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**Beyond a Government-the-Hunter Paradigm:
Challenging Government Policies on Deer in a
Critical Ecological Era**

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ABSTRACT

This Article examines the current forcible model of deer control sweeping the United States and proposes another model in its stead: one that adapts and works symbiotically with natural processes. Effective resource management and sound environmental ethics are supported by a shift away from heavy-handed animal control. A shift in management perspective makes sense when the presence of deer is officially treated as a “pest” problem. Although, with time and patience, a natural balance could be achieved. Moreover, forcible animal control can diminish biodiversity and exacerbate climate change in ways science is just beginning to understand. Emerging research results indicate the need for policy changes.

INTRODUCTION

A forcible model of deer control throughout the eastern United States currently stands as the norm, supported by the National Park Service (Park Service), the U.S. Department of Agriculture (USDA), state game and fish commissions, and several nongovernmental conservation organizations. These entities advance various forms of the prevailing response to a perceived crisis of deer overpopulation in North America. Reflecting and amplifying the concept of the U.S. deer population as an environmental crisis, *Time* magazine ran a story in December 2013 that included a cover photo of a deer with the headline “America’s Pest Problem.”¹ This conception of too many free-living animals encompasses more than the deer. Over the article’s by-line, a synopsis states: “After nearly wiping out many wildlife species 50 years ago, Americans are once again living close—sometimes uncomfortably so—to all kinds of feral creatures. Why wildlife in the U.S. needs stronger management.”²

¹ David Von Drehle, *America’s Pest Problem: It’s Time to Cull the Herd*, TIME, (Dec. 9, 2013), <http://time.com/709/americas-past-problem-its-time-to-cull-the-herd> (stating “We have too many wild animals—from swine to swans” and prescribing a modified regime of human hunting rather than a perspective attuned to natural predator-prey relationships).

² See *id.* The report suggests that we nearly wiped out many species and now the species have come back. In fact, of all species recorded as becoming extinct since the year 1500, most lived in the United States (followed by Tanzania, Uganda, and Mauritius). See *The Atlas of the Real World*, NEW SCIENTIST (Oct. 27, 2008), <http://www.newscientist.com/gallery/dn15041-the-atlas-of-the-real-world/7>.

The Nature Conservancy (TNC), a charity based in Arlington, Virginia, shows a readiness to act accordingly.³ Under the headline *Too Many Deer: A Bigger Threat to Eastern Forests than Climate Change?* TNC's science blog published a list of dangers posed by deer, ranging from the loss of east-coast songbirds and trillium to the deaths of entire forests.⁴ The webpage invokes, in large text, a quote from the 1949 writings of Aldo Leopold: "I now suspect that just as a deer herd lives in mortal fear of its wolves, so does a mountain live in mortal fear of its deer."⁵ By plucking the quote from its context, TNC fails to offer its readers the point that people have erroneously extirpated wolves. Reunited with its rich, valuable context, Leopold's quote reads:

We reached the old wolf in time to watch a fierce green fire dying in her eyes. I realized then, and have known ever since, that there was something new to me in those eyes - something known only to her and to the mountain. I was young then, and full of trigger-itch; I thought that because fewer wolves meant more deer, that no wolves would mean hunters' paradise. But after seeing the green fire die, I sensed that neither the wolf nor the mountain agreed with such a view.

Since then 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 anaemic desuetude, and then to death. I have seen every edible tree defoliated to the height of a saddlehorn. Such a mountain looks as if someone had given God a new pruning shears, and forbidden Him all other exercise. In the end the starved bones of the hoped-for deer herd, dead of its own too-much, bleach with the bones of the dead sage, or molder under the high-lined junipers.

I now suspect that just as a deer herd lives in mortal fear of its wolves, so does a mountain live in mortal fear of its deer. And perhaps with better cause, for while a buck pulled down by wolves can be replaced in two or three years, a range pulled down by too many deer may fail of replacement in as many decades. So also

³ According to its website, TNC is "the leading conservation organization working around the world to protect ecologically important lands and waters for nature and people." See *About Us: What We Do*, THE NATURE CONSERVANCY, <http://www.nature.org/about-us/index.htm> (last visited Feb. 11, 2015).

⁴ Allen Pursell, *Too Many Deer: A Bigger Threat to Eastern Forests than Climate Change?*, THE NATURE CONSERVANCY (Aug. 22, 2013), <http://blog.nature.org/science/2013/08/22/too-many-deer/#sthash.uvqz7CKL.dpuf>.

⁵ *Id.* (quoting ALDO LEOPOLD, A SAND COUNTY ALMANAC AND SKETCHES HERE AND THERE 32 (1949)).

with cows. The cowman who cleans his range of wolves does not realize that he is taking over the wolf's job of trimming the herd 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.⁶

The column published by TNC bypasses Leopold's key point: that because predators play an integral role in the healthy functioning of ecosystems, a profusion of deer is connected to the removal of predators, whether to suit hunters or ranchers. To recommend deer control without addressing the underlying predator-control policies is to argue and act based on an incomplete environmental perspective. Context must be included for the purpose of sound, rational policy.

The Nature Conservancy's webpage reflects the dominant thinking surrounding deer-related policy. It is fashioned into a "call to action" supporting state-based deer eradication measures, while ignoring the unintended consequences of imposing heavy-handed human control to fix the supposed threat imposed by heavy-handed human control itself.

Wolves no longer inhabit the eastern part of North America, south of Ontario.⁷ Across the United States, in the places where the wolves have been extirpated from their historical range, coyotes, *Canis latrans*, have wriggled in.⁸ The generally smaller mesopredators are replacing apex predators—large carnivores with no predators of their own—in the eastern United States, where habitat patches capable of supporting large carnivores are now bereft of wolves. If not artificially suppressed, coyotes can significantly help keep the eastern deer population in check.⁹

⁶ LEOPOLD, *supra* note 5, at 30-32.

⁷ See *Backgrounder on Wolf Conservation in Ontario*, ONTARIO MINISTRY OF NATURAL RESOURCES (June 2005), <http://www.web2.mnr.gov.on.ca/mnr/ebr/wolves/backgrounder.pdf>. Wolves, once at home across much of North America, were wiped out of most of the contiguous United States in the early 1900s. See Kirsten Weir, *Return of the Wolves* 10, LIFE SCIENCE NEWS, http://www.cof.orst.edu/leopold/news_articles/WRS_Wolf.pdf (last visited Mar. 19, 2015). Reintroductions and some migration from Canada have restored the predators to a small fraction of their former territory. Suzanne Bohan, *Lack of Predators Harms Wild Lands*, SAN MATEO COUNTY TIMES (June 21, 2008), http://www.lordsofnature.org/press/lon_press_san_mateo_times_6_21_08.pdf. The reintroduction of wolves into Yellowstone was opposed by ranchers and took years of litigation to effect. *Id.*

⁸ See *Canids: Foxes, Wolves, Jackals and Dogs* 81-116, THE WORLD CONSERVATION UNION (2004), <http://www.carnivoreconservation.org/files/actionplans/canids.pdf>.

⁹ Coyotes can act as apex predators in regions of the United States where larger predators have been extirpated. Gary W. Roemer, et al., *The Ecological Role of the Mammalian Mesocarnivore*, 59 BIOSCIENCE 165, 170 (2009) (noting prior research observing this dynamic as it occurs in southern California). See also notes 22-25 and

The natural role of coyotes and other predators is missing from, or devalued in, today's prevailing methods. Currently, local and state governments and federal agencies suppress the predators. In turn, they respond to social pressures to suppress the deer, which leads to high monetary expenses,¹⁰ division in communities,¹¹ and great cost to bio-communities across the continent.

In Part I, this Article considers the history of deer and their biological role in predator-prey dynamics in the United States, particularly in the eastern region where wolves have been extirpated. Part II focuses on the effects of the human population on deer and the direct, forcible interventions carried out against deer populations by federal, state, and local officials.

surrounding text. Coyotes span most North American territory. *See Canis Latrans: North American Range Map*, THE SMITHSONIAN BOOK OF NORTH AMERICAN MAMMALS (1999), available at http://www.discoverlife.org/nh/tx/Vertebrata/Mammalia/Canidae/Canis/latrans/images/Canis_latrans_map.320.jpg.html.

¹⁰ *See, e.g., infra* notes 112 and 114. Coyotes would, if not suppressed, curb deer populations “for free,” to use the ecosystem services valuation terminology popularized by economist Pavan Sukhdev, who has estimated the annual cost of anthropogenic damage to the natural world at \$2–\$4.5 trillion and as encompassing nature-watching, nature’s health benefits, and carbon capture. *See* Roger Cohn, *Putting a Price on the Real Value of Nature*, ENVIRONMENT 360 (Jan. 5, 2012), http://e360.yale.edu/feature/putting_a_price_on_the_real_value_of_nature/2481/. Other scholars have raised the concern that valuing other beings and ecosystems in terms of what they can do for our economies will weaken environmental advocacy. *See* Kent H. Redford & William M. Adams, *Payment for Ecosystem Services and the Challenge of Saving Nature*, 23(4) CONSERVATION BIOLOGY 785 (2009). Nevertheless, when states anxiously insist that managing animals to maximize hunting brings in substantial revenue, it is important to also explain the cost of deer control for which the public is obliged to pay.

¹¹ When sharpshooters on a federal contract had “reduced the deer population at Valley Forge National Historical Park by about half, killing 600,” the *Philadelphia Inquirer* described the killing as a “hotly controversial four-year culling program” while a park manager “said the operation ‘exceeded expectations. . . . We’re very pleased.’” Anthony R. Wood, *Officials Say They’re Pleased with Deer Cull at Valley Forge*, PHILADELPHIA INQUIRER (Mar. 29, 2011), http://articles.philly.com/2011-03-29/news/29362340_1_agriculture-sharpshooters-deer-population-deer-herd. For discussion of “mounting anger” in a New York community, *see* Christopher Walsh, *Mounting Anger on Deer Reduction Plan*, EAST HAMPTON STAR (Dec. 5, 2013) (noting 1880 signatures on an Internet petition titled “Stop Long Island Farm Bureau/USDA Stealth Plan to Brutally Slaughter 5,000 East End Deer”). People in and around Cornell who oppose the deer management effort at that university’s campus include James LaVeck, who started a petition, explaining that “[w]e feel we’re speaking for a lot of people who don’t want our community to become an open-air slaughterhouse.” Jim Kenyon, *Cornell’s Campus Deer Management Program Meets Opposition*, CNYCENTRAL.COM (Mar. 26, 2014), <http://www.cnycentral.com/news/story.aspx?id=1023221>.

Part III reflects on the unintended consequences of forcible deer management, including the effects in a sensitive biosphere and a warming climate. Part IV considers free-living animals' place in environmental ethics, while Part V offers recommendations for a shift in government policy and practice.

I

DEER IN THE UNITED STATES

A. Here, Gone, and Here Again

Indigenous white-tailed deer, *Odocoileus virginianus*, are familiar figures throughout the eastern United States.¹² Related are the smaller Coues deer, *Odocoileus virginianus couesi*, of Arizona, New Mexico, and Mexico, and the diminutive Florida Key deer, *Odocoileus virginianus clavium*.¹³ Deer are ungulates, from the Latin word, *ungula*, for hoof.¹⁴ As herbivores, they rely on the food and cover provided by green plants and woody browse.¹⁵ The sustenance and space for deer, and the deer themselves, were widespread when Europeans colonized the mid-Atlantic region in the early 1600s.¹⁶ By 1900, however, human hunters had nearly eradicated white-tailed deer from the region.¹⁷ In the 1930s, the dwindling deer population was

¹² Donald M. Waller & William S. Alverson, *The White-Tailed Deer: A Keystone Herbivore*, 25 WILDLIFE SOCIETY BULLETIN 217 (Summer 1997).

¹³ See Robin J. Innes, *SPECIES Odocoileus virgianaus*, U.S. FOREST SERV. (2013), <http://www.fs.fed.us/database/feis/animals/mammal/odvi/all.html>. A separate species, native to the western segment of North America, is the mule deer (*Odocoileus hemionus*). See Kelley M. Stewart, et al., *Spatial Distributions of Mule Deer and North American Elk: Resource Partitioning in a Sage-Steppe Environment*, 163(2) THE AMERICAN MIDLAND NATURALIST 400–12 (2010). The Pacific coastal (or Columbia) blacktails (*Odocoileus hemionus columbianus*) are a regional variation of mule deer, and the Sitka deer of Alaska (*Odocoileus hemionus sitkensis*) are also close relatives of mule deer. See WILD MAMMALS OF NORTH AMERICA: BIOLOGY, MANAGEMENT, AND CONSERVATION 889 (George A. Feldhamer et al. eds., 2d ed. 2003).

¹⁴ Steven Ferguson, *Welcome to the Ungulate Collection*, THE UNIVERSITY OF EDINBURGH (1997), available at: <http://www.nhc.ed.ac.uk/index.php?page=493.170> (last viewed Mar. 17, 2015).

¹⁵ THE BUCK STOPS HERE: HISTORY, BIOLOGY AND MANAGEMENT OF WHITE-TAILED DEER IN VIRGINIA, VA. DEPT. OF GAME & INLAND FISHERIES, <http://www.dgif.virginia.gov/wildlife/deer/factsheet.pdf> (last visited Apr. 29, 2015).

¹⁶ *Id.* See also Andrea S. Laliberte & William J. Ripple, *Range Contractions of North American Carnivores and Ungulates* 123–38. 54 BIOSCIENCE 2004 (stating “Species contractions were a result of Euro-American settlement and post-settlement development in North America. These effects have been widespread and indicate a rapid collapse of species distributions over the course of only 1 to 2 centuries.”).

¹⁷ VA. DEPT. OF GAME & INLAND FISHERIES, *supra* note 15.

augmented at the behest of recreational hunters through habitat restoration and the reintroduction of deer.¹⁸ Although subspecies include endangered communities as well as those recovering under legal protection,¹⁹ deer usually adapt well to their surroundings. With optimal conditions, a deer population could double in size annually.²⁰ Deer now inhabit a wide variety of environments in North America—forests, meadows, mountain terrain, coastal islands, suburbs, and cities.²¹

B. Control by Natural Predation

Wolves, historically the strongest predators of deer throughout the forty-eight conterminous United States, no longer inhabit the east.²² Coyotes and coyote-wolf hybrids have now firmly established themselves in the mid-Atlantic region.²³ Deer flesh constitutes about one third of coyote-wolf hybrids' diets,²⁴ and non-hybrid coyotes also capably prey on deer.²⁵ In Auburn, Alabama, coyotes were the leading

¹⁸ *Id.*, stating:

Since the 1930s, Virginia's deer population has rebounded as a result of protective game laws, restocking of deer into areas where they were absent, and habitat restoration. Since the early 1990s, deer management objectives have switched from restoring and increasing to controlling and stabilizing populations over much of the Commonwealth.

¹⁹ See, e.g., *Species Profile: Columbian White-Tailed Deer* (*Odocoileus virginianus leucurus*), U.S. FISH & WILDLIFE SERV., available at <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A002> (last visited Mar. 17, 2015).

²⁰ *Id.*

²¹ *Id.*

²² See William J. Ripple & Robert L. Beschta, *Linking Wolves and Plants: Aldo Leopold on Trophic Cascades*, 55 *BIOSCIENCE* 613, 615 (2005). See also *supra* note 8 and surrounding text.

²³ Hybrid offspring of coyotes and wolves—identified by their DNA and skulls—have been found in mid-Atlantic states such as New York, Pennsylvania, and Virginia. Christine Dell'Amore, *Hybrid Offspring of Coyotes and Wolves Have Spread South Along the Eastern Seaboard, a New DNA Study Confirms*, NATIONAL GEOGRAPHIC NEWS (Nov. 7, 2011), <http://news.nationalgeographic.com/news/2011/11/111107-hybrids-coyotes-wolf-virginia-dna-animals-science/#close-modal>.

²⁴ *Id.* (noting that research by Roland Kays, curator of mammals at the New York State Museum in Albany, shows that this is a much higher proportion than in western states).

