WHAT DOES ENVIRONMENTAL PROTECTION PROTECT?

Environmental protection isn't what it used to be. During the 1960s and 1970s, environmentalists enacted a legislative agenda that seems like a dream today: statutes like the Clean Air and Clean Water Acts, the National Environmental Policy Act, and the Endangered Species Act. Back in the day, those who sought to protect the environment could point to rivers that caught fire, smog that filled the air, and toxic wastes that poisoned the water. People knew that LUST referred to leaking underground storage tanks. Environmentalists defended the environment – a conceptual construct -- without having to know or say exactly what that concept included or meant.

What is "Environmental"?

I think it is fair to say that the environmental movement by some measures has become a victim of its own success. Big messes have been cleaned up. By 2009, the Cuyahoga River, which once had caught fire, had been reborn, according to the *New York Times*. The fly fishing there is very good.[1] The American Lung Association reported in 2012 that "eighteen of the 25 cities most polluted by ozone, including Los Angeles, had their lowest smog levels" ever recorded. Similarly, "Seventeen of the 25 cities with the worst annual particle pollution saw their lowest-ever levels, including Los Angeles, Pittsburgh and Cincinnati."[2] There is plenty of progress still to be made – but it is generally incremental, place-by-place, and confronts the law of diminishing returns. Is environmentalism a mopping-up operation? If the air we breathe and water we drink are safe and if rivers and lakes are fishable and swimmable, are we done?

To answer this question from a philosophical perspective, I believe, it would be helpful to define the concept of the "environment" that environmentalists want to protect. The underlying problem, as Michael Shellenberger and Ted Nordhaus wrote in 2004, has to do with the "most basic assumptions about what does and doesn't get counted as 'environmental.'"[3]

Does climate change, for example, count primarily as an environmental issue? Climate change poses a problem for the economy, industry, development, and just about everything. Energy policy – hastening a transition to low-carbon or no-carbon fuels – may be more effective than environmental policy as a way to address greenhouse gasses. If environmentalists dine out on climate change as their bailiwick or special sphere of expertise and responsibility, they might be swallowed up by it. What comes to mind is the drawing in *The Little Prince* that shows a boa constrictor trying to digest an elephant.[4] Critics taunt environmentalists by claiming that climate change is their only *cause d'etre*. A *New Yorker* cartoon shows two plutocrats at their club. One says, "Global warming, in my opinion, is the last refuge of an environmentalist."

Many environmentalists invoke the protection of *nature* or the *natural environment* as a *per se* goal of environmentalism. This is problematic, however, for many well-known reasons. As English literary critic Raymond Williams observed, the term "nature" is perhaps the most complex and contested word in the English language.[5] It may also be the most exhausted. In the wake of Bill McKibben's *The End of Nature* (1989), some philosophers have "argued for a turn to what might be called postnaturalism in environmental philosophy: for an *environmental philosophy without nature*."[6] To this, a skeptic might reply that the environmental agenda would then consist largely in cleaning up non-point sources and fretting about climate change.

It is a dilemma. The idea of the natural environment is usually considered to be central to the cause or purpose of environmentalism. Yet the concept of the "natural" is hard to associate with the concept of the "environmental." To see this, suppose we define as "environmental" the surroundings amid which an organism makes its way, earns its living, and has its habitat. Every species – perhaps every population or individual creature -- has its own environment. Few of us live outdoors or hunt and gather for a living. Whose environment is the natural environment?

Knowledge by Acquaintance vs. Knowledge by Abstraction

In this paper, I try to argue that we should include in what we count as "environmental" the natural environment – not just public safety and health -- but that we should think in terms of the natural objects that people visit rather than the conceptual objects scientists posit. The concept of the natural environment that can be recognized in policy and ethics, I hope to argue, has little in common with the concept of the natural environment as it is theorized in ecology, e.g., as the *ecosystem* or the *ecological community*. I agree with those ecologists who believe that their science can contribute to environmental consciousness best through the study of natural history. As Thomas Fleischner has written "Ecology grounded in the best natural history is more dependable, and less vulnerable to political meddling, than science floating on a sea of abstractions."[7]

I want to argue that the nature that should be counted as "environmental" comprises wild places that -- because of their beauty, history, intricacy, and majesty – people care about. By "wild" I refer to an aesthetic category that extends to an appreciation of nature happening all about us, sometimes even as it is produced by human beings or responds to them. This kind of appreciation is disinterested; we care about the object for the sheer experience, perception, or knowledge it gives us and not for the uses to which it can be put. This appreciation is typically based on good reasons that are informed by natural history and personal experience. Nature in this context depends more on knowledge by acquaintance than on knowledge by abstraction.[8]

By knowledge by "acquaintance," I refer not only to direct experience but also to what one may learn by reading about the natural history of places, seeing pictures of them, and studying the creatures in them. By "abstraction," I refer to the conceptual constructs of ecological theory, for example, postulated entities such as the structure, function, stability, resilience, or any other emergent, holistic, or theoretical property predicated of ecological communities or systems.

