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GUEST SPECIES: RETHINKING OUR APPROACH TO BIODIVERSITY IN THE ANTHROPOCENE

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Abstract

Western environmental law rests on an outdated philosophy that only fully "natural" places, species, and ecosystems should receive full protection, while human influenced places, species, and ecosystems are lesser habitats not worthy of full-throated protection. As we move into the Anthropocene—a dawning geologic age marked by the emergence of humanity as the dominant force shaping the natural world—this simplistic view loses its power to guide our decisionmaking. In a world where more than 75% of ice free land shows evidence of human alteration, if anthropogenic species, places, or ecosystems are not worth protecting, then there simply is not enough left to protect.

This Article examines management of nonnative species to illustrate the problems with using the false dichotomy between nature and humanity to determine what is environmentally good or environmentally bad. Nonnative species in North America cause more than $120 billion per year in damages. But the broad narrative of evil invasive species obfuscates something important—many nonnative species offer important cultural, economic, and environmental benefits that outweigh their negative impacts. The existing legal literature virtually ignores these species and the moral and legal questions they raise.

In light of the Anthropocene and the philosophical and regulatory readjustment it requires, we should not vilify all nonnative species, but rather evaluate them on their own merits. This Article provides case studies of several guest species, a neologism I use to describe the nonnative species that we welcome into our ecosystems. Guest species meet human needs and wants and offer environmental benefits, but our environmental laws and administrative decisions fail to honestly address the costs and benefits of welcoming these species. I conclude that we must, in limited cases, welcome guest as valuable ecosystem components worthy of protection. Guest species provide an example of the hard decisions and novel approaches involved in managing our new nature.

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I. INTRODUCTION

On August 29, 2016, an influential group of geologists, known as the Working Group on the "Anthropocene" ("AWG"),[1] recommended that the International Geological Congress formally adopt the Anthropocene as the newest geologic epoch.[2] The Anthropocene marks the beginning of a planetary scale of influence for human activities, and a brief review of select global anthropogenic impacts begins to give a sense of the scale of global changes reflected in the recommendation: widespread deposition of plastic, a humanmade substance that is now "virtually ubiquitous" across the globe;[3] increased carbon dioxide concentration and emission rates, resulting from increased fossil fuel burning;[4] increased global temperatures;[5] the radiocarbon bomb spike, a spike in the radioactive isotope Carbon-14 that resulted from the relatively widespread testing of nuclear weapons in the 1940s and 1950s;[6] increased nitrate pollution worldwide, due to the production of nitrogen fertilizer via the Haber-Bosch process beginning in 1913, which has increased the amount of bioavailable nitrogen on Earth's surface by 120%;[7] lead, deposited in ice and sediments in unprecedented amounts from leaded gasoline combustion;[8] the presence of anthropogenic persistent organic pollutants;[9] and widespread extinction and other changes in biodiversity.[10]

These global changes impact ecosystems at a local level. Climate change—resulting in extended drought, increased fire frequency, increased ocean acidification, and other broad impacts—produces significant changes in ecosystems

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[1] The AWG undertook its work at the request of the Sub-commission on Quaternary Stratigraphy, a part of the International Commission on Stratigraphy, which is itself a part of the International Union of Geological Sciences (IUGS**).** Letter from Jan Zalasiewicz & Mark Williams, Working Grp. on the Anthropocene, to Potential Members 1 (2009), https://quaternary.stratigraphy.org/workinggroups/anthropocene/ [https://perma.cc/P8WF-7PNN]. IUGS "is one of the World's largest scientific organizations. It encourages international co-operation and participation in the earth sciences in relation to human welfare . . . . IUGS has over 120 members representing over a million geoscientists." IUGS SECRETARIAT, IUGS, THE INTERNATIONAL UNION OF GEOLOGICAL SCIENCES 1 (2014), http://iugs.org/uploads/IUGS_Flyer-2014.pdf [https://perma.cc/PF44-XN4E].

[2] *Media Note: Anthropocene Working Group*, U. LEICESTER (Aug. 29, 2016), http://www2.le.ac.uk/offices/press/press-releases/2016/august/media-note-anthropocene-working-group-awg [https://perma.cc/FG99-8ZM5]. A subset of the working group spelled out the recommendation's scientific underpinning with a paper in the journal Science. Colin N. Waters et al., *The Anthropocene Is Functionally and Stratigraphically Distinct from the Holocene*, 351 SCI. 137, aad2622-1 (2016).

[3] Waters et al., *supra* note 2, at aad2622-3.

[4] *Id.* at aad2622-1.

[5] *Id.* at aad2622-2.

[6] *Id.* at aad2622-5.

[7] *Id.* at aad2622-4.

[8] *Id.*

[9] *Id.*

[10] *Id.* at aad2622-7 to 2-8.

everywhere.[11] "Ecological changes in the phenology and distribution of plants and animals are occurring in all well-studied marine, freshwater, and terrestrial groups. These observed changes are heavily biased in the directions predicted from global warming and have been linked to local or regional climate change . . . ."[12] These changes are long term and will lead to significant changes in ecosystem structure and function, changing both the species that can survive in a given location and the ecosystem benefits people will receive from their ecosystems.[13] And climate is just the most significant of the many anthropogenic changes affecting ecosystems.[14] Increases in global nitrogen supplies through industrial fixation of nitrogen accelerate biodiversity losses resulting from plant extinctions, degrade coastal ecosystems, acidify soils and freshwater ecosystems, and ultimately reduce soil fertility.[15] Many, perhaps most, ecosystems are changing, moving toward a future that has no analog in past or current natural systems.[16] Ecosystem stability in the Anthropocene is a pipe dream.

This is a serious problem for environmental law. In the late 1960s, amidst the birth of our system of modern environmental law,[17] policymakers turned to ecology for a scientific foundation for the new laws.[18] Most ecologists in the 1970s embraced a teleological view of ecosystems as entities moving through successive stages to a fixed endpoint, where the ecosystems would maintain themselves in equilibrium through some form of homeostasis: a balance of nature concept.[19] This concept is straightforward, intuitive, and wrong.[20]

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[11] Cynthia Rosenzweig et al., *Attributing Physical and Biological Impacts to Anthropogenic Climate Change*, 453 NATURE 353, 355 (2008).

[12] Camille Parmesan, *Ecological and Evolutionary Responses to Recent Climate Change*, 37 ANN. REV. ECOLOGY EVOLUTION & SYSTEMATICS 637, 637 (2006).

[13] Yann Hautier et al., *Anthropogenic Environmental Changes Affect Ecosystem Stability via Biodiversity*, 348 SCI. 336, 340 (2015).

[14] Gerald C. Nelson et al., *Anthropogenic Drivers of Ecosystem Change: An Overview*, 11 ECOLOGY & SOC'Y, no. 2, art. 29 (2006), https://www.ecologyandsociety.org/vol11/iss2/art29/ [https://perma.cc/2WTT-QE92].

[15] Peter M. Vitousek et al., *Human Alteration of the Global Nitrogen Cycle: Sources and Consequences*, 7 ECOLOGICAL APPLICATIONS 737, 737 (1997).

[16] John W. Williams & Stephen T. Jackson, *Novel Climates, No-Analog Communities, and Ecological Surprises*, 5 FRONTIERS ECOLOGY & ENV'T 475, 475–80 (2007).

[17] Gary Kroll, *The "Silent Springs" of Rachel Carson: Mass Media and the Origins of Modern Environmentalism*, 10 PUB. UNDERSTANDING SCI. 403, 403–04 (2001).

[18] From the National Environmental Policy Act's (NEPA) requirement that agencies undertake analysis of the ecosystem wide impacts of major federal government actions to the Endangered Species Act's focus on ecosystem level protection, albeit through a single species approach, many modern environment laws followed ecology's focus on ecosystems as a unit for protection.

[19] *See* Fred P. Bosselman & A. Dan Tarlock, *The Influence of Ecological Science on American Law: An Introduction*, 69 CHI.-KENT L. REV. 847, 847–73 (1994).

[20] As the field of ecology continued to develop, data from large scale field studies increasingly challenged the balance of nature idea; the data simply did not fit hypotheses spawned by this view. As the balance of nature view started to lose its dominance, a new view, predicated on ecosystems as systems constantly in flux, seemed to be a much better fit with field observations and thus emerged the mainstream scientific view. *Id.*

Nevertheless, the prevailing balance of nature view echoed and reinforced several touchstone beliefs of the broader environmental movement. As Dan Tarlock and Fred Bosselman note, "[t]he idea of . . . equilibrium fell on fertile ground. For centuries, many theologically inclined students of science had inferred a balance of nature, divinely provided until the disrupters of the Garden of Eden bungled things."[21] From this view, they note, conservationists concluded "humans should search to fit themselves into the framework of natural processes so that a condition of permanent stability could be re-established."[22] Aldo Leopold's influential land ethic encapsulates the view: "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise."[23] The balance of nature view is even enshrined in the Senate Report on the Endangered Species Act, which states that species "perform vital biological services to maintain 'a balance of nature' within their environments."[24]

This worldview—the balance of nature concept—invites a corollary view, one that paints human influences as foreign to ecosystems and humanity itself as something outside of nature. Taken together, these two views formed an ethical basis for much modern environmental work—nature had a natural balance that persisted as long as humanity stayed out of it.[25] This view, which places humanity outside of the natural system and assumes that humanity generally mucks things up when it intrudes, is termed the separatist view,[26] as opposed to the holist view, which places humanity squarely within nature, functioning like other organisms as a part of an ecosystem.[27] The separatist view creates an easy dichotomy, where natural systems are environmentally good and worth protecting, while anthropogenic systems are environmentally bad and an assault on the natural landscape.[28] Our modern environmental laws and our popular image of nature generally build on the balance of nature concept and a separatist view of humanity, but, particularly in light of the Anthropocene, these concepts no longer make sense.

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[21] *Id.* at 855.

[22] *Id.*

[23] ALDO LEOPOLD, A SAND COUNTY ALMANAC AND SKETCHES HERE AND THERE 224–25 (1949). Note, however, that some commentators believe Leopold's ethic did not stem from an equilibrium view. *See* Eric T. Freyfogle, *A Sand County Almanac at 50: Leopold in the New Century*, 30 ENVTL. L. REP. 10058, 10063–64 (2000) (suggesting that Leopold believed anthropogenic damage resulted not from disruption of a static balance of nature, but from altering environments too violently and rapidly).

[24] S. Rep. No. 93-307, at 2 (1973).

[25] Daniel B. Botkin, *Adjusting Law to Nature's Discordant Harmonies*, 7 DUKE ENVTL. L. & POL'Y F. 25, 26 (1996) ("[T]he Balance of Nature myth has three basic features: First, Nature, undisturbed by human influences, achieves a permanency of form and structure that persists indefinitely. Second, this permanent condition is the best condition for Nature: best for other creatures, best for the environment, and best for humans. Third, when disturbed from this perfect state, Nature is capable of returning to it.").

[26] Jonathan Baert Wiener, *Beyond the Balance of Nature*, 7 DUKE ENVTL. L. & POL'Y F. 1, 5 (1996).

[27] *Id.* at 4–5.

[28] *Id.*

The false dichotomy that paints humans and ecosystems as somehow separate leads to irrational policy decisions. Consider our management of nonnative species. Wild nonnative species, those species that humanity has moved away from the habitat where they evolved into a new habitat where they have naturalized, differ from native species only in that humanity precipitated their arrival in the new habitat. Species frequently move into new habitats on their own[29] without direct anthropogenic assistance, and we treat these species as natural parts of their new ecosystems.[30] In contrast, wild nonnative species are often treated with disdain even a hundred years after their human mediated migration to a new habitat.[31] Certainly, many human precipitated introductions prove disastrous, and society should not condone most new introductions, intentional or otherwise.[32] But some introduced species have integrated rather seamlessly into their new ecosystems and have evolved adaptions to their new environments. They provide valuable ecosystem services, hold important roles in the local ecosystems themselves, and often survive well in the disturbed habitats found in many human dominated ecosystems. They do not seem to be doing any more harm to native species than other native species occupying similar soles in the same ecosystem. Removal of these species is both nearly impossible and shortsighted.[33]

Nevertheless, conservationists often refer to these species with jingoistic language borrowed from nationalist movements, overlooking the beneficial roles some nonnative species play. The nonnative species, due to their anthropogenic origin, are treated with disdain and may be held up as "enemy species."[34] But treating these species differently due solely to their history discounts the integral human role in ecosystems. As we enter the Anthropocene and face the specter of climate change, we will have to take a more interventionist approach to managing ecosystems, not less.[35] This will include moving some species from their current habitats to locations where they can survive in future climate regimes, a practice called assisted migration. This process has already begun on an experimental basis. We cannot afford to treat these migrated species as lesser citizens in their new environments. More broadly, we should, be judging all nonnative species not on their method of migration, but instead on their own merits. Singling out a species that has survived and integrated well with an otherwise heavily impacted ecosystem solely because we brought it there devalues species that may play important roles in maintaining biodiversity in the Anthropocene.

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[29] Albeit at rates much lower than are seen in the world now.

[30] *See, e.g.*, Godfrey Hewitt, *The Genetic Legacy of the Quaternary Ice Ages*, 405 NATURE 907, 907–12 (2000) (discussing the extensive recolonization of the planet after the most recent ice ages. The recolonizing species are all recognized as native species in their current ranges, despite their relatively recent arrival in those areas).

[31] *See infra* text accompanying notes 62–90.

[32] *Id.*

[33] *Id.*

[34] *See infra* Part III.

[35] *See id.*

In some ways, we have already implicitly begun this process of changing attitudes; many state agencies actively manage some nonnative species as game species or otherwise conserve their populations.[36] But, in some cases, federal courts and federal agencies have stepped in to force states to shrink or eliminate these populations.[37] In other cases, federal law itself protects nonnative species, such as in the Wild Horses and Burro Act and the Migratory Bird Treaty Act.[38] These nonnative species also play important cultural roles, as with the ring-necked pheasant, a popular game bird venerated in hunting circles across the country.[39] In short, our thinking toward and policy concerning these species has been, at best, muddled, and we should address these species on a more consistent basis.

Toward this end, I propose the term guest species, a neologism to describe the nonnative species that we welcome into our ecosystems through active conservation. Technically, I define guest species as naturalized nonnative species which humans have introduced, intentionally or accidently,[40] and which we actively conserve because we benefit from having them in the wild. Viewed in the harsh light of the Anthropocene, guest species provide a good example of the hard decisions and novel approaches involved in managing our new nature.

Section II discusses the practical importance of our outdated view of the role of humanity within ecosystems. Section III undertakes a case study of several guest species to show how environmental laws generally fail to honestly address the costs and benefits of welcoming these species, based on the false dichotomy between human and natural. Section IV builds on these case studies, calls for a reassessment of normative environmental values in light of the Anthropocene, and proposes that guest species be evaluated not on their origins but on their own merit. Finally, Section V briefly concludes.

II. REJECTING THE FALSE DICHOTOMY—WHY THE SEPARATIST VIEW CANNOT SURVIVE IN THE ANTHROPOCENE

Climate change. Rampant over fertilization and eutrophication leading widespread algae blooms. Plastic pollution. Biodiversity loss. Ocean acidification. Widespread air and water pollution. The idea of the Anthropocene highlights all of these ongoing anthropogenic environmental impacts. But a recitation of the impacts, no matter how dire, does not get at the heart of the significance of declaring a beginning to the Anthropocene. These are not new facts—we know that we are

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[36] *See id.*

[37] *See id.*

[38] Gary W. Witmer et al., *Management of Invasive Vertebrates in the United States: An Overview*, 56 MANAGING VERTEBRATE INVASIVE SPECIES 127, 135 (2007).

[39] *See, e.g.*, U.S. FISH & WILDLIFE SERV., 2011 NATIONAL SURVEY OF FISHING, HUNTING, AND WILDLIFE-ASSOCIATED RECREATION 26 (2011).

[40] For accidentally introduced species, I use the term "by-product introductions," because they enter new systems as the byproduct of human activities. They are not accidents in the true sense, in that these introductions are entirely predictable. *See* Peter B. Moyle & Michael P. Marchetti, *Predicting Invasion Success: Freshwater Fishes in California as a Model*, 56 BIOSCIENCE 515, 516 (2006).

damaging our environment, and we have known that for decades. The significance of the Anthropocene is in the labeling: the realization and public recognition that we have the power to enact irreversible global change, and that we are in fact the primary force making those changes at a global level right now. Names matter. Labels matter. A medical diagnosis does not change the underlying biological facts, but, inarguably, such a diagnosis marks a turning point for the patient. In the same way, marking the start of the Anthropocene will not change the underlying environmental impacts, but it can, and indeed must, mark a turning point in our relationship with the environment. The age of the Anthropocene requires us to reassess our fundamental view of the relationship between humanity and our environment in order to better protect the nature we have left.

There are certainly risks to undertaking such a readjustment,[41] but our changing relationship with nature requires it. Many species listed under the Endangered Species Act ("ESA") illustrates that changing cannot recover without our help. Biologists call these species "conservation reliant," defined as species that are not biologically self sufficient, but instead require ongoing human intervention to maintain their populations.[42] According to the best estimates, 84% of species listed as threatened or endangered under the ESA qualify as conservation reliant: 84% of invertebrates, 85% of plants, and 81% of vertebrates.[43] Conservation reliance is likely to spread under any of the projected climate futures. "Twenty to thirty percent of species will face an 'increased' risk of extinction if average global temperature rises more than 1.5 to 2.5 degrees Celsius [and] . . . by 2050 up to two-thirds of species will need to migrate or be moved to new habitats to survive."[44]

For these species to survive, they will require continuous human intervention. Maintenance of the ecosystems they rely on now requires human management, and if, as the separatist view suggests, ecosystems impacted by humanity are compromised and somehow worth less than natural ecosystems, then we will be degrading ecosystems in an effort to save them. While examining the human role in protecting endangered species in her seminal work on *The Importance of Being Wild*, Holly Doremus, argued that:

> Protecting wild species and ecosystems means preserving them in a condition that permits them to function, to the greatest extent possible,

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[41] *See* Walter Kuhlmann, *Making the Law More Ecocentric: Responding to Leopold and Conservation Biology*, 7 DUKE ENVTL. L. & POL'Y F. 133, 165 (1996) (noting that "[u]nfortunately, while ecological theorists, historians and others often propose revisions to ecological thinking in a good faith attempt to craft responsible stewardship of resources already influenced heavily by human occupation, their concepts of managed nature are readily, and foreseeably, appropriated by managers and legislators eager to maintain business as usual for the dominance of resource extraction.").

[42] Daniel J. Rohlf et al., *Conservation-Reliant Species: Toward a Biology-Based Definition*, 64 BIOSCIENCE 601, 604 (2014).

[43] J. Michael Scott et al., *Conservation-Reliant Species and the Future of Conservation*, 3 CONSERVATION LETTERS 91, 93 (2010).

[44] Alejandro E. Camacho, *Assisted Migration: Redefining Nature and Natural Resource Law Under Climate Change*, 27 YALE J. ON REG. 171, 181 (2010).

> without human intervention. It also means leaving the future of those species or ecosystems to the ordinary processes of evolution, rather than steering them deliberately toward some human vision of usefulness or beauty.[45]

This guidance is true, as far as it goes, but it provides little guidance in most situations that conservation biologists face. What does it mean in ecosystems that are failing, where listed species need constant gardening in order to survive? In a future where, if we want functioning ecosystems with the species we try to protect, we will have to make and manage those ecosystems? In short, the false dichotomy between good, natural systems and bad, human impacted systems is no longer tenable.

The impact of the false dichotomy/separatist view on our system of environmental law has received little direct examination, although a few scholars have examined these issues. In at least one case, an exclusive focus on anthropogenic impacts led to environmental law that fails to address targeted contaminants: Weiner reports that "the Clean Water Act of 1972 defines 'pollution' as 'man-made or man-induced alteration of the chemical, physical, biological and radiological integrity of water,' such that non-human sources of contamination (e.g., microbes) are not subject to regulation."[46] Rachael Salcido and I also examined the role of separatist thinking in the EPA's recently promulgated[47] (and recently stayed)[48] rule defining the jurisdictional waters of the Clean Water Act ("CWA").[49] The rule largely excludes manmade features from protection under the CWA, including "[a]rtificially irrigated areas that would revert to dry land should application of irrigation water to that area cease";[50] "[a]rtificial, constructed lakes or ponds created by excavating and/or diking dry land such as farm and stock watering ponds, irrigation ponds, settling basins, log cleaning ponds, cooling ponds, or fields flooded for rice growing";[51] "[a]rtificial reflecting pools or swimming pools created by excavating and/or diking dry land";[52] "[w]ater-filled depressions created in dry land incidental to mining or construction activity, including pits excavated for obtaining fill, sand or gravel that fill with water";[53] "[s]tormwater control features constructed to convey, treat, or store stormwater that are created in dry land,"[54] and many ditches.[55]

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[45] Holly Doremus, *Restoring Endangered Species: The Importance of Being Wild*, 23 HARV. ENVTL. L. REV. 1, 16 (1999).

[46] Wiener, *supra* note 26, at 9.

[47] Clean Water Rule, 80 Fed. Reg. 37,054 (June 29, 2015) (codified in scattered parts of 40 C.F.R.).

[48] *In re* E.P.A., 803 F.3d 804, 808–09 (6th Cir. 2015).

[49] Rachael Salcido & Karrigan Börk, *Ditching Our Innocence: The Clean Water Act in the Age of the Anthropocene*, 46 ENVTL. L. 415, 423 (2016).

[50] Clean Water Rule, 80 Fed. Reg. at 37,107.

[51] *Id.*

[52] *Id.*

[53] *Id.*

[54] *Id.*

[55] Salcido & Börk, *supra* note 49, at 433–36.

These habitats often play significant roles in their local ecosystems,[56] regardless of whether they are manmade or natural. After reviewing a number of potential reasons for the exclusion of these habitats from the protection of the CWA, we ultimately concluded that this decision "appears to be a capitulation by the agencies to the easy argument that manmade places often are not worth protecting."[57] The problem with this argument, as discussed above, lies in the pervasiveness of humanmade places or places significantly influenced by anthropogenic changes. Faced with pending collapses in ecosystems worldwide,[58] humanity is increasingly taking on a formative role in ecosystems.[59] In a world where more than 75% of the ice free land shows evidence of human alteration,[60] if humanmade places or places that humanity must maintain are not worth protecting, then there simply is not enough left to protect.

The implicit view of the human role in ecosystems also plays a key role in the way law and science view nonnative species. Ecologists differentiate species that colonize new territory as nonnative or invasive when those species arrive through anthropogenic methods, whether through intentional or by-product introductions.[61] Species arriving of their own accord are deemed to have migrated or dispersed into new habitat, where they are considered native, or, if not native, at least on equal footing with the species that are native to that location. As discussed below, the anthropogenic introductions often, but not always, cause problems, and such species are treated as second class citizens of the ecosystems they inhabit. This dichotomous view of the world often leads to a reactionary approach, with managers harshly regulating or even seeking to eliminate introduced species. As demonstrated below, this approach does not always make sense.

III. GUEST SPECIES: RETHINKING THE ROLE OF NONNATIVE SPECIES

Conservation biologists relate a parade of evil invasive species: the zebra mussel, which is currently invading reservoirs and lakes across the United States and causing roughly $1 billion in annual damage;[62] the rats that plague cities, to the tune of $19 billion annually;[63] the brown tree snake, which has driven over 75% of native forest birds in Guam to extinction;[64] Asian carps, which may cost $18 billion to

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[56] *Id.* at 448–50.

[57] *Id.* at 452.

[58] *See* Hautier et al., *supra* note 13, at 336–39; Parmesan, *supra* note 12, at 646.

[59] Nelson et al., *supra* note 14, at 29.

[60] Richard J. Hobbs et al., *Novel Ecosystems: Implications for Conservation and Restoration*, 24 TRENDS ECOLOGY & EVOLUTION 599, 600 (2009).

[61] *See supra* text accompanying note 30.

