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When Extinction is More Ethical Than Conservation: The Endangered Species Act and the Keystone Dilemma

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When Extinction is More Ethical Than Conservation: The Endangered Species Act and the Dilemma of Keystone Conservation

Although the Endangered Species Act (ESA) at first glance seems to offer only benefits, it has been a topic of heated controversy since it was passed in 1973. The Act was created in response to the increasing awareness of animal endangerment and extinction, particularly those of the iconic American bison and passenger pigeon. When President Nixon signed the law he declared, "Nothing is more priceless and more worthy of preservation than the rich array of animal life with which our country has been blessed."

According to the International Union for Conservation of Nature (IUCN), endangerment is the second most serious threat status of species population and indicates "a very high risk of extinction in the wild." The IUCN established a set of criteria that species must meet to qualify as endangered. The species must have suffered a population reduction of 70% of greater in 10 years, or have a population number of 2,500 or fewer. In addition to the IUCN, Congress almost made it clear that species endangerment is a grave issue. In the Supreme Court's first ESA case in 1978, the syllabus document stated that "[i]t is clear from the Act's legislative history that Congress intended to halt and reverse the trend toward species extinction—whatever the cost" ("Tennessee"). In most cases, the cost has been high.

With over 5,000 species of animals and plants listed as endangered in 2012 by the IUCN, the need for species conservation continues to become more urgent. According to the World Wide Fund for Nature, the leading organization in conservation, understanding the scope of species loss is difficult. Scientists estimate that between 0.01% and 0.1% of species disappear into extinction every year. Because of varying calculations on how many species exist, this number of yearly extinctions ranges from 200 to 100,000 ("How many species"). Many of these species are never missed by humans; most are endemic to one small range and already have such limited population numbers that they are both difficult to locate and unfamiliar to the public. In 1980 a group of scientists studying insects in Panama discovered that in as few as 19 trees existed 1,200 species of beetle—over 900 of which had been previously undiscovered ("How many species"). This is only one demonstration of the sheer scope of species that science has not yet touched upon.

While such a staggering number of species may go extinct every year, many of them leave no visible holes in the ecosystem. A humble species of beetle in a distant forest can disappear, but not cause the collapse of the environment around it. For this reason, it is neither feasible nor desirable to protect every known species even if they are on the brink of extinction.

Although some species will go extinct without being mourned, other species play far greater roles in their ecosystems than insects in a rainforest. Losing such species cannot occur without causing a chain reaction of adverse effects. As Robert T. Paine, the pioneering biologist in researching these important species, discovered: "not all species in an ecosystem are created equal" (MacDonald). Paine's research brought an entirely new idea to ecology: keystone species.

Keystone Species: The Backbone of Ecosystems

Species that play a vital role in a food web are known as "keystone species." According to the article "Keystone Species," the very concept of keystones "helps determine priority species for conservation and habitats in need of protection" (Nuñez and DiMarco 229). Robert Paine coined the term in reference to the center stone of an arch that locks the structure together. Without the keystone, the arch would collapse. This analogy reflects the function of the species Paine dedicated his life to studying.

Paine's original intention of research was to study marine communities. In an experiment involving a coastal ecosystem along Makah Bay, he began to realize that much of what scientists believed about the structure of ecosystems was false. Until the mid-1960s, ecologists considered the ecosystems as "stable dramas if they have a diverse cast of species" (Yong). The idea at that time was that ecosystems flourished because all animals played an equal role, and the more species present, the healthier the ecosystem. Paine's experiment contradicted what scientists had for years accepted as fact. By manipulating populations of *Pisaster* starfish, Paine found that every other aspect of the ecosystem changed as well. When he removed the starfish—the primary predator in its ecosystem—the populations of barnacles grew exponentially to push other species into local extinction. In the absence of the starfish, the prey species population exploded to overturn the entire ecosystem. Paine's hypothesis was simple: "Local species diversity is directly related to the efficiency with which predators prevent the monopolization of the major environmental requisites by one species" (Paine). As Paine proved, the existence of a healthy ecosystem could rely entirely on a single species.

