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THE UNFORESEEABILITY FACTOR: FEDERAL LANDS, MANAGING FOR UNCERTAINTY, AND THE PRESERVATION OF BIOLOGICAL DIVERSITY

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> When we try to pick out anything by itself we find it hitched to everything else in the universe.[1]
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> - John Muir

Widely known as "the First Law of Ecology,"[2] this statement is based on practical knowledge gathered from the study of evolution and ecology Its subtle theme must be explored to fully appreciate the magnitude of the policy decisions we face regarding the reauthorization of the Endangered Species Act[3] and the stewardship of public and private lands. Biological diversity is the raw material of our nation's wealth. As our understanding of the First Law of Ecology grows, it will become strikingly clear how closely these issues are tied to our nation's short and/or long-term economic growth and stability In this context, the value of preserving any particular species need not be discussed, except to point out briefly that to ensure the continued functioning of ecological systems one must necessarily protect the individual components that define them, and vice-versa.

Each species in a contemporary biological system[4] has specialized adaptations that allow it to survive in its current surroundings and perhaps

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1. G. HARDIN, FILTERS AGAINST FOLLY: HOW TO SURVIVE DESPITE ECONOMISTS, ECOLOGISTS, AND THE MERELY ELOQUENT 57 (1985).

2. Most ecology textbooks prefer Barry Commoner's original "First Law of Ecology," which is stated simply as "Everything is connected to everything else." R. BREWER, THE SCIENCE OF ECOLOGY 12 (1988). Regardless of the source, the idea is the same.

3. 16 U.S.C. §§ 1531-1543 (1988).

4. The term 'biological system' is used loosely here to describe the whole of the complex associations surrounding a particular species that are necessary for its survival, and for the survival of other species uniquely associated with it. It is a nebulous term at best, describing a system with fluctuating spacial and temporal boundaries over time. Like the individual species that make them up, biological systems are, to a certain extent, mutually dependent. Each influences the way others develop and function, and a certain amount of energy flows from one to the next. Using the term 'biological system' in this sense allows us to avoid the term 'ecosystem,' which is often wrongly used to connotate a self-contained, sustainable system with closed rigid boundaries. It has been more accurately defined as "any part of the universe chosen as an area of interest, with the line around that area being the ecosystem boundary and anything crossing the line being input or output." J. K. AGEE & D. R. JOHNSON, ECOSYSTEM MANAGEMENT FOR PARKS AND WILDERNESS 3-13 (1988).

nowhere else on earth.[5] These adaptations developed over millions of years and were shaped by the forces of the environment, including the dynamics of other species cohabiting the region.[6] Coexistence over time weaves the interactions between species together, so that species inhabiting the same region evolve to rely on each other in complex and subtle ways.[7] Thus, each species evolves, in the presence of neighboring species, the characteristics that allow it to obtain from its environment the specific nutrients and specialized habitats necessary for survival. As a result, the different species within a biological system thrive among one another precisely because of their coexistence.[8] We do not, and perhaps cannot, understand the full extent of this interdependence,[9] but we know that species within any biological system are partially dependent interacting components.[10]

Because of this *oneness*, the fates of the individual species within any biological system are intimately linked. The extinction[11] of a single species may initiate both direct and attenuated chains of causation that eventually lead to the extinction of dozens of other uniquely dependent species.[12] Each species, no matter how seemingly insignificant, is the only one which can truly perform all the specialized functions required for its complex ecological role.[13] Its evolutionary uniqueness and temporal place in biological systems are quantities mankind cannot recreate, replace, or even fully define and understand.[14] Hence, we cannot hope to accurately predict

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5. *See generally*, C. KREBS, ECOLOGY: THE EXPERIMENTAL ANALYSIS OF DISTRIBUTION AND ABUNDANCE (3rd. ed. 1985). Note that humankind is unique in its ability to intentionally modify different environments to better extract the resources necessary for survival. Thus, unlike other species, we are able to survive in literally all varieties of specialized climates and biomes. We must strive to keep in mind that other species are not so adaptable.

6. C. KREBS, *supra* note 5, at 24, 69-84; *See also*, R. BREWER, *supra* note 2, at 353.

7. C. KREBS, *supra* note 5, 69-153.

8. C. KREBS, *supra* note 5, at 24, 69-84; *See also*, M. E. SOULE & B. A. WILCOX (eds), CONSERVATION BIOLOGY: AN EVOLUTIONARY - ECOLOGICAL PERSPECTIVE (1980).

9. *See generally*, Wolf, *On the Brink of Extinction: Conserving the Diversity of Life*, WORLD WATCH PAPER 78 (June 1987).

10. It has been suggested that on a large scale all species are mutually dependent components of the same energy cycling biological system. F BARNABY, THE PEOPLE OF GAIA 10-13 (1988).

11. Extinction is a difficult concept to define. The word 'dead' is often used as a synonym for the word 'extinct,' WEBSTER'S NEW WORLD DICTIONARY 496 (2nd College ed. 1982), but it is not truly an appropriate synonym. As finite beings, we view death as an inseparable part of the cycle of life. To us, death implies the discontinuing of an individual's life, but the continuity of life's processes. Extinction is an entirely different concept. It is the discontinuing of the *process* of life itself, the irreversible extinguishing of a portion of our world. It means no more birth, and no more death. The evolving cycle of life and death has stopped forever. No one word may be synonymous.

12. R. TOBIN, THE EXPENDABLE FUTURE: U.S. POLITICS AND THE PROTECTION OF BIOLOGICAL DIVERSITY, 11 (1990).

13. *Endangered Species Act Oversight*, 1982: *Hearings before Senate Committee on Environment and Public Works*, 97th Cong., 1st Sess. 293 (1982) (Peter H. Raven, Missouri Botanical Garden).

14. Wolf, *supra* note 9, 6-10.

the magnitude of the biological impacts and social costs resulting from the loss of individual species,[15] and the risk humanity takes when allowing even a single species to become extinct extends beyond that which we are able to comprehend.[16]

When setting policy, we must ask ourselves whether the risk of losing even *one* species is acceptable when we cannot perceive the magnitude of irreversible harm flowing from its loss.[17] We foolishly undervalue individual species simply because we cannot yet comprehend their significance.[18] Yet the survival of individual species is critical to maintaining the stability of biological systems when each species is uniquely dependent on others in the system and the extent of this interdependence is unknown.[19] Allowing multiple species to become extinct at the hand of man not only eliminates singular renewable resources, it further jeopardizes every species uniquely dependent upon those that we have allowed to expire.

The last several decades of human development have already resulted in the disruption of entire biological systems and set the stage for further biological destabilization and collapse.[20] Human-caused extinctions currently exceed the 'baseline' rate[21] by perhaps a thousand-fold or more.[22] To

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15. *Id.* at 6.

16. Jack Harlan, a prominent plant geneticist, recently warned "[t]he diversity of our genetic resources stands between us and starvation on a scale we cannot imagine." Rhoades, *The World's Food Supply at Risk*, 179 NAT'L GEOG No. 4, at 84 (April 1991).

17. Mankind's unique adaptability may lead us to believe that our survival does not run with the land and depend ultimately upon the species around us. G. HARDIN, *supra* note 1, 65-69. Make no mistake, regardless of the climate or region we inhabit, we are completely dependent on the flow of resources and ecological services provided by biological networks made up of individual species. Ehrlich & Wilson, *Biodiversity Studies: Science and Policy*, 253 SCIENCE 760-61 (1991); *See also*, Ryan, *Conserving Biological Diversity*, in THE STATE OF THE WORLD 1992 10 (1992).

18. Aldo Leopold recognized our foolishness earlier this century:

> If the biota, in the course of aeons, has built something we like but do not understand, then who but a fool would discard seemingly useless parts? To keep every cog and wheel is the first precaution of intelligent tinkering.