²⁵ Jeff Gammage, *In Suburban Forest of Valley Forge, Balancing Coyotes vs. Deer*, WASHINGTON POST (Nov. 7, 2010), <http://www.washingtonpost.com/wp-dyn/content/article/2010/11/05/AR2010110507603.html>. It comes as no surprise that coyotes kill deer, given that coyotes have been directly observed killing full-grown elk in heavy snow conditions. Eric M. Gese & Scott Grothe, *Analysis of Coyote Predation on Deer and Elk*

cause of a sixty-seven percent mortality rate among fawns.²⁶ A study run by a research biologist with the U.S. Forest Service Southern Research Station involved a similar “natural experiment” in South Carolina, where deer populations dropped after a rise in coyote populations.²⁷ The same basic pattern appears in suburban Chicago, where coyotes are the primary predators of fawns. An Illinois Natural History Survey study found that coyotes killed twenty to eighty percent of the fawns in various populations.²⁸ “As a top predator,” writes wildlife biologist Stanley D. Gehrt, “coyotes are performing an important role in the Chicago region. Increasing evidence indicates that coyotes assist with controlling deer and Canada goose populations.”²⁹ In short, deer have natural predators whose capacity for both controlling ungulates and fostering a healthy and balanced biodiversity is well understood.

Where predators are absent, prey animal populations—such as deer—increase. As deer populations increase, so does their pressure on plant life.³⁰ In this way, suppression of predators sets off a cascade

during *Winter in Yellowstone National Park, Wyoming*, 133 AM. MIDLAND NATURALIST 36, 36–43 (1995).

²⁶ Sarah Saalfeld, an Auburn University student under the direction of Dr. Stephen Ditchkoff, conducted a study to see if fawn survival was impacted by coyotes in an urban setting, and found deer as the leading cause of the fawns’ sixty-seven percent mortality rate. The *Washington Post* discussed this study in 2009 in relation to a legal challenge to the deer management plan at Valley Forge National Historical Park. Gammage, *supra* note 25.

²⁷ Statewide Deer Harvest Decreases in 2010, S.C. DEP’T OF NATURAL RES. (May 31, 2011), available at http://www.dnr.sc.gov/news/yr2011/june2/june2_deer.html. The state has undertaken a major study with researchers at the Savannah River Site investigating the affects coyotes have on the survival of deer fawns. Cumulative data throughout the study as of 2011 indicated approximately seventy percent total fawn mortality with coyotes being responsible for approximately eighty percent of these mortalities. If these findings even moderately represent a statewide situation, coyotes are significantly impacting deer populations. *Id.*

²⁸ STANLEY D. GEHRT, THE COOK CNTY., ILL., COYOTE PROJECT, URBAN COYOTE ECOLOGY AND MANAGEMENT (2011), available at <http://ohioline.osu.edu/b929/pdf/b929.pdf>. The INHS study concluded that “[c]oyotes cannot reduce deer populations because they do not often take adult deer . . . but they may slow population growth in high-density areas through their predation on fawns.” *Id.* Yet slowed population growth is more important than “reduction,” which may be cyclical.

²⁹ *Id.*

³⁰ See William J. Ripple & Robert L. Beschsta, *Wolves and the Ecology of Fear: Can Predation Risk Structure Ecosystems?*, 54 BIOSCIENCE 755, 756 (2004) (“Comparing total deer (family Cervidae) bio mass in areas of North America with and without wolves, Crête (1999) suggested that the extirpation of wolves and other predators has resulted in unprecedentedly high browsing pressure on plants in areas of the continent where wolves have disappeared.”).

of consequences that even impact climate, as discussed in Part III. As a result of trophic cascade, the “progression of indirect effects by predators across successively lower trophic levels,” vegetation is profoundly altered by herbivores in the absence of top predators.³¹ From the Greek word *trophikos*, meaning nourishment, trophic levels are successive levels of organisms consuming one another. As found in ecosystems, these levels become the entire natural system known as the food web. This point directly relates to Aldo Leopold’s observations of the ravaged eastern mountains and rivers after wolf predation was removed from the deer lifecycle.³²

Scientists have documented this dynamic in numerous areas. In the late 1990s, studies of Canada’s Jasper National Park revealed new aspen growth “following the recolonization of wolves in the park, with particularly vigorous regeneration in areas of high predation risk (i.e., near wolf trails).”³³ For decades, the browsing effects of elk and other ungulates on the northern range of Yellowstone National Park have been held responsible for the serious effects on vegetation. The broader literature and research, however, indicate the extirpation of wolves—the keystone predator in that ecosystem—as likely the chief cause of the decline in aspen, cottonwood, and willow across Yellowstone’s northern range.³⁴ The reintroduction of wolves to Yellowstone in 1995 increased the vigilance and movement of elk. Devastated cottonwood and aspen began to rebound, followed by many communities of native mammals, reptiles, and insects reliant on the foliage for food and shelter.³⁵

³¹ *Id.* at 755 (quoting the definition set out by JOHN A. ESTES et al., THE ECOLOGICAL ROLE OF PREDATORS (2001), available at <http://people.biology.ufl.edu/rdholt/holtpublications/104.PDF>).

³² Ripple & Beschta, *supra* note 30, at 755 (making this connection to Leopold’s observations).

³³ *Id.* at 756 (internal citation omitted); see also Robert L. Beschta & William J. Ripple, *Wolves, Elk, and Aspen in the Winter Range of Jasper National Park, Canada*, 37 CANADIAN J. FOREST RES. 1873 (2007).

³⁴ Ripple & Beschta, *supra* note 30, at 764. Ungulates in Yellowstone National Park include elk, bison, mule deer, white-tailed deer, moose, pronghorn antelope, and bighorn sheep. *Id.* at 758–59.

³⁵ *Id.* See also Robert L. Beschta & William J. Ripple, *Recovering Riparian Plant Communities with Wolves in Northern Yellowstone, USA*, 18 RESTORATION ECOLOGY 380, 380–89 (2010) (describing Yellowstone ecosystem’s “experiment in time” wherein elk kept woody growth from reaching more than 100cm until wolves were reintroduced).

A similar trend followed involving mule deer and cougars in Yosemite National Park. Yosemite Valley's evening primrose plants and black oaks, whose acorns support many small mammals and insect species,³⁶ failed to thrive where mule deer freely browsed rather than moved to avoid cougars, *Puma concolor*.³⁷ Since the 1920s, deer populations had surged in the valley after a government campaign to eliminate predators such as cougars and coyotes.³⁸ Within two miles from the Visitor Center, the park's main hub of human activity, deer browsed freely on acorns and oak sprouts because the tourism scared away the cougars.³⁹ Few oak trees had grown since the early 1900s, except in low browsing sites—refugia where more young trees stood than old trees.⁴⁰ Once trophic cascades begin, areas without predators also lose populations of birds, small mammals, frogs, butterflies, and insects. With over-browsed vegetation, fish dependent on streamside plants die and ravaged banks wash out.⁴¹ Also as a result of foliage loss along their banks, streams change course.⁴²

David Graber, chief scientist of the Pacific West Region for the National Park Service, remarks, "I was schooled in Berkeley in the 1970s to think predators didn't play a huge role in the ecosystem. And that's been turned on its head."⁴³ In the 1900s, natural resource managers aggressively targeted large predators. Graber states that studies connecting the presence of large predators to the vigilance and movement of ungulates, and the health of forests and wildflower blooms in turn, is "one of the most exciting new ideas in ecology within the last 25 years."⁴⁴ Yet trophic cascades specialist William J. Ripple and watershed conservationist Robert L. Beschta quote a

³⁶ See William J. Ripple & Robert L. Beschta, *Trophic Cascades Involving Cougar, Mule Deer, and Black Oaks in Yosemite National Park*, 141 *BIOLOGICAL CONSERVATION* 1249, 1251 (2008).

³⁷ *Id.* at 1250.

³⁸ *Id.*

³⁹ *Id.* at 1250–51.

⁴⁰ *Id.* at 1252. *Refugia* are sites shielded by physical barriers to deer access. *Id.* at 1251.

⁴¹ Robert L. Beschta & William J. Ripple, *The Role of Large Predators in Maintaining Riparian Plant Communities and River Morphology*, 157–58 *GEOMORPHOLOGY* 88–98 (2012). See also William J. Ripple & Robert L. Beschta, *Linking a Cougar Decline, Trophic Cascade, and Catastrophic Regime Shift in Zion National Park*, 133 *BIOLOGICAL CONSERVATION* 397, 398 (2006).

⁴² Beschta & Ripple, *supra* note 41, at 88–98.

⁴³ Suzanne Bohan, *Lack of Predators Harms Wild Lands*, *CONTRA COSTA TIMES* (June 21, 2008), http://www.contracostatimes.com/science/ci_9662208 (quoting David Graber).

⁴⁴ *Id.*

description of the general concept as early as 1943, from Aldo Leopold:

We have found no record of a deer irruption in North America antedating the removal of deer predators. Those parts of the continent which still retain the native predators have reported no irruptions. This circumstantial evidence supports the surmise that removal of predators predisposes a deer herd to irruptive behavior.⁴⁵

In the time since Aldo Leopold warned of this effect, coyotes have arisen where wolves have been ousted.⁴⁶ Coyotes, once mesopredators, are now keystone predators in these places.⁴⁷ Pennsylvania, for example, is home to an estimated 100,000 coyotes, with hunters and trappers killing more than 30,000 per year.⁴⁸ In January 2014, annual coyote killings were estimated to be 40,000.⁴⁹ Insofar as a government permits or encourages the hunting and trapping of coyotes, its policy effects the removal of primary predators from the eastern United States, thus removing a natural check on deer and other prey populations, and exacerbating the loss of biodiversity.

Like the wolves, cougars, *Puma concolor cougar*, also used to roam the eastern side of North America. Before urban growth, hunting, and bounty killings wiped out these big cats, they preyed on deer.⁵⁰ Bobcats, *Lynx rufus*, extant cats indigenous to the eastern region of the country, can also kill weak or sickly deer, and even

⁴⁵ Ripple & Beschta, *supra* note 36, at 1250 (citing Aldo Leopold, *Deer irruptions*, 35 WIS. ACAD. SCI., ARTS, AND LETTERS 351, 351–66).

⁴⁶ See *supra* notes 23, 28 and surrounding text.

⁴⁷ See *supra* notes 9–10 and surrounding text.

⁴⁸ Marcus Schneck, *Organized Coyote Hunts Will Remove Several Hundred Coyotes From Pennsylvania, Leaving About 100,000 Still Out There*, THE PATRIOT-NEWS (Feb. 17, 2013), http://blog.pennlive.com/pa-sportsman/2013/02/organized_coyote_hunts_will_remove_several_hundred_coyotes_from_pennsylvania_leaving_about_100000_st.html (citing figures provided by Tom Hardisky, wildlife biologist with the Pennsylvania Game Commission).

⁴⁹ Rita Giordano, *Coyote Conspiracy: Myth, or State-Business Collusion?*, PHILADELPHIA INQUIRER (Jan. 20, 2014), http://articles.philly.com/2014-01-20/news/46349751_1_coyotes-deer-population-state-farm.

⁵⁰ EASTERN COUGAR: FELIS CONCOLOR COUGAR, U.S. FISH & WILDLIFE SERV. (2010), available at www.fws.gov/northeast/pdf/easterncougar.pdf (giving detailed information on the decline of cougars in the eastern United States); see MARK MCCOLLOUGH, U.S. FISH AND WILDLIFE SERV., EASTERN PUMA (=COUGAR) (PUMA CONCOLOR COUGAR): FIVE-YEAR REVIEW: SUMMARY AND EVALUATION (2001), available at http://ecos.fws.gov/docs/five_year_review/doc3611.pdf.

healthy deer, particularly in winter.⁵¹ These animals belie the oft-heard claims that “no natural predators exist” and the insistence that human control (i.e., killing) of deer is essential. Discussing trophic cascades in Yosemite, Ripple and Beschta write: “Based on theoretical models of predator/prey dynamics, the overshooting of carrying capacity by ungulates would be rare or infrequent with an intact predator/prey system.”⁵² This provides a strong scientific rationale for allowing bobcats to thrive. Yet several eastern states enable trapping and hunting of bobcats.⁵³ Pennsylvania has a bobcat hunting season in late January and early February, and also has a winter trapping season.⁵⁴ The number killed rose from 58 in 2000 to 1,056 in the winter of 2012–2013.⁵⁵ How much does that enable deer populations to expand? Evidently, the impact is significant. Largely young and weak deer represent an important food source for bobcats.⁵⁶ Among deer fawns on Steens Mountain in Oregon, bobcats were responsible for ten percent of fawn mortality, and studies elsewhere show even higher rates.⁵⁷

⁵¹ See Wildlife Directory, Bobcat (*rufus*), UNIVERSITY OF ILLINOIS EXTENSION, available at http://web.extension.illinois.edu/wildlife/directory_show.cfm?species=bobcat (last visited Apr. 20, 2015); see also STATUS SURVEY AND CONSERVATION ACTION PLAN: WILD CATS, THE WORLD CONSERVATION UNION CAT SPECIALIST GROUP 141 (Kristin Newell & Peter Jackson eds., 1996), available at <http://carnivoractionplans1.free.fr/wildcats.pdf>.

⁵² Ripple & Beschta, *supra* note 36, at 1250 (internal citations omitted).

⁵³ See, e.g., HUNTING & TRAPPING IN VIRGINIA, JULY 2013–JUNE 2014, VA. DEPT. OF GAME & INLAND FISHERIES 49, available at <http://www.dgif.virginia.gov/hunting/regulations/2013-2014-virginia-hunting-and-trapping-regulations-digest.pdf>.

⁵⁴ See *2013–14 Hunting Seasons and Bag Limits*, PA. GAME COMM’N, <http://www.portal.state.pa.us/portal/server.pt?open=514&objID=576240&mode=2> (last visited Mar. 20, 2015).

⁵⁵ Ad Crable, *Bobcats, Fishers and River Otters, Once on the Ropes in the State, Are Now Firmly Established and Growing*, LANCASTER ONLINE (Jan. 22, 2014), http://lancasteronline.com/sports/outdoors/bobcats-fishers-and-river-otters-once-on-the-ropes-in/article_2bf3f147-4c7d-5604-ba9d-8f1d518340b1.html (citing Matt Lovallo, the Game Commission’s game mammal section supervisor).

⁵⁶ MATTHEW J. LOVALLO, PA. GAME COMM’N, BOBCAT (*LYNX RUFUS*) MANAGEMENT IN PENNSYLVANIA (2013–2022) 14, available at https://www.portal.state.pa.us/portal/server.pt/document/1368759/pa_bobcat_management_plan_draft_pdf (last visited Apr. 20, 2015) (internal citations omitted).

⁵⁷ *Id.*

II

HUMAN IMPACT ON DEER

Urban growth has markedly changed deer populations. Suburban sprawl and habitat fragmentation restrict and channel deer movement—setting the stage for deer concentrations in ever-shrinking green spaces and for their presence near residences and roadways. Forcible control fails to provide a fix because it misses the underlying issues: the active removal of predator animals, the construction of roads, habitat fragmentation without connecting green corridors, and the resultant pressure on deer to congregate in pockets of land. Their numerical density in pocketed areas is often cited as proof of their overpopulation. Deer can hardly be expected to avoid our roads and yards when the natural range for a male deer is about 600 acres.⁵⁸ Also, as observed in elk, deer may move out of forested areas and onto roads and private property because of a tendency to move away from hunters. This movement to avoid hunters may also contribute to the growing presence of elk on private rangelands, away from public-land winter ranges.⁵⁹

While the expansion of urban and suburban infrastructure pushes many species out of our midst, populations of a few hardy plants and animals, deer included, can thrive in and around areas of heavy human growth.⁶⁰ Often, human resentment grows as deer numbers increase. Presaging forcible control are official declarations. The Commonwealth of Virginia claims that deer “inflict millions of dollars in damage to crops, trees, and gardens and are a safety risk on our highways.”⁶¹

⁵⁸ VA. DEPT. OF GAME & INLAND FISHERIES, *supra* note 15, at 1. A doe may use 200 acres. *Id.*

⁵⁹ See generally Kelly M. Proffitt et al., *Contrasting Effects of Wolves and Human Hunters on Elk Behavioral Responses to Predation Risk*, 73 J. WILDLIFE MGMT. 345 (2009).