[62] David Pimentel et al., *Update on the Environmental and Economic Costs Associated with Alien-Invasive Species in the United States*, 52 ECOLOGICAL ECON. 273, 279 (2005). Most of the costs are related to agriculture, not natural ecosystems. *Id.* at 274.

[63] *Id.*

[64] *Id.*

control;[65] or kudzu, the infamous foot per day vine that covered the South.[66] The environmental problems associated with invasive species are well documented,[67] with total economic cost estimates as high as $120 billion per year, excluding the difficult to calculate environmental costs.[68] An estimated 5,000 plants, twenty mammal species, 100 bird species, fifty reptile or amphibian species, 140 fish species, 4,500 arthropod species, and ninety mollusk species have become naturalized in ecosystems in North America.[69] These figures include only those species introduced from outside North America; adding intracontinental translocations would push the totals much higher.[70]

These naturalized species present the primary extinction risk for almost half of the listed species in the United States[71] and are the second most common threat to imperiled species worldwide.[72] At this point, it is difficult to overstate the impacts of introduced species. They are a key aspect of most ecosystems and they are not going away. But the broad narrative of evil invasive species obfuscates important aspects of the problem. Many nonnative species come from deliberate, human mediated introductions, and some of these introductions still provide us with significant benefits. For example, excluding pest species, most mammal introductions were deliberate efforts to increase available game species for hunting, food, and pelts.[73] Many nonnative naturalized plant species have also been spread due to deliberate introductions.[74] A detailed state by state analysis of introduced fishes found that introduced fish species made up anywhere from 10% of the total species in eastern areas up to 30–60% of fish species in the west, with most of these

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[65] Todd Spangler, *$18 billion would keep Asian carp out of Great Lakes*, USA TODAY (Jan. 6, 2014), http://www.usatoday.com/story/news/nation/2014/01/06/asian-carp-report-great-lakes/4348241/ [https://perma.cc/CCD2-VBB9].

[66] Bill Flinch, *The True Story of Kudzu, the Vine That Never Truly Ate the South*, SMITHSONIAN MAG. (Sept. 2015), http://www.smithsonianmag.com/science-nature/true-story-kudzu-vine-ate-south-180956325/ [https://perma.cc/6733-R8BB]; *see also* Irwin N. Forseth & Anne F. Innis, *Kudzu (*Pueraria montana*): History, Physiology, and Ecology Combine to Make a Major Ecosystem Threat*, 23 CRITICAL REV. PLANT SCI. 401, 401–14 (2004) (discussing the threatening nature of Kudzu).

[67] Pimentel et al., *supra* note 62, at 274.

[68] *Id.*

[69] *Id.* at 273. Scientists estimate that over 50,000 nonnative species have been introduced to the United States, including those that have not escaped to the wild. *Id.* That total depends on a very broad definition of alien invasive species, including ornamental plants, cattle, cats, dogs, and other organisms not traditionally included in the list of invasive species. *Id.*

[70] *Id.*

[71] *Id.* at 275–79.

[72] Céline Bellard et al., *Alien Species as a Driver of Recent Extinctions*, 12 BIOLOGY LETTERS 1, 1–4 (2016), http://rsbl.royalsocietypublishing.org/content/roybiolett/12/2/20150623.full.pdf [https://perma.cc/4R9E-4XBU].

[73] Witmer et al., *supra* note 38, at 128.

[74] Richard N. Mack & Marianne Erneberg, *The United States Naturalized Flora: Largely the Product of Deliberate Introductions*, 89 ANNALS MO. BOTANICAL GARDEN 176, 176 (2002).

transplanted species serving as additional game species or forage for game species.[75] Humanity exhibits a long history of translocating species,[76] heralded in the biblical flood story[77] and repeated throughout much of human history, with Romans translocating carp throughout Europe and other Europeans translocating salmonids into otherwise fishless alpine lakes.[78]

Many of these introductions have gone awry,[79] and given this poor track record and the nearly insurmountable challenges associated with properly managing introductions,[80] we should approach any new introductions with more than a little hesitation and a strong sense of the precautionary principle. Nevertheless, through careful matching of species with environments, sheer volume, or pure dumb luck, some of our past introductions have led to establishment of species in North America that we have come to rely on; that serve important cultural, environmental, or other purposes; or that we just like having around; and that bring with them ecosystem impacts that may be tolerable in light of the benefits the species offer.

A. Beneficial Nonnatives

This reconsideration of nonnative species provides another list, a list of nonnative species that we tend to value. Consider a few examples: honey bees, arriving in North America from Europe in the seventeenth century;[81] the earth worms colloquially known as night crawlers, which also came from Europe;[82] pheasants,

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[75] P.B. Moyle, *Fish Introductions into North America: Patterns and Ecological Impact*, *in* ECOLOGY OF BIOLOGICAL INVASIONS OF NORTH AMERICA AND HAWAII 27, 27–29 (Harold A. Mooney & James A. Drake eds., 1986); Witmer et al., *supra* note 38, at 132.

[76] Devin Kenney, *A Goat Too Far?: State Authority to Translocate Species On and Off (and Around) Federal Land*, 8 KY. J. EQUINE AGRIC. & NAT. RESOURCES L. 303, 317 (2015) ("[T]he translocation power is as fundamental and ancient a power as any, and is central to wildlife management authority.").

[77] *Genesis* 8:15–19 (New International Version) ("Then God said to Noah, 'Come out of the ark, you and your wife and your sons and their wives. Bring out every kind of living creature that is with you—the birds, the animals, and all the creatures that move along the ground—so they can multiply on the earth and be fruitful and increase in number on it.' So Noah came out, together with his sons and his wife and his sons' wives. All the animals and all the creatures that move along the ground and all the birds—everything that moves on land—came out of the ark, one kind after another.").

[78] Moyle, *supra* note 75, at 27.

[79] Daniel Simberloff et al., *Introduced Species Policy, Management, and Future Research Needs*, 3 FRONTIERS ECOLOGY & ENV'T 12, 13 (2005) ("Where data exist, however, deliberate introductions account for about half of all problem introductions.").

[80] *See, e.g.*, Peter B. Moyle et al., *The Frankenstein Effect: Impact of Introduced Fishes on Native Fishes in North America*, *in* FISH CULTURE IN FISHERIES MANAGEMENT 415, 415 (Richard H. Stroud ed., 1986) (observing that unintended and unanticipated negative consequences often follow from introductions initially seen as beneficial).

[81] Tammy Horn, *Honey Bees: A History*, N.Y. TIMES BLOG (Apr. 11, 2008, 1:05 PM), http://topics.blogs.nytimes.com/2008/04/11/honey-bees-a-history/?r=0 [https://perma.cc/8K9P-53XW].

[82] *The Trouble with Earthworms*, NPR (Mar. 23, 2007), http://www.npr.org/templates/story/story.php?storyId=9105956 [https://perma.cc/PA2Z-2WE4].

introduced in North America in the late 1800s from China;[83] or brown trout, introduced from Germany in 1883.[84] Including translocations within the United States gives a much longer list, focused on fish species like largemouth bass, rainbow trout, salmon, brook trout, catfish, striped bass, and northern pike.[85] Including anthropogenic range expansion via habitat modification adds a host of mammals like whitetail deer, fox, and coyotes.[86] Recent research has begun to unpack a number of benefits, both to humanity and to ecosystems, from some of these nonnative species.

Schlaepfer enumerated four ways nonnative species provide conservation benefits: (1) providing habitat, food, or trophic subsidies for native species (e.g. tamarisk providing nesting habitat for listed Southwestern willow flycatchers); (2) serving as catalysts for the restoration of native species (e.g. nonnative trees modify degraded land in Puerto Rico, allowing colonization by native trees); (3) serving as substitutes for extinct ecosystem engineers (e.g. nonnative birds in Hawaii serve seed dispersal roles once filled by now extinct native birds); and (4) providing ecosystem services (e.g. nonnative African honey bees filling a role left vacant by extinct pollinators in Brazil).[87] Even species like the eucalyptus tree, often denigrated as an invasive fire hazard, may create important habitat, as in the case of the eucalyptus used by overwintering monarch butterflies in California.[88] "[T]he introduction of non-native species has almost always increased the number of

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[83] MIDWEST PHEASANT STUDY GRP., NATIONAL WILD PHEASANT CONSERVATION PLAN 1 (2012).

[84] *Nonindigenous Aquatic Species*, U.S. GEOLOGICAL SURV., https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=931 [https://perma.cc/Z6VP-YQXN] (last visited Aug. 5, 2017).

[85] *See* Moyle et al., *supra* note 75, at 416.

[86] Frank Miniter, *Embracing 9 of the Non-Native And Invasive Species that We Love to Hunt and Fish*, OUTDOORLIFE (Feb. 22, 2016), http://www.outdoorlife.com/articles/hunting/2016/02/embracing-9-non-native-and-invasive-species-we-love-hunt-and-fish#page-5 [https://perma.cc/7RXR-J9KT]. Coyotes provide a particularly good example of this phenomena. Daniel H. Thornton & Dennis L. Murray, *Influence of Hybridization on Niche Shifts in Expanding Coyote Populations*, 20 DIVERSITY & DISTRIBUTIONS 1355, 1356 (2014) ("During the 19th and 20th centuries, coyotes expanded from their historic range in the western United States and Canada to occupy virtually all of North America. This rapid spread is largely believed to be the result of changing biotic interactions and mediated by anthropogenic habitat modifications: the elimination of a major competitor across much of North America (wolves) and the transformation of forest into agriculture and urbanized lands, which may have increased coyote foraging success or given them a competitive advantage over species less adept at exploiting agricultural or human dominated environments."). Even more broadly, 98% of North American agricultural production comes from nonnative species. Pimentel et al., *supra* note 62, at 273.

[87] Martin A. Schlaepfer et al., *The Potential Conservation Value of Non-Native Species*, 25 CONSERVATION BIOLOGY 428, 430–33 (2011).

[88] Erica Goode, *Invasive Species Aren't Always Unwanted*, N.Y. TIMES (Feb. 29, 2016), https://www.nytimes.com/2016/03/01/science/invasive-species.html [https://perma.cc/EHN5-4DYY].

species in a region,"[89] and nonnatives are likely to play increasing key roles in future ecosystems:

> [S]ome non-native species may be preadapted or adapt rapidly to . . . novel ecological conditions . . . . [T]he ability of non-native species to tolerate and adapt to a broad range of biotic and abiotic conditions, as well as to expand their ranges rapidly, suggests they may persist under a variety of future climate scenarios.[90]

In fact, "non-native species could become increasingly appreciated for their tolerance and adaptability to novel ecological conditions and their contributions to ecosystem resilience and to future speciation events."[91] Beyond ecosystem benefits, "non-native species are integral to the culture and economies of most countries."[92] In 2011, the introduced "pheasants attracted 1.5 million hunters for 10 million days" of hunting in the United States.[93] And although economic costs of nonnative species are well documented, "[b]y contrast, relatively few researchers have quantified the economic benefits (e.g., value of pollination by non-native bees, fees paid to hunt non-native game) derived from non-native species."[94] As a result, we lack "a comprehensive review of the economic benefits, provided by non-native species,"[95] but they are not insignificant.[96] Thus, although some introduced species certainly deserve a healthy dose of infamy, many others are probably good to have around.[97] Why has the mixed nature of introduced species been so obscured? This view of introduced species comes, in part, from the separatist worldview and its false human/natural dichotomy.

B. Why Do We Need the New Term "Guest Species?"

A recent *Nature* piece highlights "a pervasive bias against alien species that has been embraced by the public, conservationists, land managers and policy-makers, as well by as many scientists, throughout the world."[98] The historical idea of "nativeness" began with "the English botanist John Henslow in 1835. By the late

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[89] Mark A. Davis et al., *Don't Judge Species on Their Origins*, 474 NATURE 153, 153 (2011).

[90] Schlaepfer et al., *supra* note 87, at 433.

[91] *Id.*

[92] *Id.* at 429.

[93] U.S. FISH & WILDLIFE SERV., *supra* note 39, at 26.

[94] Schlaepfer et al., *supra* note 87, at 429.

[95] *Id.*

[96] *Id.*

[97] *See id.* ("Not all nonnative species cause biological or economic harm, and only a fraction become established and have an effect that is considered harmful.").

[98] Davis et al., *supra* note 89, at 153. *But see* Daniel Simberloff, *Non-Natives: 141 Scientists Object*, 475 NATURE 36, 36 (2011) ("First, most conservation biologists and ecologists do not oppose non-native species per se—only those targeted by the Convention on Biological Diversity as threatening 'ecosystems, habitats or species.'").

1840s, botanists had adapted the terms native and alien from common law to help them distinguish those plants that composed a 'true' British flora from artefacts [sic]."[99] Jared Goldstein unpacks this metaphor, noting "[t]he complex ecological phenomenon of introduced species is made comprehensible through the nationalist metaphor of foreign invasion."[100] "Once all species are understood in nationalist terms to be natives somewhere and aliens everywhere else, it is easy to conceive of the harmful influx of aliens as an invasion."[101] He notes that these same terms apply to a variety of scenarios: military invasion by a foreign army; disease; invasions of property and privacy rights; immigration; and generally of corruption of the familiar and safe by foreign entities and ideas.[102]

As Goldstein notes, "[t]he choice of metaphor used to describe a phenomenon plays a fundamental role in shaping understanding of the phenomenon."[103] By embracing loaded language to describe nonnative species, advocates for efforts to exclude nonnative species conveyed moral judgments on those species. "[P]roponents of biodiversity preservation and ecological restoration commonly used military metaphors and exaggerated claims of impending harm to help convey the message that introduced species are the enemies of man and nature."[104] And, as Goldstein tells it, this story directly implicates the false humanity/nature dichotomy:

> As depicted in invasive species literature, the narrative of invasive species tells a familiar story. Before the arrival of Columbus, American natives—that is, native plants and animals—lived in balance and harmony with surrounding species, as they had for millennia. Native species have ancient connections with American landscapes and are uniquely adapted to local conditions. Into this harmonious Eden, aliens arrived and upset the balance of nature . . . . [A] few of the newcomers preyed on the natives, took away their land, and displaced them from their long-established homes. These invaders killed and eliminated many natives. They also brought diseases for which the natives had no resistance.[105]

Had the species arrived naturally through storms, migration, range expansion or the like, they would be considered natural, maybe native, and would not be subject to such hostility. By relying on the easy shorthand that natural is good and anthropogenic is bad, conservationists have oversimplified a complex issue and continue to overlook the benefits offered by some nonnative species. Although some argue that scientists are already considering species on their merits alone,[106] Schlaepfer convincingly argues "[s]cientific and societal perceptions of non-native

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[99] Davis et al., *supra* note 89, at 153.
[100] Jared A. Goldstein, *Aliens in the Garden*, 80 U. COLO. L. REV. 685, 691 (2009).
[101] *Id.* at 692.
[102] *Id.*
[103] *Id.* at 691.
[104] Davis et al., *supra* note 89, at 153.
[105] Goldstein, *supra* note 100, at 722–23.
[106] Simberloff, *supra* note 98, at 36.

species have likely impeded consideration of the potential beneficial effects of non-native species."[107] They note "language used to describe non-native species in the scientific literature is frequently scattered with militarized and xenophobic expressions (e.g., 'war on aliens' and 'American ecosystems under siege by alien invaders'),"[108] hardly the dispassionate language one would expect from scientists.[109] These same studies tend to ignore the increased biodiversity and economic benefits offered by some (albeit not most)[110] nonnative species.[111] The *Nature* piece discussed above[112] argues that:

> [T]he practical value of the native-versus-alien species dichotomy in conservation is declining, and even becoming counterproductive . . . . It is time for scientists, land managers and policy-makers to ditch this preoccupation with the native–alien dichotomy and embrace more dynamic and pragmatic approaches to the conservation and management of species—approaches better suited to our fast-changing planet.[113]

Although scientists themselves may just use the militarized or xenophobic language as shorthand, this attitude goes well beyond science into the realm of law and policy. This same false dichotomy and lazy thinking defines the law's approach to established populations of nonnative species, leading to nonsensical outcomes or outcomes that fail to account for the positive and negative impacts of nonnative species.

In order to promote a less emotionally fraught consideration of established populations of nonnative species, I propose a new term that more accurately captures our relationship to the nonnative species we invite in and make comfortable: guest species.[114] More precisely, I define guest species as naturalized nonnative species

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[107] Schlaepfer et al., *supra* note 87, at 429.

[108] *Id*.

[109] David M. Richardson & Anthony Ricciardi, *Misleading Criticisms of Invasion Science: A Field Guide*, 19 DIVERSITY & DISTRIBUTIONS 1461, 1463 (2013) (noting the myth that "[i]nvasions science is biased and xenophobic," and arguing that "[x]enophobes obsessed with eradicating all nonnative organisms operate on the fringe of the conservation movement—as do those who link informed efforts to manage introduced species with xenophobia.").

[110] *Id.* (noting the argument that "[p]ositive (desirable) impacts of non-native species are understated and are at least as important as their negative (undesirable) impacts," and responding that "[n]on-native species are far more likely to cause substantial ecological and socio-economic damage, such as ecosystem-level regime shifts, than are native species. Furthermore, many of the 'positive' impacts attributed to non-natives are likely to be transient, whereas the 'negative' impacts are typically more permanent and often irreversible.").

[111] *Id.*

[112] *See supra* text accompanying note 89.

[113] Davis et al., *supra* note 89, at 153.

[114] Sophie Riley, *A Weed by Any Other Name: Would the Rose Smell as Sweet If It Were a Threat to Biodiversity?*, 22 GEO. INT'L ENVTL. L. REV. 157, 167–68 (2009) (This is already a crowded nomenclatural space. Many terms cover the variations on invasive species: "pest, weed, disease, and noxious . . . exotic, alien . . . nonindigenous, non-native . . . invasive

which humans have introduced, intentionally or accidently, and which we actively conserve because we benefit from having them in the wild. Guest species include only naturalized species, that is, those species already successfully reproducing in the wild. By definition, guest species must be nonnative (hence guests), and must be species that we actively conserve because we like having them around. Conservation in this sense can include both active conservation through habitat improvement or elimination of predators and competitors, or conservation through restrictions on removal of a species from the wild, as in catch or possession limits for fish species. In addition to the three examples I highlight below (goats, striped bass, and trout), other examples include pheasant in North America, largemouth or smallmouth bass in habitats where they are not native, wild horses and burros, eucalyptus trees across California, or the Aldabra giant tortoise on the Indian Ocean islands.[115] One might even argue that we ourselves fit the definition, although that moves the term beyond the realm of usefulness.

In some ways, the term guest species is itself a bit of a misnomer, in that guests tend to visit and then go away. These species are undeniably staying in our ecosystems. But the guest species term is most appropriate because, like guest workers, these species are here because we want them here. We have, to use an ecology term, a mutualistic relationship with our guest species,[116] just as we do with human guests in our homes. In ecology, two species have a mutualistic relationship when both species benefit from the relationship (as opposed to a commensal or parasitic relationship).[117] The guest species term recognizes this mutually beneficial arrangement and removes the stigma associated with the many more xenophobic terms attached to nonnative species.[118]

C. Federal and State Laws Addressing Nonnative Species

Federal and state invasive species laws present a mishmash of overlapping and inconsistent mandates which fail to address the full scope of the nonnative species problems, as has been well discussed in other venues.[119] In light of the many discussions of this topic, this section focuses on the way this framework of laws addresses guest species. This framework addresses guest species at best inadequately for two reasons. First, federal and state invasive species law focus largely on prevention of new invasions, not management of existing invasions; and

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alien . . . 'harmful aquatic organism' [and] . . . 'quarantine pest.'" None, however, speak to this category of species, and, as shown *infra*, this category merits special attention.).

[115] Clive Hambler, *Giant Tortoise* Geochelone gigantea *Translocation to Curieuse Island (Seychelles): Success or Failure?*, 69 BIOLOGICAL CONSERVATION 293, 293 (1994).

[116] Moyle & Marchetti, *supra* note 40, at 516.

[117] *Id.*

[118] This concern, though, about the duration of guests does suggest that perhaps some longer term guest species should ultimately be formally welcomed into the family via naturalization or an analogous act.

[119] *See* Jane Cynthia Graham, *Snakes on a Plain, or in a Wetland: Fighting Back Invasive Nonnative Animals—Proposing a Federal Comprehensive Invasive Nonnative Animal Species Statute*, 25 TUL. ENVTL. L.J. 19, 35 (2011).

guest species are, by definition, invariably existing invasions. Second, most definitions of invasive species focus on those species that inflict harm, or harm that outweighs their benefits; and guest species sometimes slip by under this exception.[120] But some state and federal laws still address guest species, and a discussion of guest species issues would be incomplete without addressing this framework.

The Lacey Act—the primary federal law directly addressing nonnative species—provides a good example of the first issue. The Act seeks "to prevent the 'unwise' introduction of foreign birds and animals."[121] It uses two mechanisms to achieve that goal: (1) criminalizing import, export, or transport of any fish, wildlife, or plant in violation of federal, state, tribal, or foreign law,[122] and (2) barring import into the United States of species on a (short) black list maintained by the U.S. Fish and Wildlife Service.[123] The Lacey Act's focus on preventing establishment of new populations on nonnative species leaves out guest species almost entirely.

The next major component of federal law comes from a 1999 executive order on nonnative species, ("E.O. 13112") which includes both new introductions and existing populations, but skirts guest species through a focus on the most harmful species. The order restricts agencies from introducing or *promoting* invasive species, which could include managing existing populations.[124] But the order limits "invasive species" to any "alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health."[125] The order then limits its restriction on introductions and the like to only invasive species.[126] Moreover, it

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[120] Olympia Bowker, *A Vague Invasion: The Inadequacy of Invasive Species Definitions in Reaching Federal and State Goals, Illustrated by Application of* Ammophilia arenaria *to Coastal Dune Preservation*, 29 J. ENVTL. L. & LITIG. 579, 605 (2014) (noting that "[a]nother caveat of the federal definition is that invasive heavily depends upon the negative effects those species have on the economy: [i]f a species from another continent is beneficial to the economy, it is not invasive despite where its origins may lie.").

[121] *Id*. Perhaps most notably, the Lacey Act also "authorize[d] the *introduction* and preservation of game, song, and insectivorous wild birds." Graham, *supra* note 119, at 35 (citations omitted).

[122] 16 U.S.C. § 3372 (2012).

[123] 18 U.S.C. § 42 (2012); *see also* 50 C.F.R. §§ 16.1 to 16.33 (2017).

[124] Exec. Order No. 13112, 64 Fed. Reg. 6183 (Feb. 3, 1999). This order follows the original executive order on nonnative species, Exec. Order No. 11987, 42 Fed. Reg. 26,949 (May 25, 1977). That order, from 1977, defined "Exotic species" as "all species of plants and animals not naturally occurring, either presently or historically, in any ecosystem of the United States." *Id.* The order then directed all executive agencies to restrict the introduction of exotic species into the natural ecosystems on public lands and to "encourage the States, local governments, and private citizens to prevent the introduction of exotic species into natural ecosystems of the United States." *Id.* But the order does not apply to the introduction of any species "if the Secretary of Agriculture or the Secretary of the Interior finds that such introduction or exportation will not have an adverse effect on natural ecosystems." *Id*. The second executive order is generally similar but provides a more explicit exemption for beneficial species. *Id.*

[125] Exec. Order No. 13112, 64 Fed. Reg. 6183 (Feb. 3, 1999). An "[a]lien species" is, "with respect to a particular ecosystem, any species . . . that is not native to that ecosystem." *Id.*

[126] *Id.* at 6185.

prohibits agencies from encouraging actions likely to promote invasive species, "unless . . . the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species."[127] Thus, the order focuses only on those species whose introduction does, or is likely to cause, economic or environmental harm or harm to human health, or those whose harm is outweighed by the benefits of actions incidentally promoting the species.

The executive order created the National Invasive Species Council ("NISC") "to coordinate and ensure complementary, cost-effective Federal activities regarding invasive species."[128] The NISC provided additional clarification on the definition of invasive species, requiring "[f]or a non-native organism to be considered an *invasive species* in the policy context, the negative effects that the organism causes or is likely to cause are deemed to outweigh any beneficial effects."[129] Thus, for the executive order as a whole, species that do not cause harm or offer benefits that outweigh their harms may be exempt.

