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Biological Effectiveness and Economic Impacts of the Endangered Species Act

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BIOLOGICAL EFFECTIVENESS AND ECONOMIC IMPACTS OF THE ENDANGERED SPECIES ACT

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INTRODUCTION

Markets serve society by organizing economic activity. Markets use the prices of goods and services to communicate the wants and limits of a diverse society so as to coordinate economic decisions in the most efficient manner. The power of the market rests in its decentralized process of decision making and exchange; no central planner is needed to allocate resources. Optimal private decisions lead to optimal social outcomes.

But markets can fail to allocate environmental resources efficiently, often due to the inability of institutions to establish well-defined property rights for biological services. For endangered species and their habitats, markets will fail if prices do not communicate society's desires and constraints accurately. Prices either understate the full range of services provided by a species, or do not exist to send a signal to the marketplace about the social value of the asset. Individual decisions impose costs on or generate benefits for other individuals who are not fully compensated for losses or who do not fully pay for gains. A wedge is driven between what individuals want unilaterally and what society wants as a collective. As such, markets are better slaves than masters.

At the most basic level, the threat to endangered species exists because many of the services they provide are nonrival and nonexcludable. A service is nonrival in that one person's use does not reduce another's use, and it is non-exclusive in that it is extremely costly to exclude others from the benefits or costs the service provides. For example, the life support services provided to humanity from the diversity of species are provided to everyone.[2] As a result, endangered species with limited commercial or consumptive benefits as reflected by market prices are under-

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2. Anne Ehrlich & Paul Ehrlich, *The Value of Biodiversity*, 21 AMBIO 219 (1992).

valued. In contrast, the commodity resources of the species or the habitat sheltering the species (e.g., chemicals, minerals, timber, game) are valued on the market, and the supply and demand reflect the relative scarcity of these goods. Therefore, there is pressure to harvest the commodity and consumptive services at the expense of the public services provided by endangered species.

The Endangered Species Act (ESA)[3] was enacted in 1973 to correct for the market failure associated with the unpriced social benefits of species and their habitats. The four basic conclusions of our evaluation of the biological effectiveness and economic impacts of the ESA are:

•There is no tangible objective way to measure biological effectiveness at this time.

•Even if there were an objective measure, the time span since passage of the Act has been too short for any decisive conclusions on overall recovery of species.

•There is no national estimate of the transaction costs, opportunity costs of restricted property rights, and opportunity costs of public funds used in species recovery to private property owners. The few regional studies focusing on a specific species suggest that distribution issues may be of more concern than efficiency questions, i.e., how the economic "pie" is split between people changes, but not the size of the pie.

•There is no national estimate of the economic benefits, either private or social, of most of the nearly 1000 listed species. Those species-by-species estimates of benefits that do exist are subject to numerous technical questions that could limit their usefulness for policy analysis.

Biological Effectiveness of the ESA

Since passage of the ESA, 960 species of plants and animals have been listed as endangered or threatened.[4] In addition, 182 species are candidates for listing. Is the ESA effective in protecting these and unlisted species in the United States? Answering this question involves answering several others first. For example, in evaluating the consequences of the ESA for native species, how should we define biological effectiveness? Is the ESA effective if it provides for the recovery of listed species to the point where they can be delisted? Is it effective if it helps reverse the

3. Endangered Species Act of 1973, 16 U.S.C. § 1531-1544 (1994).

4. R. Carroll et al., *Strengthening the Use of Science in Achieving the Goals of the Endangered Species Act: An Assessment by the Ecological Society of America*, 6 ECOLOGICAL APPLICATIONS 1 (1996).

trend in species abundance prior to recovery, or is the ESA effective if it simply prevents listed species from becoming extinct? A broad interpretation of effectiveness may also include an evaluation of the degree to which the ESA encourages management actions which prevent species from declining to the point of being considered for listing.

Beyond the various broad approaches to examining the biological effectiveness of the ESA, we must confront the issue of establishing a metric to measure effectiveness. What level of recovery is necessary to conclude that the Act has been effective? For instance, how many species must have recovered and become delisted to make the judgement that the ESA has satisfactorily accomplished its goals? One? Five? A dozen? One hundred? Evaluating biological effectiveness is further complicated by the temporal scale of the extinction process and the difficulty of defining endpoints. Is twenty-four years long enough to judge the effectiveness of a law that begins working only after species have declined so far that they are in imminent danger of extinction? How long are we willing to give species to recover? In this brief review we examine the biological effectiveness of the ESA from several perspectives. We also examine the constraints on examining the biological effectiveness of a law which deals with a complex biological process which scientists have only begun to understand, species extinction.

First, we must realize that at present we really have no way to evaluate effectiveness because our evidence is only circumstantial. No controlled experiments have been conducted.[5] Realizing this limitation, however, let us look at the effectiveness of the ESA in removing species from the threatened and endangered list. Only a handful of species have achieved the goal of recovery. Among these are the eastern states brown pelican (*Pelecanus occidentalis*), Utah's Rydberg milk-vetch (*Astragalus perianus*), and the California gray whale (*Eschrichtius robustus*). With so few species achieving recovery and so many continuing to exist in a tenuous state, it might appear that the ESA is clearly ineffective in achieving its goals. But is it? Before species can recover, they obviously must halt their slide toward extinction and then increase. If we use these criteria for our evaluation, the ESA begins to look better.

A 1994 report to Congress listed the status of threatened and endangered species as follows: 42% stable or improving, 34% declining, 1.0% extinct, and 23% unknown.[6] Species downlisted from endangered to

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5. *See generally* GRAEME CAUGHLEY & ANNE GUNN, CONSERVATION BIOLOGY IN THEORY AND PRACTICE (1996).