A. LEOPOLD, A SAND COUNTY ALMANAC, WITH ESSAYS FROM ROUND RIVER (1966).

19. Wolf, *supra* note 9, 6-10; *See also*, R. TOBIN, *supra* note 12, at 11.

20. Ehrlich & Wilson, *supra* note 17, 760-761; *See also*, Wolf, *supra* note 9, 6-10.

21. Not all extinction can be attributed to human activities. Some would occur at a fluctuating rate throughout the evolutionary process even without the hand of man. But these 'baseline' or 'natural' non-catastrophic evolutionary extinctions are of a different character than current human-related extinction. Absent the hand of industrialized man or natural catastrophe, extinction may actually serve a purpose. It causes those species that are inefficient competitors to be squeezed out of the system, and assures that the species that remain are highly specialized, competitive, and energy efficient. This specialization and efficiency in turn allows the entire system to support an ever greater number of species on a relatively constant, limited supply of energy. In this sense, 'natural' evolutionary extinction actually serves as a stabilizing force, making the entire system more diverse, efficient and productive. R. BREWER, *supra* note 2, 522-30.

Current human-related extinctions are different. Because of our resourcefulness and proliferation, humanity is no longer on the same evolutionary playing field as other species. The extinctions caused by humans, unlike 'natural' evolutionary extinctions, no longer select out only the inefficient

put this in perspective, consider that during the "great dying" of the dinosaurs, only one species became extinct about every 1000 years.[23] Between the year 1600 and 1900 (before modern industrialization) human activities substantially increased the rate of extinction to about one species every four years.[24]By the mid-1970's the rate of extinction had risen even more dramatically to an estimated 100 species per year [25] Recent estimates dwarf the rate of 1970's, placing the current rate of extinction as high as 50 to 100 species *per day* [26]

These numbers are especially frightening considering that the most dramatic increase in losses has occurred during the last two decades, a period when nations around the world have begun to recognize the loss of biological diversity (biodiversity) as a threat, and have set aside nature reserves and taken other significant steps to attempt to slow the rate of extinction.[27] Apparently, these measures have been largely ineffective. When the U.S. Council on Environmental Quality (CEQ) released their *Global 2000 Report to the President* in 1980, the conservative body estimated that 20% of all species on the planet could disappear before the end of this decade.[28] Many scientists now estimate the number to be even higher, perhaps as high as 40% of those estimated to exist.[29]

When evaluating the full impact of these losses, we must keep in mind that the loss of the diversity of biological resources available to humanity is a one-way process. There is no turning back. The policy choices we make

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species. Where our ancestors may have put pressure on only one or two species simultaneously, we currently cause mass extermination, literally, on a planetary scale. This type of indiscriminate extinction has the opposite effect of evolutionary extinction. It is destabilizing. Indeed, our activities now have such widespread destabilizing impacts that it may no longer be possible to distinguish between an extinction caused by man and one that is not. Wolf, *supra* note 9, 6-10.

22. R. TOBIN, *supra* note 12, at 4.

23. *Id.* at 2.

24. N. MYERS, THE SINKING ARK 4 (1979).

25. *Id.* at 4.

26. R. TOBIN, *supra* note 12, at 3.

27. Just one example of the world-wide effort to slow the rate of extinction is in the 107-nation Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Established in 1972, CITES prohibits voluntary member nations from allowing the import or export of species near extinction for commercial purposes. *See* Lieberman, *1989 Amendments to CITES Strengthen Protection for Endangered Wildlife and Plants*, 15 ENDANGERED SPECIES TECHNICAL BULLETIN 5, 3-6 (1990).

28. THE COUNCIL ON ENVIRONMENTAL QUALITY THE GLOBAL 2000 REPORT TO THE PRESIDENT: ENTERING THE TWENTY-FIRST CENTURY, (G. O. Barney, study director), Vol. 2, THE TECHNICAL REPORT 331 (1980).

29. The problem of estimating extinction rates is complicated by the fact that we do not know the number of species that actually exist. Some scientists say 5,000,000 is a good approximation, others say 50,000,000 is more accurate. It is the subject of intense debate. R. TOBIN, *supra* note 12, at 3. Which is the better estimate makes little difference for our analysis. It remains undisputed that an incredibly large proportion of all species in existence, both known and unknown, is being lost forever. N. MYERS, *supra* note 24, at 20.

today decide precisely which biological resources will be available to meet the needs of our children, and the needs of their children, literally for hundreds of generations.[30] Even seemingly large economic sacrifices made to preserve the diversity of biological resources today will, no doubt, be overshadowed many times by the beneficial social and economic uses found for those resources by future generations.[31] Unfortunately, today's policy-makers are not accountable to this future electorate. As a result, our current resource development policy allows the quest for short-term economic growth to outweigh the long-term needs of humanity Policy-makers should consider that the biological resources we squander are not free, they are stolen from our children. We already owe the next generation a debt that we can never repay, and we have initiated a process of destabilization that can only lead to even further species depletion.[32]

THE UNITED STATES AS A MODEL FOR PRESERVING BIODIVERSITY

This article will focus on the legislative scheme protecting the diversity of our nation's biological resources, evaluate its strengths and weaknesses, and suggest simple modifications that could significantly enhance our efforts to protect biological diversity within the United States. Using the United States legislative scheme as a model has merit for several reasons. First, though the majority of species are currently being lost from the biologically rich tropical countries,[33] much of the habitat modification and biological destruction occurring in those countries can be directly attributed to megaconsumption in the United States and the corresponding demand for vast quantities of imported natural resources.[34] We are a nation enveloped in consumerism and the quest for material wealth, and we needlessly consume a wildly disproportionate share of the world's nonrenewable resources.[35] If we lack the self control to immediately reduce or alter our consumption, as a driving force behind much of the world's resource development and biological destruction, we have a duty to the rest of the world and to future generations to provide a means to meet our current consumptive demands with minimal biological impact.[36]

Additionally, as one of the wealthiest countries in the world, the United States has historically been better able to afford to alter our methods of domestic resource extraction and absorb the *supposed* costs of

30. *See generally*, E. B. WEISS, IN FAIRNESS TO FUTURE GENERATIONS (1989).
31. *Id.*, *See also*, R. BREWER, *supra* note 2, at 207.
32. R. TOBIN, *supra* note 12, at 4.
33. *Id.* at 4.
34. *Id.* at 4.
35. *Id.* at 6.
36. E. B. WEISS, *supra* note 30.

adjusting consumptive activities to preserve the integrity of natural systems. Given our level of affluence, if the United States can not muster the political will and expertise to effectively develop and implement a system to preserve biological diversity on our own soil, perhaps no country in the world can.

Finally, unlike many developing countries who are only recently developing schemes to preserve their biological resources, the United States has had legislation designed to protect our domestic environment and preserve threatened and endangered species for nearly two decades. We arguably have developed the most comprehensive environmental legislation in the world, and the performance of our system is ripe for analysis. Despite a recent lack of political leadership on biological resource issues, other countries will likely look to our developed legislative system as a model when designing their own efforts to preserve biodiversity We are cuffed with the responsibility of making sure that the system we present to the world *really works.*

THE LEGISLATIVE SCHEME IN THE UNITED STATES
- *and why it's not working to preserve biodiversity*

The federal environmental legislation that most directly impacts biological resources in the United States can be divided into four general categories: pollution control laws, wildlife protection laws, public land management laws, and the National Environmental Policy Act,[37] which makes up its own category While the preservation of biodiversity may not have been the driving force behind the enactment of every statute falling within these categories, the concept can be incorporated, either directly or indirectly, into many of them. At least one wildlife protection statute, the Endangered Species Act (ESA),[38] was enacted precisely to deal with the increasing loss of biodiversity [39] However, even when combined with all other legislation protecting biological resources, the ESA is not adequately preserving biodiversity within the United States.

The pollution control laws[40] were designed primarily to protect

37 42 U.S.C. §§ 4321-4370b (1988).

38. 16 U.S.C. §§ 1531-1543 (1988).

39. *Id.* § 1531(a),(b).

