Chapter 12
The Spectrum of Wildness and Rewilding: Justice for All

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I wish to speak a word for Nature, for absolute freedom and wildness, as contrasted with a freedom and culture merely civil...
Henry David Thoreau (Walking, 1862: 592)

Introduction

I am fortunate to have had wild places close to home for most of my life, places to which I could escape from the nerve-shattering madness of civilization. Woods, creeks, ponds, old fields, pastures, abandoned limestone quarries—all places that were damaged to varying degrees by humans but in which people do not now have a dominating presence. None of these places could be called wilderness by any stretch of the imagination. They are not natural areas in the pure sense of the term. They are semi-natural, but they are wild. Processes as old as life on Earth still operate within them, not completely overwhelmed by human activity and technology. And they are quiet, except for the songs of birds, frogs, and insects, the bubbling of brooks, the wind through the trees, and occasional sounds of automobiles, airplanes, or guns in the distance. These have been places where, since childhood, I could relax but also feel exhilarated, where I could contemplate difficult questions about life and death, where I could exercise my body and break a sweat, and where I could hone my skills as a naturalist. The other beings in a wild place, and even the rocks and waters, feel like friends and family. I am never alone there.

Who on Earth does not need wild places? I suspect that, to be sane, nearly everyone needs wild nature, whether they realize it or not. John Muir observed, "There is a love of wild nature in everybody, an ancient mother-love ever showing itself whether recognized or no, and however covered by cares and duties" (Muir, in Teale 1954:

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311). The growing literature on nature's salubrious effects on human physical and emotional health and intellectual development is persuasive (e.g. Kellert 2002; Louv 2011; Flies et al. 2017; Oh et al. 2017). Wild areas, however, have many important values aside from enhancing human well-being. The most essential value is providing habitat to wild species—each one valuable for its own sake—and sustaining ecological and evolutionary processes fundamental to all life. The "extinction of experience" (Pyle 1978) and alienation from nature that accompanies urbanization and extensive loss of wildlands is a great social injustice as well as a root cause of the biodiversity crisis.

In this chapter I review the concept of wildness, particularly how it applies to conservation ethics, biodiversity preservation, and ecological justice (sensu Washington et al. 2018). I accept the common definition of wildness as the quality of being wild, undomesticated, or untamed. Wildness is a relative rather than an absolute quality. It can be recognized within many different landscape contexts and across spatial scales ranging from vacant lots, back yards, and city parks to immense wilderness areas with intact food webs, megafaunal assemblages, disturbance regimes, and biogeochemical processes. Wildness is critically important to protect and to restore (i.e. rewilding) across all of these contexts and spatial scales. To fully serve its most essential functions (providing habitat to native species and sustaining natural processes) wild natural and semi-natural sites must collectively encompass a vast area. How much area is enough varies regionally and depends on the ecological and land-use context. Nevertheless, as discussed later, estimates based on sound science suggest approximately half of an average ecoregion, and of earth as whole, must be protected to meet well-established conservation goals. Moreover, it is a sensible policy alternative for providing justice to as many species as possible, including humans, on a deteriorating planet (Kopnina 2016).

Wildness: From Vacant Lots to Vast Wilderness

Wildness and wilderness are not the same thing. Wilderness, as defined in the landmark U.S. Wilderness Act of 1964, is, "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain" (http://legislink.org/us/pl-88-577). Although not a common term, "untrammeled" is a perfect way to describe wilderness; it means not hindered or restrained. Lack of hindrance and restraint of nature by humans is a fundamental attribute of wilderness. The U.S. National Wilderness Preservation System is the largest network of strictly protected lands in the world, now encompassing 110 million acres (445,154 km^2) (Tricker and Landres 2018). Similar systems of wilderness areas exist around the world, some of which go by the name of wilderness but in other cases are national parks or other protected areas that meet the criteria for wilderness. The IUCN recognizes the distinct qualities of wilderness in its protected area categorization. Wilderness areas (Protected Area Category Ib) are, "usually large unmodified or slightly modified areas, retaining their natural character and influence without permanent or

significant human habitation, which are protected and managed so as to preserve their natural condition" (IUCN 2008).

