

THE ENDANGERED SPECIES ACT AND PRIVATE LANDOWNER INCENTIVES

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Abstract: While intended to increase the habitat available to endangered species, the restrictions of the Endangered Species Act (ESA) increase the costs of harboring an endangered species to private landowners and create incentives for private landowners to reduce habitat. This paper illustrates the incentive for habitat destruction with a simple model of private land use under the ESA, and uses it to predict the effects of changes in policy or biological conditions on private landowner incentives. Many anecdotal accounts and recent empirical research support the predictions of the model. Because of the ESA's perverse incentives, many have proposed replacing the punitive regulations of the ESA with positive incentives for habitat creation, including takings compensation, negligence compensation rules, tradable development rights, and land purchase programs. The paper concludes by reviewing economic analysis of these proposals' effectiveness.

Key words: Endangered Species Act, incentives, private property.

In 1973, the Endangered Species Act (ESA) passed with near unanimous support in both the House and the Senate. Recent attempts at reauthorization have been much more contentious. In fact, Congress has failed to reauthorize or amend the bill since it last expired in 1992. The ESA has been renewed on an annual basis since 1992, as the debate over revision and reauthorization continues to drag on. Several environmental groups are strongly opposed to any significant revisions to what some say is the nation's toughest environmental law. Opponents of the current ESA argue that the act requires a few private landowners to provide a benefit to the public (endangered species habitat), while private landowners bear all of the costs (restrictions on land use and development).

The popularity and vast regulatory power of the ESA are important statements of the value Americans place on preventing the extinction of plants and animals, yet the law creates incentives for certain private landowners to take actions that harm endangered species recovery. To avoid costly land use regulations, landowners may engage in preemptive habitat destruction of currently unoccupied but potential endangered species habitat, conceal or hinder the collection of information about endangered species on their property, or even kill endangered species (commonly known as "shoot, shovel, and shut-up"). For simplicity, this paper primarily focuses on preemptive habitat destruction. The next section provides background on the ESA and is followed by a simple land use decision model that illustrates the habitat destruction incentive. This is followed by anecdotal and scientific evidence of habitat destruction, and a discussion of the economics of compensating private landowners for providing endangered species habitat.

BACKGROUND

The 1973 Endangered Species Act is the broadest and most powerful law in a century-old history of protecting fish, wildlife, and plants through national legislation. Two weaker laws, the 1966 Endangered Species Preservation Act and the 1969 Endangered Species Conservation Act, preceded the ESA. These laws provided a limited amount of money for the purchase of endangered species habitat as reserves and required the Secretary of Interior to publish a list of endangered animal species. They also prohibited taking endangered species on federal wildlife refuges and required federal agencies to consider the impacts of their actions on endangered species "to the extent practicable." It was not until the 1973 ESA that federal law required endangered species conservation on private lands.

The key provisions of the ESA for private landowners are found in Section 9. These provisions made it unlawful to take any endangered or threatened species on both public and private lands. Section 3 defined "take" to mean "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect." In 1975, the Secretary of Interior clarified the broad definition of "take" by defining "harm" as:

"An act or omission which actually injures or kills wildlife, including acts which annoy it to such an extent as to significantly disrupt essential behavioral patterns, which include, but are not limited to, breeding, feeding, or sheltering; significant environmental modification or degradation which has such effects is included within the meaning of "harm."

There have been several judicial rulings regarding the takings prohibitions of Section 9. In the most important Section 9 case, *Babbitt v. Sweet Home Communities*

for a *Greater Oregon* (1995), the Supreme Court overturned a lower court's decision and upheld the broad definition of "take" that includes habitat alteration.

Congress passed amendments to the ESA in 1978, 1982, and 1988. The 1978 amendments set up a formal process for exemptions to the requirements of federal agencies in section 7 and were prompted by the famous snail darter case (*TVA v. Hill* 437 U.S. 153 (1978)) in which construction was stopped on a nearly completed federal dam to save habitat for an endangered minnow. The 1982 amendments required listing solely on biological grounds, prohibiting economic factors from being considered in the listing process, and extended taking prohibitions to endangered and threatened plants on federal lands. Of most importance to private landowners, the 1982 amendments also allowed incidental taking of an endangered species if a Habitat Conservation Plan (HCP) was approved by the U.S. Fish and Wildlife Service (FWS) that provided mitigation for the takings. Infrequently used for over a decade, HCPs have become a focal point of recent ESA enforcement on private lands. The 1988 amendments increased civil and criminal penalties for ESA violations, and protected species that were proposed but not yet listed.

