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Chapter 5

Acceptable Risk of Extinction in the Context of Endangered Species Policy

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Laws and policies protecting endangered species are motivated, in part, to mitigate anthropogenic losses of biodiversity. These laws and policies operate essentially by providing special protections for species deemed to have an unacceptably high risk of extinction.

The assessment of extinction risk involves both a descriptive evaluation and a normative judgment. Descriptive evaluation of extinction risk is a largely scientific endeavor that involves synthesizing knowledge of a species in the context of a mathematical model of the species' population dynamics that produces a quantitative estimate of extinction risk. For example, red wolves in North Carolina (USA) are believed to have at least a 50 percent risk of extinction over the next forty years (Faust et al. 2016). Extinction risk assessment also entails a normative judgment about what levels of extinction risk are unacceptably high—obligating citizens of a nation (or group of nations) to provide special protections.

Much attention has been given to the descriptive element of extinction risk. That effort is valuable for developing conservation priorities—as such priorities depend on knowing which species are at greatest risk (within a nation or across the globe).

In sharp contrast, relatively little has been done to understand the normative dimension of assessing extinction risk. That is, we lack a robust understanding of what counts as an unacceptably high risk of extinction. We do not know how impacted a species should be before we owe it special protections. We do not know how much improvement should be realized in an impacted species of conservation concern before we can say, as a community, we have done well by this species. Put plainly, we do not have an adequate common understanding of what it means for a species to be an endangered species.

In addition to being generally underattended, normative judgments of extinction risk tend to be conflated with descriptive evaluations of extinction risk. In this chapter, we explain how these shortcomings represent a grave obstacle to realizing the purpose of endangered species policy, which is to lessen the rate of anthropogenic losses of biodiversity.

We also explore ideas that would lead to adequate normative judgments. We do so, in part, by recognizing that environmental policies pertaining to air and water pollution generally entail well-developed normative judgments about what counts as acceptable risk. In those contexts, acceptable risk tends to be influenced and ultimately judged by some combination of statutory guidance, decisions or guidance provided by policymakers, the common practice of experts, and what is tolerated by the public.

Finally, we illustrate our exploration of these normative judgments in the context of an important tool of international policy (the Red List of Threatened Species developed by the International Union for Conservation of Nature, IUCN), international policy (European Union's Habitat Directives and the Convention on International Trade in Endangered Species, CITES), and a federal law that is often taken as a benchmark for other federal laws (the Endangered Species Act of the United States, ESA).

THE BIODIVERSITY CRISIS

The justification and development of endangered species policy is importantly served by understanding basic principles of the biodiversity crisis. In the billion years since multicellular life first appeared, many hundreds of millions of species have come into existence via natural evolutionary processes, and nearly all of those species have gone extinct. Approximately 97 percent of all species that ever evolved have gone extinct. The salient point is that all species exhibit some natural level of extinction risk.

Each taxon has its own natural risk of extinction, which is reflected by the mean, taxon-specific lifespan of species over geologic time. For example, the average lifespan of a mammal species is approximately 1–2 million years (May et al. 1995). This corresponds to a natural risk of extinction of about 1 percent over any 10,000-year period.[1]

The biodiversity crisis is a concern that humans have increased the risk of extinction by 1,000 to 10,000 times (Mace 1998). We accelerated extinction from a process observable only over geologic time scales into one now observable over historic time scales. The severity of this crisis is indicated, for example, by concerns that an estimated 20 percent of the 40,000 species of mammal, bird, fish, and reptile inhabiting the planet are at significant risk of extinction over the next century.

The evolution of new species is a much slower process than current rates of extinction. Losses experienced during the Permian mass extinction were not recovered until approximately 10 million years had passed (Chen and Benton 2012). The current biodiversity crisis is expected to result in even greater losses. For every year the biodiversity crisis persists, many hundreds of thousands of additional years of restoration will be required.

The biodiversity crisis has another insidious manifestation. The global extinction of a species is preceded by local extinctions of that species as its geographic range contracts. (See figure 5.1 on the next page and Laliberte and Ripple [2004] and references therein.) The average mammal species has been driven to extinction over 68 percent of its historic range (Ceballos and Ehrlich 2002). The cumulative effect of these local extinctions is staggering and largely overlooked. Local extinctions have led to shocking losses of biodiversity for most regions of the planet. For example, at least 25 percent of the mammal species native to various regions throughout most of the United States and Africa have been driven to regional extinction (figure 5.1). More than 75 percent of the all mammal species have been lost from regions east of the Appalachian Mountains (USA) and the Saharan portion of Africa. These losses occurred since the colonization of North America by Europeans; elsewhere they occurred in historic times.

