# The Endangered Species Act as a Tool to Conserve Biological Diversity



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The Endangered Species Act (ESA) is the centerpiece of federal efforts to conserve biological diversity. More specifically, the ESA aims to prevent the extinction of plant and animal species. To prevent extinction, the ESA directs the secretary of interior to determine which species are endangered or threatened by extinction, to designate habitat critical to the survival of these species, and to develop a plan for their recovery. In addition, the ESA prohibits federal agencies from actions that cause jeopardy to the continued existence of a listed species (Section 7) and prohibits both public and private parties from engaging in activities that "take" a listed species (Section 9). The definition of "take," as interpreted by the U.S. Fish and Wildlife Service and backed by court rulings, includes otherwise legal activities that result in adverse habitat modification. Under the ESA, logging has been curtailed in the Pacific Northwest and the Southeast to protect the spotted owl and red-cockaded woodpecker. Other land-use restrictions have been required to protect other listed species. Additional land-use and water-use restrictions, from Washington to California, may be necessary to protect recently listed salmon stocks.

In this article, we focus on the ESA goal of preventing species extinction and ESA provisions for accomplishing this goal. Before turning to the provisions of the ESA, we begin with a discussion of two alternative motivations for conserving biological diversity: a utilitarian-based (anthropocentric) motivation and an ecological rights-based (ecocentric) motivation.

## A utilitarian-based approach to conservation

Conservation is justified on utilitarian grounds only to the extent that it benefits human society. It follows that, in principle, conservation efforts based on utilitarian grounds can be evaluated in terms of costs and benefits. As we discuss below, in practice, this is more easily said than done.

Many plant and animal species provide obvious and direct benefits to society; that is, they are natural resources in the traditional sense. In most cases, these species have been domesticated, so that the possibility of extinction is remote. For nondomesticated resources, such as marine fisheries, the main problem is overexploitation and is best dealt with through improved resource management rather than through the ESA. In contrast, the ESA is better suited for dealing with the loss of species that do not provide an obvious or direct benefit to society and are therefore not subject to traditional resource management. It is on species of this kind that we will focus here.

One oft-cited example of a utilitarian motivation for preventing the extinction of plant and animal species is the possibility that the species will provide a medicinal or other benefit in the future. While these species provide no direct benefit today, they have a kind of option value arising from

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the possibility that they will in the future (Fisher and Hanemann). A more sweeping argument for species conservation centers on the notion that ecosystems provide a wide range of indirect benefits called ecosystem services (Perrings et al., Daily). Ecosystem services include the provision of habitat for commercially important species and the maintenance of water quality through the uptake of nutrients.

What do these utilitarian arguments imply about conservation? Simpson, Sedjo, and Reid analyze the option value of conserving species for potential future pharmaceutical use. In their analysis, each species is akin to a coin toss, with heads or success representing the event that the species provides the service, and tails or failure representing the event that it does not. In the absence of specific knowledge about these species, it is reasonable to assume that the probability of success is the same for all. If, in addition, species are independent, in the sense that the outcome for one species tells us nothing about the outcome for another, then the probability of having at least one success among a collection of species is an increasing function of the number of species in the collection. In this case, conserving the largest number of species is an appropriate goal. In fact, under these simple assumptions, the probability of having at least one success is a concave function of the number of species, so that the return to increasing species number diminishes. While this does not alter the result that more species are better than fewer, it would be important in determining the optimal level of species conservation. Because there are many species, Simpson, Sedjo, and Reid find that the marginal value of conserving a species is low, at least on option value grounds.

Closely related species, however, tend to share similar characteristics. Knowing that one species has a valuable characteristic increases the chance that a close relative has the same valuable characteristic. For example, an anti-cancer drug can be derived from both the bark of the Pacific yew and the needles of the European and Himalayan yew. In our work we relaxed the assumption of independence and showed a trade-off between the number of conserved species and their joint dissimilarity or diversity (Solow and Polasky). An implication of considering this type of diversity is that it might be reasonable to shift conservation resources away from an endangered species if it has one or more close relatives that are not endangered. More generally, accounting for this kind of dependence between species would make the management of species conservation similar to the management of a portfolio of financial investments. However, as a practical matter, a lot of detailed information about species dissimilarities, genetic or otherwise, would be needed to manage species conservation in this way.