Since the last reauthorization of the ESA expired in 1992, Congress has simply appropriated funds on an annual basis to keep the ESA in force. Dozens of reauthorization bills have been proposed in both houses of Congress, but none of the bills have made it to the floor of the House or Senate for a vote. In general, the reauthorization bills sponsored by supporters of the ESA contain few changes to the current law, while bills sponsored by ESA opponents generally contain combinations of several reforms: peer-review, no surprises, and takings compensation. Peer-review would increase the rigor of scientific review before a species is listed. Several species have been removed from the ESA after subsequent biological studies have determined that the species was never endangered (Mann and Plummer 1995), and the goal of peer-review is to stop these mistakes. Critics of peer review believe the provisions are only an attempt to weaken the efficacy of the ESA by slowing down the listing process. A no surprises clause would prohibit the FWS from adding any land-use restrictions or financial burdens on a landowner with an approved habitat conservation plan. Many HCPs already include a no surprises clause, but this change would automatically make it a part of all HCPs. In proposed reauthorization bills, takings compensation usually takes the form of mandating full compensation whenever ESA regulations reduce property values beyond a threshold, usually a 20 to 33% reduction in property values. As discussed later in the paper, economists generally support some type of landowner compensation but most do not support the full compen-

sation beyond a threshold rule that is the standard in reauthorization bills requiring private landowner compensation (Brown and Shogren 1998, Innes, et al. 1998).

HR 3160 (The Common Sense Protections for Endangered Species Act) is currently the leading reauthorization bill in the 106th Congress. Similar to Senate Bill 1180, the leading reauthorization bill in the 105th Congress that failed to pass despite some bipartisan support, HR 3160 requires peer review in the listing process, forces FWS to consider economic and social impacts of recovery plans, requires no surprises policies in HCPs, and provides small grants to landowners for habitat conservation. A companion bill, HR 1142 (Landowners Equal Treatment Act), would provide compensation to landowners for whom ESA regulation reduced property values over 25%. HR 960 (Endangered Species Recovery Act) is an alternative bill supported by much of the environmental community that provides estate tax deferral to those who agree to endangered species conservation agreements on their inherited property but offers few other changes affecting private landowners.

A MODEL OF THE HABITAT DESTRUCTION INCENTIVE

A simple decision tree model (Fig. 1) can be used to illustrate private landowner incentives under the ESA. The model is not a comprehensive model of the ESA but rather a model focused on the basic incentives facing a landowner whose land is potential habitat for a currently listed species. The preemptive development decision is illustrated using a 2-period model with nature and 2 agents – a landowner (L) and a government agency enforcing the ESA, the FWS. Initially, the land harbors no endangered species, but the land is potential habitat for an endangered species. The land's value as habitat (to the species) depends on the landowner's behavior.

Fig. 1 illustrates the decision-making timeline. The landowner can choose to maintain (m) or destroy (d) potential habitat in period 1. Destroying habitat has a one-time cost (C_d) and generates benefits (B_d) from development such as timber harvest. C_d is the cost of developing early, for example, harvesting timber before it has reached the landowner's optimal harvest age. Nature (N) moves after the landowner and determines the population levels of an endangered species, which depends on the land use choice made in period 1. If the habitat is destroyed, the probability that the endangered species inhabits the land is zero. If the habitat is maintained, there is a probability (δ) that a population of the species will inhabit the land because of migration from nearby populations.