6. *See* U.S. FISH AND WILDLIFE SERVICE, REPORT TO CONGRESS: ENDANGERED AND THREATENED SPECIES RECOVERY PROGRAM (1995).

threatened include Aleutian Canada goose (*Branta canadensis leucopareia*), greenback cutthroat trout (*Salmo clarki stomias*), Virginia round-leaf birch (*Betula uber*) and bald eagle (*Haliaetus leucocephalus*).

Of course, we have no way to evaluate how many species would be extinct today without the protection of the ESA. In 1995, the National Research Council concluded that "it is impossible to quantify the ESA's biological effects, i.e., how well it has prevented species from becoming extinct . . . . [T]he ESA has successfully prevented some species from becoming extinct. Retention of the ESA would help prevent species extinction."[7] Furthermore, Belovsky et al. noted that sixty-eight species of birds and mammals in North America have been threatened with extinction since the sixteenth century, and 50% of them have gone extinct. In the fourteen cases where people have attempted to recover an endangered species, however, only one species (7%) has gone extinct.

The limited number of species which have recovered following protection under the ESA is not surprising when we consider the population dynamics of small populations. In fact, the record of stabilization, improvement, and recovery and the rarity of extinction following listing is quite surprising. Small populations, such as those listed under the ESA, are threatened by a number of stochastic processes which cannot be influenced by managers.[8] Demographic, genetic, and environmental stochasticity each contribute to extinction of small populations even after environmental conditions have improved and anthropogenic threats are removed. Therefore, during the initial phase of recovery, while populations are small, the probability of chance extinction exists even though the average rate of population growth is strongly positive. The black-footed ferret's (*Mustela nigripes*) recovery history provides a good example of a species increasing in abundance only to succumb to stochastic, uncontrollable variables.[9]

Extinctions have always occurred.[10] At least 90% of all species that have existed have disappeared.[11] Consequently some argue we cannot and should not legislate to stop natural processes. Most scientists agree, however, that today's extinction rates go far beyond "background" levels. Caughley and Gunn calculated an average background extinction rate of

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7. NATIONAL RESEARCH COUNCIL, SCIENCE AND THE ENDANGERED SPECIES ACT (1995).

8. G.E. Belovsky et al., *Management of Small Populations: Concepts Affecting the Recovery of Endangered Species*, 22 WILDLIFE SOC'Y BULL. 307 (1994); *see generally* CAUGHLEY & GUNN, *supra* note 5.

9. *See* CAUGHLEY & GUNN, *supra* note 5.

10. M.J. Benton, *Diversification and Extinction in the History of Life*, 268 SCIENCE 52 (1995).

11. NORMAN MEYERS, A NEW LOOK AT THE PROBLEM OF DISAPPEARING SPECIES (1979).

0.06% species lost every one thousand years.[12] The mass extinction of the dinosaurs resulted from an extinction rate of one per 1000 years.[13] Extinction estimates for the last quarter of the twentieth century are over 100 per day.[14] Nott et al. and Hunter concluded that based on conservative estimates, today's extinction rates are 10-1000 times background levels and that future extinction rates could be even higher.[15] Furthermore, the rate of extinctions is rapidly increasing,[16] and the extent and distribution of extinctions is unlike any previous major extinction period. Assuming human population stabilizes at ten to fifteen billion people in the next fifty to 100 years and that ecosystems stabilize concomitantly, Wilson believed we would lose 10-25% of our biota in an incredibly short period.[17]

As demonstrated, many subjective variables interfere with our ability to evaluate the ESA's biological effectiveness. Bean emphasized that the measure of progress in species conservation is "neither absolutely clear or quantifiable, nor is it likely identical for all species. These general observations are important to keep in mind if only to help resist the temptation to reach pre-mature judgments about the program as a whole based on success or setbacks involving individual species."[18] Perhaps any apparent ineffectiveness lies not with the ESA but with the fact that the ESA is expected to accomplish too much on its own too late.[19] The National Research Council also concluded that the "ESA cannot by itself prevent all species extinctions, even with modification."[20] As we reviewed earlier, small populations are difficult to recover due to stochastic processes. Can we make the ESA more effective at lower costs? Effective biological conservation must begin prior to species decline.

By the time a species becomes eligible for listing, its habitat is often destroyed or badly degraded, the population is decimated and its genetic diversity seriously eroded.[21] Additional delays in developing and implementing recovery plans under the ESA further imperil species. Recovery

12. CAUGHLEY & GUNN, *supra* note 5.

13. MEYERS, *supra* note 11.

14. *Id.*

15. M. Nott et al., *Modern Extinctions in the Kilo-Death Range*, 5 CURRENT BIOLOGY 14 (1995); *see* M.L. HUNTER JR., FUNDAMENTALS OF CONSERVATION BIOLOGY (1996);

16. G. NILSSON, THE ENDANGERED SPECIES HANDBOOK (1983).

17. EDWARD O. WILSON, THE DIVERSITY OF LIFE (1992).

18. MICHAEL J. BEAN, THE ENDANGERED SPECIES PROGRAM 347-71 (R.L. DiSilvestro ed., 1986).

19. T.H. Tear et al., *Status and Prospects for Success of the Endangered Species Act*, 262 SCIENCE 976 (1993); *see also* NATIONAL RESEARCH COUNCIL, *supra* note 7; Carroll, *supra* note 4; Belovsky, *supra* note 8.