Environmentalists may worry – I understand this -- that if the concept of the natural environment relies largely on knowledge by acquaintance or experience rather than knowledge by abstraction, it is likely to extend primarily to the sorts of things that environmental protection now protects, such as the charismatic mega-fauna and spectacular vistas people are most likely to visit or to have heard about. According to conservation biologist Michael Soulé what counts as environmental then comprises only "a small number of particularly valuable target species (e.g., trees, fishes, deer, and waterfowl) -- a tiny fraction of the total biota."[9] Soulé has argued that environmentalism should be more holistic and concerned with authentic ecosystems, which he associates with co-evolved species. According to Soulé, "Many of the species that constitute natural communities are the products of co-evolutionary processes."[10] Soulé like many theorists has postulated "that the structure, function, and stability of coevolved, natural communities differ significantly from those of unnatural or synthetic communities."[11] He has argued that ecological structure, function, and stability are the qualities that environmental protection should protect.

I want to argue against the proposition Soulé nicely states, namely, that the natural environment that matters comprises "the structure, function, and stability of coevolved, natural communities" which are thought to "differ significantly from those of unnatural or synthetic communities." I do not think these ecological abstractions are useful. The ecological sciences, insofar as they invoke these abstractions, draw a red herring across the path environmentalists should follow. Environmentalists should be working to protect places they know and love; they are too often sidetracked into chasing theoretical constructs no one understands.

To show that ecological theory can explain neither which aspects of the natural world we should count as "environmental" nor why we should do so, I shall offer two kinds of arguments. First, I briefly characterize 40 years of intense research funded by the Environmental Protection

Agency (EPA) and other organizations to support scientists to discover "ecological endpoints" of regulation. The massive research program failed to find this Holy Grail because it had no way to get from abstract concepts – such as the structure, pattern, process, scale, function, etc. of eco-systems – to management goals that made political and empirical sense. The project failed to identify ecological properties – particularly holistic and emergent properties – in ways that are meaningful to non-scientists. Whoever seeks to apply ecological theory ends up raising further questions, for example, if it is even possible to make sense of the balance of nature or the idea of biodiversity.[12] I do not think these kinds of questions are answerable or even worth asking.

The second kind of argument I offer has to do with the reasons that the search at EPA for ecological endpoints failed. I shall try to explain why the constructs, concepts, and vocabularies that ecologists theorize – vague terms such as "ecosystem" and "community" -- do not provide a way to describe the natural environment in policy-relevant language, for example, to identify the particular objects or qualities to be protected or to determine the reasons that some sites should be protected rather than others. Ecological theory has been unhelpful partly because ecologists have not been able to agree on the meanings of their own concepts and partly because they have not been able to show the policy relevance of these concepts. I do not believe that ecological theory can say how to count nature as one of the objects that environmental protection protects.

Ecological Concerns at EPA

Interest at EPA in understanding ecological systems started in the early 1970s with the regulation of pesticides.[13] Environmentalists often argued that EPA had a mission to prevent risks not only to human beings but also to wildlife and more generally to the structure, function, and stability of natural ecosystems. In response, William Ruckelshaus, founding administrator of EPA, in 1972 banned DDT and its derivatives aldrin and dieldrin. In the cancellation announcement, he

emphasized the adverse effects of these pesticides on ecosystems, particularly on fish, birds, and other wildlife. Ruckelshaus barely mentioned risks, if any, DDT and its derivatives could pose to human safety and health.[14]

In the early 1970s, Ruckelshaus at first appealed to harms to nature rather than to human health as grounds to cancel the registration of DDT and related pesticides. One can understand why. In the best-seller *Silent Spring* (1962), Rachel Carson had shocked the national conscience by describing the effects of these insecticides on western grebes. Those who defended the use of DDT argued that it was safe for human beings, whatever its effects on birds – safer, anyway, than the insecticides likely to replace it.[15] They may have been correct. The carcinogenic effect of DDT on human beings was widely doubted at the time and has been questioned since then by epidemiological studies and by subsequent empirical research.[16]

