Why Economics Matters for Endangered Species Protection

JASON F. SHOGREN,*‡‡‡ JOHN TSCHIRHART,* TERRY ANDERSON,†
AMY WHRITENOUR ANDO,‡ STEVEN R. BEISSINGER,§ DAVID BROOKSHIRE,**
GARDNER M. BROWN JR.,†† DON COURSEY,‡‡ ROBERT INNES,§§
STEPHEN M. MEYER,*** AND STEPHAN POLASKY†††

*Department of Economics and Finance, University of Wyoming, Laramie, WY 82071-3985, U.S.A.
†Political Economy Research Center, 502 S. 19th Avenue, Suite 211, Bozeman, MT 59718, U.S.A.
‡Resources for the Future, 1616 P Street NW, Washington, D.C. 20036, U.S.A.
§Ecosystem Sciences Division, 151 Hilgard Hall #3110, University of California, Berkeley, CA 94720-3110, U.S.A.
**Department of Economics, 1915 Roma St. N.E., University of New Mexico, Albuquerque, NM 87131, U.S.A.
††Department of Economics, University of Washington, Box 353330, Seattle, WA 98195, U.S.A
‡‡Harris School of Public Policy Studies, University of Chicago, 1155 East 60th St., Chicago, IL 60637, U.S.A.
§§Department of Agricultural Economics, University of Arizona, Tucson, AZ 85721, U.S.A.
***Massachusetts Institute of Technology, Bldg. E53-402, Cambridge, MA 02139, U.S.A.
†††Department of Applied Economics, University of Minnesota, St. Paul, MN 55108, U.S.A.

Abstract: *We offer three reasons why economics matters more to species protection than many people think and what this implies for the ongoing debate over the reauthorization of the Endangered Species Act of 1973. Economics matters because (1) human behavior generally, and economic parameters in particular, help determine the degree of risk to a species; (2) in a world of scarce resources, the opportunity cost of species protection—the costs of reduced resources for other worthwhile causes—must be taken into account in decision making; and (3) economic incentives are critical in shaping human behavior, and consequently the recovery of species. Endangered species protection that explicitly addresses these basic principles can avoid wasting valuable resources that yield no gain in species protection.*

Porque es Importante la Economía para la Protección de Especies en Peligro de Extinción

Resumen: *Ofecemos tres razones sobre el porque la economía es mas importante de lo que la gente piensa en la protección de las especies y lo que esto implica en el continuo debate sobre la re-autorización del acta de las especies en peligro de 1973. La economía es importante porque: la conducta humana en general y los parámetros económicos en particular ayudan a determinar el grado de riesgo de una especie; en un mundo de escasos recursos, los costos de oportunidad de protección de especies—costos de recursos reducidos para otras causas meritorias—deben ser tomados en consideraración en la toma de decisiones; y los incentivos económicos son críticos al moldear la conducta humana y consecuentemente la recuperación de las especies. La protección de especies en peligro que aborde explacitamente estos principios básicos puede evitar el desperdicio de recursos valiosos que no producen ganancia alguna en la protección de especies.*

‡‡‡*email jramses@uwyo.edu*
Paper submitted August 17, 1998; revised manuscript accepted May 5, 1999.

Introduction

Evidence suggests that Earth's species are amid a wave of extinction, disappearing at rates 10 to 1000 times greater than background or natural rates of extinction (Jablonski 1991; May et al. 1995; National Research Council 1995; Pimm et al. 1995). If we agree that the extinction problem is due to human action, then modifying human behavior must be part of the solution. And yet the consistent exclusion of economic behavior in the calculus of endangered species protection has led to ineffective and, in some instances, counterproductive conservation policy.

We argue that endangered species preservation must take into account basic principles of economic behavior to avoid wasting valuable resources while achieving no gain in species protection. We explain why economics matters more to species protection than many people think and what this implies for the ongoing debate over the reauthorization of the U.S. Endangered Species Act (ESA) of 1973.

