Recovery of imperiled species under the Endangered Species Act: the need for a new approach

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The recovery (delisting) of a threatened or endangered species is often accompanied by the expectation that conservation management of the species will no longer be necessary. However, the magnitude and pace of human impacts on the environment make it unlikely that substantial progress will be made in delisting many species unless the definition of "recovery" includes some form of active management. Preventing delisted species from again being at risk of extinction may require continuing, species-specific management actions. We characterize such species as "conservation-reliant", and suggest that viewing "recovery" as a continuum of states rather than as a simple "recovered/not recovered" dichotomy may enhance our ability to manage such species within the framework of the Endangered Species Act. With ongoing loss of habitat, disruption of natural disturbance regimes, and the increasing impacts of non-native invasive species, it is probable that the number of conservation-reliant species will increase. We propose the development of "recovery management agreements", with legally and biologically defensible contracts that would provide for continuing conservation management following delisting. The use of such formalized agreements will facilitate shared management responsibilities between federal wildlife agencies and other federal agencies, and with state, local, and tribal governments, as well as with private entities that have demonstrated the capability to meet the needs of conservation-reliant species.

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For millennia, humans have been affecting populations of other species through hunting, habitat alteration, and the introduction of exotic species. The globalization of world economies and a six-fold increase in human populations over the past 150 years have dramatically changed the temporal and geographic scales of these effects, leading to widespread concern about the accelerating pace of species loss. As these losses have become increasingly apparent, many governments have imposed regulatory restrictions on activities that harm declining species (Male 1996; Goble *et al.* 1999). In the US, the Endangered Species Act (ESA) is the primary source of protection for at-risk species. The Act's goal is to "recover" listed species; that is, to bring the species to the point at which the protection provided by the Act is no longer necessary [ESA secs 2(b), 3(3)].

As it is currently interpreted, the ESA establishes a linear process for achieving recovery. When a species is determined to have a high extinction risk, it may be listed as endangered or threatened under section 4. Following listing, the responsible federal wildlife agency (eg the US Fish and Wildlife Service [USFWS] or NOAA Fisheries [NOAA]) prepares a recovery plan that specifies how the threats to the species will be ameliorated, so that protection under the Act is no longer required. In the interim, the species is protected under the Act through both regulatory measures, such as a prohibition against take [ESA sec 9(a)(1)(b)] or jeopardizing the species [ESA sec 7(a)(2)], and incentives, such as federal funding to states [ESA sec 6(d)].

The most common threats facing imperiled species in the US are habitat degradation and invasive species (Wilcove *et al.* 1998). These threats will often require

In a nutshell:

- For many endangered species, recovery in the sense of full self-sufficiency is an unattainable goal
- Instead, recovery should be viewed as a continuum rather than a simple recovered vs not recovered condition
- "Conservation-reliant species" can maintain self-sustaining wild populations with ongoing management actions
- Ongoing conservation management under the Endangered Species Act (ESA) will require actions by state and local government as well as private and governmental landowners
- The ESA should be viewed as a way to create cooperative management relationships among all concerned parties
- Recovery management agreements can formalize these cooperative relationships and provide assurances that necessary conservation management actions will continue following delisting of conservation-reliant species

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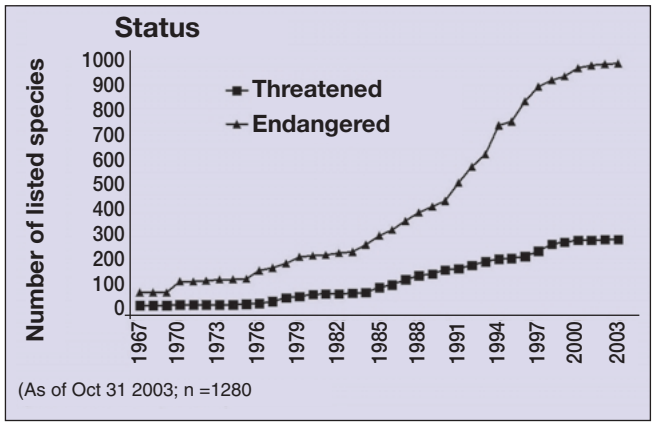

Figure 1. *Listings of threatened and endangered species since 1967 (USFWS 2004).*

active management, either to maintain habitat quality or to control invasives (Wilcove and Chen 1998). For most species, there is no specifically targeted legal protection other than the ESA or its state counterparts (Doremus 2000; Goble in press). Some laws target specific taxonomic groups (eg Bald and Golden Eagle Protection Act, Marine Mammal Protection Act), but such statutes are not as comprehensive as the ESA (eg they lack habitat protection provisions) and are not applicable to the majority of listed species. Other, less specifically focused laws incidentally protect habitat (eg Clean Water Act, state wetland laws, local zoning regulations), but such general statutes are unlikely to provide sufficient protection to most listed species.