An Appeals Court in reviewing the DDT ban in 1972 rebuked Ruckelshaus for giving only a cursory mention to the effects of the pesticide on public safety and health. The court urged the agency to emphasize health risks, stating that "candor compels us to say that when the matter involved is as sensitive and fright-laden as cancer, even a court scrupulous to the point of punctilio in deference to administrative latitude is beset with concern when the cross-reference [to carcinogenicity] is so abbreviated."[17] In response, EPA embarked on a course of regulating pesticides in terms of their health effects, primarily carcinogenicity, and of avoiding ecological arguments. In its final and successful DDT brief, EPA listed nine principles by which it tested for carcinogenicity in pesticides. It then relied on these principles – not on ecological considerations – litigation against various insecticides including heptachlor and chlordane.

Environmental historian Edmund Russell has written, "Ironically, pesticide cases that entered the legal process to prevent damage to birds emerged as efforts to protect humans from

cancer, reducing EPA's emphasis on ecological protection." According to Russell, "Ecological damage and carcinogenicity were both matters of dispute within the scientific community. In the legal community, it had become clear that judges feared human cancer more than dead birds."[18]

EPA has been successful in protecting certain iconic species and scenic areas – in reducing smog-induced haze in the Grand Canyon and other "Class I" tourist areas, for example – but it has remained invested primarily in defending public safety and health. EPA has long sought, however, as an academic or research program to learn how to assess or analyze risks to ecosystems -- "ecological risks" -- as well as risks to human health, safety, and welfare.

Ecological Risk Assessment at EPA

In 1983, Ruckelshaus responded to those who called on EPA to include natural ecosystems and communities in what gets counted as environmental. Ruckelshaus suggested that agency officials meet with ecologists to discuss "the impact of all this chemical loading over the years on the ecological systems in which human culture is embedded . . ."[19] In 1990, the EPA Science Advisory Board (SAB) stated, "The value of natural ecosystems is not limited to their immediate utility to humans. They have an intrinsic, moral value that must be measured in its own terms and protected for its own sake."[20] The Board added with regret that EPA over its then 20-year history "has considered the protection of public health to be its primary mission, and it has been less concerned about risks posed to ecosystems."[21]

The SAB statement nicely distinguishes between 1) risks to humans and 2) risks to ecosystems. Environmental protection plainly responds to risk to humans. Does it also respond to risks to ecosystems? If so, what sorts of systems and which kinds of risks are we talking about? To take an obvious example, toxic effluents leaching into public waters may endanger both human beings and water fowl. If EPA is a public health agency, then it is dead people not

dead birds it cares about, even though controlling pollution may good for both people and birds. EPA could go further to single out for protection, say, from a pesticide, particular populations of migratory water fowl because of language found in a statute. Environmental groups who delight in hunting, fishing, bird-watching, etc. may lobby for places and populations they seek to protect. It is one thing, however, to prevent the significant deterioration of air or water quality in places tourists throng; it is another thing to quantify and measure the properties of biotic communities. EPA inquired if and how it might protect not just charismatic species and scenic vistas but also the integrity, health, stability, resilience, benefits, etc. of co-evolved natural ecosystems.

Lee Thomas, who succeeded Ruckelshaus as EPA administrator, serving from 1985-1989, tried to make ecological protection – not simply public safety and health – an agency priority. As a first step, Thomas permitted his pesticide program, under the leadership of Jack Moore and Steve Schatzow, in early 1989 to ban particularly persistent forms of two chemicals, carbofuran and diazinon, on the basis of their effects on wildlife, a case EPA eventually won against one manufacturer, Ciba-Geigy, thus creating a precedent in pesticide litigation for defending nature – not just human health. In its 1989 proposal to cancel all registered uses of granular carbofuran the agency said the "risk to birds outweighs the benefits of use" to humans.[22] This action represents, as far as I can learn, the first time EPA successfully proposed to ban a pesticide wholly because of its effect on wildlife rather than on human safety and health.

Under Thomas, the agency still had to traverse a great legal, political, and conceptual distance, however, to move from 1) a concern for the effects of contaminants (e.g., the use of tributyltin as an antifoulant on boats) on particular populations of economic or iconic organisms (e.g., oysters) to 2) the protection of ecosystems or ecosystem-level properties, such as diversity, stability, and resilience, from major economic projects, such as power plants and dams.