20. NATIONAL RESEARCH COUNCIL, *supra* note 7.

21. *See* Carroll et al., *supra* note 4; BEAN, *supra* note 18; Belovsky et al., *supra* note 8.

plans are often not developed for years, if at all.[22] The lack of biological information further hampers the listing and recovery plan process.[23] Lacking a national biological survey, knowledge on species' abundance and distribution is limited. More important, information on trends in species abundance is lacking. A thorough analysis of recovery plans and goals suggests that more than half of listed vertebrates would remain in serious risk of extinction even after meeting population targets in their recovery plans.[24] Delisting targets are often not based on biological or demographic grounds but political expediency. These drawbacks, however, are not shortcomings of ESA but of its implementation. Furthermore, target populations create an impression of certainty belied by the uncertainty of techniques used to estimate population levels. In addition, static goals can induce complacency once they are reached, a complacency incompatible with other factors involved, i.e., stochastic factors.[25]

Protection at an earlier level than that legislated by the ESA may be more effective in species conservation. Because habitat degradation and loss is a primary cause of extinction,[26] habitat preservation is often a primary concern of scientists and conservationists. The Ecological Society of America Ad Hoc Committee[27] recommended that preservation of biological diversity be approached in a more proactive manner. They recommended identifying habitats and biological communities that are being seriously reduced in area or are being otherwise degraded and then establishing policies that prevent further losses of the habitats and restore degraded parts. They emphasized that such an approach could not replace a species by species approach, but that the number of species considered for listing should be greatly reduced. Identifying imperiled habitats in a proactive manner also makes more options available to managers. The Ecological Society of America Committee advocated new complementary legislation for ecosystem-level protection that could help reverse the slide toward extinction by preventing habitat degradation. Such legislation would then allow the ESA to function as a safety net for those species whose survival cannot be guaranteed within protected ecosystems. While ecosystem approaches may sound appealing, their application will not be trouble-free. Caughley and Gunn argue that the vagueness of the term

22. *See* Carroll et al., *supra* note 4.

23. *See* Tear et al., *supra* note 19; T.H. Tear et al., *Recovery plans and the Endangered Species Act: Are Criticisms Supported by Data?*, 9 CONSERVATION BIOLOGY 182 (1995).

24. Tear et al., *supra* note 19.

25. *See* CAUGHLEY & GUNN, *supra* note 5.

26. J. Terbough & B. Winter, *Some Causes of Extinction*, *in* CONSERVATION BIOLOGY: AN EVOLUTIONARY-ECOLOGICAL PERSPECTIVE 119 (Michael E. Soule & Bruce A. Wilcox eds., 1980); CAUGHLEY & GUNN, *supra* note 5.

27. Carroll et al., *supra* note 4.

"ecosystems" will render it unworkable and that species must remain the cornerstone of conservation efforts.[28]

Belovsky et al., however, stated "although the preservation of suitable habitat is necessary, it may no longer be sufficient to ensure the recovery of small populations."[29] They emphasized that the initial cause for reduced populations is a different problem from concerns for the persistence or recovery of precarious populations. Special demographic and genetic traits of small populations are integral factors of population viability analysis and recovery prospects. In their analysis of endangered species that survived versus endangered species that went extinct, 74% of those going extinct were restricted to small areas versus 35% of those that survived. Habitat approaches to conservation will need to involve larger areas than is customary today and management will need to be active, not preservation oriented.[30]

ECONOMIC IMPACT OF THE ESA

When initially enacting the 1973 ESA, Congress explicitly noted that economic criteria would not be included in either the listing or the designation of proposed critical habitat. In fact, the U.S. Supreme Court ruled in *Tennessee Valley Authority v. Hill* that "it is clear from the Act's legislative history that Congress intended to halt and reverse the trend toward species extinction—whatever the cost."[31] Not until the 1978 Amendments did economics enter explicitly into the ESA. First, under section 4, determination of endangered species and threatened species, the Secretary of the Interior may "take into consideration the economic impact, and any other relevant impact, of specifying any particular area as critical habitat" for a threatened or endangered species.[32] The Secretary can exclude an area from critical habitat designation if he or she determines that the benefits of exclusion outweigh the benefits to specifying the critical habit, "unless failure to designate leads to extinction." Second, under section 7 interagency cooperation, a federal agency, the governor of a state, or a permit or license applicant may apply to the Secretary for an exemption from the ESA. The Secretary then submits a report to an Endangered Species Committee

28. CAUGHLEY & GUNN, *supra* note 5.
29. Belovsky et al., *supra* note 8.
30. *Id.*
31. Tennessee Valley Authority v. Hill, 437 U.S. 153,154 (1978); *see* Jon Souder, *Chasing Armadillos Down Yellow Lines: Economics in the Endangered Species Act*, 33 NAT. RESOURCES J. 1095 (1993).
32. 16 U.S.C. § 1531(b)(2) (1994).

that discusses, among other things, the availability of reasonable and prudent alternatives to the agency's proposed action, and "the nature and extent of the benefits" of the action and proposed alternatives.[33]

Three executive orders[34] requiring the assessment of costs and benefits of different regulatory actions have forced decision makers to acknowledge existence of the overall private and social costs and benefits of listing species, designating critical habitat, and implementing recovery plans for the 900 or more species listed by the ESA. We now explore what we know and do not know about the basic costs and benefits of the ESA. One point to keep in mind is that a significant fraction of the ESA costs are often borne by property owners whose land is inhabited by endangered species, while the ESA benefits accrue to the entire nation, given the public-good nature of the services provided by endangered species.