The third prong of the federal approach to nonnative species, the National Invasive Species Act ("NISA"), applies only to aquatic nuisance species ("ANS"), defined by NISA as the "nonindigenous species that threaten[] the diversity or abundance of native species or the ecological stability of infested waters, or commercial, agricultural, aquacultural or recreational activities dependent on such waters."[130] NISA does not directly address established populations of species, but largely focuses on ballast water issues, and thus does not address the guest species issue. Other federal acts address individual invasive species or groups of species, but these are directed at species broadly considered harmful (e.g. brown tree snake), and so do not address guest species.[131]

States generally take the lead role in most wildlife management, and many state level laws reflect this same willingness to focus on the more harmful species. Although state level definitions may differ in subtle ways from the federal definition of invasive species,[132] some states directly draw on the definition from E.O. 13112.[133] Florida and Hawaii, the two states most plagued by nonnative species, both define their nonnative species of concern along the same lines as the order. The

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[127] *Id.*

[128] *Id.* at 6183; U.S. Dep't Agric., *About NISIC: Federal Government's Response*, http://www.invasivespeciesinfo.gov/response.shtml [https://perma.cc/557G-LVK7] (last modified July 31, 2017).

[129] INVASIVE SPECIES ADVISORY COMM., U.S. DEP'T INTERIOR, INVASIVE SPECIES DEFINITION CLARIFICATION AND GUIDANCE WHITE PAPER 3 (2006), https://www.invasivespeciesinfo.gov/docs/council/isacdef.pdf [https://perma.cc/QWT5-PRJY]. The council explicitly notes that at "[m]any non-native introductions provide benefits to society and even among species that technically meet the definition of invasive, societal benefits may greatly exceed any negative effects." *Id.*

[130] 16 U.S.C. § 4702(a) (2006).

[131] *See* Graham, *supra* note 119, at 48.

[132] Bowker, *supra* note 120, at 579.

[133] Exec. Order No. 13112, 64 Fed. Reg. 6183 (Feb. 3, 1999).

Florida Invasive Species Partnership defines "invasive species" as "[a]ny species . . . that is not native to an ecosystem; and whose introduction does or is likely to cause economic or environmental harm or harm to human health."[134] The Statewide Invasive Species Strategic Plan for Florida defines "invasive species" as "a nonindigenous species that has the ability to establish self-sustaining, expanding, free-living populations, and may cause economic and/or environmental harm."[135]

Hawaii lacks an official designation of invasive species, and the Hawaii Invasive Species Council ("HISC") is currently working on drafting and adopting administrative rules to formally define species that are invasive in Hawaii.[136] Nevertheless, the HISC suggests that the term typically includes only those species that are both "harmful to the environment, economy, and/or human health," and "not native to Hawaii (i.e., species that were introduced by human assistance rather than by their own means of introduction)."[137] In California, the Invasive Species Council defines invasive species as "non-native organisms which cause economic or environmental harm,"[138] directly and explicitly paralleling the federal executive order. California statutes similarly define invasive pests as organisms whose introduction into California "would or would likely cause economic or environmental harm."[139] California Fish and Game Code—which offers a black list of banned species—leaves out California's prominent guest species, including striped bass, largemouth and smallmouth bass, northern pike, and brown trout.[140] These examples seem to be the norm among states,[141] but more research is needed in this area.[142]

This tendency toward excluding more benign nonnative species from regulation may reflect the underlying scientific literature. Scientific sources are more divided,

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[134] U.S. Fish & Wildlife Serv., *Florida Invasive Species Partnership*, FLA. INVASIVES, https://www.fws.gov/refuge/Florida_Panther/what_we_do/FISP.html [https://perma.cc/VGT6-58RA] (last updated Nov. 26, 2013).

[135] INVASIVE SPECIES WORKING GRP., STATEWIDE INVASIVE SPECIES STRATEGIC PLAN FOR FLORIDA 8 (2002), http://evergladesrestoration.gov/content/ies/meetings/091713/Statewide_Invasive_Species_Strategic_Plan_for_Florida_2002.pdf [https://perma.cc/HAM3-6P9Z].

[136] Haw. Invasive Species Council, *Invasive Species*, HAWAII.GOV, http://dlnr.hawaii.gov/hisc/info/ [https://perma.cc/6CJ3-6PT9] (last visited Aug. 5, 2017).

[137] *Id.*

[138] Invasive Species Council of Cal., *What is an Invasive Species?*, (Aug. 5, 2017), http://www.iscc.ca.gov/is.html [https://perma.cc/HW4Q-E5RY].

[139] CAL. FOOD & AGRIC. CODE § 5260.5 (2016).

[140] CAL. FISH & GAME CODE §§ 2300–02 (2016).

[141] *See* ENVTL. LAW INSTITUTE, STATUS AND TRENDS IN STATE INVASIVE SPECIES POLICY: 2002–2009 22–47 (2010), http://100thmeridian.org/documents/ELI_Invasive_Species_State_Policy_Report_05_2010.pdf [https://perma.cc/7WAM-ESWD] (reviewing states—most states in the report distinguish between harmful and nonharmful species, and regulate only harmful species).

[142] UTAH DIV. OF WILDLIFE RESOURCES, UTAH'S AIS MANAGEMENT PLAN 1–16 (2010), https://wildlife.utah.gov/pdf/AIS_plans_2010/AIS_8Intro_Laws.pdf [https://perma.cc/2EAB-SVWX].

but they often reiterate the idea that a nonnative species should be treated as an invasive species only when the species is causing a negative impact. For example, The International Union for Conservation of Nature ("IUCN") defined *invasive species* as "animals, plants or other organisms introduced by man into places out of their natural range of distribution, where they become established and disperse, *generating a negative impact on the local ecosystem and species*."[143]

This tendency toward excluding more benign nonnative species from regulation could, perhaps, solve the guest species issue. Because guest species include only those species we actively conserve, guest species tend to be species we think of as beneficial or as having a minimal or acceptable impact on their new ecosystems. But this apparent exclusion of guest species from regulation falls apart under close scrutiny. Nearly any species added to an ecosystem has some impact on that ecosystem. I found no instance of a nonnative species that naturalized without impacting at least one other organism in a negative way.[144]

Species interact negatively in one of three broad ways: predation, parasitism, and competition.[145]As discussed below,[146] the degree of impact on other species varies tremendously, but even the relatively "good" guests, like striped bass or pheasant, have some impacts on the native ecosystem. The impacts may be no more significant than those from individual native species, or native species may rapidly adjust to the new species and thus avoid most impacts. But under the language of the invasive species definitions, these impacts would be enough to qualify the guests as invasive and thus make them qualify for regulation under these acts. And, perhaps more importantly, even these minimal impacts subject guest species to regulation under other federal laws, including both NEPA and the ESA.

NEPA requires analysis of environmental risks associated with major federal actions, including actions that may impact nonnative species, and thus gives agencies the authority to consider nonnative species in their decisionmaking.[147] NEPA analysis plays a significant role in the third case study, discussed below.[148]

The ESA protects both species listed as threatened or endangered and the ecosystems on which they depend.[149] The ESA's primary protections show up in Section 7, regulating federal actions, and Section 9, regulating actions by all entities. Section 7 of the ESA places requirements on federal agencies contemplating actions (either directly or via permitting decisions) that may impact listed species or their

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[143] Bowker, *supra* note 120, at 597–98 (citing Sarah Zielinski, *Are Humans an Invasive Species?*, SMITHSONIAN MAG. (Jan. 31, 2011), http://www.smithsonianmag.com/science-nature/are-humans-an-invasive-species-42999965/ [https://perma.cc/EB4A-4U9P]).

[144] This may stem from a lack of study on innocuous organisms or from the nature of organisms interacting in an ecosystem.

[145] DANIEL B. BOTKIN & EDWARD A. KELLER, ENVIRONMENTAL SCIENCE: EARTH AS A LIVING PLANET 197–201 (9th ed. 2014).

[146] *See infra* Part III.C.

[147] 42 U.S.C. § 4321 *et seq*.

[148] *See infra* Part III.C.

[149] 16 U.S.C. § 1531(b) (2013).

habitat.[150] The agency contemplating an action must work with the agency charged with protecting the listed species in order to ensure that the proposed action will not jeopardize the continued existence of any listed species and to get permission to incidentally impact listed species.[151] ESA Section 9 prohibits the "take" of any listed species by anyone absent a permit.[152] This take prohibition is broad and addresses both direct take and indirect take through habitat modification. Both sections implicate guest species and provide some authority for agency actions to address nonnatives generally. The Act does not offer de minimus exceptions, so any impact from a nonnative species, even a small impact, subjects the species to the Act.[153] The application of both the ESA and NEPA to guest species is addressed in more detail in the case studies presented below[154] and has resulted in significant litigation and policy disputes concerning guest species.[155]

Treatment of nonnative species also varies on different types of federal land, and some have argued that states continue to have the power to introduce or otherwise manage nonnative game species on federal lands, including the Bureau of Land Management ("BLM"), Forest Service, and wilderness lands,[156] although the BLM manual states that the "the BLM will remove, to the extent practicable and permitted by Federal law, any non-native fish or wildlife species from [Wilderness Study Areas]."[157] As other commentators note, use of the concept of native by federal land management agencies for management decisions is problematic: "[the] term 'native' is itself in question because . . . the federal land management agencies lack [explicit] statutory authorization to regulate on this basis. Not only do the organic and enabling acts of these agencies fail to define 'native,' these Acts neither reference the term nor any concept commonly associated therewith."[158] Treatment of nonnative species on federal lands merits additional study, as the limits of federal authority in this area remain unclear.[159]

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[150] *Id.* § 1536.

[151] *Id.*

[152] *Id.* § 1538.

[153] *Id.*

[154] *See infra* Part III.C.

[155] Other federal statutes, including the Clean Water Act and the Animal Health Protection Act ("AHPA"), could be used to address nonnative species, but have not been widely used in that way. *See* Graham, *supra* note 119, at 62.

[156] *See* Kenney, *supra* note 76, at 321 (noting, for example, that the Wilderness Act "specifically reserves to the States jurisdiction over management").

[157] *Id.* at 322 (citing BUREAU OF LAND MGMT., BLM MANUAL 6330—MANAGEMENT OF WILDERNESS STUDY AREAS (PUBLIC) 1–41 (2012), https://www.blm.gov/nlcs_web/sites/style/medialib/blm/wo/Information_Resources_Management/policy/blm_manual.Par.31915.File.dat/6330.pdf [https://perma.cc/XE5K-7QGW]).

[158] Aquatic Nuisance Prevention and Control Act, 16 U.S.C. §§ 4701–51 (2012). ANCPA defines "aquatic nuisance species" as any "nonindigenous species that threatens the diversity or abundance of native species or the ecological stability of infested waters, or commercial, agricultural, aquacultural or recreational activities dependent on such waters." *Id.* § 4702(1).

[159] *See* Kenney, *supra* note 76, at 303–48.

To summarize the legal landscape, most state and federal efforts to address nonnative species appear to give guest species a pass at first glance, either because the policies do not address established populations or because they attempt to focus on the most harmful species. But nearly all of these species do have some negative impacts, and these impacts subject guest species to regulation under these and other state and federal laws. This dissonant treatment of guest species leads to significant legal and policy conflicts.

Conflicts over guest species also seem to be particularly hard fought and long lasting conflicts. This results from several aspects unique to guest species. First, guest species raise federalism concerns based on the conflict between the states' traditional role as the lead entities for wildlife management and the federal environmental protection aimed at broader conservation goals. State decisions that are subject to federal oversight, either through NEPA processes, ESA take prohibitions, or other federal legislation, can become flash points for litigation or extrajudicial solutions via legislation. Second, at least some members of the public have an interest in maintaining wild populations of these species, and they tend to expend significant resources to protect their interests when traditional environmentalists would prefer to control or eliminate the guest species. These resource-backed conflicts may lead to lawsuits or drag out policy disputes. This contrasts with the typical invasive species situation, where the conflict is not over removal of the invasive species, but rather over the method or possibility of success. Third, guest species often play important roles in novel or heavily impacted ecosystems where native species may have trouble persisting. In heavily impacted or intentionally modified systems, we have often inherently made the choice not to value native species, and guest species often thrive in the modified ecosystem. This magnifies any inherent conflicts between guest species and negative species and may make the guest species targets of environmental groups. The three case studies presented below—goats and sheep in Hawaii, the striped bass in the California Delta, and the rainbow and brown trout below the Flaming Gorge Dam in Utah—illustrate these aspects of the guest species concept and the conflicts that guest species create.

D. Case Study One: The Palila and the Hungry Goats

The palila story dates to the late eighteenth century, when Captain Vancouver, an officer in the Royal Navy, introduced sheep and goats to the island of Hawaii.[160] The sheep and goats prospered on the island, eventually escaping captivity and making a naturalized home in the Hawaiian forests.[161] The wild sheep population grew as high as an estimated 40,000 sheep in 1936,[162] and the large sheep and goat populations overwhelmed the native forest. The sheep and goats thrived in the native

[160] Palila v. Haw. Dep't of Land & Nat. Res., 471 F. Supp. 985, 989 (D. Haw. 1979) [hereinafter *Palila I*].

[161] *Id.*

[162] *Id.*

māmane forest on the slopes of Mauna Kea, but the sheep and goats ate māmane seedlings, preventing regeneration of the māmane trees, and ate the leaves and stems of adult trees, weakening them.[163] The overpopulation destroyed the māmane forests, so the local government began population control measures for the sheep in 1921. Over 61,000 sheep were killed by 1946.[164] The goat population never grew quite as large, although they also had significant impacts on the forest.[165]

In 1950, the state (then territory) shifted from their unsuccessful program of eradication to managing the sheep and goats as game animals for hunting, aiming to maintain the sheep population between 1,000–3,000 and the goat population under 1,000.[166] The state managed the population by allowing limited public hunting of the sheep, with additional hunting allowed whenever population levels grew.[167] The sheep and goats supported a robust hunting trade, with many tourist hunters coming to Hawaii to hunt the goats and sheep.[168] The Hawaii State Division of Fish and Game added a closely related species, the European mouflon,[169] between 1962–1966 to improve the characteristics of the feral sheep herd, but the mouflon became a popular game animal in their own right and has naturalized as well.[170]

Although the introduced sheep and goats have prospered, they have caused significant impacts on native Hawaiian species. The sheep and goats live primarily in a State Game Management Area on Mauna Kea, which includes much of the remaining māmane forests on the island of Hawaii.[171] These forests comprise critical habitat for the palila, a beautiful small Hawaiian honeycreeper bird that feeds almost exclusively on the māmane trees.[172] Because of the destruction of the māmane by the large sheep and goat herds, the palila are restricted to about 10% of their historical range.[173] The palila were listed under the federal ESA in 1967 under a prior version of the act, and as of the late 1970s when this dispute began, fewer than 2,000 of the birds survived in the wild.[174]

In 1979, the Sierra Club and several other environmental groups filed suit against the Hawaii Department of Land and Natural Resources ("DLNR"), alleging that the DLNR's management of feral goat and sheep herds amounted to a taking of

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[163] *Id.* at 990.

[164] Paul C. Banko et al., *Evaluating the Long-Term Management of Introduced Ungulates to Protect the Palila, an Endangered Bird, and Its Critical Habitat in Subalpine Forest of Mauna Kea, Hawai'i*, 46 ARCTIC, ANTARCTIC, & ALPINE RES. 871, 878 (2014).

[165] *Id.*

[166] *Id.* at 874.

[167] *Id.*

[168] *Id.*

[169] The Mouflon are native to Corsica and Sardinia. Palila v. Haw. Dep't of Land & Nat. Res., 649 F. Supp. 1070, 1074 (D. Haw. 1986) [hereinafter *Palila III*].

[170] *Id.*

[171] Palila v. Haw. Dep't of Land & Nat. Res., 471 F. Supp. 985, 989 (D. Haw. 1979).

[172] *Id.*

[173] *Id.* at 988–89.

[174] *Id.* at 988.

the palila under the ESA.[175] As of the lawsuit's filing, the goat population in the palila's critical habitat ranged between 200–300, while the sheep population hovered around 600.[176] The "management" at issue in the suit consisted of limiting public hunting of the wild goats and sheep, but not active habitat improvement, breeding, or other positive management of the species.[177] The environmental groups sued on the theory that prohibiting hunting of the wild goats and sheep resulted in increased consumption of māmane trees, which in turn reduced the number of trees, and which resulted in less habitat available for the palila.[178] The ESA prohibits unpermitted taking of listed species.[179] The Act defines "take" as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or to attempt to engage in any such conduct."[180] By regulation, the relevant agencies defined harm to mean "an act which actually kills or injures wildlife. Such [an] act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering."[181] Based on this broad definition, the trial court (rather summarily) concluded that the state's actions violated the Act's take prohibition and ordered the state to kill or otherwise remove the sheep and goats,[182] kicking off a long series of appeals and subsequent litigation.

The DLNR appealed the 1979 decision to the Ninth Circuit, substantively arguing that their actions did not amount to a taking under the Act.[183] The Ninth Circuit affirmed in *Palila II*, concluding "[t]he state violated the Endangered Species Act by maintaining feral sheep and goats in the Palila's habitat."[184] In 1984, the Sierra Club amended its original complaint to allege the DLNR's maintenance of mouflon sheep in the palila habitat also amounted to a taking under the Act, and two years later the same district court applied the reasoning from *Palila I* and issued a decision (*Palila III*) extending the removal order beyond the original feral goats and sheep to include the mouflon.[185]

In the interim, the Sportsmen of Hawaii and several other hunting groups intervened to argue for the preservation of the goat and sheep herds.[186] The DLNR

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[175] *Id.* at 987.

[176] Palila v. Haw. Dep't of Land & Nat. Res., 639 F.2d 495, 496 (9th Cir. 1981) [hereinafter *Palila II*].

[177] *Id.*

[178] *Id.*

[179] 16 U.S.C. § 1538 (2012).

[180] 16 U.S.C. § 1532 (2012).

[181] 50 C.F.R. § 17.3 (1985). Note that the definition differed slightly in 1979, when the *Palila I* court first addressed the issue, but the differences are immaterial here. Palila v. Haw. Dep't of Land & Nat. Res., 649 F. Supp. 1070, 1075–77 (D. Haw. 1986).

[182] Palila v. Haw. Dep't of Land & Nat. Res., 471 F. Supp. 985, 999 (D. Haw. 1979).

[183] *Palila II*, 639 F.2d at 496.

[184] *Id.* at 498.

[185] *Palila III*, 649 F. Supp. at 1082–83.

[186] *Id.*

and the intervenors appealed, and the Ninth Circuit again affirmed,[187] holding that the district court's interpretation of taking and harm under the Act, coupled with its findings concerning mouflon and habitat destruction, were "enough to sustain an order for the removal of the mouflon sheep."[188] The district court reaffirmed its order in 1999, over the objection of the intervening hunting groups and the DLNR, which argued the order should be changed because total sheep removal was proving too difficult.[189] By that point, many of the animals had already been removed through a combination of DLNR "staff hunting, unrestricted public hunting, and fencing. The staff hunting included contracted hunting by helicopter."[190] As of September 22, 1998, at least 180 sheep, sheep hybrids, or mouflon remained within the critical habitat, although the goats were apparently eliminated.[191] The court noted considerable regrowth of the māmane and other native plants, with commensurate improvement in the palila's critical habitat.[192] Finally, in 2013, the district court again reaffirmed its decision,[193] this last time in response to DLNR's motion seeking reassurance that it could not be prosecuted under a provision of Hawaiian law barring "any person [from engaging] in the eradication of any animal for any reason while being transported by helicopter, airplane, or any other similar means,"[194] passed in response to the lawsuit.[195]

By the end of 2011, approximately 18,130 sheep and 310 goats had been killed since 1979, which, combined with the 61,000 sheep killed prior to 1960, gives a total of over 79,000 sheep removed for habitat improvement.[196] Nevertheless, the sheep population appears to be increasing and has been doing so since at least 1999,[197] indicating that reproduction and immigration to the critical habitat area has outstripped control efforts.[198] Current estimates put the sheep population in the critical habitat at 10,000–14,000 sheep,[199] and they continue to significantly damage the palila habitat.[200] Fencing the critical habitat to prevent additional immigration of sheep and goats is continuing due to significant federal funding awards around

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[187] Palila v. Haw. Dep't of Land & Nat. Res., 852 F.2d 1106, 1110 (9th Cir. 1988) [hereinafter *Palila IV*].

[188] *Id.* at 1110.

[189] Palila v. Haw. Dep't of Land & Nat. Res., 73 F. Supp. 2d 1181, 1187 (D. Haw. 1999) [hereinafter *Palila V*]. The Intervenors also appealed this decision to the Ninth Circuit, which dismissed the appeal for lack of standing. Palila v. Haw. Dep't of Land & Nat. Resources, 246 F.3d 675 (9th Cir. 2000) (unpublished decision).

[190] *Palila V*, 73 F. Supp. 2d. at 1183.

[191] *Id.*

[192] *Id.* at 1183–84.

[193] Palila v. Haw. Dep't of Land & Nat. Res., No. 78–00030 JMS, 2013 WL 1442485, at *4 (D. Haw. Apr. 8, 2013) [hereinafter *Palila VI*].

[194] HAW. CNTY. CODE § 14–112 (2016).

[195] *Palila VI*, 2013 WL 1442485 at *4.

[196] Banko, *supra* note 164, at 876–78.

[197] *Id.* at 877.

[198] *Id.* at 882.

[199] *Id.* at 878.

[200] *Id.* at 882.

2014.[201] The exclosures, plus increased efforts to exterminate the goats, may reverse the decline of the māmane forests, although palila numbers have fallen drastically over the last five years due to ongoing drought in Hawaii.[202] Other threats to the palila include introduced predators, particularly feral cats, "which depredate approximately 11% of palila nests annually."[203] Ongoing control efforts removed 168 feral cats between 2009–2012.[204] New herbivores have also been introduced, in particular the axis deer "recently smuggled onto Hawai'i Island from Maui in exchange for mouflon sheep,"[205] which has the potential to be as much of a threat as the goats and sheep have been.[206]

This series of cases raises myriad issues, from baseline questions—Is the baseline unregulated hunting of sheep and goats by the public? Or is the normal state of affairs no hunting, with explicit permission required for a public hunt—to causation issues—Is this causal chain just too long for a true ESA take, as suggested by Justice O'Connor?[207]—and many commentators ably address these issues.[208] From the guest species perspective, the two most interesting aspects of the case are the federalism challenges in the federal oversight of a traditional state role and the district court's unusual removal remedy, neither of which have received much scholarly interest.