A wilderness is a self-willed landscape (Nash 2001), an intact place that operates largely free of human control. Most true wildernesses are able to escape domination by people because they are large, remote, legally protected, or some combination of these qualities. Although most wilderness areas are affected to some degree by anthropogenic impacts such as air pollution and global climate change, wilderness is no place for industrial-scale activities (Allan et al. 2017) or for any commercial activities or intensive recreation that degrade its ecological health or wild character. The U.S. Wilderness Act, for example, stipulates that wilderness areas, "shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character" (http://legislink.org/us/pl-88-577).

All wildernesses are wild areas, but not all wild areas qualify as wilderness. Wildness is a broader and more accommodating concept than wilderness, but it is just as necessary to the human spirit and to biodiversity (Noss 1990). Importantly, wildness encompasses much more land, water, and species diversity than wilderness. I worry that some purist wilderness defenders set so high a bar that they are not interested in protecting smaller, more modified wild areas that serve as critical habitat for wild species and which are usually much more accessible to humans—a desirable attribute if we want people to fall in love with nature (Miller 2006). Henry David Thoreau's Walden Pond was not wilderness. It lies only 2.25 km from the center of Concord, Massachusetts, which even in the mid-19th century was a bustling town. But consider what Thoreau sought and found at Walden Pond: "I went to the woods because I wished to live deliberately, to front only the essential facts of life, and see if I could not learn what it had to teach, and not, when I came to die, discover that I had not lived" (Thoreau 1854: 343). In his essay "Walking," published one month after his death from tuberculosis at the age of 44, we find not only one of his most-quoted lines, "In wildness is the preservation of the world," but also, more emphatically, "Give me a wildness whose glance no civilization can endure" (Thoreau 1862: 609, 610).

Like probably most conservationists, I have always had my own personal Waldens. I would not have survived long without such places. But my survival, or yours, or any person's is not the primary reason for allowing wildness to persist in the landscapes we inhabit in addition to those far away. The fundamental and indispensable role of wild natural and semi-natural areas in this time of mass extinction is to provide habitat for wild species. Wild areas serve as refugia within which species can hold on through the collapse of civilization and perhaps later recolonize their former territory. Not all species require wildness, of course. Some species are synanthropic: they live with humans. Beyond our specialized parasites, such as the two species of *Demodex* mites found only on human eyelashes and the sebaceous glands connected to them, are quite a few opportunistic species that have come to depend on human-altered habitats. There are also those species humans have domesticated, which provide us meat, milk, hides, transport, and companionship.

Most species are tolerant of some level of human activity. Nevertheless, the majority of species still require secure and essentially wild places to reproduce or perform other life history functions. In Florida, where I live, several bird species are associated with anthropogenic habitats. Some are of conservation concern, such as the state-Threatened Florida sandhill crane (*Antigone canadensis pratensis*) and the federally-Endangered (i.e. under the U.S. Endangered Species Act) wood stork (*Mycteria americana*). Both of these species are often seen in roadside ditches, retention ponds, front lawns, and McDonald's parking lots. Pushed out of their original habitats, they showed the flexibility to adapt to anthropogenic habitats. Their apparent preference for human habitats is misleading, however, because both species require wild wetland sites with minimal human interference in order to nest and fledge their young. Without secure wildness, they would decline to extinction.

The Florida populations of the federally-Threatened crested caracara (*Caracara cheriway*) and state-Threatened Florida burrowing owl (*Athene cunicularia floridana*), both of which presumably migrated to Florida from western North America during the Pliocene or Pleistocene, probably once depended on grasslands grazed by now-extinct megaherbivores (Noss 2013). Today we find them in cattle pastures, with the caracara hiding its nest in the tops of isolated palms or oaks and the burrowing owl nesting in burrows, sometimes in mowed lawns as well as pasture. Research shows that the vast majority of caracara nest sites in Florida are on private cattle ranches; paradoxically, caracara appear to prefer non-native pasture to native grasslands (Morrison and Humphrey 2001). Pastures have low-stature grasses, which suit these birds because they often forage by walking. Whenever I see caracara or burrowing owls, I visualize vast herds of mammoths, mastodons, giant ground sloths, and other immense beasts roaming the ancient Florida grasslands. Both species require secure nesting sites free from direct human disturbance. Fortunately, most of the large cattle ranches of Florida provide considerable wildness and protection from such disturbance.