Costs of the ESA

The economic costs to private property owners given the ESA can be categorized into three broad areas—actual expenditures, opportunity costs of restricted land use, and opportunity costs of public expenditures on endangered species. The actual expenditures to the private property owners from the ESA are transaction costs arising from the time and money spent applying for permits and licenses, redesigning plans, and legal fees. As of now, no estimate of these transaction costs exists in the literature. As a comparison, Rich estimated that the private legal expenditures battling the enforcement of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) was over $8 billion just up to 1984, enough to clean an additional 400 Superfund sites.[35]

Opportunity costs are the more accurate measure of the economic impact of the ESA since they measure the foregone opportunities of the property owner due to restrictions on the use of private property due to listings, designation of critical habitat, and recovery plans. If a listed species is found on private land such that a current or proposed action is no longer viable, the property owner suffers an opportunity cost. These

33. 16 U.S.C. § 1536(e)(3); *see* P. BALDWIN, CONSIDERATION OF ECONOMIC FACTORS UNDER THE ENDANGERED SPECIES ACT (1989).

34. Exec. Order No. 11,821, 3 C.F.R. 203 (1974), *reprinted in* 2 U.S.C. § 1904 (repealed); Exec. Order No. 12,291, 3 C.F.R. 127 (1981), *reprinted in* 5 U.S.C. § 601 (repealed); Exec. Order No. 12,630, 3 C.F.R. 554 (1988), *reprinted in* 5 U.S.C. § 601 (1994).

35. *See* B. Rich, *Environmental Litigation and the Insurance Dilemma*, 32 RISK MGMT. 34 (1985).

opportunity costs include the reduced economic rents from restricted or altered development projects, agriculture production, timber harvesting, minerals extraction, recreation activities, wages lost by displaced workers who remain unemployed or who are re-employed at lower wages, lower consumer surplus due to higher prices, and lower county property and severance tax revenue. For example, the Bonneville Power Administration estimated that its expenditure on salmon conservation was about $350 million in 1994 (one percent of 1994 revenues), of which about $300 million represented the opportunity cost of lost power revenues.[36]

At present, there is no national estimate of the opportunity costs to private property owners due to the ESA. One study that does not estimate the national opportunity costs of the ESA but rather explores the association between the ESA and national economic growth is Meyer.[37] Based on an econometric analysis of economic growth trends in all fifty states between 1975 and 1990, Meyer argues that the effect of the ESA has not been detrimental to economic development since a negative relationship was not found between ESA listings and either construction employment or gross state product. For example, Alabama with seventy listed species had a booming economy, while Louisiana with twenty-one listings did poorly. If anything, Meyer suggests a positive relationship between growth and listings even when accounting for relative land areas, dependence on natural resource industries, size of the economy, and changes in the number of listings over time. But since Meyer's study does not measure the opportunity costs of the ESA as defined by the difference in actual economic growth with the ESA and potential economic growth without the ESA, these results need to be taken with caution. Without such an opportunity cost estimate we cannot conclude that the ESA has not had a significant economic impact on the national economy.

The existing economic literature that attempts to estimate the regional opportunity cost impacts of the ESA does not separate out impacts on private property owners from those who operate on public lands. First, Rubin et al. estimate the short-run and long-run opportunity costs of northern spotted owl protection to Washington and Oregon.[38] Short-run costs include the value of timber foregone plus the additional costs of displaced workers, whose numbers range from 13,272 lost jobs by 1995 to over 28,000 by 2000. Long-run costs include only the value of the

36. NATIONAL RESEARCH COUNCIL, *supra* note 7.

37. *See* STEPHEN M. MEYER, ENDANGERED SPECIES LISTINGS AND STATE ECONOMIC PERFORMANCE (Mass. Inst. Tech. Working Paper No. 4, 1995).

38. *See* Jonathan Rubin et al., *A Benefit-Cost Analysis of the Northern Spotted Owl*, 89 J. FORESTRY 25 (1991).

timber foregone, as these displaced workers will find other positions (assumed at an equivalent wage rate). In Washington and Oregon, the estimated short run and long-run costs are $1.2 billion and $450 million.

Montgomery et al. also estimate the opportunity cost of increasing the survival odds of the northern spotted owl.[39] Creating a biological relationship to predict owl survival odds based on habitat capacity and employing the widely-used Timber Assessment Market Model (TAMM) that projects prices, consumption and production trends in North American softwood, plywood, and stumpage markets, they compare how increased survival odds decreases economic welfare as measured by the present value of altered revenues, incomes, and consumer surplus (i.e., the difference between what a consumer is willing to pay and what he actually has to pay). According to their analysis, a recovery plan that increases the survival odds to 91% for about 1600 to 2400 owl pairs will decrease economic welfare by $33 billion (1990 dollars), with a disproportionate share of the losses borne by the regional producers of intermediate wood products, a relatively small segment of the population. If the recovery plan attempts to increase the survival odds to 95%, welfare losses increase to $46 billion.

Using an input-output modelling system, Brookshire et al. perform economic analyses of critical habitat designation in the (1) Virgin River basin for the wound fin, Virgin River chub, and Virgin spinedace, and (2) Colorado River basin for the razorback sucker, humpback chub, Colorado squawfish, and bonytail.[40] In the Virgin River study, they found that the present value of output changes in the Washington County (Utah) economy due to the designation of critical habitat for fish is about $48 million, which represents 0.0016% of the present value of the baseline stream of output. Employment and earning effects are similar in magnitude. The effect in Clark County (Nevada) of critical habitat designation is of an even smaller magnitude, 0.00001% of the baseline economic activity. For the entire region, effects on the output, employment, earnings, and tax revenue are similar in magnitude, 0.0001% decline of the baseline activity. Brookshire et al. found similar results for the Colorado River basin.[41]

39. *See*, C. Montgomery et al., *The Marginal Cost of Species Preservation: The Northern Spotted Owl*, 26 J. ENVTL. ECON. MGMT. 111 (1994).