Paine's original definition of a keystone classified them as predators that keep the populations of other species at manageable levels, but the modern definition has adjusted to reflect current research. Today, "keystone" refers to any species "whose impact on its community or ecosystem is large, and disproportionately large relative to its abundance" (Power et al. 609). Although keystones are no longer classified as only predator species, all keystones follow the basic pattern of the starfish Paine researched. In lakes and ponds, fish feed on plankton to prevent plankton from uncontrollable growth that would suffocate aquatic life; in forests, bats eat fruit to disperse seeds that allow new trees to grow; in grasslands,

rabbits feed on certain plants that would otherwise choke out other species of plant (Power et al. 612). Classic keystone examples such as the sea otter not only keep other species balanced, but the entire environment as well. A primary prey of sea otters is sea urchins. In the absence of otters, sea urchins overtake the habitat and devour the supply of kelp, which countless species of fish and ocean invertebrates rely on for food, habitat, and shelter. This demonstration proves that one species can have a tremendous impact on many other species around it.

When a species is integral in an ecosystem, it seems only reasonable that every effort be taken to preserve it from extinction. Many familiar keystone species already face the possibility of extinction, including sea otters, great white sharks, and prairie dogs. Without these species, the ecosystem is disrupted and could eventually even collapse. But in some cases, programs and efforts intended to protect a species through the ESA inadvertently causes more harm than good. At times it is more beneficial to allow these species to go extinct without human intervention. Not only is maintenance of their conservation programs extremely expensive without great success, it can take away from more manageable goals and can even cause species to decline faster.

The Endangered Species Act: History, Praise, and Criticism

The Endangered Species Act is the driving force behind the conservation efforts to protect endangered species, especially keystone species. Prior to the enactment of the ESA, the attitude toward species populations was overall shortsighted. Americans began to realize that species are not expendable; when overhunting decimated pigeons, bison, and waterfowl, people clamored to take action in preventing or reversing this extreme loss of animal life. When the decline of certain species became obvious, such as that of the bald eagle, Congress established acts to protect that species in particular. In response to the loss of eagles, the government passed the Bald Eagle Protection Act in 1940.

Before the ESA, acts to protect species focused not on endangered species collectively, but on certain species or groups of related species. Then in 1966, Congress passed the precursor to the ESA, the Endangered Species Preservation Act. This Act provided for the setting apart of land as protected habitat for endangered species. Three years later, the Act expanded to publish lists of species "threatened with worldwide extinction" (qtd. in "Endangered Species Act"). While this Preservation Act improved the situation, it offered little in comparison to the Endangered Species Act. While previous acts initiated protected habitat and created a list of endangered species, the ESA accomplished these and more: it prohibited unlicensed capture or trade of animals, required agencies to avoid any project that may put a species in danger, and called for organized efforts to restore species populations.

Despite the monumental step in promoting the protection of wildlife, the decision to give the government such authority over these endangered animals has been met by both extreme praise and harsh criticism. Many experts feel that the Endangered Species Act has done an enormous service in ensuring species survival; others believe that both species and conservationists face more harm than good by the act established to protect, conserve, and restore endangered species. An unfortunate consequence of the ESA for conservationists may be fines, lawsuits, or even imprisonment. A consequence for species, however, is more grim: under the ESA, some of these endangered species are at much higher risk for extinction.

Praise for the ESA remains plentiful. In the article "Preserve the Endangered Species Act," the editors of *Scientific American* consider the ESA as "the most successful environmental legislation ever enacted." The article points out some of the ESA's most riveting success stories, such as that of the gray wolf. By 1960, years before the implementation of the ESA, the gray wolf had almost disappeared in the United States because of encouragement from the government to exterminate "pest" species. Under later protection by the ESA, the wolf recovered populations 300% beyond expectations, increasing from a meager 300 individuals to over 5,000 in 2015 ("Gray Wolf"). A similar success is the recovery of the bald eagle. The eagle bounced from one protection list to another until 1973, when it finally received rigorous plans for recovery. In 1963, only 417 nesting pairs of eagles existed in the lower United States; in 2007, the number multiplied to nearly 10,000 pairs ("Questions"). Because of their confidence in the ESA, the editors of *SA* do not believe they are alone in their opinion of the Act's success. They claim that the ESA is "widely considered the strongest piece of conservation legislation ever implemented in the U.S. and perhaps the world" ("Preserve"). Many experts in the field of biology echo this support of the ESA.

The president and chief executive officer of the Defenders of Wildlife Jamie Clark gives similar praise to the ESA. She refers to the ESA as a law that has "prevent[ed] hundreds of extinctions and [put] many more species on a path to recovery." In her article "The Endangered Species Act at 40: Opportunities for Improvements," Clark compliments the ESA on its wide-scale success in providing protection to help secure the futures of endangered species. Following the title of her article, Clark also offers suggestions to improve the ESA. In her opinion, additional support of the ESA would be more beneficial than mere amendments. Success stories like the gray wolf's cannot occur if both financial support and government support of improvements remain limited.

