficacy of Single Calftlood Vaccination of Elk with Brucella abortus Strain 19*, 68 J. WILDLIFE MGMT. 830, 830 (2004) (concluding that a single vaccination "has low efficacy, will likely have only little to moderate effect on *Brucella* prevalence in elk, and is unlikely to eradicate the disease in wildlife" of the Greater Yellowstone Area); Ruffin Prevost, *Brucellosis Fighters Seek Stable Funding*, BILLINGS GAZETTE, May 14, 2009, http://billingsgazette.com/news/state-and-regional/wyoming/article_05f96815-1c38-5adb-a933-7cbb27185b60.html (reporting that "elk at a feedground where vaccinations were made every year for the past decade tested nearly identically for the disease as those at a second feedground where no vaccinations were made over the same period"); Animal & Plant Health Inspection Serv. [APHIS], U.S. Dep't of Agric., Brucellosis and Yel-

Dr. Bruce Smith, who spent twenty-one years on the NER and retired as senior biologist, warned in 2001:

Biologically, brucellosis is a red flag. It warns us that out of a million elk in North America, *only* those associated with the winter feeding programs in western Wyoming and adjacent eastern Idaho maintain this disease at any significant prevalence. It warns us that the conditions experienced by elk concentrated on feedgrounds are ripe for the transmission of other, more pathogenic diseases.¹²²

The disease of greatest concern now is chronic wasting disease (CWD). CWD is a transmissible spongiform encephalopathy (TSE), like mad cow disease, which affects cervids (deer, elk, and moose). It is always fatal.¹²³ When CWD becomes established on the feedgrounds (if it

lowstone Bison 4 [n.d.], http://www.aphis.usda.gov/animal_health/animal_dis_spec/cattle/downloads/cattle-bison.pdf ("Can Brucellosis Be Eradicated From Yellowstone Wildlife? Yes."). According to University of Wyoming College of Agriculture Dean Frank Galey, vaccination is also expensive: "Just to develop a decent new vaccine could cost between \$10 million to \$30 million, and could take 10 to 20 years." *Id.* Terry Kreeger, veterinary services supervisor for WGFD "said more than \$5 million in combined state and federal funds have been spent over the past nine years in Wyoming on wildlife brucellosis vaccination and research." *Id.*

¹²¹ See Kilpatrick, *supra* note 93; *infra* notes 151–58 and accompanying text; see also Tom Thorne, Presentation to the Governor's Brucellosis Coordination Team (Apr. 8, 2004), *available at* http://www.wyomingbrucellosis.com/_meeting_minutes/BCT2004minutes_2ndMtg_040804.doc (citing Brucellosis Task Force recommendation to "[c]onsider impacts compensation [to livestock producers] might have on eradication [of brucellosis] because compensation could be cheaper than eradication"). A proposal by the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) to establish a National Brucellosis Elimination Zone around Yellowstone would "facilitate the elimination of brucellosis from livestock." DEBBI A. DONCH & ARNOLD A. GERTONSON, U.S. DEP'T OF AGRIC., STATUS REPORT FISCAL YEAR 2008, at 4 (2008). But it is being resisted by area livestock producers because of the market "stigma" on those cattle. See Prevost, *supra* note 120 (citing Jerry Diemer, western regional director for APHIS). A subsequent "concept paper" revised the terminology. APHIS now proposes to establish a "disease management area" encompassing the Greater Yellowstone Area, which "will be known as a 'designated surveillance area.'" APHIS, A Concept Paper for a New Direction for the Bovine Brucellosis Program Animal and Plant Health Inspection Service Veterinary Services 7–8 (Sept. 2009), *available at* <http://www.regulations.gov/search/Regs/contentStreamer?objectId=0900006480a26f44&disposition=attachment&contentType=pdf>.

¹²² Smith, *Winter Feeding*, *supra* note 95, at 184 (emphasis added).

¹²³ See, e.g., PETERSON, GREATER YELLOWSTONE AREA, *supra* note 110, at 12 ("CWD is invariably fatal once clinical signs develop."); *cf. id.* at 6 ("At present, traditional veterinary approaches to therapy and prevention do not apply to CWD and other prion diseases. No treatment is available to prevent infections or recover affected animals; similarly, no vaccine is available to prevent CWD infection in deer or elk") (quoting M.W. Miller & E.S. Williams, *Chronic Wasting Disease of Cervids*, in MAD COW DISEASE AND RELATED SPONGI-

is not already there¹²⁴), the disease “would likely spread across the 18-million-acre Greater Yellowstone Ecosystem.”¹²⁵ Thousands of elk, as well as deer and moose, would die,¹²⁶ and habitat would be contami-

FORM ENCEPHALOPATHIES 193, 204 (D. A. Harris ed., 2004)). Remarkably, WGFD’s feeding policy seems premised in part on an assumption that “eventually we will likely learn how to slow or stop the spread of CWD, how to protect animals from contracting CWD, or even how to cure animals already infected with the disease.” See WYO. GAME & FISH DEP’T, *supra* note 91, at 11. WGFD official Eric Keszler stated publicly that his agency is “not convinced that CWD in an elk feedground population is going to be devastating to that population.” Cory Hatch, *How Did Moose Get CWD?*, JACKSON HOLE NEWS & GUIDE, Oct. 29, 2009, http://www.jhnewsandguide.com/article.php?art_id=3839.

¹²⁴ See PETERSON, GREATER YELLOWSTONE AREA, *supra* note 110, at 9 (“Assuming CWD does not already occur in the heart of the GYA [Greater Yellowstone Area], its most likely point of entry would be via infected cervids moving into Jackson Hole along the Gross Ventre drainage.”); *Defenders of Wildlife v. Salazar Memo*, *supra* note 110, at 11 (indicating that CWD may already be present but undetected in the NER and citing Dr. Tom Roffe). “CWD is not known to occur in free-roaming cervids (members of the deer family) in Montana or Idaho,” but it has been detected in mule deer east and south of the Greater Yellowstone area, in central and southeastern Wyoming, in northeast Utah, and in northwest and north-central Colorado. PETERSON, GREATER YELLOWSTONE AREA, *supra* note 110, at 8. In 2008 CWD was detected in a moose from Star Valley, about thirteen to eighteen miles from two feedgrounds and six miles from the Idaho border. See Merrill, *supra* note 111. The moose, which was euthanized, was dying from a parasite infection. *Id.* This discovery, the first west of the Continental Divide in Wyoming, was especially worrying because moose were thought to be *less* vulnerable to CWD infection than are deer or elk. See Jason Kauffman, *Elk Disease Moves West*, IDAHO MOUNTAIN EXPRESS, Nov. 21, 2008, <http://www.mtexpress.com/index2.php?ID=2005123724> (CWD “is considered extremely rare in moose. According to Wyoming Game and Fish, only three other wild moose in North America have tested positive for the disease, all of them in Colorado.”); see also Press Release, Nat’l Ass’n of State Dep’ts of Agric., APHIS Proposes to Amend Final Rule on Chronic Wasting Disease Herd Certification Program for Captive Deer, Elk and Moose (Apr. 6, 2009), available at <http://www.nasda.org/cms/7197/9060/20618/20637.aspx>.

¹²⁵ See *Defenders of Wildlife v. Salazar Memo*, *supra* note 110, at 12 (citing PETERSON, INFECTIOUS AGENTS, *supra* note 110, at 52; SMITH, *supra* note 114, at 16). “Elk and deer herds in the GYA interchange individuals with other herds of the same species to the north, south, east, and west. They also share ranges seasonally.” PETERSON, GREATER YELLOWSTONE AREA, *supra* note 110, at 8. Thus, “mountainous terrain, rivers, or other apparent topographic barriers should not be expected to prevent the spread of CWD to the GYA.” *Id.*; see also *supra* note 124. A recent study documented that CWD prions are shed in the feces of CWD-infected deer, even those that do not yet display symptoms. See Tamgüney et al., *supra* note 110, at 531. The researchers concluded that “the faecal–oral route [is] a likely natural mechanism for the transmission of CWD prions among deer and other susceptible cervid species,” and that prion “contamination of forest, shrub-steppe and grassland habitats may be largely responsible for horizontal transmission of CWD among mule deer and perhaps other species.” *Id.* at 531–32.

¹²⁶ In fact, some researchers have suggested that “local extinctions of affected deer populations might eventually occur.” See PETERSON, GREATER YELLOWSTONE AREA, *supra* note 110, at 5 (citing J.E. Gross & M.W. Miller, *Chronic Wasting Disease in Mule Deer: Disease Dynamics and Control*, 65 J. WILDLIFE MGMT. 205 (2001)). CWD prevalence rates among free-ranging deer appear to be higher than among elk. For example, *twenty-nine percent* of mule deer around Boulder, Colorado, are infected with CWD. Open Space Bd. of Trs., City

nated indefinitely with infectious prions.¹²⁷ Indeed, it is “not known whether environments contaminated with TSE agents can ever be completely disinfected.”¹²⁸ “Options for managing CWD once it exists in free-roaming cervid populations are practically nonexistent.”¹²⁹ Experts agree that CWD cannot be eradicated, yet it may be possible to slow and perhaps interrupt its spread.¹³⁰ “Thus the emphasis should be placed on preventing [CWD] from becoming established in naïve cervid populations.”¹³¹ Reducing animal density by banning supplemental feeding is among the experts’ top recommendations.¹³²

of Boulder, Chronic Wasting Disease Study Results 1 (Dec. 10, 2008), available at http://www.bouldercolorado.gov/files/openspace/pdf_osbtmemos/memo.pdf. Peterson suggests an explanation for such a high prevalence rate:

[Some researchers have] found that CWD prevalence in mule deer was almost twice as high in developed as compared to undeveloped areas in north-central Colorado due to land-use practices that fostered congregation and/or sedentary behavior in urban mule deer. Specifically, they suggested that artificial feeding, ornamental vegetation, decreased predation, and decreased human harvest associated with urbanization, as well as deer congregation in pockets of remaining habitat left behind after development, probably lead to increased CWD transmission.

PETERSON, GREATER YELLOWSTONE AREA, *supra* note 110, at 5 (citing M. L. Farnsworth et al., *Human Land Use Influences Chronic Wasting Disease Prevalence in Mule Deer*, 15 *ECOLOGICAL APPLICATIONS* 119 (2005)).

¹²⁷ See SMITH, *supra* note 114, at 10 (“A remarkable characteristic of these non-living proteins is that they are highly resistant to environmental degradation, and can be indirectly transmitted to other animals through excreta, contaminated soil, and decomposing carcasses, as well as by direct animal to animal contact.”) (citations omitted); *id.* at 19 (“Environmental contamination with the infectious agent is a particularly insidious characteristic of CWD where cervids are crowded.”); Sandra Blakeslee, *Study Spells Out Spread of Brain Illness in Animals*, N.Y. TIMES, Sept. 10, 2009, at A24 (reporting that “prions tended to bind to clay in soil and to persist indefinitely”). See generally Christina J. Sigurdson, *A Prion Disease of Cervids: Chronic Wasting Disease*, 39 *VETERINARY RES.* 41 (2008) (discussing the various mechanisms of CWD transmission and its persistence in the environment).

¹²⁸ See SMITH, *supra* note 114, at 19 (citing Elizabeth S. Williams et al., *Chronic Wasting Disease of Deer and Elk: A Review with Recommendations for Management*, 66 *J. WILDLIFE MGMT.* 551 (2002)).

¹²⁹ PETERSON, GREATER YELLOWSTONE AREA, *supra* note 110, at 6.

¹³⁰ See, e.g., Sigurdson, *supra* note 127, at 9–10; see also Blakeslee, *supra* note 127 (“[T]here is no chance chronic wasting disease will be eradicated, [Dr. Judd Aiken, prion expert and director of the Alberta, Canada, Veterinary Research Institute] said. Outside the laboratory, nothing can inactivate prions bound to soil. They are also impervious to radiation.”).

¹³¹ PETERSON, GREATER YELLOWSTONE AREA, *supra* note 110, at 6.

¹³² See, e.g., Williams et al., *supra* note 128, at 559; SMITH, *supra* note 114, at 18 (“Reducing population density is a recognized method for disease control and is based on the idea that infectious disease is density dependent. . . . Phasing out the winter feeding program will limit disease transmission and prevalence in the NER and GTNP.”); cf. PETERSON, GREATER YELLOWSTONE AREA, *supra* note 110, at 4 (“[I]t appears certain that [CWD] transmission, whether direct, indirect, or both, is dependent to some degree on the den-

Several states, including Colorado, Montana, Nebraska, and Wisconsin, have “implemented programs to reduce densities and ban private feeding of cervids.”¹³³ But in Wyoming, Smith explains, the agencies “may see winter feeding as the least painful remedy for producing immediate results to appease differing groups: agricultural interests that desire rapid resolution to crop damage, and pro-wildlife constituencies that oppose reductions in elk populations despite wildlife-human conflicts or dwindling habitat.”¹³⁴ One writer denounced this choice bluntly:

It is apparently easier to condemn the nation’s greatest elk herd to months on a reservation where they may be decimated by disease than it is to find ways to restore their natural habits and environment the way we have in Yellowstone, where elk, bison, and wolves co-exist and chronic wasting disease does not.¹³⁵

Smith suggested that “[r]emoval of livestock from the [Greater Yellowstone Area] or grazing only by neutered yearlings would remove the risk of brucellosis infections of concern to federal and state agricultural interests.”¹³⁶ But he concluded: “Both seem unlikely.”¹³⁷ The truth is, winter feeding continues because livestock producers and a few hunters and outfitters demand it¹³⁸ *and* because WGFD “has helped sell this resource management approach to the public.”¹³⁹

sity of susceptible hosts. . . . In situations where high cervid densities are maintained by humans, CWD eventually spreads throughout most of the population.”). Even WGFD, which feeds thousands of elk every winter, advises *others not to feed* elk. Indeed, one component of its “management plan” for CWD is to “seek legislation prohibiting intentional private feeding of big game animals, including deer, elk and moose.” CWD PLAN, *supra* note 108, at 3; *see also* Ronald W. Opsahl, *Chronic Wasting Disease of Deer and Elk: A Call for National Management*, 33 ENVTL. L. 1059, 1080 (2003) (“[M]any states have implemented complex regulations governing baiting or feeding wildlife . . .”).