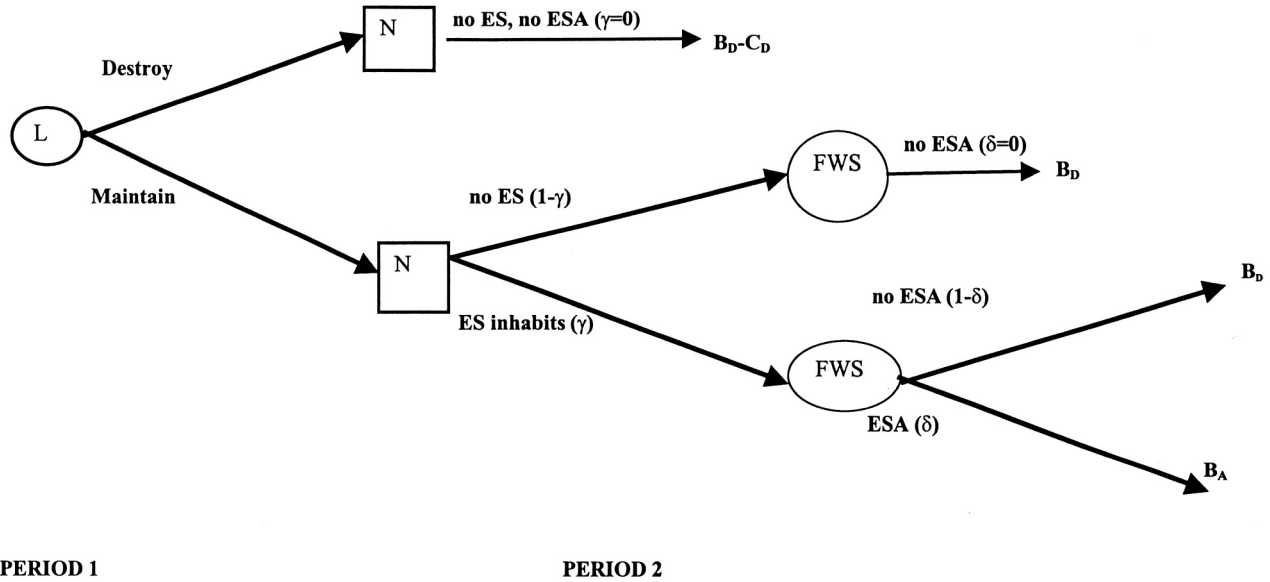


Fig. 1. Decision tree for landowner under the ESA.

If the habitat is maintained and becomes populated with an endangered species (the lowest branch in Fig. 1), the FWS will detect the presence of an existing endangered species in period 2 with probability (δ). If FWS detects an endangered species, it regulates land use (under section 9) so that habitat cannot be altered. Because FWS detection depends on the probability an endangered species inhabits the land, the probability of the ESA being in force is, assuming independent events, $\delta\delta < 1$ and the probability that the ESA will not be in force is $(1-\delta\delta) < 1$. If the ESA is in force, the firm loses all benefits from development in period 2 ($B_D = 0$ in period 2) but may earn a smaller amount of benefits from an alternative land use ($B_A < B_D$) that does not harm the endangered species habitat. If, however, L waits until period 2 to develop, he faces no costs of development ($C_D = 0$). In the absence of the ESA, it is clear that the optimal time to develop is in period 2 to avoid the extra costs of developing in period 1.

The landowner chooses his or her action in period 1, develop or maintain habitat, in order to maximize the expected value of the land. Thus, the landowner will choose to destroy the habitat as long as the expected value of early development exceeds that of waiting, or:

$$[B_D - C_D] > (1 - \delta\delta)B_D + (\delta\delta)B_A \quad (1)$$

The decision to destroy or maintain habitat will depend on the value of these parameters and leads to several straightforward predictions. First, increases in the probability that an endangered species will inhabit the land (δ) will increase the probability of preemptive habitat destruction. In other words, the habitat that is most important to the recovery of the endangered species is the most likely to be developed. Second, increases in the probability that the FWS will detect a

listed species (δ) will lead to more habitat destruction. This probability could increase because of conditions (e.g., specific to a location) that reduce detection costs or because of increases in detection and enforcement resources for FWS. Thus, the increased enforcement budgets called for by ESA supporters would lead to more habitat destruction on private lands. Third, as the relative value of development (B_D/B_A) increases, habitat destruction is more likely. Strengthening the critical habitat requirements for a particular species would decrease B_A and thus increase the incentive for habitat destruction. Recent enforcement changes that rely more on HCPs or a change in policy to include some type of landowner compensation increase B_A and reduce habitat destruction. Finally, when the costs of development (C_D) are low, preemption is more likely. These costs could be low if simple practices like grazing or plowing are sufficient to destroy habitat. These costs are also low when a species is tied to well-defined and narrow habitat type, such as the red-cockaded woodpecker (RCW), the spotted owl, and the golden-cheeked warbler. Wolves and bald eagles, for example, have much less well-defined habitat requirements and successful preemption would be relatively costly.

