Conservation-Reliant Species

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A species is conservation reliant *when the threats that it faces cannot be eliminated, but only managed. There are two forms of conservation reliance: population- and threat-management reliance. We provide an overview of the concept and introduce a series of articles that examine it in the context of a range of taxa, threats, and habitats. If sufficient assurances can be provided that successful population and threat management will continue, conservation-reliant species may be either delisted or kept off the endangered species list. This may be advantageous because unlisted species provide more opportunities for a broader spectrum of federal, state, tribal, and private interests to participate in conservation. Even for currently listed species, the number of conservation-reliant species—84% of* endangered *and* threatened *species with recovery plans—and the magnitude of management actions needed to sustain the species at recovered levels raise questions about society's willingness to support necessary action.*

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Humans have been altering the Earth's ecosystems for millennia (Diamond and Veitch 1981, Pyne 1995, Flannery 2001, Jackson et al. 2001). Since the onset of the Industrial Revolution, however, the temporal and geographic scales of these modifications have increased at an accelerating rate. The cumulative impact is such that it has been proposed that the world has entered a new geological era—the Anthropocene (Crutzen and Stoermer 2000). Regardless of the descriptor, the message is simple and damning: The accumulated effects of individual and societal actions, taken locally over centuries, have transformed the composition, structure, and function of the global environment (Janzen 1998, Sanderson et al. 2002, McKibben 2006, Kareiva et al. 2007, Wiens 2007). Ecological lows have become the new baseline (Pauly 1995). Although climates have always been dynamic, and threats have always existed, recent anthropogenic threats to the integrity, diversity, and health of biodiversity are unprecedented, not only causing additional stress to ecosystems but also challenging our ability to respond (Julius and West 2008). How do we manage species and ecosystems in a world of global threats and constant change (Botkin 1990)?

One response in the United States to the endangerment and loss of species was the enactment of the Endangered Species Act (ESA). The Act's goal is to bring species at risk of extinction "to the point at which the measures provided pursuant to this Act are no longer necessary" (ESA § 3(3)). The ESA's drafters envisioned this as a logical progression: Species at risk of extinction would be listed under the Act in a process that would identify the risks the species faced, a recovery plan to address these risks would be drafted, the management tools required to conserve the species would be identified and implemented at relevant scales, the species would respond by increasing in numbers and distribution, the recovery goals would be achieved, and the species would then be delisted as *recovered*. In the interim, it would be protected by the ESA's suite of extinction-prevention tools (e.g., prohibitions on taking listed species or adversely modifying their critical habitats; Goble 2010). With recovery and delisting, the formerly listed species would achieve the ESA's goal of planned obsolescence when the Act is no longer necessary. To the extent that management would be needed, it would be provided through existing federal and state regulatory mechanisms.

The past nearly four decades has demonstrated the naivete of this vision. The path to recovery is far more winding than had been imagined. Even species that have met their biological recovery goals often require continuing, species-specific management, because existing regulatory mechanisms are seldom sufficiently specific to provide the required ongoing management (Goble 2009). For example, few species have thrived as easily as the now-delisted Aleutian cackling goose (*Branta hutchinsii leucopareia*), whose populations recovered once foxes that preyed on breeding birds and chicks were eliminated from nesting islands and for which the Migratory Bird Treaty Act's monitoring and take restrictions are sufficient. The threats that most species face cannot be eliminated, only managed. The scale of anthropogenic alteration of most ecosystems means that many imperiled species will require conservation management actions for

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the foreseeable future to maintain their targeted population levels. Adequate postdelisting management (i.e., regulatory assurances), however, is seldom possible, because for most species, no sufficiently focused and powerful regulatory mechanism is available to replace the ESA (Goble 2009, Bocetti et al. 2012 [in this issue]).