Wild species are associated with a broad spectrum of wildness, from remnant patches of vegetation within urban and agricultural landscapes at one end to immense wildernesses on the other. Most species fall somewhere in the middle and utilize small to large patches of natural or semi-natural habitat within a human-altered landscape matrix. Mammals such as black bear (*Ursus americanus*), bobcat (*Lynx rufus*), and river otter (*Lontra canadensis*) usually require relatively large patches. And because these animals have large home ranges and disperse fairly long distances, the patches must be connected by habitat corridors or by a relatively permeable landscape matrix such as managed forest or rangeland. The presence of viable populations of these species in a region is an indicator that a considerable degree of wildness remains. Loss, fragmentation, and alteration of habitats by humans have eliminated these species from many landscapes across North America, especially in the eastern and midwestern United States and much of southern Canada (Reid 2015). Moreover, these animals are vulnerable to persecution from humans, including legal and illegal hunting and trapping, as well as road mortality. The latter increases relentlessly with expansion of road networks and traffic volume (Forman and Alexander 1998).

In some areas, populations have rebounded with recovery of native vegetation, a testimony to the power of rewilding (see following section).

At the wildest end of the spectrum are species mostly associated with large wildernesses with limited access to humans (i.e., roadless or with very low road density), not so much because they prefer wilderness, but because people actively persecute them everywhere else. In North America, these wilderness-associated species include large or medium-sized carnivores such as gray wolf (*Canis lupus*), grizzly bear (*Ursus arctos horribilis*), wolverine (*Gulo gulo*), Canada lynx (*Lynx canadensis*), and puma (*Puma concolor*) (Noss et al. 1996). The puma, however, has adapted reasonably well to human-inhabited landscapes in much of North America, so long as it has secure den sites and movement corridors (e.g., Dickson et al. 2005). The pronghorn (*Antilocapra americana*) does not require strict wilderness, but it needs large unfragmented shrub-steppe or grassland with minimal human activity or structures such as roads and fences; indeed, pronghorn perceive high-traffic roads as a risk (Gavin and Komers 2006). These examples suggest that maintenance of the full suite of species native to any ecoregion requires protection or restoration of substantial areas of connected wild habitat (Noss and Cooperrider 1994). Regions heavily dominated by intensive agriculture or cities retain mostly species associated with the domesticated or weedy end of the wildness gradient.

Although all species ultimately have equivalent intrinsic value, at any given place and time conservationists usually should concentrate on those species most threatened by human activities (Diamond 1976), and these are often species requiring large, wild landscapes. For all species on Earth to survive, protected areas must encompass the entire wildness spectrum, ideally with large blocks of wilderness in each ecoregion, but not neglecting small sites. These small sites occur not only as patches of remnant vegetation in heavily developed landscapes, but also sites in various landscapes with atypical physical conditions and species assemblages. Many local endemic species, for instance, are found only within small patches of unusual habitat, such as extreme soils (Rajakaruna 2004; Noss 2013).

Rewilding: Should We Return to the Original Meaning?

> Hope and the future for me are not in lawns and cultivated fields, not in towns and cities, but in impervious and quaking swamps.
>
> Henry David Thoreau (Walking, 1862: 611)

Can we bring back the impervious and quaking swamps that have been lost to civilization and thereby restore justice to the creatures whose homes we have defiled? Rewilding, as the word implies, means bringing back wildness. At least it should mean this. Many disparate concepts of rewilding are discussed within the conservation community (Johns 2016), which has led to considerable confusion about its meaning and goals. The earliest application of the rewilding idea did not use that term, but rather "wilderness recovery." Wilderness recovery was proposed for sev-

eral regions of North America in various articles in the *Earth First*! journal during the 1980s. One of the more detailed proposals, for the State of Florida, noted the irony that active management is now required to restore wilderness character in many regions, including such actions as, "removal of roads, structures, and other intrusions; reestablishment of original drainage patterns; reintroduction of large predators and other missing ecosystem components; and guarding against human trespass, poaching, and overuse" (Noss 1985: 18).