During the 1980s and 1990s, risk analysis was developed, vetted, sweated, and pored over (as in the "Red Book" prepared by the National Research Council in 1983) as a scientific approach to assessing the human toxicity of various effluents and emissions.[23] The enthusiasm with which both scientific and policy circles embraced risk analysis and assessment with respect to toxicity and carcinogenicity led EPA to task scientists to extend the methodology to ecological concerns.[24] Thomas convened seventy-five environmental professionals to opine on the goals of the agency. The group issued a report in 1987, *Unfinished Business*, that included ecological proetection among EPA's objectives.[25] Thomas strengthened a program Ruckelshaus began at EPA's Office of Research and Development to fund efforts (initiated in 1981 at Oak Ridge National Laboratory) to develop methods of ecological risk assessment. Historian Stephen Bocking wrote, "For agencies like the EPA, ecological risk assessment promised a means of wrapping its decisions in the clothing of science; as a product of objective science, these decisions were less likely to be overruled as arbitrary and capricious."[26] Bocking warned that "a strictly scientific basis for action will be insufficient, even counterproductive."[27]

Throughout the 1980s and 1990s, government scientists and academic researchers produced several studies, including a "Framework" (1992)[28] and "Guidelines" (1998)[29] for ecological risk assessment. EPA defined an "assessment endpoint" as "an explicit expression of the environmental value to be protected, operationally defined as an ecological entity and its attributes."[30] Over 30 years, EPA tried to understand how to measure risks to the structure, function, and stability of coevolved, natural communities. These ERA studies utterly failed, however, to produce actionable or policy-relevant ecological "endpoints" of regulation.

In 2003, EPA published a preliminary guidance for "deciding which aspects of the environment will be selected for evaluation." It stated, "Although nearly all environmental

statutes refer to the environment as an entity to be protected . . . few indicate an attribute to be protected or even the nature of the entity."[31] In 2006, in its "Ecological Benefits Strategic Assessment Plan," EPA came to much the same conclusion.[32] "The complexity of interacting ecological and economic systems creates substantial conceptual and technical difficulties for estimating ecological benefits." This report did little more than to call for further research.

Harm to Ecosystems

Public officials have lamented that they do not know – and lack authority to determine – which ecological risks to assess.[33] An EPA document bemoaned the "remarkable diversity of species, ecological communities, and ecological functions from which to choose" and the "statutory ambiguity regarding what is to be protected."[34] A prominent ERA scholar, Glenn Suter, wrote that problems arise because of "the diversity of ecological entities and attributes that might be at risk."[35] Suter editorialized with a colleague, "The most important critique of ERA is its relative lack of influence in USEPA decision making." These authors noted that "human health risks dominate rule making, remedial actions, and other regulatory decisions."[36]

Risk is the likelihood of harm. An enormous research effort culminating at the end of the last century brought toxicologists, epidemiologists, hydrologists, sociologists, psychologists, and many other kinds of experts together to examine the likelihood that various pollutants contributed as causes to diseases, notably, cancer. There was much debate about the kinds of harms people feared most and the circumstances under which those fears or concerns were justified. Yet all those who contributed to this research understood what was harmed, that is, people and their health, and what counted as the paradigm example, cancer, of that sort of harm.

There is a difference between risk assessment when used 1) as a methodology in the context of public health and 2) as a methodology in the context of ecological conservation. In

the context of public health, everyone understands what is harmed. This understanding comes fundamentally from society, e.g., from patient outcry and from jury awards. The public has very little sense of the concept of harm as it is used in the context of ecological risk. Scientists not only have to measure the likelihood of harm but also to say what is harmed and how it is harmed.

In its 1998 *Guidelines of Ecological Risk Assessment*, EPA stated, "Ecological risk assessment is a process that evaluates the likelihood that adverse ecological effects may occur or are occurring as a result of . . . anthropogenic activity." Much of the rest of the document ponders the meaning of "adverse ecological effects." The document opines, "Ecological risk assessments are developed . . . to evaluate human-induced changes that are considered undesirable."[37] The question immediately arises – considered undesirable by whom? I might consider what you do with your lawn or yard undesirable, for example, but would my preference trump yours? To decide what is or is not "desirable" from an environmental point of view, one might bend to the desires of those with legal authority over a place – as long as they respect the rule of law and the rights of person and property of others. The relevant ecological goals may be simply those of the people who own, pay for, or have the right to manage the areas in question.

Officials at EPA, the Forest Service, the Bureau of Land Management, and other agencies deal with an awful lot of public land, water, and air. These officials – unlike owners of private property – are reluctant to let their own druthers dictate what they do. As public officials, they usually look for some objective basis for determining which management goals to pursue. The *Guidelines* states, "Management goals driving a specific risk assessment may come from the law, interpretations of the law by regulators, desired outcomes voiced by community leaders and the public, and interests expressed by affected parties."[38] These are likely to conflict.

