A Critical Evaluation of the Species Approach to Biological Conservation

by
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Editor's Note: *As the newly designed Update develops, we hope it will become an outlet for ideas and thoughts on a range of species conservation issues. In keeping with this image, we are printing the following article which expresses a view of the limitations of the species focus in biological conservation. We hope that it will act as the beginning of an ongoing discussion rather than an end in itself. We welcome letters and comments on this article as well as those that will appear in future issues. The success of the Update depends upon the participation of its subscribers.*

In its recent report, *Technologies to Maintain Biological Diversity,* The Office of Technology Assessment (OTA) suggests that the conservation of biological diversity entails the maintenance of not only a diversity of species, but also a diversity of patterns and processes at all levels of organization (OTA 1987). Yet of the possible methods that might be used to achieve the type of biological conservation goals outlined in the OTA report, a single one predominates in both public and private agencies. This method, which we refer to as the species approach, involves the maintenance of viable populations of select species (Holbrook 1974, Gould 1977). In general, population levels of select "management indicator species" are used to indicate the health of the environment, the welfare of other species, the value of a parcel of land, or the impacts of habitat alteration. Public agencies rely heavily (if not exclusively) on the species approach to meet their legislative mandates to maintain biological diversity (Flood et al. 1977, Patton 1978, U.S. Fish & Wildlife Service 1980a, Schamberger and Krohn 1982, Thomas 1982). We believe, however, that the species approach is too narrow to be used alone as a conservation tool, and that additional approaches should be implemented to balance the inherent limitations of the species approach. The arguments raised here are not meant to indict the species approach. Indeed it has been of great value in raising issues and protecting species as well as habitats. Rather, it is meant to take a step back from species focused conservation in an attempt to understand its limitations. Some of these limitations are discussed below with the intent of illustrating the need for a broader approach to biological conservation.

The Niche Concept and Species Conservation

First, there is the maxim that no two species occupy the same niche; every species is unique in its needs. No biologist would argue that a single species can be chosen to speak for the welfare of all others, yet many apparently believe that a well-chosen few should be able to do so (Graul et al. 1976). U.S. Forest Service regulations specify that management indicator species can and should be used to facilitate efforts to monitor and maintain viable populations of all species (36 C.F.R. sec.219.19). Unfortunately, the regulations do not specify how many indicator species are needed to monitor the health of wildlife populations or to assess the effects of habitat alteration. Yet the question remains, how many species are needed?

To answer this, we need to understand that the National Forest Management Act requires nothing less than the maintenance of viable populations of all wildlife species in all parts of their geographic ranges (Salwasser et al. 1984, Norse et al 1986). Next we must realize that the only species whose welfare will be assured by that of an indicator species will be those whose niches are entirely subsumed by, or included within, that of an indicator species. Moreover, the narrower the niche of an indicator species, the less likely it is that another species will occur entirely within the geographic and ecological limits of that indicator. If we choose the most stenotopic species as indicators (as recommended by Graul et al. 1976 and Graul and Miller 1984), then how can the maintenance of viable populations of a more broadly distributed species be assured throughout all parts of its geographic range? If used to the exclusion of other approaches, the species approach often falls short of legislative mandates to protect all fish, wildlife, and plant species.

Competition for Public Attention

Given that conservation decisions are based on a small subset of all species, and given that no two species have identical needs, a necessary consequence is that species compete with one another for representation as management indicators. Time that might be better spent in the consideration of alternative approaches becomes funnelled toward determining which species to choose for the implementation of conservation and management programs (Thibodeau 1983). Although Fish and Wildlife Service biologists try to select indicators on the basis of objective sampling schemes (Roberts and O'Neil 1985, Fry et al. 1987), and forest service biologists are directed to draw indicators equitably from each of several categories of species (36 C.F.R. sec, 219.19), the majority of indicator species used by both agencies are those that are taken for food, sport, or hides, and those that are threatened or endangered (Thomas 1982). Considerable change is needed before we progress from our historic orientation toward game production to an orientation more consistent with the goals of broad-based biological conservation. The species approach may be hindering that transition because agencies can maintain their traditional emphasis on game production through indicator species management.