Since the inception of the Endangered Species Act in 1973, the number of endangered and threatened species listed has risen steadily (Figure 1). Although many of these species are better off today than when they were first protected under the Act, few species have improved sufficiently to declare them recovered. Of 1260 listed species in the US and its possessions, 13 have been delisted (ie "recovered"; Web Table 1), and an additional 22 species have made sufficient progress towards recovery to be downlisted from endangered to threatened (Web Table 2). Given the complexity of threats faced by species (Wilcove *et al.* 1998), the limited funding of recovery efforts (Miller *et al.* 2002), and the fact that it took many species decades or centuries to reach a point of acute vulnerability (Wilcove *et al.* 1993), it is unrealistic to expect that many more species would have recovered during the 30 years the Act has been in effect. The magnitude of the threats, and the likelihood that most will increase in intensity and pervasiveness, suggest that few additional species are likely to be delisted without some form of continuing management to keep them from slipping back into a threatened or endangered condition.

The ESA is a complex statute. We cover many of these complexities elsewhere (Goble *et al.* in press; Scott *et al.* in press). Our focus here is on recovery, a topic that has become a major target for critics of the Act (US House of Representatives 2005). We propose a reconceptualization of "recovery" that recognizes it as a continuum. We then examine how this approach would apply to "conservation-reliant species" – species that are at risk from threats so persistent that they require continuous management intervention to maintain population levels above those that would trigger listing as threatened or endangered. Finally, we propose formalizing an existing practice of creating species-specific recovery management agreements that would ensure against future declines of such conservation-reliant species.

Recovery concepts

In practice, there is no single concept of what constitutes "recovery". For example, the USFWS recovery goal for the grizzly bear (*Ursus arctos*) in the conterminous 48 states would result in the species occupying less than 5% of its pre-Columbian range (USFWS 1993). In contrast, the recovery plans for the bald eagle (*Haliaeetus leucocephalus*) call for a range that would approximate its pre-Columbian status (USFWS 1983, 1984, 1986).

The final delisting rules for the 13 delisted species also indicate how recovery has been defined in practice (Panel 1). Some species were threatened by clear and remediable threats. The Aleutian Canada goose (*Branta canadensis leucopareia*), for example, was listed as a result of the introduction of foxes (*Vulpes* spp) to its nesting grounds on several islands in the Aleutians; removal of the foxes from these islands eliminated the threat and allowed the species to recover. Continuing conservation management for the goose relies on existing instruments such as the Migratory Bird Treaty Act, flyway councils, and state waterfowl regulations. In the case of species for which there is a high probability of threats recurring, it has been necessary to fashion new management agreements as a precondition for delisting (Panel 1). For example, Robbins' cinquefoil (*Potentilla robbinsiana*) was at risk from trampling and collecting; a management agreement was drafted that mandated fencing and onsite personnel to prevent trampling and taking of specimens. With these safeguards in place, the species was delisted (USFWS 2002). Justifications for

Panel 1. Criteria for assessing whether a species is conservation-reliant

- Threats to the species' continued existence are known and treatable
- The threats are pervasive and recurrent, eg nest parasites, non-native predators
- The threats render the species at risk of extinction, absent ongoing conservation management
- Management actions sufficient to counter threats have been identified and can be implemented, eg prescribed fires, restrictions on grazing or public access, predator or parasite control
- Federal, state, or local governments – often in cooperation with private or tribal interests – are capable of carrying out the necessary management actions as long as necessary. ("In perpetuity" is a lightning rod)

the 22 species reclassified from endangered to threatened status (Web Table 2) are similar.

These examples suggest that a new, more nuanced view of recovery is needed to replace the simplistic "not recovered/recovered" dichotomy and to recognize the role of active conservation management. If a species can be delisted when there is a reasonable certainty that the human intervention needed to sustain the species in the wild will be supplied, then the objective of the ESA becomes one of fostering that intervention.