Critics of the ESA acknowledge these success stories and realize increased support could allow more recovery plans and more extensive monitoring. However, many believe that the ESA requires more than mere support to truly succeed.

Some call for a complete reorganization of the Act. According to U.S. Representative Cynthia Lummis, the goal of Congress is to "make the Endangered Species Act work" (qtd. in Jacobson). Lummis states in the interview that only 1% of the 2,015 endangered species in 2015 had been delisted. While 56 species had been removed from the list in total, 10 of the 56 were removed because the recovery plans failed and the species became extinct. Eighteen other species were taken off the list because more research and data indicated having listed them at all was in error.

As of 2016, 41 species of both plants and animals have experienced enough true population recovery to be delisted ("Delisted Species"). Among these species are the gray whale, Morelet's crocodile, red kangaroo, and peregrine falcon. The gray whale rebounded from near-extinction to a population of over 19,000, soaring from endangered to a status of "least concern" ("Gray Whale"). The Morelet's crocodile, red kangaroo, and peregrine falcon also regained populations to no longer be at risk of extinction. However, many species declared delisted are not entirely recovered. Some of these species, such as the humpback whale and Steller sea lion, have populations in different areas. While a population in one country or range may fully recover, the population in another area may still be classified as endangered. Therefore, even some delisted species have not recovered overall, and with nearly one-fourth as many extinctions as recoveries, the ESA's success stories are few.

Those who criticize the ESA point out reasons that the effort does not often reap significant results. Professor Lance Gunderson, a research scientist and founding chair of the Department of Environmental Studies at Emory University, believes the ESA is a "champion law of stakeholders, environmentalists, and legal activists." He explains that the ESA has been used in a way that puts obstacles in the paths of managers who work to restore species populations. One such obstacle is limiting how landowners use their own property. Even recreational activities like hiking or picnicking on private property may violate the ESA—any human presence that disturbs an endangered species can constitute as "harassment," which goes against the ESA's "take" clause. While the "take" clause prohibits such actions as hunting or trapping, it also prohibits any form of harassment of the species. The ESA defines harassment as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns, which include, but are not limited to, breeding, feeding, or sheltering." An example of the "take" clause using this definition to interfere with human activity is described in the recovery plan for piping plovers. In areas where piping plovers breed, even jogging, fishing, or sunbathing within 50 meters of the birds and their nests is considered

harassment ("Guidelines"). Under the ESA, mundane activities can become threats to wildlife.

Managers of conservation projects face even more difficulty than the average landowner. Instead of giving managers appropriate means to manage conservation projects, the ESA interferes in ways that can lead to regulation or loss of private property. According to the Secretary of the Interior Dirk Kempthorne, "Our conservation goals for fish and wildlife can only be achieved with the help of private citizens and landowners" ("Fish and Wildlife Service Announces"). Grants have been issued to fund some conservationist projects, and some agreements such as the Safe Harbor Agreement help assist managers in projects in association with the U.S. Fish & Wildlife Service (FWS). However, despite having these capabilities to support landowners, the ESA continues to deter attempts at conservation. One example is that of Professor David Cameron, who intended to carry out a project to restore an endangered species of fish. Although his expertise could have been an asset in conservation, he was pressured into forgoing his plan because regulations imposed on his ranch property would prevent him from using his pastures for cattle (Anderson). Any intended project must be proposed to the Endangered Species Committee for approval before the landowner receives a permit for the project. This strenuous process involves a yearly evaluation to ensure compliance with guidelines of the ESA (Meczkowski 188). Furthermore, while grants are given, they do not cover all costs of projects, and any regulation of private property is not compensated unless the landowner files a claim under certain conditions.

Maintaining Endangered Species: Operation of the Endangered Species Act

The ESA's maintenance of endangered species poses both financial and scientific challenges. Scientists cannot simply declare a species as endangered and plunge into rescue operations. Biologists, ecologists, and other researchers must first gather data about the species. When scientists discover an alarming decline in a species population, they must then pinpoint the contributing factors. The FWS lists such factors as destruction of habitat, overuse of a species for commercial purposes, disease, or insufficient current protection ("Listing"). After biologists determine the threat level and cause of population decline, they must consult numerous organizations including the FWS and the National Marine Fisheries Service. These organizations follow a regulatory procedure in which they publish data about these candidate endangered species and seek further input from other professionals. After a candidate is considered, it can take 12 months of deliberation to rule whether the species warrants legal protection.

