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Patching the Ark: Improving Legal Protection of Biological Diversity

Holly Doremus*

INTRODUCTION

The Endangered Species Act of 1973 (ESA),¹ although widely regarded as the strongest legislation ever devised for the protection of non-human species,² has failed to effectively protect the range of living resources found in the United States. The species-by-species focus of the ESA precludes effective protection of biological diversity, which should properly be the focus of protective policy. This Comment will discuss the importance of preserving biological diversity, the source of the ESA’s species-by-species approach, the results of that approach, and some alternatives which might more effectively preserve the biota.

Biological diversity³ encompasses three different concepts: ecosystem diversity, species diversity, and genetic diversity.⁴ An ecosystem comprises “an interacting system of living organisms and their nonliving environment.”⁵ Ecosystem diversity is the range of different interacting systems present in a region, a nation, or the world. This concept is not as simple as it at first appears, because ecosystems blend into one another; the line separating them is often not sharply drawn. Moreover, subtle variations may distinguish facially similar ecosystems. For example, the chaparral vegetation of California appears similar to that of Chile, but because the two evolved separately they are composed of distinct species.⁶

³. Biological diversity has been defined as “the variety and variability among living organisms and the ecological complexes in which they occur.” OFFICE OF TECHNOLOGY ASSESSMENT, TECHNOLOGIES TO MAINTAIN BIOLOGICAL DIVERSITY 3 (1987).
⁴. Id.
⁶. Id. at 581. Chaparral is a type of vegetation dominated by small shrubs, occurring in
Species diversity as used in this Comment refers to the range of species present in a given area. This concept is also more complicated than it may appear. Biologists generally define a species as a group of organisms capable of interbreeding and not able to breed freely with members of other species under normal conditions. For the most part, this definition circumscribes groups of closely related organisms. However, the fact that many plant species can produce fertile interspecific crosses and that some organisms ordinarily reproduce asexually renders this definition less than completely precise. Although the interbreeding definition works as a first approximation, the question of what constitutes a species is, in the end, not susceptible of a completely objective answer. As one commentator has put it, "[a]t least in part, what counts as a species is a matter of current fashions in taxonomy."

Genetic diversity refers to the range of possible heritable characteristics (genes) found in a population or species. Because genes are the raw material of evolution, the greater the genetic diversity within a popu-


9. See Biology of Plants, supra note 5, at 169-70. Some animal species are also interfertile. For example, the Houston toad (Bufo houstonensis) interbreeds with two other species, and one of the resulting hybrids produces fertile offspring. S. Yaffee, Prohibitive Policy: Implementing the Federal Endangered Species Act 75 (1982). Another example of animal hybridization, between the gray wolf and the coyote, may have implications for the wolf's protected status under the ESA. See O'Brien & Mayr, Bureaucratic Mischief: Recognizing Endangered Species and Subspecies; 251 Science 1187, 1187 (1991).

10. Most microorganisms, for example, reproduce primarily by asexual means. R. Stanes, E. Adelberg, J. Ingraham & M. Wheelis, Introduction to the Microbial World 203 (1979). Asexual reproduction is also common among plants, see INTRODUCTION TO PLANT BIOLOGY, supra note 6, at 156, and fungi, see Biology of Plants, supra note 5, at 226-27.

11. Russow, Why Do Species Matter?, 3 Envtl. Ethics 101, 104 (1981). Nonetheless, although the boundary lines may be fuzzy, the definition of species is far from arbitrary. See Rolston, Duties to Endangered Species, 35 BioScience 718, 720-22 (1985) [hereinafter Rolston, Duties to Species]. As Rolston puts it, "species are dynamic natural kinds." Id. at 721.

12. Genes are sequences of DNA arranged on chromosomes. Genes determine the physical characteristics of the individual, such as size and degree of pigmentation. Eukaryotic organisms (virtually all organisms other than bacteria) have two copies of each chromosome. The sequence of DNA in a gene may vary slightly between individuals, or on the two chromosomes of a single individual. The variant sequences are referred to as alleles. In some cases when an individual possesses two different alleles for a gene, only one is expressed. In other cases both are expressed, and an intermediate phenotype, or appearance, is produced. For example, a pink petunia may have the allele for red flower color on one chromosome and the allele for white flower color on the other. Alleles which are silent in the phenotype nonetheless remain useful as a reservoir of potential variability for future generations. See generally D. Suzuki & A. Griffiths, An Introduction to Genetic Analysis (1976).
lation, the greater its ability to successfully adapt to fluctuations and stresses in its environment. Even in the absence of environmental changes, organisms with a high degree of heterozygosity\textsuperscript{13} are often more robust and vigorous than others.\textsuperscript{14}

Human activities currently threaten ecosystem, species, and genetic diversity. Since the beginning of life on Earth, species and ecosystems have disappeared, but the current extinction rate exceeds that of most periods of the Earth’s history, with perhaps the exception of a few documented periods of mass extinction.\textsuperscript{15} The current rate of species and ecosystem loss far exceeds that at which evolution is creating new diversity,\textsuperscript{16} and the rate of loss continues to rise.\textsuperscript{17}

Human land use and accompanying habitat modification currently pose the single greatest threat to biological diversity.\textsuperscript{18} Construction and expansion of settlements, creation of transportation corridors, intensive agricultural cultivation, and other land uses reduce biological diversity.\textsuperscript{19} Other human-caused threats include the overharvest of both animal and

\textsuperscript{13} Heterozygosity is the presence of two different alleles, or forms of a gene, on the two homologous chromosomes. \textit{See Biology of Plants, supra note 5, at 648.}


\textsuperscript{16} P. Ehrlich \& A. Ehrlich, \textit{supra} note 15, at 7; \textit{Office of Technology Assessment, supra note 3,} at 82.

\textsuperscript{17} Roush, \textit{supra} note 15, at 5 ("[T]he trend is accelerating. Scientists predict that by the early 21st Century, we will witness several hundred extinctions per day.") (emphasis in original); \textit{see General Accounting Office,} Rep. No. RCED-89-5, \textit{Endangered Species: Management Improvements Could Enhance Recovery Program} 10 (1988) (scientists estimate that 20% of all species could become extinct over the next 30 years); J. McNeely, K. Miller, W. Reid, R. Mittermeier \& T. Werner, \textit{Conserving the World's Biological Diversity 41} (1990) [hereinafter \textit{Conserving Biological Diversity}] (perhaps 25% of total biological diversity is at risk of extinction in the next 20 to 30 years).


\textsuperscript{19} \textit{Council on Environmental Quality, supra note 18,} at 43-55.
plant species, the introduction of exotic species,\textsuperscript{20} chemical pollution, and
global climate modification.\textsuperscript{21}

Biological diversity is threatened around the globe. Many of those
calling for the protection of biological diversity have focused on tropical
forests, which are believed to hold the majority of the world's species,
including many which have yet to be described.\textsuperscript{22} This Comment will
concentrate instead on steps which can be taken to protect biological re-
sources within the United States.\textsuperscript{23}

Current federal law explicitly protects only species diversity. The
ESA is the major federal statute protecting biological resources. Its fo-
cus on single species, and the restriction of protection to vanishing spe-
cies and critical habitat, have led to poorly planned and ineffective public
policy. Broadening the focus of federal policy beyond individual species
would result in more efficient and more effective protection of the full
range of biological resources in this country. Even if the species-by-spec-
ies focus is maintained, modification of the ESA could encourage more
effective public policy.

The first part of this Comment demonstrates that preservation of
ecosystem diversity is the proper national policy goal. The next part dis-
cusses the history of the ESA, drawing some conclusions about the origin
of its species-by-species focus. The third part examines the appropriaten-
ess of this focus, concluding that it is misguided and ineffective if the
goal is to preserve ecosystem diversity, and that it is imperfect even if the
proper goal is thought to be preservation of individual species. The
Comment concludes by suggesting possible means of enhancing the legal
protection of biological diversity, and examining the feasibility and effi-
cacy of these various approaches.

\textsuperscript{20} Id. at 56-64.

\textsuperscript{21} \textit{OFFICE OF TECHNOLOGY ASSESSMENT, supra} note 3, at 78-82; \textit{see Murphy, Challenges to Biological Diversity in Urban Areas}, in \textit{BIODIVERSITY, supra} note 8, at 71, 72.

\textsuperscript{22} \textit{See, e.g., Myers, Tropical Forests and Their Species: Going, Going... ?}, in \textit{BIODIVERSITY, supra} note 8, at 28 (tropical forests cover only 7% of the Earth's land surface, yet contain
at least 50% of all species); \textit{Wilson, Threats to Biological Diversity}. \textit{Sci. Am.}, Sept. 1989, at 108
(specialists agree that more than half of the Earth's species live in moist tropical forests,
although they disagree substantially about the absolute number of species found in those
forests).

\textsuperscript{23} I have chosen this focus for two reasons. First, significant levels of protection of
domestic biota can be achieved through unilateral actions, making domestic preservation a
simpler problem than protection of the global biota. Second, the United States cannot, without
hypocrisy, call for developing nations to preserve their biological resources in the absence of
effective mechanisms for protecting its own domestic biota. To maintain its leadership role in
this area of critical global concern, the U.S. must adopt strong domestic measures.
I

PRESERVATION OF ECOSYSTEM DIVERSITY IS THE PROPER POLICY GOAL

A. Why Should We Care About Biological Diversity?

This section will provide a brief overview of the justifications for preservation of biological diversity. A great deal has been written elsewhere on this subject,\(^2\) and this Comment will not attempt to restate all of the arguments which have been advanced. For purposes of this discussion, the arguments for preservation of biological diversity can be divided into three categories: utilitarian, esthetic, and moral (or "deontological"). Each category provides powerful reasons to preserve biological resources. All three should be taken into account in crafting a national policy.

1. The Utilitarian Basis for Preservation of Diversity

The utilitarian justification for the preservation of diversity rests on the direct and indirect usefulness of biological resources to humanity. Individual species provide us with a number of direct benefits. For example, we have domesticated our food crops, both plant and animal, from wild species. Other species might provide new crops.\(^2\) Wild relatives of current crop species can also provide a source of useful genetic traits.\(^2\) As breeding and genetic engineering technologies improve, such traits are becoming transferable across ever wider taxonomic distances.\(^2\)

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\(^2\) See, e.g., P. EHRlich & A. EHRlich, supra note 15; N. MYERS, THE SINKING ARK (1979). For a useful overview of the range of justifications for valuing biological diversity, and some of the difficulties with these approaches, see THE PRESERVATION OF SPECIES: THE VALUE OF BIOLOGICAL DIVERSITY (B. Norton ed. 1986) [hereinafter THE PRESERVATION OF SPECIES].

\(^2\) Currently only a small number of plant species are cultivated as food crops, but scientists estimate that one-third of the 250,000 flowering plant species on Earth may be edible. The National Academy of Sciences has suggested that several hundred of these edible plants could potentially be useful as crops. GENERAL ACCOUNTING OFFICE, supra note 17, at 10.

\(^2\) Such traits include pest and disease resistance and salt and drought tolerance. Crop plants such as the tomato have been greatly improved in recent years through crossing with wild relatives. Ilits, Serendipity in the Exploration of Biodiversity: What Good Are Weedy Tomatoes?, in BIODIVERSITY, supra note 8, at 98, 101-03. Aside from providing a source of specific desirable traits, genetic diversity in and of itself serves a valuable function in crop plants. Monocultures are more susceptible to environmental stresses and to disease organisms than are mixtures of strains. When most farmers in a region plant a single strain of a crop, the stage is set for disaster. The classic example, of course, is the corn blight outbreak in the southern United States in 1970. A new strain of the blight fungus arose, and raced through the region's monotypic corn fields. Nearly 20% of the nation's corn crop was destroyed by the fungus. P. EHRlich & A. EHRlich, supra note 15, at 65-66.

\(^2\) See generally Gamborg, Somatic Cell Hybridization by Protoplast Fusion and Morphogenesis, in PLANT TISSUE CULTURE AND ITS BIO-TECHNOLOGICAL APPLICATION 287 (W. Barz, E. Reinhard & M. Zank eds. 1976) (Proceedings of the First International Congress on Medicinal Plant Research, held in Munich, Germany, Sept. 6-10, 1976) (describing use of tissue culture techniques to produce intergeneric hybrids); Klee, Horsch & Rogers, Agrobacter-
Biological diversity is also a useful source of new medicinal drugs. Chemicals derived from higher plants form the major ingredient in about a quarter of all prescriptions written in the United States; chemicals derived from lower plants and microbes account for another eighth. Many of these drugs can be produced more cheaply by extraction than by chemical synthesis. Numerous species have yet to be examined for their medicinal properties. Thus, many undiscovered medically useful chemicals may exist in the natural world.

A number of animal species serve another important function in medicine as model systems for the study of human diseases. For obvious reasons, researchers cannot deliberately infect human subjects to facilitate laboratory study of the progress and properties of a disease. However, they can and do use animals as laboratory subjects. Examples include the use of desert pupfish to study kidney disease and of armadillos to study leprosy. Recently AIDS has been induced in rhesus monkeys, allowing researchers to develop a clinical model for the disease.

Many biological organisms, especially plants, may also be useful as sources of specialty chemicals. For example, restrictions on whale hunting have produced a demand for an alternate source of lubricants with the properties of whale oil. Jojoba (Simmondsia chinensis) contains large quantities of a liquid wax which may prove to be an effective substitute for whale oil in cosmetic and industrial applications. Other plants,
such as crambe (*Crambe abyssinica*) and meadowfoam (*Limnanthes alba*), contain chemically unique oils which may be useful in various industrial applications.\(^{35}\)

Nature may also serve more subtle needs. Human beings may have “a deep-rooted need” for contact with other living things.\(^{36}\) Such contact may promote both mental and physical health.\(^{37}\)

Besides the direct benefits described above, ecosystems provide a number of indirect benefits to humanity. These “ecosystem services” include climate control, oxygen production, removal of carbon dioxide from the atmosphere, soil generation, nutrient cycling, and purification of freshwater supplies.\(^{38}\) Some of these functions could probably be performed by managed systems, at least on a small scale, but management of such systems on a global scale is presently beyond our technological capability.\(^{39}\) Moreover, some of these processes, such as nutrient cycling, are highly complex and not yet fully understood.\(^{40}\)

Proponents of the utilitarian value of biological diversity often raise the argument that the potential uses of many biotic resources are not yet known, both because many species have not been fully investigated and because we cannot know in advance the needs of future generations. Thus, they argue, all (or as much as possible) of the biota must be preserved, in order to preserve those organisms which may ultimately prove useful.\(^{41}\) These advocates frequently cite Aldo Leopold’s statement that “[t]o keep every cog and wheel is the first precaution of intelligent tinkering.”\(^{42}\)

2. The Esthetic Basis for Preservation of Diversity

Many people find beauty in the natural world, viewing natural objects, both living and nonliving, with a sense of admiration, wonder, or awe. Esthetic interest in nature is demonstrated in a variety of ways. For example, millions of Americans visit national parks and wildlife ref-

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\(^{37}\) Id.


\(^{39}\) P. EHRLICH & A. EHRLICH, supra note 15, at 95-98.

\(^{40}\) Id.


uges every year. Some sixty million Americans participate in bird watching, and millions more engage in other forms of wildlife-related recreation. Nature photography and gardening are enormously popular hobbies. A perennial audience exists for television nature documentaries.

Individual species and specific natural areas may also come, over time, to be imbued with powerful symbolic value. They may embody the cultural or political identity of a people. The bald eagle is one such symbolic species; Mt. Fuji is an example of a symbolic natural feature. This symbolism provides further evidence of the esthetic attractions of nature.

The interest that the biota holds for scientists and natural historians also has esthetic overtones. For example, one may appreciate the beauty of the interactions among species, or of the construction of an organism to function optimally in its environment. Appreciation of this kind of esthetic value requires some degree of ecological or biological literacy, and thus may be relatively uncommon.

The esthetic value of diversity extends to ecosystem, species, and genetic diversity. Each species is an irreplaceable work of nature. A value similar to that given to works of art can be assigned to species. Ecosystems have esthetic value beyond that of the species they contain because the interactions that occur among species, and the way the system as a whole responds to perturbations, are themselves interesting. And genetic diversity is esthetically valuable both because the differences among individuals may fascinate us (as in the case of our own species), and because it provides the building blocks from which new manifestations of nature's wonder can be constructed. To perhaps overstrain the art analogy, ecosystems can be seen as the whole canvas, species as the

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47. *See, e.g., Office of Technology Assessment, supra note 3, at 46-47.*
49. *E. Hargrove, Foundations of Environmental Ethics* 192, 198 (1989). One who accepts this view may regard species as more or less valuable than human-created art works depending upon the importance assigned to human creativity as an element of the esthetic experience. *See id. at* 186-87.
elements which make up the composition, and genetic variability as the pigments with which the work is produced.\textsuperscript{50}

3. The Ethical Basis for Preservation of Diversity

In 1949, Aldo Leopold advocated the extension of ethical obligations to the relations between man and nature, calling for the development of an "ecological conscience" reflecting "a conviction of individual responsibility for the health of the land."\textsuperscript{51} Since then, several commentators have argued that nonhuman organisms, and even nonliving natural objects, have or should have rights based on their intrinsic value.\textsuperscript{52} Under such a view, human beings have an ethical obligation not to destroy these creatures and objects, at least in the absence of a strong countervailing value.\textsuperscript{53}

An ethical obligation to "nature" could conceivably be directed primarily to individuals, species, ecosystems, or the global environment as a whole. Human beings find it easiest to empathize and identify with individual beings and with vertebrate animals, which appear more similar to humans than invertebrates or plants. Therefore, people may most readily accept a moral obligation toward individual "higher" animals.\textsuperscript{54} Animal liberation philosophers have proposed ethical obligations toward all creatures able to experience pain, or capable of valuing their lives.\textsuperscript{55}

\textsuperscript{50} The art analogy may prove too much. Virtually everyone, including museum curators, would agree that the obligation to preserve artworks extends only to exceptional or unique examples. No one argues that all works of art must be preserved. Species and ecosystems may perhaps be viewed as possessing esthetic appeal beyond that of art objects, due to the fact that they are not created through human mechanisms and are (at least at the moment) beyond full human understanding. However, it is difficult to guess what proportion of Americans would adopt this view of the relative esthetic value of species and artworks.

\textsuperscript{51} \textit{The Land Ethic, supra note 48, at 258.}

\textsuperscript{52} \textit{E.g., D. Ehrenfeld, The Arrogance of Humanism 207-10 (1978); C. Stone, Should Trees Have Standing? Toward Legal Rights for Natural Objects (1974).}


\textsuperscript{53} A related although distinct view is that human beings have an ethical obligation to future human generations to maintain the current biota. \textit{See, e.g., Train, Who Owns American Wildlife?}, in \textit{Wildlife and America} 275, 276 (H. Brokaw ed. 1978).

\textsuperscript{54} \textit{See, e.g., Russow, supra note 11, at 109. Laws against cruelty to animals show that the majority of our society accepts at least some moral obligation with respect to individual higher animals. On the other hand, currently "only a small minority of people possess much concern or empathy for the plight of endangered invertebrates" or plants. Kellert, Social and Perceptual Factors in the Preservation of Animal Species, in \textit{The Preservation of Species}, supra note 24, at 50, 59; see also id. at 57 table (survey of attitudes toward protection of various endangered species).