40. The Comprehensive Environmental Response Compensation, and Liability Act of 1980, 42 U.S.C. §§ 9601-9675 (1988); Federal Water Pollution Control Act (Clean Water Act), 42 U.S.C. §§ 1251-1387 (1988); Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. § 136(a)-(y) (1988); Clean Air Act, 42 U.S.C. §§ 7401-7642 (1988); Toxic Substances Control Act, 15 U.S.C. §§ 2601-2654 (1988), Marine Protection Research and Sanctuaries Act (Ocean Dumping Act), 33 U.S.C. §§ 1401-1445 (1988), Public Health Service Act (Safe Drinking Water Act), 42 U.S.C. § 300(f)-300(j)-(11) (1988), Solid Waste Disposal Act, 42 U.S.C. §§ 6901-6991 (1988).

human health and welfare[41] from the threats of the increasing levels of pollutants generated by our modern society These statutes also confer additional, possibly unintended, benefits on efforts to preserve biodiversity By imposing financial liability on those directly responsible for catastrophic episodes of environmental degradation,[42] those engaging in hazardous activities are encouraged to manage their activities to avoid biologically costly episodes which have the potential to destroy not only entire species, but entire biological systems as well.[43]

Additionally, by limiting 'baseline' or 'background' pollution to levels that reasonably protect human health and welfare, we insure that other

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41. The concept of protecting human 'welfare' has traditionally included a certain level of protection for wildlife, but such protection is usually limited only to those species on which we most directly rely to maintain our quality of life. Still, The Clean Water Act (CWA), 42 U.S.C. §§ 1251-1387, and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), 7 U.S.C. §§ 136(a)-(y), incorporate what would seem strong language to support the idea that they were designed to protect all species, regardless of their immediately apparent resource value. Congress' goal and purpose for implementing CWA is declared to be restoring and maintaining "*biological integrity*" to the nations waters, 42 U.S.C. § 1251(a)(emphasis added), and wherever possible to maintain "water quality which provides for the protection and propagation of fish, shellfish, and wildlife. " *Id.* § 1251(a)(2). FIFRA perhaps goes even farther, allowing the Administrator of the Environmental Protection Agency to regulate and limit the use of *any* pesticide if it unreasonably adversely effects the environment, 7 U.S.C. §§ 136(a), and defining the "environment" to include "water, air, land, and all plants and man and other animals living therein, *and the interrelationships which exist among these.*" *Id.* § 136(j)(emphasis added). This may be the most comprehensive definition in any regulatory statute supporting the preservation of biodiversity. It should be noted, however, that this strong language is tempered by a provision directing the administrator to use a social and economic balancing test when determining whether the environment is "unreasonably adversely effected." *Id.* § 136(bb). The Congressional purpose behind protecting the air resource is not nearly as strongly stated in favor of biological resources. *See* 42 U.S.C. § 7401.

42. The Comprehensive Environmental Response Compensation, and Liability act of 1980 (CERCLA), 42 U.S.C. §§ 9601-9675, holds those who contract for disposal of hazardous substances (usually including those who generate them), those who transport hazardous substances, and those who finance, own or operate facilities to store them jointly liable for all clean-up costs *and damage to natural resources* resulting from a release or threatened release of a hazardous substance transported or stored. *Id.* § 9607 (emphasis added).

43. The Exxon Valdez spill vividly illustrates our ability to disrupt or destroy entire biological systems in a brief moment of human error. It will take years to determine the long-term effects of exposing the tidal and intertidal biological systems of Alaska's Prince William Sound to 11 million gallons crude oil in March of 1989. One thing is already clear — these delicate biological systems have still not recovered despite a billion dollar clean-up effort by the Exxon Corporation. Crude oil persists below the surface on sandy beaches that are not exposed to severe winter storms, and both invertebrates and vertebrate wildlife species continue to be affected by the spill. Hodgson, *Alaska's Big Spill; Can the Wilderness Heal?*, 177 NAT'L GEOG No. 1, at 5 (January 1990). Salt marshes, which are normally among the most biologically diverse and product tidal systems, have suffered the most damage. *Id.* at 12. Central to the stability of the more than one hundred million dollar per year salmon and herring fisheries industry, it may not be possible to calculate the true economic costs of temporarily or permanently disrupting the ecological balance within these biological systems, *Id.* at 12, but recent reports suggest that the price tag of restoring the known damage to natural resources could run as high as $15 billion. TRAYNOR & TURNER (eds), IN BRIEF: A QUARTERLY NEWSLETTER,ON ENVIRONMENTAL LAW (Autumn 1991).

widespread species with pollution tolerances equivalent to or greater than our own will not be jeopardized by the by-products of our modern activities. This holds true even if the detrimental effects of pollution on these species were overlooked when setting the initial background pollution standards. The benefits of this type of blanket biological protection are apparent, especially where we do not have the resources to study the long term effects of pollution on all species prior to determining allowable background levels.

Finally, pollution control laws have also been applied specifically to ban particularly damaging pollutants, like pesticides, that enjoy widespread use and whose background levels are difficult to regulate. Again, the decrease in background pollution levels resulting from such a ban, and its spillover benefits on wildlife can be dramatic.[44] But this protection often only comes after a significant threat to human health is perceived, or when species highly visible and immediately valuable to the public, either as an aesthetic or traditional welfare promoting resource, show significant decline. There remains a frightening lack of information on the number of lower profile species in the United States threatened with extinction from the unrecognized habitat destruction wrought by 'acceptable' levels of background pollution. A similar lack of information exists on past extinctions wholly or partially attributable to the background levels of pollution we allow in our modern world.

The current regulatory scheme reflects a lack of data and concern for the long term effects of modern levels of background pollutants on less prominent species not directly relied on as a resource.[45] Little studied, highly pollution sensitive species may actually be in jeopardy because of our focus on human health and immediately apparent resource values.[46]

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44. Coggins, *Protecting the Wildlife Resources in National Parks From External Threats*, 22 LAND & WATER L. REV 1,11 (1987). [Citing the use of the Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. § 136(a)-(y) (1988), by an environmental group to force the ban of DDT use, and the subsequent benefits to several bird species, including bald eagles. *See* Environmental Defense Fund, Inc. v. Ruckelshaus, 439 F.2d 584 (D.C. Cir. 1971). Note, however, that despite the ban the eagles remain endangered, and there are other less prestigious pollution sensitive birds that continue to decline.]

45. Species confined within the boundaries of our parks and wilderness areas, including pollution sensitive species, are generally afforded a somewhat higher quality of 'background' pollution protection because of the value we place on having 'pristine' areas remain scenic and relatively free from pollution. But sensitive species will only remain protected if they do not stray from these natural areas. Additionally, even though the congressional intent is usually to "preserve" these areas, *See* 42 U.S.C. §7470, the current regulatory regime allows incremental background pollution increases. *Id.* §§ 7472-7474. Thus, as development expands around these 'protected' areas, they too will become more polluted.

46. For an example of an *entire class* of species thought to be approaching extinction because of background levels of pollution, note the recently highly publicized decline of amphibians in the United States and around the world. Ryan, *supra* note 17, at 14. Relatively little is known of their pollution

Thus, under the current regulatory system, we are threatened with losing species we have not yet discovered as a valuable resource. While our pollution control laws inherently provide for a certain level of blanket protection to biodiversity, allowable background levels may have already eliminated many less prominent species without our knowledge, and other species are still at risk. A comprehensive strategy to preserve biodiversity must address this problem.[47] Species having superficially low value as an immediate resource necessary to promote human health and welfare, nevertheless, remain necessary to maintain the integrity of the biological systems to which they belong. These systems support other species, including those we directly rely upon.

The federal wildlife protection laws[48] that have been enacted over the

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tolerance, so we may only be able to speculate which category(ies) of pollutants are the cause. Several notable examples of already endangered species kept on the brink of extinction because of background pollution levels are the peregrine falcon (*Falco peregrinus*) and the green sea turtle (*Chelonia mydas*).

As peregrine's age, they absorb and store in their bodies increasing amounts of pesticides and other pollutants from the birds they prey on (who have already absorbed the pollutants from the fish and insects they prey on). Once the concentration of pollutants in the peregrine's body reach a certain level, the falcon can no longer produce eggs with shells thick enough to protect the embryo, thus, destroying the falcons ability to reproduce. Nevertheless, peregrine populations have made a partial recovery because of widespread continuous captive breeding and release efforts. Many believe that without a continuing supply of captively hatched falcons, peregrine populations would again crash because even falcons hatched in captivity begin to accumulate levels of pollutants in their bodies sufficient to prohibit reproduction soon after they are released. Gilroy and Barclay, *DDT Residues and eggshell characteristics of re-established peregrines in the eastern United States*, in PEREGRINE FALCON POPULATIONS, THEIR MANAGEMENT AND RECOVERY 403-412 (T.J. Cade ed. 1988).