¹³³ SMITH, *supra* note 114, at 18. In addition, “[i]n 2003 Teton County and the town of Jackson, Wyoming adopted citizen-sponsored bans on private feeding of wild ungulates.” *Id.* Idaho operates one elk feedground. Kauffman, *supra* note 124 (“Fish and Game operates just one feeding area for elk midway up the Warm Springs Creek drainage in an area called the Bullwhacker feed site.”).

¹³⁴ Smith, *Winter Feeding*, *supra* note 95, at 185–86. Among the WSGA’s objections to eliminating winter feeding is that it would “increas[e] the management responsibilities of WSGA’s members and the corresponding operation costs.” WSGA Motion to Intervene, *supra* note 93, at 9.

¹³⁵ Susan J. Tweit, *The Refuge*, NAT’L PARKS, Winter 2007, at 20, 26.

¹³⁶ SMITH, *supra* note 114, at 6.

¹³⁷ *Id.*

¹³⁸ Bob Wharff, Wyoming executive director of Sportsmen for Fish and Wildlife, a pro-hunting group that opposes any reduction in elk populations, called feeding “a moral

By the mid-1950s (if not considerably earlier¹⁴⁰), elk in this region suffered from an “almost total lack of natural winter range.”¹⁴¹ Not all state and federal officials have favored feeding as a solution, however. For instance, Wyoming Game and Fish biologist Chester Andersen recognized that “artificial feeding . . . constitutes both a symptom of abused range and a cause.”¹⁴² That abuse included ranch and residential development, degradation of public-land winter ranges, and obstruction of migration routes by highways and fences.¹⁴³ *Range conditions*, not feeding, Anderson argued, “should rightfully be the principal criteria for the

issue” and stated, “[t]here’s just no other options [sic] for these animals.” See Cory Hatch, *Refuge Feeding Fought in Suit: Conservation Groups Say Practice Threatens Elk with Disease; Critics Argue Animals Will Starve*, JACKSON HOLE NEWS & GUIDE, June 4, 2008, http://www.jhguide.com/article.php?art_id=3155. According to Clark Allan, a Wyoming Game and Fish Commissioner from Jackson, “stopping supplemental feed would be a disaster. ‘If we stop supplemental feeding, 70 percent of the elk would starve to death’” *Id.*; cf. Press Release, Robert Waggener, Univ. of Wyo. Staff, University of Wyoming Research Targets Western Wyoming Brucellosis Problem (Jan. 4, 2005), available at http://www.csrees.usda.gov/newsroom/lgunews/animals/wyoming_brucellosis.html (reporting that WGFD “estimates the elimination of winter feeding would result in an elk mortality of between 40 and 80 percent in western Wyoming because of the loss of natural habitat.”). One writer attributed the feedgrounds in part to “[p]ressure from the public, which doesn’t want to see elk starve during a harsh winter.” Tweit, *supra* note 135, at 26.

¹³⁹ E-mail from Dr. Bruce L. Smith, retired senior biologist, National Elk Refuge, to author (Dec. 9, 2008, 13:40 MST) (on file with author).

¹⁴⁰ See, e.g., SMITH ET AL., *supra* note 38, at 15 (“By 1909, homesteaders and ranchers had fenced much of the elk winter range within the Jackson Hole valley bottomlands and converted it to [use] . . . for domestic livestock production.”); BISON AND ELK PLAN, *supra* note 99, at 10 (reporting that winter range to support Jackson Hole elk has been “insufficient . . . since the early 1900s.” (citation omitted)).

¹⁴¹ Chester C. Anderson, *The Elk of Jackson Hole: A Review of Jackson Elk Studies*, in WYO. GAME & FISH COMM’N, WYOMING GAME AND FISH BULLETIN No. 10, at 12 (1958), quoted in SMITH ET AL., *supra* note 38, at 117. Anderson called the lack of winter range “[t]he outstanding problem in the management of these elk.” *Id.*

¹⁴² *Id.* at 50–52.

¹⁴³ Several writers have described the historical migrations of elk between summer range at higher elevations in the Greater Yellowstone Area and lower elevation winter ranges in central and southwestern Wyoming. See, e.g., SMITH ET AL., *supra* note 38, at 15–16 (reporting that by 1912 “migration corridors to their traditional desert winter ranges were usurped by Euro-American settlement and largely lost from the herd’s memory”); Christina M. Cromley, *Historical Elk Migrations Around Jackson Hole, Wyoming*, 104 YALE FORESTRY & ENVTL. STUD. BULL. 53, 54 (2000) (summarizing sources as reporting that “fences, poaching, and easily accessible artificial feed in Jackson Hole [were] factors that contributed to the end of the migrations”). In contrast, Jackson area *cattle* enjoy a designated “driveway” through national park, national forest and national refuge lands from Moran to Ditch Creek. See *Bison Calving Area and Livestock Allotments* (map), in BISON AND ELK PLAN, *supra* note 99, available at <http://www.fws.gov/bisonandelkplan/Final%20Plan/Maps/Bison%20Calving%20Areas%20and%20Livestock%20Allotments.pdf>.

size and distribution of the [elk] herd. . . . There are no reasonable justifications for continued downward trends in range condition."¹⁴⁴

Nearly fifty years later, the senior biologist at the NER wrote:

The notion of maintaining population levels in the face of the erosion of habitat is simply unrealistic, at least from an ecological perspective. Manipulating elk populations in ways that border on semi-domestication, such as feeding and fencing them, may permit numbers to be artificially maintained on an eroded habitat base, but at what costs?¹⁴⁵

A member of the National Resource Council committee tasked with studying conditions on the NER made the analogy to cattle explicit: "To expect that elk herds, blocked from migrating and concentrated through artificial feeding do not cause the same changes in woody plant condition as cattle would under these same conditions is completely inconsistent with the western experience."¹⁴⁶

With no change in management, worsening conditions were inevitable. In 2009, elk either cannot get to their native winter ranges or are not allowed to remain there. They are intentionally funneled by fencing; hazed by horseback riders, snowmobiles, or helicopters; or *killed* to prevent damage to private property and to save public-land forage for livestock.¹⁴⁷ Cattle ranchers generally do not favor proposals to buy out

¹⁴⁴ See Anderson, *supra* note 141, at 12.

¹⁴⁵ Smith, *Winter Feeding*, *supra* note 95, at 186. Smith outlines the costs of feeding elk, including economic costs, effects on habitat, elk behavior changes, and disease. See *id.* at 178–84.

¹⁴⁶ SMITH ET AL., *supra* note 38, at 135 (quoting riparian ecologist Dr. William Platts); see also *supra* notes 36–58 and accompanying text (describing effects of browsing by domestic and wild ungulates).

¹⁴⁷ See WYO. GAME & FISH DEP'T, *supra* note 91, at 18.

In some situations elk are actually hazed away from hay crops using pyro techniques [sic; presumably pyrotechnics, e.g., use of firecrackers]. Often elk have to be physically moved or herded from cattle feedlines, typically through the use of snowmobiles or helicopters. In more severe damage situations where elk cannot be readily moved to a proper wintering area, some elk are shot. Elk may be harvested by hunters through late season depredation hunts on private lands or in extreme cases, by Game and Fish personnel through the use of kill permits.

Id. Exact figures for fencing are hard to come by, but the WGFD has built or funded the construction of hundreds of miles of fencing (statewide) to exclude elk from private property. In 2003 WGFD reported that it was responsible for maintenance of "883 miles of fence (8' elk fence and stock fence)" on "410,000 acres of lands managed for wildlife habitat and public recreational opportunity." See WYO. GAME & FISH DEP'T, WYOMING STATE GOVERNMENT ANNUAL REPORT 2003, at 3.110 (2003), available at <http://www-wsl.state.wy>.

federal grazing permits, much less to acquire private lands to provide habitat for elk.¹⁴⁸

Are there alternatives to feedgrounds today? Yes, the WGFD admits, but “it would take a reduction in elk numbers or elimination of livestock use to eliminate feeding as a management tool.”¹⁴⁹ This single sentence constitutes the complete discussion of these options in the agency’s 2004 report on feedgrounds. Even elk “habitat improvements . . . are not likely to . . . allow phasing out of elk feedgrounds,” the agency reasons, because “the *need to prevent damage to stored crops and comingling of elk and livestock* . . . reduce[s] the overall effectiveness of habitat improvement efforts.”¹⁵⁰

The State of Wyoming has spent millions of dollars on supplemental feeding, which maintains artificially high populations of elk,¹⁵¹ exceeding even WGFD population objectives.¹⁵² Annual feedground pro-

us/slpub/reports/2003/gameandfish03.pdf. Substantial fencing is also built along boundaries between national forest and private lands—for instance, the twenty-five miles of fencing west of the Soda Lake feedground between Fremont Lake and New Fork Lakes in the Upper Green River area. See WYO. GAME & FISH DEP’T, UPPER GREEN RIVER ELK HERD UNIT (E107) BRUCELLOSIS MANAGEMENT ACTION PLAN 4, 6, 37 map 3 (2006), available at <http://gf.state.wy.us/downloads/pdf/RegionalNews/E107BMAP07July06.pdf>. “Elk jumps” are installed to enable elk that manage to get on the wrong side of the fence to get back to permissible range. See, e.g., WYO. GAME & FISH DEP’T, PINEDALE REGION: HABITAT PROJECTS 85 (2002), available at http://gf.state.wy.us/downloads/pdf/rpt_02_habpinedale.pdf.

¹⁴⁸ See Nat’l Cattlemen’s Beef Ass’n, Grazing Permit Buyouts: NCBA and the Public Lands Council Oppose Grazing Buyout Programs, <http://www.beefusa.org/goveGrazingPermitBuyouts.aspx> (last visited Apr. 15, 2010); NAT’L INST. FOR ANIMAL AGRIC., 2009–2010 RESOLUTIONS: CATTLE 3 (2009), available at <http://www.animalagriculture.org/About%20NIAA/Resolutions/Current/Cattle.pdf> (“[National Institute for Animal Agriculture] opposes the acquisition of additional lands for wildlife, and strongly urges the National Park Service and U.S. Fish and Wildlife Service to continue to remain involved in active management of animal and plant species in Yellowstone National Park, Grand Teton National Park and the National Elk Refuge to protect the environment, prevent overpopulation within the existing park boundaries, and control diseases including brucellosis.”).

¹⁴⁹ WYO. GAME & FISH DEP’T, *supra* note 91, at 19. Alternatives to feedings are discussed in Smith, *Winter Feeding*, *supra* note 95, at 185–86. See also BISON AND ELK PLAN, *supra* note 99, at 312 (discussing measures to mitigate the consequences of reduction in winter feeding and possible effects).

¹⁵⁰ WYO. GAME & FISH DEP’T, *supra* note 91, at 22 (emphasis added).

¹⁵¹ See *id.* at 4. “One additional outcome of the supplemental feeding program has been the near elimination of natural over-winter mortality for elk populations in northwest Wyoming.” *Id.* at 7. Without feeding, elk populations would be limited by their constricted winter range. See *id.* at 2. Summer range is not limiting. See *id.*

¹⁵² See *supra* text at note 85. It should be noted that population objectives reflect hunter demands as well as landowner (rancher) concerns about private property. See Whitney Royster, *Agency Moves on Disease Plans*, CASPER STAR TRIB., July 31, 2006, http://trib.com/news/top_story/article_c56b1ece-f048-5069-bf7f-306ea314cb37.html (“Options are tweaked for each [elk] herd unit based on input from livestock producers in the area.”); cf. Elk Permit

gram costs are in the neighborhood of \$1.5 million dollars.¹⁵³ In addition to buying hay and employing people to do the feeding, the Department builds fences, hires helicopters to haze elk away from winter range, vaccinates elk on feedgrounds, and conducts a “test-and-slaughter program,” which involves trapping, testing, and killing cow elk that test positive for brucellosis.¹⁵⁴ Over the first five years of the program, agency biologists “captured 1845 elk and slaughtered 162, of which about half were infected.”¹⁵⁵ This equates to about \$13,000 per infected animal.¹⁵⁶ In addition, Wyoming conducts brucellosis-related

Information, *supra* note 100 (“Elk feedgrounds are a way to reduce the damage problems while maintaining the number of elk the public prefers.”).

¹⁵³ In 2004, the cost to the WGFD was \$1.36 million. WYO. GAME & FISH DEP’T, *supra* note 91, at 4. “In 2000, the bill for running the feedgrounds was \$1.2 million, plus several hundred thousand dollars more for associated expenses.” Elk Permit Information, *supra* note 100. In 1998 WGFD spent \$2,758,000 to manage elk west of the Continental Divide, where the state and federal feedgrounds are located. Smith, *Winter Feeding*, *supra* note 95, at 179. Revenues for the same area, in the form of license fees, amounted to \$1,846,000. *Id.* (citing H. Harju, WGFD, personal communication).