Restoring populations of apex predators quickly became the hallmark of wilderness recovery, for the simple reason that these species are usually the first to disappear as an area loses its wilderness character through road-building or other increases in human access. In the early 1990s Dave Foreman (e.g. Foreman 1992, 2004) substituted the term rewilding for wilderness recovery. The term, however, was apparently first used in a 1990 article in *Newsweek* magazine, which discussed the desire of radical environmentalists to protect or restore to a wild condition at least one-third of the North American continent (Foote 1990). In the first full article on rewilding (by that name), Soulé and Noss (1998: 2) noted that, in contrast to conventional biodiversity conservation focused on representation of vegetation or physical features and protection of special biotic elements, rewilding involves the, "restoration and protection of big wilderness and wide-ranging, large animals—particularly carnivores." Carnivores were emphasized because they often regulate food webs through top-down control, that is, they serve as keystone species (Terborgh et al. 1999). Moreover, due to their large body sizes and sensitivity to human persecution, large carnivores typically require very large or interconnected landscapes with limited human access (Noss et al. 1996), that is, a high degree of wildness.

Some authors have expressed concern about the emphasis on large carnivores in rewilding proposals. Reliance on the hypothesis that carnivores are keystone species is a potential weakness of the rewilding paradigm, because sometimes apex predators regulate food webs and sometimes they do not (Nogués-Bravo et al. 2016). In some ecosystems, bottom-up control by climate, other physical factors, nutrients, or plant diversity is equally or more important than top-down control by predators (Frederiksen et al. 2006; Scherber et al. 2010). A more defensible proposition might be simply that wild ecosystems with intact food webs, including apex predators, and natural processes have value for their own sake, and they are now exceedingly rare. Thus, we have an ethical obligation to restore such ecosystems wherever we can. Because large carnivores with enormous area requirements are often umbrella species, whose protection will bring along many other species (Noss et al. 1996), their emphasis in rewilding proposals is well-justified. Moreover, large carnivores, as well as some large herbivores, often serve as indicators of unfragmented landscapes and as flagships for conservation initiatives (Dalerum et al. 2008). People in general find these beasts charismatic and exciting.

The original meaning of rewilding was muddled with the publication of a controversial essay in *Nature* in 2005, which used the term to refer to the experimental introduction to North America of megafauna from other continents, such as elephants (Donlan et al. 2005). The reasoning is that these species represent the closest living relatives of animals that went extinct in North America during the late Pleis-

tocene, approximately 13,000 years ago, due at least in part to human hunting. These species probably played critical ecological roles on this continent (Donlan et al. 2005). Subsequently, to many people rewilding became synonymous with Pleistocene rewilding and was considered impractical as well as dangerous because of the uncertain impacts of introduced species on native ecosystems, among other concerns (Nogués-Bravo et al. 2016). Retaining the original meaning of rewilding—the restoration of wildness—and emphasizing recovery (including reintroductions, when necessary) of extant native species first and foremost, seems sensible. Thus, bison would come before elephants and wolves and puma before African lions in rewilding North America.

Today rewilding is discussed mostly in terms of reintroducing native species to restore ecological functionality, although in some cases, "a rewilding translocation could also take the form of a conservation introduction through ecological replacement using suitable substitute species" (Seddon et al. 2014: 411). In portions of Europe, for example, domestic cattle, horses, and ponies have been introduced as substitutes for extinct native herbivores (Gillson et al. 2011). Restoration of truly wild conditions and viable populations of large carnivores is often absent from these proposals. Indeed, Seddon et al. (2014: 411) advise us to move away from, "increasingly unobtainable concepts of self-sustaining wildlife populations within pristine landscapes untouched by human influence" and accept the alternative approach of, "restoring and sustaining species and their habitats, possibly in novel configurations, with ongoing management." While I acknowledge that this approach is the more realistic one for many human-dominated landscapes, genuine opportunities to restore complete, naturally functioning wilderness in many regions around the world should not be ignored or trivialized.