THE VALUE OF SPECIES

Ultimately, the biodiversity crisis is a crisis because we are destroying things of purportedly great value. The justification and development of endangered species policy requires understanding this value. What does it matter if a species goes extinct, globally or regionally? Scholars recognize three kinds of value that a species may possess: (1) intrinsic value, (2) instrumental value to humans, and (3) instrumental value to ecosystem functioning.

An object is instrumentally valuable if valuable as a means to some other end, and intrinsically valuable if valuable beyond its instrumental value or valuable for its own sake. While succinct definitions of intrinsic value tend to be abstract and easily misconstrued, the implication is straightforward: if something possesses intrinsic value, then we have an obligation to treat it with respect or fairly and with at least some concern for its well-being or interests (Vucetich et al. 2015). As such, it is wrong to harm an intrinsically valuable thing without an adequate reason for doing so.

Intrinsic Value of Species

One basis for acknowledging the intrinsic value of a species is their normally being homeostatic, resilient, and interconnected, and that those properties

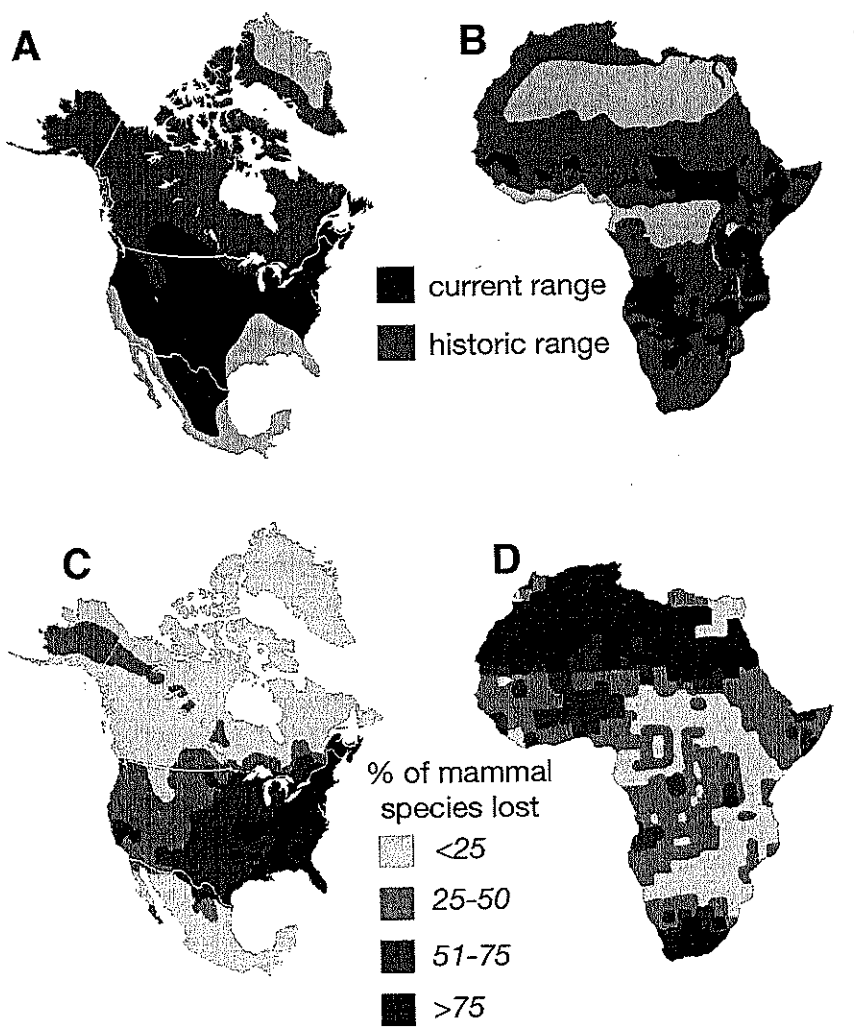

Figure 5.1. Many species of conservation concern are subject to extinction processes that involve contraction of geographic ranges as indicated, for example, by wolves in North America (A) and lions in Africa (B). The cumulative effect of many species' range contraction is that a large portion of species have already been driven to (local) extinction from most places on the planet. The magnitude of the loss is indicated, for example, by the percentage of mammal species that have been lost from particular regions of North America (C) and Africa (D). *Source*: Adapted from Ceballos and Ehrlich (2002), Bauer et al. (2016), and Bruskotter et al. (2014).

