

# *Why Economics Matters for Endangered Species*

## *Protection and the ESA*

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12 August 1998

word count: 4311

Running head: Why Economics Matters for Species Protection

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Evidence suggests that Earth's species may be in the midst of a wave of extinction, disappearing at rates 10 to 1000 times greater than background or natural rates of extinction (1). If we agree that the extinction problem is due to human action, modifying human behavior must be part of the solution. And yet the consistent neglect of economic behavior in the calculus of endangered species protection has led to ineffective and, in some instances, counter-productive conservation policy.

This paper argues that endangered species preservation must take into account basic principles of economic behavior to avoid wasting valuable resources that yield no gain in species protection. We address why economics matters more to species protection than many people think, and what this implies for the on-going debate over the reauthorization of the Endangered Species Act of 1973 (ESA).

A columnist's quip captures a common reaction to reports of species at risk: "what scientists call endangered most people call bait" (2). To others the value of protecting endangered species is so obvious, and so overwhelming, that estimates of costs and benefits seem immaterial. This view is exemplified by Roughgarden (3) who argues that economics should not be confused with morality: "[i]n fact, we *should not* take costs into account when setting environmental (or other) objectives, but we should take costs into account when considering how to implement moral objectives as policy" (emphasis in original). This view attempts to keep the morality of endangered species stewardship "outside the slick [benefit-cost] terrain of the economists and their philosophical allies" (4).

Many people expect the moral argument alone to suffice in the preservation debate. But election data, government budget allocations, and agency behavior demonstrate that current moral outrage falls short of generating the political will necessary to reverse the loss of biodiversity by strengthening the ESA. While virtually all people support the goal of protecting endangered species, many would not choose to protect species if doing so would divert too many resources from other noble goals such as providing health care, education, and a decent standard of living. In reality, endangered species policy is as much a question of social choice as of biology.

And while most people will acknowledge that the ideal of Noah's Ark has been replaced with the pragmatism of Noah's Choice (5), this realization forces the unsettling question: exactly what opportunities are lost when a moral compass molds policy? If the supporters of stewardship of endangered species adhere to their philosophy because they see a social benefit to preservation and a moralistic demand for

action, it is reasonable to investigate the opportunity costs and re-allocation of resources generated by such ethics (6). Landowners' desire to protect their investments and maintain their own heartfelt, moral self-determination has demanded as much. Ignoring whether the benefits of preservation outweigh the benefits of commercial use may ultimately cause these landowners whose property helps shelter many listed species, to reject well-intentioned ESA policy (7).

If economic analysis cannot be set aside without unfavorable consequences, how can we use such analysis to improve endangered species and biodiversity protection? Appealing to economics does not imply that legions of species must be sacrificed. Numerous economic reasons exist for preservation. Some species and habitats provide useful goods and services; others are valued aesthetically. Further, even seemingly low-value species are linked to high-value species through ecosystem interactions.

Here we offer ten reasons why economics matters to endangered species protection and the ESA. They speak to the questions: "what is the desired level of species protection?" and "what is the cost-effective way to achieve that protection?" And even if the answer to the first question is that we will try to save everything, economic analysis is still relevant because it advises us on how to minimize the costs to achieve that goal.

*First, the degree of risk to a species is as much an economic question as it is a biological one.* Whether a species is considered endangered today is usually established by assessing its likelihood of extinction or viability, as determined by the present sizes, trends, and distributions of its populations and their likely interactions with the stochastic forces of nature (8). Based on this, two comments are usually put forth in endangerment discussions—"a species is either endangered or not—economics has nothing to do with this; listing a species as endangered is a biological decision—economics should have nothing to do with this either." Both comments are open to challenge. Economics plays a role in both because human action and adaptation affect the odds of species survival, and hence endangerment. For example, suppose more habitat leads to greater odds of species survival. If this relationship is independent of key economic parameters such as local wealth and the relative price of land, the productivity of habitat for survival would be unaffected by the local community's ability to affect habitat quality. This is an unrealistic presumption, however, since richer communities can more afford to increase the productivity of habitat than poorer towns, and they can afford to set aside more expensive land holdings of higher habitat quality. By ignoring

economic parameters when estimating the odds of survival one is omitting relevant variables, thus making suspect the interpretation and use of the estimated odds of survival.