Minimum Viable Populations

Even if we could somehow monitor the populations of all species, there would remain the perplexing problem of how to determine the viable population size of any one of them (see, for example, Shaffer 1981, Salwasser et al. 1984, Gilpin and Soule 1986, Harris et al. 1987). No matter what the criteria, however, populations at higher levels of abundance are more "viable" (able to persist for a period of years) than those at lower levels; viability is therefore, a continuous variable. The species approach converts this continuum into a categorical dichotomy of "viable" and not "viable." This is not only misleading, but dangerous because it allows us to believe that we can work toward some minimum population size and still retain the values associated with the presence of that species at higher population levels.

Incomplete Data

Most species have vastly different needs at different points in space and time. For example, the needs of a warbler in one part of its breeding range will differ from its needs in another part of the same range, just as its requirements in summer differ from those in winter. It simply is too difficult to monitor and conduct habitat analysis for a single species in numerous locations, in all seasons and in different (climatologically normal and non-normal) years. We are, therefore, too narrow in our focus when it comes to defining the requirements of any one species.

In spite of the fact that the "needs" of an indicator species are often based on narrowly focused and incomplete data, those data are beginning to be used in models to determine the value of a parcel of land to the maintenance of an indicator species' population. Other models will then be used to convert this perceived importance to a dollar value so that the value of preservation can be weighed against the economic value of development (USFWS 1980b). Although managers recognize that there are problems with the data base for such modeling, they recommend its use in the face of pressing decisions (Thomas 1979a). While we recognize that decisions must be made, we question whether the use of incomplete data from the species approach alone is the best way to make decisions about the value to wildlife of a parcel of land.

Public Support

While public support may be strong for the protection of endangered species, the public shows little support for species that tend not to be featured (Kellert 1986). In addition, with the ever-increasing number of threatened and endangered species, public support for any one is bound to decline. Under the species approach, the conservation movement will become more scattered, rather than increasingly focused, as more and more species compete for the public's attention.

Disproportionate Focus on Rare & Endangered Species

The species approach invariably draws attention to organisms on the verge of extinction. This may hinder an overall effort to conserve biological diversity for several reasons. First, a focus on the needs of the rarest species means that population size is the all-important criterion in our judgement of value. For example, most of us would find efforts to preserve 200 kirtland's warblers more valuable than efforts to

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White pine and hemlock in McCormick Experimental Forest in Michigan's upper peninsula

Photo by Maria Pregitzer

maintain a million American redstarts. This is, in part, because we do not recognize the unique value of a million birds. We have difficulty relating to the value of the variety of higher-level patterns and processes represented by those million. Once a minimum viable population is reached, we tend to feel that all else is redundant. There is unique value to the million redstarts, however, we are simply untrained to recognize that value.

Consider that scrub jays are communal nesters in one part of their range and not so in another; that creosote bush grows alone in one part of its range and as part of a diverse desert plant community in another; or that fires burn frequently in some parts of the boreal forest and infrequently in others. It is just this variety of context within which a species occurs that provides us the opportunity to understand the world in which we live.

Second, rare and endangered species currently exert a disproportionate influence on the development of strategies for reserve design and placement because decisions are based largely on the locations of such species (Miller and Bratton 1987). Even The Nature Conservancy, a private organization dedicated to preserving the diversity of higher-order biological systems through land acquisition, bases its identification of key areas primarily on locations of rare species (Hoose 1983). Can the conservation of biological systems be assured through the preservation of a network of locations of rare species ?

Third, an approach that focuses on rare species raises questions about costs. Sampling low density populations to determine population trends is very expensive. The inevitable trend toward the use of zoos, captive breeding programs, and other activities associated with saving near-extinct species are so expensive that, even now, we cannot save them all. Still worse, the number of threatened and endangered species is increasing at an ever increasing rate which will exacerbate this problem (Nisbet 1978). While a broader approach may also be expensive, it would not necessarily require an exponential increase in cost to be successful.