A news columnist's quip captures a common reaction to reports of species at risk: "What scientists call endangered most people call bait" (Smith 1996). 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 (1995) who argues that economics should not be confused with morality: "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" [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" (Ehrenfeld 1988).

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. Although 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. Thus, in reality, endangered species policy is as much a question of social choice as of biology.

And although most people acknowledge that the ideal of "Noah's Ark" has been replaced with the pragmatism of "Noah's Choice" (Mann & Plummer 1995), this realization forces an unsettling question: Exactly what opportunities are lost when a moral compass directs 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 reallocation of resources generated by such ethics (e.g., Epstein 1995). The desire of landowners to protect their investments and maintain their own heartfelt, moral self-determination have 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 (e.g., Innes et al. 1998; Shogren 1998).

If economic analysis cannot be set aside without unfavorable consequences, how can we use such analysis to protect endangered species and biodiversity? Appealing to economics does not imply that legions of species must be sacrificed. Indeed, 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. Tschirhart and Crocker (1987) and Crocker and Tschirhart (1992) discuss the general equilibrium approach to modeling the integration of economies and ecosystems.

We offer three reasons why economics matters to endangered species protection and the ESA. In doing so, we speak to the following questions: What is the desired level of species protection? What is the cost-effective way to achieve protection? Finally, 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.

Economics matters because human behavior generally, and economic parameters in particular, help determine the degree of risk to a species. Establishing whether a species is currently endangered usually is accomplished by assessing its likelihood of extinction or viability, as determined by the present size, trends, and distribution of its populations and their likely interactions with the stochastic forces of nature (Gilpin & Soulé 1986; Soulé 1987; Lande 1993). Based on this assessment process, two opinions frequently are put forth in discussions of endangerment: (1) A species is either endangered or not—economics has nothing to do with it. (2) Listing a species as endangered is a biological decision—economics should have nothing to do with it. Both opinions can be challenged. Economics plays a role in determining whether a species is endangered and whether it ought to be listed because human adaptation to economic parameters affects the odds of species survival.

For example, surrounding human communities, we would expect that more preserved habitat implies greater odds of species survival. Moreover, these human communities are characterized by key economic parameters such as wealth and the relative prices of

land. Communities with greater wealth and lower relative land prices can better afford to preserve more habitat. Ignoring wealth, land prices, and other economic parameters when estimating the odds of species survival is to omit relevant variables. There is the question of whether the benefits of gathering economic information to improve the estimation of survival odds exceed the costs of data collection and the resulting delays in decision making. Evidence from parallel efforts with other environmental issues suggests they do—that is, net benefits from economic information are positive (e.g., Milon & Shogren 1995; Bockstael 1996; Agee & Crocker 1998).

Variables in economic and environmental systems are jointly determined; neither nature nor humankind is autonomous. In considering the future trajectory of species' populations, we must account for today's economic parameters. This view challenges the traditional bifurcation between risk assessment and management in which risk is first quantified by the natural sciences and then recovery strategies are implemented (Carroll et al. 1996). At the outset, proper risk assessment should incorporate parameters from both the biological and economic systems (e.g., Crocker & Shogren 1998).

Although listing decisions currently examine how forest management, housing development, and other human activities place species at risk, they do not address how people are likely to respond to a listing decision and its concomitant restrictions. Some responses take place in the political arena, and we agree that excluding political whims from risk assessment is appropriate; neglecting the economic realities of human responses, however, is not. Economics manifests itself directly in the fundamental science of species protection, not just the normative political process. By explicitly integrating economic parameters into the process, risk assessment will more accurately reflect the unbiased odds of species survival and, as a consequence, will make ESA policy more effective. This is key: everyone acknowledges that human actions affect species risk, but most people do not then account for the fact that people react to the risks and take actions that can either further accentuate or attenuate the risk. It is this feedback loop of human reaction by both landowners and government that is consistently underemphasized in species protection policy. Is the marginal benefit of adding omitted variables to improve the estimation of species risk worth the marginal cost? We think the answer is yes, and there should not be significant additional delay involved because most of the economic data exist and are readily available.