\textsuperscript{55} \textit{E.g., P. Singer, Animal Liberation} (1975); Regan, \textit{Animal Rights, Human Wrongs}, 2 Envtl. Ethics 99, 112-16 (1980). Some theories of justice, however, posit that rights must be based on reciprocal obligations. \textit{E.g.}, J. Rawls, \textit{A Theory of Justice} 510-12 (1971). Such theories necessarily exclude from the universe of rights-holders all nonhuman
Environmentalists, however, have accused the animal rights movement of being incompatible with the preservation of collections of individuals such as populations or species, and of being founded on a fundamental misperception of nature. Taking a different approach than animal rights proponents, a number of philosophers have expressed the view that man’s ethical obligation to nature extends not primarily to individuals but to species or natural systems. This view echoes Leopold’s famous statement: “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.” Those espousing this view have emphasized the importance of the continuation of the biotic community, and the moral considerability of ecosystems and species. Some commentators have argued that species have a right to function normally in their ecosystems; this right may be viewed as a right to self-actualization.

This holistic view, taken to its logical extreme, regards life itself as the fundamental good to be preserved. One possible theoretical basis for regarding life as the ultimate good has been advanced by Birch and Cobb, who point out that only life creates order out of chaos, and conclude that life is therefore the fundamental value. Rolston offers another reason for valuing life and its manifestations: nature has an “exuberant lust for kinds” that humans ought not to inhibit. The

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57. See, e.g., Conniff, Fuzzy-Wuzzy Thinking About Animal Rights, Audubon, Nov. 1990, at 120, 132 (“In reality the animal rights movement has elevated ignorance about the natural world almost to the level of a philosophical principle.”).
58. See, e.g., Rolston, Duties to Ecosystems, in Companion to a Sand County Almanac 246, 260-62 (J. Callicott ed. 1987) [hereinafter Rolston, Duties to Ecosystems]; Rolston, Duties to Species, supra note 11, at 721-22.
59. The Land Ethic, supra note 48, at 262.
60. E.g., Rolston, Duties to Ecosystems, supra note 58, at 258-62; Rolston, Duties to Species, supra note 11, at 721-23.
61. E.g., Naess, Self-Realization in Mixed Communities of Humans, Bears, Sheep, and Wolves, 22 Inquiry 231, 232 (1979) (“Every living being should have an equal right to live and flourish.”); cf. Auxter, The Right Not to Be Eaten, 22 Inquiry 221 (1979) (arguing that species and individuals have a right to existence and well-being so long as their existence promotes or does not undermine a system of beings which is as rich and diversified as possible).
62. See, e.g., N. Myers, supra note 24 at 47 (“Presumably there is only one value which represents an absolute, and that is the survival of life on Earth.”). This view leads to the corollary that species have value in proportion to their contribution to the continuation of life. Id; see Rolston, Duties to Ecosystems, supra note 58, at 258 (“The appropriate unit for moral concern is the fundamental unit of development and survival,” i.e. the ecosystem); Rolston, Duties to Species, supra note 11, at 723 (“[D]uties to a species are not duties to a class or category, not to an aggregation of sentient interests, but to a lifestyle.”).
64. Rolston, Duties to Species, supra note 11, at 725.
Earth's biota, as the product of "[s]everal billion years of creative toil," ought not to be undone.\textsuperscript{65}

Ethical obligations to nature need not rest on such a nonanthropocentric foundation. Several philosophers and theologians, while not granting "rights" similar to those held by human beings to other species or to natural systems, have appealed to a tradition of human responsibility for stewardship of the Earth.\textsuperscript{66} The theological argument for stewardship proceeds from the premise that God created nature in part for his own enjoyment. The nature of the creation gives rise to a three-fold role for man with respect to nature: man is both overlord, wondering onlooker, and caretaker.\textsuperscript{67} The combination of these roles requires that man, insofar as possible, allow nature to flourish and to continue in its place. This duty to nature is not absolute, however; it occupies a position secondary to man's duty to his fellow man.\textsuperscript{68} Man can and should also enhance nature under this view, by taking actions such as designing gardens, or creating new creatures through breeding.\textsuperscript{69}

4. Public Policy Consequences of the Various Arguments For Preservation

Acceptance of any of the arguments given above for the preservation of biological diversity leads to the conclusion that preservation of some part of our biota is desirable as a matter of public policy.\textsuperscript{70} The different bases for preservation do not, however, necessarily justify protection of the same proportion of the total, nor of the same resources. This Comment is not the place for an extended discussion of the relative merits of the utilitarian, esthetic, and ethical arguments, which have been much discussed elsewhere. A brief survey of the extent of protective policy which might result from acceptance of these common arguments seems appropriate, however.

Utilitarian grounds have been most often cited in and to Congress as justifying a national policy of protection of biological resources.\textsuperscript{71}

\textsuperscript{65} Id.


\textsuperscript{67} H. SANTMIRE, \textit{supra} note 66, at 145-61, 184-91.

\textsuperscript{68} Id. at 150.

\textsuperscript{69} Id. at 152.

\textsuperscript{70} Private protection efforts, although useful, are not likely to be sufficient. Biological diversity is a form of public good; that is, no one can exclude others from the benefits it provides. Protection of public goods typically requires public action. See, e.g., Leman & Nelson, \textit{The Rise of Managerial Federalism: An Assessment of Benefits and Costs}, 12 ENVTL. L. 981, 1001-02 (1982).

\textsuperscript{71} Examples of utilitarian appeals are legion in the hearings on the 1973 ESA, and in subsequent oversight and reauthorization hearings. For recent examples of statements by leg-
although esthetic and ethical arguments have also been made. Utilitarian appeals may be most common because the people seeking protection of plants and animals believe that these justifications will have a greater appeal to the public than will other arguments. Utilitarian appeals also fit well within the norms of our legal system. The common law has long held, for example, that a property owner may not use her property to the detriment of others; thus, arguments that the loss of biological diversity harms each of us can serve as a basis to argue that private landowners should not be allowed to eliminate the biota found on their land. The proponents of preservation, however, are often motivated by concerns other than the utilitarian ones they publicly express.

Although the utilitarian argument may be the easiest to sell to the public, it does not, by itself, provide a basis for preservation of the full spectrum of biological diversity. One common utilitarian argument is that, since most species have not been investigated with an eye to their exploitability, it would be foolhardy to allow them to become extinct before such an investigation has been made. This argument provides a


73. See, e.g., Ehrenfeld, The Conservation of Non-Resources, 64 AM. SCIENTIST 648 (1976) (cataloging the dangers of relying on utilitarian appeals and stating that defenders of endangered species have avoided appeal to attitude of respect for nature because such an attitude is considered unacceptable in Western society); Ehrlich, supra note 42, at 338 ("Arguments about the aesthetic value of nonhuman life forms or their intrinsic interest, or appeals for compassion for what may be our only living companions in the universe, mostly fall on deaf ears. Conservation must be promoted as an issue of human well-being and, in the long run, survival."); The Land Ethic, supra note 48, at 247 ("When one of these non-economic categories is threatened, and if we happen to love it, we invent subterfuges to give it economic importance."); Nations, Deep Ecology Meets the Developing World, in BIODIVERSITY, supra note 8, at 79, 81 ("The day may come when ethical considerations about biological diversity become our most important reason for species conservation. But in the meantime, if we want to hold on to our planet's biological diversity, we have to speak the vernacular. And the vernacular is utility, economics, and the well-being of individual human beings."); cf. M. SAGOFF, THE ECONOMY OF THE EARTH 65 (1988) ("If an environmentalist wants to preserve parts of the natural environment for their own sake, he might do well to concede that this is his intention.").

74. See supra text notes 41-42 and accompanying text; see also P. EHRlich & A. EHR-
solid basis for preservation of tropical systems, where little or nothing is known about a vast number of species,\textsuperscript{75} but is less applicable to developed countries like the United States, where, although large gaps in our knowledge remain, much of the flora and fauna has been at least cursorily investigated.\textsuperscript{76} Many species may have little or no utilitarian value, either individually or as components of an ecosystem.\textsuperscript{77} If utilitarian reasons are the only basis for preservation, we need not preserve these species. Similarly, there may be ecosystems which do not contribute noticeably to global stability, and which contain no useful species. A strict utilitarian would allow the elimination of these ecosystems, unless she defined human well-being as including exposure to the widest possible variety of other organisms. Such a definition would make the utilitarian argument tautological.

A strict utilitarian view would also justify extermination of a species or an ecosystem to serve a human purpose, even a fairly limited purpose. Although few would argue that a starving man might not maintain his life by eating the only available food source even if it was the last example of an endangered species,\textsuperscript{78} many choices are less stark. As an example, the bark of the Pacific yew (\textit{Taxus brevifolia}), a tree found in old-growth forests of the Pacific Northwest, contains taxol, a chemical which can act as an anticancer drug.\textsuperscript{79} The tree is rare and slow-growing, the bark contains only a low concentration of the chemical, and high doses are needed to inhibit the growth of cancer cells.\textsuperscript{80} A utilitarian view might sanction the use of all specimens of the Pacific yew in destructive experiments if there were a good chance that such a course would allow scientists to develop a synthesis for taxol.\textsuperscript{81}


\textsuperscript{75} See N. \textsc{Myers, supra note 24, at 113 (most species in tropical forests have not yet been identified, let alone documented); Raven, \textit{Our Diminishing Tropical Forests}, in \textit{BIODIVERSITY}, supra note 8, at 119, 119 (only about 500,000 out of a total of between 3 and 30 million tropical species have been catalogued).}

\textsuperscript{76} See Sun, \textit{Botany Bids for the “Big Science” League, 237 SCIENCE 967, 968 (1987)} (although information has not been collected in a single location, most of the flora of the United States has been inventoried).

\textsuperscript{77} As Ehrenfeld points out, species which have historically been present in small numbers, such as California condors, may be particularly unlikely to play a vital role in the functioning of their ecosystems. Ehrenfeld, \textit{Why Put a Value on Biodiversity?}, in \textit{BIODIVERSITY}, supra note 8, at 212, 215.

\textsuperscript{78} P. \textsc{Ehrlich & A. Ehrlich, supra note 15, at 60.}


\textsuperscript{80} Id.; see Booth, \textit{Combing the Earth for Cures to Cancer, AIDS, 237 SCIENCE 969 (1987). Production of one kilogram of taxol requires 20,000 pounds of bark, or 2500 to 4000 trees. Taxol Update, THE NATURE CONSERVANCY MAG., Jan.-Feb. 1991, at 13.}

\textsuperscript{81} A scientist now claims to be able to synthesize taxol from starting material that can be isolated from the common English yew. Barnard, \textit{New Fight for Use of Old Forests, San
The scope of an appeal for preservation based on utilitarian motives is also limited by the speculative and long-term nature of many of the expected benefits of biological diversity. Although true utilitarianism may require consideration of the needs of future generations, utilitarianism has come to signify the search for "whatever is of the greatest immediate benefit to the greatest number of people at the lowest cost." Because of this societal bias, where a development project provides short-term, readily apparent benefits, a utilitarian argument for preservation of the biological resources which will be lost to the development may well fail.

Even those who do not share the strictly utilitarian view may be tempted to espouse it out of political expediency, since our society seems to be particularly geared toward utilitarian arguments. However, as Tribe has pointed out, adoption of such an approach may stifle the development of new ethical views. Moreover, because "the best interests of individual persons (and even of future generations) are not demonstrably congruent with those of the natural order as a whole," those who wish

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Jose Mercury News, Jan. 25, 1991, at A2, col. 4. If this claim turns out to be true, pressure on the Pacific yew will be greatly reduced.

A similar moral dilemma has been described by Heffernan. "For example, suppose an aged, senile person can only be kept alive by constant injection of a serum prepared from an endangered plant species. One can imagine deciding here not to use the serum. On the other hand, suppose a population of children can be saved from a virulent plague only by a serum prepared from eggs of the endangered California condor. Here, one would probably prepare the serum." Heffernan, *The Land Ethic: A Critical Appraisal*, 4 ENVTL. ETHICS 235, 244 (1982); cf. 134 CONG. REC. S10,168 (daily ed. July 28, 1988) (statement of Sen. McClure) (responding to Sen. Mitchell's call to protect the endangered Idaho Dune evening primrose as a source of a chemical which could prove to be useful in the treatment of heart disease and arthritis, Sen. McClure stated that the development of genetic engineering was fortunate because otherwise, according to Sen. Mitchell's argument, "we would go out and destroy all the evening primroses in an effort to get [the pharmaceutical]").

84. See COUNCIL ON ENVIRONMENTAL QUALITY, supra note 18, at 39.
85. See supra notes 71-72 and accompanying text.
87. See also Ehrenfeld, supra note 73, at 651 ("In summary, the usual reasons that are advanced to persuade people to accept non-resources as resources are not very likely to convince them, regardless of their truth. When everything is called a resource, the word loses all meaning — at least in our value system."). Rolston, *Duties to Species*, supra note 11, at 719 (appeals to pragmatic values are often overstated; in fact few cases can be cited where removal of a rare species endangers an entire ecosystem).
88. Tribe, supra note 86, at 1331.
to see the whole biotic community preserved must look beyond the strictly utilitarian view.

The esthetic argument, like the utilitarian one, is essentially anthropocentric: diversity is valued because it appeals to human tastes. This argument could allow the extermination of species and ecosystems which most people do not find appealing. For example, although many biologists would disagree, most people find swamps esthetically distasteful.\(^8\) Unless a scientific elite is made the arbiter of esthetic value, swamps might properly be turned into esthetically preferable meadows.\(^9\)

Similarly, if the purpose of preservation is primarily esthetic, people may demand that their esthetic experience be given first priority even when it conflicts with the health of the species or ecosystem. Such conflicts currently occur, for example, with respect to whale watching off the California coast. Because tourists demand the best possible view of the sounding whales, tour boats endeavor to get as close as possible. Some marine scientists believe that these intrusions have caused the whales to alter their migratory path significantly.\(^9\) If the primary basis for preservation of biological wonders such as whales is esthetic, perhaps they are not worth preserving unless they can be viewed at close range during their migration.\(^9\)

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88. In common parlance, swamp is synonymous with “quagmire” or “morass.” Webester’s New World Thesaurus 439 (1974). Ecologists, by contrast, generally use the term swamp to refer to a freshwater forested wetland. See, e.g., W. Wentz, Wetlands Values and Management 3 (1984). The term is no longer used in classification of wetlands “because there is considerable disagreement among wetland scientists and managers” as to its precise meaning. L. Cowardin, V. Carter, F. Golet & E. LaRoe, Interim Classification of Wetlands and Aquatic Habitats of the United States 33 (1976) (published as an addendum to Proceedings of the National Wetland Classification and Inventory Workshop (J. Sather ed. 1976)).

89. Of course, it is by no means unlikely that professional biologists would be considered the most qualified to judge the esthetic worth of natural systems and species. We do not, after all, take polls to determine what paintings should be placed in our art museums, or what books should be placed in our libraries. The high cost of preserving species and ecosystems, however, may increase the pressure for majoritarian decisionmaking.


91. It may be possible, of course, to convince people to accept a less intimate and intrusive esthetic experience in place of the offending practice. The 100-yard rule for whale watching boats is currently in effect in Hawaii, and operators there say it has not affected their business. Man and Whales: Too Close for Comfort?, supra note 90, at A22, col.1.
In the end, the esthetic argument may be indistinguishable from the utilitarian one: “enjoyment” of nature may simply be another use mankind makes of the natural world.92 This underlying utilitarianism appears to be the source of the suggestions that “natural” experiences should be orchestrated to please the public and that advertising techniques could be used to induce people to value technologically-created “natural” environments.93 Like utilitarianism, esthetic arguments can provide a basis for the preservation of some biological resources, but not for the long-term preservation of the biota as a whole.94

By contrast, nonanthropocentric moral arguments provide a basis for preservation of the entire range of biological diversity, at least if the ethical obligation runs primarily to species or natural systems rather than to individual creatures. An ethical obligation directed at individual organisms might lead indirectly to the protection of genetic diversity, but would not, in principle, allow one to distinguish between individuals of rare and abundant species. For example, under a view that primarily values individual creatures, it would be difficult to justify removal of feral goats or sheep from an island where they are eating the last examples of a rare plant.95

92. But see Sagoff, On the Preservation of Species, 7 COLUM. J. ENVTL. L. 33, 64 (1980) ("Esthetic objects, we say, are valuable 'in themselves' and not because they serve some interest. They give pleasure, of course, but this is not the reason they are valuable. We enjoy an object because it is valuable; we do not value it merely because we enjoy it. It is the object we find excellent; our experience, albeit pleasant, is worthwhile primarily because it is an experience of that object and its valuable qualities. Esthetic experience is a perception, as it were, of a certain kind of worth.") (emphases in original).


94. The esthetic argument would justify preservation of the biotic community as a whole if the esthetic qualities of natural systems, rather than individual creatures or species, were recognized as primary. See, e.g., Sagoff, supra note 92, at 64 ("To value a species is not to put it in a zoo. It is to appreciate and admire it in nature and as a part of nature."). However, appreciation of the esthetic qualities of natural systems seems to be, at the present time, largely limited to natural scientists and environmental philosophers. As noted earlier, development of an esthetic placing primary value on natural systems may be inseparable from development of the kind of love and admiration for nature mentioned by Leopold as the basis for an ethical obligation. See The Land Ethic, supra note 48.

Norton has suggested another esthetic argument which would call for preservation of natural systems rather than protection of individual species. He states that the ideal esthetic experience of nature involves an element of “surprise” which comes from “novel and unexpected encounters” in the species’ natural habitat, but not from orchestrated encounters in zoos and botanical gardens. Norton, Avoiding Triage: An Alternative Approach to Setting Priorities for Saving Species, FOREST WATCH, June 1989, at 10, 15-16.

95. Considerable controversy has been generated by the killing of nonnative sheep and goats on islands off the California coast which harbor rare plant species. See Animal Lovers Volunteer Ass’n, Inc. v. Weinberger, 765 F.2d 937 (9th Cir. 1985) (plaintiff group sued to prevent the Navy from using helicopters to hunt feral goats on Santa Barbara Island); see also Bank, Clapper Rails Make Last Stand in South Bay, San Jose Mercury News, March 25, 1991, at B1, col. 1 (animal rights advocates have opposed the trapping of the exotic red fox, the most immediate threat to the endangered California clapper rail, in the marshes around San Francisco Bay).
Other factors also limit the reach of an ethical obligation running to individual organisms. Many (probably most) of the current threats to nonhuman species come from indirect causes, such as elimination of habitat, rather than from direct exploitation. Human activities causing these indirect threats are morally ambiguous compared to actions such as the clubbing of baby seals, as they often do not result in immediately apparent harm to individual animals. Moreover, preservation of examples of all currently existing vertebrates in zoos or other artificially managed environments might fulfill an ethical obligation to individuals but would leave the world a biotically impoverished place.

Only a moral obligation extending to ecosystems or even to the global biota as a whole provides a reason to preserve the full range of biological diversity. Such an obligation could be based on the rareness of life in the universe, the complexity of the systems which have evolved on the Earth, and the unique nature of human consciousness. Leopold and others have viewed the diversity of natural systems as a good in itself; the apparent rarity of life beyond our planet may enhance the value of that diversity.

Furthermore, Homo sapiens, as a species uniquely capable of appreciating the effects of its actions, may have a special obligation to see that those actions do not unnecessarily impinge on the biota. Humans are capable both of appreciating the range of life that has developed on Earth, and of modifying the environment in ways that threaten much of that range. This combination of awareness and power may carry with it a special responsibility to preserve, to the extent compatible with human survival, the other biological resources of the planet.

Most people probably act on the basis of a complex mixture of justifications, including utilitarian and deontological ones. Public policies may also serve multiple purposes. Our current policy of species preservation has been most explicitly justified on utilitarian grounds, but it also rests to some extent on both esthetic and moral grounds. Yet because it does not protect ecosystems, current legislation does not effectively serve the goals arising from either utilitarian, esthetic, or deontological arguments.