The recovery continuum

Recovery goals are often specified in terms of increasing the abundance of a species above some threshold. Rather than being a "yes/no" threshold, however, recovery is better viewed as a continuum of varying levels of human intervention or management (Figure 2). Species can be viewed operationally as "recovered" at several levels along this continuum.

The most extreme condition is represented by a species that occurs only in captivity. In the US and its possessions, examples include the Guam Micronesian kingfisher (*Halcyon cinnamomina cinnamomina*), Hawaiian crow (*Corvus hawaiiensis*), and ten species of plants – Haha (*Cyanea pinnatifida)*, Hau kuahiwi (*Hibiscadelphus giffardianus* and *Hibiscadelphus hualalaiensis*), oha wai (*Clermontia peleana*), Cooke's Koki'o (no scientific name available), Lo'ulu (*Pritchardia affinis*), *Phyllostegia waimeae* (no common name), *Alsinidendron obovatum* (no common name), *Silene alexandri* (no common name), and *Silene perlmanii* (no common name) (USFWS 2004; T Pratt pers comm; Figure 3). Other species may be sustained in the wild only through continued releases of captive-bred individuals, such as the California condor (*Gymnogyps californianus;* Figure 4) and Attwater's greater prairie chicken (*Tympanuchus cupido att-wateri*). Because such populations are sustained only under artificial conditions, it is inappropriate to consider either of these levels as "recovered"; to do so would be inconsistent with a principal objective of the ESA – namely, "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved" [ESA sec 2(b)].

Other species may persist with recurrent intervention to maintain suitable habitat. For example, Kirtland's warbler (*Dendroica kirtlandii*) requires prescribed burns to maintain appropriate jack-pine habitat structure. Similarly, continuing intervention may be needed to ameliorate threats; successful recruitment of least Bell's vireo (*Vireo bellii pusillus*) requires the mitigation of brown-headed cowbird (*Molothrus ater*) parasitism. Many species, such as the least tern (*Sterna antillarum*) or Hawaiian land birds, require protection from human disturbance and predators (Figure 5). Finally, some species can maintain viable populations under existing, non-ESA regulatory mechanisms without further direct intervention (apart from restrictions on purposeful killing) once the threats to their existence have been removed. Species such as the peregrine falcon (*Falco peregrinus;* Figure 6) or gray wolf (*Canis lupus*) fall into this category.

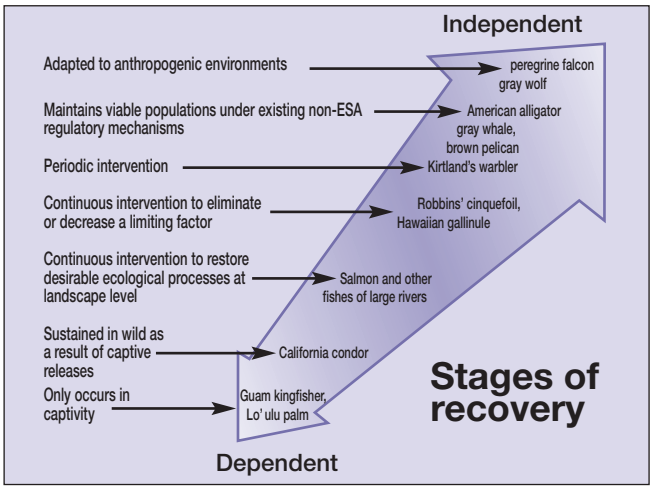

Figure 2. *The recovery continuum.*

If different points along this continuum are to qualify as "recovered" given the necessary management or intervention to stabilize a population or habitat, the key issue becomes whether there is a reasonable certainty that the human intervention will continue. Consider a fire-depen-

Figure 3. *Lo'ulu palm* (Pritchardia affinis) *– no longer exists in the wild (UFWS 2004).*

Courtesy of the Peregrine Fund

Figure 4. *California condors* (Gymnogyps californianus) *are currently maintained in the wild only as a result of releases from the highly successful captive propagation efforts (Burnham* et al. *in press). These are the cages from which they are released at the Grand Canyon.*

dent, endemic plant that occurs on only a few sites, most of which have been acquired as preserves by The Nature Conservancy or incorporated into the National Wildlife Refuge System, so that it is reasonably certain that the necessary management will occur. Is this situation sufficient to classify the plant as recovered, even if the species would not be able to maintain viable populations without such management? If not, does this mean that "recovery" is reserved for only those species that can survive unaided by human intervention? Or does "recovery" require more than a "reasonable certainty" that the required human intervention will be supplied for the foreseeable future?