This long process and involvement of so many organizations requires much effort and funding. According to the FWS, the budget for listing species in

2012 alone was over $22 million ("FY 2013"). Adding a species to the list is only the first step of many. When a species is recognized as endangered, Congress must put together a formal plan to being maintenance and recovery of the species. According to Tear et al., the "ultimate goal of these plans is 'to restore the listed species to a point where they are viable, self-sustaining components of their ecosystem'." To achieve this measure of restoration, the plans must discuss the three elements designated by a 1988 amendment to the ESA: they must outline the exact course of action to enact the plan, they must calculate the expected time and cost to complete the plan, and they must list criteria the species population should meet before ever being delisted ("Recovery"). Steps in the recovery process may include capturing animals for captive breeding programs, translocating animals to reserves or predator-free areas, and regulating or restoring habitat.

Congress has approved hundreds of recovery plans since 1973. Each one can be implemented only through dedication of time and money. In 2006, the average cost among 20 plans was $15.9 million; one plan alone to recover the whooping crane had an estimate of $125 million through 2035 (Nazzaro 4). However, many of the estimates in these 20 plans covered a period of only 5-7 years with no predictions of cost in regards to the decades it may take to recover species populations. Plans are not costly for only reasonable goals—they can misappropriate funds to even futile causes. Some listed species, such as tigers, may have populations as meager as a few hundred that continue to dwindle, but use $41 million in funds (Chadés et al. 13938). Other species may no longer exist at all, yet still receive funds for recovery programs. Iadine Chadés et al. refer to these species as "cryptic," and point to the ivory-billed woodpecker as an example. With no conclusive evidence in over 10 years that any of these woodpeckers still survive, the species still received over $20 million in conservation funds (Chadés et al. 13938). When the government suspects a species of having gone extinct, they should direct funds and donations to other goals and not continue to funnel them into lost causes.

If the ESA's recovery plans produced significant results, these millions of dollars in funding the plans would be justifiable. But many recovery plans are not equipped to help biologists bring species populations back to a level of least concern. Such plans do not contain necessary information or foresight needed to truly recover species. Despite the guidelines required in composing plans, a large percentage of the documents do not adhere to them in full. In a 2006 review, only 5 out of 107 plans included the integral information about recovery criteria (Nazzaro 4). Recovery criteria covers the five factors of delisting species, or the "5-factor analysis." Questions asked in this assessment include: Does the species face habitat loss? Does commercial use or hunting threaten populations? Is predation or disease a continued risk? Are there any current regulations on the species that

offer no protection? Do humans or natural causes contribute to the decline of the species? ("Delisting"). If these questions are not answered and addressed, the plan does not provide an adequate course of action. While the species may obtain official protection and regulation, it may not ever obtain assistance in recovery. Protection only puts the species under law to prohibit harm; regulation provides rules for how humans may interact with, study, or document the species. Recovery is only step that promotes programs not only to protect existing populations, but to increase population numbers with the goal of removing the species from the list. Unfortunately, this vital aspect of the ESA is not always included in plans for conserving endangered species.

Lack of thorough structure in the plans is evident in their outcomes. An unfortunate irony is that the goals of plans often "risk extinction rather than ensure survival" (Tear et al.). Some plans, such as that for the whooping crane, do not contain criteria for delisting at all because even considering delisting is "not feasible" (Johns et al.). Although the crane faces a high risk of extinction and receives millions of dollars in funding, it has little hope for full recovery. In 2010, only 535 whooping cranes existed, spread throughout 3 locations in the wild and 12 in captivity; only one population in the wild was classified as "self-sustaining" ("Whooping Crane"). The crane was listed as endangered in 1967, and it has taken 50 years for the population to increase from 15 to 250. Scientists estimate that before the whooping crane can be considered safe from extinction, the population must consist of 1,000 birds ("Annual"). If the population continued to grow at the same rate, it would take over 200 years to reach the point of stability. For this reason, Congress gives no guidelines for delisting the crane and focuses primarily on conserving the existing population. The whooping crane is one of many species suffering a similar situation; in 2006, 82% or over 1,000 species had recovery plans (Nazzaro 2). Considering that only 28 of those species had been delisted because of success of the recovery plans, the ESA's assistance in restoring species populations is slight.