This is hardly surprising. The species listed under the ESA all became imperiled despite existing state and federal management systems. The problems remain: Most states lack regulatory systems that address nongame and plant species (Goble et al. 1999); funding is often tied to hunting and fishing license fees and remains insufficient (Jacobsen et al. 2010). Although existing management systems (e.g., the Marine Mammal Protection Act) may be sufficient for species such as the gray whale (*Eschrichtius robustus*; Goble 2009), the expectation that our work would be done once recovery goals have been met turns out to have been wishful thinking. Just how wishful was suggested by Scott and colleagues (2010), who examined the management actions required by recovery plans for species listed under the ESA. Scott and colleagues (2010) found that 84% of the species are conservation reliant, because their recovered status can be maintained only through a variety of species-specific management actions. Even if the biological recovery goals for these species are met, continuing management of the threats will be necessary. Reed and colleagues (2012 [in this issue]) provide insight into this problem by describing the challenges to recovery and to postrecovery management for one of the world's most management-dependent communities: the endemic birds of Hawaii. These species are "conservation reliant" in the sense described by Scott and colleagues (2005).

The ESA is focused on moving species to the recovery threshold. The magnitude of conservation reliance makes it clear that attention must also be given to postrecovery management (Goble 2009, Scott et al. 2010). Furthermore, species not currently listed but at risk because of declining populations or range contractions are also likely to be conservation reliant. In this context, a range of management actions may be required to preclude the need to list the species under the ESA. Although comprehensive wildlife conservation strategies developed by states with funding from the federal government provide a blueprint for sustaining nongame species and their habitats, the available state funding for these management efforts is widely viewed as insufficient (Jacobsen 2010).

Earlier, we addressed the question of conservation-reliant species in the context of the ESA (Scott et al. 2005). We did so in part by placing species along a gradient of levels of human intervention and management. At one end were those species now known only in captivity, such as the Guam kingfisher (*Todiramphus cinnamominus cinnamominus*), or sustained in the wild only through repeated releases of individuals reared in captivity, such as the California condor (*Gymnogyps californianus*). These species require the greatest degree of human intervention to achieve the basic conservation objective: the prevention of extinction. At the other end of the gradient are species such as the peregrine falcon (*Falco peregrinus*), whose recovery, once the major threat of DDT (the insecticide dichlorodiphenyltrichloroethane) had been eliminated, was secured by its ability to adapt to human-dominated environments by nesting on skyscrapers and foraging in cities on pigeons (*Columba livia*) and starlings (*Sturnus vulgaris*). The falcon thus thrives under existing federal regulations that protect all birds used in falconry and no longer requires species-specific management. The species is no longer conservation reliant. Between these extremes are a variety of species that will require differing intensities and forms of management intervention to persist in the wild. The point along this gradient at which a species becomes conservation reliant is determined by the necessity of continuing, species-specific intervention, rather than the type of intervention. The need for continuing intervention is, in turn, determined by the threats that species face. In some instances, the threats can be eliminated through appropriate actions. The key to the recovery of peregrine falcons was the banning of the pesticides that contributed to eggshell thinning and reproductive failure. For the Aleutian cackling goose, it was the removal of an introduced predator on its breeding grounds. Both species now thrive under the general provisions of the Migratory Bird Treaty Act and are no longer conservation reliant. When, however, the threat cannot be eliminated but only controlled and conservation goals can be achieved only through continuing management intervention, the species will remain conservation reliant.

In an earlier paper (Scott et al. 2005), we stated that we did not consider species either to be conservation reliant or to be delistable if they were dependent on the release of captive-reared animals or on assisted migration at the population level. We offered the California condor and the Pacific salmon (*Oncorhynchus* spp.) as examples of such species. On reflection, we now recognize that we confused the concept of *conservation reliant* with the policy decision to delist a species. By definition, all listed species are conservation reliant. The question is whether a species that has achieved recovery goals through management actions can be delisted as *recovered* without assurances that management will continue after delisting. If species-specific assurances are required, the species is conservation reliant.