When we consider the future trajectory of species' populations, we must account for the economic forces of today—both human actions and adaptations to how species interact within the economy. Since economic and environmental systems are jointly determined, neither man nor nature is autonomous. This view challenges the traditional risk assessment-management bifurcation in which risk is first quantified by the natural sciences and then recovery strategies are implemented (9). Proper risk assessment should incorporate up front parameters from both the biological and economic systems, such as relative land prices and community wealth (10). And it is insufficient to account just for how human actions affect the risk of extinction, assessment must explicitly capture how people adapt to these risks. We agree that excluding political whims from risk assessment is appropriate, and we contend that neglecting economic realities is not. Explicitly integrating economic parameters into the process will make risk assessment more reflective of the unbiased odds of species survival, and as a consequence, ESA policy more effective.

*Second, unfortunately not every species can be saved.* Scarcity dominates our lives. We know the time, labor, and capital available to us are all scarce resources and must be spread over many human desires (11). If we cannot have everything we want including saving all species, we need to understand that important as species are, society sometimes places more value on other goods and services than on the last member of a species to be preserved. Tradeoffs exist across species and between species and society's other needs, including the possibility of saving species in one region while losing species in another region. Valuing all species equally does not reflect societal preferences for charismatic species over less appealing ones (12). And if society is unwilling to devote enough resources to save all species, some criteria to discriminate among species are necessary. ESA reauthorization should define a clear set of both biological and social criteria to rank listing decisions and implement recovery plans. Economics can frame the discussion in benefit-cost terms, although choosing the number of species to save remains problematical in an uncertain world (13). Given scarce resources, criteria and analyses that discriminate among species will be controversial, but unavoidable. Implementation of the present ESA has assuredly allowed such discrimination, without admitting or examining them openly.

*Third, at a minimum, biodiversity and opportunity costs must be measurable to make intelligent preservation choices.* Since species preservation provides benefits, monetary and non-monetary, that are difficult to quantify accurately (13), establishing a minimal level of protection for all species might be the preferred policy. But we must still know (a) how the elements of biodiversity are weighted in decision-making, and (b) the most cost-effective way to meet the desired targets. For example, we may wish to give more weight to species with no close genetic relatives or those with known commercial value rather than treating all species as being of equal value to conserve (14). Effective conservation policy requires taking account of the opportunity cost of conservation. For example, by including land cost differences, the cost of representing half of the species currently on the domestic endangered species list is approximately one-third as much as when sites are included strictly on the basis of biological factors (15). Policies that impose excessive costs face an uphill battle in the political arena. At a minimum, ESA preservation choices require that biodiversity and opportunity costs be defined and measured (13).

*Fourth, diminishing returns to preservation prevail.* Although benefits are difficult to quantify, we know qualitatively that preserving more costs proportionately more than preserving less, and preserving more is better than preserving less, but not proportionately more. Moreover, saving a species *in situ* with complete certainty is impossible over long time scales because chance events, such as natural catastrophes and other forms of environmental variation, can result in extinction of even the largest populations (8). For example, the Northern spotted owl (*Strix occidentalis caurina*) can be saved relatively inexpensively with a reasonably high probability. But the cost to improve the odds of survival to 92 percent from 91 percent has been estimated at \$3.8 billion (16). Such costs are substantial. The ESA must weigh the value of an extra one percent survival probability against the value of employing the resources devoted to survival in some other endeavor, which may include saving other species.

*Fifth, the widest possible range of positive and negative impacts of preserving or sacrificing species should be taken into account.* Economic prices affect human decisions which impact the ecosystem, while ecological prices affect nature which impacts the economy. Models that capture this interaction and feedback between and within economies and ecosystems are called general equilibrium (GE) models (17). GE models attempt to capture the web of life—both the obvious and hidden links and interactions between species protection and social order. The models address the common, but potentially

misleading, presumption that most of the impacts of preservation are economic negatives. For example, some species provide direct benefits as raw materials (e.g., fish) or aesthetic attractions (e.g., grizzly bear), while others may provide less obvious benefits (e.g., soil microbes that assist in nutrient cycling), and still others may be pests (e.g., mosquitoes). Within its native ecosystem, each species likely has a positive imputed economic value based on its contributions to ecosystem health and life support functions. We believe that species protection could be better informed through the use of GE models that explicitly account for the interactions and feedback between economies and ecosystems.

