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**THE ETHICAL ASPECTS OF BIODIVERSITY PROTECTION:
DUTIES TO HUMAN BEINGS AND DUTIES TO OTHER SPECIES**

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**BIODIVERSITY PROTECTION:
IMPLEMENTATION AND REFORM OF THE ENDANGERED SPECIES ACT**

**Natural Resources Law Center
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by Dale Jamieson

I. Introduction

There is ample evidence that for an issue to remain at the center of our national consciousness it must be associated with a credible "dread" factor. Crime is associated with images of murdered teenagers on the 6 o'clock news. Welfare is linked to pictures of unwed mothers, either living in destitution or riding around in Cadillacs, depending on the point of view of the portrayal. Even the deficit is symbolically associated with lazy, incompetent government workers.

Global change issues are not easy to connect to "dread" factors, and biodiversity loss presents the most difficult challenge of all. Perhaps climate change can be viewed as potentially bringing drought and famine, and ozone depletion can be portrayed as threatening blindness and cancer. But to many people, biodiversity loss presents nothing more serious than the possibility of a world without beetles.

There is even a great deal of confusion about what biodiversity loss is. According to an article in *Science* for 13 May, 1994, while 82% of Americans are concerned about "mass extinctions of plant and animal life," only 40% are worried about the "biodiversity crisis." Clearly some definitions are in order.

II. What is Biodiversity?

Generally, biodiversity refers to "the variety and variability among living organisms and the ecological complexes in which they occur" (US Office of Technology Assessment 1987).

However, because life is organized on different levels ranging from the genetic to the ecosystemic, several different dimensions of biodiversity can be identified. 'Genetic diversity' refers to the microlevel variety and variability that distinguishes individuals and populations

from other members of their species. 'Species diversity' refers to the variety and variability of kinds of organisms. 'Ecosystem diversity' refers to the variety and variability of communities of organisms functioning holistically.

A comprehensive definition of biodiversity is difficult to formulate because there are so many levels at which biodiversity exists, but there is a further complexity as well. As Bryan Norton (1987:260) remarks, "Biological diversity is a much broader concept than genetic diversity. Biological diversity is not just constituted by the number of species, subspecies, and populations extant; it is also constituted by the varied associations in which they exist." On this view the number of ecosystems, species, or genes that are driven to extinction is not itself a measure of biodiversity loss, but rather at most it is a sign of such loss. If ecosystems, species, or genes are becoming extinct faster than they are being created then a reduction in biodiversity is probably occurring.

III. Is Biodiversity Being Reduced?

Some researchers have argued that a cataclysm of extinction is currently underway (for example Ehrlich and Ehrlich 1981). Warnings have been sounded in joint statements by the National Academy of Sciences in conjunction with the Royal Society of London, and by the Club of Earth, an exclusive organization open only to scientists who are members of both the National Academy and the American Academy. However despite the credentials of the authors of these warnings, a great deal remains unknown.

Popular concerns about biodiversity generally center on species rather than on genes, ecosystems, or their interactions. Yet our ignorance about the earth's species is profound. In a 1992 article Robert May asked "[h]ow many species inhabit the earth?". His answer was "the sad truth is that no one knows." May estimates that between 1.5. and 1.8 million species have been identified, and he declines to guess what might be the total number of species on Earth. Various other biologists have estimated the total number of species in existence at 10-100 million (e.g. Myers 1994), while E. O. Wilson (1988) reckons that there are about 30 million.

It is worth examining in some detail how these calculations are done. In an influential paper Terry L. Erwin (1982) claimed that there are 30 million arthropod species alone. Over three seasons he collected 1,200 species of canopy beetles living on one species of tree (*Luehea seemannii*) in the Panamanian rainforest. From this data he made a series of highly speculative inferences and guesses. He assumed that there are 163 species that live exclusively in the canopy of *Luehea seemannii*, that there are 50,000 tropical tree species in all, and that the number of species that live exclusively on *Luehea seemannii* is typical. Taken together these assumptions implied 8.15 million canopy-dwelling tropical beetle species. Next Erwin assumed that beetles make up about 40% of all species of insects, spiders, and other arthropods. This implies about 20 million tropical arthropod species. If half as many species live on the ground as in the rainforest canopy, then the total number of arthropod species is 30 million.