⁶⁰ MARK L. WINSTON, NATURE WARS: PEOPLE VERSUS PESTS 61 (1999) (stating, for example: “In Chicago and Winnipeg, white-tailed deer are found at densities of 83 per square mile, up to three times higher than their densities outside of these cities.”).

⁶¹ VA. DEPT. OF GAME & INLAND FISHERIES, *supra* note 15. In Pennsylvania, State Farm Insurance estimated that drivers hitting deer resulted in more than \$400 million in damage in 2013. See Erin McCarthy, *Controversial Deer Kill Thins Valley Forge Herd*, PHILADELPHIA INQUIRER, June 9, 2014. Yet accidents involving deer are responsible for less than 2% of all motor vehicle casualties in Virginia. See VA. DEPT. OF GAME & INLAND FISHERIES, *supra*. Pennsylvania’s statistics were recently thrown into question as forty-one people—including insurance adjusters—were charged in a scheme of faking car-

A. *Hunting and Other State-Assisted Control Methods*

Using the cultural carrying capacity idea that “[t]he deer population level people will tolerate . . . is generally well below the biological carrying capacity,” Virginia’s Deer Management Plan identifies areas where deer populations should increase, decrease, or remain the same.⁶² Virginia’s official plan fails to educate people about the biological reality of deer,⁶³ opting instead to suit people’s current comfort levels, which can be very low. Low tolerance levels suit the financial customs of the states and reinforce the underlying premise that deer are appropriately perceived as targets. The Virginia Department of Game and Inland Fisheries (VDGIF) refers to all elements of the bio-community as resources for hunting and recreation when articulating its mission:

[T]o manage Virginia’s wildlife and inland fish to maintain optimum populations of all species to serve the needs of the Commonwealth; to provide opportunity for all to enjoy wildlife, inland fish, boating and related outdoor recreation and to work diligently to safeguard the rights of the people to hunt, fish and harvest game as provided for in the Constitution of Virginia; to promote safety for persons and property in connection with boating, hunting and fishing; to provide educational outreach programs and materials that foster an awareness of and appreciation for Virginia’s fish and wildlife resources, their habitats, and hunting, fishing, and boating opportunities.⁶⁴

deer accidents for millions in claims money. Queen Muse, *Forty-One Charged in Dead Deer Insurance Scam*, NBC-10 (May 30, 2014), <http://www.nbcphiladelphia.com/news/local/S-Philly-Shop-Owner-Charged-in-Multi-Million-Dollar-Insurance-Fraud-Scam-260979391.html>. The Jack H. Berryman Institute assessed various possible safeguards, including deer kills, and found multiple studies showing fencing combined with green corridors as most effectively reducing accidents. See Lauren L. Mastro et al., *Deer-Vehicle Collision Prevention Techniques*, UNIVERSITY OF NEBRASKA-LINCOLN DIGITAL COMMONS (2008), <http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1074&context=hwi>.

⁶² VA. DEPT. OF GAME & INLAND FISHERIES, *supra* note 15, at 2. The Commonwealth of Virginia promotes “the harvest of female deer” as “the most effective method available for managing wild deer populations”; yet it reports that more male deer are killed. Since 2000, Virginia reports, hunting has resulted in the death of an average of 225,000 deer annually, more than half (55%) male. *Id.* The Department’s “Earn a Buck” initiative illustrates examples of how reduction targets play out in specific spaces. See *General Information & Hunting Regulations*, VA. DEPT. OF GAME & INLAND FISHERIES, <http://www.dgif.virginia.gov/hunting/regulations/general.asp> (last visited Apr. 20, 2015).

⁶³ See *About VDGIF*, VA. DEPT. OF GAME & INLAND FISHERIES, <http://www.dgif.virginia.gov/about/> (last visited Mar. 20, 2015).

⁶⁴ *Id.*

Hunter-funded state wildlife agencies are the policy status quo.⁶⁵ “Deer hunting is a deeply-rooted social tradition in Virginia,” asserts the VDGIF.⁶⁶ “The economic impact of deer hunting in Virginia is over \$250 million annually.”⁶⁷ For Virginia and many states, financial interests constitute a key driving force behind deer hunting. The science used to manage deer is still rooted in the tradition of wildlife management rather than conservation—the former focusing on the promotion of human uses of nature and the living beings within it.⁶⁸ Gary Moody, chief of wildlife at Alabama Department of Conservation and Natural Resources, states: “Our job is to improve and strengthen hunter numbers.”⁶⁹ This view persists in New York’s 2011–2012 Hunting and Trapping Guide:

⁶⁵ Throughout the United States, states encourage a competitive perspective on killing animals. See 2006–07 FISH AND WILDLIFE ANNUAL REPORT, WIS. DEP’T OF NATURAL RES., available at <http://dnr.wi.gov/wnrmag/html/images/PDFs/FishandWildlifeinsert.pdf>.

Your purchase of hunting and fishing licenses and stamps enable us to raise hunting and fishing opportunities to a new level . . . [W]e rank first in the country for the highest single year deer harvest on record and are number one for deer harvest over the past decade.

Similarly, Kentucky’s Department of Fish and Wildlife Resources boasted that “few other states have kept pace with Kentucky in trophy deer production. Kentucky wildlife managers have earned the right to be proud of that fact.” Press Release, Ky. Dep’t of Fish & Wildlife Res., (June 9, 2004), available at <https://web.archive.org/web/20040716074654/http://fw.ky.gov/060904.asp>.

⁶⁶ VA. DEPT. OF GAME & INLAND FISHERIES, *supra* note 15, at 2.

⁶⁷ *Id.*

⁶⁸ Wildlife management has historically focused on how to artificially manipulate “habitats and populations” to allow for larger “harvestable surpluses” of those species for hunting, whereas conservation biology seeks to answer questions about how to protect biodiversity in ecosystems, species, and populations. See Eric Biber, *Which Science? Whose Science? How Scientific Disciplines Can Shape Environmental Law*, 79 U. CHI. L. REV. 471, 500 (2012).

⁶⁹ See Mark Clayton, *Hunters as Endangered Species? A Bid to Rebuild Ranks*, CHRISTIAN SCIENCE MONITOR (Sept. 27, 2005), <http://csmonitor.com/2005/0927/p01s02-ussc.html> (reporting the views of Susan Langlois, administrator of the Massachusetts Division of Fisheries and Wildlife, and quoting Gary Moody, chief of wildlife at Alabama Department of Conservation and Natural Resources). The article describes hunting as a \$20 billion industry, and reports:

Anxious to reverse the decline in the sport—and the resulting drop in state revenues from hunting licenses—hunting and gun groups and state wildlife and conservation departments are pursuing several initiatives. The National Shooting Sports Foundation (NSSF), a trade association representing the firearms industry, is funding new hunting programs in 25 states, part of its Hunting Heritage Partnership with state wildlife agencies

Funding for wildlife conservation comes from hunting and trapping license sales, and the federal excise tax on sporting arms, ammunition and archery equipment. The federal funds are apportioned to the states based on a formula that includes the number of hunting license holders. So, declining hunter numbers could also pose substantial fiscal challenges for state agencies tasked with managing wildlife resources.⁷⁰

To date, state and federal policies fail to advance balanced ecosystems. Promoting and targeting “trophy quality” deer, these policies encourage high deer populations to incentivize hunting.⁷¹ State agencies encourage high deer numbers through various methods: clear-cutting forest to create the edge habitat that deer prefer;⁷² planting deer-preferred vegetation;⁷³ and by leasing farmland in “Wildlife Management Areas” that require farmers to plant extra crops to attract and bolster groups of deer.⁷⁴ Illogically, federal agencies continually establish deer reduction projects in pockets of

⁷⁰ *Hunting & Trapping Participation in New York*, N.Y. HUNTING & TRAPPING 10, 10 (Oct. 2011).

⁷¹ DEER AND AGRICULTURE IN WEST VIRGINIA, W.V.U. EXTENSION SERVICE (1985), available at www.wvu.edu/~agexten/wildlife/deer806.pdf (claiming that “[t]he major component of most deer management programs is deer population regulation, and the only economically practical method of population regulation is hunting” and that “[t]he first step in deer management, and one often overlooked, is the establishment of a clear, well defined objective. . . . If the objective is to produce trophy quality bucks, important management actions are to keep the herd in balance with food supplies through adequate harvest of antlerless deer, to protect yearling bucks until they reach an older age when antler development is maximum, and possibly to initiate habitat improvements that increase available food.”)

The above report has been cited many times in similar publications which echo its premise. See, e.g., JONATHAN KAYS, MD. COOP. EXTENSION, MANAGING DEER DAMAGE IN MARYLAND, BULLETIN 354 (2003), available at https://extension.umd.edu/sites/default/files/docs/programs/woodland-steward/EB354_ManagingDeerDamage.pdf. “Do you want to reduce damage, but also produce trophy-quality bucks? Each of these options requires population regulation. The most practical way to regulate the population is hunting.” *Id.*

⁷² *Management of White-Tailed Deer in Virginia*, VA. DEP’T OF GAME & INLAND FISHERIES (last visited Mar. 20, 2015), http://www.dgif.virginia.gov/habitat/landowners/infosheets/white-tailed_deer.html.

⁷³ VIRGINIA DEER MANAGEMENT PLAN 2006–2015, VA. DEP’T OF GAME & INLAND FISHERIES (2007), available at <http://www.dgif.virginia.gov/wildlife/deer/management-plan/virginia-deer-management-plan.pdf>.

⁷⁴ *Farm Lease Auctions Information*, N. J. DIV. OF FISH & WILDLIFE (Dec. 3, 2012), <http://www.nj.gov/dep/fgw/wmaleases.htm>. See also RoseAnn Miller et al., *Evaluation of the Influence of Supplemental Feeding of White-Tailed Deer (*Odocoileus Virginianus*) on the Prevalence of Bovine Tuberculosis in the Michigan Wild Deer Population*, 39 J. WILDLIFE DISEASES 84 (2003) (linking supplemental feeding of deer with bovine TB in free-ranging white-tailed deer in northeastern Michigan).

land within states that work to *increase* deer populations in those areas.

Before addressing this federal role in government-assisted deer reduction plans, it is worth noting how state-level trophy interest impacts deer biology. Human hunting runs counter to the biological effects of the natural prey-predator relationship. Removal by human selection of phenotypically impressive animals from free-living populations can reduce the frequency of sought-after traits, thus negatively impacting genetics.⁷⁵ Fred W. Allendorf and Jeffrey J. Hard acknowledge that few studies clearly document evolutionary response to exploitive selection. Moreover, they acknowledge the study of exploitation-induced evolutionary change thwarting adaptive responses to natural and sexual selection “has not been widely appreciated.”⁷⁶ Yet D.W. Coltman posited that rapid contemporary evolution is known to occur more strikingly in response to exploitation than to any other anthropogenic driver—introductions of nonnative species, degradation of habitat, or climate change.⁷⁷ Hunters seek physically impressive deer,⁷⁸ thereby changing group dynamics and sexual selections by taking the strongest reproducers out of the population.⁷⁹ In short, through artificial manipulation, animals not deemed threatened or endangered—even apparently large communities of ungulates—might well be altered. The makeup of these particular groups may be substantially changed and their essential phenotypes lost. Biodiversity protection is an essential social goal. A growing body of literature asserts that evolving policy and practice value biodiversity over the wildlife management regime long applied to deer.⁸⁰

⁷⁵ FRED W. ALLENDORF & JEFFREY J. HARD, HUMAN-INDUCED EVOLUTION CAUSED BY UNNATURAL SELECTION THROUGH HARVEST OF WILD ANIMALS 9987 (2009), available at http://www.pnas.org/content/106/Supplement_1/9987.full.pdf.

⁷⁶ *Id.* at 9988.

⁷⁷ *Id.* (citing D.W. Coltman, *Evolutionary Rebound from Selective Harvesting*, 23 TRENDS IN ECOLOGY & EVOLUTION 117 (2008)).

⁷⁸ ALLENDORF & HARD, *supra* note 75, at 9990 (internal citation omitted).

⁷⁹ *Id.* (citing Aurelio F. Malo et al., *Antlers Honestly Advertise Sperm Production and Quality*, 272 PROCEEDINGS IN BIOLOGICAL SCIENCES 149 (2005) (concluding that large, complex antlers “signal” fighting ability and reproductive potential to other deer)).

⁸⁰ Biber, *supra* note 68, at 495.

Wildlife managers saw the rise of conservation biology in the 1980s as threatening; they asserted that conservation biology sought to answer the same questions wildlife management had been exploring for decades. In the intervening decades,

B. The National Park Service's Role

Two eastern national parks have initiated deer management plans in recent years.⁸¹ Valley Forge National Historical Park (Valley Forge) and Rock Creek National Park. Valley Forge, a five-square-mile piece of land in the traffic-heavy suburbs of Philadelphia, is within close proximity to the immense King of Prussia shopping mall.⁸² Rock Creek National Park (Rock Creek), a woodland preserve, winds through the city of Washington, D.C.⁸³ The managers of Valley Forge resolved to forcibly reduce the deer population from an estimated 1,277 to under 185.⁸⁴ In August 2009, the National Park Service (Park Service) issued its “Record of Decision: White-tailed Deer Management Plan and Environmental Impact Statement [(Plan/EIS)]—Valley Forge National Historical Park, Pennsylvania.”⁸⁵ As its primary reason for using forcible control, the Park Service asserted the unacceptable damage done by deer to the vegetation of its

there have been claims that the two fields have converged, as wildlife managers have become more interested in questions about the conservation of a wider range of species and ecosystems, and less interested in maximizing game species populations to benefit humans.

Id. (internal citations omitted).

⁸¹ A precedent for forcible control had been set more than a decade earlier; as one reporter noted. “At Gettysburg National Military Park, a cull that began in 1995 has reduced the herd an estimated 90 percent.” Wood, *Officials Say They're Pleased with Deer Cull at Valley Forge*, PHILADELPHIA INQUIRER, *supra* note 11.

⁸² Valley Forge National Historical Park, located eighteen miles northwest of Philadelphia beside the Schuylkill River, is fragmented or bordered by numerous busy traffic arteries, including local routes 23 and 252, the ever-expanding Route 202 that channels traffic from the Philadelphia area to the state of Delaware, and the massive Interstate 76. *See* *Friends of Animals v. Caldwell*, No. 2:09-cv-5349, 2010 WL 4259753, at *1 (E.D. Pa. 2010); RECORD OF DECISION FOR THE WHITE-TAILED DEER MANAGEMENT PLAN AND ENVIRONMENTAL IMPACT STATEMENT, NAT'L PARK SERV., [hereinafter VALLEY FORGE EIS], available at <http://parkplanning.nps.gov/documentsList.cfm?parkId=284&projectId=16911>.

⁸³ *See* RECORD OF DECISION FOR THE WHITE-TAILED DEER MANAGEMENT PLAN & ENVIRONMENTAL IMPACT STATEMENT, NAT'L PARK SERV., [hereinafter ROCK CREEK EIS], available at <http://parkplanning.nps.gov/documentsList.cfm?parkID=198&projectID=14330>.

⁸⁴ Gammage, *supra* note 25. “Officials intend to cull the herd from an estimated 1,277 to between 165 and 185. Sharpshooters are to kill 500 deer this winter, 500 the next, and between 250 and 300 in each of the third and fourth years.” *Id.* *See also* *Friends of Animals*, 2010 WL 4259753; *Friends of Animals v. Caldwell*, 434 F. App'x 72 (3d Cir. 2011). With support from the director of the environmental law clinic at the University of Denver, this paper's author developed the strategy for the plaintiffs in *Friends of Animals v. Caldwell*.