While it may be true that the ESA has aided in preventing 99% of listed species extinctions, roughly 1% of these listed species in over 40 years have recovered populations ("Preserve"). The ESA has excelled in keeping species alive, but has failed in restoring their numbers to ensure extinction will no longer be an imminent threat. Many people may argue that having saved such important keystone species as the North American brown bear and gray wolf is worth the effort of the ESA; 90% of Americans believe that the ESA is important in helping species, and 87% believe the ESA has been successful in protecting wildlife (Schlickeisen and Clark 5). Despite its limited successes, these people direct attention to the fact that saving few species is an achievement when compared to saving none. Research suggests that without protection from the ESA, 262 species

would have become extinct by 2003 (Falberg 154). However, other people have reason to point out that the approaches of the ESA continue to be misguided. As Nuñez and DiMarco state, recovery plans for keystone species are "problematic" and "controversial." While the 2003 study indicated that 262 species would have gone extinct without the ESA, 35 endangered species did go extinct. Data from the IUCN gave evidence of populations of endangered species in general decline (Falberg 154). Rather than spend millions of dollars on recovery plans that do not actually anticipate recovery, the ESA should instead focus on species that are more likely to recover.

The FWS attempts to prioritize recovery plans, but prioritization has not eliminated misguided effort or misappropriated funds. Some species like the ivory-billed woodpecker receive funds without proof that it still exists, while other species receive a disproportionate amount of funding relative to how likely they are to recover. In 1995, over half of the ESA's funds poured into only 10 species, 4 of which were salmon—from 1991 to 1999, over $2 billion was spent on recovering salmon, with "very little to show for it," according to Elizabeth Megginson, chief counsel to the House Resources Committee (qtd. in Baker). As of 2016, salmon of this genus were extinct in 40% of their habitat, with prediction that 44% of existing populations are also at large risk of extinction. Out of 214 runs of salmon, almost half are labeled at "high risk for extinction," with 106 populations in 4 states already having disappeared (Harrison). One of these species of salmon was the Chinook salmon, a vital keystone species that serves as a main food source for many predators. Even if such a species plays an important role in its ecosystem, one must ask the question: "Is it better to assist one species that may have little hope for recovery, or to put funding and efforts into more achievable plans that are far more likely to succeed?"

One may argue that assisting the one keystone species is the step that will benefit every surrounding species; thus the keystone should remain the main target of conservation efforts. The keystone may play a role of predation in keeping other species at an appropriate population level, or the keystone itself may be an important food source, such as the salmon. As in Paine's study with starfish and barnacles, the absence of one species can lead to overpopulation of another that competes for resources until all other species become crowded into extinction (Paine). The extinction of any important species could have disastrous effects; many people consider the cost of recovering species a small price to pay when compared to the possibility of losing an ecosystem. According to the Endangered Species Act itself, species of both plant and animal "are of esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people," and conservation of wildlife and ecosystems are a necessity. Because the

world could not function without ecosystems, why then consider withholding even futile conservation efforts from a keystone on which ecosystems rely?

Misguided Efforts: Keystone Extinction Does Not Kill Ecosystems, and May Detract From More Reasonable Goals

One reason keystones should not be regarded as the sole hope for an ecosystem is that research on them is not always concrete enough to provide evidence for the fact. To determine the effect a species has on its neighboring species and environment, painstaking research must be done. Because each ecosystem has variables, a study of one species in one setting may not apply to the same species in a different area. Even the first step of determining which species are keystones is challenging. According to Power et al., authors of the article "Challenges in the Quest for Keystones," the most effective way to identify a keystone species is by manipulation. This involves removing a species from its habitat and observing the changes that occur in the ecosystem, as Robert Paine did in his experiment on the coastal marine ecosystem. However, capturing and removing species from an area is not always practical or even achievable at all. In some cases, even if the target is manipulated, there may be other species acting as keystones in combination with the target species, leading to the conclusion that groups of species behave jointly as keystones (Power et al. 613). Such a relationship involves mutualism, in which the survival of one species is entirely dependent on another. One study offers the idea that even certain species of ant and herb may be keystone mutualists—the herb produces seeds having a "food body" structure that is a food source for ants, while the ants collect and disperse these seeds and allow more of the plants to grow (Ness et al. 1793). In situations such as this, involving many complex relationships, it becomes even more difficult to pinpoint what role a species plays.