The green sea turtle is likewise afflicted with the pollution woes. Originally thought to be jeopardized mainly by over-hunting and reckless killing (by shrimpers and fisherman), it is now thought that perhaps the most significant threat to the species is high levels of pollution in coastal waters. The pollutants inhibit the turtles immune system, allowing massive viral tumors to grow out of control. It should be noted that these examples are merely representative. Pollution has also been implicated as the cause of terminal viral respiratory infections in the American desert tortoise, numerous marine mammals, and a variety of unmentioned species. Though highly studied, each of these species is currently only considered valuable as an aesthetic resource in this country, and as a consequence, our national pollution control strategy has not been designed stringent enough to protect them, thus, reflecting our traditional hierarchy of biological protection.

47. Perhaps the only way to adequately protect biological resources from pollution under the current regulatory system would be to require the administrator of the EPA to set background pollution standards based on biodiversity values rather than strict anthropocentric human values. Indeed, there is a strong argument that protecting biodiversity is so directly related to human 'welfare' (even in the most anthropocentric sense) that the administrator should already be incorporating broader biodiversity considerations into standard setting. Unfortunately, Congress and the EPA have failed to address the threat pollution poses to biodiversity, and its corresponding relationship to general human welfare. The empathy on capitol hill will likely change once the full extent of this threat is realized by the public. Educating the public is therefore key to bringing about such a policy swing, and this paper is an effort to contribute to that educational process.

48. Anadromous Fish Conservation Act of 1965, 16 U.S.C. § 57(b) (1988); Fish and wildlife Coordination Act of 1958, 16 U.S.C. §§ 661-667(e) (1988); The Lacey Act of 1900, 16 U.S.C. §§ 667(e), 701 (1988); Bald Eagle Protection Act of 1940, 16 U.S.C. § 668(a)-(d) (1988); Federal Aid in Wildlife Restoration Act, 16 U.S.C. § 669(a)-(i) (1988); Migratory Bird Conservation Act, 16 U.S.C.

years also have the potential to significantly enhance the preservation of biodiversity Unfortunately, these statutes have typically been implemented to protect only highly valuable wildlife species from the human threats of over-fishing, over-hunting, and reckless killing. Like the pollution control laws, the wildlife protection laws have traditionally given little attention to the less studied 'low profile' species upon which the species perceived as highly valuable rely Thus, the wildlife protection laws do not give any minimum level of 'blanket protection' to biodiversity in general because their scope of protection is limited to a few species,[49] with little or no spillover benefits on non-target species. The notable exception in this area is, of course, the Endangered Species Act of 1973.[50]

The ESA was designed to preserve all species near extinction, no matter how great or small.[51] When Congress enacted the ESA, it expressly recognized that preserving biological systems is essential to assure the survival of threatened and endangered species.[52] Because of the ESA's comprehensive approach, the Act has been labelled "the most stringent wildlife law ever enacted by any country "[53] But amid all this fanfare, it is important that we recognize precisely what the ESA *does* and *does not* do.

The ESA *does* provide powerful protection to species that have been pushed to the verge of extinction. Once a species is proposed for listing as threatened or endangered, the Act virtually prohibits any action by federal agencies that further jeopardizes the species' survival.[54] After a species is

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§ 715(a)-(r) (1988); Wetlands Loan Act of 1961, 16 U.S.C. § 715(k)(3-5) (1988); Federal Aid in Fish Restoration Act, 16 U.S.C. § 777(a)-(k) (1988); Wild and Free-Roaming Horses and Burros Act, 16 U.S.C. §§ 1331-1340 (1988); Marine Mammal Protection Act of 1972, 16 U.S.C. §§ 1361-1407 (1988); Endangered Species Act of 1973, 16 U.S.C. §§ 1531-1543 (1988); Magnuson Fishery Conservation and Management Act of 1976, 16 U.S.C. §§ 1801-1882 (1988); Migratory Bird Treaty Act of 1980, 16 U.S.C. §§ 2901-2911 (1988).

49. Coggins, *supra* note 44, at 8.

50. 16 U.S.C. §§ 1531-1543 (1988).

51. Section 7(a)(2) of the ESA provides in part:

> Each Federal Agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of *any* endangered species or threatened species or destroy or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, .to be critical

Id. § 1536(a)(2)(emphasis added).

52. Section 2(b) of the ESA provides that "[t]he purposes of this chapter are to provide a means whereby the *ecosystems* upon which endangered species and threatened species depend may be conserved,. " *Id.* § 1531(b)(emphasis added); *See also*, House Committee on Merchant Marine and Fisheries, *Endangered and Threatened Species Conservation Act of 1973*, H. R. REP No. 5, 93rd Cong., 1st Sess., 93-412 (1973).

53. G. C. COGGINS & WILKINSON, *Federal Public Land and Resource Law* 781 (2nd ed. 1986).

54. Section 7(a) of the act requires federal agencies to insure that their activities do not jeopardize the continued existence of any threatened or endangered species, and directs them to consult or confer with the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service

listed, it becomes illegal for any private, state or federal entity to engage in any activity that directly jeopardizes individual members of the species.[55] This prohibition also extends to all actions that significantly modify a listed species' formally designated "critical habitat"[56] to the extent that the species will be adversely effected.[57] Areas eligible for the "critical habitat" designation are, however, only the specific areas crucial to the species' survival - not the areas crucial for its recovery to non-endangered and non-threatened status.[58] To supplement this limitation, the Act provides that all federal agencies who manage lands inhabited by listed species must implement "conservation" programs, taking all steps necessary to provide for the recovery of listed species.[59] Thus, the ESA has the potential to provide a significant amount of protection to listed species and to the habitats that have been formally designated as necessary for their survival.

The ESA *does not*, however, adequately preserve biological diversity Simply put, the ESA cannot effectively preserve biodiversity because it does nothing to prevent species from becoming threatened or endangered in the first place.[60] As powerful as the ESA is, it is a reactive policy,

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(NMFS) when contemplating any action which is (1) "likely to jeopardize the continued existence" of any species listed or *proposed for listing*, or which (2) "adversely modifies" the critical habitat or *proposed critical habitat* of such a species. 16 U.S.C. § 1536(a)(2)-(4)(emphasis added). Additionally, section 7(a)(2) imposes a duty on federal agencies to use "the best scientific and commercial data available" to determine if contemplated actions will jeopardize a listed species or adversely modify its critical habitat. *Id.* § 1536(a)(2).

55. Section 9 of the ESA makes it unlawful for any entity in the United States to import, possess, sell, transport or "take" any species listed as endangered under the Act. *Id.* § 1538(a)(1). The Act itself goes on to define "taking" to include any action that will "harass, harm. pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in such conduct." *Id.* § 1532(19).

56. The Secretary of Interior and the Secretary of Commerce are required to designate "critical habitat" for each listed species. *See supra* note 51. The authority and obligation to do so has been delegated to the USFWS and NMFS respectively. Section 3 of the Act defines "critical habitat" to include the area the species occupies at the time it becomes listed, and specific areas outside those occupied that are "essential for the conservation of the species." *Id* § 1532(5)(A).

57. The term "harm" in the definition of "take," *supra* note 56, has in turn been defined by the Secretary of the Interior as any action "which actually kills or injures wildlife. Such an act *may include significant habitat modification or degradation* where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering." 50 C.F.R. § 17.3 (1987)(emphasis added). Courts have construed the Secretary's definition of "harm" liberally to include habitat modification or degradation which could eventually result in the extinction of the species in question. *See* Palila v. Hawaii Dept. of Land & Natural Resources, 852 F.2d 1106 (9th Cir.1988).

58. 16 U.S.C. § 1532(5)(1988); Coggins, *supra* note 44, at 9.

59. 16 U.S.C. §§ 1536(a)(1), 1532(3)(1988); Coggins, *supra* note 44, at 9; *See also* Sierra Club v. Clark, 755 F.2d 608 (8th Cir. 1985).