There are a number of difficulties with such calculations. They assume the ability to extrapolate globally from a limited area. This is problematical because the biota is in general discontinuous, and it is obvious that we are quite ignorant of the location and dimensions of many of these discontinuities. There are also taxonomical difficulties. Debate among biologists and philosophers continues about the nature of species and how to tell one from another (Ereshefsky 1992).

Calculating extinction rates is obviously problematical when there is no reliable baseline about how many species exist. Yet many researchers believe that extinction rates are increasing. For example Myers (1994) suggests that the present rate of extinction is about 120,000 times higher than the "natural" rate. Although he acknowledges that there is no way to know the exact rate of extinction, he suggests we can arrive at an estimate by applying the techniques of island biogeography to the number of species present in a habitat before deforestation. Such a calculation suggests that when 90% of a habitat is destroyed, 50% of the species will eventually be lost. Using such methods Myers (1988) estimates that in the last 35 years 50,000 species have disappeared in Brazil and Madagascar, an extinction rate of about 1500 species per year. Using similar methods Wilson (1988) estimates that in tropical

forests world-wide, a total of 7,500 species are lost each year, and Simberloff (1986) suggests that if deforestation continues at the present rate, 15% of all plant species and about the same number of animals species will be gone by the year 2000 (as cited in Myers 1988 and Lugo 1988).

Lugo (1988) points out many difficulties with such calculations. In order to be reliable they must take into account the effect of forest types on species abundance, the spatially selective (life zone) intensity of human activity, the role of secondary forests as species refugia, and the role of natural disturbances in maintaining regional species richness. At a regional level, one also has to consider the importance of exotic species in the maintenance of species richness, particularly in ecosystems subjected to the impact of human activity.

In addition to dealing with discontinuities in the biota, calculations of extinction rates must also cope with discontinuities in time. What is regarded as the "natural" extinction rate is typically an average of periods of high and low extinction. This can be quite misleading, as David Raup (1988:54) notes.

If . . . the Cretaceous-Tertiary extinctions took place over a time as short as a single year, then calculations of long-term rates become meaningless: during short intervals of extreme physical environmental stress, extinction rates were nearly infinite, whereas between these events, extinction rates may have been virtually zero . . . extinctions are point events rather than the result of a time-continuous process.

Ignorance about extinction rates and the absolute number of species that exist have led some to say that there is little cause for concern. Simon (1994) has claimed both that "the actual data on the observed rates of species extinction are wildly at variance with Myers's and following statements" (35) and "the rate of species loss really is not known"(40). He concludes that "[t]here is now no prima facie case for any expensive species-safeguarding policy. . ."(43).

Despite the paucity of information, it seems to me that Simons's optimism about species preservation is unwarranted. Recorded recent extinctions probably underestimate the actual rate of species loss for several reasons. First, because so few species have been described relative to the total number that exist, some species have probably disappeared in recent years without having been described. Second, according to internationally recognized criteria, a species is not regarded as extinct until fifty years after the last sighting. Thus there is a long time lag between the actual extinction of a species and the official recognition of its extinction. Third, much of the habitat destruction, contamination, and population reductions that will eventually drive many species to extinction is recent. Many animals may already be doomed, yet they may continue to survive for a few generations. Peter Vitousek and his colleagues (1986) make the further point that humans are appropriating an ever increasing proportion of the products of photosynthesis, thus depriving other life forms of these energy sources. They estimate that humans now directly or indirectly use about 40% of Earth's annual net primary production, and that this proportion is likely to grow along with human population and development. In addition to the threats already mentioned, both ozone depletion and climate change have the potential to further reduce biological diversity. As was previously noted, ozone protects life forms from ultraviolet radiation, and there is evidence that ozone depletion is linked to the global reduction of amphibian populations. If significant climate change occurs it is likely to be disastrous for many species of plants and animals who are not able to migrate or adapt quickly enough to a new climate regime. Because of differing migration rates among species, ecosystems are unlikely to migrate intact. This disintegration of ecosystems may endanger species which otherwise could adapt to climate change.