40. *See* D. BROOKSHIRE ET AL., REPORT TO THE U.S. FISH AND WILDLIFE SERVICE; DRAFT ECONOMIC ANALYSES OF CRITICAL HABITAT DESIGNATION IN THE VIRGIN RIVER BASIN FOR THE WOUNDFIN, VIRGIN RIVER CHUB, AND VIRGIN SPINEDACE (1995); D. BROOKSHIRE ET AL., FINAL REPORT TO THE U.S. FISH AND WILDLIFE SERVICE; AN ECONOMIC ANALYSES OF CRITICAL HABITAT DESIGNATION IN COLORADO RIVER BASIN FOR THE RAZORBACK SUCKER, HUMPBACK CHUB, COLORADO SQUAWFISH, AND BONYTAIL (1994)[hereinafter ANALYSIS OF CRITICAL HABITAT DESIGNATION IN COLORADO RIVER BASIN].

41. *See* ANALYSIS OF CRITICAL HABITAT DESIGNATION IN COLORADO RIVER BASIN, *supra* note 40.

Three conclusions emerge. First, the difference in total economic output with and without critical habitat designation is 0.0003%. Similar results hold for earnings income, tax revenues, and employment. Second, the impact of critical habitat designation is not evenly distributed across the states in the basin as streamflow requirements may negatively impact recreation, electric power production, and future consumptive use in some states but enhance these activities in other states. Third, the national impacts of the designation are negligible.

Finally, public funds not spent on endangered species can be spent on something else, something viewed as potentially more valuable to the general public. Public expenditures for the ESA arise from conservation programs and the implementation of recovery plans for specific species. The U.S. Fish and Wildlife Service (FWS) estimates that about $177 million was spent on endangered species conservation programs in 1991; what all this covers, however, is unclear.[42] FWS spending on endangered and threatened species has increased three times faster than inflation since 1974, with much of the growth occurring in the 1970s.[43] FWS's budget for recovery plans including land acquisition, management, and research, was $10.4 million in 1991 and $39.7 million in 1995.[44] But the exact amount of money spent on recovery costs is more difficult to locate in the literature. For example, Clark et al. present case studies of recovery plans for seven endangered species including black-footed ferrets and Yellowstone Grizzly bears, and, aside from a few brief mentions of annual budgets and inadequate funding, there was not one estimate of the total actual monetary expenditures of these recovery plans.[45] Overall, the U.S. Department of Interior estimated that the potential direct costs from the recovery plans of all listed species were about $4.6 billion.[46]

The General Accounting Office recently compiled estimates of the predicted actual costs (i.e., direct outlays) and time needed to recover selected species, including the costs of implementing the most important recovery actions.[47] The GAO reported on fifty-eight approved recovery plans, finding that thirty-four plans had a total cost estimate for carrying

42. *See* NATIONAL RESEARCH COUNCIL, *supra* note 7.

43. F. Campbell, *The Appropriations History*, *in* BALANCING ON THE BRINK OF EXTINCTION: THE ENDANGERED SPECIES ACT AND LESSONS FOR THE FUTURE 134 (Kathryn Kohm ed., 1991).

44. NATIONAL RESEARCH COUNCIL, *supra* note 7.

45. *See* ENDANGERED SPECIES RECOVERY: FINDING THE LESSONS, IMPROVING THE PROCESS (Tim Clark et al. eds., 1994).

46. U.S. FISH AND WILDLIFE SERVICE, REPORT TO CONGRESS: ENDANGERED AND THREATENED SPECIES RECOVERY PROGRAM (1994).

47. Letter from the General Accounting Office to U.S. Representative Don Young (1995) (on file with the author) (estimating recovery costs of endangered species).

out the recovery, twenty-three plans had cost estimates for the initial years of recovery, and one had a cost estimate for one part of a twelve-part plan.[48] Of the thirty-four total cost estimates, estimates ranged from a 1994 cost of $145,000 for the White River spinedace (a fish) to a 1991 estimate of about $154 million for the green sea turtle and loggerhead turtle. The total estimated cost for the thirty-four species is approximately $700 million, but note that this estimate has not been converted to 1995 dollars. For the twenty-three plans with initial three-year estimates, costs range from a 1990 estimate of $57,000 for the Florida scrub jay to a 1991 estimate of $49.1 million for the black-capped vireo (a bird). The three year total costs for the twenty-three species is over $350 million, a figure again not adjusted to 1995 dollars. For the "high-priority" actions, the total estimated costs is about $223 million for three years.

Note that the FWS and the National Marine Fisheries Service, worried that these numbers would be taken out of context, attached several caveats to these costs estimates. First, they point out that these estimates are for high-priority species and are therefore unrepresentative of the vast majority of species with recovery plans projected to be less expensive. Second, they argue that the cost estimates are just that . . . estimates—best guesses that are not subject to strict economic analysis. This begs the question as to why economists are not included as part of the recovery planning team. Third, estimated costs differ considerably from actual costs due to revisions in recovery plans.

Of the money actually expended on endangered species recovery by federal and state agencies between 1989 and 1991 (1989 was the first year data were published), over fifty percent was spent on the top ten species—bald eagle ($31.3 m), northern spotted owl ($26.4 m), Florida scrub jay ($19.9 m), West Indian manatee ($17.3 m), red-cockaded woodpecker ($15.1 m), Florida panther ($13.6 m), grizzly bear ($12.6 m), least bell's vireo ($12.5 m), American peregrine falcon ($11.6 m), and whooping crane ($10.8 m).[49] In fact, over ninety-five percent of identifiable expenditures has been on vertebrates, causing Metrick and Weitzman to suggest that visceral characteristics play a greater role than scientific characteristics in governmental spending decisions on individual species.[50]

48. *Id.*

49. *See* Andrew Metrick & Martin L. Weitzman, *Patterns of Behavior in Endangered Species Preservation*, 72 LAND ECON. 1 (1996).