What I see most blatantly missing from the current rewilding agenda is attention to wild natural processes aside from predation and herbivory. Fire and other natural disturbances are among the most critical of these processes and are supreme expressions of wildness. Although restoration of natural disturbance regimes was implicit or explicit in early wilderness recovery and rewilding proposals (see Noss 1992), it is not prominent in recent discussions.

In general, natural disturbances are just as important as apex predators in maintaining ecological integrity (Pickett and White 1985; Baker 1992; Noss and Cooperrider 1994; Noss 2018). Disturbance regimes often must be actively restored in degraded landscapes and, except in very large blocks of habitat, must be managed in perpetuity. Fire is a particularly important process, which has been on Earth for some 420 million years as a dominant ecological and evolutionary force in many types of ecosystems worldwide (Pausas and Keeley 2009; He and Lamont 2017). Not only species, but entire ecosystems have evolved to become fire-dependent, in the literal sense that they would disappear in the absence of fire. In many regions restoring the fire regimes with which species evolved over thousands to millions of years would arguably do more to restore overall biodiversity than any other single action (Noss 2018). In some ecosystems, though, fire is now more abundant than historically, with negative effects on native species. Human-set fires in moist tropical forests can be highly destructive (Nepstad et al. 1999), as can fires in North American sagebrush

steppe, which have become much more frequent due to invasion by highly flammable non-native grasses such as cheatgrass (*Bromus tectorum*) (Shinneman and McIlroy 2016). Fire activity is declining globally, however, mostly due to human population growth and agricultural expansion, and this decline is likely to continue despite climatic conditions becoming more favorable to fire (Andela et al. 2017).

Just as there is a spectrum of wildness, there is also a spectrum of rewilding. At the far end of the spectrum is wilderness recovery (Noss 1985), which implies restoration of true wilderness conditions in large and interconnected blocks of land that are essentially able to manage themselves with natural disturbance regimes and predator-prey interactions. Because some disturbance regimes (such as fire in boreal forests) as well as the population processes of large carnivores operate on scales of millions of square kilometers (Noss and Cooperrider 1994), this scale of rewilding is not possible in many ecoregions within the near future. Nevertheless, it is essential that we pursue this option where feasible. Closer to home, we can bring back a degree of wildness by not mowing our lawns and be amazed by the diversity of plants and pollinators that gradually overtake it. At intermediate scales, in landscapes with patches of natural or semi-natural habitat embedded in a human-dominated matrix, rewilding should include three fundamental actions, beginning with: (1) enlargement of patch size by adding area to small nature reserves and restoring native vegetation; and (2) restoration of functional connectivity among sites. Restoring connectivity can create a whole greater than the sum of its parts, in that small reserves by themselves cannot maintain viable populations of area-demanding species, but a network of connected sites might provide enough habitat to support viable populations or metapopulations (i.e. systems of populations connected by occasional dispersal) (Noss and Harris 1986; Noss and Daly 2006). With reserves enlarged and interconnected, the third action can be implemented: reintroduction of extirpated species and management (e.g. controlled burning) to simulate natural disturbance regimes.

How Much Is Enough?