1. Lesson: Federal Oversight of State Wildlife Management Breeds Conflict

The *Palila* cases highlight conflict between state wildlife management and federal oversight. As the Supreme Court has noted, "[u]nquestionably the States have broad trustee and police powers over wild animals within their jurisdictions."[209] Congress also recognizes this traditional authority.[210] At its core, the states' responsibility for game management is a part of its public trust responsibilities, and thus the states cannot abdicate this responsibility nor surrender it to the federal government.[211] This aspect of American wildlife management—dispersed authority among the several states—is "[o]ne of the greatest contrasts between the English

[201] *Id.* at 884.
[202] *Id.* at 885.
[203] *Id.* at 884.
[204] *Id.*
[205] *Id.*
[206] *Id.*
[207] Babbitt v. Sweet Home Chapter of Cmtys. for a Great Or., 515 U.S. 687, 713–14 (1995) (O'Connor, J., concurring).
[208] *See* James R. Rasband, *Priority, Probability, and Proximate Cause: Lessons from Tort Law about Imposing ESA Responsibility for Wildlife Harm on Water Users and Other Joint Habitat Modifiers*, 33 ENVTL. L. 595, 605–18, 653–55 (2003); Andrew J. Doyle, Note, *Sharing Home Sweet Home with Federally Protected Wildlife*, 25 STETSON L. REV. 889, 900–01, 920–24 (1996).
[209] Kleppe v. New Mexico, 426 U.S. 529, 545 (1976).
[210] MICHAEL J. BEAN & MELANIE J. ROWLAND, THE EVOLUTION OF NATIONAL WILDLIFE LAW 392 n.156 (3d ed., 1997) ("Traditionally, the States have regulated fishing and hunting of resident species of wildlife.").
[211] *See Kleppe*, 426 U.S. at 545.

and American systems of wildlife management [and] . . . led to the explosion of both opportunity and exploitation in America, thus causing an overharvesting of species—many to scarcity, and some even to extinction."[212] This overharvesting and decline in game species led, in large part, to the birth of the early conservation movement and inspired many of the movements early leaders.[213] These early efforts birthed modern wildlife management in the United States, known as the North American Model of Wildlife Conservation (the "Model").[214]

The Model relies on seven "pillars," which focus on management of wildlife as a public trust resource, treating wildlife as an international resource, embracing science based wildlife policy, and maintaining the democracy of hunting through broad access and participation.[215] This model led hunters and hunting organizations to become a strong early voice for conservation. Indeed, many of the earliest National Parks were created to preserve game animals,[216] and lobbying by hunting organizations led to federal legislation like the Lacey Act, the Duck Stamp Act of 1934, the Federal Aid in Wildlife Restoration Act of 1937,[217] and even international treaties like the Migratory Bird Treaty.[218] Hunters contribute over $1.6 billion annually to conservation at the state, local, and federal level,[219] and remain a strong lobby both for wildlife protection and for hunting opportunities.

Based on this history, most game management occurs at the state level, based initially on the longstanding tradition of state ownership of wildlife[220] and then on the state police powers and the public trust doctrine.[221] This tradition of state level management of wildlife was in place by the late 1800s, when states had begun to "regulate the use of fishing grounds, restrict hunting by seasons or outright prohibitions, and terminate certain commerce in wildlife altogether."[222] Federal law

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[212] Kenney, *supra* note 76, at 311–12.

[213] *Id.* at 312 ("Public recognition of this dramatic decline in wildlife populations sparked the conservation movement. Figures like President Theodore Roosevelt and conservationist Aldo Leopold 'envisioned a nation where all citizens had an opportunity to engage in conservation and hunting.'").

[214] John F. Organ et al., *Born in the Hands of Hunters: The North American Model of Wildlife Conservation*, 4 WILDLIFE PROF. 22, 25–27 (2010).

[215] Kenney, *supra* note 76, at 313.

[216] Organ et. al, *supra* note 214, at 22–23.

[217] *Id.* at 24–25.

[218] *Id.* at 24.

[219] SOUTHWICK ASSOCS., HUNTING IN AMERICA: AN ECONOMIC FORCE FOR CONSERVATION 6 (2013).

[220] Kalyani Robbins, *Cooperating with Wildlife: The Past, Present, and Future of Wildlife Federalism*, 43 ENVTL. L. REP. 10501, 10501–02 (2013) ("State ownership of wildlife formally expired in 1979 when the Supreme Court overruled *Geer* in *Hughes v. Oklahoma*, holding that states do not have an ownership interest in wildlife that would trump Commerce Clause authority, but rather the same regulatory interest in wildlife as they do in other natural resources.").

[221] Michael C. Blumm & Lucus Ritchie, *The Pioneer Spirit and the Public Trust: The American Rule of Capture and State Ownership of Wildlife*, 35 ENVTL. L. 673, 693 (2005); *see also* Kleppe v. New Mexico, 426 U.S. 529, 545 (1976) ("Unquestionably the States have broad trustee and police powers over wild animals within their jurisdictions.").

[222] Blumm & Ritchie, *supra* note 221, at 693.

generally respects this separation. For example, "the BLM and Forest Service are statutorily limited from 'diminishing the responsibility and authority of the States for management of fish and resident wildlife' as that authority existed in 1976."[223] State interest, however, tends to focus on species of economic importance, leaving out most nongame and plant species.[224] This tendency likely stems, at least in part, from the funding sources for state agencies that regulate such things, which traditionally drew their funding almost entirely from "taxes and fees on hunters and fishers, who consequently had great influence"[225] under the model. As a result,

> States have traditionally played a significant role in managing wildlife, but play a very small role in implementing the Endangered Species Act, and an even smaller role with other federal wildlife statutes . . . . While states and local governments are best positioned to manage local habitat, federal oversight is needed to ensure that our widely shared benefits (biodiversity) are not lost to a tragedy of the commons problem.[226]

As a result, "[c]ontrol over wildlife has evolved separately at the state and national levels, nearly to the point of each operating in a vacuum. It is no surprise, then, that we see substantial regulatory overlap and little cooperation."[227] As the Supreme Court has noted, state authority to regulate wildlife "exist[s] only 'in so far as (their) exercise may be not incompatible with, or restrained by, the rights conveyed to the Federal government by the Constitution,'"[228] which includes the protection of public lands and the exercise of federal authority though legislation like the ESA.

With this background, the conflict between state interests in wildlife management and the federal efforts to remove some guest species appears inevitable. At a foundational level, state efforts seek to maximize hunting availability (democratizing hunting), and much of the state and federal conservation and management apparatus is designed around this endpoint. When federal efforts to protect nongame species become incompatible with management of a game species, conflict cannot be avoided. This is a recognized phenomenon, even at the international level. "At present, numerous national and international regimes have developed a variety of terms and descriptions to identify and define an assortment of unwanted species. Yet . . . even when regimes provide broad definitions of [invasive species], states are reluctant to adopt these definitions if the species is considered a useful resource."[229]

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[223] Kenney, *supra* note 76, at 329 (citing 43 U.S.C. § 1732(b) (2015)).

[224] Goble et al., *Conservation-Reliant Species*, 62 BIOSCIENCE 869, 870 (Oct. 2012 ("Most states lack regulatory systems that address nongame and plant species; funding is often tied to hunting and fishing license fees and remains insufficient.").

[225] Robbins, *supra* note 220, at 10503.

[226] *Id.* at 10501–02.

[227] *Id.*

[228] Kleppe v. New Mexico, 426 U.S. 529, 545 (1976).

[229] Riley, *supra* note 114, at 158.

This dynamic is apparent in the *Palila* fight. In spite of Hawaii's long term effort to comply with the court's removal order, it nevertheless placed some limits on public hunting in order to accommodate hunting interests. "To accommodate devotees of archery, handguns, and muzzleloaders, a large area of palila core habitat . . . continued to be reserved for their exclusive use during most—but not all—of the eradication program . . . ."[230] These forms of hunting—particularly archery and handguns—are hunting methods with very low harvest rates, compared to high powered rifles or helicopter hunting.[231] This difficulty has been apparent as far back as 1976: "The only solution for preventing further injury to the vegetation is to substantially reduce or totally remove all feral sheep from Mauna Kea. The primary difficulty with this plan of action is hunter opposition."[232] The opposition appears both in direct action (twenty three instances of vandalism to goat and sheep exclosure fences over a sixteen month period),[233] local legislation banning aerial shooting,[234] and in legal actions (for example, the continued intervention in the lawsuit against Hawaii by hunting groups).[235] Federal intrusion into this traditional state domain, particularly when the state and the federal government are operating under conflicting mandates, results in serious conflicts over guest species.

Sheep removal efforts have succeeded in other island contexts, on smaller islands where reinvasion can be controlled,[236] but settings like this, where dedicated local groups seek to preserve guest species and the state appears to be complicit in their efforts, are much more difficult. Even in this case, where the sheep and goats are undeniably pushing a listed species to extinction, such conflict has made removal controversial and logistically challenging when state and federal governments work at cross purposes in controlling guest species, eradication is difficult or impossible.

2. Lesson: Current Remedies are Inadequate to Address Guest Species

The district court's remedy in this case directly implicates the way we think about guest species. The court ordered the state to remedy its take violation not by ceasing to manage the goat and sheep populations, which would be the natural remedy for a violation based on this management, but rather that the state go out and actively kill the nonnative species at issue.

The court ordered removal of the guest species first by July 31, 1981,[237] then again by January 27, 1988,[238] and then the parties finally agreed on a stipulated order requiring removal efforts on an ongoing basis "for so long as the court's judgment

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[230] Banko et al., *supra* note 164, at 874.

[231] *Id.* at 876.

[232] J.G. GIFFIN, ECOLOGY OF THE FERAL SHEEP ON MAUNA KEA 82 (1975) (unpublished report).

[233] Banko et al., *supra* note 164, at 884.

[234] *Id.*

[235] *See* discussion *supra* Part III.D.

[236] Of note, the Nature Conservancy removed over 45,000 feral sheep over 20 years from Santa Cruz Island. Banko et al., *supra* note 164, at 884–85.

[237] *Id.*

[238] *Id.* at 876.

and orders . . . are still in full force and effect."[239] This is remarkable. It would be one thing if the court had ordered the state to stop actively protecting the sheep and goats—to remove any season restrictions, to stop any stocking of the animals, or even to facilitate hunting by the public. But this remedy goes much further.

As both the trial court and the Ninth Circuit determined, managing the goat population for hunting purposes amounted to a taking under the ESA.[240] When the court required the state to actively hunt and kill the populations, the court moved far beyond the mandates of the ESA, and its remedy raises concerns about future cases targeting native species management.

ESA itself draws no distinction between native and nonnative species,[241] and the court, both for the finding of a taking and for the remedy itself, would apply equally strongly in cases concerning a native species that either directly killed any listed species or indirectly harmed it through habitat modification. Consider the federally endangered California least tern, a bird species nesting in coastal areas in California.[242] Many native species prey on these terns, including crows, coyotes, kestrels, loggerhead shrikes, ravens, ground squirrels, harrier hawks, burrowing owl, raccoons, and striped skunk.[243] Many of these species are protected, in part, by federal or state laws, including general bans on hunting by the public (for harrier hawks and burrowing owls, for example) or by restrictive state laws limiting the method and timing of hunting (e.g. crows, doves).[244] Do these laws amount to a taking under the ESA? And if they do, would the likely remedy involve requiring states to reduce or eliminate populations of these native species?

Indeed, for some colonies of nesting terns, the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, and Animal Damage Control has undertaken reductions in the populations of these potential predators.[245] But there is a world of difference between an agency selectively removing some predators and a court ordered removal of a species. In at least one case, "peregrine falcons (falco peregrines), an endangered species themselves, were observed frequenting the area of several tern colonies and are suspected of preying on adult California least tern."[246] And the removals themselves have spurred lawsuits by local animal rights groups to protect the nonnative red fox.[247] Even limited to guest species, this reasoning would allow a court to require every state in the nation to remove all

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[239] Palila v. Haw. Dep't of Land & Nat. Res., No. 78–00030 JMS, 2013 WL 1442485, at *1 (D. Haw. Apr. 8, 2013).

[240] Palila v. Haw. Dep't of Land & Nat. Res., 852 F.2d 1106, 1110 (9th Cir. 1988).

[241] A word search on the full text of the Act reveals no hits for the terms native (as used with respect to species, not people), invasive, or nonnative.

[242] Peter H. Butchko, *Predator Control for the Protection of Endangered Species in California*, VERTEBRAE PEST CONF. PROC. COLLECTION 237, 238 (1990).

[243] *Id.*

[244] CAL. FISH & GAME COMM'N, AMERICAN CROW REGULATIONS: A SYNOPSIS 1–2 (2003), http://www.fgc.ca.gov/regulations/2003/crow_regs.pdf [https://perma.cc/G69B-7SGS].

[245] Butchko, *supra* note 242, at 238.

[246] *Id.* at 239.

[247] *Id.*

nonnative largemouth bass, or pheasant, or grasses, or earthworms. This would be both impossible[248] and shortsighted.

The court erred by ordering removal. Removal as a remedy presumes a degree of control over ecosystems that we simply cannot exercise, and the decision to require removal harkens back to the false dichotomy between human and natural. Courts have not targeted native species for removal in lawsuits like these, despite the lack of a legal basis to distinguish the guest species from native species.

Although removal of the sheep and goats would be an ideal solution to this controversy, the courts are not the ideal venue for resolving these difficult resource management issues. The palila lawsuit, particularly its remedy, creates a potential firestorm of litigation that could involve species management decisions in states across the nation. And even if the *Palila* court had not ordered removal but only a cessation of any limitations on hunting, the core problem of goats in the palila habitat would not be resolved. Adequately addressing this problem requires a broader effort, and any effort would have to consider the social aspects of the problem created by the hunters.

The primary option allowed by the ESA to avoid illegal take is a Section 10(a)(1)(B) permit, which can permit "any taking otherwise prohibited by [the Act] if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity."[249] The permit requires submission of an extensive habitat conservation plan, including public comment and National Environmental Policy Act compliance.[250] This might offer a path to address ESA concerns around guest species were it not for the ubiquity of these species. Completing the permitting requirements for all guest species that a state or local government manages in any way, even through actions as innocuous as prohibiting public harvest of the species, would impose huge costs on state and local governments and tie up the overburdened agencies responsible for administering the ESA for decades to come.[251]

In short, neither the courts nor current federal law adequately addresses our complex relationship with guest species.

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[248] Arian D. Wallach et al., *Novel Trophic Cascades: Apex Predators Enable Coexistence*, 30 TRENDS ECOLOGY & EVOLUTION 146, 146 (2015) ("[M]ost introduced species cannot realistically be eradicated.").

[249] 16 U.S.C. § 1539(a)(1)(B) (2012).

[250] Anne B. Hulick, *Habitat Conservation Plans: Protecting Species, Enhancing Democratic Legitimacy and Promoting Stewardship Are Not Mutually Exclusive Goals*, 25 UCLA J. ENVTL. L. & POL'Y 441, 448 (2006).

[251] ALICIA OLLER ET AL., TETRA TECH, LESSONS LEARNED FROM HABITAT CONSERVATION PLANS: APPLICATIONS FOR WIND AND ENDANGERED SPECIES 1, https://www.nationalwind.org/wp-content/uploads/assets/research_meetings/Research_Meeting_VIII_Oller.pdf [https://perma.cc/3UE6-XBM4] (reporting completion times of 1–14 years and costs of $10,000 to $9,000,000 for habitat conservation plans to permit take from wind energy projects).

E. Case Study Two: The Salmon and the Striped Bass

Striped bass are an anadromous (spawn in fresh water but mature in estuaries or the ocean) species native to the U.S. East Coast.[252] They are renowned both as a sports fish and as table fare, and so were introduced in California in 1870 by Livingston Stone at the suggestion of the California State Board of Fish Commissioners.[253] Less than thirty years later, in 1899, the U.S. Bureau of Fisheries reported a commercial catch in California of 1.234 million pounds.[254] The striped bass population reached roughly 3 million adult fish by the early 1960s.[255] As of 2008, estimates placed the population at roughly one million adult fish.[256] These fish are the primary target of California anglers, with more than 81% of anglers in the northern thirty one counties in California reporting that they had fished for striped bass over a two-year period,[257] spending on average $146.91 per day.[258] "In 2009 Bay Delta Complex anglers created more than 6,600 jobs, almost $270 million labor income, and almost $.5 billion output in the 31 counties in the Bay Delta Complex";[259] these numbers are not broken out by species, but given that more than 81% of these anglers fish for striped bass, striped bass have a significant economic impact in California. Estimates specific to striped bass value the fishery at $28.7 million per year in the regional economy, with an economic impact per fish caught of roughly $500.[260] "In 2000, CDFG obtained from the U.S. Fish and Wildlife Service ("FWS") and the National Marine Fisheries Service ("NMFS") separate incidental take permits under the ESA for the Striped Bass Management Program . . . . CDFG halted its striped bass stocking program in 2002 and the program has not been reinitiated."[261] Absent stocking, the population is expected to decline to roughly 515,000 adults in the long term.[262]

The U.S. Congress recognized the significance of the striped bass fishery in California in the Central Valley Project Improvement Act ("CVPIA"),[263] which

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[252] JOHN E. SKINNER, AN HISTORICAL REVIEW OF THE FISH AND WILDLIFE RESOURCES OF THE SAN FRANCISCO BAY AREA 71 (1962).

[253] *Id.*

[254] *Id.*

[255] CAL. DEP'T OF FISH & GAME, CONSERVATION PLAN FOR THE CALIFORNIA DEPARTMENT OF FISH AND GAME STRIPED BASS MANAGEMENT PROGRAM 21 (1999) [hereinafter CONSERVATION PLAN].

[256] Coal. for a Sustainable Delta v. Koch, No. 1:08–CV–00397 OWW GSA, 2009 WL 2151842, at *1 (E.D. Cal. July 16, 2009).

[257] THE PROGRAM FOR APPLIED RESEARCH & EVALUATION, AN ECONOMIC ANALYSIS OF STRIPED BASS, STEELHEAD, CHINOOK SALMON, BLACK BASS, HALIBUT, AND STURGEON FISHING IN A 31 COUNTY AREA OF NORTHERN CALIFORNIA 209 (2013).

[258] *Id.* at 261.

[259] *Id.* at 258.

[260] *Putting a Price Tag on Nature: Part 2*, FISHBIO (July 21, 2014), http://archive.constantcontact.com/fs112/1101950876839/archive/1117971290622.html [https://perma.cc/M8RG-J8GQ].

[261] *Koch*, 2009 WL 2151842 at *2.

[262] *Id.*

[263] Reclamation Project Authorization and Adjustment Act of 1992, Pub. L. No. 102-575, §§ 3401–12, 106 Stat. 4600, 4714 (1992).

"contains numerous provisions calling for protection and enhancement of striped bass within the Sacramento–San Joaquin Delta." [264] The CVPIA states that the Secretary of the Interior must:

> [D]evelop within three years of enactment . . . a program which makes all reasonable efforts to ensure that, by the year 2002, natural production of anadromous fish[es] [including striped bass] in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967–1991 . . . .[265]

The U.S. FWS established a goal of 2.5 million fish to fulfill their obligations under the CVPIA. The Secretary must, "if requested by the State of California, assist in developing and implementing management measures to restore the striped bass fishery of the Bay–Delta estuary."[266]

In 2008, the Coalition for a Sustainable Delta[267] filed suit against the Executive Director of the California Fish and Game Commission, which sets fish and game regulatory policy in California, and members of the California Department of Fish and Game ("CDFG"), which enforces the regulations,[268] alleging "the Commission's promulgation and CDFG's maintenance and enforcement of striped bass fishing regulations cause the unlawful 'take' of four species of ESA 'listed' fish."[269] At the time of the suit, California's striped bass regulations allowed anglers to keep two striped bass eighteen inches long or longer and no striped bass shorter than eighteen inches.[270]

The Coalition's theory of the case is that: "[t]hrough the adoption and enforcement of the striped bass fishing regulations, which include bag and size limitations . . . the Commission and CDFG have allowed and encouraged the population of the non-native striped bass to thrive in the Delta."[271] In turn, "the striped bass prey upon and consume the [l]isted [s]pecies, and this is one of several causes of the population declines of the [l]isted [s]pecies."[272] This mirrors the theory in the palila cases, albeit one step closer in the causal chain.[273] Note that at the

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[264] *Koch*, 2009 WL 2151842 at *9.

[265] Reclamation Project Authorization and Adjustment Act of 1992, Pub. L. No. 102-575, § 3406(b)(1).

[266] *Id.* § 3406(b)(18).

[267] Coal. for a Sustainable Delta v. Carlson, No. 1:08-CV-00397 OWW GSA, 2008 WL 2899725, at *1 (E.D. Cal. July 24, 2008).

[268] FISH & GAME COMM'N, STATE OF CAL., STRATEGIC PLAN 10–13 (1998), http://www.fgc.ca.gov/strategicplan/overview.pdf [https://perma.cc/36BC-HCA5]. "The Commission sets policy for the Department, while the Department is the lead state agency charged with implementing, safeguarding and regulating the uses of wildlife." *Id.* at 11.

[269] *Carlson*, 2008 WL 2899725 at *1.

[270] CAL. CODE REGS. tit. 14, § 27.85 (2017).

[271] *Carlson*, 2008 WL 2899725 at *1.

[272] *Id.*

[273] In the palila cases, the DLNR regulated hunting of goats and sheep, which increased (or prevented a decrease in) their numbers, so they ate more māmane, which in turn resulted in take of palila. Palila v. Haw. Dep't of Land & Nat. Res., 471 F. Supp. 985, 989 (D. Haw.

judgment on the pleadings stage, the court barred suit against the Executive Director of the California Fish and Game Commission based on both Eleventh Amendment immunity and legislative immunity;[274] this became significant later in the case. CDFG also argued that the CVPIA preempted the lawsuit by implicitly exempting the striped bass programs from the ESA.[275]

In response to a 2010 motion for summary judgment, the court addressed the form of take alleged by the Coalition.[276] The court considered both an approach that would treat the take as "acts of a third party that indirectly bring about a take by causing another to effect a take," a form of vicarious liability, and an approach that would treat the take as a harm due to habitat modification, because the human manipulation by increasing the predator population in effect modified the listed species habitat.[277] The court ultimately concluded that vicarious liability could not apply, because it relied on some entity at some point actually taking a listed species in violation of the Act, and the court found that "[a] fish cannot 'take' another fish under the ESA, because only a 'person' can violate the ESA's take prohibition."[278] This left the plaintiffs with a theory of take relying on habitat modification. The distinction matters here because, under the habitat modification theory, "harm by habitat modification requires proof of a population level effect,"[279] not merely proof that an individual of a listed species would be taken. Under this higher standard of proof, the Coalition's several motions for a pretrial decision failed. Due to the muddled food web relationships and ecosystem wide issues in the Delta, the Coalition could not adequately show that striped bass had a net negative population level effect on listed species.

This problem plagued the Coalition throughout the suit. For example, during early pretrial litigation, the court found the Coalition lacked standing to sue based on a failure to show redressability:

> [E]ven if it were to prevail in this case, its injury would not necessarily be redressed. If the regulations were invalidated, even if the striped bass population were reduced to a level that measurably protected salmonid species on which they prey, there are other predators (the pikeminnow) and other causes: operation of the Projects, toxics, in-Delta diverters, alien invasive species, all of which contribute to the species' jeopardy. The present Delta smelt and salmonids jeopardy findings are based on drought conditions and Project operations, as primary causes. The extent to which

1979). Here, the Commission and the CDFG regulate the catch of striped bass, which increases (or prevents a decrease in) the number of striped bass, which directly take the listed species via predation. *Carlson*, 2008 WL 2899725 at *1.

[274] *Carlson*, 2008 WL 2899725 at *14–16.

[275] *Id.*

[276] Coal. for a Sustainable Delta v. McCamman, 725 F. Supp. 2d 1162, 1167–68 (E.D. Cal. 2010).

[277] *Id.*

[278] *Id.* at 1168.

[279] *Id.* at 1169. This is probably an open question, but neither party appealed the issue in this case.

> all other cooperative causes will continue to operate is unknown. There remains total uncertainty whether reduction in the threat of some predators will have more than minimal effect on the protected species.[280]

Throughout the pretrial litigation, the court raised a host of other scientific issues around the impacts of reducing the striped bass population, some of which merit discussion as real-life examples of the difficulty in assigning cause and effect relationships in a functioning ecosystem.

At a minimum, the court notes, "striped bass predation results in mortality of at least 5% of the listed salmonid populations each year . . . . However, this is not equivalent to a finding that the invalidation of the striped bass sportfishing regulations would similarly increase listed salmonid mortality by any measurable quantity."[281] Why wouldn't elimination of the striped bass result in at least a 5% improvement in listed species survival? Striped bass are opportunistic predators, eating whatever species they can fit in their mouths.[282] They prey on many other predators of listed species, including largemouth bass and catfish, and even on their own young.[283] Removing this top predator would likely increase the abundance of the other predators, with unknown impacts on the salmon population. Although the striped bass also eat delta smelt on rare occasions,[284] reducing the striped bass population also may not result in a net reduction in delta smelt consumption by all predators for several reasons. For example, the striped bass is a primary predator on the introduced Mississippi silverside, which is itself a primary predator on (and competitor with) the delta smelt.[285] Thus, decreased striped bass abundance could lead to an increase in silversides and a concomitant decrease in delta smelt. Further, in a phenomenon known as compensatory predation, reduced predation on one life stage of a species is sometimes offset by additional predation at other life stages, resulting in no net change to the population.[286] Decreased predation on salmonids at early life stages by striped bass could result in increased predation by marine mammals in the ocean, for example. Moreover, predation often focuses on hatchery salmonids, which are poorly adapted to life in the wild and are much less likely to survive to reproduce than their wild counterparts.[287]

Taken together, these effects (striped bass predation on other predators/competitors, compensatory predation, and predation on individuals

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[280] *Carlson*, 2008 WL 2899725 at *10.