In contrast to the option value argument, which can be put on a firm analytical footing, the ecosystems services argument tends to be more qualitative. Despite this, it is still possible to work out some implications for conservation. It is clear that, to the extent that services are provided by an ecosystem as a whole, conservation efforts should be aimed at ecosystems, rather than at individual species. The issue then becomes the extent to which preventing the extinction of individual species contributes to ecosystem conservation. This is a complex issue and general rules probably do not pertain. In some cases, the loss of a single so-called keystone species can have a dramatic ecological effect, although the link to ecosystem services may be less clear. In other cases, species loss may have minimal ecological effects. Also, demographic changes short of actual extinction can have ecological consequences. Thus, in principle at least, the apparent preoccupation of the ESA with preventing extinction seems misplaced if the true concern is the maintenance of ecosystem services. In practice, however, the situation is not so clear. While the explicit goal of the ESA is to prevent extinctions, the instrument emphasized in the Act is habitat protection. The ESA could, therefore, be interpreted as mandating the protection of habitats—that is, ecosystems—that have been selected on the basis of containing one or more endangered or threatened species. Under this interpretation, the presence of endangered or threatened species serves as a warning of a broader threat. As noted above, this rule may result in the protection of an ecosystem that may be relatively unaffected by the loss of its most endangered species. It may also result in the failure

to protect an ecosystem that is threatened by demographic changes short of extinction. But, in the absence of detailed information about each ecosystem, it may be an acceptable rule of thumb.

It is important to point out that, under these and other utilitarian arguments, the conservation of species is not really a goal in itself, but an instrument for achieving a goal. If the goal can be achieved more cheaply in another way, then the argument for species conservation is lost. For example, when a process for synthesizing a drug is discovered, a species that provides the raw material for a drug may no longer be valuable for conservation. That this may strike the reader as wrongheaded or even evil suggests that there are additional ethical considerations at work.

## An ecological rights–based approach to conservation

An ecological rights–based approach for species conservation holds that an irreversible human interference in nature is wrong. Under this approach, humans do not have the right to cause species extinction. Because such arguments are based on rights, they are not amenable to the same kind of cost-benefit analysis as utilitarian arguments. This is by no means to denigrate them: the rights guaranteed under the Constitution were not based on a cost-benefit analysis, but on deeply held ethical beliefs.

There are several features of the ESA that are not completely consistent with an absolute injunction against causing extinction. First, in 1978, Congress amended the ESA to authorize formation of the Endangered Species Committee, a cabinet-level committee that can be convened to decide whether to allow actions that may jeopardize the continued existence of a listed species. The Committee may choose to do so if the benefits of the action clearly outweigh the benefits of alternatives that are consistent with conservation of the species. However, the Endangered Species Committee has only been called together on three occasions (Tellico Dam, Grayrocks Dam, and timber sales in spotted owl habitat). Further, the ESA does not apply to serious insect pests or to the small-pox virus for which there has been an ongoing debate about whether to eliminate the last known samples. Relaxing the injunction against extinction for economic reasons implies that the injunction is not based solely on ethical considerations. It is also noteworthy that the ESA does apply to species facing extinction for natural reasons. Preventing such extinction is arguably as monumental an interference in nature as causing one. Finally, rights-based injunctions can collide. If conservation resources are scarce, as they surely are, then it is not hard to imagine an injunction to conserve one species colliding with an in-

junction to conserve another. As in the utilitarian case, it may then be necessary to make a choice.

On balance, the focus of the ESA on preventing species extinctions seems more consistent with the rights-based argument than with the utilitarian-based argument. However, a case can be made that preventing extinction is justified on utilitarian grounds as a kind of rule of thumb to be applied in the absence of detailed information. To be sure, it is not necessary to associate the ESA exclusively with one particular view, particularly if it is intended to reflect the combined views of the American people.

## Provisions of the ESA

We turn now to the provisions of the ESA for accomplishing the goal of preventing species extinction and the extent to which these provisions make sense from an economic perspective. The first step mandated by the ESA is the listing of any endangered or threatened species. In theory, this is simply a statement about biological status and should not involve a consideration of the value of

the species or the cost of conserving it. In practice, presumably under the theory that the best defense is a good offense, the potential bearers of conservation costs often put political pressure on an agency not to list. Some examples suggest that listing decisions appear to have been influenced by economic factors (see Houck, and Thomas and Verner, for example). Once a species is listed, the ESA directs the secretary of interior to identify critical habitat in which economic activity may be limited or prohibited and to develop a recovery plan for the species. The ESA prohibits all actions that cause jeopardy or take a listed species, regardless of whether the benefits of the action exceed the costs, unless granted a waiver.