imbue them with intrinsic value (Leopold 1949). Those properties are sometimes said to characterize not only species but also ecological collectives—which include species, populations, and ecosystems. Some ecologists believe that ecological collectives are *not* well characterized by those properties (e.g., Davis and Slobodkin 2004). Nevertheless, whether an ecological collective possesses those traits is not entirely a scientific question, but is in an important sense a metaphysical question.

To highlight this metaphysical dimension: *Describing* the interconnectedness of a system is usefully considered a purely scientific endeavor (but see Putnam 2002). However, *judging* whether those interconnections are sufficiently intimate for the system to qualify, for example, as an organism involves significant metaphysical considerations (e.g., Eliot 2007; Ruse 2013). As such, it is relevant that many (if not most) people believe "nature possesses a delicate balance that is easily upset by humans" (Pierce et al. 1987, 60).

A second line of thinking (also developed by Leopold 1949) intends to support the acknowledgment of intrinsic value for ecological collectives. That line of thinking begins with the supposition that we humans, along with ecological collectives, are members of the same biotic community. In sharing community membership, and by extending the moral principles that apply to human communities, we ought to treat ecological collectives with respect.

Insomuch as species possess intrinsic value, then the biodiversity crisis is a moral crisis of monumental proportion.

Instrumental Value of Species to Humans

Some species are known to be of significant value to human well-being. Some species have unrecognized or undiscovered value to human well-being. And other species may be of little value to humans—compared to the effort required to maintain those species. These values to human well-being are diverse—economic value, value to health, religious value, recreational value, aesthetic value.

Instrumental Value of Species to Ecosystems

An important view among conservationists and environmentalists is that proper and healthy functioning of an ecosystem requires a full complement of native species (Leopold 1949; Noss 1990). As such, a species cannot realize its ecological value over portions of its geographic range from which it has been driven to extinction. If, for example, some policy intended to protect this value of a species, then it would almost certainly need to explicitly address elements of the extinction process that entail range contraction.

The Limits of Instrumental Value

Among species, large carnivores are sometimes portrayed as having particularly important instrumental value. As such, consider the limits of large carnivores' instrumental value:

> European colonists and their descendants drove various large carnivores to extinction over a substantial portion of eastern North America. Britain drove its large carnivores—wolves and brown bears—to extinction centuries ago. It is difficult to mount a case that the wellbeing of those humans is [consequently] worse. . .
>
> When an object (such as a species) is valued only for its utility, there is always a prospect that: (i) entire communities will fail to recognize (even innocently so) the utility of that object; (ii) the utility of that object will be outweighed by the cost of maintaining it; or (iii) the utility will seem to be replaced by some substitute.
>
> This is not a denial of species' utility. Rather it is an acknowledgement of how humans tend to treat objects that are valued only for their utility. This is no more than a claim that nature's utility is an (important, but) grossly insufficient motivation for conservation. Partial evidence in support of these claims is the degree to which arguments for conservation have recently relied on utility as a motivation for conserving species and the elevated risk of extinction of so many species. (Vucetich and MacDonald 2017, 216–17)

ASSESSING EXTINCTION RISK

The most complete and precise way to describe extinction risk is in terms of probabilities of extinction over specified periods of time (see figure 5.2 on the next page). With sufficient information, the extinction risk of any population or species can be quantified and displayed on a graph. For example, the dot on the lower graph indicates a species with a 40 percent chance of extinction within the next fifty years. The process of making such an evaluation is often referred to as population viability analysis. While locating a species on such a graph is a largely scientific (objective and non-normative) endeavor, most populations are too poorly understood to be reliably characterized in this manner.

To judge whether a species has an unacceptably high risk of extinction requires drawing a line across those graphs of extinction risk. The lower panel of figure 5.2 depicts a hypothetical case indicating regions of the graph where a species would be considered endangered. The placement of that demarcating line is deeply normative.