⁸⁵ VALLEY FORGE EIS, *supra* note 82.

forest understory, and thus to the park's biodiversity.⁸⁶ Asserting that the Park Service fell short of the National Environmental Policy Act's (NEPA) mission to "insure a fully informed and well considered decision,"⁸⁷ two nonprofit groups filed suit in November 2009.⁸⁸ While the parties initially agreed to stay the culling, the Park Service decided in the following year to proceed.⁸⁹ Nighttime shooting at Valley Forge began in November 2010.⁹⁰ Rock Creek managers put a similar plan into action in early 2014,⁹¹ claiming that to take "no action" would mean:

A continued large deer population and related browsing, resulting in decreased plant diversity, increased invasive exotic plants, and reduced forest regeneration would result in adverse effects on other wildlife. A few predator species would benefit from a large deer population and an open understory; however, the impacts of large numbers of deer browsing on vegetation would adversely affect a large percentage of habitats for other wildlife (e.g., ground-nesting

⁸⁶ Valley Forge management states:

Browsing of tree and shrub seedlings by an increasing deer population over the last two decades has prevented the ability of native forests to grow and mature. In a self-sustaining forest of this age (about 80 years) you should see a mix of tree seedlings, sapling trees, young and mature trees - a range of ages and sizes. You would see an abundant and diverse herbaceous (or non-woody) plant layer, including a variety of ferns and wildflowers. You would see a dense understory of native shrubs. This layer of the forest, often called the forest understory, provides important habitat for a variety of animals. At Valley Forge, however, this vital mix of plants that makes up the forest understory is missing and the forests are in trouble. Deer now are so dominant in the environment that there is little or no habitat for a whole range of wildlife species that depend on the understory for survival.

WHITE-TAILED DEER MANAGEMENT PLAN FOR VALLEY FORGE NATIONAL HISTORICAL PARK: FREQUENTLY ASKED QUESTIONS, NAT'L PARK SERV. 1 (2011), *available at* http://www.nps.gov/vafo/parkmgmt/upload/VAFO_Deer_FAQs_10_3_2011.pdf.

⁸⁷ Regarding NEPA's mission "to insure a fully informed and well considered decision," *see* *Vt. Yankee Nuclear Power Corp. v. Natural Res. Def. Council, Inc.*, 435 U.S. 519, 558 (1978).

⁸⁸ *See Friends of Animals*, 2010 WL 4259753. The second plaintiff, Compassion for Animals - Respect for the Environment, based in Chester County, PA, has its membership base in the Valley Forge area. *Id.*

⁸⁹ *Id.*

⁹⁰ Rick Leventhal, *Deer Battle at Valley Forge National Historical Park*, FOX NEWS (Dec. 7, 2010), <http://liveshots.blogs.foxnews.com/2010/12/07/deer-battle-at-valley-forge-national-historical-park/>.

⁹¹ Lacey Johnson, *Sharpshooters to Renew Deer Cull in Heart of Washington D.C.*, REUTERS (Jan. 2, 2014, 12:47 PM), www.reuters.com/article/2014/01/02/us-usa-deer-idus-brea010QE20140102.

birds, frogs, snakes, and turtles), resulting in adverse, long-term, and negligible to potentially major impacts, depending on the species.⁹²

The official reasoning for deer control in these national parks also includes factors wholly unrelated to conservation, such as financial risks or inconveniences to nearby gardeners. Citing NEPA requirements, the Valley Forge plan states:

NEPA requires that economic and social impacts be analyzed in an EIS when they are interrelated with natural or physical impacts. Economic impact would potentially result from deer browsing damage to crops and landscaping on private lands adjacent to the park as a result of changes in deer populations at Valley Forge NHP. Based on the research findings on white-tailed deer home range at Valley Forge NHP, it is clear that deer living in the park affect neighboring properties. The presence of deer on neighboring properties has been linked to loss and damage of ornamental vegetation.⁹³

Similarly, the Rock Creek plan states: “An overabundance of deer could lead to increased browsing of landscape vegetation on neighboring properties, having a negative economic impact on those landowners.”⁹⁴

Both of these national parks’ management plans established, as a solution to the reportedly unmanageable deer population, a mix of nocturnal shooting and, ultimately, pharmaceutical birth control.⁹⁵ Before going into effect, both parks’ deer-reduction projects drew litigation.⁹⁶ Of the two lawsuits, the challenge at Valley Forge emphasized and sought protection for the natural predator-prey relationship.

⁹² ROCK CREEK EIS, *supra* note 83, at vii.

⁹³ VALLEY FORGE EIS, *supra* note 82, at 1-34.

⁹⁴ ROCK CREEK EIS, *supra* note 83, at 31.

⁹⁵ VALLEY FORGE EIS, *supra* note 82, at 2-31. “It is assumed an acceptable reproductive control agent would be available within life of [the recommended] plan.” *Id.* The document continues:

Several chemical reproductive control agents are being developed and tested for use in deer population control. These include porcine zona pellucida or PZP vaccine; uniquely formulated PZP, such as SpayVac®; GnRH vaccine; prostaglandin F2α. Each of these agents is described briefly in Table 4 and in more detail in Appendix E, which provides an overview of available reproductive control technologies for deer management.

Id. at 2-29.

⁹⁶ For the Valley Forge litigation, see *Friends of Animals v. Caldwell*, No. 2:09-cv-5349, 2010 WL 4259753 (E.D. Pa. 2010). For the Rock Creek litigation, see *Grunewald v. Jarvis*, 930 F. Supp. 2d 73 (D. DC. 2013), *aff’d* 2015 WL 304112 (D.C. Cir. 2015).

In its Final Plan/EIS for Valley Forge, the Park Service claimed to have fully developed its alternatives using the best available science.⁹⁷ Its management plan considered four alternatives: (1) no action; (2) combined nonlethal actions (i.e., rotational fencing of vegetation and pharmaceutical birth control of deer); (3) combined lethal actions (i.e., “an immediate reduction in the deer population through sharpshooting, and capture and euthanasia”); and (4) combined lethal and nonlethal actions (i.e., shooting several hundred deer annually and using birth control “when an acceptable chemical reproductive agent becomes available”).⁹⁸ The Park Service chose to implement the last alternative—a combination of lethal and nonlethal actions.⁹⁹

When comparing and contrasting alternatives, the Park Service treated coyotes, key predators of the white-tailed deer, in a cursory manner.¹⁰⁰ Yet as coyotes could safely and beneficially fit into the park ecosystem,¹⁰¹ an approach using “best available science” would enable them to do so. This would also offer a natural experiment to ascertain if local coyotes would succeed in naturally curbing the deer population as they have in North Carolina, Alabama, and elsewhere.¹⁰² This alternative was missing from the Park Service’s discussion. Contrasting the results of the forcible model with a model based on natural processes may reveal lasting and comprehensive

⁹⁷ VALLEY FORGE EIS, *supra* note 82.

Valley Forge National Historical Park is pleased to announce the availability of the Final White-tailed Deer Management Plan and Environmental Impact Statement (EIS) to the public. Work began on the White-tailed Deer Management Plan/EIS in 2006. Extensive public involvement, including a project web-site, brochure, four public meetings, and over 80 briefings to civic organizations, local elected officials and others, led to the development of four conceptual alternatives. These alternatives have been fully developed using the best available science and evaluated based on their impacts on the human environment and ability to achieve the stated plan objectives. The NPS preferred and environmentally preferred alternatives have been identified based on this evaluation.

Id.

⁹⁸ See *Friends of Animals*, 2010 WL 4259753, at *2.

⁹⁹ *Id.* at *7.

¹⁰⁰ See VALLEY FORGE EIS, *supra* note 82.

¹⁰¹ This is implicitly acknowledged in the Plan/EIS. *Id.* at 4-42 (stating “Some species that use deer as a food source, including foxes and coyotes, could benefit from high deer density and open understory conditions.”).

¹⁰² See *supra* notes 26–29. For a general discussion of scientific methodology and, in particular, natural experiments, see ANDREW FRIEDLAND ET AL., ENVIRONMENTAL SCIENCE FOUNDATIONS AND APPLICATIONS 15–19 (2012).

benefits of the latter. A shift away from heavy-handed animal control could very well lead to salubrious effects on biodiversity and, as discussed in Part III, even to carbon sequestration.

The number of deer in Valley Forge decreased and stabilized in the years leading up to the Park Service's deer-control plan.¹⁰³ The natural reduction and stabilization of this deer population since 2005 posits questions to the key premise of the Plan/EIS—that the numbers of deer living in this community needed to be reduced at all. While challengers of the Valley Forge plan argued that the Pennsylvania Game Commission could stop facilitating the hunting and trapping of apex predators by Pennsylvanians, thus enabling coyotes to rebound to a level that further checks the already stable deer population, the Park Service declined to support any change in the policies that suppress coyotes.¹⁰⁴ In the “Reintroduction of Predators” section, the Plan/EIS first ruled out the possibility of reintroducing gray wolves, *Canis lupus*, or cougars, *Puma concolor*, “due to the lack of suitable habitat” for these big carnivores in a five-square-mile park, and because “the proximity to humans is not appropriate for reintroduction of large predators.”¹⁰⁵ Then, the Plan/EIS addressed coyotes only briefly. It did not assess the reality that letting coyotes play their part would simply constitute ceasing to suppress them, rather than reintroduce them as the section heading and text claimed:

Coyotes (*Canis latrans*) are present in the park and bobcats (*Lynx rufus*) potentially could be supported by habitats within the park. However, these predators have been shown not to exert effective control on white-tailed deer populations (Coffey and Johnston 1997). Based on these reasons, the reintroduction of predators was dismissed as a management option.¹⁰⁶

The 1997 Coffey and Johnston study cited by the Park Service, over a decade old at the time of the Plan/EIS and the only study the Park Service relied on, asserts that coyotes can not “consistently control” a white-tailed deer population, nor succeed in reducing the deer population to target levels.¹⁰⁷ The Third Circuit found that the

¹⁰³ See Jeff Gammage, *Deer in Valley Forge Targeted*, PHILADELPHIA INQUIRER (Feb. 15, 2009), http://articles.philly.com/2009-02-15/news/25282002_1_deer-animals-sharp-shooting (stating, “From 1997 to 2007, the herd grew from 772 to 1,023, peaking at 1,398 in 2003, according to a park environmental-impact study.”).

¹⁰⁴ See Gammage, *supra* note 25.

¹⁰⁵ VALLEY FORGE EIS, *supra* note 82, at 2-54.

¹⁰⁶ *Id.*

¹⁰⁷ *Friends of Animals v. Caldwell*, 434 F. App'x 72, 76 (3d. Cir. 2011).

Park Service “clearly researched, and rejected, the idea of reducing the deer population through the use of predators” although “it may have relied on only one study.”¹⁰⁸ The court further stated that “[t]he [Park Service] adequately considered and appropriately rejected the option of coyote predation because there was not a shred of evidence that such an option could achieve the [Park Service]’s stated goals.”¹⁰⁹

According to Reed F. Noss, “When information on species locations, population sizes and trends, interspecific interactions, responses to disturbance, and other factors is scarce or questionable, the best interim strategy is one that minimizes development and other human disturbance during the time needed to gather the necessary biological information.”¹¹⁰ Moreover, as previously discussed, a substantial body of evidence exists to show that a balanced ecosystem includes key predators, and that predators control ungulate populations. Collaboration between the Park Service and state game commissions to discontinue coyote suppression could help resolve uncertainties as to the efficacy of natural balancing.

When we approach destabilized ecosystems with yet more disruptions in the form of killing animals *en masse*, a cycle of forcible population control begins. With reproduction comes more killing. Consider the deer of Philadelphia’s Fairmount Park System. More than 2,500 deer have been killed in official culls in Fairmount Park since 1999—when deer populations consisted of 159 in its Wissahickon Valley area and about 362 in its Pennypack Park area, the two high-deer regions of the city park system.¹¹¹ Predictably, this approach is energy-intensive and costly wherever it is instituted—including in smaller towns,¹¹² where forcible control compromises feelings of good will and community cohesion.¹¹³

¹⁰⁸ *Id.* at 76–77.

¹⁰⁹ *Id.* at 77.

¹¹⁰ Reed F. Noss, *Some Principles of Conservation Biology, as they Apply to Environmental Law*, 69 CHI.-KENT L. REV. 893, 898 (1994).

¹¹¹ Lou Mancinelli, *More Than 2,500 Killed Since 1999—The Silent War Against Deer in Wissahickon Park*, CHESTNUT HILL LOCAL (Nov. 29, 2013), <http://chestnuthilllocal.com/blog/2013/11/29/more-than-2500-killed-since-1999-the-silent-war-against-deer-in-wissahickon-park/>. See also Rita Giordano, *Fairmount Park Commission Says Deer Herd Thinned 70%*, PHILADELPHIA INQUIRER (Apr. 03, 2001), http://articles.philly.com/2001-04-03/news/25332345_1_deer-population-animal-activists-activist-group (reporting a 362-deer population in Pennypack as of late 2000).

¹¹² See, e.g., VILLAGE OF CAYUGA HEIGHTS, CAYUGA HEIGHTS DEER MANAGEMENT PLAN (Nov. 1, 2010), available at <http://www.cayugadeer.org/pdfs/VCH%20Deer%20>

The deer management plan instituted at Valley Forge was drafted to span fifteen years (originally four years of shooting, followed by the possibility of using pharmaceutical birth-control on deer) and, from the beginning, was expected to cost up to \$2.9 million.¹¹⁴ During the winter season of the following years, the Park Service reported 600 deer killed in 2011, 377 killed in 2012, 340 killed in 2013, and 116 killed in 2014.¹¹⁵ In other words, the Park Service's numbers reveal they started the plan with 1,277 deer on site, and killed 1,433 over four years—substantially more than they started with. This indicates that either more deer are moving in or that the park's deer are rebounding at a high pace—or both. Regardless, in June 2014, the Park Service announced its plans to continue the killing, extending the Valley Forge shooting plan into its fifth successive winter.¹¹⁶

The Park Service further expanded the precedent set at Valley Forge and Rock Creek into other parks. In 2013, the Park Service announced a plan to pay sharpshooters to kill more than 2,800 white-tailed deer over a four-year period as its preferred alternative at the Antietam and Monocacy Civil War Battlefields in Maryland and the Manassas Battlefield in Virginia.¹¹⁷ In Manassas, more than 1,600

DEIS%20pt%201.pdf. The village of Cayuga Heights, New York, expects deer control to cost nearly a million dollars over the next 10 years and to raise the taxes of residents by as much as 5% per year. See *Important Public Hearing on the Draft Environmental Impact Statement*, CAYUGADEER.ORG, <http://www.cayugadeer.org/deis.htm> (last visited Mar. 20, 2015).

¹¹³ See Gammage, *supra* note 25 (stating “plainly the fate of the deer is no laughing matter, as evidenced by the controversy surrounding the park plan for ‘lethal reduction.’ . . . Animal rights activists say the killings are unnecessary and will be dangerous to people who live or travel near the park.”). See also note 13, *supra*, for a discussion of “mounting anger” in some residents of areas planning forcible deer control. In 2014, Jeff Houdret told the *Philadelphia Inquirer* of having once enjoyed watching white-tailed deer roam Valley Forge National Historical Park, and now missing them. See McCarthy, *supra* note 61.

¹¹⁴ Wood, *supra* note 11. The initial government estimate was a minimum of \$150,000, with the annual price for control including pharmaceutical contractive techniques estimated at \$194,517 annually after four years on the surviving deer, according to the National Park Service. See NAT'L PARK SERV., *supra* note 86, at 4.

¹¹⁵ McCarthy, *supra* note 61 (stating that the 116 deer killed in the 2012-14 winter were killed in eight nights between November and March, by “Department of Agriculture sharpshooters”). The original plan set forth in November 2009 stated that 500 deer would be shot in the first winter, 500 the next, and between 250 and 300 in each of the third and fourth years. Gammage, *supra* note 25.