Not only does identifying keystones pose a challenge, it also may take years to observe any consequences of the study. Robert T. Paine's experiment with the starfish lasted 25 years; studies on terrestrial species can take even longer than those on aquatic species (Power et al. 613). In researching sea otters as a keystone species, scientists studied their populations, behavior, feeding habits over a 10 year period (Konar 273). Another difficulty arises for species that are circumstantial keystones. According to Nuñez and DiMarco, a species may be a keystone for a period of time, such as in dry years, but not play a keystone role in wet years (229). Certain plants may grow in times of drought that supply food for herbivores, but in years with heavy rainfall, other plants grow abundantly and provide food, relieving the dry-year species of its burden. Because studying keystones is complicated and time-consuming, scientists cannot say without doubt exactly how important a given species may be in its ecosystem. Research on keystones in gen-

eral is so difficult that "much of what we know about [them] has come from studying the results of overhunting or overfishing" instead of organized research in the field" (Power et al. 613). Therefore, it is impossible to declare any certain species as being the only for its ecosystem. While keystones are important in their niches, their losses do not indicate an immediate fate.

Although at times presented as fragile, ecosystems are resilient and can recover from loss and harm. An ecosystem relying too heavily on a single factor would be a great risk, because if a pressure affected that single factor, the other components of the ecosystem would crumble. Ecosystems are composed of living things that adapt and react to pressures in order to survive. Even complete devastation by a disaster such as fire cannot permanently destroy an ecosystem—in the process of succession, a forest can progress from a vacant field of ash to a vibrant ecosystem flourishing with life. Some species actually rely on disasters to survive. Pyrophytic plants, many of which are gymnosperms like pines, resist or benefit from fire. One such tree is the longleaf pine; this tree withstands fire, and when most other plant life is destroyed, this species has little competition for nutrients and space and can establish itself as a dominant plant population (Boyer). Other trees, such as jack pines, need the extreme heat of fire to open their cones and release seeds. Because ecosystems not only are equipped to recover from disaster but may even contain species that rely on such disaster for survival, little can be done to destroy an ecosystem permanently. Ecosystems can recover from the loss of a keystone just as they can recover from complete destruction.

Rather than focus on conservation of a species that has little chance of success, the ESA's efforts should shift to helping the environment readjust. Some species can fill the niche previously held by another, even if the species had been a keystone. These species are said to have a factor of "functional redundancy," because their role can be filled by another species in the same environment (Nuñez and DiMarco 226). According to Kang et al., "The redundancy hypothesis proposes that some species may be ready at all times to expand their ecosystems 'jobs' to compensate when neighboring species go extinct." One idea on which research has recently begun is human assistance in choosing species with functional redundancy.

A handful of studies have been conducted by introducing nonnative species to environments in which native keystone species have become extinct, with results showing signs of success. An article by Brigitte Osterath explains the ongoing project in the Île aux Aigrettes islands that involves restoring the ecosystem and introducing foreign species. Two species of giant tortoises, the domed Mauritius giant tortoise and the saddle-backed Mauritius giant tortoise, were keystone species on the islands before going extinct. To fill the vacancy in the newly growing ecosystem, scientists began introducing different species of giant tortoises

from the Seychelles Islands. The nonnative Seychelles tortoises fulfill the same role—seed dispersal—as the extinct native species (Osterath). Martin A. Schlaepfer, a professor of biology, states that nonnative species have "contribut[ed] to achievement of conservation objectives." He explains how nonnative species can provide shelter or be a food source, such as plants; one such species, the tamarisk (salt cedar), became integrated in an ecosystem as nesting sites for an endangered species of bird (Schlaepfer et al. 430). Introduced species of bird in Hawaii function as essential components of seed dispersal. An unexpected example of successful species invasion is the honeybee in North America. Research shows that the honeybee, a keystone pollinator, was brought to America from Europe in the 1600s ("Research"). In rare instances, nonnative species can become such an important and accepted part of an ecosystem that it is difficult to imagine life without it.

Success of projects like that of the tortoises does not imply, however, that introduced species should replace extinct ones in every situation. Introducing species poses a risk of the nonnative species crowding out native ones and disrupting the ecosystem. When species are considered as possible keystone replacements, they must be determined to pose little reasonable threat of disruption. The tortoises, for example, reproduce slowly and do not predate on many other species; therefore, because they fulfill the same role as the native species and have no qualities that could endanger other species, they were excellent replacements for the extinct keystones. In many cases, introduction of species has been harmful—in Australia, invasive rabbits and cane toads overtake the habitat of endemic species. However, with careful research and study, replacing keystones can be an option in some situations. Because nonnative species can at times take over keystone roles, it can be more beneficial to the ecosystem to refrain from exhausting efforts on vanishing keystones and instead work toward restoring the ecosystem before the situation becomes dire.