Two biologists who worked on ERA wrote that "the most important requirement for a risk assessment is knowing what it is that we want to protect."[39] The *Guidelines* affirm, "Management goals are desired characteristics of ecological values that the public wants to protect."[40] With respect to human beings, it is safety and health. With respect to the natural environment, however, it is not clear. The *Guidelines* continues, "Part of this is a challenge for science to define natural systems and their natural states, but part is a more general challenge of defining what it is about these natural systems that we value."[41] One may ask who "we" are. This may raise the question of who owns the property and who pays for its management. There is no mention I can find in these documents of the limits private property rights might place on the public authority to regulate the natural environment. Also ignored is the problem of paying for whatever conservation endpoints are considered desirable after much scientific research.

Ecosystems as Organisms

Agency officials who believe they do not have – or do not wish to take – responsibility for deciding what is or is not environmentally desirable have empanelled ecologists to advise them. Scientists proposed that "changes considered undesirable are those that alter important structural or functional characteristics or components of ecosystems."[42] As a result, the 1998 *Guidelines* emphasized the need to "sustain the natural structure, function, and biodiversity of an ecosystem or its components." Biologists Norman Christensen and Jerry Franklin summarized, "we may liken ecosystem functioning to the processes that comprise physiological functioning in an organism. These functions are the basis for sustained provision of 'goods' and 'services' upon which humans depend."[43]

The analogy between ecosystems and organisms, however, is not one many ecologists any longer take seriously. It involves too many conceptual conundrums. Field biologists

observe that environments are in constant flux as populations move through them and conditions change. To constitute objects from this flux, scientists must say which properties of ecological systems or "organisms" are essential and which accidental. They must offer criteria to determine 1) when a site meets conditions necessary to remain the same organism or system and 2) when it alters so much that it becomes something else or turns into a mere collection of things.[44]

Ecologists have recently acknowledged the need to provide identity conditions for the objects they study. "The answer to whether a particular ecosystem, such as a boreal forest, is persistent will vary," ecologist Kurt Jax has written, "depending on whether 'ecosystem' is defined, for example, by a particular species composition …, by a particular physiognomy …, or just by some specific rates of matter and energy flow."[45] These criteria appear to be arbitrary.[46]

Second, ecology confronts the task of bounding ecosystems in space. Philosopher Baird Callicott noted the problem. "Unlike most familiar organisms, ecosystems . . . have no obvious spatial boundaries, no delimiting epidermis. Hence one may wonder whether or not ecosystems are distinct entities."[47] Ecologist Dan Simberloff has written, "whereas a species is usually easy enough to define, the boundaries of an ecosystem are not so apparent, and which ecosystems are so similar as to be representative of the same type is often not a trivial question."[48]

Third, ever since Daniel Simberloff in 1980 published "A Succession of Paradigms in Ecology," ecologists have conceded that they have not reached anything like a consensus about if and how ecological communities are structured or organized either as organisms or in any other way.[49] Theoretical postulates, mathematical theories, metaphorical analogies, and conceptual constructs abound.[50] Nothing has changed since George Woodwell commented in 1976, "No single model dominates, none is clearly preferred, even by ecologists. And the credentials of paradigm spinners all look pretty much the same . . . ."[51]

EPA has called on scientists to determine what is meant by "harm" to ecosystems. For decades, experts published technical papers analyzing abstract ideas, such as that of self-organization, in the hope that models or theories might reveal something about the emergent or holistic properties of ecological communities. This research program has petered out. EPA no longer sponsors much ERA research; now it's about ecosystem services. A large amount of conceptual and theoretical research is now undertaken to determine what is meant by an ecosystem service and how it is to be measured. *Plus ça change, plus c'est la même chose*. Perhaps in 1972 the Appeals Court was prescient to tell Ruckelshaus to talk about dead people not dead birds.[52] It is not surprising that EPA "has considered the protection of public health to be its primary mission, and it has been less concerned about risks posed to ecosystems."[53]

Ecosystems as Self-Organizing Systems

Consider the postulate: "Ecosystems are prototypical examples of complex adaptive systems, in which patterns at higher levels emerge from localized interactions and selection processes acting at lower levels."[54] Ecologists Eric Schneider and James Kay agree. "We must always remember that left alone, living systems are self-organizing; that is, they will look after themselves. Our responsibility is not to interfere with this self-organizing process."[55] A widely-used textbook on ecological modeling asserts this assumption:

> We know that evolution has created very complex ecosystems with many feedback mechanisms, regulations, and interactions. The coordinated co-evolution means that rules and principles have been imposed for cooperation among the biological components. These rules and principles are the governing laws of ecosystems . . . [56]