¹⁵⁴ See WYO. GAME & FISH DEP’T, *supra* note 91, at 18; Press Release, Wyo. Game & Fish Dep’t, Test-and-Removal Pilot Project Continues 1, 2 (Nov. 9, 2006), available at http://gf.state.wy.us/downloads/pdf/RegionalNews/T&R_continues_11-9-06_FINAL.pdf [hereinafter Test-and-Removal Project Continues]; Jennifer Womack, *Wyo Game & Fish Highlights Management and Research Efforts*, WYO. LIVESTOCK ROUNDUP, Apr. 15, 2009, http://www.wylnet.com/index.php?option=com_content&task=view&id=395&Itemid=15. “Test-and-removal” is “agency speak” for “test and slaughter.” Only cows (and some calves) are tested because brucellosis is believed to be spread primarily by cow elk. See Cat Urbigkit, *Crew Captures Feedground Elk*, CASPER STAR TRIB., Jan. 25, 2010, http://www.trib.com/news/state-and-regional/article_b4c29e66-092a-591d-8367-6d2574273925.html (“Because brucellosis is a bacterial-caused disease of the reproductive tract, only adult female elk are subject to blood testing.”); see also WYO. GAME & FISH DEP’T, *supra* note 91, at 9 (“The most common route of transmission is thought to be oral as a result of an animal licking or ingesting infected fetuses, placentae, fetal fluids, or vaginal exudates.”). The big game hunters that WGFD is trying to appease are interested only in killing bulls with large racks.

¹⁵⁵ Prevost, *supra* note 120.

¹⁵⁶ *Id.* (citing Terry Kreeger, WGFD veterinary services supervisor). The cost per elk removed has actually increased since the program began. See Test-and-Removal Pilot Project Continues, *supra* note 154, at 2 (reporting first-year program costs of about \$342,848, or “about \$590 per elk removed”). Traps alone cost nearly \$100,000 each. But an early (2005) article in the Casper Star Tribune reported: “Game and Fish Director Terry Cleveland said he expects the elk trap at Muddy Creek to cost about \$600,000” See Jeff Gearino, *Test and Slaughter: Game and Fish Gears Up for Pinedale Pilot Project*, CASPER STAR TRIB., Sept. 6, 2005, http://trib.com/news/state-and-regional/article_bcaaf4415-4820-5583-8b8a-538cc0cfff3.html. A WGFD document reported a cost of more than \$153,000. See Brandon Scurlock, Pinedale Elk Herd Unit Test and Removal Pilot Project Year One: Muddy Creek Feedground 7 tbl.2 (2006), available at http://gf.state.wy.us/downloads/pdf/RegionalNews/TR_report_2006_Final.pdf. The same number was reported in 2007. See Brandon Scurlock, Pinedale Elk Herd Unit Test and Removal Pilot Project Year Two: Muddy Creek Feedground 6 tbl.2 (2007), available at http://gf.state.wy.us/downloads/pdf/RegionalNews/TR_report_2007_Final.pdf.

research,¹⁵⁷ and it shares with the U.S. Fish and Wildlife Service the cost of feeding on the NER. During the 2007–2008 winter, the cost of alfalfa pellets was about \$803,600.¹⁵⁸

Wyoming's largesse on behalf of livestock producers is longstanding and perhaps unrivaled. A 1952 audit of the Game and Fish Commission by the Wildlife Management Institute reported:

In previous studies of the fish and game laws of many states, no instance has been found in which the laws give so much special consideration to livestock operators at the expense of the fish and game resources as is found in Wyoming In some cases the earmarking of Fish and Game funds for these purposes by legislative action has so many undesirable features that it is difficult to believe that any legislature having any knowledge of or interest in the valuable fish and game resources of the state will continue it.¹⁵⁹

¹⁵⁷ See Prevost, *supra* note 120 (“Kreeger said more than \$5 million in combined state and federal funds have been spent over the past nine years in Wyoming on wildlife brucellosis vaccination and research.”); Wyo. Outdoor Council, Chronic Wasting Disease Fact Sheet 1–2 [n.d.], available at http://wyomingoutdoorcouncil.org/html/what_we_do/wildlife/pdfs/ChronicWastingDisease-FactSheet.pdf; see also Womack, *supra* note 154.

¹⁵⁸ Press Release, U.S. Fish & Wildlife Serv., National Elk Refuge Ends Supplemental Feeding for the Season (Apr. 21, 2008), available at http://www.fws.gov/nationalelkreftuge/Documents/Press%20Releases/04_21_08FeedSeason.pdf (reporting that more than 8.4 million pounds of alfalfa pellets were fed). “It’s hard to comprehend how large and expensive this feeding program has become,” said refuge manager Steve Kallin. *Id.* Other federal expenditures include personnel salaries and wages, facilities maintenance, etc.

¹⁵⁹ IRA N. GABRIELSON, REPORT TO THE WYOMING GAME AND FISH COMMISSION, STATE OF WYOMING 31, 31–32 (Mar. 1952) (copy located in Neal L. Blair papers, American Heritage Center, University of Wyoming), quoted in Leonard R. Carlman, *Wildlife-Private Property Damage Law—Once Upon a Time in Wyoming There Was Room for Millions of Cattle and Enough Habitat for Every Species of Game to Find a Luxurious Existence. In the Aftermath of Parker, Can We All Still Get Along?* Parker Land and Cattle Company v. Wyoming Game and Fish Commission, 845 P.2d 1040 (Wyo. 1993), 29 LAND & WATER L. REV. 89, 94 n.34 (1994). “Special consideration to livestock operators” is not limited to the State of Wyoming, however. In 2000 the National Park Service, U.S. Forest Service, APHIS, and the State of Montana spent about \$2.5 million to manage bison on the northern and western borders of Yellowstone National Park to reduce the risk of brucellosis transmission from bison to cattle—a risk that would be far lower but for supplemental feeding. See Kilpatrick et al., *supra* note 93, at 480–82. According to these researchers:

[T]he National Park Service, the US Forest Service, Animal and Plant Health Inspection Service, and the state of Montana have put into place a plan, the [Interagency Bison Management Plan], that costs ~\$2.5 million per year in 2000 to reduce this risk [of brucellosis transmission from bison to cattle]. Unless brucellosis can be eradicated from bison, there is no apparent endpoint for this management plan.

That the State has continued its biologically and economically irrational practice of feeding elk reflects the fact that things have not changed.¹⁶⁰ As two commentators recently remarked: “Wyoming has never been a state to let science or facts get in the way of culture, custom, and wishful thinking. Our 1880s-era political system is based on a one cow, one vote premise”¹⁶¹

Id. (citations omitted). “The 2009 [Montana] Legislature allocated \$2.4 million to cover [brucellosis] testing costs and compensate brand inspectors and livestock yards for handling the [cattle].” T.J. Giles, *Brucellosis Plan Takes Aim at Elk*, BILLINGS OUTPOST, June 17, 2009, http://www.billingsnews.com/index.php?option=com_content&view=article&id=197:brucellosis-plan-takes-aim-at-elk&catid=80:local-a-state&Itemid=89.

¹⁶⁰ The economics of these programs—supplemental elk and bison feeding, which in turn necessitate intensive bison management—are highly questionable. With respect to bison management, a recent study concluded that a far cheaper “management option would be to cease grazing cattle in the areas where bison leave the park in winter and compensate the ranchers for lost earnings and wages.” Kilpatrick et al., *supra* note 93, at 483.

Assuming a value of \$875 per head of cattle . . . , the yearly cost for the 1441 cattle grazing on public and private property in the northern and western [special management areas] would be \$1,261,362 which is half of the current management costs, and much less than the potential impacts to Montana’s livestock industry, valued at \$1.1 billion in 1997, if it loses its brucellosis-free status.

Id. The authors state that their “work provides a model framework for quantifying the risk of wildlife–livestock pathogen transmission to guide management actions.” *Id.* at 484. The fact that both programs have “no apparent endpoint” highlights their irrationality. *See id.*; cf. William H. Rodgers, Jr., *Building Theories of Judicial Review in Natural Resources Law*, 53 U. COLO. L. REV. 213, 223–25 (1982) (describing the federal government’s similarly irrational solution to wolf predation on one farmer’s livestock).

¹⁶¹ Taylor & Taylor, *supra* note 85. By 1880, ten years before it became a state, Wyoming boasted 500,000 head of cattle. *See* Ketcham, *supra* note 55, at 69. The State of Wyoming’s human population did not reach 500,000 until about 125 years later. *See* U.S. Census Bureau, State and County QuickFacts, <http://quickfacts.census.gov/qfd/states/56000.html> (last visited Apr. 10, 2010) (reporting an estimated 2008 population of 532,668, and a population in 2000 of 493,782). Ironically, a bison (which had largely been exterminated in Wyoming by 1880) is the prominent feature on the Wyoming state flag. *See* Welcome to the State of Wyoming, <http://www.wyoming.gov/general.aspx> (last visited Mar. 26, 2010). Reflecting the importance of the cattle culture, however, the bison is “branded” with the Wyoming state seal. *See id.* (“On the bison, once the monarch of the plains, is the seal representing the custom of branding.”). In fact, the State classifies bison as livestock, not wildlife. *See* WYO. STAT. ANN. § 23-1-102(a)(xvi) (2009) (“Bison are considered livestock unless otherwise designated by the Wyoming livestock board and the commission.”); *id.* § 23-1-101(a)(xiii) (“Wildlife’ means all wild mammals . . . and wild bison designated by the Wyoming game and fish commission and the Wyoming livestock board within Wyoming.”). The WGFC is authorized to “designate individual bison or identifiable herds of bison as wildlife,” but only “when the action is subsequently approved by the Wyoming livestock board.” *Id.* § 23-1-302(a)(xxvii).

In sum, feedgrounds, like predator control policies, reflect a long-standing cultural and political bias—a bias that continues to trump science and defy common sense.

IV. CLIMATE CHANGE

Readers might be surprised to learn that thirty years ago Congress was aware of a connection between grazing and climate change. In the Public Rangeland Improvement Act of 1978 Congress declared that “unsatisfactory range conditions on public rangelands . . . may ultimately lead to unpredictable and undesirable long-term local and regional *climatic* and economic changes.”¹⁶² Recent studies have greatly extended our understanding of the role of livestock in environmental problems, including climate change. A major study by the United Nations Food and Agriculture Organization (FAO) concluded that livestock production is “one of the top two or three most significant contributors to the most serious environmental problems, at every scale from to local to global,” and it is a “major stressor on many ecosystems and the planet as a whole.”¹⁶³ Livestock production accounts for nearly twenty percent of global greenhouse gas (GHG) emissions—more than the transportation sector.¹⁶⁴ It is a major source of methane and nitrous oxide,¹⁶⁵ which are 23 and 296 times, respectively, more potent warm-

¹⁶² 43 U.S.C. § 1901(a)(3) (2006) (emphasis added).

¹⁶³ FAO, *supra* note 3, at xx, 267; *see also infra* note 177 and accompanying text. 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); *see also* C.A. McAlpine et al., *Increasing World Consumption of Beef as a Driver of Regional and Global Change: A Call for Policy Action Based on Evidence from Queensland (Australia), Colombia and Brazil*, 19 GLOBAL ENVTL. CHANGE 21, 22 (2009) (highlighting “the contribution of extensive grazing and intensive feedlots as a major driver of regional and global change”); *supra* notes 7–8.

¹⁶⁴ FAO, *supra* note 3, at xxi (ranking emissions in terms of CO₂ equivalents).

¹⁶⁵ *See* Gerber et al., *supra* note 8, at 245 (reporting that the “livestock commodity chain” contributes “about 9 percent of total anthropogenic carbon dioxide emissions, but 37 percent of methane and 65 percent of nitrous oxide emissions”); WORKING GROUPS I, II, & III OF THE IPCC, CLIMATE CHANGE 2007: SYNTHESIS REPORT: SUMMARY FOR POLICY-MAKERS 5 (Rajendra K. Pachauri et al., eds., 2007) (“It is *very likely* that the observed increase in CH₄ [methane] concentration is predominantly due to agriculture and fossil fuel use. . . . The increase in N₂O [nitrous oxide] concentration is primarily due to agriculture.”); WORLD BANK, *supra* note 163, at 201 (“Livestock and crops emit CO₂, methane, nitrous oxide, and other gases, making agriculture a major source of GHG emissions. . . . Agriculture contributes about half of the global emissions of two of the most potent non-carbon dioxide greenhouse gases: nitrous oxide and methane.”).

ing agents than carbon dioxide.¹⁶⁶ Beef production is of particular concern.¹⁶⁷

The good news here, as Dr. Barry Popkin commented recently: “If we cut by a few ounces a day our red-meat intake, we would have [a] big impact on emissions *and* environmental degradation.”¹⁶⁸ In fact, because “methane cycles out of the atmosphere in just eight years” (in contrast to carbon dioxide, “which can remain in the air for more than a century”), reducing livestock production would help cool the earth more quickly than would other measures, like driving less or changing our light bulbs.¹⁶⁹

¹⁶⁶ Pew Ctr. on Global Climate Change, Glossary of Key Terms, http://www.pewclimate.org/global-warming-basics/full_glossary/glossary.php (last visited Mar 26, 2010) (reporting global warming potentials [GWPs] of methane (CH₄) and nitrous oxide (N₂O) of 23 and 296, respectively). GWPs are “[a] system of multipliers devised to enable warming effects of different gases to be compared,” in which carbon dioxide (CO₂) is assigned a value of 1. *Id.* On December 15, 2009, the U.S. Environmental Protection Agency (EPA) included CH₄ and N₂O among the six GHGs which “together constitute the root cause of human-induced climate change and the resulting impacts on public health and welfare.” U.S. Env’t Prot. Agency, Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,496, 66,516 (Dec. 15, 2009) [hereinafter EPA, Endangerment Finding]. According to EPA, CH₄ and CO₂ are the “two most important directly emitted, long-lived greenhouse gases,” and their concentrations in the atmosphere “are well above the natural range of atmospheric concentrations compared to at least the last 650,000 years.” *Id.* at 66,517. “The global atmospheric concentration of methane has increased by 149 percent since pre-industrial levels (through 2007); and the nitrous oxide concentration has increased 23 percent (through 2007).” *Id.*

¹⁶⁷ See, e.g., FAO, *supra* note 3, at 61; McAlpine et al., *supra* note 163, at 22 (“It is important . . . to recognise the contribution of extensive grazing and intensive feedlots as a major driver of regional and global change. It is also timely to question the role of increasing world consumption of beef as a driver of regional and global environmental change, and to identify appropriate policy responses to reduce these impacts.”); Schiessl & Schwägerl, *supra* note 7 (reporting that the German consumer group Foodwatch “concludes that the principal approach to making agriculture more climate-friendly would require a drastic reduction in beef production”).