Human Intervention: A Death Blow to Keystones

While funding and the availability of other options are reasons to withdraw misguided efforts from endangered species, the most urgent reason that human intervention often has an adverse effect on wildlife. By engaging in efforts to conserve species, humans can exert pressure on the population until it dwindles at a much faster rate. According to Holly Dublin, Chair of the Species Survival Commission with the IUCN, 99% of extinctions are directly related to human activity. However, human factors such as hunting, poaching, pollution, and habitat destruction are not the only causes of population decline—attempts to conserve species can push them closer to extinction. Species decline can be greatly accelerated through the very programs designed to reverse it.

Multiple factors contribute to this seemingly paradoxical consequence of conservation. One reason that protecting species may cause them more harm is that laws associated with the ESA can discourage people from seeking to assist in protecting endangered species. The government has utilized the "take" clause found in Section 9 of the ESA to regulate any land that is habitat, or could be habitat, for an endangered species. This does not only affect conservationists or managers as discussed previously. Any private landowner can suffer because of these regulations on species and habitats. Even if an endangered species has not been found resident on a property, the property can still be regulated on the terms that it offers suitable habitat; altering this property falls under the penalties for unlicensed destruction of habitat. Such stringent regulations prevent people from doing with their property as they wish. Even chopping down old trees near one's home may be punishable by both fines and jailtime, because certain trees are inviting habitat for endangered species. T. R. Mader, research director at the Abundant Wildlife Society of North America, offers in particular one case of the ESA interfering with the lives of landowners:

> An elderly couple in Georgia, needing money for medical expenses, sought to sell timber on their private land only to be stopped by a bird, the red-cockaded woodpecker. No, the bird doesn't live on their land, but U.S. Fish and Wildlife Service (FWS) and the Georgia Forestry Commission officials reportedly found 17 trees with 'possible' abandoned red-cockaded woodpecker nests. The family has lived there for 80 years. Nobody, including the FWS, has ever seen this woodpecker on the property. (qtd. in Reiland)

To avoid having their land under government control, some people feel they must take preemptive measures. Robert J. Smith, director of environmental studies at Cato Institute in D.C., summarizes how these people interpret the government's use of the ESA: "Make sure there is nothing on your land that might attract wildlife or rare species. It will merely bring oppressive attention from federal bureaucrats" (qtd. in Reiland). Preemptive measures against property regulation can be drastic, and the brusque colloquial term for them reveals the lengths landowners may go to in order to avoid regulation. The "3 S's"—"shoot, shovel, and shut up"—is a tactic used to remove endangered species or habitat for them from a property before the government places restrictions on how landowners may use their property (Anderson). The presence of endangered species on property has been devastating in some cases. In a drought that swept California, one family of farmers had to watch as 1,000 acres of almond trees died without water. Because an endangered species of fish, the delta smelt, lived in many water bodies, the water could not legally be exported or used for farms (Noon). Because limitations on property can cost hundreds of thousands of dollars in loss, private landowners

may resort to clandestinely killing endangered species or destroying their habitats to retain rights to their property.

The ESA does not lead to destruction of species and habitat only by regulating them. It can also lead to greater destruction even through the small step of announcing a species as endangered. Species cannot be protected, regulated, or restored unless they are acknowledged as endangered, but recognition of endangerment leads to "perceived rarity" (Hall et al. 75). When species are pronounced rare, the value in markets such as exotic pets, hunting trophies, or products such as fur or caviar increases (Hall et al. 75). Rhinoceroses and elephants are hunted for their valued tusks, tigers and seals are hunted for fur, and sharks are hunted for use in delicacies. As more attention is drawn to a species through conservation efforts, the consumer base is more likely to grow and develop interest in obtaining these species or products derived from them. The more that the species is poached or hunted, the further its populations plummet, which only increases the rarity and therefore the market. This in turn leads to more poaching and hunting until the species becomes extinct. In the article "Rarity Value and Extinction," Franck Courchamp et al. refer to this cycle as the "anthropogenic Allee effect." The cycle is driven entirely by humans—exploiting a species for profit can be the single cause of its extinction.

However, while illegal acts of hunting or poaching have extremely detrimental effects by pressuring species extinction, legal institutions operating in the best interest of wildlife also cause irreversible damage. Zoos are important in offering both captive breeding programs and protected habitat for species. Because zoos play a large role in the conservation of species, they are exempt from the ESA's rules on transporting, exhibiting, and interfering with endangered species. In fact, only "sale and transport, and other non-animal husbandry related acts will be regulated" by the ESA (Grech). However, while zoos do much to conserve species, the attention they give to endangered species can worsen the species' conditions. As Matthew Chrulew explains in his article "Managing Love and Death at the Zoo," animals can be "subjected to *too much* love," and that their "membership of an endangered species singles them out for intense intercession on the part of concerned scientists." When the line of extinction draws too close, the few remaining members of a species may be viewed only in terms of how they are capable or reproducing to revive the species.