EVIDENCE OF HABITAT DESTRUCTION ON PRIVATE LANDS

Anecdotal evidence of preemptive habitat destruction has been building for a variety of species from a variety of sources, including journalists, biologists, government officials, economists, lawyers, and environmentalists (e.g., Dolan 1992, Mann and Plummer 1995, Kennedy et al. 1996, Wilcove et al. 1996, Stroup 1997, Thompson 1997, Epstein 1997, Ruhl 1998). Perhaps the most famous reported case is that of North Car-

olina landowner Ben Cone, who dramatically increased his harvest of old growth pine in response to potential ESA regulations (Stroup 1997). In 1991, the FWS restricted Cone from harvesting timber on 1,500 acres of his 7,200-acre property to protect 12 colonies of the endangered RCW. A consultant estimated the market value of timber on the 1,500 acres to be US\$2 million (roughly US\$1,300 per acre). In response, Cone proceeded to clear-cut potential woodpecker habitat on nearby but currently unregulated acres. Rather than waiting to cut trees at age 80, he cut them at age 40 before they were prime RCW nesting habitat. Cone also sent a letter to his neighbors describing the situation, and at least one soon began clear-cutting his pine stands. In Texas, Mann and Plummer (1995) report habitat destruction for the golden-cheeked warbler and Ruhl (1998) reports the same for the black-capped vireo. Gidari (1994) finds evidence of clear-cutting in the Pacific Northwest in order to avoid logging restrictions designed to protect the northern spotted owl. Dolan (1992) and Seasholes (1997) find less-known cases in California (where development values are high) and elsewhere around the country. The National Association of Home Builders actually advises preemption in its *Developers Guide to Endangered Species Regulation* (1996, p. 109; cited in Bean 1998, p. 10706),

“The highest level of assurance that a property owner will not face an ESA issue is to maintain the property in a condition such that protected species cannot occupy the property . . . This is referred to as the ‘scorched earth’ technique.”

This anecdotal evidence is further supported by a recent scientific study investigating the timber harvest choices of landowners in areas of North Carolina that are home to the red-cockaded woodpecker. Lueck and Michael (2000) use data on over 1,000 individual forest plots from the U.S. Forest Service’s Forest Inventory and Analysis and the results of a 1997-98 survey of over 400 private landowners to test the hypothesis that the closer a landowner is to known populations of RCWs, the more likely the landowner will take action to destroy the habitat for RCWs, primarily by “prematurely” cutting their pine forest. By preventing the establishment of an old growth pine stand, landowners can insure that RCWs do not inhabit their land and avoid ESA regulations that limit or prohibit timber harvest activity. Data from the Nature Conservancy’s Natural Heritage Program on RCW colony location was used to construct various measures of the probability that a forest plot will become inhabited by RCWs. Probit regressions estimate the probability that a plot is harvested and ordinary least squares regressions (corrected for harvest selection bias) estimate the age at which a plot is harvested. After accounting for economic conditions and landowner characteristics, Lueck and Michael (2000)

find that increases in the proximity of a plot to RCWs increases the probability that the plot will be harvested and decreases the age at which the forest is harvested. Specifically, a given forest plot is about 30% more likely to be harvested when located in an area with large numbers of RCWs, and the age of the stand at harvest is predicted to be 39 years compared to 46 years in an area with low numbers of RCWs.

Lueck and Michael (2000) use these results to estimate the reduction in pine forest acreage suitable for RCWs between 1984 and 1990. They find that between 12,253 and 69,359 additional acres of mature pine were harvested in North Carolina in order to avoid potential ESA regulations. In the 5-county Sandhills region alone, where RCWs are most populous, and an area targeted by the FWS for recovery, the preemption acreage ranges from 6,634 to 29,927. Looking more closely at the Sandhills region, the preempted habitat acreage would be sufficient to support between 33 and 150 colonies of RCWs, assuming a typical habitat of 200 acres per RCW colony. Considering that only 70 colonies of RCWs can be found on private lands in this region (Campbell 1998), it appears that the ESA led to the destruction of as much habitat as it protected around private-land colonies.