¹⁶⁸ Rob Stein, *Daily Red Meat Raises Chances of Dying Early*, WASH. POST, Mar. 24, 2009, at A1 (Dr. Popkin is a professor of global nutrition at the University of North Carolina.); see also McMichael et al., *supra* note 8, at 1253 (recommending that global average meat consumption be limited to “not more than 50 g per day coming from red meat from ruminants (i.e., cattle, sheep, goats, and other digastric grazers)”; McAlpine et al., *supra* note 163, at 21, 29 (recommending, *inter alia*, that governments “stop subsidising beef production and promoting beef consumption”); Douglas A. Kysar, *Law, Environment, and Vision*, 97 NW. U. L. REV. 675, 722 (2003) (“Each kilogram of red meat requires three thousand liters of water, the equivalent of two liters of gasoline in petrochemicals and other farm inputs, and five kilograms of corn and meal that otherwise could be used to feed humans.”).

¹⁶⁹ See Brad Knickerbocker & Peter Spotts, *Humans’ Beef with Livestock: A Warmer Planet*, CHRISTIAN SCI. MONITOR, Feb. 20, 2007, at 3.

Grazing on public lands is a small contributor to beef production and thus to the sector's total GHG emissions.¹⁷⁰ But eliminating public-land grazing would promote ecosystem restoration over *several hundred million acres*, which in turn would both (1) *mitigate* climate change by enhancing carbon sequestration in soils and plant matter and reducing erosion, and (2) promote *adaptation* to climate-related changes that are inevitable.¹⁷¹ Experts tell us that “immediate and major acceleration of efforts” on both mitigation and adaptation will be needed to prevent “climate change from becoming a catastrophe.”¹⁷²

Adaptation is defined as “actions by individuals or systems to avoid [or] withstand . . . current and projected climate changes and impacts. Adaptation decreases a system's vulnerability, or increases its resilience to impacts.”¹⁷³ Ecosystem restoration is a prime adaptation strategy, as

¹⁷⁰ See FAO, *supra* note 3, at 261; see also DONAHUE, *supra* note 17, at 250–63. But the FAO concluded that intensification of livestock production (and less reliance on extensive grazing) would reduce overall environmental impacts, including GHG emissions. See FAO, *supra* note 3, at 261, 280–81 (recommending that “extensive grazing” should be “reorient[ed] towards provision of environmental services”); see also Schiessl & Schwägerl, *supra* note 7 (reporting that “grass-fed beef” production causes 1.6 times the amount of GHG emissions resulting from “more intensive [beef] production methods”); Donahue, *supra* note 10, at 106 (pointing out that grazing animals emit more CH₄ than do feedlot cattle, and that extensive grazing produces less beef per acre, thus rendering their potential impact on climate disproportionate to their numbers); *infra* text at note 171. Moreover, eliminating *public*-land grazing is quite likely to reduced grazing use on associated *private*-land base properties, which would expand the benefits noted in the text. See Donahue, *supra* note 10, at 121; cf. *infra* note 177.

¹⁷¹ See, e.g., Donahue, *supra* note 10, at 110. Moreover, the EPA reasoned:

[The] unique, global aspects of the climate change problem tend to support consideration of contribution at lower percentage levels of emissions than might otherwise be considered appropriate In this situation it is quite reasonable to consider emissions from source categories . . . even if their absolute contribution initially may appear to be small.

EPA, Endangerment Finding, *supra* note 166, at 66,538. Politically, ending grazing on federal lands would signal to other countries that the United States is committed to combating climate change, thus encouraging other nations that have been slow to address this source of GHG emissions to increase their efforts.

¹⁷² See CONFRONTING CLIMATE CHANGE, *supra* note 13, at ix.

¹⁷³ PEW CTR. ON GLOBAL CLIMATE CHANGE & PEW CTR. ON THE STATES, CLIMATE CHANGE 101: ADAPTATION 3 (2009) [hereinafter CLIMATE CHANGE 101]. According to Working Group II of the IPCC, “*Adaptation* is the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.” IMPACTS, ADAPTATION AND VULNERABILITY, *supra* note 32, at 6.

healthy, biologically diverse ecosystems are more resilient and thus better able to withstand major change.¹⁷⁴

Subsidizing unsustainable and ecologically damaging agricultural practices, such as public-land grazing in the western United States, adds to the pressures on climate-stressed ecosystems.¹⁷⁵ While the world succeeded in increasing food production and lowering food prices in the twentieth century, these gains were “achieved at growing costs in the form of the degradation of many ecosystem services.”¹⁷⁶ Around the world, livestock production “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.”¹⁷⁷ In its

¹⁷⁴ See, e.g., Christensen et al., *supra* note 50, at 672 (“Long-term adaptations of ecosystems to changes in climate and other environmental variables are strongly dependent upon available biological diversity.”); José M. Rey Benayas et al., *Enhancement of Biodiversity and Ecosystem Services by Ecological Restoration: A Meta-Analysis*, 325 SCIENCE 1121, 1124 (2009). Based on their review of eighty-nine restoration projects, Dr. Benayas and his co-authors concluded that at national, regional, and local scales ecological restoration is beneficial:

[E]cological restoration is likely to lead to large increases in biodiversity and provision of ecosystem services, [thus] offering the potential of a win-win solution in terms of combining biodiversity conservation with socio-economic development objectives. Because ecological restoration can be effective in restoring natural capital, it should be implemented in areas that have undergone environmental degradation.

Id. Restoration ecology was the topic of a special section of *Science* magazine’s July 31, 2009, edition. See 325 SCIENCE 555–76 (2009). According to the introduction, restoration ecology is a “relatively new science . . . but in its short life it has assumed a major role in sustainable development efforts across the globe.” Leslie Roberts et al., *Introduction: The Rise of Restoration Ecology*, 325 SCIENCE 555, 555 (2009).

¹⁷⁵ See Mary O’Brien, *Uneasy Riders: A Citizen, a Cow, and NEPA*, 39 ENVTL. L. REP. (ENVTL. LAW INST.) 10,632, 10,634 (2009) (“The particular impacts consequent to livestock grazing have ever-growing significance in light of observed and predicted climate change impacts in the Southwest . . .”). Dr. O’Brien argues that the “Forest Service has a responsibility to initiate a public exploration of alternatives, under NEPA and in light of climate change, to current management of livestock grazing on the national forests of the arid and semi-arid West.” *Id.* at 10,635. Dr. O’Brien is an ecologist and Southern Utah Forests Project Manager at the Grand Canyon Trust. *Id.* at 10,632.

¹⁷⁶ MILLENNIUM ECOSYSTEM ASSESSMENT, ECOSYSTEMS AND HUMAN WELL-BEING: SYNTHESIS 5 (2005).

¹⁷⁷ *Id.* at 47. Dust formation, via a positive feedback mechanism, is directly relevant to climate change. Deposition of wind-blown dust on snow-covered lands downwind causes the snowpack to melt earlier, thus exacerbating the early runoff that climate change is predicted to cause in parts of the West. See Mark Losleben et al., *Red Dust Layer Surface Effects on Snowpack Temperature Gradients, Subalpine Forest, Niwot Ridge, Colorado* (2006), http://culter.colorado.edu/Climate/Mrsclimate/DustEffectsSnowTemperatures_MtnClim2006_copy.pdf (noting that “radiative activation of [a] red dust layer” increased snow surface tem-

landmark 2006 study, the FAO called attention specifically to grazing on federal lands in the United States (and Australia). Noting the “small contribution” that these “marginal lands” make “to overall livestock supply,” FAO advised ending grazing and returning the lands “to their original state” to help meet “growing demands for other uses such as recreation [and] other environmental services.”¹⁷⁸

Federal land management offers a variety of what the Pew Center on Global Climate Change calls “no regret,” “low regret,” and “win-win” adaptation opportunities:

- **No regret:** “[a]ctions that make sense or are worthwhile regardless of additional or exacerbated impacts from climate change,” such as “protecting/restoring systems that are already vulnerable or of urgent concern for other reasons”;
- **Low regret:** employing “[m]easures with relatively low costs for which benefits under climate change scenarios are high[,]” such as “incorporating climate change into forestry, water, and other public land management practices and policies”; and
- **Win-win:** taking actions “that provide adaptation benefits while meeting other social, environmental, or economic objectives, including climate change mitigation.”¹⁷⁹

The underlying theme here is that protecting and helping to restore ecosystems will increase their resilience to climate change, while providing other environmental benefits and promoting other important objectives.¹⁸⁰

perature and contributed to an increased rate of snow melt). Livestock grazing in the western United States has been empirically linked with dust storms. Jason C. Neff et al., *Increasing Eolian Dust Deposition in the Western United States Linked to Human Activity*, 1 *NATURE GEOSCIENCE* 189, 192 (2008) (concluding from lake-sediment core data that the increased dust deposition in the West, which “began between 200 and 100 yr ago with peak deposition rates in the first half of the twentieth century,” was attributable not to drought events but to “an intensification of western US land use, and particularly livestock grazing activities, that began in the early 1800s”).

¹⁷⁸ See FAO, *supra* note 3, at 261 (noting also the “widespread degradation” of these lands); cf. McAlpine, *supra* note 163, at 21 (recommending that governments “stop subsidizing beef production and promoting beef consumption; control future expansion of . . . extensive grazing; protect and restore regrowth forests in grazing lands; and allocate resources to less environmentally damaging alternative land uses”); Gerber et al., *supra* note 8, at 246 (“[s]uggesting a shift from some of the current negative [extensive] grazing practices to environmental service-oriented grazing”).

¹⁷⁹ CLIMATE CHANGE 101, *supra* note 173, at 6.

¹⁸⁰ As I have argued elsewhere: “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

Reestablishing ecosystem attributes, such as biodiversity and ecological function, by removing livestock from public lands would qualify as a “low regret” and a “win-win” opportunity.¹⁸¹ Ending livestock grazing would improve conditions in both upland and riparian plant communities, leading to healthier streams and riparian areas better able to withstand impacts of climate change, such as drought and variable runoff.¹⁸² Riparian and aquatic communities would benefit from the conserved moisture, enhanced food supplies and shelter, reduced erosion, etc. Producing fewer cattle also would avoid the need to divert huge volumes of water to irrigate forage crops in the arid West,¹⁸³ which would contribute further to these improvements. Eventually, the ecological integrity of whole watersheds might be reestablished.

Moreover, some scientists and policy experts have emphasized the importance of protecting and restoring ecosystems to insure against natural disasters. Indeed:

GHG control and conservation of water, soil, and biodiversity.” Donahue, *supra* note 10, at 113; cf. U.S. ENVTL. PROT. AGENCY, EPA 430-R-05-006, GREENHOUSE GAS MITIGATION POTENTIAL IN U.S. FORESTRY AND AGRICULTURE 7-1 (2005) (“Changes in land-use and management practices as a result of GHG mitigation actions can produce non-GHG environmental co-effects,” including benefits to “water quality, air quality, soil quality, and biodiversity.”).

¹⁸¹ See CLIMATE CHANGE 101, *supra* note 173, at 6; cf. Benayas et al., *supra* note 174, at 1124.

[E]cological restoration is likely to lead to large increases in biodiversity and provision of ecosystem services, offering the potential of a win-win solution in terms of combining biodiversity conservation with socio-economic development objectives. Because ecological restoration can be effective in restoring natural capital, it should be implemented in areas that have undergone environmental degradation.

Id. (citation omitted).

¹⁸² “Excluding cattle from riparian areas is the most effective tool for restoring and maintaining water quality and hydrologic function, vegetative cover and composition, and native species habitats.” NRC REPORT, *supra* note 14, at 393. But as noted earlier, livestock grazing “also must be managed on uplands to protect riparian areas.” See *id.*; see also *supra* note 21 and accompanying text.

¹⁸³ In Wyoming, for example, 175,000 hectares of alfalfa are irrigated—a “greater hectareage than that of all other irrigated cash crops combined.” D. Claypool et al., *Genetic Improvement of Alfalfa to Conserve Water*, Wyoming Water Conf., Apr. 21–22, 1997, Casper, published in WHAT’S NEW IN THE TOOLBOX: APPLIED RESEARCH FOR MANAGEMENT OF WYOMING’S WATER 214, 214, available at <http://library.wrds.uwyo.edu/wrp/97-05/97-05.pdf>; see also George Wuerthner, *Guzzling the West’s Water*, NEWWEST, Oct. 9, 2008, http://www.newwest.net/topic/article/guzzling_the_wests_water/C41/L41/ (“In Montana, agriculture takes 97 percent of all water used in the state, and just about the only irrigated crop there is hay and pasture forage; more than 5 million acres in the state are irrigated hay meadows.”).