[281] *McCamman*, 725 F. Supp. 2d at 1196 (citations omitted).

[282] *Id.*

[283] *Id.* at 1193–94.

[284] *Id.* at 1193.

[285] *Id.*

[286] *Can We Measure Impact of Predator Management Actions Intended to Protect ESA-Listed Salmon/Steelhead*, COLUMBIA BASIN FISH & WILDLIFE NEWS BULL. (Jan. 15, 2016), http://www.cbbulletin.com/435861.aspx [https://perma.cc/G8C5-RS62] [hereinafter NEWS BULL.].

[287] Peter B. Moyle & William A. Bennett, *Striped Bass Control: Cure Worse Than Disease?*, CAL. WATERBLOG (Jan. 31, 2011), https://californiawaterblog.com/2011/01/31/striped-bass-control-the-cure-worse-than-the-disease/ [https://perma.cc/FAP7-SGX5].

unlikely to reproduce) make it very difficult to document any positive impacts from predator control efforts. In the Pacific Northwest, for example, the native northern pikeminnow consumes roughly eight percent of the salmon and steelhead population, and since 1991, the Pacific States Marine Fisheries Commission and the U.S. Department of Energy have funded a control program to reward anglers who catch and kill the pikeminnow.[288] By the start of 2015, anglers participating in the program eliminated 4.1 million native pikeminnows,[289] with no discernable impact on the salmon population.[290] And, notably, California striped bass in some areas prey as frequently on pikeminnow as they do on salmon or steelhead.[291]

Beyond the convoluted food web relationships, population level data related to this population of striped bass does not support the Coalitions causal argument. The court noted that listed species are rare in the striped bass diet,[292] and found that "available historical information on population trends does not suggest that high periods in striped bass abundance coincided with lower populations of salmon as would be expected if striped bass were a major factor limiting salmon abundance."[293] Indeed, regression analysis looking for relationships between striped bass abundance and those of the listed species showed a *positive* relationship between striped bass abundance and winter-run salmon abundance,[294] not a negative relationship, suggesting that the salmon do well when striped bass do well. The analysis showed

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[288] STEVE WILLIAMS, REPORT ON THE PREDATION INDEX, PREDATOR CONTROL FISHERIES, AND PROGRAM EVALUATION FOR THE COLUMBIA RIVER BASIN EXPERIMENTAL NORTHERN PIKEMINNOW MANAGEMENT PROGRAM 1 (2014), http://www.pikeminnow.org/wp-content/uploads/2017/03/2014-Pikeminnow-AR.pdf [https://perma.cc/W954-FHSG]; Raymond C.P. Beamesderfer et al., *Evaluation of the Biological Basis for a Predator Control Program on Northern Squawfish (*Ptychocheilus oregonensis*) in the Columbia and Snake Rivers*, 53 CAN. J. FISHERIES & AQUATIC SCI. 2898, 2898 (1996). In 2014, anglers were paid $4 to $8 per fish, depending on how many fish they took during the season. STEVE WILLIAMS, REPORT ON THE PREDATION INDEX, PREDATOR CONTROL FISHERIES, AND PROGRAM EVALUATION FOR THE COLUMBIA RIVER BASIN EXPERIMENTAL NORTHERN PIKEMINNOW MANAGEMENT PROGRAM 3 (2014), http://www.pikeminnow.org/wp-content/uploads/2017/03/2014-Pikeminnow-AR.pdf [https://perma.cc/W954-FHSG]. In 2014, anglers caught a total of 163,037 northern pikeminnow, roughly 10% of the wild population in the target size range, and anglers received $1,186,274 in compensation. *Id.* at 4, 47. The highest grossing angler in 204 earned $73,698 in reward payments. *Id.* at 36. The dead pikeminnow are sent to a rendering facility for disposal. *Id.* at 15. Researchers were unable to discern if other predator populations increased in response to the fishery. *Id.* at 5. Modeling suggests that this control may be reducing pikeminnow predation on salmonids, but any effect has been difficult to detect. *Id.*

[289] WILLIAMS, *supra* note 288, at 10.

[290] Michael P. Carey et al., *Native Invaders—Challenges for Science, Management, Policy, and Society*, 10 FRONTIERS ECOLOGY & ENV'T 373, 373 (2012); *see also* NEWS BULL., *supra* note 286.

[291] Brian Schreier et al., Oral Presentation at the 2014 Bay-Delta Science Conference: Predation in the North Delta: Tales from the Digestive Goo (Oct. 30, 2014).

[292] Coal. for a Sustainable Delta v. Koch, No. 1:08–CV–00397 OWW GSA, 2009 WL 2151842, at *3 (E.D. Cal. July 16, 2009).

[293] *Id*.

[294] Coal. for a Sustainable Delta v. McCamman, 725 F. Supp. 2d 1162, 1193–94 (E.D. Cal. 2010).

"no relationship between striped bass abundance and either spring run, or delta smelt abundance."[295] Even at the most optimistic outcome, total removal of all stripers from the Delta would increase "winter-run [Chinook salmon] recovery probabilities by slightly more than three percent and . . . the winter run would still have about a one in five chance of extinction in the next 50 years."[296]

Due in large part to these uncertainties, in February 2011, the parties came to a settlement agreement.[297] As a result of the agreement, the court never had to rule on the CVPIA preemption argument, noting only that "the evidence suggests it is possible, but not certain, that enforcement of the ESA in this case can be harmonized with implementation of the CVPIA."[298] The settlement agreement required defendants to prepare a recommendation for the Commission, "based upon the best available scientific information to modify the striped bass sport fishing regulation to reduce striped bass predation on the listed species."[299] The court could not compel the Commission to accept the proposal due to the Commission's aforementioned immunity to suit.[300] Per the agreement, the defendants developed the proposal in collaboration with the U.S. Fish and Wildlife Service and the National Oceanic and Atmospheric Administration National Marine Fisheries Service, and CDFG submitted the proposal to the Commission.[301] The Commission considered the proposal, and, in February 2012, unanimously rejected it.[302] Pursuant to the settlement agreement, the court dismissed the Coalition's suit with prejudice.[303] No parties to the suit have taken significant actions since the Commission's decision, and the future of this dispute is unclear.

As noted, California once held a Section 10(a)(1)(B) permit under the ESA, which would have permitted them to take some actions with respect to the striped bass populations without violating the take restrictions in the ESA.[304] Specifically, California sought permitting for:

> (1) annual stocking of 1- and 2-year-old striped bass in the San Francisco Bay/Sacramento-San Joaquin Estuary at numbers sufficient to restore and

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[295] *Id.*

[296] *Koch*, 2009 WL 2151842, at *3–4.

[297] Coal. for a Sustainable Delta v. McCamman, No. 1:08-CV-00397 OWW GSA, 2011 WL 1332196, at *5 (E.D. Cal. Apr. 6, 2011).

[298] *McCamman*, 725 F. Supp. 2d at 1202.

[299] *McCamman*, 2011 WL 1332196 at *5.

[300] *Id.*

[301] Stipulation and Order to Dismiss First Amended Complaint with Prejudice, Coal. for a Sustainable Delta v. McCamman, 1:08-CV-00397-LJO-MJS (E.D. Cal. Feb. 28, 2012).

[302] Ross Purnell, *Striped Bass Proposal Rejected—More Litigation Promised*, FLYFISHERMAN (Feb. 15, 2012), http://www.flyfisherman.com/news/striped-bass-proposal-rejected-more-litigation-promised/ [https://perma.cc/9GMK-6GCJ].

[303] Stipulation and Order to Dismiss First Amended Complaint with Prejudice, Coal. for a Sustainable Delta v. McCamman, 1:08-CV-00397-LJO-MJS, (E.D. Cal. Feb. 28, 2012).

[304] Availability of an Environmental Assessment and Receipt of an Application for an Endangered Species Act Incidental Take Permit for the California Department of Fish and Game's Striped Bass Management Program Conservation Plan, 64 Fed. Reg. 71735-01 (Dec. 22, 1999).

> maintain a striped bass population of 712,000 adults . . . ; (2) possible changes in the striped bass fishing regulations to help reach and maintain the target population level; and (3) monitoring of the overall striped bass population . . . .[305]

This population level would still have fallen short of the CVPIA requirements.[306] The stocking program allowed under the Section 10(a)(1)(B) permit ceased after two years in 2001, when striper populations hit the maximum levels allowed under the permit.[307] California has not publicized any plans to renew the permit.

At this point, the fishing regulations remain in effect and the case had been dismissed, but the state does not have any ESA permitting for the striped bass management.

1. Lesson: People Love Their Guest Species; This Increases Conflicts

Like the *Palila* cases, this case highlights the conflict between state wildlife management goals (maintenance or improvement of the striped bass fishery) and federal ESA enforcement, but this case also highlights the role that a dedicated constituency can play in resource protection. The striped bass lobby in California includes the Sportfishing Conservancy, the California Sportfishing League, the Coastside Fishing Club, the California Striped Bass Association, and the California Sportfishing Protection Alliance, among many, many others.[308] These organizations represent a large number of individuals with a strong interest in maintaining a striped bass fishery in California, with a long history of political activism to achieve their goals. For example, the California legislature banned commercial fishing for striped bass in 1935 as a result of strong lobbying by recreational anglers.[309] The CVPIA's inclusion of striped bass in its doubling goal for fish populations stands as another example of concerted effort by local groups to protect their guest species fishery.

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[305] *Id.*

[306] CONSERVATION PLAN, *supra* note 255, at 41 ("Further stocking . . . would be required to achieve longer-term abundance goals set by the California Fish and Game Commission (1.1 to 3 million) and CVPIA (2.5 million).").

[307] Cal. Dep't of Fish & Game, *Why Has DFG Suspended Stocking Striped Bass in the Sacramento-San Joaquin Estuary*?, https://web.archive.org/web/20060621111303/http://www.delta.dfg.ca.gov/stripedbass/QuestionoftheMonth.asp?quid=0 [https://perma.cc/QR76-4PY7] (last visited Aug. 5, 2017).

[308] Letter from John Beuttler, Allied Fishing Groups, to Sonki Mastrup, Executive Director, Cal. Fish and Game Comm'n. (July 21, 2014), http://www.fgc.ca.gov/meetings/2014/aug/Exhibits/30.27_LTR_Striped_Bass_Recovery_Allied_Fishing_Groups_Beuttler_072114_xxxxx.pdf [https://perma.cc/3N8C-XJFQ] (listing members of Allied Fishing Groups, the association representing the striped bass lobby).

[309] Denis Cuff, *Bay Area Commercial Fishing: Inside the Decline*, MERCURY NEWS (Mar. 1, 2013), http://www.mercurynews.com/2013/03/01/bay-area-commercial-fishing-inside-the-decline/ [https://perma.cc/9GBL-LEMX].

The striped bass lobby also created a Striped Bass Stamp,[310] a way to tax themselves in order to increase striped bass populations via stocking.[311] Recognizing even then the potential for conflicts over striped bass, the groups ensured that 15% of the striped bass stamp fee went for salmon conservation.[312]

In some ways, even this lawsuit itself is a testament to the power of the striped bass lobby. The CVPIA cannot achieve the striped bass doubling goal without significant influxes of additional water, far beyond what agricultural groups would be likely to consider reasonable.[313] This lawsuit, then, appears to be an effort to cut the striped bass lobby off from other environmental groups more interested in conserving listed species (e.g. CalTrout, Trout Unlimited, the NRDC, and other conservation-oriented groups) and to hamstring their efforts to get more water. Although the plaintiff claims they are protecting salmonids, plaintiff Coalition for a Sustainable Delta is "a coalition of agricultural water users in the San Joaquin Valley that contract for State Water Project ("SWP") water deliveries from the Delta,"[314] hardly the first group that comes to mind when thinking about salmon protection.

Finally, a subsection of this striped bass community rallied around the effort to convince the Commission to reject the proposed rule limiting protection for striped

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[310] Mike McKenzie, *Bay/Delta Stamp No Longer Required as of Jan. 1, 2010*, CAL. SPORTFISHING PROTECTION ALLIANCE (Oct. 17, 2009), http://www.calsport.org/10-17-09.htm [https://perma.cc/H66Y-9J44].

[311] Bill Analysis, S. SB 692, at 3 (Cal. 2003) http://leginfo.ca.gov/pub/03-04/bill/sen/sb_0651-0700/sb_692_cfa_20030721_161140_asm_floor.html [https://perma.cc/SU69-S7L4].

[312] *History*, CAL. STRIPED BASS ASS'N, http://striper-csba.com/history/ [https://perma.cc/GF2L-7ESY] (last visited Aug. 5, 2017).

[313] 3 U.S. FISH & WILDLIFE SERV., WORKING PAPER ON RESTORATION NEEDS: HABITAT RESTORATION ACTIONS TO DOUBLE NATURAL PRODUCTION OF ANADROMOUS FISH IN THE CENTRAL VALLEY OF CALIFORNIA 3-Xf-9 (1995), https://www.fws.gov/lodi/anadromous_fish_restoration/documents/WorkingPaper_v3.pdf [https://perma.cc/EPV8-B8UD] (determining that "[f]low recommendations [necessary to double the striped bass population] are likely to be considered unreasonable by water users").

[314] The plaintiff suggests that healthier stocks of listed species would allow them to divert more water from the Delta, but the lawsuit appears on its face to be an effort to politically separate the striped bass fishermen in California, who constitute an active lobby for reduced irrigation diversions, from other environmental interest groups that focus on listed species (i.e. CalTrout, Natural Resources Defense Council, etc). The Coalition maintains it filed the suit because

> [t]he illegal and unmitigated take of the Federally-Protected species, including the delta smelt, by defendants injures [the Coalition] because it reduces the population of the Federally-Protected species thereby worsening the baseline status of the species, which must be taken into account by FWS and NMFS when they determine whether proposed SWP exports from the Delta comply with the ESA. Therefore, defendants' ESA violations threaten deliveries of SWP water to members of the [Coalition].

Complaint at ¶ 40, Coal. for a Sustainable Delta v. Carlson, No. 1:08-CV-00397 OWW GSA (E.D. Cal. 2008).

bass,[315] providing the Commission with a strong incentive to nix the proposal.[316] Dedicated local or statewide groups make for more intense controversies and may lack significant opposition at the state level.[317]

These controversies spurred in part by interest groups seeking to protect guest species are not limited to game species. As noted above, other groups have filed lawsuits protecting nonnative species, including red foxes preying on endangered terns.[318] Moreover, groups and dedicated individuals[319] devoted to the protection of nonnative species have managed to pass federal law protecting some guest species. For instance, "[t]he Wild Free-Roaming Horses and Burros Act . . . was enacted in 1971 to protect 'all unbranded and unclaimed horses and burros on public lands of the United States,' . . . from 'capture, branding, harassment, or death.'"[320] The Act required the responsible land management agencies "to protect and manage [the animals] as components of the public lands . . . in a manner that is designed to achieve and maintain a thriving natural ecological balance on the public lands."[321] The Wild Free-Roaming Horses and Burros Act labels the horses and burros "an integral part of the natural system of the public lands."[322] As the Supreme Court noted, "[a]ccording to Congress, these animals, if preserved in their *native* habitats, 'contribute to the diversity of life forms within the Nation and enrich the lives of the American people.'"[323] Of course, in spite of the Supreme Court's view, the horses

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[315] A coalition of sportfishing and outdoor recreation organizations opposing the petition include: California Sportfishing League, American Sportfishing Association, CCA-Cal, Coastside Fishing Club, Congressional Sportfishing Foundation, Water4Fishing.org, Fishing League Worldwide, Bass Conservation and the National Marine Manufacturing Association. Mark Lassange, *Controversial Striped Bass and Black Bass Petition Withdrawn*, BASS ANGLER MAG. (Aug. 23, 2016), http://bassanglermag.com/controversial-striped-bass-and-black-bass-petition-withdrawn/ [https://perma.cc/25VX-WUJD].

[316] *See* Tom Martens, *Is it Bye Bye Bass in Delta?*, DAVIS ENTERPRISE (Dec. 14, 2011), http://www.davisenterprise.com/sports/sports-columns/is-it-bye-bye-bass-in-delta/ [https://perma.cc/GZG7-KC2Y].

[317] *See* A. Dan Tarlock, *Local Government Protection of Biodiversity: What Is Its Niche?*, 60 U. CHI. L. REV. 555, 558 (1993) (observing that "[t]o further complicate the problem, local controversies are more intense and less subject to countervailing forces.").

[318] *See* Butchko, *supra* note 242, at 238.

[319] Velma B. Johnston, also known as Wild Horse Annie, led the charge for the Free-roaming Horses and Burros Act, in cooperation with her International Society for the Protection of Mustangs and Burros (ISPMB). *See Wild Horse Annie*, ISPMB, http://www.ispmb.org/Annie.html [https://perma.cc/3NMF-GWTV] (last visited Aug. 5, 2017). Annie and the ISPMB created the federal Adopt-A-Horse program in 1976. *See ISPMB Achievements*, ISPMB, http://www.ispmb.org/Achievements.html [https://perma.cc/DJ23-H5MS] (last visited Aug. 5, 2017). Her grassroots campaign to protect horses led to the second largest outpouring of mail to Congress in legislative history, *id.*, and ultimately both the House and Senate passed the bill by unanimous vote. Bureau for Land Mgmt., U.S. Dep't of the Interior, *Program History*, https://www.blm.gov/programs/wild-horse-and-burro/about-the-program/program-history [https://perma.cc/ZUK5-7JBF] (last visited Aug. 5, 2017).

[320] Kleppe v. New Mexico, 426 U.S. 529, 541, 541 n.10 (1976).

[321] 16 U.S.C. § 1333(a) (2012).

[322] *Kleppe*, 426 U.S. at 529.

[323] *Id.* at 535 (quoting 16 U.S.C. § 1331 (1970)) (emphasis added).

and burros are not in fact in their native habitats, at least in the sense that the horses had been extinct from North America for 10,000 years before the Spanish reintroduced them.[324] That did not keep Congress from passing the law itself, and it certainly did not keep the people of Nevada from choosing a stirring scene of wild horses for their state quarter coin in 2005.[325] These horses, feral though they may be, pull at the public heartstrings.

In California, state water law accommodates guest species by extending minimum instream flow protections to nonnative fishes, even if those fishes are not fully naturalized and must be periodically restocked.[326] More broadly, "[p]ublic perception and lack of support have affected efforts to manage or eradicate vertebrate species in the US,"[327] particularly for species like wild horses, primates,[328] dingos in Australia,[329] and redmasked parakeets in California.[330]

Generally, "the public does not readily distinguish between native and non-native species: as long as an animal looks nice and is not threatening people or causing undue harm, the public tends to view species equally."[331] Given the at worst, indifference, and at best, adoration with which many people view guest species, efforts to manage these species often run into strong local opposition. As others have noted, leadership from local groups, particularly hunting and game management groups, will be critical to guest species management, and such efforts must involve those communities in a meaningful way.[332] Attempting to manage guest species without addressing locals who care about the species leads to serious conflict.

2. Lesson: Guest Species Can Eventually Become Part of the Local Ecosystem

At the February 2nd, 2012 meeting of the California Fish and Game Commission, after the Commission voted 4–0 to reject the proposed reduction in protection for striped bass populations, Commission President Jim Kellogg declared the striped bass a "native species" in California, due to their long residence in the

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[324] *See* Brian Kooyman et al., *Identification of Horse Exploitation by Clovis Hunters Based on Protein Analysis*, 66 AMERICAN ANTIQUITY 686, 686–91 (2001).

[325] *See Nevadans Choose Wild Horse Design for State Quarter*, L.V. SUN (June 2, 2005), https://lasvegassun.com/news/2005/jun/02/nevadans-choose-wild-horse-design-for-state-quarte/ [https://perma.cc/4P5E-BUZX].

[326] *See* Karrigan S. Börk et al., *The Rebirth of California Fish & Game Code Section 5937: Water for Fish*, 45 U.C. DAVIS L. REV. 809, 874 (2012) ("[The California State Water Resources Control Board] holding that [California Fish & Game Code Section] 5937 . . . require[s] the dam owner to keep in good condition any fish that may be planted below the dam. The Water Board held that 5937 allowed it to require protection of the highly valued fishery consisting most importantly of an introduced, and periodically restocked, species.").

[327] Witmer et al., *supra* note 38, at 134.

[328] *See id.*

[329] *See* Schlaepfer et al., *supra* note 87, at 434.

[330] *See id.*

[331] Witmer et al., *supra* note 38, at 134.

[332] *See* Banko et al., *supra* note 164, at 884–85.

state.[333] Science offers some support for this position. Consider the Chinook salmon populations introduced from California to New Zealand between 1904 and 1907.[334] These salmon all originated from a single fall run population of salmon in Battle Creek, California, a Sacramento River tributary.[335]

Roughly 90 years later, scientists studied salmon from several populations in New Zealand and found that salmon differed in all life history traits examined among rivers.[336] "The variable traits (age at maturity, growth rate, time of adult migration and pawning, and freshwater residence period) are all known to be controlled by both genetic and environmental factors,"[337] suggesting "considerable adaptation to local conditions has occurred in about 20 generations."[338] This adaptation appears to have a genetic basis.[339] Moreover, the populations in various New Zealand rivers have already developed a strong population structure evident at the genetic level.[340] In lay terms, these populations are in the process of forming new species of Chinook salmon. Were they transplanted back into their historic homes, they would be differentiated from the other salmon by their genetics, run timing, size, and other life history traits.[341]

This is not an isolated phenomenon. Relatively rapid evolution has been discovered in both invading species and in native species that are responding to an invasion.[342] Species like the striped bass, which has been in California for almost 150 years, have almost certainly adapted to their new environment, making them distinct from the populations that remained in their native habitat. In a real, biological sense, some of these guest species are evolving into new species, natives of their new habitat. Regardless of how they arrived there, these particular guest species populations have evolved to fit their new home, which in turn have evolved

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[333] Purnell, *supra* note 302.

[334] *See* Michael T. Kinnison et al., *Egg Size, Fecundity, and Development Rate of Two Introduced New Zealand Chinook Salmon (*Oncorhynchus tshawytscha*) Populations*, 55 CAN. J. FISHERIES & AQUATIC SCI. 1946, 1946–47 (1998).

[335] *See id.*

[336] Thomas P. Quinn & Martin J. Unwin, *Variation in Life History Patterns among New Zealand Chinook Salmon (*Oncorhynchus tshawytscha*) Populations*, 50 CAN. J. FISHERIES & AQUATIC SCI. 1414, 1414 (1993).

[337] *Id.* at 1420.

[338] *Id.* at 1414.

[339] *See* Thomas P. Quinn et al., *Evolution of Chinook Salmon (*Oncorhynchus tshawytscha*) Populations in New Zealand: Pattern, Rate, and Process*, 112 GENETICA 493, 505−06 (2001); Thomas P. Quinn et al., *Evolution of Temporal Isolation in the Wild: Genetic Divergence in Timing of Migration and Breeding by Introduced Chinook Salmon Populations*, 54 EVOLUTION 1372, 1372 (2000) [hereinafter *Evolution of Temporal Isolation*].

[340] *See* Michael T. Kinnison et al., *Reconstructing Recent Divergence: Evaluating Nonequilibrium Population Structure in New Zealand Chinook Salmon*, 11 MOLECULAR ECOLOGY 739, 740–41 (2002).

[341] *See* Quinn et al., *Evolution of Temporal*, *supra* note 339, at 1382.