These individuals are put through rigorous breeding programs and often-invasive procedures to research their genomes and monitor their health. Chrulew gives a grim summary of the lives of these animals, which involves "regular testing, extraction of fluids, transportation, enforced tranquilisation, separation and recombination of social groups, imposed breeding, and the removal of offspring." The ethics of keeping species under constant human monitoring comes into play.

Their existences are never without human interferences, and without experiencing natural habitat or even natural behavior, the "wild" aspect of wildlife blurs. Even when extensive breeding programs succeed, the offspring produced in captivity and raised in the presence of human often cannot return to their natural habitats. Over one half of captive-born individuals die within one year after being released (Chrulew). For predator species like tigers, the number jumps to a 67% chance of death (Owen). Thus putting animals through the stress of monitoring and forced breeding to restore the population of endangered species can have little long-term benefit.

Organizations such as zoos also contribute to more rapid extinction rates because of a false sense of security. According to David Hancocks, former zoo director, "Many people now believe they don't have to worry about saving animals, because zoos are doing the job" (qtd. in Fravel). The more awareness that is raised for endangered species, the less people feel obligated to contribute their own efforts because of the belief that other support is already sufficient. When this occurs, donations and financial support is not adequate in funding the programs to conserve species. The Association of Zoos and Aquariums (AZA) offered a 2010 estimate that out of over 200 accredited zoos and aquariums, less than 2% of their budgets was used for conservation projects (Kaufman). Because human intervention is invasive and does not boast great success in population or conservation, it is more harmful to clamor about keeping a species alive than to allow it to disappear peacefully.

Conclusion: Solutions to the Conservation Dilemma

Protection, conservation, and restoration efforts are important for both humans and wildlife. However, these worthy goals when acted upon with misguided approaches cause far more destruction than good. When work, time, and funds are put toward goals that are not achievable, these resources are robbed from more manageable goals. Conserving species is necessary, but not to the extent that the endangered species, neighboring species or humans suffer as a result. Losing keystone species is devastating, but when conserving them is more detrimental to their wellbeing than allowing them to naturally go extinct, people should not interfere.

Many steps can be taken in improving the situation. People should not fully withdraw from conservation, nor should the ESA be repealed. Rather, the ESA can be reorganized to manage species. As Jamie Clark explains, adjustments to how the ESA operates would be beneficial. Increased habitat protection could prevent population decline because of habitat destruction before the population decreases to a point of concern. More effective species prioritization would also be an improvement. Clark states that new rules should better clarify what level of

protection a species requires suited to its specific needs, which would allow resources to be better used for the species most in danger (Clark 925). Prioritization has proved to be a success—in New Zealand, 100 more species were assisted for the same amount of money than without prioritization (Clark 925). Better management of funds in services such as the U.S. Fish & Wildlife Service would allow more efficient sharing of information and tracking data on populations.

Additionally, people should be given more incentive to engage in conservation and not be deterred by threats of confiscated property, fines, or imprisonment. According to Bill White, field chief of the Missouri Department of Conversation's private land services division, private landowners are "the key to conservation success" (qtd. in Dufur). Because over 60% of the land in the United States is privately owned, landowners can be assets in projects to improve habitat conditions for endangered species, planting trees or other plants to offer shelter or food for the species, or restoring wetlands and other vanishing habitats ("Challenges and Opportunities"). Therefore, landowners should be given more government assistance and exemptions from lawsuits in their projects. As Anderson states, "Rather than publish private landowners who conserve wildlife, we should reward them for serving the public's interest" (Anderson). Individuals who wish to aid in conservation should be given the freedom to do so; this freedom could provide a far greater opportunity for endangered species to rebound.

While it is often dangerous to endangered species for humans to become involved, the problems with the ESA and the system of protection, conservation, and restoration can be remedied. However, the ESA has not been updated to reflect changes in society: "[a]lthough our scientific understanding grows incrementally over time, the law, itself, does not undergo a similar evolution—it changes only when Congress modifies it" (Rohlf et al. 859). The situation is not hopeless, but it is up to the government to amend the laws in ways that will provide the most assistance to endangered species. Until these changes are made, it will be better—and kinder—to allow our endangered species to go extinct.

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