Conservation scientists had considered whether there might be some population condition—in particular a minimum viable size—for which a population would qualify as viable. Conservation scientists abandoned that idea, in part,

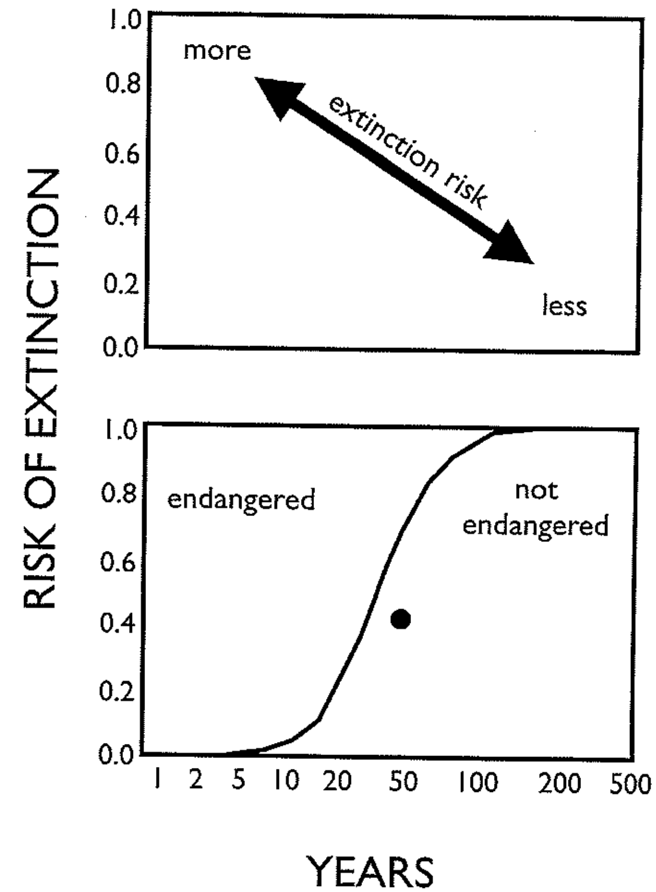

Figure 5.2. The most complete and precise assessment of extinction risk involves two dimensions—time and probability—and is quantified by probabilities of extinction over specified periods of time. The upper graph highlights a basic circumstance; that is, extinction risk is greatest in upper-left portions of the graph. The lower panel highlights a distinction between the scientific and normative dimensions of extinction risk. The dot represents the scientific endeavor of determining what place on the graph represents the most accurate description of a species' extinction risk. The line represents the result of a normative judgment that categorizes some levels of extinction risk as unacceptably high.

because extinction risk (and viability) is not so naturally treated as a dichotomous trait. They also explicitly understood that making judgments about acceptable extinction risk depended on what they were concerned would be arbitrary decisions about the time horizons and probabilities in figure 5.2 that would represent viability (e.g., Shaffer 1981; Boyce 1992; Brook et al. 2006; Traill et al. 2010).

Moreover, making this judgment requires advanced statistical expertise because the probability statements associated with extinction risk are notoriously easy to misinterpret, even for many conservation professionals (Vucetich and Waite 1998). Those difficulties arise from the extreme left skewedness of statistical distributions of times to extinction, an interest to understand the extreme left tail of those distributions, and the complex nonlinear relationship between extinction risk and population size. As a result of those properties, decreasing extinction risk from, for example, 20 percent to 10 percent (over some specified time frame) might require only a modest increase in population abundance; but decreasing extinction risk from 10 percent to 5 percent is likely to require a surprisingly large increase in population size.

To emphasize, the assessment of extinction risk involves both a descriptive (scientific) element and a normative element that should be informed by science, but entails much more. If figure 5.2 represented the only useful way to evaluate extinction risk, then normative policy judgments would be understandable only to an elite group of experts with the requisite statistical abilities. We shall see that figure 5.2 is not the only adequate means of assessing extinction risk.

POLICY TOOLS AND POLICIES

Having discussed the magnitude of the biodiversity crisis, the value of species, and the assessment of extinction risk, we are now prepared to consider several policy tools and policies as they pertain to the conservation of endangered species.