60. Some would argue that by monitoring and protecting certain key 'indicator' species, we adequately protect the entire 'ecosystems' on which they rely, thereby preventing other species from becoming threatened and endangered and protecting biodiversity in general. This simply is not so. As discussed earlier (*See supra* note 4), the 'ecosystem concept' and the interrelationships therein are more subtle and complex. A particular higher order species may be highly specialized and have such

essentially, a last ditch effort to save species that have been pushed to the brink of extinction. By relying on this type of policy, we have placed ourselves in the awkward position of having to 'manage' the populations of threatened and endangered species in perpetuity to assure their continued survival and the preservation of biodiversity

Of the nearly 600 species in the United States currently listed under the Act, only *four* have been 'de-listed' in the past two decades because their populations are considered recovered.[61] This pathetic recovery rate can be largely attributed to the fact that nearly all species close to extinction become so precisely because the habitat and biological systems critical for their survival have become severely fragmented and destroyed by human intrusions.[62] By the time a species is recognized as needing protection under the Act, there is often no longer suitable habitat remaining undisturbed to allow the species to survive in the wild without constant, direct, human intervention.[63] The areas which remain eligible to receive the "critical habitat" designation[64] and the protection that goes along with it,[65] may no longer be large enough to support the species. As a

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high energy demands that it is dependent on numerous species for survival., but its survival in turn only affords absolute protection to those species which most directly and completely rely on *it*. Thus, a species at the top of a biological pyramid may indeed be a good indicator of the health of that particular system, but its survival in no way protects the entire system. Further, if its population is kept healthy only by artificial means (*See infra* p. 13 & note 66), its survival no longer gives any indication of the health of the system. Indeed, if the species population has already declined to the point that it is endangered, doesn't that indicate only that the biological system on which it relies has already been compromised?

61. Culbert, *Local Planning and Biological Diversity*, 6 ENDANGERED SPECIES UPDATE 7 (1988).

62. Schaffer, *Minimum Viable Populations; Coping With Uncertainty*, in VIABLE POPULATIONS FOR CONSERVATION 69 (M. E. Soule ed. 1987); *See also*, R. TOBIN, *supra* note 12, at 8.

63. Compounding this problem is the fact that there is often a *significant* lag period between the time a species is recognized as needing protection, and the time when it is formally listed and begins to receive the protection afforded by the Act. Consider that the U.S. Fish and Wildlife Service (USFWS) has identified approximately 4,000 domestic species as candidates for listing, yet in the past two decades, they have listed only about 600. Because the normal listing process proceeds at such a snail's pace (no pun intended), candidate species needing protection and their critical habitats may expire before they receive protection under the Act. At least 200-300 of the nearly 4,000 candidate species awaiting listing are already believed to be extinct. *See* Chadwick, *Mission For the 90's; The Biodiversity Challenge*, DEFENDERS MAGAZINE SPECIAL REPORT 2 (1990). Congress attempted to deal with this problem in the 1988 amendments to the Act by requiring the Secretary of the Interior to monitor those candidate species warranting protection and directing him to use the Act's emergency listing authority where necessary to prevent a significant risk to the species. 16 U.S.C. § 1533(b)(3)(C). While having the potential to afford some protection to the mass of candidate species lined up for listing under the Act, an effective monitoring plan comprehensive enough to adequately cover all the designated candidate species has yet to be implemented, and many question whether such a program can ever be implemented with the resources available. *See generally*, Fitzgerald, *The 1988 Recovery Amendment: Its Evolution and Content*, 7 ENDANGERED SPECIES UPDATE 1-5 (1989).

64. *Supra* note 56 and accompanying text.

65. *Supra* note 57 and accompanying text.

result, captive breeding and/or translocation programs are becoming an increasingly important part of recovery plans implemented under the Act.[66] The majority of these well intentioned 'recovery' plans are, in reality, mechanisms to keep listed species healthy by relying on the only option we have left - perpetual human manipulation of their populations. Like caring for species confined to a zoo, this type of management does not recognize the importance that maintaining biological systems has to preserving biodiversity [67]

In 1978, Congress amended the ESA to require recovery plans for all listed species.[68] Unfortunately, there has been no corresponding increased emphasis on acquiring sufficient habitat to avoid leaving perpetual management as the only means to ensure long-term survival. Perhaps this lack of political will can be attributed to the expense and difficulty of reclaiming habitat once it is lost to human activities. However, policymakers must realize that as the list of threatened and endangered species continues to grow, it will become more and more expensive and politically difficult to maintain the current policy of providing each listed species with long-term intensive management. At current levels of funding, we are able to provide this type of management for about half of the nearly 650 domestic species currently listed. Are we willing to spend the financial resources to provide it for the growing mass of 4,000 candidate species anxiously awaiting listing?

A more preemptive approach is in order. We must recognize that while the ESA is a necessary tool to preserve species pushed to the brink of extinction, it is not working to prevent additional species from declining to the point of endangerment. The ESA's mechanisms will become increasingly overwhelmed and ineffective unless it is supplemented with a more preventative approach. Biodiversity can not be preserved by simply 'managing' endangered and threatened wildlife populations to keep them artificially high in compromised landscapes that are no longer able to sustain stable wild populations without manipulation. Such a scheme only removes threatened and endangered populations from the dynamics of the

66. The 1978 'recovery amendment' to the ESA made the development and implementation of 'recovery plans' for the "conservation and survival" of listed species mandatory. 16 U.S.C. § 1533(f). The Secretary (USFWS & NMFS) is required to design the plans, and they must provide site specific management guidelines to all agencies involved. *Id.* § 1533(f)(1)(B)(i). Many of the plans already implemented rely on artificial means to keep populations stable over the long term, including continuous genetic exchange programs between isolated populations and captive breeding/release programs conducted by federal, state and private entities. Because of Administrative delays, only about 50% of the species currently listed are covered by such plans, nevertheless, the administrative costs that accompany such extensive 'management' are already being felt and the number of species requiring this type of management continues to grow.

67. *Supra* pages 1-6.

68. *Supra* note 66 and accompanying text.

biological systems of which they are an inseparable part. It is a methodology that can not preserve biodiversity and will not accomplish the underlying goals of the ESA.[69] There can be no true *recovery* of any threatened or endangered species, and no comprehensive protection of biodiversity, until we have removed or diffused the human intrusions that compromise the biological systems (ecosystems) on which all species rely Nature will manage itself.[70] We must learn to manage ourselves more effectively to avoid disrupting its process.

The public land management laws[71] and the National Environmental Policy Act,[72] when combined, provide perhaps the most effective *existing* means to change our focus and implement a more preemptive, and thus more effective, approach to protecting the habitat and biological systems necessary to preserve biodiversity Federal public lands comprise nearly 37% of this country and contain a large proportion of our remaining national biodiversity, including a representative sample of nearly every biome.[73] Taken as a whole, these lands are less developed than their private counterparts, and they correspondingly contain lower levels of all but the most widespread pollutants.[74] Additionally, because these lands are owned by all the American people and managed by the federal government, it may be both politically and physically easier to regulate and control human intrusions that compromise the biological resources they contain. Indeed, the protection of biological diversity is already required by statute on a large portion of these lands.[75] When these statutory mandates are

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69. *Supra* note 52 and accompanying text.

70. *See generally*, J. LIVINGSTON, THE FALLACY OF WILDLIFE CONSERVATION (1981).

71. The National Park Service Organic Act, 16 U.S.C. §§ 1-8(a)(1988); the Refuge Recreation Act of 1962, 16 U.S.C. §§ 460(k) to (k)-(4)(1988); the National Wildlife Refuge System Administration Act of 1966, 16 U.S.C. § 668(dd)-(ee) (1988); the Wilderness Act, 16 U.S.C. §§ 1131-1136 (1988); the Wild and Scenic Rivers Act of 1968, 16 U.S.C. §§ 1271-1287 (1988); the Federal Land Policy & Management Act of 1976, 43 U.S.C. §§ 1701-1783 (1988); the Resource Planning Act of 1974, 16 U.S.C. §§ 1601-1613 (1988); the National Forest Management Act of 1976, 16 U.S.C §§ 1601-1614 (1988).

72. 42 U.S.C. §§ 4321-4370(b)(1988).

73. Grumbine, *Cooperation or Conflict? Interagency Relationships and the Future of Biodiversity for US Parks and Forests*, 15 ENVIRONMENTAL MANAGEMENT 28 (1991).