New tools and concepts

Conservation-reliant species

Past experience with recovery efforts and the need for species-specific management plans that confer adequate protection after delisting raise the question: are there listed species for which no protection is required, beyond existing regulatory mechanisms? We suspect that the only "walk-away" species are likely to be those few that are threatened by clear and remediable threats that are highly unlikely to recur. Most listed species will require continuous management action in order to maintain their recovered status. They are "conservation-reliant" species, in other words, species that can maintain a self-sustaining population in the wild only if ongoing management actions of proven effectiveness are implemented. A "self-sustaining" population should be able to remain stable or increase over time without human assistance to reproduction or dispersal in the wild. Although occasional translocations to maintain genetic diversity would not violate this notion of a self-sustaining population, frequent translocations to overcome anthropogenic dispersal barriers or to compensate for losses due to predation, disease, or other mortality factors would.

Examples of management actions that would meet our criteria for defining "conservation-reliant" include control of invasive species, the recurring use of prescribed fire to maintain suitable habitat, restrictions on grazing or public access, predator control, regularly scheduled water releases from dams, or limited translocations to maintain genetic diversity. We would not consider species to be conservation-reliant if they are dependent upon releases of captive-reared individuals (eg California condor or hatchery-reared salmon; Myers *et al.* 2004) or manipulation of large portions of a species' population rather than manipulation of its habitat (eg barging of salmon smolts across dams to overcome migration barriers; Ward *et al.* 1997; Levin and Tolimieri 2001; Figure 7). Considering a species to be recovered on the basis of populations sustained only

(a) Courtesy of T Burr, US Navy

(b) Courtesy of J Jeffrey

Figure 5. *(a) Maintenance of positive rates of reproduction for many species, such as the least tern* (Sterna antillarum)*, is dependent on elimination of human disturbance, or (b) in the case of many Hawaiian forest birds, predator control.*

through captive propagation, removal from the wild, or artificial migration is inconsistent with the objective of the ESA to conserve ecosystems [ie ESA sec 2(b)].

The conservation-reliant species concept serves at least two purposes. First, it explicitly acknowledges that the simplistic model of recovery – a species is listed, steps are taken to resolve the threats, the species is delisted and lives happily ever after – is unrealistic. Most rare species are dependent upon ongoing conservation management. Second, and more important, the conservation-reliant species concept can assist in recovery by allowing a species whose population has stabilized at or above its recovery goals to be delisted, even though the threats to its existence can only be successfully mitigated rather than eliminated by ongoing conservation management. Robbins' cinquefoil is one example of a conservation-reliant species that has been delisted. The management agreements that the USFWS has implemented for this species provide a model of a successful effort. A species that falls short of recovery goals but which can be sustained with continuing conservation management can be reclassified as threatened. This gives meaning to a category intended to be an intermediate point between endangered and unlisted, but that has often been indistinguishable from endangered. For these threatened, conservation-reliant species, statutory restrictions could be replaced with more flexible regulations as long as the needed management is being supplied.


Courtesy of The Peregrine Fund

Figure 6. *Peregrine falcons (*Falco peregrinus*) have found homes in cities from San Diego to New York. They have successfully nested on buildings and bridges and feed on feral pigeons, starlings, and other city-dwelling species.*

Recovery management agreements

Conservation-reliant species depend on continuing conservation management. Some agency or organization must therefore assume responsibility for those actions. To facilitate the recovery of conservation-reliant species, and to provide assurances that the species will be adequately protected following delisting or reclassification, we propose the creation of a new group of conservation agreements under section 10 of the ESA [ESA sec 10(a)(1)(A)]. These "Recovery Management Agreements" (RMAs) would include both a set of biological standards and a set of legal requirements that the conservation management plan must satisfy. The species' recovery plan should provide guidance for the development of an RMA. The biological standards would be determined by the known and treatable threats the species faces. In addition, the RMA should be operational well before the species is downlisted or delisted. This will provide the track record necessary to ensure that the management actions are in fact mitigating the threats to the survival of the species.

The legal requirements for recovery should also be formalized through an RMA. The instrument will consist of an enforceable contract between the federal wildlife agency and another entity with the authority and financial resources to provide the necessary conservation management for the foreseeable future. Typically, the latter will be a federal land-management agency or a state, tribal, county, or municipal government; in appropriate circumstances, it could be a non-governmental organization with the resources to fulfill long-term obligations and a track record of doing so successfully. It is imperative that all agencies and organizations involved in the required management participate in drafting the RMA.