> A 1:1 ratio of natural to developed environment would provide a basis for an optimum environmental-use program.
>
> Odum and Odum (1972: 183)

> The current ratio of protected to exploited land in the United States is a lopsided 5:95. I would suggest 50:50 as a more reasonable compromise.
>
> Noss (1991: 121)

> Justice demands setting aside at least half Earth's lands and seas for nature, free from intensive economic activities.
>
> Kopnina (2016: 176)

How much wild area is needed to minimize extinctions and provide ecological justice for all species? In his 2016 book *Half Earth*, E. O. Wilson proposed protecting

half of the biosphere in order to save the vast majority of species (Wilson 2016). Surprisingly, this proposal is considered by many conservationists and others a new and radical idea. The three quotations above show that suggestions to protect at least half of the Earth extend back several decades before Wilson's book and continue today, often in the name of ecological justice. Wilson did not invent the idea of Half Earth, but built on the legacy of others. Nevertheless, because he is deservedly such a well-respected figure, Wilson did a great service by bringing this bold but biologically defensible goal to a broad audience, perhaps ultimately making it more acceptable to society. Below I review some of the history of proposals to protect on the order of half the Earth as wild or natural area, showing that this idea is not so radical after all, but rather follows from solid research and reasoning. And it just might be attainable.

Until recently most widely publicized targets for land protection were based more on political or pragmatic judgments than on science. And they were excessively modest. The 1982 World Parks Congress in Bali urged governments to protect 10% of their land area, with no specific justification for this percentage (Noss 1996). The 12% target proposed by the Brundtland Commission of the United Nations amounted to a tripling of global protected area at that time, which was about 4% (World Commission on Environment and Development 1987). The 12% target was deemed politically feasible, but it was also assumed to be biologically adequate so long as protected areas captured representative samples of all global ecoregions.

The most recent global policy that set targets for protection arose from the 2010 meeting of the Convention on Biological Diversity (CBD), a multilateral treaty. In particular, Aichi Target 11, one of 20 policy targets adopted by the Convention, states: "By 2020, at least 17 per cent of terrestrial and inland water areas and 10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascape" (Convention on Biological Diversity 2010). Target 11 is a modest improvement over previous policy targets for land and water protection, but it is best viewed by conservationists as an interim goal—a step in the right direction, but only a small step. Target 11 is science-based only in its language. Truly science-based conservation plans and the informed judgments of conservation scientists almost always result in much higher percentages of land allocated to nature conservation than political targets such as Aichi (Svancara et al. 2005; Noss et al. 2012).

When did truly science-based, or at least science-informed, targets begin to emerge? To my knowledge, the first publication that offered a science-based protection target was an overlooked paper by the eminent ecologist brothers E. P. and H. T. Odum. Based on what we would today call an ecosystem services argument, the Odums suggested that half of each region be kept as natural area (Odum and Odum 1972). They acknowledged that aesthetic, recreational, religious, and cultural values have sometimes provided sufficient justification for conservation of large areas of land. They reasoned, however, that with rapid technological and population growth, these arguments would no longer suffice. Rather, nature must be valued for its sup-

port of human civilization. To this end they developed an "ecosystem management model" for South Florida derived from systems ecology. The model considered flows of energy and materials between developed and natural lands and the long-term sustainability of life-support systems. Beyond their argument for, "1:1 ratio of natural to developed environment" in South Florida (Odum and Odum 1972: 183), they offered a bold general recommendation: "Until this kind of systems analysis procedure can be refined and becomes a basis for political action, it would be prudent for planners everywhere to strive to preserve 50% of the total environment as natural environment" (Odum and Odum 1972: 183).

The argument of Odum and Odum (1972) was anthropocentric and did not explicitly consider biodiversity or welfare of nonhuman species (i.e., ecological justice). An ecocentric ethic holds more promise for protecting nature on a vast scale (Kopnina et al. 2018). The modern field of conservation biology began to develop a few years after the Odums' paper. Conservation biology was marked from the beginning by a biocentric or ecocentric philosophy, which recognizes intrinsic value in nature as fundamental, while not ignoring nature's many other values and services to humans (Soulé 1985; Meine et al. 2006; Piccolo et al. 2018). The idea that the land as a whole has intrinsic value is not new; indeed, it was a central tenet of Aldo Leopold's land ethic (Leopold 1966 [1949]), as well as being implicit in the writings of Thoreau, Muir, and other nature writers. Legitimate conservation biologists seek to ensure that no additional species go extinct due to human actions and that evolutionary processes continue (Noss and Cooperrider 1994; Wilson 1999).