50. *Id.*

Benefits of the ESA

Environmental resources provided by endangered species on private property can supply a flow of direct and indirect private and social benefits to the property owner. The services provided by these endangered species and their corresponding levels of biological diversity are multifarious, ranging from basic life-support to new genetic material for pharmaceutical purposes. These resources provide a nearly limitless set of valuable services — some private services are priced through the market based on their commercial or consumptive value, but many of their public services remain unpriced by the market. These public services are rarely bought and sold by the pound on the auction block, and therefore never enter into private markets and remain unpriced by the public sector. For example, the market price of land does not generally account for the complete value of wildlife habitat services if the associated costs and benefits accrue to more than just the owner of the land. Wildlife does not stay within the confines of one owner's property. This inability to exclude others from enjoying benefits or suffering costs prevents the market price from sending the correct signal about the true value of the endangered species.

To some people, the private and social benefits of endangered species are so obvious that total benefits need not be measured. The essential ecological services of regulating climate, water filtration, maintaining soil fertility, pollinating crops, and other life-supporting functions are so valuable that the benefits of preservation will always exceed the benefits of development. This view is supported by Roughgarden: "In 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."[51] Essentially, the morality of environmental stewardship is not subject to benefit-cost analysis. If one accepts this view, then planners should attempt to establish a safe minimum standard, the level of preservation that guarantees survival of the species in question.[52] The safe minimum standard essentially puts endangered species beyond the reach of economic tradeoffs, and the goal then becomes estimating the least cost solution to achieve this standard. The safe minimum strategy becomes the practical alternative to optimal resource allocation.[53]

51. J. Roughgarden, *Can Economics Protect Biodiversity?*, *in* THE ECONOMICS AND ECOLOGY OF BIODIVERSITY DECLINE 149, 153 (T. Swanson ed., 1995) (emphasis in original).

52. *See* S. CIRIACY-WANTRUP, RESOURCE CONSERVATION: ECONOMICS AND POLICIES (1952).

53. R. Bishop, *Economic Efficiency, Sustainability, and Biodiversity*, 22 AMBIO 69 (1993).

To others, however, the benefits of preservation may not outweigh the benefits of development. This view is exemplified by Epstein who argues:

> Some people believe that it is important to develop nature to the full, to overcome poverty and to ensure prosperity; others believe that nature should be left in its original condition to the extent that that is possible, even if it means a cutback in overall standards of living. It is not within the power of either side to convert the doubters to the opposite position, and coercive systems of regulation are the worst possible way to achieve uniform social outcomes in the face of social disagreement. The interconnectedness of what goes on in one place and what goes on in another cannot be presumed on some dubious theory of necessary physical linkages for all events.[54]

For these individuals, estimation of the private and social benefits of endangered species is paramount. They want more evidence that the benefits of preservation outweigh the benefits of development.[55]

Private benefits to property owners include the commercial use, the consumptive use, and recreation. Commercial uses arise from the potential value in new pharmaceutical products from endangered species. First, consider the value of genetic material for medicine. Genetic material from a species provides leads to help create better synthetic chemicals. Examples include the drug vincristine derived from the rare plant called the rosy periwinkle; the Pacific yew tree that produces taxol used in ovarian cancer treatment, a market estimated to reach $1 billion in 1996;[56] alkaloids from the Houston toad that may help reduce heart attacks; and the fatty acids from salmon useful for blood pressure and cholesterol control.[57]

Simpson et al. provide one of the first systematic economic models to estimate the value of a marginal species for use in pharmaceutical research.[58] They estimate the maximum value of a marginal species at

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54. RICHARD EPSTEIN, SIMPLE RULES FOR A COMPLEX WORLD 278 (1995).

55. *See* A. ANDO, DELAY ON THE PATH TO PROTECTION: BALANCING COSTS AND BENEFITS UNDER THE ENDANGERED SPECIES ACT (1995).

56. Rob Norton, *Owls, Trees and Ovarian Cancer*, FORTUNE, Feb. 5, 1996, at 49.

57. Statement of W.R. Irvin, *Reauthorization of the Endangered Species Act* (1995) (on file with the *Land and Water Law Review*).

58. *See* R. Simpson et al., *Valuing Biodiversity For Use in Pharmaceutical Research*, 104 J. POL. ECON. 163 (1996).

about $9,400 given a model based on a series of independent statistical trials with equal probability of success, and using the parameters of 250,000 sampled species, ten expected new products arising from the genetics in these species, $300 million in costs of research and development, $450 million in revenue from the new products, and a ten percent discount rate. They note that the value of a marginal species is very sensitive to the probability of success — an order of magnitude increase in the probability of a successful "hit" causes the value of a marginal species to decline to less than $0.0000005. Substitution opportunities are the key to understanding why an increased likelihood of a profitable species reduces the value of a marginal species. As one species substitutes for another in potential market success, the value of an expansive species exploration declines because it is likely that the firm will find a profitable species more quickly.

Another private benefit is the commercial and recreational harvesting of species. For example, commercial and recreational fishing for salmon in the Pacific Northwest helps support 60,000 jobs and over $1 billion in personal income in the regional economy.[59] Recreation benefits also exist in the form of ecotourism. Ecotourists are willing to pay to view, or at least have a high likelihood of viewing, rare species, e.g., the $200 million California whale watching industry.