[342] *See* Fred Bosselman, *A Dozen Biodiversity Puzzles*, 12 N.Y.U. ENVTL. L.J. 364, 451 (2004).

to accommodate them.[343] If native species are the species that evolved in a particular ecosystem, or if they are the species that have coevolved with the other species in the ecosystem, then guest species with well-established populations in their new ecosystems probably become native species in a biological sense after as little as twenty to thirty generations, based on the data from the New Zealand salmon.[344]

Removing these species shows just how well-integrated into a new ecosystem they may be. Although some ecosystems with few modifications can recover preinvasion dynamics,[345] as a general matter it is almost impossible to predict how an ecosystem will react to the removal of an established component of the system. This is particularly true when the species is, like the striped bass, an apex predator in the system—that is, a predator that regulates the abundance of many other species. "For example, on New Zealand's Stewart Island, invasive feral cats prey on an endangered parrot, but the the [sic] mainstay of the of the cats' diet is rats, which attack the parrots nests, so elimination of the cats could harm the parrot more than it would help it."[346] On other islands, removal of cats led to explosions of nonnative rabbit populations, destroying native vegetation.[347] Removal of Australian dingoes, introduced to Australia by humans as domesticated dogs 3,500 years ago,[348] led to an increase in fox populations and a subsequent decrease in native marsupials.[349] At best, removal of top predators will have unknown effects, and the ecosystems "are so highly altered that attempting to restore them to an earlier condition or stable state is largely not possible."[350]

This is all the clearer in new anthropogenic ecosystems, which ecologists often term "novel ecosystems."[351] Novel ecosystems are characterized by "(1) novelty: new species combinations, with the potential for changes in ecosystem functioning; and (2) human agency: ecosystems that are the result of deliberate or inadvertent human action, but do not depend on continued human intervention for their

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[343] *See* Wallach et al., *supra* note 248, at 147 ("While evolutionary novelty can hamper coexistence in some cases, native species can also adapt through behavioral changes and trait evolution in response to novel organisms, within only a few generations.").

[344] Quinn et al., *Evolution of Temporal Isolation*, *supra* note 339, at 1372.

[345] Jesse M. Lepak et al., *Rapid Food Web Recovery in Response to Removal of an Introduced Apex Predator*, 63 CAN. J. FISHERIES & AQUATIC SCI. 569, 571–72 (2006).

[346] Bosselman, *supra* note 342, at 451 (citation omitted).

[347] *See* Wallach et al., *supra* note 248, at 146.

[348] Peter Savolainen et al., *A Detailed Picture of the Origin of the Australian Dingo, Obtained from the Study of Mitochondrial DNA*, 101 PROC. NAT'L ACAD. SCI. U.S. 12387, 12387 (2004). Perhaps the Dingoes have been in Australia long enough to be considered native, in spite of their human mediated arrival on the continent. "Though dingoes are migrants, their arrival was distant enough that they have become quintessentially Australian and, in this sense, unique to this part of the world." THE DINGO DEBATE: ORIGINS, BEHAVIOUR AND CONSERVATION xi (Bradley Smith ed., 2015).

[349] Wallach et al., *supra* note 248, at 146.

[350] P. B. Moyle, *Novel Aquatic Ecosystems: The New Reality for Streams in California and Other Mediterranean Climate Regions*, 30 RIVER RES. & APPLICATIONS 1335, 1335 (2014).

[351] Also termed emerging or no analog ecosystems. Hobbs et al., *supra* note 60, at 599.

maintenance."[352] Ecologists credit three factors for ubiquity of these ecosystems: (1) anthropogenic local extinction of "most of the original animal, plant and microbial populations" and the concomitant introduction of nonnative life; (2) the erection of barriers (urban environments/degraded landscapes) to natural recolonization of impacted sites or the reduction of sources of species for recolonization; and (3) fundamental alterations of the abiotic environment that render the environments unsuitable for the original ecosystem.[353] We cannot turn back the clock on novel ecosystems to restore them to a historic state. Consider the Sacramento River: full restoration would require elimination of dams, removal of reservoirs, reestablishment of wetlands, removal of levees . . . the list goes on and on.

Partial restorations have improved habitat in some places,[354] but these efforts will always be extremely limited and the rest of the river habitat favors nonnative species. [355] In these systems, the habitat that allowed the original ecosystem is gone, and many of the remaining fish—the delta smelt, the winter run Chinook salmon—are poorly adapted to the current environment. So what should the rest of the river look like? What species should live there? What is a native species in this new system? The guest species in the system are at least as adapted to the novel ecosystem as the original native species. Does that mean the guest species are natives of the new ecosystem?

Perhaps, though, this is less a question for science and more a question of how we decide to treat these species. When do guest species "get their green card" or become naturalized like citizens do?[356] Should there be a "path to citizenship" for some guest species? "Traditionally, conservation goals have been defined by historical, static benchmarks aimed at protecting flagship species and 'pristine'

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[352] Richard J. Hobbs et al., *Novel Ecosystems: Theoretical and Management Aspects of the New Ecological World Order*, 15 GLOBAL ECOLOGY & BIOGEOGRAPHY 1, 2 (2006) [hereinafter Hobbs et al., *New Ecological World Order*]. Note that some quibble with the latter part of that characterization, the idea these ecosystems do no depend on continued human intervention. *See* Daniel Simberloff et al., "*Novel Ecosystems" Are a Trojan Horse for Conservation*, ENSIA (Jan. 21, 2015), http://ensia.com/voices/novel-ecosystems-are-a-trojan-horse-for-conservation/ [https://perma.cc/3837-GDWS]. It is probably too early to determine which of these ecosystems will or will not last.

[353] Hobbs et al., *New Ecological World Order*, *supra* note 352, at 2.

[354] *See, e.g.*, Peter F. Alpert et al., *Riparian Forest Restoration Along Large Rivers: Initial Results from the Sacramento River Project*, 7 RESTORATION ECOLOGY 360, 361 (1999) (discussing the potential effects of dam removal along the Sacramento river); G. Mathias Kondolf et al., *Projecting Cumulative Benefits of Multiple River Restoration Projects: An Example from the Sacramento-San Joaquin River System in California*, 42 ENVTL. MGMT. 933, 938–39 (2008) (discussing reparation by replacing previously naturally occurring gravel pits).

[355] Moyle, *supra* note 350, at 1336 ("Alien species are particularly likely to dominate in rivers downstream of dams where operations tend to reduce natural flow variability, creating uniform conditions that favour aliens and discourage native species adapted for less stable conditions, such as the California roach.").

[356] Joseph Hayes, *Just the Facts: Immigrants in California*, PUB. POL'Y INST. CAL. (Jan. 2017), http://www.ppic.org/publication/immigrants-in-california/ [https://perma.cc/6E3T-Q4SJ].

ecosystems and their putative integrity and stability . . . ."[357] But in many places, these historic systems are gone, and they aren't coming back. In the highly altered ecosystems that remain, no species is native, in the sense that none of the species found there originally evolved in that modified habitat. Why, then, should we discriminate against the nonnative species solely on the basis that they are nonnative? Some guest species have been in their new habitat so long, "there is little point in regretting the history that has made them part of the ecosystems they now inhabit."[358]

F. Case Study Three: The Suckers and the Trout

The first two lawsuits reflect an underlying disconnect between societal attitudes towards guest species and conservation policy objectives. This disconnect is pervasive, although it does not always result in litigation. For example, NEPA analysis also demonstrates the inherent conflicts surrounding the role and maintenance of guest species in an ecosystem that no longer supports its native species due to anthropogenic changes. Consider the story of the cold water trout fishery in the Flaming Gorge, Utah.

The Green River, a primary tributary of the Colorado River,[359] flows down and out of the Wind River Mountains in Wyoming, into the northeastern corner of Utah, where it is impounded in the Flaming Gorge Reservoir by the Flaming Gorge Dam. The river flows out of the dam and into the Flaming Gorge, a seven mile long canyon with towering flaming red cliffs on either side.[360] The Green River emerges from the canyon into Browns Park, where it widens and shallows into several braided channels as it flows into Colorado. Eventually, the river enters one of the most dramatic landmarks in the West, the Gates of Lodore.[361] The Green—now within Dinosaur National Monument—flows through Lodore Canyon, where it gains the flow of the Yampa River and then loops back into Utah. The Green continues on through a pair of proposed dam sites, the basis of the epic showdown between David

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[357] Schlaepfer et al., *supra* note 87, at 430 (citation omitted).

[358] Bosselman, *supra* note 342, at 443 (quoting William Cronon, *Resisting Monoliths and Tabulae Rasae*, 10 ECOLOGICAL APPLICATIONS 473, 475 (2000)).

[359] E. D. Andrews, *Downstream Effects of Flaming Gorge Reservoir on the Green River, Colorado and Utah*, 97 GEOLOGICAL SOC'Y AMERICA BULL. 1012, 1013 (1986).

[360] *Green River Float-In Campsites, UT*, RECREATION.GOV, https://www.recreation.gov/camping/green-river-floatin-campsites/r/campgroundDetails.do?contractCode=NRSO&parkId=117489 [https://perma.cc/YCW7-QQ6W] (last visited Aug. 5, 2017); Tom Wharton, *Flaming Gorge: The Place Few People Knew*, SALT LAKE TRIB. (May 17, 2012), http://archive.sltrib.com/story.php?ref=/sltrib/outdoors/53972285-117/flaming-gorge-river-webb.html.csp [https://perma.cc/V2AQ-W5TA].

[361] In a typical canyon, a river drops down into the canyon itself. In Lodore Canyon, in contrast, the canyon rises up around the Green River, and the Gates are the first towering canyon walls that swallow the river. Joel L. Pederson & Kevin W. Hadder, *Revisiting the Classic Conundrum of the Green River's Integration Through the Uinta Uplift*, *in* UINTA MOUNTAIN GEOLOGY 149, 149 (Carol M. Dehler et al. eds., 2005).

Brower's Sierra Club and the Bureau of Reclamation,[362] before it eventually joins the Colorado River in Canyonlands National Park, near Green River, Utah.[363]

Historically, as the Green River emerged from Flaming Gorge into Browns Park, it had become a desert river,[364] warm and silty,[365] with summer temperatures averaging around 20 °C.[366] This was not an easy place for fish to live. The river generally flooded with cold snowmelt in the spring, dropped to a warm, low level in the summer, and nearly froze in the winter.[367] The high variability, scouring floods, and heavy sediment loads challenged most fish species, but a hardy contingent of four large fish species evolved to take advantage of those conditions. These fishes include the bizarre looking humpback chub, the bony tail sucker, the razorback sucker, and the magnificent Colorado River pikeminnow.[368] The Colorado River pikeminnow is the largest North American member of the minnow family (cyprinidae), historically reaching lengths of five to six feet and weights of over one hundred pounds.[369] These four river fishes live only in the Colorado River drainage,[370] and they are all now listed as federally endangered.[371]

The 1956 Colorado River Storage Project authorized the Flaming Gorge reservoir on the Green River,[372] with the dam located roughly thirty miles north of

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[362] The dams were never built, largely as a result of the work by Brower. Andrew C. Mertha & William R. Lowry, *Unbuilt Dams: Seminal Events and Policy Change in China, Australia, and the United States*, 39 COMP. POL. 1, 5 (2006). *But see* Mark W.T. Harvey, *Echo Park, Glen Canyon, and the Postwar Wilderness Movement*, 60 PAC. HIST. R. 43, 46-47 (1991).

[363] Nat'l Park Serv., *Rivers*, NPS.GOV, https://www.nps.gov/cany/planyourvisit/rivers.htm [https://perma.cc/VTC4-T67G] (last updated June 29, 2016).

[364] FISH & WILDLIFE SERV., U.S. DEP'T OF THE INTERIOR, OPERATION OF FLAMING GORGE DAM, FINAL ENVIRONMENTAL IMPACT STATEMENT: FINAL BIOLOGICAL OPINION TECHNICAL APPENDIX 53–54 (2005) [hereinafter 2005 FLAMING GORGE BIOP].

[365] ROBERT T. MUTH ET AL., FLOW AND TEMPERATURE RECOMMENDATIONS FOR ENDANGERED FISHES IN THE GREEN RIVER DOWNSTREAM OF FLAMING GORGE DAM 1-7 (2000) http://www.coloradoriverrecovery.org/documents-publications/technical-reports/isf/flaminggorgeflowrecs.pdf [https://perma.cc/8CHZ-NEFG] (describing the historical "Green River [as] an unregulated, turbid, temperate stream").

[366] Julian D. Olden, *Challenges and Opportunities for Fish Conservation in Dam-Impacted Waters*, *in* CONSERVATION OF FRESHWATER FISHES 107, 134–35 (Gerard P. Closs et al. eds., 2016) (relating that the average pre dam temperature between May and August was 17.2°C, with high mean temperatures in July and August around 20°C).

[367] E. L. BOLKE & K. M. WADDELL, CHEMICAL QUALITY AND TEMPERATURE OF WATER IN FLAMING GORGE RESERVOIR, WYOMING AND UTAH, AND THE EFFECT OF THE RESERVOIR ON THE GREEN RIVER: GEOLOGICAL SURVEY WATER-SUPPLY PAPER 2039-A A2 (1975) ("Prior to closure of the dam, the average monthly temperature of the Green River below the damsite ranged from 0°C to 19.5°C.").

[368] Eric J. Hilton & Gerald R. Smith, *The American Society of Ichthyologists and Herpetologists as an Advocacy Group: The Green River Poisoning of 1962*, 2014 COPEIA 577, 578 (2014).

[369] *Id.* at 578, 587.

[370] *Id.* at 587.

[371] *Id.* at 578.

[372] *Id.* at 577.

Vernal, Utah.[373] Construction of the Flaming Gorge Dam began in 1959, and water storage began in 1962. The reservoir provides water storage, flood control, recreation, and hydroelectric power.[374] In order to maximize the fishing recreation potential by improving the likelihood of establishing a good trout population in the new reservoir, the Utah Fish and Game and Wyoming Game and Fish departments carried out a fisheries "rehabilitation" project prior to the closure of the dam.[375] The purported rehabilitation project sought to remove potential competitors and predators of the planned trout population through a wholesale poisoning of the Green River above and below the planned dam site.[376]

On September 4, 1962, workers began adding the fish poison rotenone to the river, with poison drip sites established roughly every ten miles throughout the Flaming Gorge and nearby areas.[377] The poisoning continued for three days.[378] Although the poison was supposed to be neutralized at a site twenty-six kilometers upstream of the Dinosaur National Monument, the neutralization failed.[379] Ultimately, the rotenone caused "an extensive and severe kill of aquatic life . . . throughout some 524 miles of the Green River basin, even including the length of Dinosaur National Monument."[380] The rehabilitation killed individuals from twenty species of fish and over one hundred species of identified aquatic invertebrates.[381] It also decimated populations of the humpback chub, bony tail sucker, razorback sucker, and Colorado River pikeminnow.[382] The poisoning of the Green River remains the largest deliberate river poisoning in U.S. history.[383]

As dire as this poisoning was, these actions predate the modern ESA, NEPA, Clean Water Act, and indeed what many think of as the beginning of the modern environmental movement.[384] Some may be inclined to brush these actions away as vestiges of the past, but, in terms of the modern incarnation of the guest species problem, these events really just set the stage. The next chapter of the story illustrates our continued difficulties in coming to terms with the way we manage guest species in our ecosystems. This next portion of the story depends on water temperature fluctuations throughout the Green River below the Flaming Gorge Dam.[385]

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[373] BOLKE & WADDELL, *supra* note 367, at A2.

[374] *Id.*

[375] Hilton & Smith, *supra* note 368, at 577–78.

[376] *Id.*

[377] *Id.* at 577, 588.

[378] *Id.* at 577.

[379] *Id.*

[380] *Id.*

[381] *Id.* at 578.

[382] *Id.* at 587.

[383] *Id.* at 588. After the poisoning, then Secretary of the Interior Stewart Udall took action to ensure that such events would be unlikely to occur in the future. *Id.* at 585.

[384] Kroll, *supra* note 17, at 403.

[385] Temperature data in this section generally comes from the Green River gauge near Greendale, UT, gauge number 09234500. The period of record for temperature goes from October 1956 to September 1959, October 1963 to September 2000, October 2001 to September 2003, February 2004 to current year. *See* U.S. Geological Surv., *Green River Near Greendale, UT*, https://waterdata.usgs.gov/nwis/inventory/?site_no=09234500&

Trout like cold water,[386] and the river below Flaming Gorge Dam initially proved an ideal temperature as the dam began to fill with water.[387] Trout proliferated, creating a legendary recreational fishery for both brown and rainbow trout.[388] But as the reservoir filled and stratified,[389] the water released from the dam cooled to the point that it no longer supported the vast, fast growing populations of trout that anglers expected.[390] Because—down to a few degrees above freezing—cooler water is denser than warm water, cooler water sinks in large reservoirs, creating thermal stratification.[391] Water drawn from the deeper parts of a reservoir is much colder than water near the surface.[392] In the Flaming Gorge Reservoir, maximum stratification occurs during the summer, with temperatures deep in the reservoir hovering around 4 °C and temperatures at the surface reaching roughly 23 °C, with a temperature gradient of 1.6 °C/m.[393] Immediately after the reservoir filled, the water at the fixed intake to the dam varied from 3.5 °C to 10 °C throughout the year,[394] far below the rainbow trout's preferred temperature of roughly 13–17 °C,[395] resulting in lackluster trout growth. To restore the trout fishery, the Bureau of Reclamation and the Utah Division of Wildlife Resources modified the penstock intakes on the dam in June 1978 with the sole goal of allowing the dam operators to draw water at the best temperature for the trout, from whatever depth that temperature water might be at in the reservoir's water column.[396] The modified

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agency_cd=USGS& [https://perma.cc/US62-36B6] (last visited Aug. 5, 2017).

[386] *See* Randall B. Filbert & Charles P. Hawkins, *Variation in Condition of Rainbow Trout in Relation to Food, Temperature, and Individual Length in the Green River, Utah*, 124 TRANSACTIONS AMERICAN FISHERIES SOC'Y 824, 824 (1995).

[387] JAMES E. JOHNSON ET AL., FINAL REPORT: FLAMING GORGE TAILWATER FISHERIES INVESTIGATIONS: TROUT GROWTH, HARVEST, SURVIVAL, AND MICROHABITAT SELECTION IN THE GREEN RIVER, UTAH, 1978–82 9 (1987).

[388] *See id.*

[389] BOLKE & WADDELL, *supra* note 367, at A13. Dams like the Flaming Gorge Dam, which back up enough water to create deep reservoirs with thermal stratification, significantly change the downstream water temperatures. *See* MUTH ET AL., *supra* note 365, at 1-5. Summer temperatures tend to be much colder than the historical temperatures, and winter lows tend to be much warmer. *Id.* These changes make such rivers resemble cold mountain streams (in everything but the size of the river itself), and so they provide ideal habitat for coldwater trout fisheries in the river stretch immediately downstream of the dam, termed a tailwater. *Id.*

[390] JOHNSON ET AL., *supra* note 387, at 9 (relating that "[e]xcessively cold water temperatures depressed trout growth and detracted from the tail water's recreational appeal").

[391] *Id.*

[392] *Id.*

[393] BOLKE & WADDELL, *supra* note 367, at A13.

[394] *See id.* at A2.

[395] E. T. Garside & J. S. Tait, *Preferred Temperature of Rainbow Trout (*Salmo Gairdneri Richardson*) and Its Unusual Relationship to Acclimation Temperature*, 36 CAN. J. ZOOLOGY 563, 563 (1958); K. E. F. Hokanson et al., *Effects of Constant Temperatures and Diel Temperature Fluctuations on Specific Growth and Mortality Rates and Yield of Juvenile Rainbow Trout,* Salmo gairdneri, 34 J. FISHERIES RES. BOARD CAN. 639, 639 (1977).

[396] U.S. DEP'T OF THE INTERIOR, BUREAU OF RECLAMATION, UPPER COLO. DIV., NEGATIVE DETERMINATION OF ENVIRONMENTAL IMPACT A-3 (1976) (observing "The

intakes allowed for much warmer summer water, in the trout's ideal growth range,[397] and growth shot up three fold.[398] As a result, angler harvest, use, and yield dramatically increased,[399] and the Green River below Flaming Gorge Dam remains one of the top ten trout fishing areas in the United States.[400] Fishing guides know the river sections close to the dam as "the aquarium," due to the crystal clear water and the many trout.[401] Utah officials estimate fish densities up to 22,000 fish per mile.[402] It is a great place to catch a trout, and it has proved an economic boon to the region and the state. As of 2005, an estimated 83,500 people per year visit the Green River below the dam,[403] with direct expenditures by river visitors of roughly $21.4 million per year.[404]

Although the trout, the fishermen, and the regional economy have fared very well with the dam and the modified temperature regime, not so the native fishes. The introduced trout species generally do not directly interact with native fishes, because the species require a markedly different temperature regime than the native fishes.[405] But places that trout love make poor habitat for the historic fishes of the Upper Colorado River Basin.

Managers demarcate the Green River into three management reaches below the dam: reach 1: from the Flaming Gorge Dam to the Yampa River confluence (river mile ("RM") 410 to 345 (upstream numbers are higher)), where flow and temperature are almost entirely dam dependent; reach 2: from the Yampa River confluence to the White River confluence (RM 345 to 246), where flow and temperature depend on both inflow from the Yampa River and releases from Flaming Gorge Dam; and reach 3: from the White River confluence to Colorado

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purpose of the penstock modifications is to increase the Green River tailwater temperatures to improve trout production and the recreational fishery use."). The penstocks created several possible inlet levels and allowed the dam operators to choose the level of water withdrawal from the reservoir, and those the temperature of the released water. *Id.*

[397] Olden, *supra* note 366, at 134 (relating that the average post dam temperature from May to August increased from 5.7°C to 11°C after the modification, with average high temps in July and August around 13°C or 14°C).

[398] *Id.* at 2.

[399] *Id.* at 69.

[400] *See, e.g.*, David Knapp, *18 Greatest Trout Streams in the Western U.S. and Canada*, WIDE OPEN SPACES (Aug. 30, 2016), http://www.wideopenspaces.com/18-best-trout-streams-western-us-canada-pics/ [https://perma.cc/B42Y-5XCB]; John Merwin, *John Merwin Fishes America's Best Tailwater: Utah's Green River*, FIELD & STREAM (Mar. 31, 2005), http://www.fieldandstream.com/articles/fishing/fly-fishing/where-fish/2005/03/john-merwin-fishes-americas-best-tailwater-utahs-gre [https://perma.cc/5BSG-Q8DY].

[401] Merwin, *supra* note 400.

[402] *Green River Details*, GREEN RIVER FLY FISHER, http://www.greenriverflyfisher.com/river.php [https://perma.cc/YZ5C-7PQ7] (last visited Aug. 5, 2017).

[403] U.S. DEP'T OF THE INTERIOR, BUREAU OF RECLAMATION, UPPER COLO. REGION, OPERATION OF FLAMING GORGE DAM: FINAL ENVIRONMENTAL IMPACT STATEMENT App-282, A-297 (2005) [hereinafter 2005 FLAMING GORGE EIS]. Of note, visitation on the reservoir created by the dam is roughly ten times higher than the river visitation. *Id.*

[404] *Id.*

[405] *See* MUTH ET AL., *supra* note 365, at 1-6.