[T]he conservation of nature to reduce vulnerability to disasters may present one of the greatest and most-consistently under-valued natural services provided by biodiversity. The protective value of ecosystems may exceed income from the use of their resources. Ecosystems' protective services, such as the prevention of erosion, floods, landslides, avalanches, cyclones and other natural and unnatural disasters, deserve far more attention when it comes to assessing their value.¹⁸⁴

Thus broadly considered, the benefits—environmental, recreational, safety, and aesthetic—from restoring public land watersheds would eclipse the minor economic costs to livestock producers and some communities.¹⁸⁵

Climate change adaptation is not “just another” argument for ending public-land livestock grazing, like one more authority in a “string cite.” Climate change is impacting ecosystems now, and some level of additional impacts is inevitable, regardless of measures taken to reduce GHG emissions.¹⁸⁶ Global climate change makes the need for “ecological recovery of herbivore-impacted ecosystems . . . even more urgent.”¹⁸⁷

¹⁸⁴ JANET ABRAMOVITZ ET AL., ADAPTING TO CLIMATE CHANGE: NATURAL RESOURCE MANAGEMENT AND VULNERABILITY REDUCTION 24 (2002), available at http://www.iisd.org/pdf/2002/envsec_cc_bkgd_paper.pdf. This document is a joint effort of World Conservation Union (IUCN), Worldwatch Institute, International Institute for Sustainable Development (IISD), and the Stockholm Environment Institute/Boston. *Id.* at 2.

¹⁸⁵ See THOMAS MICHAEL POWER, LOST LANDSCAPES AND FAILED ECONOMIES: THE SEARCH FOR A VALUE OF PLACE 182–85 (1996); Debra L. Donahue, *Western Grazing: The Capture of Grass, Ground, and Government*, 35 ENVTL. L. 721, 800–01 (2005) (discussing real and purported costs of ending public-land grazing to western communities). See generally Thomas M. Power, *Taking Stock of Public Lands Grazing: An Economic Analysis*, in WELFARE RANCHING, *supra* note 25, at 263. For present purposes, it is also worth noting that ending grazing on public lands could reduce if not obviate the “need” for supplemental feeding of elk, which would yield significant cost savings. See *supra* notes 152–58 and accompanying text; see also KARYN MOSKOWITZ & CHUCK ROMANIELLO, ASSESSING THE FULL COST OF THE FEDERAL GRAZING PROGRAM 1 (2002) (estimating that the “full cost of the federal grazing program to the U.S. Treasury is likely to approximate \$500 million annually,” and that the “full cost to the U.S. public,” considering “the many other indirect costs borne by state and local government agencies, individuals and private institutions . . . could approach \$1 billion annually”).

¹⁸⁶ See U.S. GOV'T ACCOUNTABILITY OFFICE [GAO], CLIMATE CHANGE: AGENCIES SHOULD DEVELOP GUIDANCE FOR ADDRESSING THE EFFECTS ON FEDERAL LANDS AND WATER RESOURCES 44 (2007); see also DANIEL B. FAGRE & COLLEN W. CHARLES ET AL., U.S. CLIMATE CHANGE SCI. PROGRAM, THRESHOLDS OF CLIMATE CHANGE IN ECOSYSTEMS: FINAL REPORT, SYNTHESIS AND ASSESSMENT PRODUCT 4.2, at 1 (2009), available at <http://downloads.climate.science.gov/sap/sap4-2/sap4-2-final-report-all.pdf>.

¹⁸⁷ Beschta & Ripple, *Large Predators*, *supra* note 35, at 12 (“There is an increasing awareness in other parts of the world that existing large carnivores may be necessary for

While we might not be able to fend off irreversible ecosystem “tipping points,” we *must not* make them more likely.¹⁸⁸ To borrow a line from the United Nations Foundation, our strategy, as well as our goal, should be to “avoid[] the unmanageable and manage the unavoidable.”¹⁸⁹ By taking steps to alleviate *manageable* environmental stressors, such as livestock production, we can reduce and better cope with the impacts of climate change.

V. CURRENT LAW AND ANALYSIS

The prior parts of this Article have outlined three land-use and environmental problems that share a common cause—livestock production. None of them will be resolved if livestock’s causal role continues to be ignored. On the other hand, each of them could be alleviated, in some cases substantially, by changes in livestock production practices. Specifically, I have advocated an end to livestock grazing on the public’s land in the American West.

This Article elaborates on three specific reasons *why* we should do that:

1. to enable broader reintroduction of top predators so as to foster restoration of communities and ecosystems, which have been disrupted and transformed by excess herbivory and the ensuing cascade of effects;¹⁹⁰
2. to obviate the perceived need to feed elk and thus halt the environmental damage feedgrounds are causing and, hopefully, forestall the spread of serious diseases;¹⁹¹ and
3. to mitigate climate change and promote regional adaptation to its effects.¹⁹²

Note that, in each case, solving the problem involves restoring ecosystems, an objective that ending livestock grazing or reforming production practices would promote.¹⁹³

It is neither feasible nor necessary to undertake a thorough exploration of the relevant law. I have argued at length elsewhere that exist-

maintaining native species biodiversity and, where possible, large carnivore recovery may be needed to reverse ecological degradation.”).

¹⁸⁸ See DONAHUE, *supra* note 17, at 146–52, 159–60 (discussing thresholds).

¹⁸⁹ See CONFRONTING CLIMATE CHANGE, *supra* note 13 (referencing the report title).

¹⁹⁰ See *supra* Part II.

¹⁹¹ See *supra* Part III.

¹⁹² See *supra* Part IV.

¹⁹³ See *supra* Parts II–IV.

ing law supports removing livestock from public lands.¹⁹⁴ The U.S. Government Accountability Office's recent conclusion that the federal land agencies have ample authority to adjust their management to respond to climate change is consistent with the power to alter grazing practices or terminate grazing.¹⁹⁵ This Part will focus on legal arguments specific to feedgrounds and predators.

Despite agency assertions to the contrary, the legal arguments against maintaining feedgrounds on public lands are strong.¹⁹⁶ Officials of the Bridger-Teton National Forest claimed in an environmental document that Wyoming's "jurisdiction over state wildlife" deprives the

¹⁹⁴ See DONAHUE, *supra* note 17, at ch. 7. See generally Donahue, *supra* note 10; Donahue, *supra* note 3. The Federal Land Policy and Management Act (FLPMA) explicitly authorizes "elimination" of previously allowed uses, like livestock grazing over large areas. See 43 U.S.C. § 1712(e) (2006). In fact, a strong argument can be made that in many situations the law requires that livestock be removed. See DONAHUE, *supra* note 17, at ch. 7. While *The Western Range Revisited* focused on lands managed by the Bureau of Land Management (BLM), much of its reasoning and many of the same laws apply to national forest land management as well. FLPMA governs grazing on BLM lands and national forests. See 43 U.S.C. §§ 1751–1753. Environmental laws, including the Clean Water Act and Endangered Species Act, apply equally to both agencies. See 33 U.S.C. § 1323(a) (2006); 16 U.S.C. § 1536(a)(2) (2006).

¹⁹⁵ See GAO, *supra* note 186, at 44 (concluding that the BLM, Forest Service, Fish and Wildlife Service, National Oceanic and Atmospheric Administration, and National Park Service "are generally authorized, but not specifically required, to address changes in resource conditions resulting from climate change in either their resource management actions or planning efforts"). According to a secretarial order issued in 2009, the Department of the Interior is "taking the lead in protecting our country's water, land, fish and wildlife, and cultural heritage and tribal lands and resources from the dramatic effects of climate change that are already occurring." SEC'Y OF THE INTERIOR, U.S. DEP'T OF THE INTERIOR, SO#3289A1 2/22/10, ORDER No. 3298, AMENDMENT No. 1: ADDRESSING THE IMPACTS OF CLIMATE CHANGE ON AMERICA'S WATER, LAND, AND OTHER NATURAL AND CULTURAL RESOURCES § 1 (2010), available at http://206.131.241.18/clips/SO_word/so3289A1.doc. The Order declares that, "for the first time ever," the Department "is now managing America's public lands . . . to promote environmentally responsible renewable energy development." *Id.* The Order established a Climate Change Response Council, which is tasked with coordinating climate change activities of Interior agencies and other federal departments and agencies, and with "implement[ing] an integrated strategy for responding to . . . climate change impacts" to Interior resources. *Id.* § 3. The Council is charged with working with "a network of collaborative 'Landscape Conservation Cooperatives'" to "develop landscape-level strategies for understanding and responding to climate change impacts." *Id.* § 3(c).

¹⁹⁶ Environmental organizations have sued the U.S. Department of Interior and the U.S. Forest Service over elk feeding policies on the NER and national forests in Wyoming, respectively. The former case was dismissed in March 2010. See Cory Hart, *Judge: Keep Feeding Elk: Conservationist Groups Might Appeal Decision Supporting Refuge Policy*, JACKSON HOLE NEWS & GUIDE, Mar. 30, 2010, http://www.jhnewsandguide.com/article.php?art_id=5812. The latter was dismissed in July 2009. See *infra* note 235.

Forest Service of any authority to regulate elk feeding.¹⁹⁷ Even if feeding were disallowed in national forests, the document continued, the State would just establish feedgrounds elsewhere.¹⁹⁸ This stance cannot be squared with the Forest Service's broad powers. First, its multiple-use mandate, like the Bureau of Land Management's, explicitly encompasses wildlife; it is *not* limited to wildlife habitat.¹⁹⁹ Indeed, the Federal

¹⁹⁷ DEIS LONG TERM SPECIAL USE AUTHORIZATION, *supra* note 103, at 22–23. Conversely, according to spokesman Eric Keszler, the WGFD “takes the position that it doesn’t need approval from the federal land management agencies to feed elk or take other wildlife-management actions.” Associated Press, *Judge Allows Wyoming Stock Growers into Elk Feeding Lawsuit*, BILLINGS GAZETTE, June 5, 2006, http://billingsgazette.com/news/state-and-regional/wyoming/article_3fa78b14-fba6-509c-a39d-dc0bdd0f2bd3.html.

¹⁹⁸ See LONG TERM SPECIAL USE AUTHORIZATION, *supra* note 103, at 4 (“The effects analysis for this alternative [No Action—No Special Use Authorization] projects that elk winter management activities would continue to be performed by [Wyoming Game and Fish Commission (WGFC)] on other federal, state, or private lands.”); *id.* at 8 (“The potential effect of CWD on elk populations is similar for all alternatives in this analysis because the WGFC will continue to feed elk on Federal lands or other locations on State or private lands as near to the current site(s) as possible.”); *id.* at 6 (table summarizing effects by alternative, showing basically identical effects on wildlife species and on disease transmission). (About a third of existing state feedgrounds are on private or other federal lands.) This syllogism allowed the Forest Service to shrug off as “unavoidable” *all adverse environmental effects* of feedgrounds. See U.S. FOREST SERV., U.S. DEP’T OF AGRIC., FINAL ENVIRONMENTAL IMPACT STATEMENT: LONG TERM SPECIAL USE AUTHORIZATION FOR WYOMING GAME AND FISH COMMISSION TO USE NATIONAL FOREST SYSTEM LAND FOR THEIR WINTER ELK MANAGEMENT ACTIVITIES 97–98 (2008). These included impacts to soils, vegetation, wildlife, water quality, and riparian areas, and increased probability of disease and parasite transmission among elk. *Id.* at 98. Forest Supervisor, Carole “Kniffy” Hamilton acknowledged these impacts in her Record of Decision and identified the “No Special Use Authorization” alternative as the environmentally preferred alternative. U.S. FOREST SERVICE, U.S. DEP’T OF AGRIC., RECORD OF DECISION: LONG TERM SPECIAL USE AUTHORIZATION FOR WYOMING GAME AND FISH COMMISSION TO USE NATIONAL FOREST SYSTEM LAND FOR THEIR WINTER ELK MANAGEMENT ACTIVITIES 10, 8–9 (2008). In choosing to reauthorize the feedgrounds she wrote: “It is the responsibility of the WGFC to manage wildlife populations, including studying and managing the potential for disease transmission and determining acceptable levels of disease prevalence and risk.” *Id.* at 8. Thus:

The decision whether or not to feed elk in the winter is a Wyoming Game and Fish Commission decision. I have the discretion to authorize or not authorize the use of NFS lands for this purpose. . . . I decided that continuing to authorize use of NFS land for feedgrounds while encouraging and supporting WGFC in exploration of alternative ways to manage elk populations in north-west Wyoming is the prudent course of action. Any alternatives to winter feeding such as development or improvement of winter range would take many years to accomplish, and would not eliminate the need for supplemental elk feeding in the short-term.

Id.

¹⁹⁹ See Multiple-Use Sustained-Yield Act, 16 U.S.C. § 528 (2006), National Forest Management Act, 16 U.S.C. § 1604(e)(1) (2006); FLPMA, 43 U.S.C. §§ 1701, 1702(c) (2006);

Land Policy and Management Act of 1976 (FLPMA) authorizes each agency to regulate or close areas to hunting “for reasons of public safety, administration, or compliance with . . . applicable law.”²⁰⁰ Having authorized this infringement on a traditional state prerogative,²⁰¹ Congress surely contemplated that the agencies could exercise *less* intrusive powers respecting wildlife—for instance, to forbid supplemental feeding—where federal interests are implicated.²⁰²

Even before passage of FLPMA, the U.S. Supreme Court announced that federal power over the public lands under the Property Clause “necessarily includes the power to regulate and protect the wildlife living there,” and that exercise of this power by Congress “overrides conflicting state laws.”²⁰³ Nor is the Forest Service helpless to prevent the State from feeding on *nonfederal* lands, if that activity threatens uses or interests in adjacent national forests.²⁰⁴

Feedgrounds arguably contravene the Forest Service’s governing laws and special-use permitting regulations in several ways.²⁰⁵ For example: Feedgrounds are not a “public” or a “national” use or activity.²⁰⁶ As

see also *Kleppe v. New Mexico*, 426 U.S. 529, 546 (1976) (“[T]he Property Clause also gives Congress the power to protect wildlife on the public lands, state law notwithstanding.”).