Estimating the social value of endangered species, however, presents a more challenging exercise given (1) the problems of assigning economic value to goods that most people will never directly use, and (2) the controversial methods used to elicit these values. Economists have a distinct and well-defined definition of economic value based on the ideals of rationality and consumer sovereignty—the rational consumer is purposive, and he is best able to make the choices that affect his or her own welfare. But how can we attach an economic value to the mere existence of an environmental good that we may never use directly or even visit?

Following Krutilla, economists have answered this question by proposing the concept of total value.[60] Total value is the idea that consumers have both use and nonuse values for environmental resources. Use value is straightforward—the economic value of current commercial, consumptive or recreational use. But estimating the level of a nonuse value is more problematic and controversial. Option value is the economic value of potential future use of a resource, while existence value is the value of its mere existence, with no plans to ever use it. As academicians

59. Statement of W.R. Irvin, *supra* note 57.

60. *See* J. Krutilla, *Conservation Reconsidered*, AMERICAN ECON. REV. 787 (1967).

debated the theoretical justification, the United States Court of Appeals for the District of Columbia ruled in 1989 that nonuse value constitutes a valid representation of economic value. In *Ohio vs. United States Dep't of the Interior*, the court stated that "option and existence values may represent 'passive use' but they nonetheless reflect utility derived by humans from a resource and thus prima facie ought to be included in a damage assessment."[61]

If we accept the idea that total value is a valid measure of the social benefits of endangered species, one tool to elicit these values is the controversial contingent valuation method (CVM). CVM directly elicits value by constructing a hypothetical market for a nonmarket good through the use of a survey. A hypothetical market attempts to create an opportunity for an individual to reveal his maximum willingness to pay or minimum willingness to accept compensation for a change in the level of the good. The survey is constructed so that features of actual markets and institutions are used to describe what the good is, how it will be changed, who will change it, how long the change will occur, and who will pay for the change. The major advantage of CVM is its flexibility to construct a market where no market currently exists. But flexibility is also the major weakness of CVM, as it allows ample opportunity for misperception. A researcher can specify a hypothetical good and elicit a value, but a respondent's hypothetical value may be based on perceptions of the good that are quite different than expected by the researcher. Alternatively, indirect methods based on actual market data can also be used to estimate benefits of endangered species if some degree of complementarity or substitutability exists between the species and an actual market good.[62] Actual market data would include the costs of traveling to view an endangered species or the fraction of land or housing value that could be attributed to the nearby existence of a species, although until some incentive schemes exist to reward those private property owners who protect species this value is likely to be negative. Most studies using market data have focused on wildlife, rainforests, and ecotourism outside the United States.[63]

Loomis and White summarize the few CVM valuation studies that have attempted to value an endangered species.[64] They report evidence

61. 880 F.2d 432, 464 (D.C. Cir. 1989).

62. *See* MEASURING THE DEMAND FOR ENVIRONMENTAL QUALITY (John Braden & C. Kolsted eds., 1991).

63. *See* Mohan Munasinghe, *Biodiversity Protection Policy: Environmental Valuation and Distribution Issues*, 21 AMBIO 227 (1992).

64. J. Loomis & D. White, Economic Benefits of Rare and Endangered Species: Summary and Meta Analysis (1996) (unpublished material, Colorado State University).

that the average individual's lump sum willingness to pay ranges from $12.99 to avoid the loss of the sea turtle (which one is not clear) to over $254 to increase the population of the bald eagle; the average individual's annual willingness to pay ranges from $6 to avoid the loss of the striped shiner to over $95 to avoid the loss of the northern spotted owl.[65] Based on a twenty three percent response rate to a CVM survey, Rubin et al. estimated that the aggregate benefit of preserving the northern spotted owl was about $100 million for residents of Washington and Oregon, and was about $1.5 billion for the total United States.[66]

But total value as measured by CVM has its opponents who argue that total value is not really a measure of value of any particular environmental asset or endangered species. Instead it is a surrogate measure of general preferences toward the environment, a 'warm glow' effect. Eliciting existence values with a contingent valuation survey provides the opportunity for a respondent to state his or her general preference toward the environment rather than for the specific species in question. This is often the first, if not only, occasion the person has been asked to reveal a public opinion on the environment and, as such, the value revealed may reflect the 'warm glow' of contributing to save the general environment rather than the specific service in question.

The exchange between Kahneman and Knetsch and Smith further illustrates the debate.[67] Kahneman and Knetsch observed that the average willingness to pay to clean up one lake in Ontario was not significantly greater that the willingness to pay to clean up all the lakes in the province. They cite this as evidence that individuals are not responding to the good, but rather to the idea of contributing to environmental preservation in general—the warm glow. Smith questioned this view, arguing that incremental willingness to pay should decline with the amount of the good already available, and as such the evidence is consistent with economic theory. But other reports such as Desvousges et al. support the warm glow argument, finding evidence that the average willingness to pay to prevent 2,000 birds from dying in oil-filled ponds was not significantly different than the value to prevent 20,000 or 200,000 birds from dying.[68]

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65. *Id.*

66. Rubin et al., *supra* note 38. *See also* D. Hagen et al., *Benefits of Preserving Old-Growth Forests and the Spotted Owl,* 10 CONTEMP. POL'Y ISSUES 13 (1992).