Economics matters because, in a world of scarce resources, the opportunity cost of species protection—in terms of the reduced resources for other worthwhile causes—must be taken into account in decision making. Scarcity is a reality. The time, labor, and capital available to us are all scarce resources and must be spread over many human desires. Demands that economics "transcend a paradigm of scarcity of value in species" is like asking biology to surrender its notion of organisms (O'Neal et al. 1995). Because every preservation program has an opportunity cost—the benefits foregone from not spending the resources on other worthwhile causes—society may place more value on other goods and services than on the last species to be preserved. Consequently, as important as species are, choices among species and between species and other programs must be made.

Understanding the nature of these choices requires that we explicitly account for the benefits and costs of various proposed programs. Such an accounting is already being conducted implicitly, so incorporating such calculations to discriminate among species achieves greater openness and transparency in how we make listing decisions and implement recovery plans. Criteria and analyses that discriminate among species will be controversial but unavoidable. Implementation of the present ESA assuredly has allowed such discrimination, without admitting or examining it openly. Allowing administrators to compare costs and benefits subjects these factors to explicit review (Arrow et al. 1996; Metrick & Weitzman 1996).

Despite this argument, most researchers acknowledge that accurately measuring preservation benefits for endangered species protection is difficult (Brown & Shogren 1998). An alternative to comparing costs and benefits is to adopt as a goal cost-effectiveness, finding the least expensive path to a desired target. Three examples underscore how cost-effective policies can improve resource allocation. First, populations on the U.S. endangered species list are dispersed throughout the country, which creates the problem of allocating limited funds to preserve those sites that will maximize the number of species protected. By taking into account that land values vary across the United States instead of treating land as homogeneous, the costs of protecting half of the species on the list can be cut by two-thirds (Ando et al. 1998). Second, there are diminishing returns to increasing the probability of species survival, and cost-effective policies will stop short of full protection. 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 from 91% to 92% has been estimated at $3.8 billion (Montgomery et al. 1994). The value of an extra 1% survival probability must be weighed against the value of employing these resources to some other endeavor, including saving other species.

Third, the old adage that "an ounce of prevention is worth a pound of cure" is applicable to species protection programs (e.g., Eisner et al. 1995; B. Babbitt, 17 July 1997 speech to the National Press Club). Single species recovery programs are cures: they often cost U.S. $50,000–500,000 annually and can run to $1,000,000 if captive

breeding must be undertaken (Snyder et al. 1996). Preventive measures such as landscape conservation approaches, including the establishment of parks and reserves, and the enactment of habitat and other conservation planning efforts are likely to be more cost-effective because they protect multiple species simultaneously. The odds are that the ESA will achieve greater success and better cost-effectiveness by improving its emphasis on proactive approaches such as natural community conservation planning, developing a formal candidate list, and stressing collaboration through habitat conservation planning (Noss et al. 1997; O'Connell & Johnson 1997; Beissinger & Perrine 2000). The inclusion of economic behavior is vital if the goal is to move toward a more proactive and effective ESA that focuses on strategic risk reduction through prevention rather than cure.

Economics matters because economic incentives are critical to shaping human behavior and consequently to the recovery of species. 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. A landowner may have financial incentives to prevent government scientists from finding listed species on his or her 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 (e.g., Innes et al. 1998). Agencies or private parties can attempt to prevent such actions by providing an incentive for the landowner to cooperate, using either compensation or permits and fines.

In the first of these incentive approaches, the government pays full compensation to landowners (Goldstein & Heintz 1993; Innes et al. 1998). For instance, Defenders of Wildlife compensates ranchers for livestock losses to wolves. 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 implemented properly, however, compensation can introduce its own undesirable incentives, such as prompting excessive levels of investment to increase the market value of land (Blume et al. 1984; Innes 1997) or even a de facto repeal of the ESA if underfunded by Congress. Such incentives can be avoided if the compensation is not tied to private losses but is tied to the property's habitat value. In these cases, a landowner is not rewarded for higher investment levels through the ESA. This approach, coupled with take permits, would be consistent with one of the few provisions in the ESA (Section 10(a)) that provide explicit incentives to private landowners (e.g., Bean & Wilcove 1997; Shilling 1997).