²⁰⁰ 43 U.S.C. § 1732(b). In “emergencies” the agencies may exercise this power without first consulting the state. *See id.*

²⁰¹ *See Kleppe*, 426 U.S. at 541 (referring to the “State’s traditional trustee powers over wild animals”); *Missouri v. Holland*, 252 U.S. 416, 434 (1920) (“No doubt it is true that as between a State and its inhabitants the State may regulate the killing and sale of [wildlife], but it does not follow that its authority is exclusive of paramount powers.”).

²⁰² *See* 43 U.S.C. § 1732(b).

²⁰³ *See Kleppe*, 426 U.S. at 541, 543.

²⁰⁴ *See id.* at 546 (stating that “regulations under the Property Clause may have some effect on private lands”); *United States v. Lindsey*, 595 F.2d 5, 6 (9th Cir. 1979) (upholding USFS regulations issued pursuant to 16 U.S.C. § 551 and holding: “It is well established that [the Property] clause grants to the United States power to regulate conduct on non-federal land when reasonably necessary to protect adjacent federal property.”). *See generally* *Camfield v. United States*, 167 U.S. 518 (1897) (discussing federal power to protect public lands even if there are some negative consequences to private lands).

²⁰⁵ The Forest Service Organic Act authorizes the Secretary of Agriculture “to permit any State . . . to use and occupy suitable areas of land within the national forests not exceeding eighty acres and for periods not exceeding thirty years, for the purpose of constructing or maintaining any buildings, structures, or facilities necessary or desirable . . . for any public use or in connection with any public activity.” 16 U.S.C. § 497 (2006); *see also* 36 C.F.R. §§ 251.50–.65 (2009) (special-use permit regulations).

²⁰⁶ *See, e.g.*, 16 U.S.C. § 531(a) (directing that forests be “utilized in the combination that will best meet the needs of the American people”); § 497 (directing that in issuing special use permits the “general public[’s] . . . full enjoyment” of national forests must be considered); § 1600 (referring to the “national interest” and to the “public interest” in “the Nation’s renewable resources,” and to “meet[ing] the requirements of our people in perpetuity”); § 1601(a) (referring to “America’s renewable resources” and “national renewable resource programs”); § 1604(g) (requiring planning consistent with the princi-

we have seen, the chief motivation for feeding is to protect private property (secondarily, it helps satisfy hunter demands for more tags and longer seasons).²⁰⁷ The unavoidable results include damage to soils, water, and vegetation and higher disease rates and risks among elk, moose, and deer—all public resources.²⁰⁸ Nor are feedgrounds a “suitab[le]” use of national forests.²⁰⁹ They “impair[] the productivity of the land”;²¹⁰ they arguably “preclude the general public from full enjoyment of the natural, scenic, recreational, and other aspects of the national forests”;²¹¹ and they cause rather than “[m]inimize damage to scenic and esthetic values and fish and wildlife habitat and otherwise protect the environment.”²¹² Moreover, they are likely to cause *permanent* soil contamination²¹³—a feature that surely violates the thirty-year term limit on special uses, the requirement that uses be revocable, and the prohibition against disposing solid waste or hazardous substances.²¹⁴

ples set forth in § 531). The same objections apply to feedgrounds located on BLM lands, and FLPMA provides analogous authority. *See, e.g.*, 43 U.S.C. § 1701(a)(1) (2006) (providing for disposal of land parcels if it would serve the national interest); § 1701(a)(2) (realizing the national interest through inventories and planning); § 1701(a)(12) (concerning the Nation’s need for food, fiber, and minerals); § 1702(c) (defining multiple use in terms of needs of the American people); § 1752(a)–(b) (contrasting land used for grazing with “land . . . devoted to a public purpose”). FLPMA does not explicitly authorize the use of land for local or private purposes; references to local interests are few and qualified. *See, e.g.*, 43 U.S.C. § 1712(c)(9) (calling for coordination with “local government” land use plans “to the extent consistent with” federal public land laws); § 1716(a) (referring to the “needs of . . . local people” for land exchanges).

²⁰⁷ *See supra* Part II.

²⁰⁸ *See supra* notes 98–99, 110–16, 119–20, 122, 124–27, 198 and accompanying text.

²⁰⁹ *See, e.g.*, 16 U.S.C. § 1604(e)(2), (g)(2) (both referring to the “suitability [of lands] for resources management”). *See generally* 16 U.S.C. § 1600 (containing congressional findings regarding management of the Nation’s renewable resources).

²¹⁰ *See* 16 U.S.C. § 531(a) (directing management of the “surface resources of the national forests . . . without impairment of the productivity of the land”); § 1604(g)(3)(C) (requiring “evaluation of the effects of each management system to the end that it will not produce substantial and permanent impairment of the productivity of the land”).

²¹¹ *See* 16 U.S.C. § 497.

²¹² *See* 36 C.F.R. § 251.56(a)(1)(i)(B) (one of the terms and conditions that special use permits “must contain”).

²¹³ *See supra* notes 127–28 and accompanying text.

²¹⁴ *See, e.g.*, 36 C.F.R. § 251.51 (2009) (defining “permit” as “a special use authorization which provides permission . . . to occupy and use National Forest System land or facilities for specified purposes, and which is both *revocable and terminable*” (emphasis added) and “term permit” [essentially, the same]); § 251.54(e)(1)(ix) (requiring that proposed uses meet certain minimum requirements, including that they “not involve disposal of solid waste or . . . hazardous substances”); § 251.60 (describing the agency’s authority to revoke or suspend special use authorizations); *see also* § 251.54(e)(1)(iv) (requiring that the special use “not create an exclusive or perpetual right of use or occupancy”). The Forest Service rules recognize that “[i]mmediate suspension of a special use authorization, in whole

The U.S. Fish and Wildlife Service (USFWS or the Service) is arguably on even shakier legal ground with respect to supplemental feeding. The Service has a mandate to conserve and, where appropriate, *restore* national wildlife refuges.²¹⁵ “Conserve” is defined as “to sustain and, where appropriate, restore and enhance, healthy populations of fish, wildlife, and plants utilizing . . . methods and procedures associated with modern scientific resource programs.”²¹⁶ Congress has further directed the agency to maintain the “biological integrity, diversity, and environmental health of the [National Wildlife Refuge] System . . . for the benefit of present and future generations of Americans.”²¹⁷ Supplemental feeding on the National Elk Refuge (NER) violates these mandates in several obvious ways, for instance, by maintaining elk populations at levels unsupportable by their habitat, degrading riparian plant and animal communities, and defying the scientific consensus that crowding exacerbates disease risks.²¹⁸ Indeed, NER personnel publicly stated that “USFWS policy . . . requires that wildlife densities do not reach excessive levels that would result in adverse effects on habitat and other wildlife species, including increased disease risks.”²¹⁹ Moreover, because supplemental feeding “materially interfere[s] with” fulfillment of the National Wildlife Refuge System’s conservation and restoration

or in part, may be required when . . . necessary to protect the public health or safety or the environment.” See § 251.60(f). Furthermore, it provides that the permit “holder shall remain liable for the costs of removal and site restoration.” § 251.60(i). In a case involving BLM special use permits, the Court of Appeals for the District of Columbia concluded that a regulatory requirement that permits be revocable prohibited authorization of “licensee’s plans to invest sizable amounts of capital in improvements on the licensed property,” reasoning that “there is no real intent ever to exercise the right to revoke, for to do so would require destruction of the investment.” See *Wilderness Soc’y v. Morton*, 479 F.2d 842, 872 (D.C. Cir. 1973); see also *id.* at 871 n.60 (“[A revocable permit] can not [sic] be used as a basis for granting, under the guise of a temporary license, a substantially permanent right to maintain a railroad.” (quoting *Revocable Licenses*, 22 Op. A.G. 240, 246 (1898))). The commitment of these national forest lands to use as elk feedgrounds is *not* revocable when the likelihood of CWD contamination may prevent their use for that or any other purpose indefinitely, perhaps permanently. See *supra* notes 127–28 and accompanying text.

²¹⁵ See 16 U.S.C. § 668dd(a) (2).

²¹⁶ *Id.* § 668ee(4).

²¹⁷ *Id.* § 668dd(a) (4) (B). Smith et al.’s *Imperfect Pasture* was written, in part, “to fulfill [legal and policy] requirements” for developing habitat management plans for national wildlife refuges. See SMITH ET AL., *supra* note 38, at 1 (citing requirements to develop plans that identify species and communities of concern, based on changes from historically natural conditions and ecological processes, and which discuss “optimal management . . . to maintain and restore biological integrity, diversity, and environmental health, including a rationale for resolving conflicting habitat needs among resources of concern”).

²¹⁸ See *supra* notes 98–99, 111–16, 122, 124–27 and accompanying text.

²¹⁹ See BISON AND ELK PLAN, *supra* note 99, at vii.

mission, as well as “the purposes of the refuge,”²²⁰ it plainly is *not* a “compatible use” of the NER.²²¹

The Service’s winter feeding policy is influenced in part by a “desire to not markedly impact the Wyoming Game and Fish Department’s [(WGFD)] ability to annually meet their Jackson elk herd objective.”²²² But a federal court has ruled unequivocally that federal authority over wildlife on the NER is paramount to that of the State.²²³ And the Ser-

²²⁰ The Act establishing the NER provides:

There is established a winter game (elk) reserve in the State of Wyoming, which shall be located . . . south of the Yellowstone Park, and shall include not less than two thousand acres . . . , and the Secretary of the Interior is authorized to purchase said lands with improvements, to erect necessary buildings and inclosures, and to incur other expenses necessary for the maintenance of the reserve

16 U.S.C. § 673. A former senior biologist at the NER asserts that feeding is inconsistent with this purpose, noting that the Act “makes no mention of feeding elk.” See SMITH ET AL. *supra* note 38, at 18 (citing An Act Making Appropriation for the Department of Agriculture for Fiscal Year Ending June Thirtieth, Nineteen Hundred and Thirteen, Pub. Law No. 62-621, 37 Stat. 269, 293 (1912)). Rather, “[b]y default, feeding elk became policy out of repeated practice.” *Id.* A subsequent statute in 1927, accepting a gift of lands from the Izaak Walton League, to become part of an expanded refuge, set forth “conditions,” namely:

that [the lands] be used and administered by the United States, under the supervision and control of the Secretary of the Interior, *for the grazing of, and as a refuge for,* American elk and other big game animals, and that . . . [the lands] shall become a part of the winter elk refuge established under section 673 of this title, and shall be subject to any laws governing the administration and protection of said refuge.

Joint Resolution Authorizing the Acceptance of Title to Certain Lands in Teton County, Wyoming, Pub. Res. No. 56, 44 Stat. 1246, 1246 (1927) (codified at 16 U.S.C. § 673a) (emphasis added). The reference to “grazing,” in connection with the absence of explicit authority to feed, reinforces Smith et al.’s argument. It is worth noting that the National Wildlife Refuge System Improvement Act (NWRISA) gives priority to an individual refuge’s purposes in the event of a conflict with “the mission of the [national] System.” See 16 U.S.C. § 668dd(a) (4) (D).

²²¹ See 16 U.S.C. § 668ee(1) (defining “compatible use”).

²²² See BISON AND ELK PLAN, *supra* note 99, at 10.

²²³ See *Wyoming v. United States*, 279 F.3d 1214, 1227–28 (10th Cir. 2002). The court ruled that the NWRISA “plainly vest[s] the FWS with authority to administer the Act and manage the [National Wildlife Refuge System].” *Id.* at 1228. The court also noted that the “Tenth Amendment does not reserve to the State of Wyoming the right to manage wildlife, or more specifically vaccinate elk, on the NER, regardless of the circumstances.” *Id.* at 1227. Furthermore: “The Secretary [of the Interior] alone is authorized, ‘under such regulations as he may prescribe,’ to ‘permit the use of any area within the System for any purpose . . . whenever he determines that such uses are compatible with the major purposes for which such areas were established.’” *Id.* at 1234 (quoting 16 U.S.C. § 668dd(d) (1) (A)).

vice itself has acknowledged that it has the legal authority to break with state policies regarding feeding and disease management.²²⁴

Feedgrounds are objectionable under state law as well. Water and wildlife are public resources, which states hold in trust for their citizens and therefore are obligated to protect.²²⁵ According to the Wyoming

²²⁴ See BISON AND ELK PLAN, *supra* note 99, at xii (“Plans to follow the state CWD management plan have been made in deference to the state and could change if the National Park Service and/or the U.S. Fish and Wildlife Service adopted service-wide management requirements that differed from what is currently being done.”).

²²⁵ See, e.g., *Kleppe v. New Mexico*, 426 U.S. 529, 545 (1976) (“Unquestionably the States have broad trustee and police powers over wild animals within their jurisdictions.”); cf. *Baldwin v. Fish & Game Comm’n*, 436 U.S. 371, 388 (1978) (“The elk supply, which has been entrusted to the care of the State by the people of Montana, is finite and must be carefully tended in order to be preserved.”). Chief Justice Burger filed a concurring opinion in *Baldwin*, wherein he referred to the state’s “special interest in regulating and preserving wildlife for the benefit of its citizens” 436 U.S. at 392 (Burger, C.J., concurring). As attorneys Musiker et al. explained in their article on the public trust doctrine:

The state, as trustee, must prevent substantial impairment of the wildlife resource so as to preserve it for the beneficiaries—current and future generations. . . . [T]he state must [*inter alia*]: (1) consider the potential adverse impacts of any proposed activity over which it has administrative authority; (2) allow only activities that do not substantially impair the state’s wildlife resources; [and] (3) continually monitor the impacts of an approved activity on the wildlife to ensure preservation of the corpus of the trust

Deborah G. Musiker et al., *The Public Trust and Parens Patriae Doctrines: Protecting Wildlife in Uncertain Political Times*, 16 PUB. LAND L. REV. 87 (1995). See generally James L. Huffman, *Speaking of Inconvenient Truths—A History of the Public Trust Doctrine*, 18 DUKE ENVTL. L & POL’Y F. 1 (2007) (providing a unique historical account of the public trust doctrine in the United States); Joseph Sax, *The Public Trust Doctrine in Natural Resource Law: Effective Judicial Intervention*, 68 MICH. L. REV. 471 (1970). According to Susan Morath Horner:

[A] workable model for effectuating the public trust in wildlife must, at a minimum, include the fundamental elements of any trust relationship, as currently recognized in Anglo-American law. For wildlife and other resource managers, these translate into the following:

- 1) The designation of identifiable trustees;
- 2) The de-politicization of the process and assured independence of trustee action;
- 3) High-visibility decision-making;
- 4) A clearly articulated right by the beneficiaries of the trust to challenge those actions that fail to meet trust standards;
- 5) An elevation of the standard of care by which the trustees’ actions are judged;
- 6) Ascertainable and, where possible, objective standards for decision-making; and
- 7) New ways of thinking about the funding of wildlife management agencies.