Still, some may think that concerns about extinction are misguided. Extinction is every bit as important to the workings of nature as speciation. Of all the species that have ever existed, no more than 6% exist today. Even before humans evolved, mass extinction was a way of life on our planet. The late Permian extinction, which occurred about 200 million years ago, eliminated between 91% and 96% of existing species. The most recent mass extinction was in the Late Cretaceous period about 65 million years ago. Most marine plankton were

destroyed along with many invertebrates, and perhaps all dinosaurs.

The current epidemic of extinction is both similar to and different from those in the past. It is different with respect to cause: the current epidemic of extinctions is caused by humans. Human causes of extinction take many forms including habitat destruction and fragmentation, exploitation, pollution, and the introduction of exotic species. The current epidemic of extinction may be similar with respect to scale: The mass extinctions now occurring may well be the most extreme in 65 million years. Virtually all ecosystems are under threat, including those that play the most important roles in evolutionary processes (e.g. coral reefs, wetlands, rainforests). A significant proportion of terrestrial plant species are threatened with extinction. The loss of so many plant species seriously depletes the resource base on which evolutionary processes can operate. These impacts are so severe that Soule' and Wilcox (1980) have said that we are not facing just the death of species, but with an "end of birth." Unfortunately a recent definitive report from the World Conservation Monitoring Centre (1992) probably has it right: "it is indisputable that the extinction rate in recent times has been far higher than this [the background rate] and that man has been the overwhelming cause. It is also widely accepted that mankind is in danger of precipitating further extinctions on a scale and at a rate at least comparable with those of the major extinction events in the distant past" (197).

4. Why Protect Biodiversity?

Arguments for protecting biodiversity are often divided into two categories: anthropocentric and biocentric. Anthropocentric arguments appeal to human interests; biocentric arguments appeal to the interests of elements of the natural world. Anthropocentric arguments can be either narrow or broad. Narrow anthropocentric arguments appeal to shallow, short-term human interests, of the sort that are measured by standard economic statistics. Broad anthropocentric arguments appeal to deep, long-term human interests that are difficult to quantify or concern our ideals. Biocentric arguments can be divided into those that are sentientist and those that are not. Sentientist arguments appeal to the welfare of all creatures that have experiences, a class that is much larger than that of human beings. Non-

sentientist arguments appeal to the interests of entities that cannot be the subjects of experience. I will argue that neither narrow anthropocentric arguments nor non-sentientist biocentric arguments are plausible. The two families of arguments that are plausible, those that are broad anthropocentric and sentientist biocentric, converge on the conclusion that we have strong moral duties to protect biodiversity.

A. Implausible Arguments

- 1) Arguments from Ignorance (Norton 1986)
- 2) Slippery Slope Arguments (Ehrlich and Ehrlich 1981)
- 3) Appeals to What is Natural (Callicott 1980)
- 4) Duties to Species, Ecosystems and Other Wholes (Rolston 1988)
- 5) Duties to Plants (Taylor 1986)
- 6) Intrinsic Value of Diversity and Complexity (Lovejoy 1950)

B. Plausible Arguments

- 1) Duties to Nonhuman Animals (Singer 1990)
- 2) Duties to Future Generations (Partridge 1981)
- 3) Aesthetic Arguments (Sober 1986)
- 4) Appeals to Character (Hill 1983)

V. Concluding Remarks

In my opinion the best arguments for preserving biodiversity appeal to people's values rather than their immediate interests. I believe that most of us most of the time (if not all of us all of the time) prefer a world of richness and variety to one of simplicity and uniformity. Many of us also believe that other forms of life have a presumptive right to exist. If biodiversity were to be defended by appeals to the goodness of variety or the existence rights of other life forms, this would lead us away from the "species-centrism" characteristic of most arguments for preserving biodiversity, towards valuing populations, subspecies, and individuals as well as species.

Biodiversity reduction continues to be one of the most difficult and least understood problems that we face. A great deal of attention is paid to species extinction, but much less to variety in all of its other forms. The case for preserving biodiversity is often cast in shallow economic terms rather than in a broader moral framework. While most people want to preserve species, they have little idea how to do it and what the trade-offs are. The problem of biodiversity reduction will only become more acute.

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