¹¹⁶ McCarthy, *supra* note 61.

¹¹⁷ *Plan Targets 2,800 Deer at MD, VA Battlefields*, ASSOCIATED PRESS (Sept. 3, 2013), available at <http://baltimore.cbslocal.com/2013/09/03/plan-targets-2800-deer-at-md-va-battlefields/>.

deer were targeted.¹¹⁸ Here again, and in accordance with its preferred alternative, the Park Service announced it would use chemical contraceptives to maintain an acceptable deer density after several years of shooting—assuming an appropriate reproductive control agent becomes approved for such use.¹¹⁹ Explaining why a combination of sharpshooting and chemical birth control is considered appropriate, the Battlefields’ Plan/EIS states that “[t]raditional wildlife management techniques such as hunting and trapping are often unfeasible, publicly unacceptable, or illegal in many parks, urban, and suburban areas, forcing wildlife managers to seek alternative management methods. . . .”¹²⁰ This suggests a lack of controversy around pharmaceutical control methods when indeed such controversy exists.¹²¹ State game officials already anticipate this sort of combined control. Virginia’s Department of Game and Inland Fisheries, while asserting that “[r]egulated hunting is the most effective method available for managing wild deer populations,” nevertheless refers to “[e]xperiments with contraception” and “sharpshooter programs.”¹²² The Battlefields’ Plan/EIS states, however, that “fertility control is not a viable option for controlling wild deer populations at this time.”¹²³

¹¹⁸ *Id.*

¹¹⁹ See ANTIETAM NATIONAL BATTLEGROUND, MONOCACY NATIONAL BATTLEGROUND, MANASSAS NATIONAL BATTLEGROUND: DRAFT WHITE-TAILED DEER MANAGEMENT PLAN AND ENVIRONMENTAL IMPACT STATEMENT, SPRING 2013, NAT’L PARK SERV. 126–27 [hereinafter Battlefields EIS], available at <http://parkplanning.nps.gov/document.cfm?parkID=173&projectID=35457&documentID=54708>.

¹²⁰ *Id.* at 367.

¹²¹ At least one group firmly opposed it. See PHILADELPHIA ADVOCATES FOR THE DEER, PUBLIC COMMENTS ON THE BATTLEFIELDS PLAN AND ENVIRONMENTAL IMPACT STATEMENT (2013), available at <http://www.scribd.com/doc/171600356/Philadelphia-Advocates-for-the-Deer-Public-Comments-on-the-Federal-Plan-to-Kill-2800-Deer>.

“Philadelphia Advocates for the Deer wishes to be clear that we feel imposing pharmaceutical control methods, just like imposing shooting or net-and-bolt techniques on deer, is politically unacceptable.” *Id.* Note: this author drafted this public comment for Philadelphia Advocates for the Deer, at the request of the advocacy group’s founders.

¹²² VA. DEP’T. OF GAME & INLAND FISHERIES, *supra* note 15.

¹²³ The Battlefields Plan/EIS states that “[i]t has been offered that immunocontraceptive vaccines offer significant promise for future wildlife management” and supplies a lengthy discussion of a wide variety of technologies and experiments in Appendix B: Review of White-Tailed Deer Fertility Control. See Battlefields EIS, *supra* note 119, at 368. This section of the Plan/EIS concludes that the methods will remain under study:

The alternatives proffered in the Battlefields' plan did not acknowledge the importance of the predator-prey relationship on deer and why preserving both sides of that relationship—the capacity of deer and predators, such as coyotes, to interact on nature's terms—would support the biological balance. The Plan/EIS maintained that coyotes are simply scavengers,¹²⁴ and that “these species appear to be opportunists that take advantage of specific periods of deer vulnerability and none of these predators has demonstrated a consistent ability to control deer populations.”¹²⁵ While coyotes are hunted and trapped in both Maryland and Virginia, the Plan/EIS does not address those practices—even though the practices impact the biological balance of the parks at issue.¹²⁶

The radical approach being taken by the Park Service—shooting the vast majority of deer—is no more attuned to evolutionary biology than is recreational hunting. Reed F. Noss writes:

Human disturbances that mimic or simulate natural disturbances are less likely to threaten species than are disturbances radically different from the natural regime. Species have evolved along with disturbances. Natural selection has provided species with ways to escape, tolerate, or exploit natural disturbances, so that life histories of species are often closely tied to a specific disturbance regime.¹²⁷

Five criteria were established by the NPS that reflect minimum desired conditions for using a reproductive control agent. Only when these criteria are met would reproductive control be implemented. 1. There is a federally approved fertility control agent for application to free-ranging populations. 2. The agent provides multiyear (3–5 years) efficacy. 3. The agent can be administered through remote injection. 4. The agent would leave no hormonal residue in the meat (i.e., meat derived from treated animals should be safe for human consumption according to applicable regulatory agencies, and safe for consumption by other animals). 5. Overall, there is substantial proof of success with limited behavioral impacts in a free-ranging population, based on scientific review and NPS policy.

Id., at 374.

¹²⁴ Battlefields EIS, *supra* note 119, at 239.

¹²⁵ *Id.* at 119.

¹²⁶ Maryland coyote hunting regulations enable year-round hunting of coyotes in unlimited numbers every day except Sundays. See *2013-2014 Furbearer Seasons & Limits*, MD. DEP'T OF NAT. RES., <http://www.eregulations.com/maryland/hunting/2013-2014-furbearer-seasons-limits/> (last visited Mar. 20, 2015). Virginia has similar allowances. See *Furbearer Hunting Seasons*, VA. DEP'T OF GAME & INLAND FISHERIES, <http://www.dgif.virginia.gov/hunting/regulations/furbearerhunting.asp#coyote> (last visited Mar. 20, 2015).

¹²⁷ Noss, *supra* note 110, at 906.

According to Noss, “Any human-induced change in the type, size, frequency, intensity, or seasonality of disturbance can be expected to affect biodiversity.”¹²⁸

Serious unintended consequences from mass deer killings on federal lands can be expected. The most obvious and immediate consequence involves a park’s community of deer after most have been killed, with even more killed annually to maintain the low number.¹²⁹ As very few, if any, deer survive annual mass shootings long enough to reach full maturity, the population of Valley Forge deer today is unnaturally young. Some deer regularly gather in highly visible places, such as at the edge of the park, behind and within the adjacent properties, and beside heavily used roads.¹³⁰ In Rock Creek Park, deer reportedly avoided the annual shooting by moving to adjacent residential areas.¹³¹ “They also migrated to the 578-acre campus of the National Institute of Standards and Technology in Gaithersburg.”¹³²

C. Federal Deer Control in Residential Areas

Large shoots also occur in residential areas surrounding Valley Forge.¹³³ “Culls and controlled hunts have become ever more popular in developed areas.”¹³⁴ Yet these shoots are not popular across the board. Because deer and other plants and animals acclimated to human infrastructures “provide us with a view of nature within the

¹²⁸ *Id.*

¹²⁹ *See supra* notes 115–16 and accompanying text.

¹³⁰ This observation is based on the author’s regular, twice-weekly visits to Valley Forge National Historical Park over the five-year period from the initiation of the Plan/EIS through the publication of this Article.

¹³¹ *See* Steve Hendrix, *At the NIH, White-Tailed Deer Get Sterilized in Luxurious Surgery Rooms*, WASHINGTON POST (Dec. 24, 2014), available at http://www.washingtonpost.com/local/at-the-nih-white-tailed-deer-get-sterilized-in-luxurious-surgery-rooms/2014/12/24/0b4eb23e-8ae0-11e4-8ff4-fb93129c9c8b_story.html.

¹³² *See id.*

¹³³ *See, e.g.*, Open Letter from Friends of Animals, Philadelphia Advocates for the Deer, and Native Return, LLC, to Township Manager Robert Zienkowski and the Commissioners of Radnor Township, Sergeant Chris Flanagan, Superintendent of Police William Colarulo, and the Public (May 23, 2012), available at <http://www.scribd.com/doc/235209919/Advocates-Reply-to-White-tailed-Deer-Killing-Plan-of-Radnor-Pennsylvania-May-2012> (commentary in reply to “White-tailed Deer Management Plan for Radnor Township, Delaware County” (Apr. 2012), submitted by Gino J. D’Angelo, PhD to the Township of Radnor, Pennsylvania on behalf of USDA-APHIS).

¹³⁴ Wood, *supra* note 11.

city,” today “[m]any people are beginning to believe that they should be cultured rather than condemned, nurtured rather than poisoned.”¹³⁵ The media and all levels of government often amplify the countervailing view. As Kristine Webber describes, “It’s fine so long as wildlife is at arm’s length, but as soon as it impacts anyone personally, it becomes a different issue. A small amount of plants and animals in the city is OK, but when it’s a large amount it’s unmanageable, and they become pests.”¹³⁶

In 1999, calls for deer control prevailed in Philadelphia’s Fairmount Park, the largest city-owned green space in the United States.¹³⁷ Philadelphia undertook a contract with the USDA to shoot deer, because, as in the city- and suburb-based federal parks discussed above, recreational hunting is generally not permitted within dense residential areas.¹³⁸ Taking over a pilot program begun in 1999, USDA wildlife biologist Gino D’Angelo was hired to supervise the killing after, in the words of a local reporter, “a controversial two-meeting public process in which hundreds of residents spoke both for and against killing.”¹³⁹

“Getting to the heart of an environmental conflict often requires that we examine differences among people in their basic value

¹³⁵ WINSTON, *supra* note 60, at 79.

¹³⁶ *Id.* Webber is also quoted as asking a question that—more than merely rhetorical—is biologically valid: “I don’t know why we can’t view ourselves in the same light that we’re viewing all the other species.” *Id.*

¹³⁷ *Philadelphia’s Parks and Trails*, THE PHILADELPHIA CONVENTION & VISITORS BUREAU, available at <http://www.discoverphl.com/visit/explore/sports-and-outdoors/green-philadelphia/> (last visited Mar. 20, 2015) (referring to Fairmount Park as “the largest city-owned urban park system in the world”).

When William Penn first drew up the plans for Philadelphia, he envisioned a “Greene Country Towne,” with five city squares anchoring the City’s neighborhoods. His legacy is still visible today as visitors stroll through Washington Square, picnic at Rittenhouse Square, or enjoy Philadelphia’s many other pocket parks and urban oases. In fact, with the largest city-owned urban park system in the world, Philadelphia is the greenest city in America—see for yourself by exploring some of our most beloved parks. Fairmount Park is one of the nation’s largest urban green spaces. . . .

Id.

¹³⁸ See *Nuisance Management*, PA. GAME COMM’N, <http://www.portal.state.pa.us/portal/server.pt?open=514&objID=622266&mode=2>. “[W]ildlife problems are compounded by people who draw wildlife into residential areas with feeders and improperly-stored garbage. And it doesn’t help communities that hunting and trapping cannot be pursued within their limits because of safety zone limitations.” *Id.*

¹³⁹ See Mancinelli, *supra* note 111.

systems.”¹⁴⁰ Policies involving deer and their predators living in our midst, as well as our living in their midst, rarely examine those differences effectively. Letting nature take the lead in bio-communities not only makes sense for environmental reasons—it also allows government officials to withdraw from the role of silencing environmentally respectful opposition.

III

UNINTENDED ECOLOGICAL CONSEQUENCES OF FORCIBLE DEER MANAGEMENT

A. Deer Removal and Biodiversity Loss

The National Park Service repeatedly claims that killing hundreds of deer would be a boon to woods and vegetation. The Battlefields’ Plan/EIS, for example, states:

The purpose of this action is to develop a deer management strategy that supports preservation of the cultural landscape through the protection and restoration of native vegetation and other natural and cultural resources. Action is needed at this time because the sizes of deer herds and deer population density have increased substantially over the years at all three battlefields. Results of vegetation monitoring in recent years have documented the effects of the large herd size on forest regeneration in all three battlefields. In addition, deer browsing has resulted in damage to crops and associated vegetation that are key components of the cultural landscapes of the battlefields. It is important to all three battlefields to preserve and restore important cultural landscapes and to preserve agricultural viability within the battlefield grounds.¹⁴¹

Research carried out under the aegis of Ohio State University and the Park Service itself challenges the science that suggests deer ravage forest ecosystems.¹⁴² Instead, high numbers of deer might

¹⁴⁰ Noss, *supra* note 110, at 895.

¹⁴¹ See Battlefields EIS, *supra* note 119, at i. The Service also claims this controls Chronic Wasting Disease, though there have been no outbreaks of CWD in these parks. See, e.g., *id.* at 383.

¹⁴² Katherine Greenwald et al., *Indirect Effects of a Keystone Herbivore Elevate Local Animal Diversity*, 72 J. WILDLIFE MGMT. 1318 (2008). Tom Rooney describes the results as “somewhat surprising” and calls for follow-up research. *Research News: Deer Elevate Local Animal Diversity*, DEER IMPACTS BLOG (Oct. 27, 2008), <http://deerimpacts.blogspot.com/2008/10/research-news-deer-elevate-local-animal.html>. The original research was conducted in Cuyahoga Valley National Park in Ohio. *Id.*

attract a greater number of species. Robust deer populations enrich soil, creating ripple effects throughout the food web and fostering diverse populations—among them, earthworms, spiders, ants, slugs, snails, insects, snakes, and salamanders.¹⁴³ Deer exclosures described in the Ohio State and Park Service study were built in 1999. A comparative biodiversity study conducted in 2004 and 2005 found red-backed salamanders nearly three times more abundant in deer plots, with snakes nearly five times higher and gastropods nearly ten percent higher.¹⁴⁴ The outcomes suggest that the level of deer predation needed for healthy ecosystems may be far lower than what resource managers expect, and that patience with nature's processes may enable us to avoid forcible deer control and its negative consequences. Moreover, enabling ungulates to move in their natural ways is ecologically beneficial. William J. Ripple and Robert L. Beschta write:

In addition to restoring large carnivores such as wolves, it may be important to recover historical ungulate migrations as much as possible, especially in situations where ungulates tend to avoid natural migrations in an effort to lower their risk of predation or other impacts from humans and, as a consequence, reside inside park or reserve boundaries.¹⁴⁵

B. Forcible Deer Management and the Sidelining of Predator Conservation

Federal and state law and policies encourage the systematic suppression of natural predators of deer, including coyotes and bobcats. Predators die year-round under laws and policies that promote shooting, trapping and bounties,¹⁴⁶ poisoning,¹⁴⁷ and even the

¹⁴³ *Id.*

¹⁴⁴ *Id.*

¹⁴⁵ Ripple & Beschsta, *supra* note 30, at 765.

¹⁴⁶ Virginia allows counties to establish bounties, *see* VA. DEP'T OF GAME AND INLAND FISHERIES, *supra* note 126, though not all states do likewise. In November 2013, a bill passed in Pennsylvania's House Game and Fisheries Committee to allow a \$25 bounty on coyotes. Coyotes can already be hunted every day of the year with no daily limit, and legally trapped from late October through late February; additionally, many hunting groups hold winter coyote killing contests. Carl G. Roe, Executive Director of the Pennsylvania Game Commission, asserted that if the bill is established as approved, the state would need a \$700,000 fund. Gary Blockus, *Coyote Bounties Not Well Thought Out*, THE [ALLENTOWN, PA] MORNING CALL (Nov. 26, 2013), *available at* http://articles.mcall.com/2013-11-26/sports/mc-outdoor-ramblings-11252013-20131126_1_coyotes-bounties-season-opener.

confining of foxes or coyotes to train dogs to kill them.¹⁴⁸ The passage of the Animal Damage Control Act (the Act) in 1931 established federal predator-control authority.¹⁴⁹ The USDA's Division of Wildlife Services administers the Act in conjunction with states, individuals, agencies, organizations, and businesses.¹⁵⁰ The Act has led to heavy financial costs,¹⁵¹ vast harm to non-target animals, loss of biodiversity,¹⁵² and a lack of public understanding of predators' role in healthy bio-communities.¹⁵³

¹⁴⁷ See Philip Shabecoff, *U.S. Sanctions a Poison Device to Kill Coyotes*, N.Y. TIMES (July 13, 1985), available at <http://www.nytimes.com/1985/07/13/us/us-sanctions-a-poison-device-to-kill-coyotes.html>. In 1985, the Environmental Protection Agency approved the use of poisoned collars on sheep and goats to kill coyotes, overturning a 13-year-old ban. *Id.* See also note 198, *infra*.