The recognition that conservation reliance is a deeper and more widespread problem for listed and at-risk species than we (and others) initially thought has led us to a more nuanced perspective on this problem. In fact, two forms of conservation reliance affect species: population-management reliance and threat-management reliance. Although the ability of a species to persist is ultimately related to the characteristics and condition of both populations and the threats they face, conservation actions are often focused primarily either on managing populations or on managing threats. For example, species such as the northern Idaho ground squirrel (*Spermophilus brunneus*) live in isolated patches of habitat and may require some level of direct human intervention to move among those patches, even after local population sizes are stable (Garner et al. 2005). In contrast, other species may persist without direct population management if appropriate habitat is available. Given current land uses (and other pressures of the Anthropocene), however, human intervention may be required to maintain the habitat. As a result, it is not only species that are conservation reliant but entire ecosystems and the associated disturbance regimes (such as fire) and ecological succession pathways that define them. For example, the Karner blue butterfly (*Lycaeides melissa samuelis*), the red-cockaded woodpecker (*Picoides borealis*), and Kirtland's warbler (*Dendroica kirtlandii*) rely on periodic fire to maintain their habitat. The natural fire regimes that shaped the habitats and habitat associations of these species no longer occur, so prescribed burns must be used instead. Species such as these will continue to require threat management for the foreseeable future, even after the direct management of populations is no longer required. The two forms of conservation reliance are not independent of each other. For example, threats often influence what population actions are necessary: Where habitat encroachment has isolated small populations from each other, manipulation of the habitat may reduce habitat loss and fragmentation and may increase gene flow between the populations.

The conservation challenge is clear. The number of species that will require ongoing management is already large, and it will get larger as climate change, land-use change, human population growth, and other manifestations of the Anthropocene push more and more species to their limits. The ESA has been an effective approach for recognizing taxa that are on the brink of extinction and defining the steps needed to reverse their downward trajectory. The need for continuing intervention, even for "recovered" species, was not anticipated. We now face the conundrum that building on our conservation success will require long-term investments.

Paradoxically, continued listing under the ESA for many currently listed species may not be the best way to achieve long-term persistence. The legal restrictions imposed by the ESA may preclude some appropriate management actions. For example, landowners are often reluctant to manage their land in ways that might attract an endangered species because of the regulatory constraints imposed by the ESA (Wilcove 2004). Similarly, the paperwork and its concomitant costs in time and money are disincentives to the use of available conservation tools such as habitat conservation plans, candidate conservation agreements, and safe harbor agreements (Lin 1996, Burnham et al. 2006, Fox et al. 2006). However, delisting a species may open the door to an increasing array of unregulated threats that push it back into peril. For example, the delisting of gray wolves (*Canis lupus*) in the Northern Rocky Mountains resulted in unsustainable mortality from hunting and other pressures (Creel and Rotella 2010), which led to a judicial decision to relist the species (US District Court 2010) and a congressional decision to again delist the species through a budget rider (US Congress 2011).

To avoid such costly and contentious course reversals, a mechanism is needed to ensure that the appropriate management actions are implemented once the recovery goals for a species are met. Although no changes to the ESA are necessary to make this possible, we do need to acknowledge that continuing management is often needed after a species meets its biological recovery goals: We need a tool kit of management structures that will facilitate the transition from listed to delisted. Fortunately, examples are plentiful. The Robbins' cinquefoil (*Potentilla robbinsiana*) was delisted under a postdelisting management agreement under which the landowner (the US Forest Service) and a recreational group (the Appalachian Mountain Club) agreed to monitor and manage both the species' habitat and the threat (hikers) in order to maintain the recovered population (Goble 2009). Similarly, the Bureau of Land Management acquired nearly 3000 hectares of habitat for the Columbian white-tailed deer (*Odocoileus virginianus leucurus*) and agreed to manage its habitat through prescribed burning, grazing modifications, and restoration actions. In addition, Douglas County, Oregon, adopted a series of land-use and zoning ordinances designed to maintain habitat and corridors for the species (Goble 2009). The conservation management agreement for the grizzly bear (*Ursus arctos horribilis*) in the Greater Yellowstone Area is an example of an agreement among federal, states, and tribal land- and wildlife-management agencies that can provide a structure through which postdelisting management can be assured (USFWS 2007). Such agreements operate like candidate conservation agreements that have been used to preclude the need to list at-risk species (Lin 1996).