Four well-accepted goals emerged from the early years of conservation biology: (1) represent all native ecosystem types and seral stages across their natural range of variation; (2) maintain viable populations of all native species in natural patterns of abundance and distribution; (3) maintain ecological and evolutionary processes; and, (4) be responsive to short-term and long-term environmental change and maintain the evolutionary potential of lineages. Focusing on these goals, Noss (1992) sought to determine how much of a given region, and in what configuration, should be protected or managed with biodiversity conservation as a primary objective. While recognizing that, "each region must be assessed individually," Noss (1992: 15) generalized that, "at least half of the land area of the 48 conterminous states [of the U.S.] should be encompassed in core reserves and inner corridor zones…within the next few decades." A more thorough review concluded that, "most regions will require protection of some 25–75% of their total land area … assuming that this acreage is distributed optimally with regard to representation of biodiversity and viability of species and well connected within the region and to other reserve networks in neighboring regions" (Noss and Cooperrider 1994: 168).

The question of "how much is enough?" is not an entirely scientific question—values, worldviews, ethics, and socioeconomic factors also come into play—but it can be addressed empirically by applying the principles and analytic techniques of systematic conservation planning (Margules and Pressey 2000; Kukkala and Moilanen 2013). This is when generalizations no longer suffice and when ecoregion-specific studies, plans, and protection targets are essential. Several factors make some ecoregions more demanding than others in terms of the extent of land protection needed

to meet similar sets of conservation goals. These factors include population viability of the most area-demanding species; topography and other physical heterogeneity; level of endemicity (i.e. number of species found in the ecoregion but nowhere else); beta diversity (the differences or turnover in species composition among sites); the spatial scale of natural disturbance regimes; and the amount of land in the region already protected, converted to human land-uses, or unprotected but not yet converted (Noss 1996). A heterogeneous ecoregion packed with endemic species will require more protected area than a more homogeneous ecoregion with few or no endemic species. An ecoregion that is still largely intact can afford more protected area than an ecoregion that has been extensively converted to agriculture or urban development. Importantly, "protected" does not usually mean human-free or unmanaged, but it does mean the needs of the native biota come first in the design and management of landscapes (Noss and Cooperrider 1994; Noss 1996).

A review of systematic conservation planning found that, "recent comprehensive conservation plans have delineated around 50% or more of regions for nature conservation" (Pressey et al. 2003: 122). Noss et al. (2012: 2) reviewed the literature and confirmed that, "In contrast to policy-driven targets, scientific studies and reviews suggest that some 25–75% of a typical region must be managed with conservation of nature as a primary objective to meet goals for conserving biodiversity." Addressing their conservation biology peers, they stated, "Nature needs at least 50%, and it is time we said so" (Noss et al. 2012: 4). Thus, the Nature Needs Half movement (Locke 2014; https://natureneedshalf.org) was born, with the goal of protecting 50% of Earth by 2050.

Just how impractical is the "at least 50%" recommendation? Perhaps not so impractical after all. Dinerstein et al. (2017) prepared a revised classification and map of the Earth's 846 terrestrial ecoregions and assessed progress toward the goal of protecting 50% of the terrestrial biosphere. Encouragingly, 12% of the ecoregions already exceed half protected, with many having sufficient unaltered habitat to move well beyond 50%. Although these ecoregions are concentrated in the tropical and subtropical moist forests and tundra biomes, 12 of the 14 global biomes have at least one ecoregion that has achieved this status. The take-away message from this study is that more than three-quarters of the Earth's ecoregions already have achieved, *or could achieve with rewilding*, the status of half protected.