96. See Smith, supra note 52, at 377.
97. An ethical obligation to individual animals could potentially include a duty not to disturb their natural environment. This strong obligation would be effective in preservation of those ecosystems which are dominated by vertebrates. It would still allow for the destruction of communities lacking a centerpiece with which people can identify, however. See supra text accompanying note 54.
98. See, e.g., The Land Ethic, supra note 48, at 253; Naess, supra note 61, at 232-33; Rolston, Duties to Species, supra note 11, at 725.
99. See infra text accompanying notes 105-15.
B. What Should We Seek To Preserve?

Whether one views utilitarian, esthetic, or deontological justifications (or some mixture of the three) as the appropriate basis for preservation of the biota, issues of the proper scope and focus of the optimal preservation program must inevitably be faced. This Comment will argue that ethical, esthetic, and utilitarian goals are all served most effectively by focusing our preservation efforts on ecosystems.100

1. Preservation of Life Forms or Life Processes?

As Alan Randall has pointed out, a program of biological preservation may have either of two very different goals: preservation of the currently extant biota ("life forms"), or preservation of the capacity for future evolution ("life processes").101 A narrow focus on either life forms or life processes would be inappropriate under each of the three general bases for preservation discussed above. An optimal policy should include preservation of both life forms and life processes.

From the utilitarian point of view, we want to preserve those extant life forms which provide us with tangible benefits. We also want to preserve life processes, because they provide a source for development of future beneficial organisms.102 An esthetic focus leads to the same conclusion. Evolution may produce new, beautiful, or interesting life forms as well as useful ones. Furthermore, both existing life forms and the processes which lead to the development of new ones may be esthetically appealing and hence worthy of preservation.

Depending upon one's choice of moral focus, the primary obligation could be either to life forms or to life processes. In my view, the strongest obligation should be to preserve life processes.103 These processes are more fundamental than any single manifestation of them: without life...
processes, no life forms would exist. An obligation to protect processes would extend not only to maintenance of those processes, but also to allowing them to function with minimal interference.

We also have, I believe, an obligation to protect life forms, which are the unique and irreproducible manifestation of the processes through which evolution has acted in the past. This obligation does not require us to affirmatively preserve these forms, since extinction as well as speciation is a necessary part of the evolutionary process. Rather, it requires that we refrain from unnecessarily exterminating them. Such an obligation can be justified by appeals to the diversity and complexity of the existing forms, which have both esthetic and deontological value. Perhaps a more direct and convincing reason to avoid extermination of life forms springs from the obligation to preserve the integrity of life processes. Natural extinction is part of those overall processes, but extinctions due to human activities not related to human survival arguably are not. Thus "premature" extinctions are a form of interference with life processes, and as such should be avoided.

2. Ecosystem Preservation Would Provide the Most Effective Means of Preserving Both Life Forms and Life Processes

A preservation program could theoretically concentrate on individual organisms, species in artificial environments, species in the wild, or ecosystems. The most effective method to achieve broad preservation of both life forms and life processes would be to focus on protection of ecosystems in situ.

Protection of individual organisms cannot achieve the goal of preserving life processes. In fact, it could well be inimical to those processes, since evolution cannot proceed without the death of less well-adapted organisms. Moreover, such a program would be very difficult to implement. How would one select which individuals to protect? What would happen when the survival interests of, for example, a particular deer and a particular wolf conflict? Perhaps one would choose to maintain the largest possible total number of organisms; to achieve this goal one would have to sacrifice species at the highest trophic level, losing that whole level of interactions.

Nonetheless, humans do currently have the capacity to substantially interfere with processes such as speciation. In fact, we may already have effectively ended the evolution of large mammals in the tropics and in much of the temperate zone. See Soulé, supra note 14, at 166-67. An ethical obligation to protect the processes of life would presumably forbid wholesale interference with those processes as well as their complete destruction.

104. The terms "preservation" and "protection," as used throughout this Comment, refer to the avoidance or prevention of human-caused extermination.

105. Trophic levels are levels in the food chain. Producers (typically plants) occupy the lowest level, herbivores the next, and successive levels of carnivores occupy the higher levels.
Preservation of species in zoos, botanical gardens, and gene banks will also not, by itself, meet the requirements of either the utilitarian, esthetic, or moral arguments. Such means of preservation effectively "freeze" evolutionary processes, preventing the development of new useful and/or esthetically interesting organisms. Moreover, the interactions among species, which may provide both esthetic pleasure and useful knowledge, would not be protected by such an approach. Furthermore, our current lack of knowledge about the needs of many species makes them difficult to maintain in artificial environments. All ex situ methods of preservation suffer from size and financial resource constraints limiting the number of individuals and species that can be maintained. Ex situ preservation methods are also generally more expensive than in situ preservation, and they tend, over the long term, to select for or cause changes in the preserved material which adversely affect its viability.

Nor is preservation of individual species in the wild likely to achieve the goal of preservation of both life processes and a range of life forms effectively. Such an approach may work in cases where species can be used as "surrogates" or "indicators" for an ecosystem, so that their protection will assure the protection of the associated ecosystem. However, a policy of protecting individual species will not be an effective mechanism for preservation of ecosystems unless the species to be preserved are chosen with that goal in mind. Moreover, protection of


106. The protests over capture of the last wild condors, despite good evidence that the capture was necessary to avoid extinction, demonstrate that ex situ preservation of species does not, for many people, fulfill the purposes of preservation. See, e.g., National Audubon Soc'y v. Hester, 801 F.2d 405 (D.C. Cir. 1986) (plaintiffs sought to enjoin the Fish & Wildlife Service from capturing the last remaining wild condors for captive breeding program); 60 Protest Trapping of Wild Condors, L.A. Times, Dec. 1, 1986, at A2, col. 3 (describing protests by members of Earth First! and Earth Island Institute over attempts to capture the only three condors then remaining in the wild).

107. Cf. E. Wolf, On the Brink of Extinction: Conserving the Diversity of Life 44 (Worldwatch Paper No. 78, 1987) ("... the interactions among wild species in natural assemblages give ecosystems their integrity. Only ecosystem-based conservation and restoration can preserve interactions.").

108. For discussions of some of the difficulties associated with captive breeding programs, see Benirschke, Lasley & Ryder, The Technology of Captive Propagation, in Conservation Biology, supra note 14, at 225; Kleiman, The Sociobiology of Captive Propagation, in Conservation Biology, supra note 14, at 243.

109. One writer has estimated that, if all of the existing zoo space in North America were given over to captive propagation programs, about 300 species of birds and mammals could be maintained. About 900 species could be preserved by conversion of all the zoo space in the world. Seal, Intensive Technology in the Care of Ex Situ Populations of Vanishing Species, in Biodiversity, supra note 8, at 289, 290.


111. See infra notes 264-69 and accompanying text.

112. See infra note 271 and accompanying text.
individual species, unless it is undertaken before the species shows signs of disappearing, will not effectively preserve genetic diversity.\textsuperscript{113}

By contrast, ecosystem preservation would satisfy utilitarian, aesthetic, and deontological goals. Preservation at the ecosystem level would ensure protection of many of the ecosystem's species and, to some extent, its genetic diversity. The utilitarian desire to achieve maximum benefits at minimum cost would also be fulfilled because preservation of diversity at the ecosystem level is likely to prove more cost-effective than other approaches. Ecosystem preservation should be the most cost-effective approach because it would facilitate deployment of protective measures before ecosystems and their associated species reach the brink of extinction.\textsuperscript{114} Furthermore, administration of an ecosystem reserve is likely to be far less costly than individual management of each of the component species in such a reserve. Ecosystems in a sense manage their component species themselves, providing conditions under which the species can thrive. Particularly for species whose needs have not been fully studied, maintenance within an ecosystem is likely to be both easier and more effective than maintenance in a completely artificial setting. Thus, "[w]here the conservation objective is to maintain as much biological diversity as possible, the only practical and cost-effective approach is to maintain ecosystem diversity."\textsuperscript{115}

\begin{itemize}
\item \textsuperscript{113} If protection is delayed until a species nears extinction, the population level is likely to have become reduced enough to lead to loss of genetic diversity through inbreeding and chance events.
\item \textsuperscript{114} Theoretically, species-by-species preservation efforts might also begin before a species is on the brink of extinction, but a blanket policy to that effect would be extremely difficult to implement, given the large number of species concerned.
\item \textsuperscript{115} Office of Technology Assessment, supra note 3, at 89-90; see Conserving Biological Diversity, supra note 17, at 57 ("Species are best conserved as parts of larger ecosystems where they can continue to adapt to changing conditions as part of their respective communities"); Council on Environmental Quality, supra note 18, at 69 ("the ecosystem approach has many substantial advantages"); Norton, Epilogue, in The Preservation of Species, supra note 24, at 268, 278-80 (ecosystem approach most effective in all non-crisis situations); Scott, Csuti, Jacobi & Estes, Species Richness: A Geographic Approach to Protecting Future Biological Diversity, 37 Bioscience 782, 783 (1987) ("Management costs per species increase, and the probability of successful recovery decreases, as conservation actions are focused on lower levels of [the] hierarchy [of landscape, ecosystem, community, species, population, and individual]."); Shaffer, Minimum Population Sizes for Species Conservation, 31 Bioscience 131 (1981) ("The intricate interdependencies of living things dictate that conservation efforts be focused on the community and ecosystem level."). But see Johnson & Agee, Introduction to Ecosystem Management, in Ecosystem Management for Parks and Wilderness 3, 12 (J. Agee & D. Johnson eds. 1988) [hereinafter Ecosystem Management] ("Ecosystems generally are too complex to manage as unified wholes. One approach to ecosystem management, therefore, focuses on components but recognizes the linkages between various parts of the system."). Note that even under this approach, management efforts are limited to a few key components of the ecosystem.
\end{itemize}
C. The Ethics of Making Choices

I have argued that we have an ethical obligation not to exterminate species and ecosystems. To some, that obligation is absolute, requiring us to protect, to the best of our ability, the entire range of global biota. Protection of all species and ecosystems may also serve an educational need, helping the public understand the intrinsic value of nonhuman organisms.

Even if one agrees that all species and ecosystems have intrinsic value and ideally should be protected, however, one need not adopt a policy of protecting all species and ecosystems equally. In a world of limited resources and large potential for conflict between the interests of humans and other organisms, we simply cannot avoid making choices as to the degree of protection we are willing to provide to nonhuman organisms. Absent a dramatic and rapid reduction in the human population (an event few conservationists foresee and even fewer are willing to publicly endorse) it seems inevitable that some species will become extinct in the next few weeks, months, and years as a result of human activity. Rather than let such extinctions occur more or less randomly, we should endeavor to preserve those species most vital to the functioning of ecosystems, and the greatest possible range of diversity, even at the cost of some other species. Such considered preservation requires that we establish some system of priorities.

116. Consider, for example, the comments of Paul Ehrlich: "[T]oo many conservationists are willing to compromise. . . . Conservationists who think it is 'reasonable' to exterminate any species could learn a lot about principles from 'unreasonable' conservationists like David Brower." Ehrlich, supra note 42, at 338.

117. Cf. Ehrenfeld, supra note 77, at 215 ("If conservation is to succeed, the public must come to understand the inherent wrongness of the destruction of biological diversity.").

118. Willingness to make choices in the face of limited resources and less limited threats need not imply that not all species possess inherent value. Such difficult choices must be faced whenever resources are limited. For example, difficult choices have recently attracted considerable attention in the field of medical care, where hospitals and overseers of public medical care facilities are increasingly recognizing that, although such decisions may be difficult and discomforting to make, they are unavoidable. See, e.g., Elson, Rationing Medical Care: A Fiscal Squeeze Points to Drastic Measures, TIME, May 15, 1989, at 84; Tough Medical Choices: Letting the People Decide, N.Y. Times, June 14, 1990, at B12, col. 3.

119. Cf. Senate ESA Hearings, supra note 41, at 293 (statement of Peter H. Raven, Director, Missouri Botanical Garden) ("No matter what we do, however, many species are going to become extinct, and tradeoffs for human welfare will be necessary."); W. Anderson, To Govern Evolution: Further Adventures of the Political Animal (1987) (arguing that we are already inevitably controlling the course of evolution on Earth, and should do so in a more considered, deliberate fashion); N. Myers, Tackling Mass Extinction of Species: A Great Creative Challenge 23-27 (Horace M. Albright Lectureship in Conservation, University of California at Berkeley, No. 26, 1986); Lovejoy, We Must Decide Which Species Will Go Forever, SMITHSONIAN, July 1976, at 52 (both domestically and internationally, unconsidered choices are determining which species go extinct; while no extinctions are desirable, if some are inevitable rational priorities should be set).

120. Even Ehrenfeld agrees that limited resources may force us to choose among communities or species. Ehrenfeld, supra note 73, at 653. Nonetheless, he objects to formal ranking
Both scientists and policy analysts now generally agree that ecosystem preservation is a more effective means of protecting biological diversity than species-by-species preservation. How then did the ESA, the centerpiece of the federal program for preservation of the biota, come to take a strictly species-by-species approach?

This part of the Comment examines the history of the ESA in order to shed some light on the origin of the species-by-species approach. It concludes that a number of factors, including the historical dominance of the states with respect to regulation of both wildlife and land use, uncertainty about the scope of permissible federal power, and unfamiliarity with the science of ecology and with the true nature of the most severe threats to species, contributed to the ESA's emphasis on protection of one species at a time and its concentration on preventing the "taking" of listed species. Given the modern state of the law and scientific knowledge, the statute should be modified to address the problem of loss of biological diversity more effectively.

A. Early American Wildlife And Plant Law

Early American wildlife law, which derived from the English common law, gave the states full authority over the wildlife within their borders. Under English law, the Crown and later the Parliament controlled the right to hunt game animals. This control passed to the colonies, and subsequently to the states, evolving into the concept of state "ownership" of wildlife.

Throughout the nineteenth century, the doctrine of state ownership of wildlife dominated American wildlife law. The Supreme Court articu-
lated the state ownership doctrine in *Geer v. Connecticut*,
upholding a state law prohibiting possession of game birds shot within the state with the intent to ship them beyond the state's borders. State ownership was more akin to a public trust concept than to private ownership. States "owned" wildlife for the common benefit of their citizens, and therefore had the right to limit the taking of game animals. The *Geer* opinion did recognize, however, that the reach of state ownership was limited by the United States Constitution.

Since the beginning of the twentieth century, however, federal authority to regulate and control the taking of wild creatures has gradually expanded. The trend toward greater federal authority has been accompanied by a trend away from exploitation and toward preservation of biological resources. As the next section will show, the federal government now possesses the legal authority to regulate with respect to wildlife virtually as intrusively as it desires, although it may not possess the political will to push this authority to its limits. Both Congress and the courts have contributed to the growth of federal power in this area.

**B. Developments in Land Use Law**

Land use law in the United States has traditionally been the province of local government. Local primacy has persisted because land use has long been viewed as primarily a matter of local concern, with regulatory decisions having strictly local consequences. Under this view, leaving decisions to local authorities should lead to regulations that are attuned to the needs of the local community, while at the same time protecting the community's right to political self-determination.

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126. *Id.* at 528.
127. T. LUND, supra note 122, at 47-48. Lund explains that state voters have more to gain from harvest of fish and game than those outside the species' range. Local residents also incur more of the costs of preservation of local wildlife in the form of damage to crops and livestock and disruption of economic activity. Residents of urban areas and of other states do not suffer these costs, but do gain the esthetic and moral benefits of wildlife preservation. Therefore, state legislatures tend to be primarily concerned with exploitation of game species and eradication of pest species, while Congress is better able to implement preservationist policies. *Id.*
The federal government, for the most part, has been reluctant to intrude on state and local land use decisionmaking authority. For example, despite endorsement by the Nixon administration, the proposed National Land Use Act failed to pass Congress in the early 1970's. Federal courts are also reluctant to intrude on local land use planning, which they perceive as a "sensitive area of social policy." Over the past twenty years, however, the shortcomings of local primacy in the area of land use planning have received increasing attention. Commentators have noted that the consequences of local land use decisions may extend far beyond the borders of the local jurisdiction. And despite the rejection of the National Land Use Act, the Congress has increasingly resorted to direct and indirect regulation of land use in order to achieve environmental goals. One example of direct federal regulation is the Clean Water Act, which requires that a federal permit be obtained before a land owner may fill a wetland on his property. Indirect federal land use regulations include the Coastal Zone Management Act, which sets general standards for coastal land use and makes states eligible for federal grants if they develop a program to manage their coastlines in accordance with those standards. So long as federal land use regulations, direct or indirect, can be justified on health and safety grounds (as can pollution controls), or on Commerce Clause grounds (as can most environmental regulations), courts appear willing to uphold them.


135. Id. § 1344.


137. Id. § 1455.

138. See infra notes 162-83 and accompanying text.

139. Cf. Mandelker & Wafer, supra note 131, at 62 (stating that courts are more receptive to environmentally-based land use controls). But note that, when interpreting the Clean Air Act provision under which EPA sought to compel states to enact transportation control programs which included land use regulations, several courts construed the provision to exclude such power. Developments in the Law — Zoning, supra note 133, at 1613-14. These courts sought in part to avoid Tenth Amendment difficulties, id., which have been at least temporarily laid to rest by Garcia v. San Antonio Metro. Transp. Auth., 469 U.S. 528 (1985), overruling National League of Cities v. Usery, 426 U.S. 833 (1978).
C. Sources of Federal Power to Regulate Wildlife

Although regulation of wildlife has traditionally been carried out at the state level, the federal government, under current constitutional interpretation, holds nearly unlimited power to preempt state regulations relating to wildlife and promulgate its own. This power extends to the ability to override local land use controls in order to protect biological resources.

Federal wildlife law has been justified chiefly by reference to three constitutional grants of power: the Treaty Power;\textsuperscript{140} the Property Power;\textsuperscript{141} and the Commerce Power.\textsuperscript{142} The scope of federal power with respect to regulation of wildlife under these provisions was unclear in 1973 when the ESA was enacted. Since then, however, the courts have made it clear that federal power in this area is virtually limitless.

1. The Treaty Power

The Treaty Power provided the earliest successful defense of a challenge to federal assertion of authority over wildlife in the face of the state ownership doctrine.\textsuperscript{143} In 1920, the Supreme Court upheld the constitutionality of the Migratory Bird Treaty Act in \textit{Missouri v. Holland}, holding that legislation implementing a valid treaty was necessarily valid.\textsuperscript{144} The Court stated that "[i]t is obvious that there may be matters of the sharpest exigency for the national well being that an act of Congress could not deal with but that a treaty followed by such an act could."\textsuperscript{145}

The \textit{Missouri v. Holland} decision rested in part on the fact that the birds in question were migratory.\textsuperscript{146} It left open the degree to which federal authority could be extended, under the Treaty Power, to nonmigratory species. More recently, however, the Treaty Power has been cited as one justification for the imposition of federal controls on taking of the palila (\textit{Psittirostra bailleui}), a nonmigratory Hawaiian bird, under the Endangered Species Act.\textsuperscript{147} The sweep of federal authority to

\begin{itemize}
\item \textsuperscript{140} U.S. CONST. art. II, § 2, cl. 2.
\item \textsuperscript{141} U.S. CONST. art. I, § 8, cl. 17, and art. IV, § 3, cl. 2.
\item \textsuperscript{142} U.S. CONST. art. I, § 8, cl. 3.
\item \textsuperscript{143} M. BEAN, supra note 122, at 19-21.
\item \textsuperscript{145} Holland, 252 U.S. at 433.
\item \textsuperscript{146} Id. at 434 ("The whole foundation of the State's rights is the presence within their jurisdiction of birds that yesterday had not arrived, tomorrow may be in another State, and in a week a thousand miles away. If we are to be accurate we cannot put the case of the State upon higher ground than that the treaty deals with creatures that for the moment are within the state borders.").
\item \textsuperscript{147} Palila v. Hawaii Dep't of Land and Natural Resources, 471 F. Supp. 985, 992-94 (D. Haw. 1980), aff'd on other grounds, 639 F.2d 495 (9th Cir. 1981). Congress, in enacting the ESA, found that "the United States has pledged itself as a sovereign state in the international
displace state wildlife law under the Treaty Power thus appears to be very broad.\textsuperscript{148}

2. \textit{The Property Power}

The Property Power provides another important source of federal authority to regulate the taking of wildlife and plants. The federal government owns about one-third of the land in the United States.\textsuperscript{149} Federal lands harbor a significant fraction of the nation's biota.\textsuperscript{150} The Property Power gives Congress the authority to regulate the use of these lands.\textsuperscript{151} State law operates on federal lands, but federal legislation can supplant it.\textsuperscript{152} The states have a particularly strong interest in applying their wildlife laws to federal lands, since they may gain substantial revenue from the sale of licenses to hunt and fish on federal lands, and since federal lands may sustain a large proportion of the state's wildlife population.\textsuperscript{153}

community to conserve to the extent practicable the various species of fish or wildlife and plants facing extinction, pursuant to a number of international agreements, including migratory bird treaties with Canada, Mexico, and Japan; the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere; and the Convention on International Trade in Endangered Species of Wild Fauna and Flora. 16 U.S.C. § 1531(a)(4) (1988). One purpose of the ESA is to assure achievement of the purposes of these agreements. 16 U.S.C. § 1531(b) (1988). The palila is listed as a species of special urgency under the Convention on Nature Protection, permitting the argument that the federal government may give it even stronger protection than other endangered species.