67. *Compare* D. Kahneman & J. Knetsch, *Valuing Public Goods: The Purchase of Moral Satisfaction,* 22 J. ENVTL. ECON. MGMT. 57 (1991) *with* V.K. Smith, *Arbitrary Values, Good Causes, and Premature Verdicts,* 22 J. ENVTL. ECON. MGMT. 71 (1992).

68. *See* W. DESVOUGES ET AL., MEASURING NATURAL RESOURCE DAMAGES WITH CONTINGENT VALUATION: TESTS OF VALIDITY AND RELIABILITY (1992).

While accepting the argument that willingness to pay for additional protection probably does decline, Arrow et al. note that the drop to zero "is hard to explain as the expression of a consistent, rational set of choices."[69] In another example, Crocker and Shogren find evidence of surrogate bidding for atmospheric visibility in Oregon, observing no significant difference in values for improved visibility in one specific mountain location as compared to the value for state-wide improvements. After examining a vast number of CVM studies, Arrow et al. note that the bimodal distribution of value estimates—zero or a positive value around $30 to $50—suggests that these values may serve a function similar to charitable contributions.[70] Not only does the respondent want to support a worthy cause, but he or she also receives a 'warm glow' from donating to the cause.

Finally, there are several other issues involved with estimating the social value of endangered species. First, a piecemeal species-by-species approach will most likely overestimate economic value because it does not address potential substitution and adaptation possibilities. Going back to Loomis and White, if one was to sum the average stated values of the eighteen species and multiply this grand willingness to pay ($953) by the number of households in the United States (about 75 million) we get a total benefit estimate of $71 billion in 1993 dollars, one percent of the 1995 U.S. Gross National Product of over $7 trillion.[71] Even if we just focus on the five studies where people were asked to state a one-time lump sum payment for either bald eagles, humpback whales, monk seals, gray wolves, or arctic grayling/cutthroat trout, the national benefit estimate is $44 billion (1993 dollars). The summed values of five unique studies over each species most likely will exceed the value of one study valuing these five endangered species together. Hoehn and Loomis find that independent aggregation of the benefits of only two programs overstates their total benefits by twenty-seven percent; the overstatement with three programs is fifty-four percent.[72] We need to better understand the relationship between the values for species and their substitution/adaptation possibilities before any national estimate of non-use values will be useful in the ESA debate.

69. K. ARROW ET AL., RESOURCES FOR THE FUTURE; REPORT OF THE NOAA PANEL ON CONTINGENT VALUATION (1993).

70. T. Crocker & Jason F. Shogren, *Dynamic Inconsistency in Valuing Environmental Goods*, 7 ECOLOGICAL ECON. 143 (1991); ARROW, *supra* note 69.

71. Loomis & White, *supra* note 64.

72. J. Hoehn & J. Loomis, *Substitution Effects in the Valuation of Multiple Environmental Programs*, 25 J. ENVTL. ECON. MGMT. 75 (1993).

Second, even if we get beyond warm glows and elicit meaningful values for endangered species, we must still acknowledge that many individuals are unfamiliar with most of the services and functions that ecosystems and biodiversity provide. As an example, a survey of Scottish citizens revealed that over seventy percent of the respondents were completely unfamiliar with the meaning of biodiversity.[73] Such levels of unfamiliarity are of concern if consumer sovereignty is to command respect in resource policy questions. Third, benefit estimation should account for the fact that the resource allocation decisions each of us make today generate costs and benefits that can accrue far off into the future. Although scientists and policy makers have questioned the use of individuals' preferences toward the present to construct social discount rates, they nevertheless acknowledge their importance. If we do not understand how individuals actually discount the future consequences of their choices, endangered species policy that ignores individuals' preferences toward the present guarantees unintended results.[74]

CONCLUDING COMMENTS

At a national level, the biological effectiveness and economic impacts of the ESA are unknown at this date. No one has even attempted a back-of-the envelope guess, however crude. On the biological side, this refusal to hypothesize is driven by the lack of an objective measure of biological effectiveness, and insufficient time to judge the overall success of the different species recovery plans. On the economic side, our conjectures are restrained by the lack of any estimates of the national cost and benefit of protecting all of the nearly 1000 listed species; we have not computed the transaction costs, opportunity costs of restricted property rights, opportunity costs of public funds used in species recovery, and the subsequent economic benefits from the current listings decisions, critical habitat designations, or recovery plans. Obvious research priorities are to estimate both the national economic costs and benefits of the ESA by integrating our economic tools with a viable set of ecological indicators.[75]

A final note. We have examined the economic impact of the ESA through the narrow lens of standard cost-benefit analysis. It is worth

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73. N. HANLEY & C. SPASH, UNIVERSITY OF STERLING, REPORT TO THE SCOTTISH FORESTRY COMM.; THE VALUE OF BIODIVERSITY IN BRITISH FORESTS (1993).

74. *See, e.g.*, Crocker & Shogren, *supra* note 70; N. Hanley et al., *Problems in Valuing the Benefits of Biodiversity Protection*, 5 ENVTL. RESOURCE ECON. 249 (1995).

75. INTEGRATING ECONOMIC AND ECOLOGICAL INDICATORS (J.W. Milon & J. Shogren eds., 1995).

remembering, however, that this standard analysis is embedded in a more general economic framework that considers the consequences of selecting alternative institutions and property right configurations that promote one end over another. As we begin to address the broader trade-off of secure property rights and protection of endangered species, we will need to move beyond measuring the consequences of the status quo to capturing the trade-offs between two polar views of incommensurability. One person's inalienable right to protection of endangered species will need to be balanced against another's inalienable right of self-determination. This will become the critical question in the ESA reauthorization debate. Effectively addressing this question will require the policy makers to further develop and support institutions that promote cooperative solutions based on both biology and economics.