Embryo, Not Fossil: Breathing Life into the Public Trust in Wildlife, 35 LAND & WATER L. REV. 23, 43 (2000).

Supreme Court, elk have “been entrusted to the care of the State by the people . . . and must be carefully tended in order to be preserved.”²²⁶ The State’s “duty to preserve, protect, and nurture the wild game” led the Wyoming high court to strike down a statute, which it determined had caused overhunting and “serious depletion of deer.”²²⁷ By the same token, these trust duties would support—if not compel—a state decision to end supplemental feeding, which promotes the spread of chronic wasting disease, a malady fatal to elk and other cervids.

State law does authorize the Wyoming Game and Fish Commission (WGFC) to “make suitable provisions for the feeding of the game animals, birds, and fish of Wyoming in such localities as may be deemed necessary.”²²⁸ But this begs the question of what is either “suitable” or “necessary.” Can a practice, which the agency itself concedes *increases* the prevalence of diseases and parasites in elk, seriously be defended as a measure designed to “preserve, protect, and nurture” elk populations?²²⁹ Does making elk dependent on artificial feeding keep them “wild”?²³⁰ Can feeding certain elk populations every winter for sixty years be justified as “necessary”?

The State’s report on feedgrounds leaves no doubt that the fundamental purpose of feeding is *not* to protect elk but primarily to safe-

²²⁶ See *O’Brien v. State*, 711 P.2d 1144, 1148 (Wyo. 1986) (quoting *Baldwin v. Fish & Game Comm’n*, 436 U.S. 371 (1978)); see also Tim W. Clark, *Wildlife Resources: The Elk of Jackson Hole, Wyoming*, in *PROTECTING THE COMMONS: A FRAMEWORK FOR RESOURCE MANAGEMENT IN THE AMERICAS* 91, 93 (Joanna Burger et al., eds., 2001) (“[T]he State of Wyoming . . . owns the elk in public trust as a commons resource.”); cf. *State v. Fertterer*, 841 P.2d 467, 470 (Mont. 1992) (holding that the state holds wildlife “in its sovereign capacity for the use and benefit of the people generally” (quoting *Rosenfeld v. Jakways*, 216 P. 776 (Mont. 1923)), *overruled on other grounds* by *State v. Gatts*, 928 P.2d 114 (Mont. 1996).

²²⁷ *Schakel v. State*, 513 P.2d 412, 415 (Wyo. 1973) (ruling that the State must employ means that are “reasonable and . . . appropriate for the accomplishment of [its] duty to protect and nurture the game”).

²²⁸ WYO. STAT. ANN. § 23-1-302(a) (ix) (2009). The statute also authorizes the Commission to “open game preserves for hunting when they are overstocked or a serious shortage of feed exists. These preserves shall be so managed that they do not cause overstocking or other damage to the surrounding area.” *Id.* § 23-1-302(a) (xviii). It’s noteworthy that (1) this provision does *not* authorize feeding as a remedy for a “serious shortage of feed,” and (2) it warns against overstocking—which, as the feedgrounds demonstrate, is a side effect of feeding. See *id.*

²²⁹ See *supra* notes 119, 132 and accompanying text.

²³⁰ Elk quickly become dependent on feeding by humans and are tamed relatively easily. Elk on feedgrounds are treated like domestic livestock. They are in close daily contact with humans who use motorized vehicles to feed them. On some feedgrounds they are vaccinated against brucellosis, a livestock disease, by being shot with “biobullets” fired from an air-powered rifle. WYO. GAME & FISH DEP’T, *supra* note 91, at 15–16, 18.

guard private ranching interests.²³¹ In fact, feeding is just one of a “variety of [WGFD] techniques designed to keep elk and cattle separated” for the benefit of stock and stock owners; others include providing ranchers with materials to enclose hay stack yards, hazing elk, and “lethal take of elk.”²³² Moreover, the amount spent on these management activities—funded almost exclusively by hunting and fishing license fees—has “show[n] a dramatic increase . . . over the past 20 years.”²³³ The Department has *no* legislative mandate to protect livestock from diseases found in wildlife—the mainstay of the Department’s argument that feedgrounds are necessary.²³⁴

The NER feedground and the state feedgrounds on national forests have been targets of litigation,²³⁵ but no court has yet reached the legal

²³¹ See generally *supra* notes 101–03, 138–39, 149–50 and accompanying text.

²³² WYO. GAME & FISH DEP’T, *supra* note 91, at 18. WGFD spends, on average, “\$26,752 per year [on game warden salaries] addressing elk damage. There are additional costs for equipment such as trucks, snowmobiles, and aircraft charter. The Game and Fish Department has spent between \$1,000 and \$10,000 in most years using helicopters to haze elk. Annual snowmobile operation costs routinely exceed \$10,000.” *Id.* How does shooting elk (to prevent severe damage to livestock operations) “preserve, protect, and nurture” them? See *supra* text at note 227.

²³³ WYO. GAME & FISH DEP’T, *supra* note 91, at 18.

²³⁴ See generally *supra* discussion at notes 101–03, 119, 149–50. The Wyoming Supreme Court rejected a livestock producer’s argument that WYO. STAT. ANN. § 23-1-901 (2009), by which the State assumes some liability for damage caused by big game to livestock and private land, also requires compensation for livestock losses allegedly attributable to wildlife-carried disease. See *Parker Land & Cattle Co. v. Wyo. Game & Fish Comm’n*, 845 P.2d 1040, 1041 (Wyo. 1993); cf. *Baldwin v. Fish & Game Comm’n*, 436 U.S. 371, 376 n.12 (1978) (“[A] property owner in [Montana] must recognize the fact that there may be some injury to property or inconvenience from wild game for which there is no recourse” (quoting *State v. Rathbone*, 100 P.2d 86, 93 (Mont. 1940))).

²³⁵ Several groups, including the Greater Yellowstone Coalition (GYC), sued the U.S. Forest Service and BLM in 2006 over feedgrounds on Bridger-Teton National Forest (BTNF) and BLM lands, raising procedural challenges, including that the agencies had violated the National Environmental Policy Act (NEPA) by not analyzing the environmental effects of their decisions to authorize or reauthorize feedgrounds. The Tenth Circuit Court of Appeals dismissed as moot the NEPA claims relating to six feedgrounds, which the BTNF had evaluated in an environmental impact statement (EIS) prepared after suit was brought. See *Greater Yellowstone Coal. v. Tidwell*, 572 F.3d 1115, 1128 (10th Cir. 2009) (referring to BTNF July 2008). The court affirmed the decision of the U.S. District Court in Wyoming on the remaining claims, i.e., that (1) GYC lacked standing to raise a NEPA challenge to unpermitted BTNF feedgrounds and there was no final agency action under the Administrative Procedure Act (APA); (2) GYC lacked standing on its permitting claim regarding the test-and-slaughter program, and its NEPA claim failed because authorization of the facilities was not a major federal action; and (3) “BLM adequately authorized the [BLM] feedgrounds pursuant to [a 1981 Memorandum of Understanding]” and thus, effectively GYC lacked standing. See *id.* at 1120; see also Associated Press, *Foes of Elk Feed Sites Lose Court Decision*, BILLINGS GAZETTE, July 10, 2009, http://www.billingsgazette.com/news/state-and-regional/wyoming/article_455d1dc6dce-11dc-b9c3-001cc4c03286.html (“Three of the eight feedgrounds [on national

merits of feeding. When a court *does* reach the merits in a challenge to the feedgrounds, it should rule that supplemental feeding policies, if not actually *ultra vires*, are arbitrary and capricious, and thus unlawful.²³⁶ None of the agencies involved has “articulate[d] a satisfactory explanation for its action including a ‘rational connection between the facts found and the choice made.’”²³⁷ In deferring to private ranching interests, the agencies have relied on factors that the legislatures did not intend them to consider. The decision to continue or allow feeding “runs counter to the evidence” concerning disease risks and “is so implausible that it could not be . . . the product of agency expertise.”²³⁸

If the laws governing public lands and resources were applied honestly and sensibly, our management prescriptions would change. We would manage BLM lands and national forests *sustainably*, in the *national* interest, to *prevent impairment* of their productivity.²³⁹ Giving due regard to the *relative value and scarcity* of resources,²⁴⁰ we would accord priority to protecting riparian areas²⁴¹ and other native communities and species, recognizing that they “cannot be duplicated elsewhere.”²⁴²

forest land] had never been subjected to environmental analysis, and the most recent analysis for the other five occurred in 1981.”). In separate litigation, the Defenders of Wildlife and other groups challenged feeding on the NER, raising procedural and substantive claims under the APA and NWRSA. See Memorandum in Support of Plaintiffs’ Motion for Summary Judgment, *Defenders of Wildlife v. Salazar*, No. 08-cv-00945-RJL (D.D.C. Feb. 18, 2009). To date, no legal challenge has been brought against the State of Wyoming. Thus, the possibility of bringing claims against the Forest Service or the State of Wyoming based on the merits of feeding remains open.

²³⁶ See Administrative Procedure Act, 5 U.S.C. § 706(2) (2006); Wyoming Administrative Procedure Act, WYO. STAT. ANN. § 16-3-114(c) (2009).

²³⁷ See *Motor Vehicle Mfrs. Ass’n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983) (quoting *Burlington Truck Lines v. United States*, 371 U.S. 156, 168 (1962)).

²³⁸ See *id.*

²³⁹ See, e.g., 16 U.S.C. § 531 (2006); 16 U.S.C. § 1604(b), (e), (g); 43 U.S.C. § 1702(c) (2006); 43 C.F.R. §§ 4100.0-2, 4180.2 (2009).

²⁴⁰ See, e.g., 43 U.S.C. § 1702(c); 16 U.S.C. § 529. In 16 U.S.C. § 1531, Congress stated its finding that “encouraging the States and other interested parties . . . to develop and maintain conservation programs which meet national and international standards is a key to meeting the Nation’s international commitments and to better safeguarding, for the benefit of all citizens, the *Nation’s heritage in fish, wildlife, and plants.*” 16 U.S.C. § 1531(a)(5) (emphasis added).

²⁴¹ See 43 U.S.C. §§ 1701(a)(11), 1711(a), 1712(c)(3); *supra* notes 14, 24–27 and accompanying text (discussing the importance of riparian areas). For example, “[r]iparian zones can contain nearly all the small mammal species in neighboring habitats, but the reverse is not true.” SMITH ET AL., *supra* note 38, at 131.

²⁴² See SMITH ET AL., *supra* note 38, at 130 (quoting Chester Anderson who, in describing the economic importance of the wildlife habitat in the Jackson Hole area, wrote: “This habitat cannot be duplicated elsewhere. Its loss would detrimentally affect the entire state.”). It is widely recognized that Wyoming’s wildlife is a principal drawing card for tourists who visit the state. See, e.g., *id.* at 16 (reporting that “elk were instrumental in support-

We would close the NER feedground to protect and restore the refuge's ecological integrity, diversity, and health,²⁴³ and the state feedgrounds because they violate the public trust in wildlife²⁴⁴ and basic principles of multiple use and sustained yield.²⁴⁵ We would reestablish predators, as that holds promise for restoring crucial habitats, promoting watershed health, and enabling us to cope with climate change.²⁴⁶ We would end public land grazing because using these lands to grow a commodity that can be produced *anywhere*²⁴⁷ is plainly not "the most judicious use."²⁴⁸

Public land grazing is on the wane—for a host of reasons, including declining profitability, a shrinking pool of ranchers, inadequate water supplies, species listings under the Endangered Species Act, and litigation.²⁴⁹ Why not just let it "die out naturally"? Or why not phase it

ing the local [Jackson Hole] economy" of the early 1900s, and citing the 1911 Preble Report); Prevost, *supra* note 93 ("Wildlife and outdoor activities were the primary reasons tourists listed [in a survey c. 2005] for visiting Wyoming."). According to Lee Haines, director of public relations for the Buffalo Bill Historical Center, "[p]eople come here to see wildlife and to see Yellowstone and to experience a *part of the natural world they can't get anywhere else . . .* That's why . . . it's critical we figure out a way to maintain those resources for the long term." *Id.* (citing Haines; emphasis added). Tourists spent \$2.25 billion in Wyoming in 2005; "wildlife watching generated \$300 million" of the total. *Id.* (citing Terry Cleveland, director of the WGFD); *cf. id.* ("Tourism professionals and policymakers from around the state . . . put protection of wildlife and natural resources at the top of their priority list.").

²⁴³ See 16 U.S.C. § 668dd(a) (4) (B).

²⁴⁴ See, e.g., Blake Hudson, *The Public and Wildlife Trust Doctrines and the Untold Story of the Lucas Remand*, 34 COLUM. J. ENVTL. L. 99, 109–12, 146–47 (2009) (discussing the public trust doctrine and its application to wildlife resources); see also *supra* notes 225–27 and accompanying text.