\textsuperscript{148} The Convention on Nature Protection could potentially justify the protection of all endangered species. It binds its signatories to "adopt, or to propose such adoption to their respective appropriate lawmaking bodies, suitable laws and regulations for the protection and preservation of flora and fauna within their national boundaries." Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere, Oct. 12, 1940, 56 Stat. 1354, T.S. No. 981, 161 U.N.T.S. 193. The Convention also states that the signatories wish to "protect and preserve in their natural habitat representatives of all species and genera of the native flora and fauna . . . in sufficient numbers and over areas extensive enough to assure them from becoming extinct through any agency within man's control." Id. preamble.

\textsuperscript{149} Coggins & Harris, supra note 29, at 269.

\textsuperscript{150} For example, up to 65\% of the endangered or threatened plant species in the United States are found on public lands. Comment, Legal Protection for Rare Plants, 29 AM. U.L. REV. 515, 524 (1980).

\textsuperscript{151} The Property Power is divided into two strands, arising from two separate clauses in the Constitution. See T. LUND, supra note 122, at 51-52. Congress has "exclusive" legislative power over areas purchased by the federal government with the consent of the states. Id. at 51 (interpreting U.S. CONST. art I, § 8, cl. 17). Such areas are referred to as "federal enclaves." Although some national parks are located in federal enclaves, the more important branch of the property power for purposes of wildlife law is found in article IV, which applies to all federal property. Id. at 51-52.

\textsuperscript{152} See id. at 52-54. Early Supreme Court cases construing article IV held that the federal government had no more power than a private landowner. Id. at 52. But by the late 1920's courts had upheld federal actions designed to protect federal land and property even when those actions conflicted with state wildlife laws. See M. BEAN, supra note 122, at 22; Gottschalk, supra note 124, at 291.

\textsuperscript{153} See, e.g., Gottschalk, supra note 124, at 300; Note, Regulation of Wildlife in the National Park System: Federal or State?, 12 NAT. RESOURCES J. 627, 629 & n.14 (1972).
The precise scope of the Property Power with respect to the operation of wildlife laws on federal lands remained in some doubt until 1976. In that year, the Supreme Court sustained the Wild and Free-Roaming Horses and Burros Act as a valid exercise of the Property Power. The Act gave federal authorities jurisdiction over wild horses and burros on public lands, and required that private landowners return animals which had strayed from public lands to the federal government. In upholding the Act, the Court held that legislation with respect to the public lands need not be limited to direct protection or disposal of those lands. Rather, Congress has complete authority over the public lands, authority that "necessarily includes the power to regulate and protect the wildlife living there." Kleppe declined to decide the extent to which the Property Power could protect wildlife that strayed from public lands onto private ones.

An aside in Kleppe indicated that the Court might have been willing to find that the animals themselves could be considered federal property subject to congressional regulation. The district court in Palila, also in dicta, took this suggestion further, stating that "[t]he importance of preserving such a national resource may be of such magnitude as to rise to the level of a federal property interest." This reasoning could justify federal protection of virtually any biological resource, but apparently no other courts have picked up on the idea of wildlife as federal property. In fact, this concept may not add much to the extent of federal power to regulate with respect to wildlife, given the current broad construction of other sources of federal power.

3. The Commerce Power

The Commerce Clause, as interpreted by modern courts, provides perhaps the broadest federal power to protect and regulate biological resources. At the start of the twentieth century the Commerce Power clearly validated the Lacey Act, which forbade interstate transportation of animals killed in violation of state law. Before the New Deal,

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156. Id. at 536-37.
157. Id. at 541.
158. Id. at 546.
159. "[I]t is far from clear that . . . Congress cannot assert a property interest in the regulated horses and burros superior to that of the State." Id. at 537.
161. See M. Bean, supra note 122, at 25 (scope of federal power to regulate wildlife is so broad after late-1970’s Supreme Court cases that there is no need to pursue the Palila suggestion).
however, it was far from clear that the Commerce Power could be used to regulate wildlife in the absence of an actual interstate shipment. In the early part of this century two federal courts struck down as exceeding the Commerce Power a statute giving the Interior Department the authority to regulate hunting of migratory birds. Since that time, however, the Supreme Court has greatly increased judicial deference to congressional power under the Commerce Clause.

As currently interpreted, the Commerce Power has a virtually unlimited sweep. Under modern Commerce Clause doctrine, Congress is not limited to regulating activities which actually constitute interstate commerce; it may regulate activities which are themselves purely intrastate if those activities affect interstate commerce. Activities can be regulated even if their connection to interstate commerce is fairly remote and speculative. The volume of commerce affected is immaterial. If a class of activities, taken as a whole, affects commerce, the entire class may be regulated, even if some activities within the class have little or no individual effect on commerce.

Courts must defer to a congressional finding that an activity affects interstate commerce, unless there is no rational basis for that finding. Once Congress has found that an activity is related to interstate commerce, it may regulate that activity in any manner reasonably related to the end it desires to achieve. The fact that Congress' "true motive" in enacting a statute may have been to solve a moral or social problem does not affect its validity under the Commerce Power.

163. T. Lund, supra note 122, at 49.
166. The Supreme Court has not invalidated any federal statute as exceeding the Commerce Power since Carter v. Carter Coal Co., 298 U.S. 238 (1936), with the limited and now overruled exception of National League of Cities v. Usery, 426 U.S. 833 (1976) (overruled by Garcia v. San Antonio Metro. Transit Auth., 469 U.S. 528 (1985)), which tried to carve out an area of essential state sovereignty beyond congressional power.
170. Perez, 402 U.S. at 152-54.
171. Virginia Surface Mining. 452 U.S. at 276; Hodel v. Indiana, 452 U.S. at 324.
172. Hodel v. Indiana, 452 U.S. at 323-24; see also Virginia Surface Mining, 452 U.S. at 276.
The modern Commerce Clause provides a potent source of federal power to protect wildlife. In passing the Marine Mammal Protection Act of 1972, Congress explicitly based its authority on the Commerce Clause, reasoning that disruption of populations of marine mammals that are not themselves the subject of commerce may disturb ecosystems, thereby affecting populations of animals that are the subject of commerce. One commentator has noted that “this theory might at its logical extreme support federal legislation with regard to everything that is alive.”

The scope of the Commerce Clause with respect to wildlife regulation was not tested in the courts until the late 1970's. The Supreme Court in 1979 confirmed the broad sweep of the Commerce Clause with respect to wildlife law. In Hughes v. Oklahoma the Court expressly overruled the doctrine of state ownership of game set forth in Geer, invalidating an Oklahoma statute forbidding transport beyond the state’s borders of minnows taken from the wild within the state. The Court recognized the state's legitimate interest in conservation, but held that state laws serving this interest must not unreasonably impinge on interstate commerce. And in Andrus v. Allard, the Court applied the Hughes reasoning to find the Migratory Bird Treaty Act valid under the Commerce Power as well as the Treaty Power.

A lower federal court found that the Commerce Clause justified federal restrictions on the taking of a nonmigratory species of bird found only on state land in Palila v. Hawaii Department of Land and Natural Resources. The Palila court reasoned that preservation of endangered species also preserved the possibility of commerce in those species, and of movement of persons across state lines to study the species. These possibilities sufficed to bring the ESA under the umbrella of the Commerce Power.

175. Id. § 1361(5)(B).
176. T. LUND, supra note 122, at 50.
178. See id. at 337-39.
180. Id. at 63 n.19.
182. Id. at 995.
183. See Nelson, Palila v. Hawaii Department of Land and Natural Resources: State Governments Fall Prey to the Endangered Species Act of 1973, 10 ECOLOGY L.Q. 281, 293-97 (1982) (concluding that Palila court’s application of the Commerce Clause, while ‘not unassailable,’ was justified). The Ninth Circuit recently held that the Commerce Clause was broad enough to allow Congress to extend the Army Corps of Engineers’ jurisdiction to wetlands used by migratory birds or endangered species. Leslie Salt Co. v. United States, 896 F.2d 354, 360 (9th Cir. 1990), cert. denied, 111 S.Ct. 1089 (1991). One judge on the panel dissented from this holding, but nonetheless acknowledged congressional authority under the Commerce Clause to regulate endangered species. Id. at 361 n.1 (Rymer, J., concurring in part and dis-
D. Federal Endangered Species Legislation

Federal protection of endangered species has progressed from limited, noncontroversial regulations of conduct to sweeping regulations of broad scope. This progression probably reflects both increasing confidence in federal regulatory authority and the growing recognition that more limited efforts have not solved the problem of species loss.

1. The Endangered Species Preservation Act of 1966

The first federal statute directed generally at the protection of endangered species was the Endangered Species Preservation Act of 1966, enacted "to provide a program for the conservation, protection, restoration, and propagation of selected species of native fish and wildlife, including migratory birds, that are threatened with extinction." The Act directed the Secretaries of Agriculture, Interior, and Defense to protect domestic species threatened with extinction and, "insofar as is practicable and consistent with the primary purposes" of their agencies, to preserve the habitats of such species on land under their jurisdiction. Species were protected if found by the Secretary of the Interior, "after consultation with the affected States," to require assistance for their survival.

The 1966 Act relied primarily on land acquisition, the method least likely to arouse political controversy, to protect endangered species. It empowered the Secretary to use his authority under earlier statutes to acquire land for the purpose of conserving endangered species. It also created new land acquisition authority, using money from the Land and


186. Id. § 1(a).

187. Id. § 1(b).

188. Id. § 1(c).

Water Conservation Fund. The Act directed the Secretary to consult with the states before acquiring land to protect endangered species.

The 1966 Act included other provisions, but they were largely hortatory. For example, it directed the Secretary to review other programs within the jurisdiction of the Department of the Interior and use them "to the extent practicable" to further the Act's purposes. The Secretary was also told to "encourage other Federal agencies" to further these purposes, and to assist them in that endeavor. The 1966 Act also prohibited the taking of plants and animals which constituted "personal property of the United States" on lands within the National Wildlife Refuge System. However, it specifically stated that this provision did not affect the authority of states to regulate "fish and resident wildlife" within the Refuge System.

Passage of the 1966 Act was "remarkably uncontroversial." Events like the publication of Rachel Carson's *Silent Spring* in 1962 had sensitized the public to the need to protect biological resources. Votes for the Act were seen as a low-cost way to show support for this goal. Most members of Congress believed that the law would primarily aid popular or charismatic species.


The 1966 Act was supplemented three years later by the passage of the Endangered Species Conservation Act of 1969. The 1969 Act expanded protective authority to explicitly include invertebrates and less charismatic vertebrates, such as reptiles. It largely prohibited the import of listed species into the United States. It also amended the


192. Id. § 2(d).

193. Id.

194. Id. § 4(c).

195. Id. This rather odd language was inserted because the Department of the Interior was at that time engaged in a dispute with the states over the authority to control hunting and fishing on federal lands. See Gottschalk, *supra* note 124, at 300. Congress sought to "maintain the status quo" with respect to this issue in the 1966 Act. S. REP. No. 1463, 89th Cong., 2d Sess. (1966), reprinted in 1966 U.S. CODE CONG. & ADMIN. NEWS 3342, 3347-48.

196. S. YAFFEE, *supra* note 9, at 41.

197. Id.


199. Id. § 1(2). The Interior Department had interpreted the "fish or wildlife" language of the 1966 Act to include only vertebrates. M. BEAN, *supra* note 122, at 322.

Lacey Act, which prohibited interstate commerce in fish, birds, and mammals protected by state or foreign laws, to extend coverage to reptiles, amphibians, mollusks, and crustaceans. The 1969 Act also provided more money for land acquisition to protect endangered species.

3. The Endangered Species Act of 1973

The shortcomings of the 1969 Act were quickly recognized. President Nixon, in his 1972 Environmental Message to Congress, warned that the 1969 Act did "not provide the kind of management tools needed to act early enough to save a vanishing species." Congress responded by enacting the Endangered Species Act of 1973 almost without opposition.

The ESA was the product of strong public interest in environmentalism combined with an "increased belief in federal regulation as appropriate public policy." It was preceded by a spate of regulations and laws demonstrating increased federal willingness to control the taking of wildlife and to preempt state wildlife law. For example, in 1972, the Nixon administration promulgated an Executive order prohibiting the poisoning of predators on federal lands. The same year Congress also passed the Marine Mammal Protection Act, which preempted all state authority over marine mammals.

The ESA marked a substantial change from the cautious approach of the 1966 and 1969 Acts. First, it allowed any species of plant or animal to be accorded protected status. Second, it prohibited the tak-
ing of endangered species of animals within the United States, on both private and public lands. While it did not prohibit the taking of endangered or threatened plants, it did outlaw their transportation, sale, or possession.213

A third innovation of the ESA was the introduction of two categories of protected species: "endangered" and "threatened." The ESA defined "endangered species" as a species "in danger of extinction throughout all or a significant portion of its range."214 A "threatened species" was one likely to become endangered "within the foreseeable future."215 Threatened species are not automatically entitled to the same level of protection as endangered species,216 but the Fish and Wildlife Service (FWS) has for the most part treated the two categories of species identically.217 The ESA also authorized the Secretary to treat any species as endangered or threatened if it so closely resembled an endangered or threatened species that enforcement personnel would find it difficult to tell the two apart.218

A fourth new feature of the ESA was the requirement that federal agencies and departments ensure that their actions would not "jeopardize the continued existence of endangered species and threatened species."219 Furthermore, federal actions were required not to destroy or modify habitat designated by the Secretary as critical for an endangered or threatened species.220 The ESA provided no standards for the designation of critical habitat, however, and did not even define the term.

The ESA mandated federal cooperation with state governments to the maximum extent practicable.221 Congress was reluctant to preempt state regulations, although it was willing to do so where those regulations were not sufficiently protective.222 This reluctance was due in part to

212. 16 U.S.C. § 1538(a)(1)(B) (1988). The ESA defines taking very broadly: "[t]he term 'take' means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Id. § 1532(19).
213. Id. § 1538. Subsequent amendments have provided some further protection for listed plant species. See infra text accompanying notes 241, 244-45.
215. Id. § 1532(20).
216. "Whenever any species is listed as a threatened species . . . the Secretary shall issue such regulations as he deems necessary and advisable to provide for the conservation of such species." Id. § 1533(d).
217. M. BEAN, supra note 122, at 333 n.66.
219. ESA § 7, Pub. L. No. 93-205, 87 Stat. 884, 892 (1973). This provision has since been amended to provide that federal agencies need only ensure that their actions are "not likely" to jeopardize a listed species. 16 U.S.C. § 1536(a)(2) (1988).
221. Id. § 1535(a).
recognition that the federal government lacked sufficient resources to enforce the provisions of the ESA without state cooperation. Reluctance to disturb the traditional role of the states in regulating wildlife may also have played a role.

4. Subsequent Amendments

The ESA has been amended several times; only the major changes will be discussed here. The first major amendments to the ESA were enacted in 1978. In contrast to the ESA itself, the 1978 amendments were the subject of extensive, and sometimes acrimonious, debate. Even members of Congress who had been among the strongest supporters of the law favored its amendment, fearing that failure to provide some mechanism whereby other values could be balanced against species protection would lead to its repeal.

In the 1978 amendments, Congress introduced a procedure whereby federal agencies could obtain an exemption from the duty not to jeopardize endangered species or their critical habitat. An exemption can be granted by the Endangered Species Committee only if the Committee

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224. Reluctance could have come from both the long-established primacy of the states in wildlife regulation and the fact that many states already provided legal protection to endangered species. Thirty-five states had some form of legislation protecting endangered species before the ESA was enacted. Many of these laws provided stronger protection than the ESA. See 119 CONG. REC. 25,679 (1973), reprinted in ESA LEGISLATIVE HISTORY, supra note 204, at 385 (statement of Sen. Tunney).
227. The most obvious and best-publicized example was the conflict between protection of the snail darter, a small minnow-like fish, and completion of the Tellico Dam. The Supreme Court, enjoining completion of the dam, ruled that the ESA required the protection of listed species at all costs. Tennessee Valley Auth. v. Hill, 437 U.S. 153, 184 (1978).
228. For example, Representative Morris Udall stated that “[w]e are going to get ourselves in real trouble if we do not try to find some way of avoiding this kind of situation. . . It gets the whole act into trouble and into disrepute.” 124 CONG. REC. 38,145 (1978), reprinted in ESA LEGISLATIVE HISTORY, supra note 204, at 856.
230. This Committee consists of the Secretaries of Agriculture, the Army, and the Interior; the Chairman of the Council of Economic Advisors; the Administrator of the EPA; the Administrator of NOAA; and a representative of each affected state. 16 U.S.C. § 1536(e) (1988). It has come to be referred to as the “God Committee.”
finds that: (1) there is no "reasonable and prudent" alternative to the proposed agency action; (2) the benefits of the proposed action "clearly outweigh" the benefits of alternatives which would not affect a listed species; and (3) the proposed action is of regional or national significance.\textsuperscript{231} The Committee may impose reasonable and appropriate mitigation measures.\textsuperscript{232}

The 1978 amendments also introduced, for the first time, a definition of critical habitat. This definition was quite narrow, encompassing only areas which contain physical or biological features both "essential to the conservation of the species and . . . require[ing] special management considerations or protections."\textsuperscript{233} The designated critical habitat was not, except in special circumstances, to include the entire range of a species.\textsuperscript{234}

Under the 1978 amendments, the Secretary of the Interior was required to designate critical habitat when proposing to list a species.\textsuperscript{235}

\begin{footnotesize}
\begin{enumerate}
\item Id. § 1536(h)(1)(B). For a detailed description of the exemption process, see Coggins & Russell, \textit{supra} note 2, at 1480-95. One of the Committee's first tasks was to examine the Tellico Dam project. The Committee rejected the request for an exemption for this project. \textit{See} Dingle, \textit{The Flooding of an American Canaan: The Endangered Species Act and the Value of Wildlife}, 22 Urb. L. Ann. 161, 162 (1981). Congress subsequently approved legislation which exempted the Tellico Dam from the provisions of the ESA. Energy and Water Development Appropriation Act, Pub. L. No. 96-69, 93 Stat. 437 (1979). The provision allowing completion of the Dam was tacked onto a general appropriations bill, and was not read, described, or discussed on the floor of the House. Plater, \textit{Reflected in a River: Agency Accountability and the Tennessee Valley Authority Tellico Dam Case}, 49 Tenn. L. Rev. 747, 783 (1982). The gates of the Tellico Dam were closed in November 1979. Dingle, \textit{supra}, at 161. Subsequently, small populations of the snail darter were located elsewhere. \textit{See} Norman, \textit{Snail Darter's Status Threatened}, 212 Science 761 (1981); Plater, \textit{supra}, at 766 n.65.
\item Id. § 1532(5)(C) (1988).
\item Pub. L. No. 95-632, § 11(1), 92 Stat. 3764 (1978). Critical habitat was required to be designated concurrently with listing "to the maximum extent prudent." \textit{Id.} This phrase was intended to allow the Secretary not to designate critical habitat only in the rare circumstances "where it would not be in the best interests of the species to do so." H.R. Rep. No. 1625, \textit{supra} note 228, at 16-17, \textit{reprinted in ESA Legislative History, supra} note 204, at 880.
\end{enumerate}
\end{footnotesize}
The Secretary was also directed, in making the determination of critical habitat, to consider the economic impacts of such designation. Areas could be excluded from designation if the Secretary found that the benefits of exclusion outweighed those of making the designation, unless the failure to include those areas would "result in the extinction of the species." As originally proposed, the amendments applied this provision only to critical habitat designation for invertebrate species, but it was altered on the floor of the House to apply to all species. Critical habitat designation has become one of the most controversial features of the ESA; it is also the facet of the Act that comes closest to direct land use regulation.