*Sixth, political and economic forces drive the need to consider benefits and costs of preservation.* According to the ESA, decisions to list and protect species are to be made primarily on scientific grounds—political economy considerations are secondary (18). But the realities of private incentives and social tradeoffs cannot be banished by legislative or judicial fiat (19). The agencies that administer the ESA are subject to political pressure from interest groups and legislatures that respond to the perceived costs and benefits associated with listings of endangered species. Interest groups and legislatures threaten to consume greedily the political capital needed to keep the ESA afloat. Costs and benefits enter in a muddled fashion, filtered through ideologically colored glasses, and neglecting benefits that have public good characteristics. Given these realities, it may be preferable to allow administrators to consider cost and benefit factors explicitly so they are subject to formal review (20).

*Seventh, protection should be pro-active, and refocused on habitats in addition to species.* Preventing the need to list a species as endangered may be less costly than recovering a listed species. Most proposals to reform the ESA include the old adage that an ounce of prevention is worth a pound of cure (21). Single species recovery programs often cost \$50,000 – \$500,000 annually and can run to \$1,000,000 if captive breeding must be undertaken (22). Yet such programs by their nature will conserve only a few species at a time. Landscape conservation approaches, including the establishment of parks and reserves, and the enactment of habitat and other conservation planning efforts range in investment from modest planning costs to more ambitious land acquisition. The odds are that the ESA will be more successful and cost effective by improving its emphasis on proactive approaches such as natural community conservation planning, developing a formal candidate list, and by stressing collaboration through habitat conservation planning (23). But proactive strategies will only work if society changes the incentives that force people to

push hard choices off until the future. It is clear that early action to prevent listings would be better for the species, the regulator, and perhaps some developers. But since other developers will challenge any early efforts promoted with uncertain data, risk averse regulators currently have incentive to wait until they have irrefutable evidence to list the species. By then, the costs of recovery will most likely have increased.

*Eighth, when endangered species inhabit private land, incentives are likely to be needed to encourage landowners to preserve their property.* Currently, the ESA provides little incentive for landowners to cooperate with species conservation policy (24). A landowner may have a financial incentive to prevent government scientists from finding listed species on his lands, to reduce the value of the land as habitat for listed species, or to “take” listed or potentially listed species. These actions are wasteful because they may result in direct harm to listed species, destroy or reduce the value of habitat, and increase the costs of designating habitat and species recovery (25). Agencies or private parties can try to prevent such actions by providing an incentive for the landowner to cooperate, using either compensation or permits and fines. One approach is to have the government pay full compensation to landowners (26). Doing so removes any financial penalty for cooperating with conservation policy, which should make species conservation policy on private land less controversial and less adversarial. If not done properly, however, compensation can introduce its own undesirable incentives, such as prompting excessive levels of investment to increase market value (27); or a de facto repeal of the ESA if under funded by Congress. Such perverse incentives can be avoided if the compensation is not tied to the market value of the property, but rather to the property’s habitat value. Alternatively, the government could require landowners to obtain permits prior to taking any action that would result in significant habitat modification, with stiff penalties for non-compliance. Permits would be issued only after proof that the action would not result in harm to a listed species. This approach is consistent with requirements for Habitat Conservation Plans and Incidental Take Permits (28).

*Ninth, understanding how compensation affects the incentives of the government to carry out conservation policy is also important.* When government agencies have considerable latitude in making decisions and are susceptible to the influence of special interest groups, accounting for government incentives is as important as accounting for private incentives. In the absence of compensation, government

may undertake more ESA actions than are desirable because it will understate the costs of action to the landowners. Alternatively, if the government must pay full compensation, it can be expected to undertake fewer ESA actions than are desirable, especially if compensation is raised through a tax system that inevitably distorts other decisions in the economy and is politically unpopular. Whether carrots or sticks are used to get landowner cooperation greatly affects the incentives and the ability of government to undertake conservation actions.