Finally, with a focus on rare species, our conservation effort resembles a brinkmanship game as we rush to save one near-extinct species after another.

The Integrity of Ecological Patterns and Processes

The species approach does not meet the conservation goal of preserving diversity at all levels of biological organization because it does not explicitly recognize as valuable, anything other than, or above the level of species. It makes the conservation of species *per se* the goal. If there are viable populations of the chosen indicator species present, then we assume that we are conserving all levels of biological diversity. To use the Ehrlich's (1981) analogy of species as rivets in the Spaceship Earth, if we concentrate so much on individual rivets (species), we will be unaware if the spaceship itself remains in good shape. Thus, it is theoretically possible to preserve all of the earth's species but lose the integrity of higher order patterns and processes (Fritz 1983). The whole is greater than the sum of its parts (Noss and Harris 1986); but the species approach is based on the unlikely assumption that "...the entire ecosystem will be preserved if the indicator species are preserved" (Graul et al. 1976).

The species approach has also led to an increasing focus on gene banks and captive breeding programs as means toward the larger end of biological conservation. Although these efforts are to be praised, the integrity of patterns and processes above the species level cannot be assured through an approach that is slanted toward endangered species preservation. Efforts to conserve nature out of context are, for the most part, efforts toward the treatment of symptoms, rather than toward the development of a cure (Conway 1980).

Just as dangerous is the notion that if the species of concern is absent, then there is no conservation value in a parcel of land. This is well illustrated by the current controversy surrounding planned development in Glacier National Park (Anon. 1987). The only thing standing in the way of further development on McDonald Lake is a pair of bald eagles, which are protected by the Endangered Species Act. Forcing a single species such as the spotted owl or the bald eagle to stand not only for itself, but also to represent the value of entire ecosystems, puts undue responsibility on that species (Heinrichs 1983). Any single item, no matter how exotic, will pale in the face of fancy development plans. As beneficial as the Endangered Species Act is for the eagles, it is not effective as a general conservation act. Without that one pair of eagles, development would continue unchallenged because the presence of a listed species in the management area is required before the Act can be used to signal a potential conflict. Any conservation act that is species oriented would suffer the same limitation.

Human Population Growth

It is possible to maintain populations of select indicator species in the face of continued human population and resource exploitation. Therefore, the species approach may mislead us into thinking that we humans can continue to increase in population size while maintaining the integrity of nature. This is because we can grow and still maintain the presence of selected indicator species. Shaffer, (1981) for example, suggested that the adage, "the bigger the reserve, the better" must be replaced with "precise prescriptions for how much land is enough to achieve our conservation objectives". Such a statement implies that there is some minimum acceptable standard of biological diversity, above which all else is redundant. In reality, there is no way we can alter the land even a bit and retain its previous biological value. The reality of this continuous trade-off is not appreciated by the public; it is, in fact masked by the species approach, which suggests that we can avoid the negative impacts of growth and development through proper management. We need to supplement the species approach with an approach that reflects the trade-off reality that we cannot both preserve everything we have and continue to

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grow; further human population growth will necessitate a loss of biological diversity.

Conclusion

We believe the disadvantages outlined above warrant serious consideration of the species approach as a sole means to conserve diversity at all levels of biological organization. One solution would be to supplement the species approach with a land-based approach. The use of landscape patterns as a tool to maintain ecosystem-level patterns and processes (Ricklefs et al. 1984, Noss and Harris 1986, Noss 1987) stands as a promising supplement to the species approach, as do habitat based (Norton 1986b) and biogeographical (Diamond 1986, Scott et al. 1987) strategies. We hope this paper might stimulate further development along these lines and encourage further discussion of how to avoid the shortcomings of a species oriented conservation policy.

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