In 1982, Congress added a prohibition on the removal or reduction to possession of endangered or threatened plants from federal lands. Until this time, commerce in endangered and threatened plants had been prohibited, but the taking of such plants had not. The 1982 amendments also added a provision allowing the government to give private parties permission to take endangered species under certain conditions.

Congress made two major changes in the ESA in 1988. First, some protection was provided for species that were proposed but not yet finally listed. The Secretary was directed to monitor the status of such species, and to use his authority to issue emergency regulations if necessary "to prevent a significant risk to the well-being of any such species." Second, the protection afforded endangered and threatened plants was further strengthened, although it still did not reach the protection afforded listed animals. Maliciously damaging plants on federal land was added


237. Id.
238. See H.R. REP. NO. 1625, supra note 228, at 16, reprinted in ESA LEGISLATIVE HISTORY, supra note 204, at 740.
239. 124 CONG. REC. 38,156 (1978), reprinted in ESA LEGISLATIVE HISTORY, supra note 204, at 884-85.
240. See, e.g., Salzman, supra note 235, at 335-38 (explaining some of the reasons for opposition to critical habitat designation).
242. Taking is allowed only if: (1) it is incidental to the applicant's activity; (2) the applicant submits a "conservation plan" showing that he or she will minimize the impact of the taking to the maximum extent practicable; and (3) the taking will not appreciably reduce the likelihood of survival and recovery of the species. 16 U.S.C. § 1539(a)(2)(B) (1988). The Secretary has the authority to add any necessary or appropriate measures to the applicant's conservation plan. Id. § 1539(a)(2)(A)(iv). For a general discussion of the history and operation of the incidental taking provision, see Comment, Habitat Conservation Plans Under the Endangered Species Act, 24 SAN DIEGO L. REV. 243 (1987).
to the list of prohibited acts. Moreover, removing, damaging, or destroying plants, whether found on federal lands or not, "in knowing violation" of any state law was also prohibited.

E. Summary: The Origin of the Single-Species Focus of the ESA

The history recited above gives some insight into the origin of the species-by-species focus of the ESA. Legal and political constraints both operated to make Congress reluctant to enact sweeping legislation. In 1973, when the ESA was enacted, doubt remained as to the scope of federal power to preempt state wildlife regulations. This doubt was not resolved until the late 1970's. Even granting that Congress had the authority to override state wildlife regulation, they were reluctant to do so.

Congress was probably also unwilling to intrude any further than necessary on land use regulation, a traditionally local function. A proposed National Land Use Act had recently been debated and rejected by Congress. It is not surprising, then, that early federal endangered species legislation restricted only commerce and activities on federal lands, and that even these restrictions applied only to vertebrates.

The prevailing scientific climate may also have contributed to the species-by-species orientation of the ESA. Although a handful of scientists had been pursuing the study of interactions among species since the time of Darwin, the 1960's brought a sudden expansion in the study of ecology. In the mid-1960's, when the first federal endangered species legislation was drafted, the term ecology was just beginning to become familiar to nonscientists. In fact, a House report on the bill which became the ESA of 1973 referred to ecology as if it were a new concept. Congress also may not have appreciated fully the fact that habitat loss due to human land uses was the major threat to the well-being of many species.

244. Id. § 1006 (codified as amended at 16 U.S.C. § 1538(a)(2)(B) (1988)).
245. Id.
246. See supra notes 140-83 and accompanying text.
247. See supra notes 222-24 and accompanying text.
248. See supra notes 128-32 and accompanying text.
249. The National Land Use Policy and Planning Act of 1972, S. 632, 92d Cong., 2d Sess., passed the Senate, see 118 Cong. Rec. 31,217 (1972), but was never considered on the floor of the House.
252. Congress was presented with a number of statements indicating that habitat loss was a major threat to species. See, e.g., H.R. Rep. No. 412, supra note 251, at 5, reprinted in ESA Legislative History, supra note 204, at 144; 119 Cong. Rec. 30,162 (1973), reprinted in ESA Legislative History, supra note 204, at 192; S. Rep. No. 307, 93d Cong., 1st Sess. 2 (1973), reprinted in ESA Legislative History, supra note 204, at 301. Nevertheless, until the experiment was tried, no one could know for sure how effective or ineffective broad restric-
Nonetheless, Congress was capable of writing a statute with a broader focus at the time of the ESA's passage. The Marine Mammal Protection Act (MMPA),\textsuperscript{253} enacted in 1972, states that its primary objective is the maintenance of the health and stability of the marine ecosystem.\textsuperscript{254} It protects all marine mammals, with special protection for any that fall below an optimal sustainable population.\textsuperscript{255} Furthermore, the MMPA unambiguously preempts all state authority over marine mammals.\textsuperscript{256}

Political reality probably largely explains the different orientations of the MMPA and the ESA. A number of factors makes protection of marine mammals less controversial than protection of other species. Marine mammals are "charismatic" animals; many people identify with them. They are also a limited group of organisms, and relatively easy to protect. The need to avoid disturbing marine habitats interferes with relatively few development projects.\textsuperscript{257} The justifications for traditional state authority over terrestrial wildlife\textsuperscript{258} do not apply to marine mammals.\textsuperscript{259} Protection of marine creatures generally does not interfere with local land use regulation authority. Furthermore, acquisition of habitat has never been a viable option for protecting marine mammals.

The manner in which the ESA developed may also help explain its limited focus. The ESA followed the 1966 and 1969 Acts, with their emphasis on vertebrates and protection through land acquisition. The ESA was formulated as an improvement of the earlier Acts, not as a radical departure from their approach. Since 1966, Congress has been periodically applying bandages to those elements of endangered species legislation which seem to be in need of repair. It has never undertaken a complete overhaul of that legislation. Although the activities prohibited

\begin{footnotesize}
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\item 254. Id. § 1361(6).
\item 255. See, e.g., id. §§ 1372(b)(3), 1362(1) (1988). The optimum sustainable population is that population which results in maximum productivity, keeping in mind the carrying capacity of the ecosystem. Id. § 1362(8).
\item 256. Id. § 1379(a). The federal government may return regulatory authority to those states that meet certain requirements. Id. § 1379(b).
\item 257. While the MMPA would seem to provide a potential mechanism to halt offshore mineral development, claims that such projects would violate the MMPA have rarely been recorded in published judicial opinions. In one such case, a federal court considered a claim that a lease sale program off the coast of Alaska violated the MMPA because it would result in the taking of bowhead whales, grey whales, and polar bears. The court rejected the claim on the grounds that the alleged harm was not certain. North Slope Borough v. Andrus, 486 F. Supp. 332 (D.D.C.), rev'd in part, aff'd in relevant part, 642 F.2d 589 (D.C. Cir. 1980).
\item 258. See supra notes 122-27 and accompanying text.
\item 259. In contrast to land, ocean waters and their contents have traditionally been the province of federal rather than state law. For example, the framers of the Constitution specifically gave the federal government authority over admiralty law. See U.S. CONST. art. I, § 8, cl. 10, and art. III, § 2, cl. 1.
\end{itemize}
\end{footnotesize}
and the species protected by federal endangered species laws have greatly expanded over time, this expansion has occurred only incrementally.

The species-by-species nature of the ESA has prevented it from becoming an optimal tool for the preservation of biological diversity. Doubts about federal power to legislate with respect to wildlife and land use have been resolved. It has become clear that restrictions on the taking of listed species do not by themselves ensure the survival of species or their ecosystems. It is time for Congress to take a new look at the problem of loss of biological diversity, and enact more effective protective legislation.

III
SHORTCOMINGS OF THE ENDANGERED SPECIES ACT

The ESA, the cornerstone of the federal program for preservation of the biota, does not effectively protect biological diversity. The species-by-species focus of the ESA, although historically unsurprising, has limited its effectiveness in preserving biological diversity at levels other than the species level. Even in terms of species diversity, the ESA does not work as well as it could, in part because it provides no mechanism for distinguishing one species from another or for examining the range of species protected. Furthermore, listing decisions must be based on data which are difficult and costly to obtain. This both exacerbates the problem of chronic underfunding and allows the FWS to incorporate political considerations into listing decisions which are ostensibly strictly technical.

A. The ESA Does Not Effectively Protect Biological Diversity

The species-by-species orientation of the ESA leads to protection of ecosystems only occasionally and coincidentally. In some instances, in fact, the single-species orientation of the ESA may encourage or even require an agency to take actions that are incompatible with the protection of ecosystems.

I. Not All Species Are Protected by the ESA, Nor Can They Be

Theoretically the ESA, despite its species-by-species orientation, could protect all forms of biological diversity. Protection of all species, at least if they were all protected in their natural habitats, would simultaneously maintain their ecosystems. And if species were protected at population levels sufficient to ensure continued vitality, genetic diversity would also be preserved.
However, it is simply impractical for all species to be protected under the ESA.\footnote{260} The FWS has nowhere near enough money to produce the required scientific justification for listing all the species which currently meet the criteria for endangered and threatened status, much less to devise and implement recovery plans for these species.\footnote{261} Furthermore, as more species are listed, political opposition to further listings increases.\footnote{262} And even if resources were unlimited, species are not eligible for protection under the ESA until they are in demonstrable danger of extinction or likely to become so within the foreseeable future.\footnote{263} Thus, the ESA will never protect all species.

\footnote{260} Prior to the 1978 amendments, the ESA treated every species as being incalculably valuable. See Tennessee Valley Auth. v. Hill, 437 U.S. 153, 184 (1978). Although it currently allows other values to override that of species preservation in extreme circumstances, the statute continues to treat all species as having equivalent and nearly infinite value. Despite this statutory treatment, preservation of all species is probably impossible, at least in the absence of drastic reductions in human population and drastic changes in human lifestyles. Thus, the ESA can be viewed as a "symbolic" or "aspirational" statute, one that sets a goal that the statute's authors know or should know cannot reasonably be achieved. Such statutes distort the political process and subject agencies to great pressures to modify their literal reach. See, e.g., Dwyer, The Pathology of Symbolic Legislation, 17 ECOLOGY L.Q. 233 (1990). Society may gain something, however, through the symbolic affirmation that all species are of great value, even if they cannot, in fact, all be protected. See, e.g., Franklin, Endangered Species: Where to From Here?, AM. FORESTS, Nov.-Dec. 1987, at 57 (stating that the ESA has raised consciousness about biological diversity, generated concern for species, and encouraged state preservation programs); Sagoff, supra note 92, at 66 ("We believe that Congress should express not just our interests as consumers but our aspirations and convictions as citizens."); see also Ehrenfeld, supra note 73, at 653 (arguing that setting ranking systems for species is undesirable because such systems rationalize the making of choices that should not be easily made).

\footnote{261} Appropriations for the endangered species program from 1981 through 1989 amounted to about $232 million. OFFICE OF INSPECTOR GENERAL, DEP'T OF THE INTERIOR, AUDIT REPORT NO. 90-98, THE ENDANGERED SPECIES PROGRAM OF THE U.S. FISH AND WILDLIFE SERVICE 3 (1990) [hereinafter INSPECTOR GENERAL'S REPORT]. These funds cover all aspects of the program, not just the listing process. The FWS estimates that it costs approximately $60,000 to officially list a species. Id. at 7. At that rate, the cost of listing the 1900 to 2400 current candidate species estimated to merit listing would be $78 million to $108 million. Id. The current annual listing budget is $3.5 million. Id. The Inspector General estimates that the cost to fully recover all current listed and candidate species likely to merit listing could be as high as $4.6 billion, while annual resources available for this task are only $8.4 million. Id. at 11.

\footnote{262} Cf. CONSERVING BIOLOGICAL DIVERSITY, supra note 17, at 43 ("The hidden danger of ever-growing lists of threatened species is that individual recovery efforts are diluted each time a new plant or animal is added to the list."); O'Toole, Pay Land Managers to Protect Species, ENVTL. F., July-Aug. 1990, at 33 ("Given that most endangered species are threatened by human development, each new listing makes the act more costly and less politically stable.").

\footnote{263} 16 U.S.C. §§ 1532(6), 1532(20), 1533(b) (1988); see infra notes 301-08 and accompanying text (further discussion of the difficulty of demonstrating that a species is near extinction).
2. The ESA Can Protect Ecosystems, But Currently Does So Only at Random

Concentrating data-gathering and protection efforts on a single species can effectively preserve an entire ecosystem or habitat type under certain circumstances. For example, sometimes one species is crucial to the health of the ecosystem. These crucial species are termed "keystone" species; decreases in their number produce extreme changes in the species composition of the community as a whole. Where such keystone species exist, their protection should be an effective method to preserve the whole community.

The sea otter (Enhydra lutris) is one example of a keystone species. The sea otter lives in near-shore communities in the northeastern Pacific Ocean. It feeds on marine invertebrates, including the sea urchin (Strongylocentrotus polycanthus). Sea urchins are heavy grazers of marine plants such as kelp. A flourishing sea otter population limits sea urchins to a population of a few scattered individuals, allowing large kelp beds to develop. These beds in turn support a complex community of plants and animals. Loss of sea otters from the ecosystem leads to a rapid expansion in the sea urchin population, which in turn causes denudation of the kelp and loss of its associated community. The effects on the community can be very far-reaching, extending to the exclusion of harbor seals and bald eagles from locations where sea otters have been overexploited.

Other communities have "indicator species" whose population levels reflect the overall health of the community and thus can serve as a convenient monitoring mechanism. For example, the spotted owl (Strix occidentalis) has been touted as a useful indicator of the health of

265. See, e.g., Estes & Palmisano, Sea Otters: Their Role in Structuring Near-Shore Communities, 185 Science 1058 (1974); Estes, Smith & Palmisano, Sea Otter Predation and Community Organization in the Western Aleutian Islands, Alaska, 59 Ecology 822 (1978); Simenstad, Estes & Kenyon, Aleuts, Sea Otters, and Alternate Stable-State Communities, 200 Science 403 (1978). The discussion of sea otter ecology which follows is taken from these references.

Large carnivores such as wolves may also play a keystone role in their ecosystems. For example, at Isle Royale National Park, wolf predation affects the size of the moose and beaver populations, which in turn apparently influence the species composition, density, and height structure of the vegetation. See Peterson, The Pit or the Pendulum: Issues in Large Carnivore Management in Natural Ecosystems, in Ecosystem Management, supra note 115, at 105, 111.

266. Estes & Palmisano, supra note 265, at 1059.
267. The measurable attributes of indicator species (such as population density or reproductive success) serve as surrogate measures for other species or conditions which are too difficult to measure. Landres, Verner & Thomas, Ecological Uses of Vertebrate Indicator Species: A Critique, 2 Conservation Biology 316, 317 (1988).
old-growth forests.\textsuperscript{268} A number of other species, including birds, mammals, amphibians, reptiles, invertebrates, and plants thrive in habitats suitable for the spotted owl. Because the owl appears to require larger areas of undisturbed habitat than these other species, management of the area to ensure the owl's viability should protect the other species as well.\textsuperscript{269} Thus, indicator species can serve as useful surrogates for the ecosystem, making evaluation of the efficacy of management efforts easier. Furthermore, because indicator species require relatively large areas of usable habitat, declines in their numbers may provide advance warning of ecosystem endangerment. Intervention when an indicator species becomes threatened or endangered may be early enough to save the ecosystem.

Under the ESA, however, protection of keystone or indicator species cannot be relied upon to protect ecosystems. First, if intervention comes too late and an indicator species goes extinct, the ecosystem as a whole would lose all protection. Second, the ESA authorizes the FWS to remove species from the wild if it determines that such a drastic measure is necessary to avoid extinction.\textsuperscript{270} Obviously, protection of a species in captivity will not help its associated ecosystem. The most important reason why the ESA (as currently written and implemented) cannot protect ecosystems through surrogate species is that species' keystone or indicator status is not considered in making listing decisions. Thus, a keystone or indicator species has, on the face of it, no greater chance of being listed than any other species. Nor do such species have priority in the formulation and funding of recovery plans.\textsuperscript{271} The ESA is simply not designed to take a species' role in its ecosystem into account.

Although the statute does not explicitly favor them, species vital to some ecosystems may have an increased opportunity for listing because they possess a constituency — those committed to saving the ecosystem as a whole.\textsuperscript{272} The species-by-species nature of the ESA requires those

\textsuperscript{268} See Salwasser, Managing Ecosystems for Viable Populations of Vertebrates: A Focus for Biodiversity, in Ecosystem Management, supra note 115, at 87, 95. Top carnivores may serve as indicator species in other ecosystems. See Peterson, supra note 265, at 112.

\textsuperscript{269} See Salwasser, supra note 268, at 95; cf. Shaffer, supra note 115, at 131 (if species with low population densities are preserved, other "less space-demanding" community members should also survive). However, a large area requirement alone does not make a species a good indicator; the chosen species must also show a response to environmental perturbations similar to that of other species dependent on the habitat. See Landres, Verner & Thomas, supra note 267, at 322.

\textsuperscript{270} See National Audubon Soc'y v. Hester, 801 F.2d 405 (D.C. Cir. 1986) (upholding FWS decision to capture all remaining wild California condors).

\textsuperscript{271} The Inspector General's Office has suggested that the FWS should explicitly decide whether to focus listing and recovery efforts on protecting ecosystems through key species or to limit its focus to individual species. Inspector General's Report, supra note 261, at 13. The FWS disagreed with this recommendation. Id. at 14.

\textsuperscript{272} For a discussion of the importance of public interest in a species to listing decisions,
interested in preserving ecosystems to work through surrogate species. However, opponents of such listings criticize those who seek to list indicator species for "misusing" the Act to achieve a purpose other than species protection.\[note 273\]

The spotted owl controversy epitomizes this problem. Whether or not the owl is endangered, old-growth forests are a unique habitat type, examples of which should be preserved. The decline of species that depend on this type of habitat indicates that the amount of old-growth may be falling below the level needed to sustain the ecosystem. The possible extinction of spotted owls is not the best reason to stop cutting the old-growth forests; the possible extinction of this unique ecosystem is. Allowing the dispute to be cast as humans versus owls misrepresents and trivializes the issue, making it easier for opponents of preservation to rally support.