Imperfect information about the population biology of species and their roles in ecosystems confounds the design of preservation policy (Beissinger & Westphal 1998; Simberloff 1988). In like manner, imperfect information about economic behavior exacerbates the government's problem. On private land, the government needs landowner cooperation to gain the information necessary to administer conservation policy, yet landowners may have been able to escape regulation 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 elicit information. But herein lies the dilemma: lower compensation is good because it lessens the incentive for landowners to take advantage of their private information, but lower compensation also results in fewer acres set aside for habitat. The net result is either that the realized habitat will be smaller than preferred or that the desired habitat will be more expensive than may be justified (Polasky & Doremus 1998; Smith & Shogren 2000). This suggests that a combination of mechanisms might be needed, including government compensation, verification of habitat as a requirement for a subsidy, government or conservation group purchases of land or development rights, insurance programs, tax breaks, and government-established tradable rights in habitat conservation or development.

Because government decision makers also respond to incentives, understanding how compensation affects government incentives to carry out conservation policy is likewise important. Government agencies have considerable latitude in making decisions and are susceptible to the influence of special interest groups. 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 obtain landowner cooperation greatly affects the incentives and the ability of government to undertake conservation actions.

Just as policy makers cannot ignore the laws of nature, neither can they ignore the laws of human nature when protecting endangered species. Economic behavior matters in protecting and recovering endangered species. Effective federal and local policy requires that we adjust our perspectives and better integrate knowledge about human actions and reactions to species risk into the mix of influences on endangered species policy.

Acknowledgments

This paper evolved from a conference titled "Social Order and Endangered Species Preservation" held at the

University of Wyoming in April 1997. We thank the University of Wyoming for supporting 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. The superb comments of T. Crocker, D. Francis, G. Hayward, D. Wilcove, and two anonymous reviewers were most helpful. All views remain our own.

Literature Cited

Agee, M., and T. Crocker. 1998. Economies, human capital, and natural assets. Environmental and Resource Economics **11:**261–271.

Ando, A., J. Camm, S. Polasky, and A. Solow. 1998. Species distributions, land values, and efficient conservation. Science **279:**2126.

Arrow, K., M. Cropper, G. Eads, R. Hahn, L. Lave, R. Noll, P. Portney, M. Russell, R. Schmalensee, V. K. Smith, and R. Stavins. 1996. Is there a role for benefit-cost analysis in environmental, health, and safety regulation? Science **272:**221–222.

Bean, M., and D. S. Wilcove. 1997. The private-land problem. Conservation Biology **11:**1–2.

Beissinger, S., and J. Perrine. 2000. Extinction, recovery, and the endangered species act. In press. In J. Shogren and J. Tschirhart, editors. Endangered species protection in the United States: biological needs, political realities, economics choices. Cambridge University Press, New York.

Beissinger, S., and M. I. Westphal. 1998. On the use of demographic models of population viability in endangered species management. Journal of Wildlife Management **62:**821–841.

Blume, L., D. Rubinfeld, and P. Shapiro. 1984. The taking of land: when should compensation be paid? Quarterly Journal of Economics **100:**71–92.

Bockstael, N. 1996. Modeling economics and ecology: the importance of a spatial perspective. American Journal of Agricultural Economics **78:**1168–1180.

Brown, G., and J. Shogren. 1998. Economics of the endangered species act. Journal of Economic Perspectives **12:**3–20.

Carroll, R., C. Augspurger, A. Dobson, J. Franklin, G. Orians, W. Reid, R. Tracy, D. Wilcove, and J. Wilson. 1996. Strengthening the use of science in achieving the goals of the endangered species act: an assessment by the ecological society of America. Ecological Applications **6:**1–11.