Bocetti and her colleagues (2012) provide an example of how a biologically and legally defensible postrecovery conservation management agreement can be developed and funded. The biggest challenges lie in finding conservation partners and obtaining funding to implement the needed management actions at ecologically relevant scales. This can be complicated on an American landscape in which two-thirds of listed and other at-risk species occur on private lands outside protected areas (Groves et al. 2000). No single mechanism can meet all needs. Instead, we envision a suite of conservation tools that can be matched to the species and landscapes that meets both the conservation threats and the diverse needs of landowners with different economic and personal interests. Funding through tax rebates, real estate transfer taxes, excise taxes, general funds, and private dollars are tools that have all been used to support wildlife and their habitats (Mangun and Shaw 1984, Smith and Shogren 2001). In addition, nongovernmental groups such as the Rocky Mountain Elk Foundation, Ducks Unlimited, Trout Unlimited, and Pheasants Forever have been formed to actively manage selected species and their habitats.

Management actions undertaken to benefit conservation-reliant species offer opportunities to accelerate the removal of species from the endangered species list and to prevent other species from becoming endangered (USFWS 2001). What is required is demonstrably effective management agreements that include management and funding commitments outside the framework of the ESA. But our focus needs to shift to abating those factors that lead to endangerment, and a conservation-reliant framework may be of assistance in doing so (Averill-Murray et al. 2012 [in this issue]). Given the criticisms of the ESA and the lower potential costs of conserving species before they are listed, understanding the ongoing management requirements of a species and responding before listing is needed has the potential to be a universal societal goal regarding species conservation. The challenge will be in creating reliable alternative funding and management structures.

The barriers to conserving and eventually delisting species are nowhere more apparent than in the Hawaiian Islands. In a thoughtful examination of our recurrent failure to implement identified recovery actions, Leonard (2008) suggested several not unrelated reasons: a lack of funding (Restani and Marzluff 2001), a lack of understanding both in the islands and on the mainland of the importance and urgent need for conservation action, and social and political barriers that reflect conflicting management goals for areas in which endangered species occur (e.g., hunting mouflon sheep [*Ovis aries orientalis*] versus maintaining the integrity, diversity, and health of palila [*Loxioides bailleui*] habitat; Banko 2009).

The consequences of failing to implement needed management actions are not trivial. The refusal to remove feral ungulates from the critical habitat of the species, despite its priority in a 1977 recovery plan and several court orders, has resulted in the continuing decline of the palila (Banko 2009). On Kauai, despite a 1984 recovery plan (Sincock et al. 1984) that called for the removal of feral ungulates from the core habitat of endangered forest birds, no action was taken until 2011. In the interim, five species went extinct (Pratt 2009) and two more species have been added to the list of endangered wildlife (USFWS 2010). The failure to act on the information in the recovery plans was a consequence of social and political pressures resulting from the perceived conflict between management intervention to recover endangered species and the continued hunting of introduced ungulates. A lack of funding also contributed to the problem.

The task we face is daunting. There are nearly 1400 listed species, and there are indications that the actual number of at-risk species is an order of magnitude or greater more (Wilcove and Master 2005). At this point, it is naive to continue to assume that funding will be available for the management needed to prevent the listing of at-risk species or to recover and manage listed species. The average expenditure for the recovery of listed species is less than a fifth of what is needed (Miller et al. 2002), and expenditures for recovery are often distributed among species for nonbiological reasons (DeShazo and Freeman 2006, Leonard 2008). Furthermore, the number of warranted but precluded decisions by the US Fish and Wildlife Service (USFWS) is increasing, and recovery has been designated a fourth-tier priority in the USFWS's guidelines for recovery planning.

Continuing business as usual, in which the majority of recovery funds are used to conserve a few iconic species while others are only monitored or simply ignored, will achieve little of lasting value. Even with increased funding, it is unlikely that we can conserve all species facing extinction, particularly as the queue gets longer. We must develop sensible ways of assigning conservation priorities in which both the magnitude of management required and the potential benefits of management and conservation actions are considered. Information about the degree of conservation reliance of a species is central to developing sensible conservation priorities.

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