River confluence (RM 246 to 0), where more natural conditions predominate.[406] The endangered fish populations in the Green River generally stay downstream of reach 1 (below the Yampa River confluence), because the unregulated Yampa restores the more natural river flow, sediment load, and temperature profile the native fishes require for survival and successful reproduction.[407]

Low temperatures below the dam prevent pikeminnow from breeding in reach 1[408] and have eliminated bony tail and humpback chub from much of their former habitat.[409] As a reference point, trout may experience negative impacts at water temperatures above 18 °C,[410] although they may be able to tolerate temperatures as high as 24 °C under some conditions.[411] In contrast, reproduction for the listed species does not occur below 18 °C.[412] When reproduction does occur, growth of all of the endemic Colorado River fishes is dramatically faster at temperatures above 20 °C—perhaps even orders of magnitude faster—resulting in far higher survival.[413] Water temperatures below 22 °C have severe negative impacts on development and growth of young Colorado pikeminnow, virtually halting growth in many cases.[414] For these fishes, thermal modification to warm the rivers is likely the only way to increase successful reproduction below the dam,[415] and successful restoration efforts cannot afford to disregard river stretches immediately below dams.[416]

The science is clear that warmer waters will improve the survival of these native fishes. The 1992 Biological Opinion ("BiOp") recognized the role of water temperatures:

> The change in water temperatures as a result of impoundments is believed to be one of the causes for the decline in rare and endangered fish

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[406] *Id.* at 3-6 to 3-8.

[407] *See id.* at 1-8.

[408] *See* U.S. FISH & WILDLIFE SERV., FINAL BIOLOGICAL OPINION ON THE OPERATION OF FLAMING GORGE DAM 13 (1992) [hereinafter 1992 FLAMING GORGE BIOP]. For Colorado pikeminnow, temperatures resulting in optimum spawning period range from 20 or 22 to 25, and spawning appears to be temperature dependent. *Id.*

[409] Robert W. Clarkson & Michael R. Childs, *Temperature Effects of Hypolimnial-Release Dams on Early Life Stages of Colorado River Basin Big-River Fishes*, 2000 COPEIA 402, 402–03 (2000). Humpback chub require temperatures above 17ºC to begin their spawning activities, and their young need long, warm growing seasons to stimulate fish growth. MUTH ET AL., *supra* note 365, at 5-4.

[410] 2005 FLAMING GORGE EIS, *supra* note 403, at S-35.

[411] Filbert & Hawkins, *supra* note 386, at 824. Boughton et al. found no drop in steelhead growth rates at temperatures up to 16.5ºC in conditions of high food availability. David A. Boughton et al., *Stream Temperature and the Potential Growth and Survival of Juvenile* Oncorhynchus mykiss *in a Southern California Creek*, 52 FRESHWATER BIOLOGY 1353, 1353 (2007).

[412] 1992 FLAMING GORGE BIOP, *supra* note 408, at 13. For Colorado pikeminnow, temperatures resulting in optimum spawning period, range from 20 or 22 to 25, and spawning appears to be temperature dependent. *Id.*

[413] Clarkson & Childs, *supra* note 409, at 407.

[414] MUTH ET AL., *supra* note 365, at 4-26.

[415] Clarkson & Childs, *supra* note 409, at 410.

[416] *Id.*

> throughout the Colorado River Basin. Water temperature was shown to influence spawning migrations, spawning, egg viability, larval survival, feeding, and growth of endangered fish. Providing warmer water during critical life history periods could further benefit the affected fish.[417]

The scientific paper underlying the 2005 BiOp also acknowledged the myriad benefits of warmer water:

> Warmer water would provide cues for adults migrating to spawning areas, aid gonadal maturation, enhance the likelihood of reproduction by Colorado pikeminnow in Lodore Canyon, and enhance growth of early life stages of fishes in nursery habitat . . . . Improving [temperature] conditions in Lodore Canyon also could result in expansion of endangered fish populations . . . .[418]

In recent years, Colorado pikeminnow have once again begun spawning just above the confluence with the Yampa, but only after water temperatures were marginally increased under the latest Dam BiOp.[419] To sum up the science, if a dam were truly to be operated in a way that favored native river fishes, the temperature of water releases would be as high as possible.

In fact, the Flaming Gorge Dam is supposed to be operated in a way that favors native river fishes.[420] Indeed, the dam officially serves as native fish mitigation for the Upalco, Jensen, and Uinta Units of the Bureau of Reclamation's Central Utah Project, the Duchesne River Basin Project, the proposed Narrows Project, the ongoing Price-San Rafael Salinity Control Project, and other water development related projects in the Colorado River Basin.[421] The 2005 Flaming Gorge BiOp requires that the dam and reservoir "compensate for those depletions and be operated for the benefit of the endangered fishes in conjunction with [their] other authorized purposes."[422] Thus the Flaming Gorge Dam should be protecting and conserving the listed species downstream, but the biological opinions authorizing operation of the dam have largely written off conservation of the listed species in Reach 1, the first sixty-five miles below the dam.

Even though the BiOp for the 1992 Flaming Gorge Operations FEIS "is fully intended to benefit the endangered Colorado River fish,"[423] it ignored the potential for recovery in the first reach below the dam and instead only recommended target temperatures and flows beginning near Jensen, Utah, ninety-eight miles downstream from the dam.[424] The BiOp agreed that "[p]resent operation of Flaming Gorge Dam

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[417] 1992 FLAMING GORGE BIOP, *supra* note 408, at 32.
[418] MUTH ET AL., *supra* note 365, at 5-13 (alteration added).
[419] Clarkson & Childs, *supra* note 409, at 410.
[420] 2005 FLAMING GORGE BIOP, *supra* note 364, at 4–5.
[421] *Id.*
[422] 2005 FLAMING GORGE EIS, *supra* note 403, at S-6
[423] 2005 FLAMING GORGE BIOP, *supra* note 364, at 91.
[424] *Id.* at 3.

through [reach 1] does not provide desirable flow and temperature conditions for endangered fish,"[425] even though "[t]he dominant factor influencing water temperature in Reach 1 is the temperature of water released from Flaming Gorge Dam."[426] By avoiding temperature targets for reach 1—where the trout-based sports fishery operates—the 1992 BiOp avoided much of the inherent conflict between management for trout and management for native species. Nevertheless, the 1992 BiOp required the Bureau to:

> [D]etermine the feasibility and effects of releasing warmer water during the late spring/summer period . . . [because] water temperatures in the Green River between Flaming Gorge Dam and the confluence with the Yampa River in Echo Park often remain below those deemed suitable for reproduction and growth of the endangered fish species . . . .[427]

The 1992 temperature requirements left reach 1 far too cold for native species and left much of reach 2 too cold for consistent use by the listed species.

In the 2005 BiOp, and the 2000 technical report underlying it, regulators again largely ignore reach 1. The 2000 technical report noted, "[r]ecommendations for Reach 1 are limited to Lodore Canyon because suitable water temperatures and other habitat needs are unlikely to be met upstream of the canyon. . . . [S]pecific recommendations for those species in Reach 1 are not warranted at this time."[428] "[H]abitat for endangered fishes in Reach 1 is limited to Lodore Canyon because the summer water temperatures upstream are too cold . . . ."[429]

They are too cold, in large part, because the dam operators choose water from the Flaming Gorge Reservoir that is ideal for the introduced trout, not the native fishes, and because of the decisions the dam operators made when installing the modified penstocks in 1978.

Nevertheless, the operators of the dam currently have some wiggle room in how they manage temperatures based on movement of the penstocks, but they tend to use that wiggle room to benefit the guest species. The 2000 technical report recommended that the dam operators release "relatively warm water from Flaming Gorge Reservoir (up to 15°C),"[430] which would result in water that would be barely within the listed species tolerance limits in the lower reaches of Lodore Canyon.[431] Even this target, which favors the trout fishery over the listed species,[432] has not been

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[425] 1992 FLAMING GORGE BIOP, *supra* note 408, at 24–25.

[426] MUTH ET AL., *supra* note 365, at 3-32. Under the 1992 BiOp, "[r]eservoir operators adjust the withdrawal system to find a layer of water with a temperature of 13°C [(55°F)] throughout the summer, so that a constant temperature of release water is maintained until mid-October," when the released water is colder. *Id.*

[427] *Id.* at 1-9.

[428] *Id.* at 5-1.

[429] *Id.* at xxvi.

[430] *Id.* at xxvii.

[431] *Id.* at 5-10.

[432] *Id.* at 4-92. The preference for trout extends beyond the exclusion of native fish from reach 1. Under the new temperature guidelines, the Service is still expecting mortality "as a

achieved. Under the current BiOp, the dam's "[o]perational guidelines direct operators to achieve maximum gate elevation (40 feet below reservoir surface) by June 15 of each year in order to deliver outflow temperatures of 15.0-16.0 °C, [as measured at the Greendale Gage, USGS 09234500] . . . during the summer months,"[433] but "[r]eleases of water from Flaming Gorge Dam averaged 13.5 °C (56.3 °F) from June through September 2013 and temperatures in excess of 16 °C (60.8 °F) occurred once on July 24."[434]

This account should not be read to entirely fault the current dam operators and the many technical experts and others working on Flaming Gorge temperature issues. In some ways, Flaming Gorge Dam was committed to management for trout in 1978 when the modified inlets were added to the dam. They are designed to favor water temperatures that benefit trout and do not allow for release of water from the top level of the reservoir, which averages 23 °C during the summer.[435] And some of the equipment in the dam may face challenges operating with water temperatures above 15.5 °C, although the nature and extent of the challenges are unclear.[436] The dam operations are saddled with a legacy that explicitly prefers the continuation of an introduced trout fishery to the detriment of the native listed fishes, and the more recent temperature analysis has just perpetuated that preference.

This aspect of the Green River story best highlights another reason guest species lead to conflict—the trout at issue here have been favored guests for so long that humanity has reshaped the local ecosystem itself to make them feel at home, and the novel ecosystem cannot coexist with the native species. When the Utah Fish and Game and Wyoming Game and Fish Departments poisoned the Green River in September 1962, and the Bureau of Reclamation and the Utah Fish and Game Department modified the penstocks in 1978 to deliver the ideal temperature for trout not native fishes, the ecosystem itself was remade into a perfect trout habitat. This places the trout in conflict with the native species, but it does so in a way that largely escapes attention under existing environmental law.

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result of drifting Colorado pikeminnow larvae in the Yampa River being exposed to thermal shock of differing water temperature in the Green River at their confluence," 2005 FLAMING GORGE BIOP, *supra* note 364, at 4-91 to 4-92, and suggests that the larva may require "temperature differences between the two rivers [of] 2°C or less."

[433] U.S. DEP'T OF THE INTERIOR, BUREAU OF RECLAMATION, ANNUAL REPORT OF OPERATIONS FOR FLAMING GORGE DAM, WATER YEAR 2013 16–17 (2015) [hereinafter OPERATIONS REPORT].

[434] *Id.* at 17.

[435] BOLKE & WADDELL, *supra* note 367, at A13.

[436] OPERATIONS REPORT, *supra* note 433, at 17 ("On July 24, operating temperatures on one of the units exceeded equipment thresholds, a high temperature alarm sounded, and as a result SWS gates were lowered to 45 vertical feet below the surface of the reservoir. Temperature of water passing through the unit at the time of the alarm was 15.6° C (60.0 °F). On July 29, high water temperatures were once again recorded and SWS gates were lowered an additional 5 vertical feet.").

1. Lesson: Guest Species May Be Better Adapted for the Current Environment than Native Species

In the Flaming Gorge, the dam and modified penstock system have changed the ecosystem to make it ideal for trout, which virtually eliminates the native fish species from the tail water stretch of the river. This habitat manipulation was deliberate, originally a choice to favor the nonnative trout, but managers now operate largely within the constraints set up by prior managers' decisions. Without serious investment and retooling of the penstocks and the hydropower equipment, managers are unable to return the habitat to its historic conditions.[437]

This same scenario plays out in ecosystems everywhere. In the example of the striped bass, the listed species in the Delta are in trouble not because of the striped bass itself, but because of anthropogenic habitat manipulation. The listed winter run Chinook salmon face extinction in part because large dams block access to their entire historic spawning habitat.[438] They are able to spawn only in the tail water below Shasta Dam, and they require cold-water releases from the reservoir to spawn there.[439] Warmer water temperatures due to prolonged drought or from other climate-change induced impacts will result in their extinction.[440] Similarly, delta smelt face extinction due to habitat loss, drought, climate change, and large scale water exports from the Delta.[441] Most of the fishes doing well in the Delta today are nonnative, and climate change will make the situation worse for the natives. A multifactor analysis of California fish populations under future climate scenarios found that "[m]ost native fishes will suffer population declines and become more restricted in their distributions; some will likely be driven to extinction. . . . In contrast, most alien fishes will thrive, with some species increasing in abundance and range."[442] In these systems, removing nonnative species will not restore the original systems. Indeed, they may just be the only species that can thrive in the novel ecosystems themselves. "A conservation strategy that eradicates species

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[437] Nat'l Oceanic & Atmospheric Admin., *Species in the Spotlight: Sacramento River Winter-Run Chinook Salmon*, http://www.nmfs.noaa.gov/stories/2015/09/spotlight_chinook_salmon.html [https://perma.cc/93K4-7TYA] (last visited Aug. 5, 2017).

[438] Such a modification has already been completed at Shasta Dam, in California, to provide cold water for salmon to spawn downstream in the Sacramento River, and is under consideration for Glen Canyon Dam, to provide warmer summer waters for a new population of humpback chub in the Colorado River through the Grand Canyon. Tracy B. Vermeyen, *An Overview of the Design Concept and Hydraulic Modeling of the Glen Canyon Dam Multi-Level Intake Structure*, *in* WATERPOWER '99: HYDRO'S FUTURE: TECHNOLOGY, MARKETS AND POLICY 1, 1 (1999).

[439] *Id.*

[440] Peter B. Moyle et al., *Climate Change Vulnerability of Native and Alien Freshwater Fishes of California: A Systematic Assessment Approach*, 8 PLOS ONE 1, 1 (2013).

[441] Jane Kay, *Delta Smelt, Icon of California Water Wars, Is Almost Extinc*t, NAT'L GEOGRAPHIC (Apr. 3, 2015), http://news.nationalgeographic.com/2015/04/150403-smelt-california-bay-delta-extinction-endangered-species-drought-fish/ [https://perma.cc/THG6-6W78].

[442] Moyle et al., *supra* note 440, at 1.

simply because they are non-native could undermine the very biological entities that may be the most likely to succeed in a rapidly changing world."[443]

Reconciliation ecology, the "[s]cience of inventing, establishing, and maintaining new habitats to conserve species diversity in places where people live, work, or play,"[444] offers one potential solution. Reconciliation ecology recognizes that much of our landscape consists of heavily managed habitats, habitats we are unwilling or unable to give up due to their economic importance, their location in the midst of our cities, or their centrality to our culture. We are unlikely to remove the ring dams around the Central Valley in California, or the major reservoirs throughout the Midwest that make the Mississippi River navigable. We need farmland to grow our food, energy to power our technology, and cities where we can live. These activities necessarily compromise habitat, but that habitat need not be written off. Instead, reconciliation ecologists seek to conserve species diversity in those compromised habitats to manage ecosystems in the places we live.[445]

"Reconciling novel ecosystems involves . . . : (1) setting realistic policy goals (including which species to favour); (2) understanding the basic ecology of the managed systems; (3) taking into account the needs of diverse segments of society; and (4) managing river flows and infrastructure on a more holistic basis . . . ."[446] As these three case studies show, the very first step, "setting realistic policy goals (including which species to favour)," is a step we have not taken. We have "the responsibility to determine what we want these integrated ecosystems to look like and what species we want them to contain,"[447] but thus far we have abdicated that responsibility.

2. Lesson: Existing Approaches to Guest Species Aren't Working

Ultimately, the Flaming Gorge trout call out the biggest questions about guest species. What should we do with them? They are here, they are not going away even with herculean efforts, and they will require ongoing management if we want to see a noticeably different species balance than what we have right now. As others have noted, this is largely a normative question. "[T]he decision process should start by asking the question 'what kind of ecosystem do we want?' The answer to the question will depend on societal values . . . and on views of what is actually possible as climate and other change occurs."[448] The easy answer, that the species we have added to an ecosystem are bad and should be removed, does not suffice. This facile analysis, which builds on the false dichotomy between humanity and nature, ultimately fails as a guidance metric. "Philosophically, we question how human actions differ from those of other species. In other words, why is a dispersal event

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[443] Schlaepfer et al., *supra* note 87, at 434.

[444] MICHAEL L. ROSENZWEIG, WIN-WIN ECOLOGY: HOW THE EARTH'S SPECIES CAN SURVIVE IN THE MIDST OF HUMAN ENTERPRISE 7 (2003).

[445] *Id.*

[446] Moyle, *supra* note 350, at 1342.

[447] *Id.* at 1337.

[448] *Id.* at 1342.

that is facilitated by, say, a migratory bird or storm event . . . considered natural, whereas a human-transported species is non-native and thus undesirable . . . ?"[449]

Even when focusing on the question of what species we should seek to maintain, the scientific community is divided.[450] And, as noted above, the idea that any human-mediated migration is a bad thing fails in light of the needed assisted migrations in the face of climate change. "[I]n some instances, the movement of species to new locations is a natural and desirable way of adapting to environmental change."[451] "One study estimates that climate change is forcing species to relocate at a rate ten times faster than occurred during the climate change at the end of the last ice age."[452] In short, "[n]early two centuries on from the introduction of the concept of nativeness, it is time for conservationists to focus much more on the functions of species, and much less on where they originated."[453] What should guide our decisionmaking with respect to guest species?

Some restoration ecologists propose a return to earlier ecosystem states. Much of the "[s]trong opposition to non-native species comes from those who wish to retain the historical character of a region[,]"[454] but in many cases, we can no longer turn back the clock. The anthropocene label heralds many global changes, directional changes, moving ecosystems away from historical norms at rates too fast for evolution or other adaptation to handle. Many ecosystems face local scale alterations that preclude survival of listed species absent ongoing human manipulation. Even if we could turn back the clock, we would face the question of which ecosystem to aim for and from which historical period. In the Midwest, would we seek to restore the native prairie as an ocean of grass? This open ecosystem was maintained only by regular burning by indigenous groups, and a more historic ecosystem in those areas would be an oak woodland.[455] In the West, would we allow wild horses? Ancestral wild horses were a part of the western landscape for thousands of years, before they were hunted to extinction, and the "second round" of wild horses have lived in the West for hundreds of years.[456] Or should one mimic the landscapes from the interim years, when horses were absent? Or would we

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[449] Schlaepfer et al., *supra* note 87, at 434; *see also* Bosselman, *supra* note 342, at 442 ("But what makes a species 'exotic'? Any attempt to define 'exotic' species must address the issue of unassisted migration versus introduction by humans.").

[450] Bosselman, *supra* note 342, at 443 ("Finding agreement among biologists about the desirability of particular exotic species has been difficult.").

[451] *Id.* at 506.

[452] *Id.* at 450.

[453] Davis et al., *supra* note 89, at 154. *But see* Simberloff, *supra* note 98, at 36.

[454] Schlaepfer et al., *supra* note 87, at 434.

[455] John M. Briggs et al., *Spatial and Temporal Patterns of Vegetation Within the Flint Hills*, 100 TRANSACTIONS KAN. ACAD. SCI. 10, 12 (1997); Fred B. Samson et al., *Great Plains Ecosystems: Past, Present, and Future*, 32 WILDLIFE SOC'Y BULL. 6, 9 (2004).

[456] Brian Kooyman et al., *Identification of Horse Exploitation by Clovis Hunters Based on Protein Analysis*, 66 AMERICAN ANTIQUITY 686, 687 (2001).

mimic the landscapes from the years horses were absent? Return to an historic landscape does not provide an easy way out of this debate.[457]

Could we leave the ecosystems as they are, abdicating any management responsibility? As Peter Moyle argues, "[t]he key for maintaining desirable . . . species and conditions in . . . ecosystems is active management towards a defined set of goals."[458] This requires well defined goals. As discussed above,[459] Doremus, argued that "[p]rotecting wild species and ecosystems means . . . leaving the future of those species or ecosystems to the ordinary processes of evolution, rather than steering them deliberately toward some human vision of usefulness or beauty."[460] The birth of the Anthropocene challenges this view and strongly suggests that a nature where humans seek to minimize their intervention is a nature very different—and arguably much impoverished—from the one we see around us right now.

Deciding what to do with guest species, value laden as it is, requires hard choices. Do we favor native species over guest species? Do we favor native species when their ecosystems have changed and their former habitats no longer exist? Do we favor native species when they are unlikely to persist in their current habitats over the longer term? Refusing to answer these questions is unlikely to end well for native species, healthy ecosystems, and all of us who depend on them. Further, these questions should not be left to the courts—as the palila and striped bass cases suggest, courts are not well-equipped to make these normative decisions, particularly without any comprehensive federal legislation providing guidance.

Ignoring the problem or returning to a historical baseline simply will not produce acceptable results. As others have noted, "[t]he Anthropocene invites a critical reassessment of the principles that guide environmental law."[461] "[S]ince the disruptions of the Anthropocene have begun, and will continue, human society needs to guide its adaptation by recognizing a new set of legal principles."[462] Resolving these questions requires a rethinking of our modern environmental philosophy.

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[457] SUSAN J. ARMSTRONG & RICHARD G. BOTZLER, THE ANIMAL ETHICS READER 542 (2016) (Suggesting of ecologists in the future, "[i]nstead of determining what species formerly occurred in an area and how to restore these species, they might determine what they want the area to look like in the future. Species that are economically or biologically damaging will likely be controlled, regardless of their historic origin. Conversely, species that are considered desirable for their aesthetic beauty, rarity, economic, or intrinsic value will likely be protected, subsidized, or left alone, regardless of whether their former status was native or non-native.").

[458] Moyle, *supra* note 350, at 1337.

[459] Doremus, *supra* note 45, at 1.

[460] *Id.* at 16.

[461] Nicholas A. Robinson, *Fundamental Principles of Law for the Anthropocene?*, 44 ENVTL. POL'Y & L. 13, 25 (2014).

[462] *Id.* at 13.

IV. TOWARD DEVELOPMENT OF GENERAL PRINCIPLES OF MANAGEMENT IN THE ANTHROPOCENE

As noted in the Introduction, much of our modern environmental law holds the Balance of Nature myth as its philosophical foundation. To reiterate:

> the Balance of Nature myth has three basic features: First, Nature, undisturbed by human influences, achieves a permanency of form and structure that persists indefinitely. Second, this permanent condition is the best condition for Nature: best for other creatures, best for the environment, and best for humans. Third, when disturbed from this perfect state, Nature is capable of returning to it.[463]

This myth embodies both the idea of ecosystems as generally permanent and humans as a force outside the ecosystems bent on disturbing them.[464] Rejecting this myth raises serious philosophical concerns about what exactly we are protecting.

These philosophical concerns seem particularly pressing because some commentators have used the reexamination of balance of nature to launch an attack on the foundations of environmental protection.[465] The idea that there is no inherent balance to nature, no "right" natural kind of ecosystem for a given location, has led some to conclude there is no ethical responsibility to protect nature at all.

Ecologists embraced the balance of nature myth in their descriptions of ecosystems, viewing the ecosystem as a self regulating entity that, absent outside disturbance, tended to maintain itself over time.[466] Although the equilibrium view of ecosystems does not require a separatist view of humanity, such a view has been implicit in the equilibrium view from the beginning. For example, in 1936, Clements, the father of the equilibrium or balance view, cautioned that "[m]an alone can destroy the stability of the [ecosystem] during the long period of control by its

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[463] Botkin, *supra* note 25, at 26.

[464] *See, e.g.*, Jonathan Baert Wiener, *Law and the New Ecology: Evolution, Categories, and Consequences*, 22 ECOLOGY L.Q. 325, 344 (1995) (blending the disequilibrium concept with what he terms the "separatist-taint presumption," that man should lead well enough alone and then nature will be "OK").

[465] *But see* Peter Manus, *Our Environmental Rebels: An Average American Law Professor's Perspective on Environmental Advocacy and the Law*, 40 NEW ENG. L. REV. 499, 503 (2006) ("There is plenty of support for the notion that Americans gauge the social acceptability of behavior on its legality—or, more precisely, on whether the behavior, legal or not, tends to be *punished* under the law."). Manus further suggests "that morality is defined in American culture by the law, so that, in fact, the only logical basis upon which we Americans may come to breed an environmental ethic into our everyday thinking is the law." *Id.* Under Manus's reading, the existing law informs environmental ethic, suggesting that these philosophical changes may have little real world impacts, at least on the morality side of the question.