3. The ESA's Critical Habitat Provision Does Not Effectively Protect Ecosystems

The ESA currently requires that the FWS designate critical habitat for a species at the time of listing or within a year thereafter.\[note 274\] Critical habitat encompasses those specific areas which hold physical or biological features essential to the species and which may require special management or protection.\[note 275\] When the ESA requires interagency consultation, the FWS must determine whether the proposed federal action will jeopardize the continued existence of a listed species or destroy or adversely modify its critical habitat.\[note 276\]

Thus, areas designated as critical habitat and all species within those areas are to some extent protected by the ESA. Since designation of critical habitat is based entirely on its value to a single species, however, protection of diversity is at best accidental.\[note 277\] Furthermore, designated areas need be managed only for their ability to support the listed species. Modifications of the area which do not affect that species may go forward, despite any adverse effect on other inhabitants.

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\[note 275\] Id. § 1532(5)(A).

\[note 276\] Id. § 1536(a)(2).

\[note 277\] See Smith, supra note 52, at 386-87.
The severe underutilization of the critical habitat provision also limits its effectiveness as a means of protecting biological diversity. Despite the legal duty to designate critical habitat, the FWS has failed to make such a designation for a large majority of all listed species.278 Both the difficulty of determining critical habitat and political opposition to critical habitat designation have contributed to this failure.279 The task of determining critical habitat is further complicated by the requirement that the Department of the Interior determine the economic impact of designating an area as critical habitat and weigh that impact before making a designation.280

Even when critical habitat is designated, that designation may come too late to save much of the diversity supported by the habitat. Because habitat degradation is often the primary cause of a species' decline toward endangered or threatened status, designation usually follows, rather than precedes, significant levels of habitat destruction.281

4. Protection of Individual Species Can Conflict with Protection of an Ecosystem

In some cases, protection of a listed species may directly clash with preservation of other species or an entire ecosystem. The Florida Everglades are currently the site of one such conflict.282 Because of state water management policies, the Everglades have been much drier than normal for many years,283 and the lack of water has come to threaten the health of the Everglades ecosystem.284 In order to increase the flow of water into Everglades National Park, the National Park Service has come up with a plan to release water from nearby impoundments.285 However, the FWS has threatened to block the plan under the ESA because the impounded water supports a population of the endangered snail kite.286 Under the ESA, keeping water impounded to serve the needs of a listed species would be the legally correct choice, even if the listed entity were threatened only in one portion of its range, or if it were a population or a subspecies with numerous abundant close relatives. The fact that the Everglades is a unique ecosystem would not affect the management decision unless the survival of some other listed species depended on the Everglades receiving the water.

278. Critical habitat has been officially designated for only 22% of listed species. Salzman, supra note 235, at 332.
279. See id. at 339.
281. Smith, supra note 52, at 388.
283. Id. at 107.
284. Id. at 108-10.
285. Id. at 106, 110.
286. Id. at 106.
There are many potential conflicts between the protection of one or more individual species and preservation of ecosystem diversity and other species. For example, some units of the National Wildlife Refuge System have been converted from woodland to grassland-wetland to enhance waterfowl populations. While such conversion may be appropriate, particularly in light of the high proportion of historic wetlands that has been lost in many parts of this country, it should not be undertaken without awareness and explicit acknowledgement of its effects on biota other than the target species. In other examples, management designed to improve the water supply for the endangered Owens pupfish nearly caused the loss of an endemic snail in California's Owens Valley, and shrub clearing designed to enhance the habitat of the Morro Bay kangaroo rat has reduced the habitat of the banded dune snail.

B. The ESA Does Not Effectively Protect Species Diversity

The species-by-species focus of the ESA makes its failure to effectively preserve ecosystem diversity unsurprising. Even if preservation of diversity at the species level is viewed as the proper goal, however, the ESA has been less than completely successful. Although some species have unquestionably been aided in their struggle for survival by the ESA, others have fallen through the cracks. The major problems with the ESA as a tool for the protection of species diversity come from its lack of mechanisms for obtaining a broad overview of the status of the nation's biota and setting priorities among species.

1. The ESA Does Not Provide Policymakers with a Broad Overview of the Status of the Nation's Biota

Under the ESA, policymakers deal with one species at a time, in isolation from the rest of the world. The ESA provides no means whereby those making listing decisions can obtain an overview of the number and distribution of species already listed. Policymakers' in-

287. OFFICE OF TECHNOLOGY ASSESSMENT, supra note 3, at 230.
289. Refuges are often managed for waterfowl at the expense of other species which require wetland habitat, such as the Sandhill crane. D. JENSEN, M. TORN & J. HARTE, IN OUR OWN HANDS: A STRATEGY FOR CONSERVING BIOLOGICAL DIVERSITY IN CALIFORNIA 51 (California Policy Seminar Research Rep., 1990) [hereinafter IN OUR OWN HANDS]; see id. at 41 & n.7.
289. Scott, Csutí, Jacobi & Estes, supra note 115, at 784. Endemic species are species that are found in only one location. IN OUR OWN HANDS, supra note 289, at 19. Although they are often common in these locations, endemics may have rigid habitat requirements. Terborgh, Preservation of Natural Diversity: The Problem of Extinction Prone Species, 24 BIO-SCIENCE 715, 720 (1974).
290. The listing decision is crucial because listed species are entitled to the full range of protection, but candidate species awaiting listing are entitled to very little. Thus, whether or
ability to survey the status of the nation's biota makes preservation of diversity under the ESA difficult. All species do not have equal value with respect to the maintenance of diversity, yet the ESA treats them all equivalently.

If the goal of the ESA is to protect species diversity, protected species should be chosen, at least in part, on the basis of their uniqueness. Species without close relatives contribute more to the overall pool of diversity than those whose relatives are abundant. Thus, if protection of diversity (rather than protection of the largest number of randomly selected species and subspecies) is the goal, taxonomic distance from other protected species should be explicitly considered in the listing process.

At present, the Act itself provides no basis for such consideration. The FWS has developed guidelines for listing priorities which include consideration of taxonomic status, with a species which is the only member of its genus favored over one which is not, and species favored over subspecies. These priorities allow consideration of the status of the candidate species, but not of other species previously listed. In order to protect diversity, if seven species of cactus, but no orchids, are already on the protected list, an orchid subject to the same degree of threat as an eighth species of cactus should be given higher priority for listing, even if the cactus is the only member of its genus and the orchid is not. Under the FWS guidelines, however, the cactus would have listing priority over the orchid. To add another complicating factor, the FWS apparently does not follow its stated priorities very closely.

2. The ESA Does Not Provide a Mechanism for Setting Priorities Among Species

The ESA treats all species as equivalent for listing purposes, and does not provide any mechanism for the listing agency to set priorities among species. Although the FWS has promulgated listing priority guidelines, it has not followed them. Nonetheless, the agency inevitably sets priorities, and the current ESA allows these priorities to be determined primarily by political, rather than biological, factors. The agency has responded to political pressures by concentrating their listing and recovery efforts on highly visible, charismatic species, as well as on those not a species is placed on the list may make the difference between survival and extinction. Since the FWS has the resources to go through the listing process for only a small fraction of the species that technically qualify, see supra note 261 and accompanying text, setting priorities at this stage is crucial.


293. The FWS acknowledges that its guidelines do not provide for consideration of all relevant factors and has suggested that other relevant considerations be taken into account. Id. at 43,099.

294. See GENERAL ACCOUNTING OFFICE, supra note 17, at 4.
close to recovery. Further, priority-setting is insulated from public scrutiny, and hence from the crucible of public debate. Since even the scientists making listing decisions are not required or encouraged to consult the overall protected list to see whether particular taxa are under- or overrepresented, choices that determine which species obtain protection are not made rationally in view of the overall status of the biota.

3. The Standards for Listing Are Vague and Open to Manipulation

The ESA protects species that are endangered, defined as “in danger of extinction throughout all or a significant portion of [their] range,” or threatened, that is “likely to become . . . endangered . . . within the foreseeable future throughout all or a significant portion of [their] range.” Listing decisions must be based solely on the best available scientific and commercial data. The ESA leaves the evaluation of what constitutes the best available data largely to the Interior Department, although Congress intended that the Department seek the advice of scientific organizations, specialists in the field, and state and federal government officials.

These apparently strictly technical decisions hide an abundance of agency discretion. The data needed to establish that a species is near extinction are often quite difficult to gather. The agency must deter-

295. Id. at 4-5. Species viewed as being “higher” in the evolutionary order and species of special interest to the biologists responsible for recommending species for listing also tend to be given higher priorities. S. YAFFEE, supra note 9, at 72; see id. at 129 (“In general, if a species is to be put on the protected list, it has to have an advocate either inside the FWS or in an environmental or scientific group.”).
297. Id. § 1532(20).
300. S. REP. No. 526, 91st Congress, 1st Sess. 5 (1969), reprinted in 1969 U.S. CODE CONG. & ADMIN. NEWS 1413, 1417. The House acknowledged that the standard left a large amount of discretion to the Secretary, but felt that it would be impractical to devise more specific listing standards. H.R. REP. No. 382, 91st Cong., 1st Sess. 6 (1969). Few judicial decisions have interpreted the meaning of best available scientific and commercial data. The First Circuit, interpreting similar language in the provision governing interagency consultation, has stated that the agency must make a good-faith effort to obtain the necessary data, including performing tests and studies which are reasonably suggested by the evidence. Roosevelt Campobello Int’l Park Comm’n v. Environmental Protection Agency, 684 F.2d 1041, 1052 & n.9 (1st Cir. 1982). The data employed need not, however, be beyond challenge. See, e.g., Friends of Endangered Species, Inc. v. Jantzen, 760 F.2d 976, 983 (9th Cir. 1985). One district court has described the agency’s role as being to “assess the technical and scientific data in the administrative record against the relevant listing criteria . . . and then to exercise its own expert discretion in reaching its decision.” Northern Spotted Owl v. Hodel, 716 F. Supp. 479, 480 (W.D. Wash. 1988). The agency may not, however, make a decision contrary to the available scientific evidence without offering a “credible alternative explanation.” Id. at 483.
301. See S. YAFFEE, supra note 9, at 70-85.
302. See id. at 73-74.
mine both the size of the current population and likely future trends. Candidate species, especially animals, are likely to be rare and difficult to locate. Statistically significant data on population size in such a case are very difficult (and hence costly) to obtain. What is more, because of this difficulty, population studies are vulnerable to challenge by listing opponents. A common result of listing proposals is a battle of competing population studies.

Even more difficult than conducting a census of the current population is predicting how population size is likely to change in the future. Such predictions require a store of baseline data on population level changes over time, as well as on responses to various environmental perturbations. Since they usually must work from inadequate data, wildlife managers and others tend to rely on experience and intuition in judging a species' status. After listing, decisions about whether and to what extent to designate critical habitat, as well as about the amount of resources to devote to recovery efforts, present the same sort of difficulties.

The vagueness and uncertainty of the standards provided by the ESA have led to accusations that the FWS responds more to political pressures than to biological reality in making listing decisions, critical habitat designations, and evaluations of whether proposed projects will jeopardize a listed species. These pressures may sometimes induce the

303. See id. at 78-82.
304. Id. at 78. Plant species, on the other hand, may be very easy to census, at least if their location is known and especially if (as is the case with many endemic species) their range is small.
306. Some examples of such battles are given in S. Yaffee, supra note 9, at 79-80. See also Hunting the Mountain Lion: California's Elusive Wildlife Population Poses a Problem, L.A. Times, Aug. 29, 1988, § 2, at 3, col. 1 (discussing disagreements over size of mountain lion population in the context of controversy over hunting ban).
307. See S. Yaffee, supra note 9, at 80. Basic methods for determining population characteristics and responses to perturbation are explained in R. Ricklefs, supra note 105, at 279-526.
308. See S. Yaffee, supra note 9, at 80-81.
309. Id. at 82-84. Political pressures on the agency are particularly strong with regard to the decision to designate critical habitat. These pressures explain, at least in part, the low proportion of listed species for which a critical habitat designation has been made. See Salzman, supra note 235, at 335-38; see also Yagerman, Protecting Critical Habitat Under the Federal Endangered Species Act, 20 Envtl. L. 811, 851-55 (1990) (discussing vulnerability to political pressures produced by the scientific uncertainty of critical habitat designation decisions).
310. State agencies charged with similar responsibilities tend to suffer from similar problems. For example, the California Native Plant Society has charged that the California Fish and Game Commission “consider[s] both economic repercussions and efficacy of listing,” contrary to the requirements of the California Endangered Species Act, which requires that
agency to make a listing which is not justified by the available data. For example, the American alligator was placed on the endangered species list partly in response to public calls to halt the trade in alligator leather, in spite of opposition from the State of Florida, which regarded the alligator as a nuisance.\footnote{Recent data indicate that the alligator population was probably never in danger of extinction.}\footnote{Recent data indicate that the alligator population was probably never in danger of extinction.} Political pressures also play a role in decisions to remove species from the endangered or threatened list. For example, the FWS has given notice that it intends to downlist the bald eagle from endangered to threatened status in all regions of the country except the Southeast.\footnote{The FWS claims the eagle has recovered to levels justifying downlisting or even delisting in these regions.} Environmentalists have reacted with dismay, charging that the proposed downlisting was motivated by a desire to brag about the success of the bald eagle recovery program.\footnote{Environmentalists have reacted with dismay, charging that the proposed downlisting was motivated by a desire to brag about the success of the bald eagle recovery program.} These groups have admitted that they oppose downlisting because they fear that removal from the list of the eagle, with its overwhelming symbolic importance, will make fundraising more difficult.\footnote{Environmentalists have reacted with dismay, charging that the proposed downlisting was motivated by a desire to brag about the success of the bald eagle recovery program.} It remains to be seen whether the FWS will carry through on its proposal.

More commonly, political pressures contribute to decisions not to list a species, designate critical habitat, or issue a jeopardy opinion. In numerous instances, environmental groups and the General Accounting Office (GAO) have charged the FWS with failing to list species or to

listing decisions be based on the best available scientific evidence. BULL. CAL. NATIVE PLANT SOC., Oct.-Nov.-Dec. 1990, at 6-7. The Commission recently declined to list the Delta smelt, a three-inch long fish found only in the Sacramento-San Joaquin River Delta, and believed to be declining as a result of water diversions reducing fresh water flows into the Delta. Delta Smelt Endangered, THE BAY WATCHER, Oct. 1990, at 2, 10 (newsletter of Save San Francisco Bay Ass'n). Save San Francisco Bay Association, a nonprofit environmental group, has alleged that the Commission ignored "overwhelming evidence" that the fish was near extinction and "bowed to heavy pressure from the Department of Water Resources and the water lobby." Id. at 2.

\footnote{Gottschalk, supra note 124, at 295.} \footnote{Lewis, Searching for Truth in Alligator Country, NAT'L WILDLIFE, Oct.-Nov. 1987, at 12, 14. The alligator has recently been downlisted to "threatened due to similarity of appearance" throughout its range. United States Fish and Wildlife Service, Endangered and Threatened Wildlife and Plants, 52 Fed. Reg. 21,059 (1987) (to be codified at 50 C.F.R. pt. 17). This designation means that the FWS no longer considers the American alligator to be threatened but wishes to retain some control over alligator harvests, largely because products made from American alligator hides are difficult to distinguish from those made from the hides of other crocodilians which are near extinction. Id. at 21,062. The downlisting means that American alligators are no longer protected by ESA § 7, which requires interagency consultation. Id.} \footnote{An Environmental Success Story: The Eagle Flies Again, USA Today, April 17, 1990, at 1A.} \footnote{Id.; Bald Eagle Soars Toward Recovery, Christian Science Monitor, Aug. 9, 1990, at 6.}
designate appropriate critical habitat as a result of political pressures. For example, charges have been made that the FWS' reversal of its determination that construction of the Stacy Dam in Texas would threaten a rare water snake population was politically motivated.317 Similarly, in a 1979 report, the GAO discussed three instances in which the FWS had decided not to list invertebrates and fish because the agency felt that listing would interfere with important projects and that the species in question were not important enough to justify the controversy likely to ensue.318 Two recent GAO documents indicate that this attitude persists. The GAO found in 1989 that nonbiological considerations led the FWS to deny the petition for listing of the northern spotted owl.319 More recently, the GAO concluded that the FWS Regional Director responsible for a biological opinion on the effects constructing a proposed telescope on Arizona's Mt. Graham would have on the endangered Mt. Graham red squirrel had been swayed by his perception of the significance of the telescope project.320

The ESA's attempt to equally protect all species has recently led to attacks on the law itself. Interior Secretary Manuel Lujan, the Cabinet official primarily responsible for implementation of the Act, has publicly stated that the ESA "is just too tough," and that he does not believe every subspecies needs to be preserved.321 An explicit mechanism for priority-setting might increase public support for the Act by removing the perception that it puts the interests of all species and subspecies above all human interests.322

317. Franklin, supra note 260, at 74. Similar accusations have been made with respect to the agency's delay in listing a population of flattened musk turtles threatened by an Alabama strip mining project. Id. at 60.
318. GENERAL ACCOUNTING OFFICE, REP. No. RCED-79-65, ENDANGERED SPECIES: A CONTROVERSIAL ISSUE NEEDING RESOLUTION 12-20 (1979). An FWS program manager told the General Accounting Office that:

Not all species can be saved, it's a judgment decision, somebody has to play god and decide which will go. In this case I am doing just that, contrary to my staff's recommendations. I make bio-political decisions every day. Right now my main concern is saving the act. . . . Some species will have to become extinct.

Id. at 16. An attorney from the Solicitor General's office also stated that several mussels, snails, and fish threatened by a dam on the Duck River in Tennessee were not listed because "fights must be carefully selected and a few mussels are not worth losing the Act for." Id. at 17.
321. Abramson, Species Protection Irks Lujan; Interior Secretary Calls Law 'Too Tough,' San Jose Mercury News, May 12, 1990, at A1, col. 1. Lujan's comments were apparently sparked by the conflict between astronomers and preservationists over the Mt. Graham telescope project. Lujan observed that no one had successfully described to him the difference between this squirrel and any other. Id.
322. This perception is, of course, incorrect. The "God Committee" has the power to
Although choices made in the absence of perfect information necessarily must rest on policy decisions, the FWS is not the proper agency to make such decisions, nor is the listing stage the proper time at which to make them.\(^2\)\(^3\) The FWS, when it decides not to list a species, may be motivated largely by a desire to keep a low profile and avoid unfavorable attention, rather than by a carefully considered conviction that preservation of the species in question is simply not worth the cost. Ideally, policy choices should be presented and debated in a public forum, with the evidence of future consequences set out forthrightly in as accessible a form as possible. In some circumstances, the proper choice for society may result in species extinction, but that choice can only be made rationally in the presence of full information. Such choices should be made by Congress or by a group such as the ESA's "God Committee."\(^3\)\(^2\)\(^4\)

4. **The ESA Precludes Early Intervention**

Species are not eligible for protection under the ESA until they are demonstrably threatened or endangered. If the goal is (as the ESA proclaims) recovery of species to a level no longer requiring protection, waiting until species reach this dire situation makes neither scientific nor economic sense.\(^3\)\(^2\)\(^5\) By the time a species reaches the point where it is known to be endangered or threatened, recovery may require extremely expensive measures, and may be impossible even if vast sums are expended.

The California condor (\textit{Gymnogyps californianus}) is one example of the difficulty of bringing a species back to a viable population size once it has reached the brink of extinction.\(^3\)\(^2\)\(^6\) The last four wild condors were captured in 1986 and 1987 because the FWS feared that they would not declare that other interests outweigh the value of species preservation. \textit{See supra} notes 229-32 and accompanying text. Moreover, incidental taking can be permitted pursuant to an approved Habitat Conservation Plan. \textit{See supra} note 242. Nonetheless, the perception itself may reduce the ESA's effectiveness by leading the Congress to reduce appropriations for endangered species programs, or to amend the Act to require greater consideration of economic values.