74. Please note, this statement is not intended to imply the biological resources on federal lands are adequately protected from pollution. Acid rain, which affects primarily high altitude lakes and forests, is but one example of widespread pollutants already posing a serious threat to biodiversity on public lands. G. WETSTONE AND A. ROSENCRANTZ, ACID RAIN IN EUROPE AND NORTH AMERICA. NATIONAL RESPONSES TO AN INTERNATIONAL PROBLEM 28-29 (1983). Despite this, until biodiversity considerations are more directly incorporated into pollution control laws, relatively remote areas of our public lands remain some of the least polluted areas available. *Supra* note 45.

75. The National Park Service Organic Act, 16 U.S.C. §§ 1-8(a) (1988), states that the purpose of the Park Service "*is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.*" *Id* at § 1 (emphasis added). Section 1a-1 of the Act further imposes a legal duty on the National Park Service (NPS) to protect park resources

combined with the National Environmental Policy Act (NEPA), which gives third parties the power to ensure each land management agency abides by its respective mandate[76] and requires federal land managers to assess all reasonably foreseeable environmental impacts when making land management decisions,[77] they provide a complex, but seemingly potent means to protect biological resources on federal lands.[78]

Unfortunately, this federal land management system is not working to preserve the diversity of biological resources on federal lands even when combined with the overlapping protection afforded by the pollution control

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consistent with section 1, and only direct and specific congressional intervention can negate this obligation. *Id.* § 1a-1 (1988). The NPS has made efforts to meet its obligation by incorporating biodiversity considerations into park planning policy. *See* U.S. Dept. of Interior, National Park Service, Management Policies 4:1, 2 (1988).

The National Forest Management Act, 16 U.S.C. §§ 1601-1614 (1988), directs the Forest Service (FS) to "*provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple use objectives.*" *Id.* at § 1604(g)(3)(B)(emphasis added). To meet its 'overall multiple use objectives,' the agency must plan to preserve biodiversity "*so that it is at least as great as that which would be expected in a natural forest,*" 36 C.F.R. § 219.27(g) (1988), including maintaining "*viable populations of existing native and desired non-native vertebrate species in the planning area.*" *Id.* at § 219.19 (emphasis added). Additionally, the Forest Service must recognize the ecological relationships which are essential to preserving biodiversity. *Id.* at § 219.2(6)(3).

Though not expressly calling for the preservation of biodiversity, the National Wildlife Refuge System Administration Act of 1966, 16 U.S.C. § 668(dd)-(ee) (1988), the Wilderness Act, 16 U.S.C. §§ 1131-1136 (1988), and the Wild and Scenic Rivers Act of 1968, 16 U.S.C. §§ 1271-1287 (1988), provide a significant amount of protection to biological resources on lands managed under their authority by requiring that the lands be maintained in a relatively primitive state (subject to a limited number of resource extractive activities and recreational uses). Additionally, the Federal Land Policy & Management Act of 1976, 43 U.S.C. §§ 1701-1783 (1988), necessarily mandates a certain amount of biological resource protection on Bureau of Land Management (BLM) lands by requiring the BLM to manage for "multiple use and sustained yield," without unnecessary degradation of the environment. *Id.* § 1732(a),(b).

76. *Supra* note 75 and accompanying text.

77. NEPA prohibits uninformed decision making by federal agencies even where scientific evidence concerning the likelihood an environmental impact will occur is not certain. CEQ guidelines § 1502.22 (as amended) requires federal agencies to evaluate all reasonably foreseeable significant adverse effects on the human environment by (1) affirmatively disclosing the fact that information important to evaluating significant adverse effects on the human environment is missing; (2) explaining the relevance of the missing information; (3) summarizing the existing credible scientific evidence which is relevant to the agency's evaluation of the significant adverse impacts on the human environment; and (4) evaluating that evidence. 50 Fed. Reg. 32,234 (1985). It must be noted for our purpose, however, that section 1502.22 does not require a "worst case analysis" where the environmental consequences may be disastrous but have a low probability of occurrence. *See* Robertson v. Methow Valley Citizens Council, 490 U.S. 332 (1989). Still, any potential environmental impacts, including biological ones, must be evaluated using section 1502.22 if they are a reasonably foreseeable consequence of federal agency action and meet the traditional "significance" test required to trigger NEPA. 40 C.F.R. § 1502.22 (1992).

78. For a fully developed discussion of the potential this type of approach has for promoting coordination between land management agencies for ecosystem management, *See generally*, Keiter, *NEPA and the Emerging Concept of Ecosystem Management on The public Lands*, 25 LAND & WATER L. REV. 43 (1990).

laws and the Endangered Species Act. In the past several decades forty-two species of native mammals have vanished from fourteen of our national parks, even though these species were present and completely protected when the parks were established.[79] A recent study, targeting national forest lands in the continental United States, calculated the mean number of species extirpated per national forest at 4.7 [80] In total, we have lost more than 500 *known* species and subspecies of native plants and animals to extinction since Europeans settled North America.[81] The number of extinctions occurring on this continent is clearly increasing beyond a linear rate, putting our potential losses proportionally on par with the more massive losses occurring in biologically rich tropical nations.[82]

THE UNFORESEEABILITY FACTOR

The reasons for the escalating loss of biodiversity on federal public lands despite seemingly comprehensive protective legislation are complex, but several factors predominate. First, *most impacts on biodiversity are not 'reasonably foreseeable' and thus are not evaluated by land management agencies contemplating biologically destructive activities.* Because NEPA only obligates land managers to evaluate those impacts that are "reasonably foreseeable" (instead of requiring a more far reaching "worst case analysis"[83]) even the land manager who is directed to preserve biodiversity[84] will be hard pressed to modify resource development activities to do so. With the biological information currently available, the impacts a particular action will have on the long-term preservation of biodiversity can be predicted only in the most limited sense.[85] Most of the resulting impacts on biodiversity will be attenuated and not quantifiable at the time a development action is taken, making the land managers 'reasonably foreseeable' predictions fall far short of a truthful accounting of the abstract but *real* impacts the action will have on biodiversity

The casual string between each development activity an agency permits and its singular and cumulative impacts on biodiversity may in fact be indescribable, *but it is there.* The current unanticipated biological disruption and escalating loss of biodiversity on federal lands are powerful evidence that the full biological impact of yesterday's land management decisions will be felt even though they may have been abstract, not

79. Chadwick, *supra* note 63, at 4.
80. Bixby, *The Next Step: Part One,* 6 ENDANGERED SPECIES UPDATE 5 (1988).
81. Chadwick, *supra* note 63, at 2.
82. *Id.* at 2.
83. *Supra* note 77 and accompanying text.
84. *Supra* note 75 and accompanying text.
85. Wolf, *supra* note 9, 6-10.

quantifiable, and largely unforeseeable when the agency originally acted. By limiting our NEPA analysis to only those impacts that are reasonably foreseeable, we have chosen to err on the wrong side of caution when evaluating the biological impacts of potentially destructive activities. Indeed, we will continue to pay the biological price for our shortsightedness until we either implement a mechanism to expand our evaluation of contemplated activities and their impacts to include the unforeseeable, or begin to incorporate broader biodiversity considerations into our land management planning process.