EFFICIENT COMPENSATION OF PRIVATE LANDOWNERS

A number of theoretical papers address the issues of takings, compensation and private landowner incentives under the ESA (Miceli and Segerson 1996, Innis 1997, Polasky et al. 1997, Smith and Shogren 1997, Stroup 1997, Brown and Shogren 1998, Innes et al. 1998, Polasky and Doremus 1998, Innes 2000), and other types of government regulation (Blume et al. 1984). In general, the papers specify game theoretic models of private landowner and government regulator behavior with the objective of deriving the optimal compensation level to private landowners that eliminates the incentive for preemptive habitat destruction and concealing information from regulators, and results in a socially efficient level of endangered species conservation. The compensation rules evaluated include full compensation for lost private use values (the type of takings compensation proposed in recent legislation), payment equal to the public conservation value of the habitat preserved, negligence compensation rules, tradable development rights, and government purchases of desired habitat under eminent domain.

Standard takings compensation (full payment of the loss in private use value in the event of endangered species regulation) is inefficient for 2 reasons. First, it fails to reward landowners for improvements in the public conservation value. Second, it creates an incentive to overdevelop in some settings because landown-

ers do not need to consider the public conservation value of their land (Blume et al. 1984). An efficient compensation scheme will cause a private landowner to value each of their land use alternatives at the same level as society. Under takings compensation, the landowner receives the private use value whether they commit the property to conservation or development purposes. In addition to the overdevelopment incentive, takings compensation invites contrived claims and would entail large administrative and legal costs (Goldstein and Watson 1997).

Private land-use incentives are fully aligned with social benefits and costs when landowners are paid the public conservation value of their land (pigouvian compensation). Public conservation value includes both the market and nonmarket value of all the conservation benefits produced by the undeveloped land that are received by someone other than the landowner. However, the efficient compensation scheme would be difficult to implement in practice because of the difficulty in accurately quantifying the public conservation value and the large sum of public funds necessary to pay it. Although economists have made great advances in quantifying values for nonmarket goods such as endangered species protection, nonmarket valuation techniques are still controversial and determining nonmarket values for individual properties would have high research costs. Pigouvian compensation may also involve a greater budgetary cost than takings compensation. When considering the efficiency (deadweight) costs of raising these funds through the tax system, the high budgetary outlays necessary for pigouvian compensation could substantially reduce the social efficiency of such a policy (Innes et al. 1998).

An ideal system creates incentives similar to pigouvian compensation at lower budgetary costs to the government. Innes (2000) shows that this could be achieved under a linear compensation rule that penalizes landowners for higher private land values or through the use of a negligence compensation rule. Under a negligence compensation rule, landowners with endangered species habitat receive positive compensation only if they take socially efficient actions to protect the public conservation value of their land. A negligence compensation rule reduces the overinvestment incentive of standard takings compensation, because landowners will no longer undertake development solely for the purpose of eliciting greater amounts of takings compensation.

The difference between takings compensation and a negligence compensation rule can be illustrated by considering a simple example of beachfront property where conservation as endangered species habitat has a higher social value than development. Under takings compensation, the landowner may have an incentive to

wastefully enhance the property's development value, for example by building a road. By increasing the development value, the landowner buttresses his or her takings claim and increases the chance that the claim exceeds the value loss thresholds (e.g., 25%, 33%) specified in the takings law. Under a negligence compensation rule, the landowner triggers compensation by taking actions that enhance the property's conservation value, such as protecting or planting dune grass. In practice, the difficulty of implementing such a system is determining whether or not a landowner has efficiently protected the property's public use value.

Extensions to the basic optimal compensation models include consideration of multi-parcel, spatial issues in compensation rules, tradable development permits, and asymmetric information between regulators and landowners. Incorporating spatial issues makes it efficient to offer higher payments to adjacent landowners providing endangered species habitat (Smith and Shogren 1997) because clusters of habitat are potentially more valuable to the long-term recovery of species. A policy of tradable development rights improves economic efficiency with zero government outlay because those who buy the permits compensate those who sell development permits and give up their property for public use as endangered species habitat (Kennedy et al. 1996). By lowering the cost of endangered species to development-minded landowners, tradable development rights reduce but do not eliminate the incentive for preemptive habitat destruction. Habitat destruction incentives are reduced because development-minded landowners with endangered species can develop their property if they purchase permits from a landowner that will mitigate the resulting habitat loss. If the permits have high prices, endangered species will still be a costly liability for landowners who may still choose to destroy habitat in order to protect against the need to purchase development permits. Low permit prices reduce or eliminate the incentive for preemptive habitat destruction but do not provide much of an incentive for habitat creation or enhancement. There are also significant administrative difficulties in such a system for endangered plant and wildlife habitat.