²⁴⁵ See, e.g., 16 U.S.C. §§ 528, 531(a), 1601(d)(1), 1604(e)(1), 1607; 43 U.S.C. §§ 1702(c), (h), 1712(c)(1); *cf.* Christensen et al. *supra* note 50, at 682 ("[M]anagement that focuses on commodity resources alone, that does not acknowledge the importance of diversity and complexity, that is not aware of influences of and impacts on surrounding areas, and that concerns itself with short time frames, is not likely to be sustainable in the long term."); *id.* ("[S]ustainability must be the primary objective [of strategies to provide ecosystem goods and services], and levels of commodity and amenity provision [must be] adjusted to meet that goal."); *id.* at 673 ("[O]verexploitation of resources resulting in diminished diversity often has both ecological and economic long-term opportunity costs that far exceed the short-term benefits."); *id.* ("Given ever-changing environments, the capacity to adapt is central to the long-term sustainability of ecosystem function.").

²⁴⁶ See *supra* Parts III–IV.

²⁴⁷ See 43 U.S.C. § 1712(c)(6) (directing the Secretary of the Interior to consider, when developing land use plans, "the relative scarcity of the values involved and the availability of alternative means . . . and sites for realization of those values").

²⁴⁸ This is a criterion for "multiple use," found in both the Forest Service and the BLM definitions of the term. See 16 U.S.C. § 531; 43 U.S.C. § 1702.

²⁴⁹ See Leshy & McUsic, *supra* note 12, at 369–70, 376.

out legislatively—for instance, by permanently withdrawing lands from grazing when a willing permittee irrevocably relinquishes her permit?²⁵⁰ *Because*.

- range degradation continues,
- agencies are unwilling or unable to enforce their standards (and the standards are indisputably inadequate),²⁵¹ and
- “*entire ecosystems*” are on the line—at a threshold or tipping point, at risk of being “permanently transformed.”²⁵²

Scholars and commentators report this risk matter-of-factly—without, apparently, appreciating what it means to “permanently transform” an ecosystem.²⁵³ It means that species will be extinguished and communities will unravel and possibly disappear over millions of acres; it means that genetic potential will be lost forever, hydrologic cycles and water supplies will be irreparably altered, and other indispensable ecosystem services will be forfeited.²⁵⁴ It means watching many of our cherished “pleasuring grounds” disappear,²⁵⁵ jeopardizing our ability to feed ourselves, and condemning ourselves to a future of inexorably shrinking options.

However capacious the discretion of public-land managers, surely the law does not condone these choices.

CONCLUSION

In closing, let us return to riparian areas. Those thin green cords that lace our landscapes also tie together the wide-ranging topics touched on here.

In his lyrical *Song of the Gavilan*, Aldo Leopold wrote:

²⁵⁰ See *id.* at 388–97 (proposing a voluntary surrender and legislatively mandated retirement solution).

²⁵¹ See *supra* discussion at note 22 (regarding condition of public rangelands).

²⁵² See Leshy & McUsic, *supra* note 12, at 372–73. As I explained in *The Western Range Revisited*, Congress recognized grazing’s causal role in transforming ecosystems when it passed the Taylor Grazing Act and, starting about 1990, range ecologists explained the phenomenon and documented ecosystem shifts that had *already* occurred and conditions signaling other imminent transformations. See DONAHUE, *supra* note 17, at 34–35, 146–51, 179, 198, 316 n.96. Still, for the most part, BLM and the Forest Service continue to ignore the science concerning thresholds. See Donahue, *supra* note 3, at 305.

²⁵³ See, e.g., Leshy & McUsic, *supra* note 12, at 373 (illustrating scholars’ matter of fact statements about permanent ecosystem transformation).

²⁵⁴ See *id.*

²⁵⁵ See 16 U.S.C. § 21 (2006) (establishing Yellowstone National Park “as a public park or pleasuring ground for the benefit and enjoyment of the people”).

The life of every river sings its own song, but in most the song is long since marred by the discords of misuse. Overgrazing first mars the plants and then the soil. Rifle, trap, and poison next deplete the larger birds and mammals; then comes a park or forest with roads and tourists. Parks are made to bring the music to the many, but by the time many are attuned to hear it there is little left but noise.²⁵⁶

Watercourses and their riparian areas are *the* most valuable habitats in the Interior West.²⁵⁷ They are also among the most degraded.²⁵⁸ Experience suggests *only two* affordable²⁵⁹ and sustainable ways to rehabilitate damaged riparian areas at landscape scales—removing livestock and reestablishing top predators.²⁶⁰ Removing livestock from public lands would improve watershed conditions *and* make the return of predators politically feasible.²⁶¹ Removing livestock also would facilitate closing elk feedgrounds.²⁶² Closing the feedgrounds would slow the spread of disease, avoid long-term soil contamination, and directly improve conditions on several thousand acres now treated as sacrifice areas.²⁶³ Collectively, these measures—removing livestock, returning predators, and closing feedgrounds—would enhance prospects for coping with climate change.²⁶⁴

A landscape, Leopold suggested, is “the owner’s portrait of himself.”²⁶⁵ Among western farmers and ranchers of the 1930s he found

²⁵⁶ LEOPOLD, *supra* note 51, at 149–50.

²⁵⁷ See *supra* notes 24–27, 232 and accompanying text.

²⁵⁸ See *supra* notes 27–31 and accompanying text.

²⁵⁹ See E.S. Bernhardt et al., *Synthesizing U.S. River Restoration Efforts*, 308 *SCIENCE* 636–37 (2005) (reporting costs for various restoration goals; the median cost of \$15,000 for livestock exclusion for riparian management was less, sometimes dramatically less, than for any other “common restoration activities”).

²⁶⁰ Interview with Dr. Robert L. Beschta, Emeritus Professor of Watershed Processes & Hydrology, Or. State Univ., in Corvallis, Or. (Oct. 5, 2009); cf. DONAHUE, *supra* note 17, at 286 (“[E]limination of grazing lands holds greater potential for benefiting biodiversity than any other single land use measure.”); Benayas et al., *supra* note 174, at 1122 (reporting that thirteen of the restoration assessments examined involved “passive restoration,” that is “cessation of degrading action [such as overgrazing] only”). Noting that restoration is costly and “does not necessarily achieve the values of biodiversity or ecosystem services found in intact ecosystems,” Benayas and his co-authors stressed “the primary need to conserve wild nature and avoid environmental degradation wherever possible.” *Id.* at 1124.

²⁶¹ See *supra* notes 18–21, 58, 84 and accompanying text.

²⁶² See *supra* notes 134, 136–38, 149–50, 231–32 and accompanying text.

²⁶³ See *supra* notes 131–33, 191 and accompanying text.

²⁶⁴ See *supra* notes 52, 58–59, 92, 169, 171, 178, 181–83 and accompanying text.

²⁶⁵ NEWTON, *supra* note 50, at 261 (quoting and citing Leopold, *The Farmer as a Conservationist*).

“no sense of pride in the husbandry of wild plants and animals, no sense of shame in the proprietorship of a sick landscape.”²⁶⁶ National forest and Bureau of Land Management rangelands paint a similarly unflattering picture of their owners: at best, ignorant; at worst, greedy, short-sighted, and insensitive to the needs of what Leopold referred to as the “land community.”²⁶⁷

Leopold’s land ethic was inspired by the need to “protect the public interest in private land.”²⁶⁸ It “provided the ecological base for a new understanding of private landownership, giving content to the individual’s duty, as [Leopold] put it, ‘to manage his land in the interest of the community, as well as in his own interest.’”²⁶⁹ In the public lands arena, the relevant community is the nation. “[S]o long as the lands are owned by the whole nation,” professor and former interior solicitor John Leshy wrote recently, “the ultimate test is what best serves the national interest.”²⁷⁰ Whether on public lands or on private, the relevant and essential standard is land health,²⁷¹ a concept that Leopold summarized as “the capacity of the land for self-renewal.”²⁷²

²⁶⁶ LEOPOLD, *supra* note 51, at 158. Leopold continued: “We tilt windmills in behalf of conservation in convention halls and editorial offices, but on the back forty we disclaim even owning a lance.” *Id.*

²⁶⁷ See NEWTON, *supra* note 50, at 269–73.

²⁶⁸ See *id.* at 349–50 (“[Leopold’s land ethic] provided the means to protect the public interest in private land, an issue for Leopold from his first days in the Southwest.”).

²⁶⁹ See *id.* at 350 (quoting Aldo Leopold, Conservation 1 (Aug. 8, 1946)) (unpublished manuscript, stapled to letter from Horace Fries).

²⁷⁰ See Leshy & McUsic, *supra* note 12, at 389. Leshy and McUsic propose federal legislation that “directs the responsible federal agency to retire federal land from grazing permanently *if* the holder of the federal permit requests it.” *Id.* at 388 (emphasis added). They explain:

By enacting our proposed statute, Congress would be making a national policy decision for the lands managed by the BLM and U.S. Forest Service. This is appropriate because, so long as the lands are owned by the whole nation, the ultimate test is what best serves the national interest. We hasten to add that the statute would not operate unless the owner of the grazing permit decided to sell the permit to the conservation buyer.

Id. at 389. The proviso, which these writers “hasten to add,” is testament to the political clout long wielded by public-land ranchers. See *id.* Their proposed legislative solution is not sufficient. What is needed is a “national policy decision” by Congress that public-land livestock grazing should end *now*, not if or when individual ranchers decide to retire.

²⁷¹ Cf. NEWTON, *supra* note 50, at 349 (“Leopold phrased his land ethic in general terms, . . . grounded in the most up-to-date ecological research. Leopold’s guiding land ethic and the goal of land health could be applied to the use and conditions of all lands.”). According to a National Research Council committee, “‘healthy’ rangelands are capable of producing a wealth of tangible goods or commodities other than livestock forage, including “wildlife habitat, water, minerals, energy, recreational opportunities, some wood products, and plant and animal genes,” as well as intangible values and services, including

The national interest standard would seem self-evident.²⁷³ As rangeland management principles, however, that standard and “land health” have been ignored or misunderstood or manipulated for decades by Congress and agency officials. Two hundred million acres of public lands have been treated as sacrifice areas.²⁷⁴ A vanishingly small segment of the population has profited from public resources, to the detriment of nearly every other user, and undermined the lands’ overall, long-term productivity. By any calculus, allowing ranchers to fatten their livestock on public lands has been neither in the national interest nor consistent with maintaining land health.

Public rangelands comprise a heritage of immense, and rapidly appreciating, worth.²⁷⁵ The nation’s interest in these lands is best served by conserving their unique values—resources “which can shrink but not grow.”²⁷⁶ Restoring and maintaining soils, vegetation, water, and wildlife will generate long-term benefits in the form of ecosystem

scenic beauty, solitude and open space, wilderness, sources of spiritual and cultural enrichment, and opportunities for scientific research. See Donahue, *supra* note 3, at 301 n.11 (quoting RANGELAND HEALTH, *supra* note 4).

²⁷² NEWTON, *supra* note 50, at 321 (quoting LEOPOLD, *supra* note 51, at 221). Leopold explained:

The land consists of soil, water, plants, and animals, but health is more than a sufficiency of these components. It is a state of vigorous self-renewal in each of them, and in all collectively. Such collective functioning of interdependent parts for the maintenance of the whole is characteristic of an organism. In this sense land is an organism, and conservation deals with its functional integrity, or health.

Id. at 322 (quoting ALDO LEOPOLD, *Conservation: In Whole or in Part?*, in *THE RIVER OF THE MOTHER OF GOD AND OTHER ESSAYS BY ALDO LEOPOLD*, *supra* note 17, at 310 (previously unpublished manuscript)). The reintroduction of wolves to Yellowstone has demonstrated the interdependent functioning of the components of the land organism. See discussion *supra* notes 41–52.

²⁷³ *But see* Eric T. Freyfogle, *Federal Lands and Local Communities*, 27 ARIZ. L. REV. 653, 679 (1985) (noting the “longstanding issue of whether federal lands should be managed to further the interests of the national public or should be managed with greater emphasis on the interests of the local public”). I have addressed this issue and disagree with Freyfogle’s suggestion. Donahue, *supra* note 185, at 729–30 n.39.

²⁷⁴ See Leshy & McUsic, *supra* note 12, at 368, 376–77, 388.

²⁷⁵ Rangeland resources and amenities, such as clean water and recreation opportunities, grow in value as our population increases and climate change escalates. See *supra* notes 178, 184; see, e.g., H. Bradley Kahn, *Uses and Values of the National Elk Refuge, Wyoming*, 104 YALE FORESTRY & ENVTL. STUDIES BULL. 139, 139 (2000) (referring to the Jackson Hole refuge as “one of the most treasured, recognizable, and visited ecosystems in the world”). See generally Jan G. Laitos & Thomas A. Carr, *The Transformation on Public Lands*, 26 ECOLOGY L.Q. 140 (1999).

²⁷⁶ *Cf.* Leopold, *supra* note 51, at 199 (describing wilderness as a “resource which can shrink but not grow”). The same can be said of most *public* values of public lands.

goods and services, at a scale not otherwise possible. One of these services, as discussed above, is climate change mitigation²⁷⁷—a national interest of the highest order.

On western public lands we have an opportunity—perhaps a final opportunity—to bring back the music of the rivers²⁷⁸ and to rebuild the land community. But we must choose between grazing livestock and restoring the land. On the public's lands, *our land*, the choice should be easy.

²⁷⁷ See *supra* Part IV.

²⁷⁸ “[T]he good life on any river,” Leopold suggested, might also “depend on the perception of [the river’s] music, and the preservation of some music to perceive.” LEOPOLD, *supra* note 51, at 154; see also *supra* text accompanying note 256.