Biogeographical Limitations

Compounding the problem of unforeseeable biological impacts is the size of the areas we manage primarily as nature reserves (national parks, wilderness areas, and wild and scenic rivers). *The areas we manage as nature reserves are simply too small and fragmented to preserve biodiversity* Nature reserves are increasingly becoming isolated pockets surrounded by a sea of resource development and human activity Biogeographers now recognize that because of this, reserves behave much as geographically isolated islands with regard to species differentiation and diversity In general, the longer such an island remains isolated and the smaller its area, the larger the proportional drop in biodiversity [86] Apparently, small isolated areas cannot support enough diverse vegetative mass and lower order animal species to provide sufficient energy resources to maintain sustainable populations of large vertebrate species. Indeed, even smaller vertebrate species in these areas may be compromised by restricted gene pools that amplify undesirable traits and cannot accommodate changes in the environment or natural catastrophic events.[87]

As a general rule of thumb, an isolated geographic area, similar in all aspects to another area but only one tenth as large, will contain only about half the diversity of species types as the larger area.[88] Expanding this general rule on a continental scale is at least illustrative of our current predicament. Only 5% of the continental United States is utilized as nature reserves.[89] If these fragmented areas can truly be expected to behave as geographically isolated islands, we can anticipate that current reserves will support less than 25% of the species indigenous to this country Further, because the majority of our large nature reserves were set aside because of high scenic value rather than high biological value, these areas are often located at biologically inhospitable high elevations containing mostly rock

86. Chadwick, *supra* note 63, at 4.
87. *Id.* at 3.
88. *Id.* at 4.
89. *Id.* at 4.

and ice. The actual number of species they will support may be proportionally much less than their area might first lead us to believe. Indeed, as one scientist puts it, "The future looks bright for high altitude lichens,"[90] but other species, particularity vertebrates, are in more dire straits. Recent studies in conservation biology tell us that even our largest reserves may be *six times* too small to support even minimum viable populations[91] of large vertebrate species.[92] An increasing number of scientists feel that if current nature reserves must be relied upon as the sole reserves protecting biodiversity, the outlook for many species' survival beyond the individuals currently living or a few subsequent dwindling generations is truly dismal.[93]

THE SEARCH FOR SOLUTIONS
-throwing out the current theory of protection

The present theory of biological protection in the United States clearly is not capable of preserving large portions of our national biodiversity The pollution control laws provide only a minimal amount of blanket biological protection and have yet to incorporate broader biodiversity considerations. Our wildlife protection laws are inadequate as well, protecting only individual species perceived highly valuable and those already pushed to the brink of extinction. The biological protection afforded by this scheme is limited mainly because surprisingly little emphasis is placed on preemptively preserving the habitat and biological systems necessary to prevent further biological decline. In effect, the current policy is one that increasingly relies on costly *restoration* biology rather than on more economical *conservation* biology It is a policy that

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90. *Id.* at 5.

91. The term 'minimum viable population' connotates the threshold number of individuals below which a species can not survive over the long term (100 years or more). It is a difficult and controversial number to predict because it is a function not only of gene pool size and the unique reproductive and behavioral aspects of each individual species, but also is intimately tied to the quality of the species habitat and the stability of the biological systems on which it relies. Thus, the minimum viable population for each species differs, and it differs between populations of the same species depending on external factors. For some of the more highly studied species, conservation biologists indicate that 500 may be an effective population size, but this number is approached with caution, and most biologists agree that for some species a minimum viable population may be closer to 5000 individuals. *See generally*, M. E. SOULE (ed.), VIABLE POPULATIONS FOR CONSERVATION (1987); *see also*, Grumbine, *Viable Populations, Reserve Size, and Federal Lands Management; A Critique*. 4 CONSERVATION BIOLOGY No. 2, 127-33 (June 1990).

92. The species included in the study were the wolverine (*Gulo luscus*), mountain lion (*Felis concolor*), black bear (*Ursus americanus*), grizzly bear (*Ursus arcto horribilis*), and gray wolf (*Canis lupus*). Grumbine, *supra* note 91, at 128; *See also*, Newmark, *Legal and Biotic Boundaries of Western North American National Parks: A Problem of Congruence*, 33 BIOLOGICAL CONSERVATION 197-208 (1985).

93. Grumbine, *supra* note 91, at 128.

propagates itself.

Federal lands may present the best opportunity to protect the large tracts of relatively unpolluted and undeveloped habitat necessary to preserve intact the biological systems required to support large portions of our national biodiversity Unfortunately, areas currently managed as nature reserves are simply too small to support even minimum viable populations of many species native to their region, and agencies managing adjacent federal lands pay little or no regard to protecting the biological resources in reserves and the biological systems that cross agency boundaries.[94] Yet because of biogeographical limitations, to maintain the biological resources within reserves, it is absolutely essential that agencies managing adjacent federal lands initiate broad biodiversity planning that crosses administrative boundaries. A true landscape-oriented land-use planning system is needed.

PLANNING FOR (RATHER THAN AROUND) BIOLOGICAL DIVERSITY *-a new theory of public land management*

Requiring the Forest Service and the Bureau of Land Management (who manage the multiple-use federal lands bordering nature reserves) to assess the environmental impacts of each proposed activity does little to encourage them to incorporate broader regional biodiversity considerations into their planning processes.[95] Even if NEPA were amended to

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94. Section 1508.27(a) of the CEQ guidelines requires federal agencies to analyze the regional impacts of an activity when determining if it will "significantly" effect the environment for NEPA analysis. Unfortunately, this section [1508.27(a)] also qualifies the scope of regional analysis depending on the character of the activity. For example, for site-specific actions, the regulation says the regional analysis may be limited to the locale of the action to determine if it will have significant 'regional' impacts. 40 C.F.R. § 1508.27(a)(1988). This limiting language clearly makes section 1508.27 inadequate to compel multiple-use agency planners and land managers to use a true regional analysis, encompassing both multiple-use lands and adjacent preserves, when contemplating biologically destructive activities that may impact biodiversity in a broad geographic sense. In fact, current USDA Forest Service policy, which specifically precludes buffer zones adjacent to existing wilderness areas, is evidence of section 1508.27(a)'s shortcomings. *Forest Service Manual* 2320.3-2 (4186, Amend. 97); *See also*, Keiter, *Natural Ecosystem Management in Park and Wilderness Area: Looking at the Law*, in ECOSYSTEM MANAGEMENT FOR PARKS AND WILDERNESS 33 (Agee & Johnson eds. 1988). Indeed, the Forest Service has narrowly interpreted its biodiversity mandate (*see supra* note 58) to apply only to the biological resources within its own borders, often using the mandate as an excuse to permit activities known to adversely effect sensitive species and biological resources in adjacent preserves because the detrimental activities (clearcuts, etc.) open up densely wooded ares on national forest lands, allowing species normally absent from dense forests to take advantage of the 'edge' created by patches of deforestation, thereby increasing the literal number or 'diversity' of species present. This policy is spurred by the agency regulations which limit the definition of biological diversity to mean "the distribution and abundance of different plant and animal communities and species *within the area covered by a land and resource management plan*" 36 C.F.R. § 219.3 (1988)(emphasis added).

95. 16 U.S.C. § 1604(g)(1)(1988) already requires the Forest Service to comply with NEPA when preparing its Forest Management Plans and NEPA compliance does not insure a true regional

explicitly require these agencies to assess the impacts each proposed activity will have on biological resources in adjacent reserves,[96] little would be gained because the attenuated impacts resulting from a biologically destructive activity are usually not reasonably foreseeable or even describable when such an activity is first approved. Without a mechanism to accurately predict the full scope of biological impacts *before a development action is taken*, multiple-use land managers will not be able to incorporate comprehensive biodiversity considerations into daily management and planning decisions. Multiple-use land managers cannot be expected to place biodiversity on equal footing with other activities, making politically and economically unpopular resource decisions based on impacts that are not quantifiable when decisions are made.

Simply prohibiting biologically destructive activities on all federal lands would be perhaps the only way to completely protect the biological resources they contain. What we can do in the alternative, however, is set up a public land management system that plans for a sustaining the diversity of biological resources by allowing a margin of safety to compensate for unforeseeable impacts that might jeopardize individual species. This type of planning would involve a paradigmatic shift in our current philosophy of biological protection - moving away from a policy that relies on mitigating the negative impacts of biologically destructive activities towards a policy that prohibits those activities in areas where they have the *potential* to degrade key biological systems.

Land management models utilizing a 'margin of safety' approach already exist.[97] In general, these models involve managing a core area as a nature reserve, large enough to support healthy viable populations of all species contained, and surrounding it with a flexible boundary region. The models differ from our current land management scheme; absolutely no potentially damaging resource extraction is contemplated within the core area, and such activities are managed in the boundary region *for the benefit of the core*. Resource extractive activities are actually *used* (as opposed to being merely allowed or regulated) as a means to provide a flexible

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analysis will be taken. *Supra* note 75 and accompanying text.

96. Since 1988 several versions of a 'Biodiversity Bill' have been circulated in Congress. A current version would require all federal agencies to consider the impacts each action, program, or policy has on biodiversity and would require the Administrator of the EPA to take into account the impacts each proposed action will have on biodiversity when reviewing environmental impact statements. *See generally*, S. 58, 102nd Cong.,1st Sess. (1991).