Crocker, T., and J. Shogren. 1998. Endogenous risk and environmental program evaluation. Pages 255–269 in G. Knaap and T. Kim, editors. Environmental program evaluation: a primer. University of Illinois Press, Urbana-Champaign.

Crocker, T., and J. Tschirhart. 1992. Ecosystems, externalities, and economies. Environmental and Resource Economics **2:**551–568.

Ehrenfeld, D. 1988. Why put a value on biodiversity? Pages 212–216 in E. Wilson, editor. Biodiversity. National Academy Press, Washington, D.C.

Eisner, T., J. Lubchenco, E. O. Wilson, D. Wilcove, and M. Bean. 1995. Building a scientifically sound policy for protecting endangered species. Science **268:**1231–1232.

Epstein, R. 1995. Simple rules for a complex world. Harvard University Press, Cambridge, Massachusetts.

Gilpin, M., and M. E. Soulé. 1986. Conservation biology: the science of scarcity and diversity. Sinauer, Sunderland, Massachusetts.

Goldstein, J., and H. Heintz Jr. 1993. Incentives for private conservation of species and habitat: an economic perspective. Office of Policy Analysis, U.S. Department of Interior, Washington, D.C.

Innes, R. 1997. Takings, compensation, and equal treatment for owners of developed and undeveloped property. Journal of Law and Economics **40:**403–432.

Innes, R., S. Polasky, and J. Tschirhart. 1998. Takings, compensation, and endangered species protection on private lands. Journal of Economic Perspectives **12:**35–52.

Jablonski, D. 1991. Extinctions: a palentological perspective. Science **253:**754–757.

Lande, R. 1993. Risks of population extinction from demographic and environmental stochasticity and random catastrophes. The American Naturalist **142:**911–927.

Mann, C., and M. Plummer. 1995. Noah's choice: the future of endangered species. A. Knopf, New York.

May, R., J. Lawton, and N. Stork. 1995. Assessing extinction rates. Pages 1–34 in J. Lawton and R. May, editors. Extinction rates. Oxford University Press, New York.

Metrick, A., and M. Weitzman. 1996. Patterns of behavior in endangered species preservation. Land Economics **72:**1–16.

Milon, J., and J. Shogren, editors. 1995. Integrating economic and ecological indicators. Preager Press, Westport, Connecticut.

Montgomery, C., G. Brown Jr., and D. Adams. 1994. The marginal cost of species preservation: the Northern Spotted Owl. Journal of Environmental Economics and Management **26:**111–128.

National Research Council. 1995. Science and the Endangered Species Act. National Academy Press, Washington, D.C.

Noss, R., M. O'Connell, and D. Murphy. 1997. The science of conservation planning: habitat conservation under the Endangered Species Act. Island Press, Washington, D.C.

O'Connell, M., and S. Johnson. 1997. Improving habitat conservation planning: the California natural community conservation model. Endangered Species Update **14:**1–3.

O'Neal, A., A. Pandian, S. Rhodes-Conway, and A. Bornbusch. 1995. Human economies, the land ethic, and sustainable conservation. Conservation Biology **9:**217–228.

Pimm, S., G. Russell, J. Gittleman, and T. Brooks. 1995. The future of biodiversity. Science **269:**347–350.

Polasky, S., and H. Doremus. 1998. When the truth hurts: endangered species policy on private land with imperfect information. Journal of Environmental Economics and Management **35:**22–47.

Roughgarden, J. 1995. Can economics save biodiversity? Pages 149–153 in T. Swanson, editor. The economics and ecology of biodiversity decline: the forces driving global change. Cambridge University Press, New York.

Shilling, F. 1997. Do habitat conservation plans protect endangered species? Science **276:**1662–1663.

Shogren, J., editor. 1998. Private property and the Endangered Species Act. Saving habitat, protecting homes. University of Texas Press, Austin.

Simberloff, D. 1988. The contribution of population and community biology to conservation science. Annual Reviews of Ecology and Systematics **19:**473–511.