*Tenth, imperfect information about economic incentives is as fundamental to effective species protection policy as imperfect information about natural systems.* Imperfect information about the population biology of species and their roles in ecosystems confounds the design of preservation policy (29). In like manner, imperfect information about economic behavior complicates policy. On private land, the government needs landowner cooperation to gain the information necessary to administer conservation policy. Landowners may have been able to escape regulation altogether by hiding information from the government. If so, conservation policy may need to use the carrot of compensation rather than the stick of permits and fines to be effective. But here is the rub. The agency should lower the subsidy to lessen the incentive for some landowners to take advantage of their private information, but smaller subsidies result in fewer acres set aside for habitat. The net result is either that the realized habitat will be less than desired, or the desired habitat will be more expensive than may be justified. Coupled with reasons eight and nine above, this suggests policies to implement the ESA need to understand the incentives under imperfect information. This implies that a combination of mechanisms might be needed including government compensation, government or conservation groups purchases of land or development rights, insurance programs, tax breaks and government established tradable rights in habitat conservation or development. Just as policymakers cannot ignore the laws of nature, neither can they ignore the laws of human nature when protecting endangered species. Economic behavior matters for protecting and recovering endangered species. Effective policy requires that we adjust our perspectives, and better integrate human actions and reactions into the mix of viewpoints guiding endangered species policy.

## References and Notes

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2. *Las Vegas Review Journal* and *Las Vegas Sun* columnist John Smith was referring to the Moapa dace—a fish as rare as “ocean-going chipmunks”—that inhabits desert oases like Warm Springs, found at the headwaters of the Muddy River near Las Vegas (July 1996).
3. J. Roughgarden, *The Economics and Ecology of Biodiversity Decline* (Cambridge University Press, Cambridge, 1995).
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6. See for example R. Epstein, *Simple Rules for a Complex World* (Harvard University Press. Cambridge, 1995).
7. About half of the listed vertebrates and three-fourths of the listed plants and invertebrates are found primarily on non-federal lands (private, county, state). U.S. General Accounting Office, Correspondence to Representative Don Young on Estimated Recovery Costs of Endangered Species (Washington, DC, B-270461, 1995). Also see J. Shogren, ed., *Private Property and the Endangered Species Act. Saving Habitat, Protecting Homes* (University of Texas Press, Austin, in press).

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9. See the Ecological Society of America's statement to maintain the bifurcation, R. Carroll, C. Augspurger, A. Dobson, J. Franklin, G. Orians, W. Reid, R. Tracy, D. Wilcove, and J. Wilson, *Ecological Applications* 6, 1 (1996).
10. T. Eisner, J. Lubchenco, E.O. Wilson, D. Wilcove, and M. Bean, *Science*, 268, 1231, (1995); T. Crocker and J. Shogren, *Environmental Program Evaluation. A Primer* (University of Illinois Press, Urbana-Champaign, 1998) discuss how omitting relevant economic variables biases the epidemiology of human health, and can cause a systematic under-valuation of the value of reduced health risk (e.g., about a 30 percent too low in the case lead poisoning in children). The same phenomenon is at work for endangered species.
11. Like gravity, scarcity is a fact of life. Demands that economics "transcend a paradigm of scarcity of value in species" is like asking biology to surrender its notion of organisms (see O'Neal et al., *Conservation Biology*, 9, 217 (1995)).
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15. A. Ando, J. Camm, S. Polasky, and A. Solow, *Science*, 279, 2126 (1998).
16. C. A. Montgomery, G. M. Brown, Jr. and D. M. Adams, *Journal of Environmental Economics and Management*, 26, 111 (1994).
17. J. Tschirhart and T. D. Crocker, *Transactions of the American Fisheries Society*, 116, 469 (1987). T. D. Crocker and J. Tschirhart, *Environmental and Resource Economics*, 2, 551 (1992).
18. In the ESA, Congress initially ignored economic criteria in the listing and designation of critical habitat. In *Tennessee Valley Authority v. Hill*, the US Supreme Court reinforced that intent: "...it is clear from the Act's legislative history that Congress intended to halt and reverse the trend toward species extinction—whatever the cost" (437 U.S. 184 (1978)). Economics entered with the 1978 ESA Amendments. In Section 4, the Secretary of the Interior can exclude an area from critical habitat designation if the benefits of exclusion outweigh the costs. In Section 7, a Federal agency, a Governor, or a permit or license applicant can apply for an exemption, and the Secretary determines "the nature and extent of the benefits" of the action and proposed alternatives. Also, Presidential Executive Orders (EOs 11821, 12291, 12630, 12866) require benefit-cost assessment of major of regulatory actions. See J. Souder, *Natural Resources Journal* 33, 1095 (1993).
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**21.** These include Interior Secretary Bruce Babbitt's ten principles to improve implementation of the ESA (see *Endangered Species Bulletin*, 10, 4 (1995)); E. Beedy, *Endangered Species Update*, 12, 12 (1995); T. Eisner et al., *Science*, 268, 1231, (1995).