IUCN Red List

The IUCN has developed a Red List of species threatened with extinction. The list is widely considered the most authoritative global assessment of extinction risk. The Red List categories include three levels of threat (*critically endangered, endangered,* or *vulnerable*) and two levels of not threatened with extinction (*near threatened* or *least concern*). The criteria for each category are precise and measurable (in the objective and empirical sense). The complete set of criteria is complicated (IUCN 2001). Nevertheless, a useful sense of the criteria is indicated in classifying a species as "endangered" if the risk of extinction within five years exceeds 10 percent and as "critically endangered" if the risk within ten years exceeds 50 percent. Determining a species' status according to such criteria requires data that is often unavailable. As such the IUCN has also developed criteria that require less information—classifying a species as "endangered" if the

extent of its geographic range is <5,000 km^2 and as "critically endangered" if the extent is <100 km^2.

Architects of the Red List criteria (Mace et al. 2008) and custodians of the list (IUCN 2017) emphasize that the Red List is no more than an objective ranking of species at more or less risk of extinction. For example, they write (IUCN 2001, section 11), "The category of threat is not necessarily sufficient to determine priorities for conservation action. The category of threat simply provides an assessment of the extinction risk under current circumstances." Yet, Harris et al. (2012, 64–65) asserted—without explanation—that the IUCN Red List "make[s] normative decisions that include risk tolerance in the designation of category boundaries." (See IUCN [2001] for more details, and Mace et al. [2008] for the development and justification of Red List methods.) A careful reading of those documents reveals only an emphasis on the objective nature of the list criteria. However, the assertion is well founded insomuch as the labels assigned to these categories (e.g., threatened and not threatened) represent an *implicit*—yet influential—normative judgment, that is, species that fit the criteria of threatened *should* receive special protection, but not otherwise.

That cryptic influence is almost certainly present in, for example, two Red List applications celebrated by the IUCN (IUCN 2015), that is, the United Nations' Millennium Development Goals and the Aichi Biodiversity Targets of the Convention on Biodiversity. In both cases, the goal is framed in terms of the Red List Index, which is calculated from "genuine" changes in the number of species in each Red List category. More precisely, the goal is an increase in the index, indicating a lessening rate of biodiversity loss. The cryptic normative influence is indicated, for example, in that a real-world (objective, empirical) change in the rate of biodiversity loss can be made to appear as a greater (or lesser) change in the index depending on the (normative) boundaries of the threat categories.

IUCN Red List criteria are one of many sets of criteria for threatened species. Others have indicated how these lists are generally vulnerable to the cryptic influence of normative considerations when used in a less-than-thoughtful manner for setting conservation priorities and justifying policies that constrain activities that would further imperil species on the list (Possingham et al. 2002; Grammont, Paloma, and Cuarón 2006).

Rodrigues et al. (2006, 75) write:

> Over the past two decades, there have been long debates regarding the Red List criteria, as a result of which the Red List structure is now remarkably sound. These disputes have now largely subsided, and future debate is less likely to be concerned with the criteria than it is with Red List process and implementation.

The considerations presented here suggest it may be unwise to move past discussions about the underattended normative influence of the criteria themselves.

U.S. Endangered Species Act

The IUCN Red List is an interesting contrast to the U.S. Endangered Species Act of 1973 (16 U.S.C. Sections 1531–1544) (ESA). The Red List emphasizes descriptive evaluation of extinction risk with a focus on precise, quantitative, empirical bases for ranking species. The Red List is then used by others to advance various normative agendas for conserving species. By contrast, the ESA—being a law—is its own normative agenda. This normative agenda is framed by the language of the law itself. In particular, the ESA expresses concern over anthropogenic loss of biodiversity:

> Various species . . . have been rendered extinct as a consequence of economic growth and development untempered by adequate concern and conservation; other species . . . have been so depleted in numbers that they are in danger of or threatened with extinction; these species of fish, wildlife, and plants are of esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people. . .(Sec 2(a)(1–3))

The ESA is explicit about its normative purpose:

> The purposes of this Act are to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved [and] to provide a program for the conservation of such endangered species and threatened species . . . (Sec 2(b))

That normative purpose is further contextualized where the ESA requires:

> Giv[ing] priority to those endangered species or threatened species, without regard to taxonomic classification, that are most likely to benefit from such plans, particularly those species that are, or may be, in conflict with construction or other development projects or other forms of economic activity. . .(Sec 4(f)(1)(A))

Finally, the ESA obligates Americans to invoke special protections for endangered species, most importantly: (1) prohibition on take[2] and (2) development and implementation of a plan for recovery. Given those obligations, it is important to ask: What is an endangered species? That is, when does the risk of extinction become unacceptably high such that those special protections ought to be invoked?