RMAs operate by transferring some or all management authority from the federal wildlife agency to the conservation manager. This transfer can promote recovery because

Panel 2. Requirements for Recovery Management Agreements (RMAs)

To satisfy legal and biological requirements, RMAs would necessarily include:

- Biological goals tied to the recovery plan
- Explicit management actions that reflect the risks facing the species
- Adaptive management strategies that ensure that the RMA is evaluated and revised regularly
- A defined duration
- Assurances by the conservation manager of its ability to implement the agreement
- Incidental-take authority may also be necessary for management actions undertaken before delisting of the species

Courtesy of C Peery, Univ of Idaho.

Figure 7. *Downstream migrating salmon smolts are collected at federal hydropower dams, loaded onto barges, and transported to the Columbia River estuary.*

of the broader range of authorities available to some local partners (eg the power of state and local governments to zone land uses). As a species nears its recovery goals, or the point at which existing management is likely to be sufficient to maintain a target abundance and distribution, an RMA would be negotiated. The conservation manager would assume responsibility, subject to federal oversight. This transition would give the conservation manager experience and allow the federal agency to develop confidence in the manager.

Section 4 of the ESA specifically recognizes that state and local governmental actions to conserve species are relevant to the decision to delist a species [ESA sec 4(b)(1)(A)]. There is also precedent for the use of intergovernmental agreements to facilitate recovery (eg Safe Harbor agreements; USFWS 1998, 1999). Our proposal is an extension of such existing practices and a formalization of the elements of successful management agreements (Panels 1 and 2).

Conclusions

There is a developing consensus that additional tools are needed if we are to increase the effectiveness of efforts to protect imperiled species. We have argued for the value – indeed, the necessity – of casting recovery of such species in a broader context than the current model. One reason for doing so is to recognize the fact that both species and their environments are dynamic. Natural or anthropogenic changes such as droughts, wet years, or the re-establishment of fire as an ecological process can result in recovery of a species previously considered to be unrecoverable. Alternatively, these forces can erase years of conservation progress, as happened in Puerto Rico when Hurricane Hugo killed nearly half of the wild population of Puerto Rican parrots (*Amazona vittata*; Wide 1991). Changes in human activities over time can also have important consequences for wildlife. For example, farm consolidation resulting in hedgerow elimination, the creation of programs such as the Conservation Reserve Program, or shifts in timber production illustrate how land-use changes create a constantly shifting stage on which recovery efforts play out.

For many species, the factors that led to their at-risk status stem from irreversible human alterations of the environment, such as destruction of habitat or increasing numbers of non-native species. Under these conditions, active, continuing management must be part of the recovery strategy. If there is a reasonable certainty that such management will be provided, there is little value in continuing to list these species as endangered or threatened. Regarding them as conservation-reliant species may be a more realistic alternative.

Ultimately, of course, the determination of how much the risk of extinction must be reduced to constitute "recovery" is a societal decision. Societal values determine how much effort or how many resources should be allocated to preventing extinctions and maintaining populations of rare or threatened species. Regardless of the conservation targets chosen, the requirements for continuing conservation management must be included in the balance sheet. Fully implementing recovery management agreements, and the resulting restrictions in land uses, will impose monetary costs. It has been estimated that some $32–42 million per year (1997 estimates) would be required to manage currently occupied habitats for the approximately 60% of the listed species threatened by alien species or the disruption of fire regimes (Wilcove and Chen 1998). Given these ongoing management costs, our proposal to include such management in defining recovery may seem unrealistic. If we can adjust the regulatory restrictions imposed by the ESA to achieve progress in moving listed species into a relatively secure status by adopting the concepts of a continuum of recovery and of conservation-reliant species, however, the gains will more than justify the costs.

Acknowledgements

The concepts of conservation-reliant species and Recovery Management Agreements grew out of a conference on the ESA in Santa Barbara, CA, in November 2003, and subsequent workshops. The idea that recovery is difficult at best and will require continuous intervention by humans is not new; it has been argued forcefully by H Doremus and M Rosenzweig. The International Association of Fish and Wildlife Agencies proposed the concept of State Conservation Agreements, which have many of the elements we include in RMAs.

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