Another study shows that current protected areas plus unprotected wilderness-quality lands with a very small human footprint (<3.3 on a scale of 0–50) already encompass approximately half of Earth (Pimm et al. 2018). The problem is that most protected areas (especially large ones) are located in wilderness landscapes, which are generally cold, dry, high-elevation, or otherwise unproductive for agriculture (Scott et al. 2001). Even when supplemented with the remaining unprotected wilderness, protected areas inadequately represent the world's species, most of which have small ranges (i.e., endemics) and are located in warmer and more productive regions with relatively high levels of human population and associated habitat loss; such regions are known as biodiversity hotspots (Myers et al. 2000; Mittermeier et al. 2011; Noss et al. 2015). Only five regions, comprising tropical moist forests, tropical woodlands, and subtropical deserts, have globally high biodiversity (in terms of endemic species)

combined with wilderness conditions (Mittermeier et al. 2003). Thus, "expanding protection to the wilder half of Earth is far from sufficient to protect biodiversity" (Pimm et al. 2018: 2). It appears theoretically possible to represent all species in less than half of Earth, if selection of new protected areas is carefully optimized. To do so, most new protected areas would have to be located in areas with lower degrees of wildness, and by necessity most will be relatively small. To achieve other benefits of big wilderness—together with comprehensive protection of biodiversity—probably more than half of Earth is required, but more research is needed to confirm this.

An obvious trade-off for meeting the 50% protection goal, especially on an ecoregion scale, is the high probability of significant losses of food-production capacity, given current production and consumption patterns and practices (Mehrabi et al. 2018). Unfortunately, the projected losses of food calories are higher in land-sparing approaches, which set aside large contiguous blocks of natural habitat, than under land-sharing regimes. Existing evidence suggests that most species benefit when food is produced on as little area as possible, while sparing as much wild area as possible (Phalan 2018). Competition between feeding people and protecting nature could be mitigated by agricultural intensification, reductions in food waste, and dietary shifts away from animal-based foods (Mehrabi et al. 2018). All of these changes would be challenging to implement, but not impossible. For the terrestrial land surface as a whole, the ethically responsible and practically necessary goal of 50% or more protected is not unattainable, but it requires that human population be stabilized and then begin to decline within this century. Crucial steps to this necessary de-growth include increasing access to contraception and family planning, educating women, and achieving gender equality (Crist et al. 2017).

Conclusion: Wildness and Ecological Justice

> For us of the minority, the opportunity to see geese is more important than television, and the chance to find a pasque-flower is a right as inalienable as free speech.
>
> Aldo Leopold (1966 [1949]: ix)

Ecological justice—justice for all species, human and non-human (Shoreman-Ouimet and Kopnina 2015)—must be foregrounded; that is, it must become the central consideration in debates about justice (Washington et al. 2018). Otherwise, it will inevitably be breached by immediately pressing socioeconomic concerns. Ecological justice depends on wildness to the extent that native species and healthy ecosystems require wildness. As discussed in this chapter, non-human species require varying degrees of wildness. Quite a few species persist perfectly well in human-dominated and tame landscapes; some perform optimally in such landscapes or even depend on them. Other species require wilder places, ranging from small patches of natural or semi-natural habitat embedded in urban or agricultural landscapes up to vast wilderness regions with little or no human activity. Similarly, ecological and evolutionary processes operate in all landscapes, but the scale of some fires and other

disturbance regimes, and the population processes of large carnivores, are so huge that only the largest and least human-modified landscapes are able to accommodate them (Noss and Cooperrider 1994). We have a duty to protect and restore the entire spectrum of wildness for its myriad benefits to humans and non-humans.

Regarding social justice, individual humans require varying degrees of wildness to meet their psychological needs and be happy, healthy, and intellectually well developed. Although research suggests exposure to wild nature benefits everyone (e.g. Kellert 2002), some people seem to need more wildness than others to be happy. I am one of those people who need daily contact with natural or semi-natural areas to be reasonably well-adjusted psychologically, and I require occasional immersion in big wilderness to be fully satisfied. Access to wild areas for all people, according to their personal needs, is a social justice imperative. A central tenet of democracy is that minority rights must be defended as vigorously as majority rule (Kymlicka 1995). Thus, we of the minority who need frequent contact with wild nature must be provided such opportunity. Although shrinking the human population and economy is ultimately the only way we can achieve justice for all species (Crist et al. 2017), in the meantime rapid establishment of new protected areas, strategically located, is the best way to block the most serious breach of justice imaginable—extinction. Education of the populace of the urgency of this mission is our task at hand.

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