323. The House Merchant Marine and Fisheries Committee indicated in 1978 that it did not believe that the Fish and Wildlife Service should decide which species were worth saving. \textit{See ESA LEGISLATIVE HISTORY, supra} note 204, at 737.

324. \textit{See supra} notes 229-32 and accompanying text (explanation of the "God Committee").

325. \textit{Cf.} 135 \textit{Cong. Rec.} E890 (daily ed. March 21, 1989) (statement of Rep. Scheuer) ("At best, the Endangered Species Act serves as a 'biological Superfund' — providing emergency room care only after the catastrophe has occurred.").

326. The condor is simply a convenient example of the costs of recovering a species which has fallen to a very low population level. I do not mean to suggest that the condor was allowed to reach this level because its decline could not be demonstrated. In fact, the condor population was estimated at about 50-60 individuals in the late 1960's. \textit{United States Fish and Wildlife Service, Dep't of the Interior, Revised California Condor Recovery Plan} 10 (1984). The condor was included on the first official U.S. list of endangered species. \textit{Id.} at 1.
long survive in the wild.\textsuperscript{327} Currently, the condors are being bred in captivity. Andean condors have been imported to hold the California condor's place in the ecosystem until the latter can be returned to the wild. The importation of Andean condors will also help scientists to learn more about the fate of released condors.\textsuperscript{328} Such activities are quite costly,\textsuperscript{329} and may never result in recovery of a viable wild condor population.

The peregrine falcon (\textit{Falco peregrinus}) provides another example of the difficulty and high cost of saving a species which has come close to extinction. The peregrine population in the eastern United States had virtually disappeared by the 1960's, largely as a result of the use of DDT and related pesticides.\textsuperscript{330} The Peregrine Fund began a captive breeding program in 1970.\textsuperscript{331} By 1980, the Fund had reestablished breeding pairs in the wild, and six years later thirty pairs laid eggs in the wild.\textsuperscript{332} The recovery program has been successful; the FWS' official recovery goal of 175 breeding pairs should be reached this year.\textsuperscript{333} Currently, there are more than 540 peregrine falcon pairs in the United States, and some experts speculate that the bird may soon be removed from the endangered list.\textsuperscript{334} However, the peregrine recovery program has cost several million dollars and has involved numerous government agencies, conservation organizations, universities, and others.\textsuperscript{335} And this effort is only one of the four peregrine recovery programs under way in this country.\textsuperscript{336} It is doubtful that such a campaign could be mounted for a less charismatic species.\textsuperscript{337}
IV

IMPROVING LEGAL PROTECTION OF BIOLOGICAL DIVERSITY

Given that the current ESA does not effectively protect biological diversity, what legal strategy might prove more effective? This part of the Comment will consider and evaluate the most obvious alternatives to our current policy, which include directly protecting representative ecosystems, expanding the public trust doctrine to include the biota, explicitly requiring consideration of effects on biological diversity under the National Environmental Policy Act (NEPA),\(^3\) and modifying the ESA to introduce priorities among species.

The most effective policy for preservation of biological diversity would combine direct protection of ecosystems with species protection under the ESA. If such a policy proved politically infeasible, other approaches would provide some increased protection for biological diversity. Relatively minor modifications of the ESA’s implementing regulations could achieve substantial improvements over the current level of protection for diversity. Amendment of NEPA or of its implementing regulations would also provide some, albeit limited, improvement. Expansion of the public trust doctrine might prove useful in some situations, but is not likely to provide a viable means of protecting a broad range of biological resources.

A. Protection of Representative Ecosystems

Direct protection of ecosystems would most effectively preserve the full range of biological diversity. A Representative Ecosystems Act (REA) could be devised to implement a program of ecosystem preservation.\(^3\) Such a program would not obviate the need for individual protection for species with special symbolic or esthetic value, such as bald eagles. Nor would it render unnecessary prohibitions on the taking of migratory or other species that may occasionally stray from their pro-

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tected areas. An REA supplemented with the current ESA would, however, provide an excellent mechanism for protecting biological diversity.

Implementing a program of representative ecosystem protection would require a method for delineating and comparing ecosystems. Because each ecosystem differs to some extent from all others, this program would also require the ability to sort ecosystems by type, determining which differences are significant and which are not. To some extent, classification of ecosystems requires the drawing of arbitrary distinctions. Nonetheless, classification schemes can be and have been devised. Such schemes may not be perfect, but neither are the schemes which have been devised for classifying species. Congress should request a report from the Ecological Society of America, or perhaps the National Academy of Sciences, on the delineation of ecosystems. The report should include a discussion of how broad or narrow the classification should be, and what sort of factors could most readily be used to distinguish ecosystem types.

A survey of the different ecosystem types found in the United States will have to be carried out. Such a survey would require the establishment of a database containing information on the status of the nation's biological resources. This database should be modeled on the Natural Heritage Programs devised by the Nature Conservancy, a nonprofit or-

340. Christensen, Succession and Natural Disturbance: Paradigms, Problems, and Preservation of Natural Ecosystems, in ECOSYSTEM MANAGEMENT, supra note 115, at 62, 77; see Sullivan & Shaffer, Biogeography of the Megazoo: Biogeographic Studies Suggest Organizing Principles for a Future System of Wild Lands, 189 SCIENCE 13 (1975) ("Communities may be fewer in number than species, but they are still numerous and are variously amenable to discrete classification.").

341. For example, the FWS, the Army Corps of Engineers, and the Environmental Protection Agency have jointly produced a manual for identifying wetlands, based on vegetative composition, soil type, and hydrology. Agreement Reached on New Manual for Identifying and Delineating Wetlands, 14 ENDANGERED SPECIES TECH. BULL., Oct. 1989, at 1, 3.

342. See supra notes 8-11 and accompanying text.

343. Mapping vegetation types is a straightforward, albeit time-consuming, exercise once a classification scheme has been devised. In OUR OWN HANDS, supra note 289, at 27. Deciding how many categories to include in such a scheme, however, is difficult. For example, the California Department of Forestry's Forest and Range Resource Assessment Program uses a classification system recognizing 31 major terrestrial vegetation types in California. By contrast, the California Department of Fish and Game's Natural Diversity Data Base System includes 273 terrestrial vegetation types. Id. at 28. Data should probably be acquired using the most detailed categorization system practicable. Subsequently, classes can be merged if appropriate.

Studying the distribution of individual vegetation types or habitat types may not suffice; some birds apparently require two or more types of vegetation in close proximity to each other. See Noss, A Regional Landscape Approach to Maintain Diversity, 33 BIOSCIENCE 700, 702 (1983). Mosaics of communities may constitute an important level of organization. Romme & Knight, Landscape Diversity: The Concept Applied to Yellowstone Park, 32 BIOSCIENCE 664 (1982). Perhaps a preservation policy should include a focus on landscape structure. Because this is a difficult technical problem, evaluation of the proper level of organization to survey should be left to an expert body.
ganization dedicated to the preservation of biological diversity, and operated in conjunction with state agencies in nearly every state. These databases gather information on the distribution and current status of species native to each state. The federal program could profit from these existing databases, which could be combined to form a national database and clearinghouse for information on species, under the auspices of the FWS. Besides collecting existing data, the FWS should identify large gaps in the material and provide research grants to universities or nonprofit groups with the capability to fill those gaps.

The agency could analyze the data generated using a Geographic Information Systems (GIS) approach. GIS can be used to map habitat type, species richness, or any other feature against a map of existing preserves. This comparison would show the agency which ecosystems or habitat types are already sufficiently protected, which are found on federal land and could be protected simply through more careful management, and which are largely in private hands. The maps produced might also distinguish private ownership by groups such as The Nature Conservancy and the Audubon Society from ownership by individuals or groups less inclined to voluntarily protect the biota on their holdings.

Protection priorities should be set among ecosystems and habitat types. Those ecosystems and habitats which are most reduced from their historic range, or which are currently found only in a few locations, should be protected first. The program should endeavor to protect at least a portion of all habitat types found in the nation.


346. Several federal agencies, including the FWS, have contracted with individual state heritage programs to undertake field work and inventory review. See *INSPECTOR GENERAL'S REPORT*, supra note 261, at 9; Chafee, supra note 344, at 20; Roush, supra note 345, at 9.

347. See Scott, Csuti, Jacobi & Estes, supra note 115, at 782. The House Committee on Science, Space, and Technology has expressed support for the use of a GIS approach based on a database compatible with the Natural Diversity Data Base system. See *H.R. REP. No. 901, 101st Cong., 2d Sess. 24* (1990).

348. Using this approach to analyze vegetation types in California, a graduate student concluded that 95% of existing alpine areas, but only 1% of riparian areas, are protected. Scott, Csuti, Jacobi & Estes, supra note 115, at 785.

349. Some existing state reserve programs, such as Ohio's, include among their purposes the preservation of major or characteristic habitat types. See *TNC REPORT*, supra note 339, app. at A1-4. For a survey of state natural area programs, see id., app. at A2-1 to A2-56. Merely stating a goal is not enough, however: some or all of these state programs may not be achieving much progress toward their stated goals. See, e.g., *IN OUR OWN HANDS*, supra note 289, at 38 (discussing California's programs).
protection statute should not require that an ecosystem be near disappearance before providing protection, as such a requirement would render the program difficult and costly to implement and perhaps ineffective. Priority should also be given to areas with a high proportion of endemic species, to areas harboring species that are particularly intolerant of habitat modification (such as large carnivores), and to areas or ecosystems that contain especially large numbers of species (such as riparian habitats in California).

Decisionmakers also must determine how much of each selected ecosystem to protect. To some extent, this decision can be made on a scientific basis. Maintenance of keystone or high trophic level species will require a certain minimum reserve size and a minimum population size, both of which can be at least roughly estimated. Edge effects also play a role in the decision: small, narrow reserves will contain a high proportion of edge bordering on a different habitat type. The edges of a habitat typically support a different set of species than interiors, so that preservation of an area rich in edge may produce a subtly different community than preservation of an area with a higher proportion of interior to edge. To some extent, of course, the decision as to what size to make a reserve may already have been made: in a disturbed landscape, the size of ecosystem reserves is limited by the present boundaries of the ecosystem.

Decisions will also have to be made as to how many examples of an ecosystem type to preserve. In some cases, ecosystems may already be reduced to such a small percentage of their historic extent, or more importantly to such a small absolute amount, that all remaining examples should be preserved. In other cases, ecosystem types in undisturbed

351. See In Our Own Hands, supra note 289, at 52-53, 60. Other factors may also need to be considered. For example, Soulé and Simberloff recommend that reserves contain complete watersheds where possible to avoid the problems associated with diversion of water beyond the reserve boundaries. Soulé & Simberloff, supra note 350, at 22. Federal reservation of water rights may solve this problem in some cases.
352. See generally Soulé & Simberloff, supra note 350; Shaffer, supra note 115. Note that the minimum viable population size may not be the same as the minimum ecologically functional population size. Conner, Wildlife Populations: Minimally Viable or Ecologically Functional?, 16 WILDLIFE SOC'Y BULL. 80, 81 (1988). This disparity provides further justification for preferring ecosystems to species as the primary focus of preservation policy.
353. See, e.g., Simberloff, supra note 14, at 479; see also Wilcove, Empty Skies. THE NATURE CONSERVANCY MAG., Jan.-Feb. 1990, at 4 (describing disappearance of songbirds from the eastern deciduous forest as development fragments the forest in both the U.S. and Latin America into increasingly smaller pieces).
354. One candidate for this high level of protection is riparian forest in California. In the Central Valley, more than 99% of the riparian forest has been lost since the 19th century. Reiner & Griggs, TNC Undertakes Riparian Restoration Projects in California, 7 RESTORATION & MANAGEMENT NOTES 3 (1989).
form have been all but eliminated. Attempts should be made to restore these ecosystems if possible. 355

Some ecosystem types are relatively easy to preserve because they do not readily lend themselves to other uses. Alpine ecosystems are the classic example. 356 For other ecosystems, however, hard choices must be faced. The largest and most pristine specimens should be given top preservation priority. Others may have to be sacrificed to development.

Perhaps the most difficult decision will be choosing the degree of protection to provide to those ecosystems designated for protected status. The government could theoretically purchase all ecosystems deemed worthy of preservation. This approach is not feasible, however, given the current state of the federal budget. Land and Water Conservation Fund monies could be used to purchase some of the highest priority areas, perhaps those most sensitive to disturbance, but would not suffice for the acquisition of samples of every domestic ecosystem.

One option would be to adopt the ESA approach and prohibit any modification of listed ecosystems. Such an approach might be counterproductive, however, since it would give rise to strong pressures to avoid listing ecosystems. In some situations, such regulation could be ruled a taking of private property requiring compensation. 357 Moreover, it might not be necessary; some ecosystems may tolerate significant amounts of disturbance.

Rather than absolutely forbidding all modification, the REA should incorporate a mechanism similar to the ESA's interagency consultation procedure to establish standards for activities allowed in a protected

355. Tall-grass prairie is one example. Using tiny remnants and prairie plants growing among introduced aliens as seed sources, workers have restored patches of tall-grass prairie in several Midwestern locations, including the area within the accelerator ring at the Fermi National Accelerator Laboratory. See Jordan, Ecological Restoration: Reflections on a Half-Century of Experience at the University of Wisconsin-Madison Arboretum, in BIODIVERSITY, supra note 8, at 311, 313; Nelson, Prairie Restoration in the Chicago Area, 5 RESTORATION & MANAGEMENT NOTES 60 (1987). Although these restored areas do not contain all of the animal species that populated the original tall-grass prairie, their plant communities may quite closely resemble those of the historic prairie, and may harbor a number of threatened and endangered plants. Jordan, supra, at 311. Efforts are being made to restore other ecosystems, including California riparian forests, see Reiner & Griggs, supra note 354, at 3, and others. See Cairns, Increasing Diversity by Restoring Damaged Ecosystems, in BIODIVERSITY, supra note 8, at 333.

356. As much as 95% of California's existing alpine habitat is found in preserves. See Scott, Csuti, Jacobi & Estes, supra note 115, at 785.

357. Modern courts routinely uphold extensive regulations against takings challenges, but there are limits. See, e.g., Sax, Property Rights in the U.S. Supreme Court: A Status Report, 7 UCLA J. ENVTL. L. & POL'Y 139, 145-47 (1988). Restrictions that take the form of existing-use zoning may more readily withstand a takings challenge. See Humbach, Law and a New Land Ethic, 74 MINN. L. REV. 339, 348-60 (1989). Similarly, where a reasonable claim can be made that the land serves a vital ecological function, courts may be more willing to sustain the regulation. See generally Hunter, An Ecological Perspective on Property: A Call for Judicial Protection of the Public's Interest in Environmentally Critical Resources, 12 HARV. ENVTL. L. REV. 311 (1988).
area. The Act could follow the approach taken by the UNESCO Biosphere Reserve Program, preventing nearly all modification of a core area while allowing greater use of a surrounding buffer zone.358 Alternatively, or in conjunction with a buffer/core organization, the REA could employ conservation easements, either through purchase or regulation. Conservation easements define the range of activities private owners can undertake on their land; they may limit activity slightly or extensively, depending on the situation.359

Ideally these standards should be adopted before development projects are undertaken.360 At the same time that it designates priority ecosystems, the appropriate agency could establish guidelines for the amount of disturbance those ecosystems will tolerate. At a minimum, private owners should be forbidden to adversely modify listed ecosystems (as by altering drainage patterns, removing keystone species, etc.), and federal agencies should be required to consult with the FWS when their actions may affect a listed ecosystem.

Perhaps the best model for an REA would be one of federal-state cooperation. The federal government should develop an overview of ecosystems, and designate those most in need of protection. States should retain a local management role, provided they meet federal standards.361 States could be afforded some flexibility with regard to what portions of ecosystems to protect and what activities to allow in protected areas, within federal specifications.

Any proposed scheme to protect biological resources must acknowledge the possibility, if not the likelihood, of rapid global climate change over the next century.362 Changes in temperature and rainfall patterns could make preserved areas less suitable for the species they harbor. The

360. Cf. Linder, "Are All Species Created Equal?" and Other Questions Shaping Wildlife Law, 12 HARV. ENVTL. L. REV. 157, 195 (1988) (pointing out that the ESA allows projects to be halted at any stage if an endangered species is found on the site, with the result that developers lack certainty that their project can proceed, even after approval).
361. Many federal environmental statutes follow this model, with the federal government mandating development of an acceptable state plan before management authority is handed over to the state. See, e.g., Coastal Zone Management Act, 16 U.S.C. §§ 1454-1455 (1988); Clean Air Act, 42 U.S.C. § 7410 (1988) (amended by Clean Air Act Amendments of 1990, Pub. L. 101-549, §§ 101(b)-(d), 102(b), 108(d), 104 Stat. 2399, 2404, 2422, 2466 (1990)). These provisions employ either the carrot of making states with an accepted program eligible for grant money or the stick of imposing sanctions and/or a federal program on uncooperative states.
mildest effect of climate change would be to increase the amount of management needed for preserve areas.

One possible approach which might be taken to deal with the possibility of future climate change is to link preserves by corridors, allowing wildlife to migrate from one preserve to another.363 Corridors linking preserves may be desirable even in the absence of climate change, in order to allow gene flow between preserves.364 In some cases, however, corridors may do more harm than good, providing opportunistic invaders with access to the preserve, or facilitating the spread of disease.365 Furthermore, if climate change is truly rapid, many species (particularly plant species) will not migrate rapidly enough to compensate for the change, whether or not corridors are provided.

Preserves encompassing a range of elevations may provide inhabitants with a better opportunity to adapt to climate change than preserves found at a single elevation. Obviously, however, only certain ecosystems are found in such areas. Many preserves simply cannot be sited so as to include a significant elevation change.

The bottom line may be that the timing and extent of climate change are still too uncertain to allow for much planning. Nonetheless, preservation of diversity now, at all levels, will increase options for the future. The possibility of climate change in the future may be one of the best arguments for preservation of genetic diversity, as greater genetic diversity improves the likelihood of successful adaptation to new conditions, whether in the same location or in a new one.366

B. Other Possible Approaches

Obviously, an REA is an ambitious proposal, and perhaps not realistically achievable. Other, less drastic, approaches could also provide greater protection for biological diversity than the current ESA.

I. Expansion of the Public Trust Doctrine

The public trust doctrine developed in the context of navigable waters and their associated shorelines, beds, and banks.367 It limits the

364. See, e.g., Noss, supra note 343, at 703-04; Simberloff, supra note 14, at 477-78.
365. See Soulé & Simberloff, supra note 350, at 33-34.
366. Although it may be necessary to deal with the likelihood of global climate change in fashioning an ecosystem preservation strategy, such a strategy is not the appropriate method by which to address the problem of global climate change. Separate legislation limiting emissions of greenhouse gases and ozone-depleting chemicals will be required to forestall or prevent climate change.
power of the government to alienate certain property, and can impress upon the government a fiduciary duty to protect certain resources.  

Public trust law is largely judge-made, although courts may look to a statutory scheme in order to discern if a public trust applies to the resource in question.  

The public trust doctrine has expanded somewhat beyond its historical roots. Originally, the doctrine protected only commercial uses. However, some courts now interpret the public trust to protect ecological values, at least in the context of waterways and the land underlying them. Based on the observation that wildlife was historically viewed as being owned by the state in trust for its people, at least one author has advocated extension of the public trust doctrine to wildlife. Such an extension would provide some protection for biological diversity.