The problem is that none of this makes sense. In saying this, I do not mean simply to refer to a vast literature, convincing though it is, that shows that ecological theory lacks agreed-

upon general rules, principles, and even unifying concepts.[57] I mean to ask how one would test the proposition that natural ecosystems are complex adaptive systems. One would have to observe a difference between 1) sites where co-evolution has imposed rules and principles for cooperation on the biological components and 2) sites filled up with non-native or introduced species that share no evolutionary history. If there were any but magical thinking behind the idea that ecosystems are complex, adaptive systems, scientists could tell by observation and experiment which biotic components play by the rules and which do not. They could tell which is an ancient complex, adaptive, heirloom ecosystem, and which a recent hodgepodge.

In fact, biologists apparently have no way to tell other than by documenting the history of a site whether it represents a 1) natural, co-evolved community and its states or 2) a collection of colonizing species gathered in the wake of human activity.[58] If biologists cannot tell by observation or by experiment which system is "co-evolved" and which "novel" or, indeed, which species are long-timers and which newcomers, the distinction between natural and synthetic communities is a privative one. Just as cold is defined as the absence of heat, so the function, structure, integrity, and other self-organized qualities of nature seem to be defined as the absence of human effects. Creatures are evolving everywhere, moreover, to take advantage of us.[59] Is this co-evolution? In that case, human presence not absence may be the key factor in forcing co-evolution and this in shaping complex adaptive ecosystems where these may indeed exist.

If ecological theory is to be relevant to environmental policy, it must be able to tell sites that have desirable ecological properties from sites that do not. Why would environmentalists include as environmental for purposes of policy natural sites defined privatively, i.e., in terms of the absence of human influence? Sartre suggested one justification: "Hell is other people." While this may be true, pure misanthropy may not be the best platform for environmentalism.[60]

As ecologists often concede, “Many ecosystems are dominated directly by humanity, and no ecosystem on Earth's surface is free of pervasive human influence.”[61] Classic studies from the time of George Perkins Marsh (1874) and W.L. Thomas (1956) make the point that places uninfluenced by human activity are not found.[62] Long ago the world entered the “Anthropocene.”[63] Ecologist David Western has concluded, “Drawing a sharp line between the human and natural realms serves no purpose when our imprint is as ancient as it is pervasive.”[64]

Michael Soulé might to some extent agree with this. Ten years after he published the remarks I quoted earlier, Soulé wrote, "Certainly the idea that species live in integrated communities is a myth." He added, "So-called biotic communities, a misleading term, are constantly changing in membership.” Soulé continued: “In a sense, the science of ecology has been hoist on its own petard by maintaining, as many did during the middle of this century, that natural communities tend toward equilibrium. . . . The principle of balance has been replaced with the principle of gradation—a continuum of degrees of human disturbance.”[65]

The concept of a continuum of degrees of human disturbance, however, hoists ecological science higher on the same petard. How is it to assess “degrees of human disturbance”? What instrument – like a Secchi disk -- would determine this? In what kinds of units would human disturbance be measured? These questions are so unanswerable that they are not worth asking.

The literature is full of references to wonderful ecological sites constituted by species that are recent arrivals.[66] One cannot tell old from new, however, except by doing the kind of empirical research Margaret Davis undertook to show that what seem to be forests primeval were not there a few centuries ago.[67] The problem is not just that “pristine” environments no longer exist. The problem is that nature changes all the time, so they never did exist, even when human activity was not present. “Wherever we seek to find constancy, we discover change," forest

ecologist Dan Botkin has observed. Nature "is not constant in form, structure, or proportion, but changes at every scale of time and space."[68] Since nature is always in flux, there seems no way to tell complex adaptive ecosystems from what Emma Marris has called rambunctious gardens.[69]

Rambunctious Gardens

In 1998, Michael Soulé and Reed Noss introduced "rewilding" as a new perspective or as a novel conceptual purchase on the intersection of natural and the human environment. They contrasted "rewilding" to the "Monumentalism" that John Muir and his followers advocated during the 20th Century.[70] According to Soulé and Noss, "Muir and allies wished to save places of extraordinary natural beauty—the grand spectacles of nature . . . [They] appealed to patriotism, deism (respect for God's creation), spiritual inspiration, and aesthetics in their advocacy for wild places."[71]