¹⁴⁸ See Eric Staats, *Florida May Shut Down Pens Used to Train Dogs to Capture Foxes, Coyotes*, NAPLES DAILY NEWS (Aug. 28, 2010), available at <http://www.naplesnews.com/news/2010/aug/28/florida-may-shut-down-fox-pens-train-dogs-capture/>.

¹⁴⁹ Animal Damage Control Act of March 2, 1931, (46 Stat. 1468) provided broad authority for investigation, demonstrations and control of mammalian predators, rodents and birds. Public Law 99-19, approved December 19, 1985 (99 Stat 1185), transferred administration of the law from the Secretary of the Interior to the Secretary of Agriculture. "The Secretary of Agriculture may conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program." 7 U.S.C. § 426 (2012). Trapping, snaring, poisoning, denning, aerial killing, calling and shooting, and M-44 (sodium cyanide) poison devices are just some of the lethal control methods that have applied under the authority of the Animal Damage Control Act.

¹⁵⁰ See, e.g., U.S. Dep't of Agric. Animal & Plant Health Inspection Serv., Wildlife Services Directive 3.101: Interfacing with Business and Establishing Cooperative Programs (2015), available at http://www.aphis.usda.gov/wildlife_damage/directives/3.101_interfacing_with_business_establishing_prog.pdf.

¹⁵¹ See RANDAL O'TOOLE, THE THOREAU INST., AUDIT OF THE U.S.D.A. ANIMAL DAMAGE CONTROL PROGRAM (last visited Mar. 31, 2015) (including the figures and related critique).

¹⁵² See *id.* (stating that federal and state initiatives under the Animal Damage Control Act have "succeeded in exterminating wolves, grizzly bears, and other predators from many states that might otherwise still have populations of such animals").

¹⁵³ See *id.* This effect runs contrary to the beginnings of the Animal Damage Control Act:

[The Animal Damage Control Act] traces its history to an 1885 USDA survey asking farmers about crop damage by birds. In 1896, when USDA's Division of Biological Survey was created, one of its missions was "to educate farmers about birds and mammals . . . so that the destruction of useful species might be prevented." This indicates USDA's intent goal was to protect, not to destroy.

Id.

In plain terms, when humans substitute themselves for natural predation, natural predators are put out of work. When coyotes, wolves, jaguars, and other predator animals are viewed as vermin or as a danger to human society, they are often hunted, trapped, or shot.¹⁵⁴ Scientists are also experimenting with the sterilization of wolves and coyotes in order to cater “to sportsmen who rely on surplus mule deer” and to protect the profits of sheep farmers.¹⁵⁵ In turn, governments subject prey animals to experiments involving artificial birth control.¹⁵⁶ The Park Service has stated its intention to rely on pharmaceutical methods in the future to keep, for example, the deer population in Valley Forge to between 165 and 185.¹⁵⁷ The interest in controlling the reproductive systems of free-living animals is encouraged by influential animal-advocacy charities. A public comment noted that the Humane Society of the United States previously offered to conduct research on the effectiveness of chemical reproductive control within Valley Forge and urged that this

¹⁵⁴ See, e.g., Terry Karkos, *Wily Coyotes?* [Lewiston, Maine] SUN JOURNAL, Nov. 11, 2007, http://web.archive.org/web/20071020003214/http://www.sunjournal.com/story/238014-3/RiverValley/Wily_coyotes/ (quoting Wally Jakubas of the Maine Department of Inland Fisheries and Wildlife as stating, “Some people still feel that coyotes are vermin and just shoot them and kick them in a ditch.”). As in Pennsylvania, shooting coyotes is permitted year round in Maine. See *id.*

¹⁵⁵ See ENVIRONMENTAL ASSESSMENT: GRAY WOLF DAMAGE MANAGEMENT IN MONTANA FOR THE PROTECTION OF LIVESTOCK, OTHER DOMESTIC ANIMALS, HUMAN SAFETY, AND OTHER RESOURCES, U.S. DEPT. OF AGRIC. ANIMAL & PLANT HEALTH INSPECTION SERV. (2012) (citing L.D. Mech et al., *Wolf Management in the 21st Century: From Public Input to Sterilization*, 1 J. WILDLIFE RES. 195, 195–98 (1996); C. Bromley & E.M. Gese, *Effect of Sterilization on Territory Fidelity and Maintenance, Pair Bonds, and Survival Rates of Free-Ranging Coyotes*, 79 CANADIAN J. ZOOLOGY 386 (2001)), available at http://www.aphis.usda.gov/regulations/pdfs/nepa/Montana%20Wolf%20EA%20October_2012.pdf.

¹⁵⁶ One of the forerunning series of experiments involved free-roaming horses. The Annenberg Foundation has assisted the Humane Society of the United States with \$1,756,850 in grant money for a project called “Assateague of the West: Protecting Wild Horses through Immunocontraception.” The Humane Society of the United States introduced PZP to wild horse populations in 1988, assisted by federal park administrators and the Bureau of Land Management. Under the law, the BLM is to “preserve and maintain a thriving natural ecological balance.” See Press Release, U.S. Humane Soc’y, *Environmental Protection Agency Announces First Fertility Control Vaccine Approved for Wild Horses in the United States* (Feb. 17, 2012), available at http://www.humanesociety.org/news/press_releases/2012/02/EPA_Announces_First_Fertility_Control_Vaccine_for_Wild_Horses.html (last visited Mar. 31, 2015).

¹⁵⁷ See *supra* note 82 and surrounding text. Deirdre Gibson, Chief of Resources for Valley Forge, reiterated in 2014 that contraception will eventually be available, but mentioned health concerns immunocontraceptives could pose to humans eating deer. See McCarthy, *supra* note 61.

idea be implemented through the park's management plan.¹⁵⁸ When the Borough Council of Swarthmore, a Philadelphia suburb, amended its firearms ordinance to clear the way for a deer kill, two emeritus professors decried school administrators' consultations with the Pennsylvania Game Commission that resulted in permission to shoot the deer. Instead, the professors urged the use of immunocontraceptive vaccines to reduce deer pregnancy rates.¹⁵⁹

Advocates who believe contraception is a humane way to manage deer might be unaware that these substances can compromise the natural survival mechanisms, social lives, and genetic diversity of the controlled animals.¹⁶⁰ Deleterious effects of pharmaceutical reproductive control have been shown during the development of hormone-based substances and immunocontraceptives for application in captive white-tailed deer.¹⁶¹ Possible side effects of various birth control substances include changes in social interactions, abnormal antler development, inflammation, abscesses, pain, and heightened risk of malnutrition.¹⁶²

Sterilization is another new method of birth control forced on deer. At Cornell University, this involved an unsuccessful project involving tubal ligation. Anthony DeNicola, a biologist identified as "president

¹⁵⁸ NAT. PARK SERV., VALLEY FORGE NATIONAL HISTORICAL PARK DEER MANAGEMENT PLAN / ENVIRONMENTAL IMPACT STATEMENT: PUBLIC COMMENT ANALYSIS REPORT (2007), available at <http://www.nps.gov/vafo/parkmgmt/upload/PublicCommentAnalysisReport091307.pdf> (last visited Mar. 31, 2015). See also note 154, *supra*.

¹⁵⁹ A December 18, 2008, letter to *The Swarthmorean* written by two emeritus philosophy professors, Priscilla Cohn and Tom Regan, advocated for deer contraception as an alternative to shooting (on file with author). For additional background on the shooting plan, see Apolline Berty, *Deer Cull to Occur During Winter Break*, THE SWARTHMORE COLLEGE PHOENIX, Sept. 11, 2008, available at <http://web.archive.org/web/20080917012239/http://www.swarthmorephoenix.com/2008/09/11/news/deer-culling-to-occur-during-winter-break> (last visited Apr. 20, 2015; article also on file with author).

¹⁶⁰ Direct physical and social effects of contraceptives have been noted in horses; see Cassandra M.V. Núñez et al., *Immunocontraception Decreases Group Fidelity in a Feral Horse Population During the Non-Breeding Season*, 117 APPLIED ANIMAL BEHAV. SCI. 74 (2009) (finding that immunocontraceptives alter the social lives of the horses of Shackleford Banks, North Carolina enough to destabilize equine group dynamics).

¹⁶¹ See, e.g., GARY J. KILLIAN & LOWELL A. MILLER, BEHAVIORAL OBSERVATIONS AND PHYSIOLOGICAL IMPLICATIONS FOR WHITE-TAILED DEER TREATED WITH TWO DIFFERENT IMMUNOCONTRACEPTIVES (2000), http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1039&context=icwdm_wdmconfproc.

¹⁶² See, e.g., Paul D. Curtis et al., *Pathophysiology of White-tailed Deer Vaccinated With Porcine Zona Pellucida Immunocontraceptive*, 25 VACCINE 4623 (2007).

of a conservation nonprofit that promotes surgical sterilization as a way to control deer populations,” has a team removing the ovaries from white-tailed does at the 322-acre fenced campus of the National Institutes of Health in Bethesda, Maryland.¹⁶³ DeNicola conducted Virginia’s first ovary-removal operation, subjecting eighteen deer to the procedure in the garage of a police station in Fairfax, Virginia.¹⁶⁴

The essential question is not which method of deer control works best. Rather, it is whether policies will continue promoting artificial, public-pleasing animal populations over guiding and encouraging the public to appreciate natural ecosystems. Appreciation for the role of natural predation, as opposed to substitution for it, carries particular importance as top predators decline worldwide at faster rates than many other species.¹⁶⁵ Humans “typically cannot replicate the effects of carnivores on ecosystems,” write William Ripple et al. in *Science Magazine*. The authors conclude with an uncommonly strong call to action: “[L]arge-carnivore conservation might also be seen as a moral obligation—the recognition of the intrinsic value of all species.” They add:

A 40-year history of the field of environmental ethics has both rigorous and systematic rationales for valuing species and nature itself. Large-carnivore conservation, therefore, might benefit greatly from a more formal relationship with practitioners of environmental ethics. It will probably take a change in both human attitudes and actions to avoid imminent large-carnivore extinctions. A future for these carnivore species and their continued effects on planet Earth’s ecosystems may depend upon it.¹⁶⁶

The thrust of policy at every level should be to increase the “cultural carrying capacity” for natural predation—a key to fostering robust bio-communities and integrating environmental ethics.

C. Possible Effect of Predator Loss on Carbon Uptake

Biodiversity sustains ecosystems, ensuring they are productive and resilient to change.¹⁶⁷ Recent studies further suggest that biodiversity

¹⁶³ Hendrix, *supra* note 131. NIH officials consulted with the Maryland Department of Natural Resources, which recently approved surgical sterilization as a deer-management technique. *Id.*

¹⁶⁴ *Id.*

¹⁶⁵ William J. Ripple et al., *Status and Ecological Effects of the World’s Largest Carnivores*, 343 *SCIENCE* 1241484 (2014).

¹⁶⁶ *Id.*, at 1241484-9.

¹⁶⁷ FRIEDLAND, *supra* note 102, at 6.

loss can influence the Earth's climate. The release of excess carbon dioxide into our atmosphere results from many human activities already well understood—including the burning of fossil fuels, deforestation, and animal agribusiness.¹⁶⁸ Additionally, predator loss can induce the release of greenhouse gases associated with climate change.

A study at the Yale School of Forestry & Environmental Studies examines the connection between biodiversity and carbon sequestration.¹⁶⁹ In the study, the presence of spiders made plants' carbon uptake 1.4 times faster than when just grasshoppers were present and 1.2 times faster than when no animals were present.¹⁷⁰ When under the stress of predators, grasshoppers ate more herbs instead of grass, and less plant matter overall.¹⁷¹ Grasses stored more carbon in their roots as a response to the presence of herbivores and carnivores together.¹⁷² Where only herbivores were present, plants tended to breathe out, rather than store, carbon.¹⁷³

Other scientists suggest similar effects in coastal areas from Vancouver Island to the western Aleutian Islands, where a loss of sea otters correlates with higher emissions.¹⁷⁴ Sea urchins, prey of the now-diminishing otters, are ravaging the kelp forests that would otherwise act as carbon sinks.¹⁷⁵ “Predator-induced trophic cascades

¹⁶⁸ EDGAR G. HERTWICH ET AL., UNITED NATIONS ENVTL. PROGRAMME, ASSESSING THE ENVIRONMENTAL IMPACTS OF CONSUMPTION AND PRODUCTION (2010), available at http://www.unep.org/resourcepanel/Portals/24102/PDFs/PriorityProductsAndMaterials_Report.pdf. The report examines fossil fuel consumption, land use, and the impacts of population growth, and states: “A substantial reduction of impacts would only be possible with a substantial worldwide diet change, away from animal products.” *Id.* at 82.

¹⁶⁹ See Michael S. Strickland et al., *Trophic Cascade Alters Ecosystem Carbon Exchange* (2013), 110(27) PROC. NAT. ACAD. SCI. 11035 (2103).

¹⁷⁰ *Id.*

¹⁷¹ *Id.*

¹⁷² *Id.*

¹⁷³ *Id.* The scientific experts who study climate change for the United Nations don't consider these multiplier effects in their models. Oswald Schmitz, professor of ecology and one of the coauthors of the study, has asserted, “People are arguing for a paradigm change.” See *Study: Predators Affect the Carbon Cycle*, YALE SCH. OF FORESTRY AND ENVTL. STUDIES (June 19, 2013), <http://environment.yale.edu/news/article/study-predators-affect-the-carbon-cycle/>.

¹⁷⁴ Christopher C. Wilmers et al., *Do Trophic Cascades Affect the Storage and Flux of Atmospheric Carbon? An Analysis of Sea Otters and Kelp Forests*, 10 FRONTIERS ECOLOGY & ENV'T 409.

¹⁷⁵ *Id.*

likely influence the rates of C [ecosystem carbon] flux and storage in many other species and ecosystems.”¹⁷⁶ The ecological implications of this data to mid-Atlantic ecosystems should be noted in any report with policy implications for predators, as the stakes for all ecosystems are so high. By 2100, rising levels of human-produced greenhouse gases and subsequent climate change are expected to modify plant communities so drastically that nearly forty percent of land-based ecosystems will change from one major ecological community type—such as forest, grassland or tundra—into another.¹⁷⁷ If substituting forcible control for the natural predator-prey relationship exacerbates carbon dioxide release, and thus climate change, further research results may support the policy changes this Article suggests.

Global climate change is mitigated significantly when the oceans absorb carbon dioxide (CO₂) emissions, as the oceans are the planet’s main carbon sink. In the last ten years, their capacity to absorb has diminished because of climate change itself, with its effect of winds increasingly mixing into surface ocean.¹⁷⁸ When CO₂ dissolves in the ocean, carbonic acid forms and ocean acidity rises.¹⁷⁹ Today the oceans are acidifying at least ten times faster than any time over the past fifty million years.¹⁸⁰ All told, the current rate of CO₂ release is

¹⁷⁶ *Id.*

¹⁷⁷ *Climate Change May Bring Big Ecosystem Changes*, NASA (Dec. 14, 2011), <http://www.jpl.nasa.gov/news/news.php?release=2011-387> (referring to simulations carried out by according to researchers from NASA researchers and the California Institute of Technology in Pasadena and published in the journal *Climatic Change*). Studies predict a wetter Earth, with global temperature rising drastically: 3.6 to 7.2 degrees Fahrenheit (2 to 4 degrees Celsius) by 2100, about the same warming that occurred following the Last Glacial Maximum almost 20,000 years ago, but about 100 times faster. *Id.*

¹⁷⁸ Nat’l Ctrs. for Scientific Research, *Ocean Less Effective at Absorbing Carbon Dioxide Emitted by Human Activity*, SCIENCE DAILY (Feb. 23 2009), <http://www.science.dailly.com/releases/2009/02/090216092937.htm>.