From an economic perspective, these conservation actions are justified only if their benefits exceed their costs. Critics fault the ESA for failing to use benefit-cost criteria. In fact, while the economic aspects of conservation actions are not prominently featured in the ESA, there are several ways in which they do enter its implementation. First, a waiver of the "no jeopardy" and "no taking" prohibitions can be granted. As mentioned above, the Endangered Species Committee can grant exemptions to the "no jeopardy" prohibition if the benefits of doing so exceed the costs. Incidental take permits may also be granted to landowners with approved Habitat Conservation Plans. Second, critical habitat can be excluded from designation if the costs of desig-

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nation exceed the benefits unless the exclusion will result in extinction of the species. Third, the U.S. Fish and Wildlife Service (and, in the case of marine species, the National Marine Fisheries Service) will suggest "reasonable and prudent" alternatives to federal agencies engaged in activities that will be prohibited upon designation. In the event of "truly irreconcilable conflicts" between protection and development, it is possible to receive a waiver. Fourth,

in developing recovery plans, priority is given to species for which conservation actions are likely to be effective.

By including these eventualities as exceptions, the ESA appears to place the burden of proof on the economic side rather than on the conservation side. In other words, the ESA presumes that conservation actions will be taken unless it can be shown that their costs exceed their benefits. While this may not be completely satisfactory from an economic perspective, it may be a reasonable response to the complexities of cost-benefit analysis in this area. For example, it is likely that the consequences of losing a species will always be highly uncertain. This uncertainty will arise from a combination of the difficulty of assessing the purely ecological consequences of species loss and the difficulty of attaching an economic value to those consequences. If, in contrast, the cost of protection is well understood, then risk aversion may tip the balance toward conservation. A different view holds that the values associated with species conservation are so complex that they are best expressed through the political process and not through some formal cost-benefit calculus. Under this view, if the provisions of the ESA lead to overconservation, then a correction will be made at the ballot box.

Turning to more practical matters, two elements of efficient species conservation seem to be underemphasized in the ESA. First, the ESA often focuses on single species rather than on multispecies or ecosystems. The ESA does not, however, focus solely on single-species protection plans. For example, under the incidental take provisions of section 10 of the ESA, multispecies Habitat Conservation Plans are encouraged by the U.S. Fish and Wildlife Service. Because listed species may share the same habitat, efficiency in conservation can be gained by protecting habitat that is common to listed species. In economic terms, species that share the same habitat are bundled goods. Ecologists have used this idea in recommending sites for biological reserves. For example, Dobson et al. showed that habitat for approximately half of the listed species is located in around one percent of the counties in the United States. Interestingly, some of the highest-priced real estate in the country is found in these counties. By incorporating land values, we have shown that it is possible to protect the same number of species for far less cost by choosing areas that maximize the species represented per dollar spent rather than by maximizing species represented per land area (Ando et al.). Second, instead of dichotomizing between species that are endangered or threatened and species that are not, it would be better to admit a continuum of extinction probabilities. For example, early action to prevent a spe-

cies from slipping into the threatened category may be less costly than later action to promote recovery.

A different practical problem arises from the inclusion of harassment in the definition of taking. Entanglement in nets and ship strikes pose a serious problem for marine mammals. Some evidence suggests that the frequency of such events can be reduced by the deployment of pingers and other sonic devices on nets and ships to repel marine mammals. Unfortunately, this constitutes harassment under the ESA and is prohibited.

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## Informing the debate

The conservation of biological diversity in general, and of endangered species in particular, raises difficult issues. Preventing extinction, which is the goal of the ESA, is a laudable, though not wholly practical, ideal. Asserting the right of all species to exist is a consistent philosophical position. However, trying to implement a policy to prevent *all* extinction is infeasible on biological grounds. Further, attempting to minimize the risk of extinction would impose a tremendous economic burden. On the other hand, taking a utilitarian approach and deciding which extinction risks are tolerable requires making inherently difficult value judgments. For example, is the value of timber harvest from a given forest patch worth the small increase in extinction risk for the spotted owl or other species? Despite the great effort to develop and apply the tools of nonmarket valuation, it is not clear that it will ever be possible to get a reliable objective estimate of the worth of a species.

Economic considerations are not prominently mentioned in the ESA, and those that are tend to favor conservation. Additionally, the ESA generates incentives that discourage private landowner conservation (Innes, Polasky, and Tschirhart). However, conservation policy, which affects species existence, like other environmental policies such as

the Clean Air or Clean Water Acts, which affect human health, deal with fundamental values. The notion that every decision—including those involving matters of fundamental beliefs or rights—can be easily reduced to a problem of comparing monetary costs and benefits is problematic. Economic analysis can inform decision makers, but the political process will continue to consider factors besides estimated costs and benefits. **C**

## ■ For more information

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