Smith, J. 1996. Endangered species? Las Vegas Review Journal & Las Vegas Sun: 16 July.

Smith, R., and J. Shogren, 2000. Voluntary incentive design for endangered species protection. Journal of Environmental Economics and Management: in press.

Snyder, N., S. Derrickson, S. R. Beissinger, J. W. Wiley, T. B. Smith, W. D. Toone, and B. Miller. 1996. Limitations of captive breeding in endangered species recovery. Conservation Biology **10:**338–348.

Soulé, M. E., editor. 1987. Viable populations for conservation. Cambridge University Press, New York.

Tschirhart, J., and T. Crocker. 1987. Economic valuation of ecosystems. Transactions of the American Fisheries Society **116:**469–478.

Literature Cited

Species Distributions, Land Values, and Efficient Conservation

Amy Ando; Jeffrey Camm; Stephen Polasky; Andrew Solow

Science, New Series, Vol. 279, No. 5359. (Mar. 27, 1998), pp. 2126-2128.

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Science, New Series, Vol. 272, No. 5259. (Apr. 12, 1996), pp. 221-222.

Stable URL:

http://links.jstor.org/sici?sici=0036-8075%2819960412%293%3A272%3A5259%3C221%3AITARFB%3E2.0.CO%3B2-5

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Conservation Biology, Vol. 11, No. 1. (Feb., 1997), pp. 1-2.

Stable URL:

http://links.jstor.org/sici?sici=0888-8892%28199702%2911%3A1%3C1%3AETPP%3E2.0.CO%3B2-B

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Steven R. Beissinger; M. Ian Westphal

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American Journal of Agricultural Economics, Vol. 78, No. 5, Proceedings Issue. (Dec., 1996), pp. 1168-1180.

Stable URL:

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Thomas Eisner; Jane Lubchenco; Edward O. Wilson; David S. Wilcove; Michael J. Bean

Science, New Series, Vol. 269, No. 5228. (Sep. 1, 1995), pp. 1231-1232.

Stable URL:

http://links.jstor.org/sici?sici=0036-8075%2819950901%293%3A269%3A5228%3C1231%3ABASSPF%3E2.0.CO%3B2-X

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Stable URL:
http://links.jstor.org/sici?sici=0895-3309%28199822%2912%3A3%3C35%3ATCAESP%3E2.0.CO%3B2-D

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David Jablonski
Science, New Series, Vol. 253, No. 5021. (Aug. 16, 1991), pp. 754-757.
Stable URL:
http://links.jstor.org/sici?sici=0036-8075%2819910816%293%3A253%3A5021%3C754%3AEAPP%3E2.0.CO%3B2-N

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Russell Lande
The American Naturalist, Vol. 142, No. 6. (Dec., 1993), pp. 911-927.
Stable URL:
http://links.jstor.org/sici?sici=0003-0147%28199312%29142%3A6%3C911%3AROPEFD%3E2.0.CO%3B2-W

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Andrew Metrick; Martin L. Weitzman
Land Economics, Vol. 72, No. 1. (Feb., 1996), pp. 1-16.
Stable URL:
http://links.jstor.org/sici?sici=0023-7639%28199602%2972%3A1%3C1%3APOBIES%3E2.0.CO%3B2-Y

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Amy E. O'Neal; Anand S. Pandian; Satya V. Rhodes-Conway; Alan H. Bornbusch
Conservation Biology, Vol. 9, No. 1. (Feb., 1995), pp. 217-220.
Stable URL:
http://links.jstor.org/sici?sici=0888-8892%28199502%299%3A1%3C217%3AHETLEA%3E2.0.CO%3B2-E

The Future of Biodiversity
Stuart L. Pimm; Gareth J. Russell; John L. Gittleman; Thomas M. Brooks
Science, New Series, Vol. 269, No. 5222. (Jul. 21, 1995), pp. 347-350.
Stable URL:
http://links.jstor.org/sici?sici=0036-8075%2819950721%293%3A269%3A5222%3C347%3ATFOB%3E2.0.CO%3B2-N