97. Indeed, this type of land management model has existed for some time. The Man and the Biosphere Program is one such model that has been around for two decades. For a more up-to-date version of a similar model, *see generally*, Schonewald-Cox, *Boundaries in the Protection of Nature Reserves; Translating Multidisciplanary Knowledge into Practical Conservation*, 38 BIOSCIENCE No. 7, 480-486 (July/August 1988).

'generated edge' to protect the biological systems in the core.[98] A greater proportion of our national biodiversity could be maintained on federal public lands if multiple-use lands immediately adjacent to nature reserves were managed in this fashion to protect the biological resources in the reserves. Conservation biologists have already demonstrated the increased protection that this type of interagency federal land management would provide to declining vertebrate species.[99]

Unfortunately, there has been no attempt to create flexible boundary regions around reserves, and under the current land management system there may be no mechanism to create them. Because contemporary nature reserves are too small to support even minimum viable populations of many species, boundary regions must be created well within the multiple use lands bordering reserves. The Forest Service and Bureau of Land Management are currently unwilling and/or unable to manage their lands in this fashion.[100] Yet it remains undisputed that implementing cross-jurisdictional landscape oriented biological protection is absolutely essential to preserving the large portion of our national biodiversity that remains on federal lands.

Implementing Cross-Jurisdictional Biodiversity Planning

Inconsistent policies and historical usage patterns preclude implementing cross-jurisdictional biodiversity planning under the current land management system. Cooperation between land management agencies with conflicting goals has proven to be an inefficient means to protect biological systems that ignore administrative boundaries.[101] As an alternative, scholars have searched for legal authority that would allow the National Park Service (NPS), our most 'preservation' oriented agency, to regulate activities outside its boundaries that impact biological resources within the parks.[102] Indeed, many have concluded that the NPS already has the authority to regulate external threats on a case-by-case basis, and there certainly is nothing legally precluding the NPS from taking a more participatory role in the land management planning and NEPA review processes of neighboring agencies.

Even so, *biodiversity cannot be preserved on a case-by-case or species-by-species basis*. History has shown the NPS lacks the aggressive disposition and administrative resources required to constructively partici-

98. *Id.* at 482.

99. Salwasser, Schonewald-Cox & Baker, *The Role of Cooperation in Managing for Viable Populations*, in Viable Populations For Conservation 169-171 (M. E. Soule ed. 1987).

100. *Supra* note 94 and accompanying text.

101. Coggins, *supra* note 44, at 20.

102. *Id.* at 19.

pate in the planning process of neighboring agencies.[103] Absent a clear Congressional directive or a stronger incentive to protect park resources from external threats, the NPS is unlikely to change its current policy of non-interference, especially where the autonomy of neighboring agencies is at stake. Further, the unforeseeable nature of the biological impacts arising from activities on neighboring lands makes attempting to regulate external threats on a case-by-case basis a poor method for providing long-term protection for park resources. Indeed, even if the NPS could effectively challenge destructive activities on adjacent lands and actively participate on the planning process of neighboring agencies, one must concede that many 'nature reserves' (i.e. Wilderness Areas and Wild and Scenic Rivers) are not managed by the NPS.

Perhaps a more effective means of protecting the biological resources in nature reserves would be to eliminate the administrative costs of joint multi-agency planning and simply focus on the multiple-use agencies managing biologically critical lands bordering reserves. Focusing on the planning process of the Forest Service (FS) and the Bureau of Land Management (BLM) may be the most efficient way to implement cross-jurisdictional biodiversity planning that allows a margin of safety for unforeseeable biological impacts.

Since the enactment of the Resource Planning Act in 1974,[104] the National Forest Management Act (NFMA) and the Federal Land Use Policy and Management Act (FLPMA) in 1976,[105] both the Forest Service and the Bureau of Land Management have been required to implement comprehensive long-term land management plans at both regional and local levels. Additionally, NFMA already directs the FS, which manages the majority of biologically productive lands bordering preserves, to preserve biodiversity and to take ecological relationships into account when preparing forest management plans.[106]

A cross-jurisdictional landscape-oriented approach to preserving the diversity of biological resources on federal lands could be achieved if both NFMA and FLPMA were amended to place preserving the native diversity of biological resources within each FS and BLM planning unit an explicit priority over other multiple-use activities, and if each FS and BLM planning unit were expressly expanded for biodiversity purposes to include

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103. *See generally*, Sax & Keiter, *Glacier National Park and Its Neighbors: A Study of Federal Interagency Relations*, 14 ECOLOGY LAW QUARTERLY 207-263 (1987).

104. 16 U.S.C. §§ 1601-1613 (1988).

105. 16 U.S.C. §§ 1601-1614 (1988).

106. *Supra* note 75 and accompanying text. Unfortunately, this biodiversity mandate, when combined with the promulgated definition of biodiversity in Forest Service regulations, only requires the agency to plan for maintaining the diversity of biological resources within their own lands. *Supra* note 94 and accompanying text.

neighboring nature reserves. Ideally, these amendments would not alter the geographic jurisdictional boundaries between the multiple-use agencies and the Park Service; they would merely obligate the FS and the Bureau of Land Management to protect the biological resources in adjacent reserves and to shape their multiple-use planning process accordingly

A land management scheme of this type would finally put practical meaning to the idealized land management principle of "multiple-use and sustained yield."[107] For such a strategy to work, preserving biological resources must be given absolute priority in federal land use planning. Sustained yield incarnate, preserving the existence and diversity of biological resources would have priority over each federal action and over all other resource values and uses, regardless of the potential these uses present for immediate economic gain. As one biologist puts it, "Biodiversity is no frill. It is life, and all that sustains life. It is worthy of respect. Maintenance of biodiversity must become our primary mission as a society, the principle that guides all resource use."[108]

The suggested amendments would give the FS and the BLM the authority, which they currently lack, to regulate private activities on the multiple-use lands they manage solely for the purpose of protecting biological resources in neighboring reserves. Additionally, the amendments would place preserving the integrity of biological systems and species diversity in core reserve areas the highest priority because multiple-use activities on adjacent national forest and BLM lands must be servient to these resources if they are to be maintained and the principle of sustained yield followed. Boundary designations for areas immediately adjacent to reserves could be included in the amendments, along with management guidelines designed specially for those regions. These changes would set biological priorities and prescribe a flexible 'zone' type management system on federal lands to provide a margin of safety for protecting biological resources in core reserve areas.

CONCLUSION

The suggested amendments to NFMA and FLPMA would be a simplistic method to implement a more preemptive approach to preserving

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107. First enacted in 1960, the Multiple Use Sustained Yield Act, 16 U.S.C.A. §§ 528-31, declared that the policy of Congress was to direct the Forest Service to use the principle of "sustained yield" as an underlying guideline for managing national forest lands. "Sustained Yield" was defined as "the achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the national forests without impairment of the productivity of the land." *Id.* § 531(b). The various renewable resources include wildlife and fish. *Id.* § 528.

108. *See* Reed Noss, in Chadwick, *supra* note 63, at 4.

the diversity of our biological heritage. An approach that minimizes administrative delays and focuses on preserving the habitat and biological systems necessary to support our nation's remaining native biological diversity is clearly needed. Public lands may present the best opportunity to preserve a large portion of this diversity, and the legislative framework establishing long-term land use planning is already in place. The next step is to set biological priorities and implement a management system flexible enough to allow nature to manage itself. If we are serious about preserving biodiversity, it must be a system that provides a margin of safety to compensate for the unforeseeable biological impacts of multiple-use activities on federal lands.

The amendments suggested would provide planning authority for multiple-use agencies to regulate the activities on their lands for the sole purpose of ensuring the long-term preservation of biodiversity in neighboring nature reserves and on federal lands in general. Surprisingly, the Forest Service and the Bureau of Land Management currently have no explicit obligation to insure that activities on their multiple-use lands do not jeopardize the biological resources in nature reserves. The contemplated amendments would change this, obligating these agencies to plan *for* the protection of biological resources that ignore administrative boundaries, and giving them the express regulatory authority to do so.