Asymmetric information could involve landowners withholding biological information from the regulator (Polasky and Doremus 1998) or withholding information about their private conservation values, and thus their willingness to accept lower payments to provide habitat (Innes et al. 1998). Stroup (1997) argues that a market approach with a budget constraint and compensation paid in the form of land and easement purchases or habitat rental will result in the government seeking out low-cost providers of habitat and the low-cost producers coming forward. Low-cost producers of endangered species habitat are those with high private

conservation values so that habitat conservation has a relatively small impact on the land's private use value. These landowners may be willing to protect habitat for far less than full compensation and would make up the lower portion of supply curve for endangered species habitat where "willingness to accept payment for habitat protection" is the vertical axis and "habitat acres preserved" is the horizontal axis.

A straightforward alternative to the landowner compensation rules discussed above is full government acquisition of habitat for the creation of biodiversity protection reserves. Unlike the compensation rules, the acquisition of biodiversity reserves could be pursued as a supplement to the current ESA and would not necessarily change the way private landowners are regulated under the ESA. Ando et al. (1998) used data on the location of endangered species and average county land values in the U.S. To solve a budget constrained site-selection problem that maximized the number of endangered species covered by reserves. Their results showed that optimal reserve locations were concentrated in the southwestern states such as Arizona, Nevada, and New Mexico. Polasky et al. (1999) have solved a similar, more detailed problem for selecting forest reserve sites in Oregon. Because these studies assume the outright purchase of properties for a biodiversity reserve, the cost of adding acreage to a reserve is the price of land. An alternative strategy is the purchase of conservation easements, where the definition of cost is the difference between the unregulated market value of the land and the value of alternative land uses that preserve adequate habitat. For example RCW can thrive on properties used for quail hunting, golf courses, pine straw raking, and residential development even though the most valuable use of most properties, short rotation timber production, does not provide suitable habitat. Solving the low-cost easement purchase problem would likely result in a different distribution of reserves and is a question that merits further research. A problem with the reserve purchase approach is that assembling large reserves will ultimately require the government to acquire some properties via eminent domain rather than a voluntary sale with individual landowners. The involuntary nature of such a program could lead to political problems and potentially create new incentive problems despite full compensation.

Another alternative to private landowner compensation recognizes that the key to the ESA's perverse incentives is the ability of private landowners to manipulate the conservation value or development value of their land through their management choices. Polasky et al. (1997, pp. 72-73) state:

"In order to effectively limit the ability of landowners to manipulate outcomes, regulatory decisions must be based on factors

that are difficult for landowners to manipulate. In the species conservation context, regulators might assess the land's potential suitability for listed species rather than the current presence or absence of those species. Suitability might be judged on the basis of soil type, topography, and climate conditions - factors largely outside landowners' control."

The location of a property with respect to species location, public lands, and existing habitat is another important criteria that could be used to judge suitability. Of course, regulating land based on suitability rather than the actual presence of endangered species may be politically difficult. However, such criteria could be effective if policy changed to embrace market mechanisms such as land and easement purchases, and rental payments in place of the current regulatory approach.

CONCLUSION

Current reauthorization proposals for the ESA only recommend limited or inefficient compensation for private landowners such as standard takings compensation, estate tax credits, and cost sharing for habitat improvements. No legislation has proposed payments that are linked to public conservation value, utilize negligence rules, or provide payments at any level less than full takings compensation. In addition, no proposals include funds for simple land acquisition despite the fact that funding for public purchase of properties and conservation easements for other environmental reasons are very popular. Many states (e.g., Colorado, Maryland) have authorized millions of dollars for land and easement acquisition and it appears the proposed Lands Legacy program will authorize several hundred million (if not more than a billion) dollars in federal funds for similar purposes. Ultimately, endangered species policy on private lands must address the fact that landowners can affect the public conservation value of their land through their management choices. Because of this, traditional regulatory approaches such as the current ESA and policies that punish landowners for harm are ineffective. In this setting, where public use values are in private hands, positive compensation is necessary for social efficiency. The challenge for future economic research is to consider how theoretical derivations of efficient, low-cost compensation rules can be made simple and easy to implement in practice.

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