[466] Wiener, *supra* note 464, at 350.

climate, and he accomplishes this by fragments in consequence of a destruction that is selective, partial or complete, and continually renewed."[467]

To ecologists, one's view of an ecosystem does not prescribe an ethical approach, but simply informs how one understands ecosystem functions through time. To the extent that the environmental movement understood the ecosystem approach as requiring or justifying an ethical view, that understanding seems to stem from the preexisting balance of nature view discussed above.[468] Nevertheless, the ecosystem paradigm shift away from the equilibrium view and its longstanding association with a separatist philosophy has offered some an opportunity to argue that environmentalists are artificially and unfairly targeting human impacts on the environment. "The newly popularized view of nature as an erratic, competitive phenomenon . . . has provided moral and scientific justification for the attempted backlash against social and legal programs protecting it."[469] Those opposing the forces of conservation used this opportunity to revive arguments that the human impact on nature is just one among the uncountable collection of hard knocks delivered between and among Earth's species. If there is no balance, no integrated symbiotic whole, then, as one commentator asked: "why not go ahead with all our private ambitions, free of any fear that we may be doing special damage?"[470] "[A] vision of nature in motion . . . and of a nature that encompasses humans as well—wipes away the concept of a stable balance of nature, and along with it the dividing line between what is human and what is nature, what is presumptively good and presumptively bad."[471] Myriad attacks on modern environmentalism exploit this angle, on issues ranging from the birth of the modern environmental movement,[472]

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[467] Frederic E. Clements, *Nature and Structure of the Climax*, 24 J. ECOLOGY 252, 256 (1936).

[468] Wiener, *supra* note 464, at 350.

[469] Peter Manus, *One Hundred Years of Green: A Legal Perspective on Three Twentieth Century Nature Philosophers*, 59 U. PITT. L. REV. 557, 644 (1998). Manus suggests that this gave the 104th Congress some scientific cover to attack command and control environmental programs. *Id.* at 645. Even more insidious, supporters of sustainable development have used the new ecology to argue for more intervention in ecosystems, with a focus on human needs and no recognition of the inherent value of biodiversity. "[I]t is not always true that 'nature knows best' because nature often creates ecosystems that are inefficient, wasteful, and destructive. Thus, the non-equilibrium perspective proposes that by using reason, knowledge, imagination, and toil, people can shape ecosystems that have more efficient qualities that nature could not achieve." Lakshman Guruswamy, *Integration & Biocomplexity*, 27 ECOLOGY L.Q. 1191, 1195 (2001). As Kuhlmann notes, "these ideas are a throwback to the good old days of Gifford Pinchot's 'scientific management' when it was understood that humans were in charge, and whatever served 'the greatest good of the greatest number' of humans was the right answer." Kuhlmann, *supra* note 41, at 135.

[470] Donald Worster, *The Ecology of Order and Chaos*, 14 ENVTL. HIST. REV. 1, 16 (1990).

[471] Wiener, *supra* note 464, at 350.

[472] *See, e.g.*, ROGER MEINERS ET AL. EDS., SILENT SPRING AT 50: THE FALSE CRISES OF RACHEL CARSON 3, 6, 143 (2012) (listing several examples of authors using ecology's rejection of the balance of nature view to attack environmentalism writ large).

to management of old growth forests,[473] to climate change,[474] to the entire federal environmental framework.[475]

This is not merely an academic struggle; the emerging ethos shows up in both the lay view and in management approaches. For example, the climate skeptic websites are rife with "there is no balance of nature" arguments,[476] which essentially make the argument that anthropogenic carbon emissions are not upsetting the natural carbon cycle, because that cycle was never inherently balanced in the first place, and thus there is no balance to upset. Kuhlmann provides an excellent overview of the dangers of this approach bleeding into management decisions, as embodied in the Forest Service's ecosystem management:

> This new approach gives the full range of human action within a forest equal standing with those structural and functional elements of the "system" which are biologically interactive and interdependent from an ecological and evolutionary perspective. . . . In these proposed Forest Service regulations, I see the legal echo of the imperial ecologist/historian claim that we inhabit "a planet in which the human and the natural can no longer be distinguished" or the characterization of wilderness as largely a "complex cultural construction."[477]

If the human and the natural cannot be distinguished, and wilderness is largely a cultural construction, then the biological costs that humanity imposes on forests for its own benefit cease to be their own responsibility and instead are just part of the eternal struggle between coequal species.[478] In short, "[a]dmitting that change is

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[473] ALSTON CHASE, IN A DARK WOOD: THE FIGHT OVER FORESTS AND THE RISING TYRANNY OF ECOLOGY 166–79 (1995).

[474] Michael Crichton, Address at the National Press Club (Jan. 25, 2005), http://michaelsantomauro.blogspot.com/2009/11/michael-crichton-case-for-skepticism-on.html [https://perma.cc/6FCS-A7MY].

[475] RANDY T. SIMMONS ET AL., NATURE UNBOUND: BUREAUCRACY VS. THE ENVIRONMENT 1–7 (2016).

[476] *See* Michael Rivero, *Climategate: A Crime Against Humanity*, WHAT REALLY HAPPENED, http://www.whatreallyhappened.com/WRHARTICLES/climategate.php [https://perma.cc/R3J9-JH6D] (last visited Aug. 5, 2017); Daniel B. Botkin, *Botkin and the Balance of Nature*, SKEPTECO (Feb. 17, 2013), https://skepteco.wordpress.com/2013/02/17/botkin-and-the-balance-of-nature/ [https://perma.cc/W4YU-LFST] (book review).

[477] Kuhlmann, *supra* note 41, at 155–56.

[478] Further,

> rather than moving toward a clearer picture and public understanding of the biological costs of intensive forest manipulation (e.g., more conservation biology in environmental impact statements), the strategy is to commingle the biological needs of other species with the socio-economic needs and desires of humans, thereby avoiding any separate accounting for the impoverishment of the land. In simple terms, even if species and rare habitats are being threatened and lost at unprecedented rates, if the benefits to human needs and desires are substantial enough, then the net impact of a management plan is deemed positive and can be proclaimed "good for the ecosystem."

necessary seems to open a Pandora's box of problems for environmentalists. The fear is simple: Once we have admitted that some kinds of changes are good, how then can we argue against any changes—against any alteration of the environment?"[479]

The answer cannot be that we should recognize human activities in ecosystems as just another natural force in a chaotic system, thereby placing our whims on a coequal footing with ecosystem health. We must reject these calls as the smokescreen they are. Recognizing that ecosystems change, and that humanity is a part of those ecosystems, does away with the easy shorthand that natural is good and that human interference is bad.[480] But it simply does not follow that all human impacts on ecosystems are acceptable or, because they are natural, that they are therefore unobjectionable. If the Anthropocene teaches us anything, it is that human environmental impacts are different in character from most other biogenic impacts.

Anthropogenic change can be differentiated from "natural" change based on its unusually fast rate and degree, which tends to outstrip the ability of most ecosystems, and, indeed, life itself to adapt to new conditions.[481] Moreover, "human activities . . . cause linear, unidirectional, continuous change that take[] us into realms beyond the experience of ecological systems."[482] These changes, like increasing carbon dioxide in the air and nitrogen in the water, are likely to move ecosystems out of the cycles to which we are accustomed and into "areas beyond the ability of science to foresee the effect on the natural world."[483] Consider again the potential markers of the Anthropocene: widespread deposition of plastic;[484] globally distributed fuel ash;[485] increased global temperatures;[486] increased CO2 levels resulting in ocean acidification; the radiocarbon bomb spike;[487] increased nitrate concentrations essentially everywhere;[488] the presence of anthropogenic persistent

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Id. at 136.

[479] Bryan Norton, *Change, Constancy, and Creativity: The New Ecology and Some Old Problems*, 7 DUKE ENVTL. L. & POL'Y F. 49, 52 (1996).

[480] Timothy H. Profeta, *Managing Without a Balance: Environmental Regulation in Light of Ecological Advances*, 7 DUKE ENVTL. L. & POL'Y F. 71, 75 (1996) ("This is not to say that all human influence on the environment is *per se* valid. It only means that humans must engage in a much more complex analysis of our impacts, rather than reverting to a simple separatist model.").

[481] Norton, *supra* note 479, at 57; s*ee also* Judy L. Meyer, *The Dance of Nature: New Concepts in Ecology*, 69 CHI.-KENT L. REV. 875, 882 (1994).

[482] Fred Bosselman, *What Lawmakers Can Learn from Large-Scale Ecology*, 17 J. LAND USE & ENVTL. L. 207, 220 (2002).

[483] *Id.* at 221; s*ee also* Reed F. Noss, *Some Principles of Conservation Biology, as They Apply to Environmental Law*, 69 CHI.-KENT L. REV. 893, 908 (1994) ("In ecology and conservation biology, the more we learn, the more we recognize our profound ignorance.").

[484] Waters, *supra* note 2, at aad2622-1.

[485] *Id.* at aad2622-2.

[486] *Id.* at aad2622-5.

[487] *Id.*

[488] *Id.* at aad2622-4

organic pollutants;[489] and widespread extinction and other changes in biodiversity.[490] Not since the Great Extinction Event 2.4 billion years ago, when photosynthesizing bacteria poisoned most existing life by creating the modern oxygenated atmosphere, has any other organism made global changes like these. Arguing that anthropogenic changes should get the same treatment as any other natural change simply is not tenable. Or perhaps the changes should get the same treatment that any other change would, if other changes paralleled these anthropogenic changes in degree. The distinction is unlikely to matter for most major anthropogenic ecosystem impacts, given the degree of our impacts.[491] Regardless of the natural or anthropogenic origin of significant impacts on a given ecosystem, if the impacts are destroying the ecosystem, we tend to seek to address the impacts. Just as human actions in ecosystems are not inherently bad, they are not inherently good and acceptable. We can distinguish between acceptable and unacceptable human impacts. As Michael Pollan notes, "it is possible to make distinctions between kinds and degrees of human intervention in nature. Isn't the difference between the Ile de France and Love Canal, or a pine forest and a condo development, proof enough that the choice isn't really between 'all or nothing'?"[492] Accepting, then, that not all human activities are permissible as merely part of nature, the question remains: what normative values should guide conservation work in the Anthropocene?

Other commentators have begun the difficult process of establishing new normative guidance through "a lively debate about how to re-imagine our relationship with the places that shape us as individuals, communities, and nations."[493] Most of the principles bandied about fall into a short list of general

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[489] *Id.*

[490] *Id.* at aad2622-7 to -8.

[491] Tarlock seems to suggest as much, even with respect to the use of ecology as a guide for what kinds of impacts are acceptable.

> The non-equilibrium paradigm does not undermine the need for biodiversity protection because it accepts the principal lessons of ecology, that unregulated, humans can damage ecosystems, and that the magnitude of human intervention is often too great. In many instances, the paradigm strengthens the scientific case for ecosystem management while exacerbating the politics of that management. The non-equilibrium scale of management is larger and the emphasis is on the maintenance of processes that produced undisturbed systems. The new paradigm is also the basis for the argument that since nature is in flux, human change is just another "flux" to be tolerated; however, ecologists reject this argument because it undermines the functional, historical and evolutionary limits of nature.

A. Dan Tarlock, *Environmental Law: Ethics or Science*, 7 DUKE ENVTL. L. & POL'Y F. 193, 202 (1996); s*ee also* Profeta, *supra* note 480, at 76 (calling the separatist/holist debate "an irrelevant semantic argument . . . . for management purposes, it is a distraction.").

[492] MICHAEL POLLAN, SECOND NATURE: A GARDENER'S EDUCATION 194 (1991).

[493] Anastasia Telesetsky, *Ecoscapes: The Future of Place-Based Ecological Restoration Laws*, 14 VT. J. ENVTL. L. 493, 496 (2013); s*ee also* Melinda Harm Benson, *Reconceptualizing Environmental Challenges—Is Resilience the New Narrative?*, 21 J. ENVTL. & SUSTAINABILITY L. 99, 100 (2015); Sanford E. Gaines, *Reimagining Environmental Law for the 21st Century*, 44 ENVTL. L. REP. 10188, 10188 (2014); Nicholas

concepts: environmental rights,[494] sustainable development,[495] resilience, "biophilia" or appreciation of nature,[496] and large scale protection of coupled social/natural systems ("ecoscapes").[497] Just as, in "the 1960s, modern environmental law emerged as a key expression of a new social awareness of the deteriorating environmental conditions," these concepts may emerge from the environmental law community as a social response to the depth of the Anthropocene crisis.[498] This discussion is only beginning, and I suggest several additional principles that merit consideration: maintenance of natural biogeochemical cycles; giving ecosystems space and time to develop natural dynamics like local adaptations and population structure; embracing the notion that manmade nature is better than nothing; and perhaps that less management is better than more management.[499] These ideas need development, criticism, and additional research, and this Article is only a first step into a long and, I hope, productive discussion.

Among the principles others have proposed, environmental rights, appreciation, resilience, and conservation of ecoscapes seem to be the most promising, and some of these principles provide guidance on the question of guest species. Environmental

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A. Robinson, *Keynote: Sustaining Society in the Anthropocene Epoch*, 41 DENV. J. INT'L L. & POL'Y 467, 467 (2013); Robinson, *supra* note 461, at 13.

[494] Robinson, *supra* note 461, at 13 ("Nations are reacting to the new demands by promulgating substantive environmental rights and procedural means to enforce those rights. Environmental rights seek to shift society toward attaining societal wellbeing, or happiness, and not economic growth as such."). "This new paradigm of environmental rights is being forged, incrementally, across and within nations worldwide." *Id.* at 16. The environmental rights paradigm can be envisioned narrowly, encompassing only human rights and including other principles like sufficiency, wellbeing or happiness, justice, and cooperation. *Id.* It can also be envisioned more broadly, including foresight and justice for nature itself. *Id.*

[495] Robinson, *supra* note 493, at 467–68. Sustainable development is unlikely to suffice as a principle to address the Anthropocene, as it has thus far large encouraged business as usual. "At the plane of international law, and at the national law level, it must be conceded that the promise of 'sustainable development' remains elusive, despite many best efforts to embrace the many sensible prescriptions around the concept." *Id.* at 475–76.

> [W]e must admit that we have no idea what we can sustain. Our overarching thesis can be summarized with this three-pronged analysis: (1) sustainability goals for natural resources and the environment are based on assumptions of stationarity, (2) climate change and associated ecological dynamics are eliminating our ability to rely on stationarity, and therefore (3) we need a new paradigm for a world of continual change.

Benson, *supra* note 493, at 112–13.

[496] Robinson, *supra* note 493, at 490.

[497] Telesetsky, *supra* note 493, at 524.

[498] Gaines, *supra* note 493, at 10188.

[499] Some of these principles may also be found in Anastasia Telesetsky's Ecoscapes approach. Telesetsky, *supra* note 493, at 521 ("What is needed is a cognitive shift by both decision-makers and other individuals to an ecologically based restoration that begins with the land and water as places that we inhabit and presumably value as something more than fungible commodities. For restoration to be effective as a long-term ecological conservation strategy, we need to recover natural processes to a condition where they might be capable of natural resilience.").

rights and conservation of ecoscapes seem to lack the specificity needed to analyze the guest species issue, as they seem more about conservation of natural systems generally than about what kind of natural system to conserve or the hard decisions that factor into management of these systems.

Nicholas Robinson proposed "appreciation" to recognize "our positive instincts about nature."[500] Others note "humans do feel instinctively drawn to the natural world. Even the most minimal access to green space has been shown to expedite healing in hospital patients, help children learn more effectively in schools, increase productivity in the workplace and help people find mental solace overall. People report feeling at peace when immersed in nature and often report a sense of being part of something larger."[501] People who participate in outdoor recreation tend to engage in proenvironment behavior at much higher levels than the general public.[502] Promoting this appreciation requires inducing people to interact with nature, and, as noted above, these interactions often include or depend on guest species.

Removing guest species may have the effect of excluding people from places or activities they love and devalues the appreciation people have for guest species, likely reducing their proenvironment attitudes. It may also, as seen in the goat case study, result in direct action by the public to frustrate conservation efforts. This principle suggests that access to nature-based recreation, including guest species, will be vital for future conservation efforts. This does not suggest that species like the goats should not be controlled or removed, only that, in doing so, resource agencies should balance public desires and perhaps establish areas in already degraded habitats where guest species populations can be maintained. This was suggested early in the goat removal project and could have eased public reaction to the goat elimination effort.[503] Building on the North American Model of Wildlife Conservation, hunting fees could cover both the establishment of new hunting areas and mitigation for the listed species, by diverting part of the license fee to pay for mitigation. This could be accomplished via Section 7 consultations (for any involved federal agencies) or via Section 10 incidental take permits. However, a cleaner solution would involve federal legislation recognizing and "naturalizing" select guest species, a form of the "white listing" of approved species suggested in other settings.[504] Neither of these solutions addresses the problem of indirect take via state regulation of hunting, a la *Palila*, but that problem is ultimately not a problem of

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[500] Robinson, *supra* note 493, at 469.

[501] Sonya Sachdeva, *Religious Identity, Beliefs, and Views about Climate Change*, OXFORD RES. ENCYCLOPEDIA CLIMATE SCI. (Sept. 2016), http://climatescience.oxfordre.com/view/10.1093/acrefore/9780190228620.001.0001/acrefore-9780190228620-e-335?print=pdf [https://perma.cc/2F8C-66PW] (internal citations omitted).

[502] Gene L. Theodori et al., *The Association of Outdoor Recreation and Environmental Concern: Reexamining the Dunlap-Heffernan Thesis*, 63 RURAL SOCIOLOGY 94, 94 (1998).

[503] GIFFIN, *supra* note 232, at 82 ("Resistance can partially be overcome by providing alternate hunting areas.").

[504] Sophie Riley, *Peak Coordinating Bodies and Invasive Alien Species: Is the Whole Worth More than the Sum of Its Parts?*, 35 LOY. L.A. INT'L & COMP. L. REV. 453, 469 (2013).

native species versus guest species but instead results from implementation of the ESA. Appropriate regulatory guidance could constrain these suits.

For Melinda Benson, resilience is "the capacity of a system to absorb a spectrum disturbance and reorganize so as to retain essentially the same function, structure, and feedbacks—to have the same identity."[505] She puts "the emphasis in resilience thinking . . . on understanding the dynamics and complexities of the [social-ecological systems], not on determining and then maintaining a fixed system state. The emphasis is *building adaptive capacity* rather than *maintaining stationarity*."[506] Robinson would frame this concept "as a duty[:] 'states shall sustain and enhance characteristics of resilience within all systems under their jurisdiction or control.' This definition would extend to human socio-economic systems, ecosystems, and other nature phenomena such as hydrologic systems."[507] In light of this principle, eliminating guest species from habitats where they are thriving, where they are not unduly impacting native species, and where native species are not likely to persist seems like a strange decision. It seems foolish to give up something that works and is resilient for something that does not.

This would not apply in the case of the goats, where the goats themselves are dangerously destabilizing the ecosystem. But in the case of the striped bass in the Delta, the bass are not destabilizing the system. They are fulfilling a natural predator role, distinguished only by their anthropogenic origin, and absent the striped bass, another predator would likely take up the slack. Getting rid of a species like this weakens the system and reduces its resilience. "Some observers argue that the globalization of so many species is reducing the diversity of ecological systems worldwide because so many of them are becoming occupied by similar species,"[508] but many of these new populations are on new evolutionary trajectories and may eventually become species in their own right. And if not, having a successful species in an ecosystem is still an improvement over a depauperate system. Although invasive species can sometimes destabilize a system and are more inclined to do so than species in a coevolved ecosystem, "[t]he growing number of observations of rapid adaptation in novel ecosystems . . . , together with the phenomenon of 'native invaders,' . . . suggest that the harms associated with non-native species are not inevitable outcomes of their history or biology."[509] Some ecologists use this idea to reconsider nonnative species from a different viewpoint, one that does not rely on their place of origin. "Thus, the phenomenon we usually refer to as 'invasive species' can instead be considered a general process of species undergoing population irruptions . . . . Within community ecology, population irruptions and their consequences are well-known responses to the loss of top-down regulation . . . ."[510] Native species like the spruce beetle, responsible for killing millions upon millions of trees in the west, or the overpopulated whitetail deer in the Midwest or the elk in

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[505] Benson, *supra* note 493, at 115.
[506] *Id.* at 116.
[507] Robinson, *supra* note 493, at 496.
[508] Bosselman, *supra* note 342, at 442.
[509] Wallach, *supra* note 248, at 148.
[510] *Id.*

Yellowstone would be recognized as threats in need of control in this view, on the same plane as the goats in Hawaii. This approach puts the emphasis back on ecosystem resilience, not on the origin of the species in the ecosystem. This seems particularly appropriate for our many novel ecosystems, where no species can truly be said to be native, at least in the sense that no species evolved in that novel ecosystem.

In the end, perhaps this is all guest species require—to be weighed on their own merits, without a finger on the scale due to their anthropogenic origin. Like some native species, some guest species—goats, pigs, northern pike in some habitats, for example—present such a danger that they should be strictly limited or, when possible, eliminated. Certainly, given the history of nonnative species, the default view of nonnative species should still be one of suspicion,[511] and new introductions should be assiduously avoided. But from a policy perspective, for some guest species, the good guests that we have made a part of our ecosystem and culture, it is time to remove the guest label altogether and consider them natives of our new nature.

Many existing guest species do little harm, fit well in the ecosystems they have joined, and should be allowed to persist and even be conserved. A longstanding metaphor considers an ecosystem like a watch, and cautions that every part likely plays a role, even if we cannot discern the role for every piece of the system. Similarly, as we go about the tricky business of building and managing new watches in the age of the Anthropocene, we would be well-served not to throw away pieces just because we do not like how those pieces got to the repair table in the first place. We must evaluate guest species on their own merits.[512]

V. CONCLUSIONS

The separatist view, which considers humans as something outside of ecosystem, inheres in our longstanding philosophy of the balance nature and in our environmental laws based on that philosophy. But the separatist view is actually a false dichotomy and leads us astray in our conservation efforts. In the age of the Anthropocene, when human impacts are more evident and human management of ecosystems more important than ever before, this view cannot survive. This false dichotomy leads to a general bias against nonnative species; in order to provide a clean break from this bias and begin a new narrative over select nonnative species,

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[511] Richardson & Ricciardi, *supra* note 109, at 1463 (responding to the argument that "[t]he biogeographic origin of a species has no bearing on its impact. The native/nonnative dichotomy holds no value to science. Therefore, these factors should not guide management, and there is no rationale for invasion science," with the response that "[i]gnoring biogeographic origins as a mediator of impact ignores the importance of evolutionary context in species interactions. Non-native consumers inflict greater damage on native populations. The more 'alien' an established animal, plant or microbe is to its recipient community, the greater the likelihood it will be ecologically disruptive.").

[512] This leaves unresolved the question of how conflicting values can be addressed under this more pragmatic approach to guest species, a question requiring additional long term consideration.

we need to embrace the neologism "guest species" for those naturalized nonnative species which humans have introduced, intentionally or accidently, and which we actively conserve because we benefit from having them in the wild.

These species are caught up in many legal or policy conflicts, because they raise federalism concerns based on the conflict between the states' traditional role in wildlife management and federal efforts aimed at broader conservation; because some members of the public have a strong financial or cultural interest in maintaining wild populations of these species; and because guest species often play important roles in novel or heavily impacted ecosystems where native species may have trouble persisting. Based on three in-depth case studies of these species, I extracted six lessons about guest species: (1) federal oversight of state wildlife management breeds conflict; (2) court ordered removal is the wrong remedy; (3) people love their guest species and this increases conflicts; (4) guest species can eventually become part of their new ecosystem; (5) guest species may be better adapted for the current environment than native species; and (6) existing approaches to guest species are not working. Emerging principles of environmental management for the Anthropocene need additional development and study, but my initial review suggest that they offer some support for the idea that guest species should not be undervalued solely based on their origin. I conclude that considering "both negative and positive potential effects of nonnative species," without consideration of their place of origin, will lead to better environmental outcomes.[513]

[513] Schlaepfer et al., *supra* note 87, at 435.