¹⁷⁹ *Ocean Acidification: Carbon Dioxide is Putting Shelled Animals at Risk*, NATIONAL GEOGRAPHIC, <http://ocean.nationalgeographic.com/ocean/critical-issues-ocean-acidification/> (last visited Apr. 10, 2015). As the oceans continue to absorb more CO₂, their capacity as a carbon storehouse could diminish—leaving more of the emitted carbon dioxide we emit in the atmosphere. *Id.*

¹⁸⁰ See NAT’L. OCEANIC & ATMOSPHERIC ADMIN., STATE OF THE SCIENCE FACT SHEET: OCEAN ACIDIFICATION (2013), available at http://www.noaa.gov/factsheets/new%20version/SoS%20Fact%20Sheet_Ocean%20Acidification%2020130306%20Final.pdf (stating that acidification is occurring “at least ten times faster than at any time over the past 50 million years and can be observed in extended ocean time-series observations”). For an example of possible consequences, see, e.g., Philip L. Munday et al., *Ocean Acidification Impairs Olfactory Discrimination and Homing Ability of a Marine Fish*, 106(6) PROC. NAT. ACAD. SCI. 1848 (2009) (stating that acidification prevents larval clownfish from finding reef habitat).

poised to drive a mix and magnitude of geochemical changes potentially unparalleled over some 300 million years of the oceans' history, raising the possibility that we are entering into an unknown territory of marine ecosystem change.¹⁸¹ Increasingly prevalent extreme weather events may further impede carbon uptake by terrestrial ecosystems, creating feedback loops as extreme weather events caused by climate change fuel more climate change.¹⁸²

Against this bleak backdrop, a sensible approach to managing deer populations would examine emerging science on how suppression of predators can induce carbon releases. In some studies, CO₂ emissions are shown to have risen as much as tenfold.¹⁸³ Emerging science raises some uncertainties, as it requires us to draw inferences from new data samples. Still, the studies are relevant to a sound assessment.¹⁸⁴ Reed F. Noss asserts that “[t]he philosophy underlying conservation biology and other applied sciences is one of prudence: in the face of uncertainty, applied scientists have an ethical obligation to risk erring on the side of preservation.”¹⁸⁵ So it is in the question of preserving predator-prey dynamics rather than replacing them with forcible control.

IV ANIMALS' PLACE IN ENVIRONMENTAL ETHICS: THE MORAL SIGNIFICANCE OF CONSCIOUSNESS

Above, this Article notes the urgent call from several ecologists to respect the inherent value of carnivores and of nature.¹⁸⁶ Already known is how to respect the inherent value of human individuals and

¹⁸¹ Baerbel Hoenisch et al., *The Geological Record of Ocean Acidification*, 335 SCIENCE 1208277 (2012).

¹⁸² Climate change is predicted to increase the frequency and severity of storms, heavy rain events, heat waves, and droughts; and recent studies have shown that that terrestrial ecosystems absorb approximately 11 billion tons less carbon dioxide every year than they otherwise would because of extreme climate events—roughly equal to 1/3 of global carbon dioxide emissions each year. M. Reichstein et al., *Climate Extremes and the Carbon Cycle*, 500 NATURE 287 (2013).

¹⁸³ Trisha B. Atwood et. al., *Predator-induced Reduction of Freshwater Carbon Dioxide Emissions*, 6 NATURE GEOSCIENCE 191 (2013).

¹⁸⁴ See Biber, *supra* note 68, at 488 (describing “cutting edge” as relatively more fallible—yet precisely the kind of science most likely to be relevant for policy-making).

¹⁸⁵ Noss, *supra* note 110, at 897.

¹⁸⁶ See Ripple et al., *supra* note 165 and surrounding text.

their communities. At the most basic level, people are respected because they are conscious of life experiences—because we recognize other people as conscious, and extend empathy to them. The psychological health of human beings is a vital social value. Indeed, the U.S. Supreme Court acknowledges that “effects on human health can be cognizable under NEPA, and that human health may include psychological health.”¹⁸⁷ Can environmental ethics encompass the existence of nonhuman consciousness, and the reality that animals have cognitively adapted to their various ecological niches? Arguably, yes. State anticruelty laws recognize and attach legal significance to animals’ suffering—one element of consciousness. A parallel concept need not be missing from law and policy pertaining to animals in natural settings, as it is missing today. For example, officials in New Jersey are permitted to trap deer with netting that “ensnares groups of deer who sometimes are thrown violently in the air, and who cry out and struggle in a state of terror as they . . . are methodically shot in the head with a captive[-]bolt device which fires a metal rod into their skulls.”¹⁸⁸ The acute stress of this process is itself severe enough to kill deer, says the New Jersey Society for the Prevention of Cruelty to Animals:

[T]he deer inside the net tend to thrash violently, often resulting in injuries, including broken limbs and antlers, and endure a significant amount of stress . . . because deer are “flighty” animals, the netting process alone causes undue stress and panic. Stress may be so acute as to cause the death of some of the deer prior to bolting
¹⁸⁹

In animals of all kinds, scientists have found individual personality differences. In the words of Natalie Angier, “animals, like us, often

¹⁸⁷ Metro. Edison Co. v. People Against Nuclear Energy, 460 U.S. 766, 771 (1983).

¹⁸⁸ The Cayuga Heights trustees oversaw Draft Environmental Impact Statement (DEIS) for their deer-killing proposal. Their plan considers the “net-and-bolt” technique via a special permit from the New York Department of Environmental Conservation. VILLAGE OF CAYUGA HEIGHTS, *supra* note 112. Jack Schrier, a former member of the Fish & Game Council in New Jersey, wrote:

[T]he poor creatures do struggle, do scream, and do try mightily to escape their fate. That natural and instinctive activity makes it virtually impossible in many instances for the bolt to be used accurately with a single shot. Too often the bolt misses the target, followed by second and third attempts before getting the bolt into the deer. Even then, the head often is missed entirely Certain it is not. Swift, it is not. Humane, it surely is not. . . .

Id.

¹⁸⁹ *Id.*

cling to the same personality for the bulk of their lives.”¹⁹⁰ Alison M. Bell, who studies personality in stickleback fish, asserts that “we’re not being cute and anecdotal; we’re looking at consistent differences in behavior that we can test and measure.”¹⁹¹ Ralf H.J.M. Kurvers, studying barnacle geese, found the only reliable predictor of goose leadership was not biology but boldness in approaching novel items and places.¹⁹² There are countless examples.¹⁹³ In 2012, signing the Cambridge *Declaration on Consciousness in Non-Human Animals*, a group of neuroscientists affirmed that the field of consciousness research is rapidly evolving, and that “arousal of the same brain regions generates corresponding behavior and feeling states in both humans and nonhuman animals.”¹⁹⁴ The scientists also noted evidence that human and nonhuman animal emotions and deliberations arise from homologous brain networks—that “the weight of evidence indicates that humans are not unique” in our capacity for consciousness.¹⁹⁵ To comprehend the consciousness of animals would strengthen environmental ethics. If “the environment” is understood not simply as a backdrop to human existence and events, but also for its inherent reality, then we should be concerned with non-human consciousness as well as the biological phenomena that develop within it.

The moral significance of nonhuman consciousness has yet to inform the process of policy-making on public lands, and it was not brought up for discussion when the Park Service made the final decision to shoot more than eighty-five percent of the Valley Forge deer. It may, however, be detected in the statutory background. Under NEPA,¹⁹⁶ to demonstrate standing to challenge agency actions that impact the environment, a plaintiff must establish (i) injury-in-fact

¹⁹⁰ Natalie Angier, *Even Among Animals: Leaders, Followers and Schmoozers*, N.Y. TIMES, Apr. 5, 2010 at D1.

¹⁹¹ *Id.*

¹⁹² *Id.*

¹⁹³ See, e.g., *id.* “[S]cientists have found evidence of distinctive personalities . . . in chimpanzees, monkeys, barnacle geese, farm minks, blue tits and great tits, bighorn sheep, dumpling squid, pumpkinseed sunfish, zebra finches, spotted hyenas, even spiders and water striders, to name but a few.” *Id.*

¹⁹⁴ PHILIP LOW, THE CAMBRIDGE DECLARATION ON CONSCIOUSNESS (2012), available at [http://fcmconference.org/img/Cambridge DeclarationOnConsciousness.pdf](http://fcmconference.org/img/Cambridge%20DeclarationOnConsciousness.pdf).

¹⁹⁵ *Id.*

¹⁹⁶ Nat’l Env’tl Pol’y Act of 1969, 42 U.S.C. §§ 4321–4370 (2012).

within NEPA's zone of interests, (ii) causation, and (iii) redressability.¹⁹⁷ The Supreme Court found that Congress established the NEPA's zone of interests to encompass "the physical environment—the world around us, so to speak."¹⁹⁸ The Supreme Court asserted:

The statements of two principal sponsors of NEPA, explaining to their colleagues the Conference Report that was ultimately enacted, illustrate this point: "What is involved [in NEPA] is a declaration that we do not intend as a government or as a people to initiate actions which endanger the continued existence or the health of mankind: That *we will not intentionally initiate actions which do irreparable damage to the air, land and water which support life on earth.*"¹⁹⁹

Because NEPA has no citizen-suit provision, plaintiffs must look to another statute, typically the Administrative Procedure Act (APA),²⁰⁰ to seek judicial review of a "final agency action."²⁰¹ To meet the APA standing requirement, the plaintiff must be "[a] person suffering legal wrong because of agency action, or adversely affected or aggrieved by agency action within the meaning of a relevant statute."²⁰² The Supreme Court interpreted this as requiring a personalized relationship between an environmental plaintiff and the natural community that plaintiff sets out to defend: "By

197 *Bell v. Bonneville Power Admin.*, 340 F.3d 945, 951 (9th Cir. 2003).

198 *Metro. Edison Co. v. People against Nuclear Energy*, 460 U.S. 766, 772 (1983).

199 *Id.* at 773.

200 Administrative Procedure Act, 5 U.S.C. §§ 500, 551–559, 701–706 (2012).

201 *See Lujan v. National Wildlife Federation*, 497 U.S. 871, 882 (1990), stating:

the person claiming a right to sue must identify some "agency action" that affects him in the specified fashion; it is judicial review "thereof" to which he is entitled. The meaning of "agency action" for purposes of § 702 is set forth in 5 U.S.C. § 551(13), see 5 U.S.C. § 701(b)(2) ("For the purpose of this chapter . . . agency action' ha[s] the meanin[g] given . . . by section 551 of this title"), which defines the term as "the whole or a part of an agency rule, order, license, sanction, relief, or the equivalent or denial thereof, or failure to act," 5 U.S.C. § 551(13). When, as here, review is sought not pursuant to specific authorization in the substantive statute, but only under the general review provisions of the APA, the "agency action" in question must be "final agency action." See 5 U.S.C. § 704 ("Agency action made reviewable by statute and final agency action for which there is no other adequate remedy in a court are subject to judicial review").

Id.

202 A person suffering legal wrong because of agency action, or adversely affected or aggrieved by agency action within the meaning of a relevant statute, is entitled to judicial review thereof. 5 U.S.C. § 702.

particularized, we mean that the injury must affect the plaintiff in a personal and individual way.”²⁰³

Accordingly, members of two nonprofit groups challenging the Valley Forge deer kill described their visits to the park and their sightings of the deer there, and how they would personally feel if the management plan went ahead. In some cases, declarants described individual deer.²⁰⁴ The judge, deciding on the side of the Park Service, conflated natural predation with unnatural culling and decided the plaintiffs could not support the former yet oppose the latter:

While the National Park Service has commenced with its plan to reduce the number of deer in Valley Forge, this alone does not establish irreparable harm, particularly in light of Petitioners’ main argument at summary judgment, suggesting the infusion of coyotes. Petitioners have never advocated that this is a case about whether or not to cull the deer. Rather, Petitioners have challenged the method by which the deer population will be reduced and are the primary proponents for another lethal method of reduction—introducing coyotes to eat the deer. The two arguments simply are not reconcilable in that Petitioners cannot suggest that it would be reasonable for the National Park Service to introduce coyotes to “naturally reduce” the deer population, while also arguing that the current cull (albeit by a different lethal means) is causing irreparable harm by “removing” particular deer with which they have developed “special relationships.”²⁰⁵

But these positions are reconcilable. We can reject killing and pharmaceutical control by human officials, yet accept predation as a natural fact. (Petitioners did not urge “introducing” coyotes; the petition simply called on the federal government and Pennsylvania’s game commission to stop suppressing these predators.)²⁰⁶ Plaintiffs face a legal Catch-22 if they are pressed by case law to declare a

²⁰³ Lujan v. Defenders of Wildlife, 504 U.S. 555, 579 (1992).

²⁰⁴ The court noted that petitioners claimed the management plan “is causing irreparable harm by ‘removing, particular deer with which they have developed ‘special relationships.’” Friends of Animals v. U.S. Nat’l Parks, No. No. 2:09-cv-5349, 2010 U.S. Dist. LEXIS 123464, at *7 (E.D. Pa. Nov. 22, 2010).

²⁰⁵ *Id.* at *6–7.

²⁰⁶ As coyotes already live in and around the park, they need not be “introduced” there; rather, the petitioners called upon the federal government to work with Pennsylvania in order to stop suppressing area coyotes through hunting and trapping. See Jeff Gammage, *Let Coyotes, Not Hunters, Control Valley Forge Deer*, *Animal-Rights Advocates Say*, PHILADELPHIA INQUIRER (Oct. 18, 2010), available at https://web.archive.org/web/20101023094526/http://www.philly.com/philly/news/20101018_Let_coyotes_not_hunters_control_Valley_Forge_deer_animal-rights_advocates_say.html.

personalized sense of appreciation for the deer specific to the park, yet not permitted to respect trophic dynamics. An appreciation for the consciousness and individuality of free-living animals, as well as their interactions and collective evolution, can be understood and valued even as we acknowledge that these individuals and communities experience life and death within the trophic levels.

Current laws, rules, and policies recognize undomesticated animals in numerical terms. They unscientifically treat only human feelings as genuinely noteworthy (even humans' feelings about their ornamental garden plants); and the non-human experience typically receives no notice at all.²⁰⁷ But it is not insignificant. For example, because young bobcats cannot fend for themselves until they are close to a year old, body counts of adult cats do not convey the whole story of how social groups are impacted. Numbers of "harvested" bobcats and coyotes erase the reality of the process—their agony in traps, their struggle to return to dependent young, or their death at the hands of trappers intent on killing without damaging the pelt.

Wherever law and policy support the natural laws of biology and are aligned with evolutionary science, recognition of the environment as the territory of morally significant beings—beings with life experiences, individual preferences, and roles within their communities—is possible to conceive. It is both scientifically and ethically sensible to adjust policies in order to advance our comprehension of, and appreciation for, other animals rather than regard and describe them solely in numerical terms.

To be sure, intrinsic value-based conservation of biological communities can work even before discussing consciousness.²⁰⁸ The

²⁰⁷ Even in the field of animal law, this lack of attention to animals themselves is prevalent. In a critique of the field and its laws, Catharine MacKinnon writes:

Who asked the animals? References to what animals might have to say are few and far between. Do animals dissent from human hegemony? I think they often do. They vote with their feet by running away. They bite back, scream in alarm, withhold affection, approach warily, and swim off. But this is interpretation. How to avoid reducing animal rights to the rights of some people to speak for animals against the rights of other people to speak for the same animals needs further thought.

CATHARINE A. MACKINNON, *Of Mice and Men: A Fragment on Animal Rights*, in *WOMEN'S LIVES, MEN'S LAWS* 98 (2005).