However, several factors would limit the effectiveness of the public trust doctrine as a basis for broad preservation of biological resources. First, the doctrine, as judge-made law, varies considerably from state to state. Second, it necessarily is formed piecemeal as the result of litigation; it would be very difficult for a judge examining a public trust claim that the state has a duty to protect a specific population of some animal to look to the overall state of the nation's biota in making a decision. Thus, the public trust doctrine could not provide the kind of overview required for an optimal policy. Third, the doctrine would not generalize well to plants. Plants have no history of being held in trust by the state or of being viewed as common property. Rather, title to perennial plants has traditionally followed title to the land on which they are found. Fourth, courts rarely act to protect a resource itself under the public trust doctrine, but rather protect the resource's public uses. Thus, while the public trust doctrine might prove useful in a specific in-

372. See supra note 122-27 and accompanying text.
374. See supra notes 291-94 and accompanying text.
375. See Comment, supra note 150, at 528 & n.63.
376. Meyers, supra note 373, at 732.
stance in protecting a species or natural area, it would not provide a sound basis for an overall policy of preserving biological diversity.

2. Amendment of the National Environmental Policy Act

Another method which could potentially provide legal protection for biological diversity would be to amend NEPA or modify its implementing regulations to require that environmental impact assessments include consideration of the effects of the proposed action on biological diversity. This approach would have both advantages and disadvantages compared to the REA strategy.

On the positive side, this approach would be relatively inexpensive, since it would not require that the government purchase or condemn land in order to preserve ecosystems. The NEPA requirement would apply to all land, not just to designated areas, at least where a federal project or permit was involved. Also, such an approach might be less likely to arouse organized political opposition than an REA.

Using NEPA to protect biological diversity has several drawbacks, however. First and foremost, NEPA, as interpreted by the Supreme Court, is a procedural rather than a substantive law. Thus, while it would require that the effects of a project on biological diversity be made public and considered during the planning process, it would not mandate protection of any particular biological resource. Second, NEPA’s system of requiring environmental impact statements (EIS’s) does not work well for evaluation of incremental, long-term, or indirect effects. Many impacts on biological diversity are incremental, and may not even be detectable for several years. These impacts would be difficult to bring within the scope of an EIS. Third, NEPA regulates only federal actions and those private activities that require some form of federal permit.

377. The Council on Environmental Quality has issued regulations, which are binding on all federal agencies, governing the preparation of environmental impact statements and other aspects of NEPA compliance. See 40 C.F.R. §§ 1500-1517 (1990). These regulations were issued in 1978 in response to a directive from President Carter. Executive Order No. 11,991, 3 C.F.R. § 123 (1978). They have remained virtually unchanged since. Rodgers, NEPA at Twenty: Mimicry and Recruitment in Environmental Law, 20 ENVTL. L. 485, 495 (1990).

378. See generally Yost, NEPA’s Promise — Partially Fulfilled, 20 ENVTL. L. 533 (1990); cf. Shilton, Is the Supreme Court Hostile to NEPA? Some Possible Explanations for a 12-0 Record, 20 ENVTL. L. 551, 553 (1990) (“The Supreme Court has never decided a case, or for that matter a single issue in a case, in favor of a NEPA plaintiff.”).

379. Cases involving alleged failure to fully consider cumulative impacts or impacts of related projects are legion. For one effort to untangle the confusion resulting from these cases, see Thatcher, Understanding Interdependence in the Natural Environment: Some Thoughts on Cumulative Impact Assessment Under the National Environmental Policy Act, 20 ENVTL. L. 611 (1990).

380. This may not be a very strong objection given the pervasiveness of modern federal regulation and the fact that many states have statutes modeled on NEPA which they might amend to correspond to legislative changes in the national act.
A bill introduced in the 100th and 101st Congresses, entitled the “National Biological Diversity, Conservation, and Environmental Research Act,” would use NEPA to protect biological diversity. The bill includes a definition of biological diversity, and a declaration that “[i]t is the public policy of the United States that conservation of biological diversity is a national goal, and efforts toward conservation are a national priority.” It would establish a National Center for Biological Diversity and Conservation Research to gather and compile data on biological diversity and to develop a plan for preservation of biological diversity. The bill, if enacted, would also amend NEPA to require consideration in environmental impact statements of the effect a federal action would have on biological diversity.

Like NEPA itself, the bill is more symbolic than substantive. It would create a large, and probably unnecessary, federal bureaucracy. Requiring that biological diversity be considered during the EIS process would have some beneficial effect, but probably no more so than requiring federal agencies to go through the type of consultation required by Section 7 of the ESA. In fact, the latter is more likely to be effective, because the FWS can act as an advocate for the ecosystem (although admittedly it may not always be a very effective one), and the biological diversity issue will not be buried in a thousand-page EIS.

Amendment of NEPA to require consideration of effects on biological diversity in EIS’s may not be necessary. NEPA may already implicitly require such consideration. Unless the Council on Environmental

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381. This bill was introduced in the 100th Congress as H.R. 4335, and in the 101st Congress as H.R. 1268. The bill was reported favorably out of the House Committee on Science, Space, and Technology in the 101st Congress. See H.R. Rep. No. 901, supra note 347.

382. “For purposes of this Act the term ‘biological diversity’ means the full range of variety and variability within and among living organisms and the ecological complexes in which they occur, and encompasses ecosystem or community diversity, species diversity, and genetic diversity.” H.R. 1268, 101st Cong., 1st Sess. § 3(1) (1989).

383. Id. § 5(a).

384. Id. § 6.

385. Id. § 5(d).

386. Furthermore, under NEPA the lead agency has the final word on whether a project may go ahead despite the environmental consequences. See 42 U.S.C. § 4332 (1988); Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 351 (1989) (“[O]ther statutes may impose substantive environmental obligations on federal agencies, but NEPA merely prohibits uninformed — rather than unwise — agency action.”) (footnote omitted). By contrast, under the ESA, projects cannot continue if they will jeopardize an endangered species, unless an exemption is granted. See 16 U.S.C. § 1536 (1988).

387. If this claim has been made in litigation, courts apparently have not been very sympathetic to it. In Elliott v. United States Fish & Wildlife Service, 747 F. Supp. 1094 (D. Vt. 1990), the court noted that the plaintiffs were “legitimately concerned” that application of lampricides to Lake Champlain might cause a loss of biological diversity. Id. at 1101. The court declined to rule on the plaintiffs' claim that the lampricide program violated NEPA, but denied their request for an injunction on the ground that they had failed to establish that they would suffer irreparable harm. Id. at 1097 n.1. No other published federal case appears to
Quality (CEQ) modifies its regulations, however, courts are unlikely to insist upon consideration of effects on biological diversity except when a project has an unusually apparent impact on diversity.\textsuperscript{388} However if the CEQ were to mandate that EIS's contain an analysis of the effect of a project on biological diversity, the courts would likely honor that direction.\textsuperscript{389}

3. \textit{Modification of the ESA to Set Priorities Among Species}

As explained above, many of the ESA's shortcomings can be traced to its inability to set priorities among species, and its lack of a provision for gathering data on the status of the nation's biota as a whole.\textsuperscript{390} As a second-best alternative to a Representative Ecosystems Act, the ESA could be modified to provide both of these elements, allowing it to better protect biological diversity.\textsuperscript{391}

Achievement of this goal would require several changes in the ESA. First, the purposes of the Act should be modified to include preservation of the range of biological diversity found in the nation. Biological diver-

\begin{footnotesize}
\footnote{388. The Supreme Court has shown particular deference to the CEQ regulations, and may be reluctant to impose additional requirements. See \textit{Methow Valley}, 490 U.S. at 354-56; Shilton, supra note 378, at 559.}

\footnote{389. Another bill considered in the 101st Congress, H.R. 1113, would make explicit the CEQ's authority to issue binding regulations with respect to NEPA compliance, and would direct that such regulations include guidelines for the assessment of effects on biological diversity. H.R. REP. No. 219, 101st Cong., 1st Sess. 11 (1989).

390. See supra notes 291-94 and accompanying text.}

\footnote{391. Modification of the ESA might be politically easier than enactment of an REA, because opposition to an REA might be more focused. Prospective developers all over the country might see an REA as dangerous, while those who are unaware of any endangered species in the path of their proposed project might not oppose modifications of the ESA. However, the events of the last couple of years have raised political opposition to the ESA to a high point; serious attention currently is being given to the possibility of amending the ESA to weaken its protections for species. See, e.g., Fein & Meese, \textit{Endangering A Species: Our Own}, L.A. Times, July 30, 1990, at B7, col. 5. Although efforts to weaken the ESA have so far been unsuccessful, see, e.g., Morgan, \textit{Environmentalists Win 1, Lose 2 Votes in Senate; Victory Seen for Spotted Owl Protections}, Wash. Post, Oct. 24, 1990, at A6, col. 5, pressure is likely to increase as the ESA threatens other important industries. See, e.g., Balzar, \textit{Salmon Spawn a New Crisis}, L.A. Times, Nov. 15, 1990, at A1, col. 1. Furthermore, as pointed out above, an REA approach would provide more certainty to developers; they would be less likely to bring a project almost to completion only to find it blocked by an endangered or threatened species. Thus, legislative modification of the ESA might not, in fact, prove politically easier than enactment of an REA.}
\end{footnotesize}
sity should be explicitly defined to include genetic, species, and ecosystem diversity, and to extend to all five kingdoms of the biotic world. The revised statute should emphasize that protection of ecosystem diversity is to be given priority over species diversity, with genetic diversity given the lowest priority.

Like the REA approach, setting priorities under the ESA would require evaluation of data on a national scale. A national natural diversity database would be required. This database could largely use existing information. The agency would need additional information to set priorities, but much of this information could be sought from the literature by agency biologists. For example, the agency would have to know which species are keystone members of their communities, and which have only a weak influence on community structure. Needless to say, not all species or ecosystems have been studied exhaustively, but sufficient information does exist to allow some reasoned choices. The federal agencies which fund basic ecological research at universities could be encouraged to fund more research on the interactions of species within ecosystems.

To increase the ESA’s effectiveness in preserving biological diversity, it should also be amended to remove the requirement that species be demonstrably on the brink of extinction before protection is provided. Earlier intervention makes protection both more economical and more effective. Of course, other means of determining which species merit protection would have to be substituted for the endangered or threatened standard.

Introduction of a carefully considered system of priorities for listing species is the most important alteration which could be made to the ESA to enhance the protection of biological diversity. This change could be

392. See supra note 344-46 and accompanying text.
393. See, e.g., Paine, Food Webs: Linkage, Interaction Strength, and Community Infrastructure, 49 J. ANIMAL ECOLOGY 667 (1980) (describing the relative strength of various species' interactions with other members of marine benthic ecosystems).
394. Other commentators have recognized the need for prioritization under the ESA, and have suggested various schemes. Sagoff, for example, has suggested that species “higher” in the evolutionary scale or those which contribute most to “the diversity of nature” should be given highest priority. Sagoff, supra note 92, at 57. The latter suggestion is essentially the basis on which I have tried to devise a ranking system. Another suggestion that has been made is to give the highest priority to those species whose numbers have fallen close to a minimum viable population level, species with functional value to their ecosystem, rare species (apparently referring to taxonomic uniqueness), and indicator species. Smith, supra note 52, at 402-05. These priorities are very similar to the ones I have suggested, except that I would not put such an emphasis on the population level. First, minimum viable population levels are difficult to estimate since they vary with different species. See, e.g., Soule & Simberloff, supra note 350, at 31-32. Moreover, population level data are often difficult to gather. Finally, in some cases resources may be more effectively expended on species whose populations have not yet reached critically low levels.

Another commentator has suggested that priority ranking should be based on the species'
made administratively, with no need for new legislation. The FWS already has regulations setting listing priorities among species; they need only alter these priorities to more accurately reflect species' importance to their ecosystems.

Listing priorities should be set on the basis of several factors. Keystone species, whose protection can maintain an entire community and whose loss can disrupt that entire community, should be given the highest priority. Indicator species, whose health tends to parallel that of the ecosystem, should also be treated in this category. Top predators should be given the next priority. Because large carnivores often require more contiguous undisturbed habitat than other species, their protection can indirectly protect those other, less demanding, species.

Taxonomic uniqueness should be the next factor considered in setting priorities. For example, a species which is the only one in its family would warrant greater protection than one which is in an abundant family but the only representative of a genus would in turn get higher priority than a species from a fifty-species genus. The distribution of species already accorded protection should be explicitly considered in evaluating this factor.

Species currently under a high degree of threat should be given the next priority, although a cutoff point should be introduced. Scarce resources should not be expended on species not likely to be saved by extraordinary measures. Thus, other priorities being equal, the species

direct value to man, in terms of utilitarian benefits and public appeal, with other factors such as ecosystem function and indicator status considered only for "lesser-known species." Campbells, Federal Protection of Endangered Species: A Policy of Overkill?, 3 UCLA J. ENVTL. L. & POL'Y 247, 272-73 (1983). This system is seriously flawed. Those species which provide direct economic benefits to man are in fact the least appropriate for protection at government expense. Although government regulation of access or exploitation may be required to prevent overuse, see, e.g., Hardin, The Tragedy of the Commons, 162 SCIENCE 1243 (1968), those who stand to gain from such regulation should bear its costs. Moreover, setting priorities on the basis of direct value to humanity would ignore the other reasons for protecting the biota discussed supra, in notes 43-99 and accompanying text.

Ehrenfeld contends that formal priority ranking systems should be avoided because imperfect knowledge may lead to incorrect priorities, and because, in his view, formal priorities ratify the making of choices among species, which he regards as unacceptable. Ehrenfeld, supra note 73, at 653. These problems are not inconsiderable, but in my view the gains from setting priorities outweigh the risks.

395. See supra note 292 and accompanying text.
396. The General Accounting Office has suggested that the FWS rethink its priorities for listing species, but the agency has refused to do so. INSPECTOR GENERAL'S REPORT, supra note 261, at 13.
397. See supra notes 264-66 and accompanying text.
398. See supra notes 267-69 and accompanying text.
399. Large carnivores also tend to fit the next two categories identified as priorities.
400. See supra notes 292-93 and accompanying text.
401. This notion of making the most effective use of limited resources echoes the World War I concept of "triage." Overworked medics in understaffed facilities divided wounded soldiers into three categories: those not requiring immediate attention, those with wounds so
under the greater imminent threat from habitat loss or some other source, should be protected first. But if the scientific data indicate that the species' population has been so greatly reduced that in all likelihood it cannot recover, or that its recovery will require extraordinary expenditures, other species should be protected first.402

Finally, some species may warrant protection simply because of their symbolic value in the public mind. The bald eagle, for example, may deserve protection because it is the national symbol. Decisions to protect symbolic or charismatic species should be made carefully and with full deliberation, however; since resources will always be limited, such protection will necessarily result in reduced protection of other species. The priority-setting mechanism outlined here should ensure that the effects of such a decision will at least be considered.403

One real difficulty with this sort of priority system is that it provides no easy point of reference for the FWS to use to identify the species to be considered in devising a priority list. The ESA's current focus on endangered species at least provides this reference point. Under the present scheme, while the agency may not be able to identify all the species which deserve consideration for listing, it can readily identify a large number of species which it need not consider. Under a priority ranking system such as that suggested here, theoretically all species would have to be given some sort of ranking, although abundant species which serve no known important ecosystem function could be lumped in a low priority group. Still, the administrative task of formulating a priority list would be daunting.

Inevitably under such a program, as under any other program for the preservation of natural resources, decisions will have to be made as to how much protection is enough. In this case, that issue translates into how much of the current biota should be preserved. The ESA essentially declares that all species must be preserved, but it does not provide unlimited funds to accomplish that goal. Decisions as to how much protection severe that treatment would likely be ineffective, and those with serious but treatable wounds. Those in the third category were treated first. See K. SHRADER-FRECHETTE, RISK ANALYSIS AND SCIENTIFIC METHOD 61 (1983); Norton, supra note 94, at 10.

402. In this sort of extreme case, it might be appropriate to bring the last few members of a species in from the wild and set up a breeding program in a zoo or botanical garden. Such a program would be directed primarily not toward returning the species to the wild, although that might be a future goal, but to its maintenance in captivity, facilitating study and observation.

403. Norton has proposed a similar system, although he goes even further. He suggests that the listing process might be completely phased out. Norton, supra note 94, at 17. "The Office of Endangered Species would then concentrate efforts on species that seem to have documentable value, for whatever reason. If a species is of known economic value, if it has some cultural importance, is [sic] it is pleasing aesthetically or distinctive genetically, then special efforts to save it are appropriate." Id. Norton suggests such an approach to saving species as an adjunct to habitat or ecosystem preservation. In the absence of such a program, however, the listing process could not be eliminated.
to provide currently are made through the appropriations process, and through the priorities (explicit and otherwise) used by the FWS in making listing and recovery decisions. The addition of an explicit ranking system, such as that described here, could make these decisions both more explicit and more public. The FWS could take the funds available for recovery programs and go down the list of priority species until those funds are exhausted. In their budget request, they could identify the species that will be helped at any given funding level.

Nonetheless, determining what level of protection to provide for each priority species under this program would be very difficult. Currently, once a species is listed as endangered, it is entitled to all the protections of the ESA, which include prohibitions on taking, consultation with the Department of the Interior by federal agencies before they undertake projects which might adversely affect the species or its critical habitat, and development and implementation of a recovery plan. The Secretary of the Interior is authorized to issue whatever regulations are considered appropriate for the protection of threatened species, but in practice has as a rule simply applied the same protections to threatened as to endangered species.

The current uniform protections could continue to apply under a priority system, with all species above a certain level on the priority list entitled to the full protections provided by the current ESA. Such an approach seems impractical, however, since no obvious cutoff point can be identified. Another possibility would be to establish a range of protection levels. At the lowest level, no protection would be provided. For intermediate priority species, direct taking and traffic in the species could be prohibited. For higher priority species, habitat modification could be restricted and finally banned. Recovery plans could be designed and implemented for the highest priority species. This approach would be effective, but might be too costly to implement in terms of the agency time required to divide species into different protection levels. It would also suffer from the problem of lack of certainty; landowners could not guess in advance what sort of restrictions the agency might place on their use of their land.

Thus, adequate protection of biological diversity could theoretically be provided by retaining the current ESA framework with the addition of a new set of priorities for listing decisions and a new set of protection levels. Such a program, however, would be expensive to implement and

405. Id. § 1536(a)(2).
406. Id. § 1533(f).
407. Id. § 1533(d).
408. See 50 C.F.R. § 17.31 (1989) (except as otherwise specifically provided, same prohibitions apply to threatened as to endangered species).
cumbersome to administer. In addition, the administrative costs of implementing this complete program might well outweigh the benefits. Altering the listing priorities set by regulation, however, would be a simple change which could provide real improvement in the ESA's efficacy in protecting biological diversity.

CONCLUSION

Current domestic law protecting the biota centers on the ESA, which primarily seeks to protect species diversity. The ESA unquestionably has saved some species from impending extinction. However, it insufficiently protects ecosystem diversity, which should be the primary focus of national policy. Moreover, it does not make the best use of the limited resources available for the protection of species diversity.

Several approaches could increase protection of biological diversity. The most attractive one involves development of a Representative Ecosystems Act, which could provide a needed overview of the entire domestic biota as well as the flexibility to allow different levels of protection for different areas.

Other approaches would provide less protection than an REA, but nonetheless might serve to increase protection of biological diversity over current policy. Expansion of the public trust doctrine by itself would not seem to provide a viable basis for a policy of preserving biological diversity, but the doctrine might be effective in specific instances. Another option would be to require consideration of effects on biological diversity under NEPA. This option could be achieved through administrative action rather than through legislation. NEPA's nonsubstantive nature would limit the efficacy of this approach, however.

A third alternative, which might be easier to achieve than enactment of an REA because it would not require legislation, would be modification of the ESA to allow priority setting. To be completely effective, however, this approach would also require a legislatively mandated overview of the state of the nation's biota.

Whichever option is chosen, action must be taken as soon as possible to provide greater protection of biological diversity. Every day that passes without such protection brings more ecosystems and species to the brink of extinction.