**22.** N. F. R. Snyder, S. R. Derrickson, S. R. Beissinger, J. W. Wiley, T. B. Smith, W. D. Toone and B. Miller, *Conservation Biology*, 10, 338 (1996).

**23.** M. O'Connell and S. P. Johnson, *Endangered Species Update* 14, 1 (1997). R. Noss, M. O'Connell, and D. Murphy, *The Science of Conservation Planning* (Island Press, Washington, D.C. 1997). S. Beissinger and J. D. Perrine, *Social Order and Endangered Species Preservation* (forth-coming).

An example of a proactive private-public partnership is the Black Bear Conservation Committee whose goal is to conserve the Louisiana black bear (*Ursus americanus luteolus*). The BBCC created a system that gives responsibility to all those who own and use the resource, in which the bear is an asset not a liability to the private landowner. See J. Bullock and W. Wall, "Proactive Endangered Species Management: A Partnership Paradigm," (1997).

**24.** U.S. Senate Bill 1180 is a reauthorization of the ESA and was introduced on 30 September 1997 by Dirk Kempthorne (R-ID), John Chafee (R-RI), Max Baucus (D-MT) and Harry Reid (D-NV). Although it is backed by Secretary Babbitt, environmental groups see it as a significant weakening of the original ESA. The Senate (S. 1256) and House (H.R. 1534) are also considering legislation in which landowners could receive compensation for takings. The National Governors Association, the National League of Cities and 37 state Attorneys General oppose these bills.

**25.** See R. Innes, S. Polasky, and J. Tschirhart, *Journal of Economic Perspectives* (in press).

**26.** For instance, Defenders of Wildlife compensate ranchers for livestock losses to wolves. J. Goldstein, and H. Heintz, Jr., "Incentives for Private Conservation of Species and Habitat: An Economic Perspective,"

Office of Policy Analysis, U.S. Department of Interior (1993); D. Clark and D. Downes, *Journal of Environmental Law and Litigation*, 9, 11 (1997).

27. L. Blume, D. Rubinfeld and P. Shapiro, *Quarterly Journal of Economics*, 100, 71 (1984); R. Innes, *Journal of Law and Economics*, (1997)

28. Habitat Conservation Plans (HCPs) are one of the few provisions in the ESA (Section 10(a)) that provide incentives to private landowners. HCPs allow landowners to incidentally take some endangered individuals in exchange for developing and adhering to a plan that minimizes their overall impact. Although some critics complain that HCPs facilitate habitat destruction, HCPs use a “no surprises” policy—no additional requirements will be expected of them in the future—to give incentive for landowners to participate. See M. Bean, and D. S. Wilcove, *Conservation Biology*, 11, 1 (1997). F. Shilling, *Science*, 276, 1662, (1997).

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### **Acknowledgements**

This paper evolved from conference “Social Order and Endangered Species Preservation” at the University of Wyoming, April 1997. We thank the UWYO supporters of this research—the Stroock Distinguished Professorship in Natural Resource Conservation and Management, the Bugas Fund, the Lowham Fund, the Colleges of Agriculture, Business, and Law, the School and Institute of Environmental and Natural Resources, and the Department of Economics and Finance. Comments from Tom Crocker, David Francis, Greg Hayward, and David Wilcove have been helpful. All views remain our own.