²⁰⁸ Kent H. Redford has asserted that traditional conservationists sought to protect nature primarily for its own sake, meeting with significant successes. See Richard Conniff, *What's Wrong with Putting a Price on Nature?*, *YALE ENV'T* 360 (Oct. 18, 2012), http://e360.yale.edu/feature/ecosystem_services_whats_wrong_with_putting_a_price_on_nature/2583/. It is arguably not enough to value coyotes only insofar as they perform

concept, however, applies with special strength to living, feeling beings in a bio-community. The current neglect of ethical consideration for living and conscious members of the bio-community, on the part of government decision makers, is conducive to urban sprawl and the erasure of ecosystems.²⁰⁹ Policies throughout the United States target indigenous animals as nuisances.²¹⁰ These policies are antithetical to the acknowledgement of conscious responses of living animals. For example, one of the poisons used to kill coyotes is Compound 1080—it is put into collars strapped onto goats and lambs and causes the animal biting the collar to die a hideously slow death lasting three to fifteen hours.²¹¹ This ill-suits a modern society that acknowledges animal cruelty as wrong.²¹² The

“ecosystem services” for human benefit. See Kent H. Redford & William M. Adams, *Payment for Ecosystem Services and the Challenge of Saving Nature*, 23 CONSERVATION BIOLOGY 785 (2009).

²⁰⁹ To discuss “erasure” of living groups across the United States is not hyperbole, considering the country has one of the world’s top three extinction rates. See *Species Extinct*. WORLDMAPPER.ORG, http://www.worldmapper.org/posters/worldmapper_map267_ver5.pdf (last visited Apr. 20, 2015) (a map produced by researchers from the Social and Spatial Inequalities Group (SASI) of the University of Sheffield and Mark Newman for the Worldmapper website).

²¹⁰ The state of New York, for example, refers visitors to the state office of the U.S. Department of Agriculture’s Wildlife Services, and offers information on how to contact a Nuisance Wildlife Control Operator in order to “hire an expert to remove problem wildlife from your property” and further gives information on how to “[r]emove or ‘take’ nuisance animals on your own in accordance to New York State laws and regulations.” *Tips to Eliminate Wildlife Conflicts*, NEW YORK STATE DEP’T OF ENVTL. CONSERVATION, <http://www.dec.ny.gov/animals/89522.html> (last visited Apr. 4, 2015).

²¹¹ President Nixon’s Executive Order 11643 banned Compound 1080, strychnine, cyanide, and thallium by federal agents on federal public lands and the then Environmental Protection Agency Administrator, William D. Ruckelshaus, barred these poisons for killing native carnivores by administrative order. 37 Fed. Reg. 5718 (Mar. 9, 1972). See also 40 Fed. Reg. 44,726, 44,734–35 (Sept. 29, 1975). But the Fish and Wildlife Service in 1977 petitioned the EPA to be allowed to use Compound 1080 in baits and “livestock projection collars” that strap poison-filled sacks onto the necks of sheep and goats. In 1982, Compound 1080 was reinstated for use in the collars. *Timeline*, WILDEARTH GUARDIANS, http://www.wildearthguardians.org/site/PageServer?pagename=priorities_wildlife_war_wildlife_timeline (last visited Apr. 4, 2015).

²¹² Some legislative indicators suggest that state governments do acknowledge ethics issues involved in trapping or poisoning coyotes and other free-roaming animals. See N.J. STAT. ANN. §§ 23:4-22.1, 23:4-22.2, 23:4-22.3 (2013) (banning steel-jaw leg-hold traps); OKLA. STAT. ANN. tit. 29, § 5-502 (2013) (restricting uses of traps); R.I. GEN. LAWS ANN. § 20-16-6 (West 2012) (prohibiting the use of snares or the spreading of any poison, for the purpose of catching or killing any animal, unless allowed by other provisions of state regulations); VT. STAT. ANN. tit. 10, § 4706 (2013) (prohibiting the use of snares).

USDA Wildlife Services kills tens of thousands of animals annually.²¹³ As for prey animals, they are baited, shot, captured and killed with bolt guns, and subjected to contraception experiments. All of these methods of control disrupt their social interactions, and all are associated with some form of bodily invasion and pain.

V RECOMMENDATIONS

The National Park Service claims that an abundance of deer reduces forest regeneration, adversely affecting other living beings.²¹⁴ The best approach does not entail killing the deer. Scientific studies have shown that deer bolster ecosystems, and that fostering both ungulate populations and the carnivores with which they have co-evolved would benefit bio-communities.²¹⁵

The Park Service has, in substantial ways, followed public opinion rather than informing it. For example, the Park Service repeatedly suggests that high deer populations lead to increased browsing of landscape vegetation on private properties, thus having a negative economic impact on those landowners.²¹⁶ A more prudent approach would feature outreach and explanations to local residents regarding the value of flexibility and respect for indigenous animal life, especially on the part of gardeners with homes near a national park.

Transcending the pattern of forcibly suppressing nature, coyote co-existence initiatives have emerged in various suburban areas throughout the country.²¹⁷ These initiatives should replace forcible

²¹³ The full name of the agency is U.S. Department of Agriculture-Animal and Plant Health Inspection Service, Wildlife Services. See Wendy Keefover-Ring, *War on Wildlife: The U.S. Department of Agriculture's "Wildlife Services": A Report to President Barack Obama and Congress*, WILDEARTH GUARDIANS (Feb. 2009), http://www.wildearthguardians.org/support_docs/Publication_War_on%20Wildlife_report_FINAL_highres.pdf. Most of Wildlife Services' budget comes from federal tax dollars, but states and counties also contribute. The agency receives funding from private cooperators such as the Woolgrowers Association and the Cattlemen's Association. *Id.*

²¹⁴ See *supra* notes 87, 93, and 139 and surrounding text.

²¹⁵ See *supra* notes 142–44 and surrounding text.

²¹⁶ See *supra* notes 94–95 and surrounding text.

²¹⁷ See, e.g., THE COYOTE COEXISTENCE PROJECT, <http://coyotecoexistence.com> (last visited Apr. 4, 2015).

Our aim is to promote education about coexistence in order to stop coyote trapping and killing. We began in the Atlanta area but are now available to help elsewhere. We need to spread the word about coexistence, an alternative coyote management approach, which works in other urban areas: Denver, Seattle, Vancouver, Chicago, New York, San Francisco. A coexistence policy can work in our community.

control. As such models gain traction, they inform communities about the importance of predators. To be sure, people need time to adjust to the understanding that predators have a natural place in our environment. Coyotes are wary of people as well.²¹⁸ Generally, they steer clear of humans,²¹⁹ and the rare conflict can be avoided by straightforward and sensible precautions.²²⁰

There is precedent for coyote coexistence policies in the eastern United States. New York's Department of Environmental Conservation (DEC) offers a webpage titled "Coyote Conflicts." It states that "[t]he Eastern coyote is firmly established in New York. They live in New York as an integral part of our ecosystems. People and coyotes can usually coexist if the natural fear of people that coyotes have is maintained."²²¹ Having established coyotes in our midst as an acceptable ecological fact, the page suggests ways to prevent acclimation of coyotes to humans: preventing the feeding of coyotes, eliminating the availability of bird seed (coyotes are attracted to the concentration of birds and rodents that come to feeders), and aggressively shooing coyotes away if they are near.²²² The potential does exist for coyote attacks in New York, and a failure to understand how coyotes respond to humans could put people at risk. Here, some

²¹⁸ See Stanley D. Gehrt, *Ecology of Coyotes in Urban Landscapes*, PROCEEDINGS OF THE 12TH WILDLIFE DAMAGE MANAGEMENT CONFERENCE (2007), available at http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1062&context=icwdm_wdmconfproc.

²¹⁹ *Id.*

Virtually all studies that have reported on coyote activity in urbanized landscapes have been consistent, with an increase in nocturnal activity with the level of development or human activity within the home range (Atkinson and Shackleton 1991, Quinn 1997a, Gibeau 1998, Grindler and Krausman 2001b, McClennan et al. 2001, Tigas et al. 2002, Riley et al. 2003, Morey 2004). Coyotes typically reduce their activity during the day as a result of living in close proximity to people.

Id. See also Tom Wright-Piersanti, *Coyote Spotted Roaming Through Scotch Plains*, [N. J.] STAR-LEDGER (July 16, 2013), available at http://www.nj.com/union/index.ssf/2013/07/coyote_spotted_roaming_through_scotch_plains.html (stating that coyotes are generally wary of humans, but can be emboldened by access to food discarded or made available by humans).

²²⁰ See, e.g., *Guidelines for Coexistence*, COYOTE COEXISTENCE (2012), <http://coyote-coexistence.com/2012/12/27/coyote-information-and-facts-3/>.

²²¹ *Coyote Conflicts*, N.Y. STATE DEP'T OF ENVTL CONSERVATION, <http://www.dec.ny.gov/animals/6971.html> (last visited Apr. 4, 2015).

²²² *Id.* Nevertheless the DEC lists hunting and trapping among the "great deal of benefits" coyotes provide for New Yorkers—along with observation and photography opportunities. *Id.*

would say no risk at all is acceptable. “However,” the DEC states, “a little perspective may be in order. On average 650 people are hospitalized and one person killed by dogs each year in New York State. Nationwide, only a handful of coyote attacks occur yearly.”²²³ While coyotes can and do kill cats, the DEC notes, “so do foxes, dogs, bobcats, vehicles, and even great horned owls. Cat owners need to be aware that cats allowed to roam free are at risk from many different factors.”²²⁴ As for small dogs, the DEC offers some words of explanation and advice:

Conflicts between dogs and coyotes . . . are more likely in the months of March and April. It is during this time that coyotes are setting up their denning areas for the soon-to-arrive pups. Coyotes become exceptionally territorial around these den sites in an attempt to create a safe place for their young. Coyotes view other canines (dogs) as a threat to their young. Essentially it comes down to a territorial dispute between your dog and the coyote. Both believe that your yard is their territory.²²⁵

The DEC points out that large- and medium-sized dogs will hold their own with coyotes, but when walking a small dog at night, people are advised to “[b]e alert of your surroundings and take precautions such as carrying a flashlight or a walking stick to deter coyotes.”²²⁶

Humans could decide not to bother with coexistence. Instead, we could continue with an uninterrupted record of sprawl, forcible animal management, and destruction of bio-communities wherever we go. With this approach, natural resource managers and municipalities would miss the opportunity to provide sound guidance and dismiss the potential of residents to become citizen ecologists.²²⁷ The public funds saved from trapping and killing could be shifted to public education about predators’ beneficial role and how we can live safely with coyotes. This would increase ecological literacy at the community level while curbing the type of human actions and habits that invite disquieting encounters with these animals.

A human culture that can express respect for the autonomy of free-living beings is an eco-friendly humanity. It is a humanity that brings

²²³ *Id.*

²²⁴ *Id.*

²²⁵ *Id.*

²²⁶ *Id.* Though it is “rather uncommon,” coyotes have scratched or bitten people shielding small dogs. *Id.*

²²⁷ See generally UNIV. CAL. BERKELEY, A BLUEPRINT FOR SCIENTIFIC INVESTIGATIONS 5 (2012), available at http://undsci.berkeley.edu/lessons/pdfs/how_science_works_p3.pdf (“The process of science is intertwined with society.”).

itself to question the acceptability of stripping the land, polluting rivers and bays, and destabilizing our common atmosphere for commercial benefit. Shifting to policies that value, spare, and respect herbivores and predators alike (rather than regard them all as pests) would spare human and economic resources from the current norm of cyclical killing.²²⁸ Unsuppressed by annual cycles of hunting and trapping, coyotes would need time to resume their roles as organized and effective predators.²²⁹ The government could play a helpful role by guiding people to acceptance and safe coexistence.

Because coyote populations are already present in the mid-Atlantic region²³⁰ and need not be introduced, the testing could occur through a natural experiment.²³¹ Numerous “natural experiments through time” already link the flourishing of large predators with forest health and wildflower blooms in Western wildlands.²³² Parallel thinking would benefit managers in the mid-Atlantic region. In this natural experiment, deer could be expected to gradually decrease or have their population growth rate notably reduced.²³³

²²⁸ See Frederick F. Knowlton et al., *Coyote Depredation Control: An Interface between Biology and Management*, 52(5) J. RANGE MGMT. 398, 407 (1999) (“Because coyote populations are dynamic and resilient, effects of coyote removal are ephemeral, with normal demographic responses attempting to return the populations levels consistent with available food and habitat conditions.”).

²²⁹ See N.Y. STATE DEP’T ENVTL. CONSERVATION, *supra* note 218 (explaining that coyotes “live in New York as an integral part of our ecosystems. People and coyotes can usually coexist if the natural fear of people that coyotes have is maintained.”). At the same time, efforts to permit wolves to expand their ranges will be important, as coyotes naturally fit the role of mesopredator rather than apex predator. Laura T. Prugh et al., *The Rise of the Mesopredator*, 59(9) BIOSCIENCE 779, 780, 784 (2009).

²³⁰ William J. Ripple et al., *Widespread Mesopredator Effects After Wolf Extirpation*, 160 BIOLOGICAL CONSERVATION 70, 71 (2013).

²³¹ As coyotes are already present, the basic experimental set-up exists. See generally UNIV. CAL. BERKELEY, *Tactics for Testing Ideas*, http://undsci.berkeley.edu/article/0_0_0/howscienceworks_08 (last visited Apr. 20, 2015).

²³² William J. Ripple & Robert L. Beschta, *Trophic Cascades in Yellowstone: The First 15 Years after Wolf Reintroduction*, 145 BIOL. CONSERV. 205, 205 (2011). The 1995 reintroduction of wolves to Yellowstone pushed elk away from devastated cottonwood, willow and aspen, which began to rebound, followed by many communities of native animals. See *id.* at 206. See also *supra* notes 4–7 and surrounding text. Cf. Sandi Doughton, *Can Wolves Restore an Ecosystem?*, SEATTLE TIMES, Jan. 25, 2009, available at http://seattletimes.com/html/nationworld/2008667916_wolves25.html (visited July 29, 2014) (considering potential benefits of predators returning to Olympic National Park, according to the same scientists).

²³³ Testing occurs in “two logical steps: (1) if the idea is correct, what would we expect to see; and (2) does that expectation match what we actually observe? Ideas are supported

Contrast the results to date of the previously mentioned forcible control in Philadelphia, where a USDA wildlife biologist now supervises what began as a one-year pilot program in 1999 and where, since then, more than 2,500 deer have been shot across five park areas within the Fairmount Park system.²³⁴ A high percentage of deer killed are pregnant, according to Wildlife Services.²³⁵ Assuming the control of coyotes has not changed significantly, the deer population data suggest that more deer arise to fill forcibly created vacuums, and that deer are reproducing with compensatory speed.

CONCLUSION

The forcible model of deer control used by the National Park Service, the U.S. Department of Agriculture, states, and numerous local governments reacts to a perceived crisis of deer overpopulation in North America. A shift away from this model makes sense. The environmentally reasonable answer to the issue of a growing deer population is the natural relationship between deer and the predators they co-evolved with. By substituting firearms and pharmaceutical control for the vital part that predators play in maintaining healthy biodiversity and a sustainable environment, policy makers devalue coyotes, wolves, big cats, and other predator animals and their role in the ecological balance. The detriments inherent in this customary practice are substantial and multifaceted. Because of natural interdependencies, when humans suppress top predators, the environment is adversely affected—including in ways likely to exacerbate biodiversity loss and the continuing climate emergency.

Environmental ethics underscores the value of shifting away from heavy-handed animal control. Biological communities have inherent value and are vital to protect. Moreover, within these biological communities are beings capable of life experiences. The current neglect of ethical consideration for living and conscious members of the bio-community, on the part of government decision-makers, restrains policy-makers from finding biologically sound policies and effective biodiversity conservation.

when results match expected observations and are contradicted when they do not match.” See UNIV. CAL. BERKELEY, *Testing Scientific Ideas* (2012), http://undsci.berkeley.edu/article/0_0/howsciencewords_06 (last visited Apr. 20, 2015).

²³⁴ See Mancinelli, *supra* note 111.

²³⁵ See *id.*