Conservationists soon recognized, however, that the number of species "was often greatest in less grandiose ecosystems, particularly the warmer lowlands, wetlands, streams, humid forests, and in coastal areas" which were also attractive to farmers, loggers, and developers. Instead of fencing off wilderness areas, environmentalists found themselves fighting a guerilla war within settled or human-dominated areas to protect or expand the pockets of wildlife in them. Soulé and Noss argued that this approach failed because small habitat remnants were vulnerable to "dissipative phenomena—edge effects, and invasions of exotic plants, animals, and pathogens—hastening the local extirpation of species and ecosystem disintegration."[72]

In response, conservation biologists including Soulé and Noss have suggested the radical possibility of "rewilding" large areas that are available – perhaps because they are no longer used as agricultural land – to create landscapes in which myriad plants and animals, including carnivores, could have their day or way. A group of scientists writing in *Nature* in 2005 recommended rewilding for "areas of the Great Plains in the United States, [where] human populations

are declining." These experts suggested that "camelids, cheetahs, Asian (grey) and African (black) elephants, and lions" along with all sorts of other nifty megafauna could do well if properly introduced into the Great Plains and other relatively abandoned North American lands.[73]

These biologists may be right. In a fascinating article, "Recall of the Wild," Elizabeth Kolbert in the *New Yorker* describes an attempt the Dutch government began in the 1980s to use "land reclaimed from the sea to create a fifteen-thousand-acre park that mimics a Paleolithic ecosystem." A better word than "mimics" might be "mocks" because this impressive area, the Oostvaardersplassen, which lay several feet under the sea for millennia before being drained in the nineteen-fifties, now hosts Heck cattle (from Germany), red deer (trucked in from Scotland), foxes, geese, egrets, ducks, ravens, horses, buzzards, goshawks, herons, kingfishers, eagles, and wolves among many other species which were introduced or just appeared. Also found in this ecological happening or "be-in" are film crews and visitors on safari-like tours of "the Serengeti behind the dikes." Kolbert comments, "It occurred to me that, like so many post-modern projects, the Oostvaardersplassen was faintly ridiculous. It was also, I had to admit, inspiring."[74]

What is inspiring, I venture, is the spectacle of *Natura naturans* or *Nature naturing*, i.e., nature doing its thing. Seen from this both empirical and aesthetic perspective, nature has no definite form, direction, or end; it does not have a design or essential properties; it appeals more to the imagination than to the understanding. What might be faintly ridiculous is belief of scientific managers that the project is supposed to "create a Paleolithic landscape," to quote Kolbert. This objective -- to restore *Natura naturata*, i.e., nature according to a concept of its authentic design – leaves experts to wrangle about that design. There are many ways the world was or might have been at various points in the distant past but all these seem to have strut and fret their hour on the stage to be heard no more – unless we try to create a theater for them.

The task of bringing the original cast of biological characters back together to replay or "rewild" ecosystems confronts biological difficulties. Kolbert explains, for example, that while about 1.5 billion cattle graze pastures and feedlots in the world today, none resembles the wild aurochs – *Bos primigenius* – from which they are descended. These mammoth beasts were plentiful in Paleolithic times but went extinct in the 17th century. Heck cattle were introduced to the Oostvaardersplassen because they were thought to be more like – while still a far cry from – the prehistoric aurochs. At a nearby Dutch city, Kolbert visited the TaurOs project, a back-breeding effort "the stated goal of which is to give 'the rebuilding of the aurochs a serious try.'"[75]

This is just the beginning. The idea of bringing the Flintstones to life has been discussed as a biological possibility. In an on-line Q&A session published by the German magazine *Der Speigel* in January 2013, George Church, an eminent microbiologist at the Broad Institute at Harvard, is cited as saying that technology under development in his lab can make human cells similar to those of the Neanderthals. According to this interview, Church speculated that eventually, an "adventurous female human" could serve as a surrogate mother for the first Neanderthal baby and, from many such individuals, "a kind of Neandertal culture" could arise that might gain "political significance."[76] Who would bother to visit Colonial Williamsburg and similar cultural reconstructions when one can get the real deal by "rewilding" human genomes?

Anyone who has read *The Yiddish Policemen's Union* (2007), a novel by Michael Chabon, may remember a plot in which a team of biologists breeds a pure red heifer as a way to bring about the coming of the Messiah and the End Times. A prophecy to this effect is based on Numbers 19:2: "Speak unto the children of Israel, that they bring thee a red heifer without spot." Whether one breeds a *Bos primigenius* in anticipation of restoring the Paleolithic, a Neanderthal

in hopes of recreating the Cenozoic, or a red heifer in expectation of rebuilding the Temple depends on one's view of historic authenticity and what it requires. The same biology – the same empirical science – is involved in each of these efforts. What differ are the purposes to which biological knowledge and know-how is put. About this choice the science can tell us nothing.

Conclusion

Let me return to the "most basic assumptions about what does and doesn't get counted as 'environmental.'"[77] Should the structure, function, and stability of coevolved, natural communities (to recall the quotation from Soulé) be counted as "environmental" and included among the items environmentalists seek to protect? The International Union for the Conservation of Nature (IUCN) believes so. According to its website, it works "to protect the long-term ecological integrity of natural areas that are undisturbed by significant human activity, free of modern infrastructure and where natural forces and processes predominate . . ."[78] IUCN makes one of its principal missions, "Protecting large mainly untouched areas where ecosystem processes, including evolution, can continue unhindered by human [activity]." Ecologist R.V. O'Neill has described (without endorsing) this view of life. "The ecosystem concept typically considers human activities as external disturbances . . . *Homo sapiens* is the only important species that is considered external from its ecosystem, deriving goods and services rather than participating in ecosystem dynamics."[79]

To separate humanity in a metaphysical way from the rest of nature for purposes of scientific inquiry is to assume – as Descartes did – that human beings are made of an essentially different substance than other animals and are therefore subject to different powers or principles. The idea that ecosystem processes, including evolution, can be hindered by human activity makes this metaphysical presupposition. It is like saying that the principles of gravity, thermo-

dynamics, magnetism, etc. can be disrupted by human activity. On the contrary, natural forces predominate everywhere, whether people are present or not. We may use or apply these principles but cannot change or disturb them. Darwin began the *Origin of Species* with a discussion of artificial selection as an example of evolution. He did not draw a distinction between intact environments and those human beings disturb when he wrote:

> It may be said that natural selection is daily and hourly scrutinizing throughout the world, every variation, even the slightest; rejecting that which is bad, preserving and adding up all that is good; silently and insensibly working, whenever and wherever opportunity offers, at the improvement of each organic being in relation to its organic and inorganic conditions of life.[80]

Many commentators have ascribed to religious sentiment the separation of humanity from the rest of nature. They have described theoretical ecology as "the science of Eden."[81] These commentators suggest that the Christian belief that mankind is "fallen" and nature divinely planned accounts for the apparent plausibility of ecosystem theory, in other words, the credulity with which people accept the view that human activity is external to and disturbs nature's authentic balance, design, integrity, complexity, adaptiveness, resilience, stability, structure, function, process, pattern or whatever it is that is lost as a result of human depredation. The long-time editor of *Land Economics*, Daniel Bromley, has put the point succinctly. He wrote that "contemporary ecology is nothing but intelligent design for agnostics."[82]

While I concede that there is a lot of truth to this observation, I believe it accounts only for one aspect of the "rewilded" landscape Kolbert described – the part she found ridiculous. There is also much that is inspiring. From an aesthetic point of view, the power, grandeur, and suffering in the Oostvaardersplassen can be overwhelming. (Kolbert discusses the predation,

starvation, disease, and other miseries that attend nature even or especially when protected by or from human beings.) This kind of historical re-enactment must be understood as a cultural production. As an artistic installation, a "rewilding" project such as the Oostvaardersplassen dwarfs in scale if not veracity historical reenactments like those of the Civil War and exceeds even the landscape-large work of great masters like Christo and Jeanne-Claude.

While these attempts to remake or replay the past can be wonderful fun – even inspiring as Kolbert wrote – they cannot be said to restore the environment to a more authentic or more natural condition. This is because from a scientific point of view every state of affairs is equally authentic and equally natural. In spite of this fact, the postulate that there is an ideal or authentic ecological community – a resilient, stable, self-organizing, adaptive system that over millennia evolves in and belongs to a place – has inspired ecologists to elaborate impressive mathematical models ranging from evolutionary stable strategies[83] to complex adaptive systems.[84] Bromley pointed out, "Ecologists seem to have succumbed to the warning of the German philosopher Georg Christoph Lichtenberg, who noticed, 'Delight at having understood a very abstract and obscure system leads most people to believe in the truth of what it demonstrates.'"[85]

The belief that from a scientific and not simply from an aesthetic perspective the natural environment is more integrated or authentic in one presentation than in another is not credible. What are called ecosystems or ecological communities are so mixed up, contingent, fractious, improvisational, extemporaneous, ephemeral, intractable, unexpected, protean, erratic, variable, fickle, and dodgy they repel the mathematical abstractions theorists lay over them. That ecological theory persists, however, is understandable. It is often hard to distinguish the sublime from its intimate neighbor.

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