The determination of acceptable risk in the context of law and policy has been more thoroughly studied in the context of air and water pollution policies (e.g., Hunter and Fewtrell 2001). In that context, acceptable risk is often conceived in terms of maximum allowable concentrations of some pollutant and that concentration is often causally linked to the risk of some adverse outcome—often framed in terms of human health or the economic cost

associated with some impact on human health. The scholarship on acceptable risk in that context indicates that acceptable risk is typically determined by some combination of the following influences:

1. statutory guidance,
2. decisions or guidance provided by policymakers,
3. the common practice of experts, and
4. what is tolerated by the public.

For emphasis, this broad list represents a description of how acceptable risk tends to be determined, not a justification for how it ought to be determined. Below we consider each of those four influences, as they might apply to judging acceptable risk in the context of the ESA. Doing so sheds light on general concerns over the development and evaluation of policies pertaining to species conservation.

Statutory Guidance

The ESA provides important statutory guidance on acceptable risk of extinction through its legal definition of an endangered species, which is (Sec 3(6)) "any species which is in danger of extinction throughout all or a significant portion of its range." The ESA was preceded by two similar laws, the Endangered Species Preservation Act of 1966 (Public Law 89–669) and Endangered Species Conservation Act of 1969 (Public Law 91–135), which both required protecting a species only when the entire species was in danger of extinction with the intention of merely preventing global extinction (Sec 1(c) of P.L. 89–669 and Sec 3(a) of P.L. 91–135). The ESA of 1973 is distinguished, in part, by redefining "endangered species" to include the concept of "significant portion of its range." In a 2005 case, a U.S. federal court concluded (*Defenders of Wildlife v. Norton 2005*): "The new definition's expansion to include species in danger of extinction 'in *any* portion of its range' represented 'a significant shift in the definition in existing law which considered a species to be endangered only when it is threatened with worldwide extinction'" (with the judge quoting a U.S. House of Representatives Report 1973, 149, emphasis in the original report). In this regard, Congress indicated its intent for a recovered species to be reasonably well distributed throughout its historic range to the extent feasible. This understanding of "endangered species" has been supported by approximately a dozen court cases (Enzler and Bruskotter 2009; Greenwald 2009).

The ESA's legal definition also follows from the synthesis of the ESA's stated purpose and scientific understanding of extinction processes. In particular, the purpose of the ESA is to mitigate anthropogenic increases in extinction risk, and conservation science indicates that anthropogenic extinction risk (i.e., risk beyond "natural" risk, which would occur in the absence of adverse human impacts) is marked by the extent to which a species' geographic range has been reduced in relation to its range prior to having been impacted by humans (Gaston and Blackburn 1996; Purvis et al. 2000; Diniz-Filho et al. 2002; Jones et al. 2003). That geographic range is usefully labeled "historic range."

Some object to basing conservation goals on some historic condition because doing so would be arbitrary. The objection is often expressed with rhetorical questions: what point in history? the Pleistocene? the dawn of historic times? the Industrial Age?[3] That concern about referencing an arbitrary point in history is addressed, for example, by letting conservation aim to maintain or restore—to the extent feasible—species to their condition at the time just before humans began treating a particular species unfairly, or—as expressed in the ESA—treated in a manner that is driven "untempered by adequate concern" (Sec 2(a)(1)). The standard is normative, but not arbitrary. What matters is whether a good reason can be offered for any standard. That reason may or may not be associated with a point in history.

The legal definition is also consistent with the ESA's acknowledgment that species possess "ecological" value. The ESA does not define ecological value, but conservation science would suggest that ecological value refers to the idea that ecosystem health depends on an ecosystem being inhabited by a full complement of native species. A species cannot manifest its ecological value on portions of its historic range where it no longer persists.

In plain language, the ESA indicates that a species is no longer endangered when it securely occupies a large portion of its historic range. Beyond the reasons offered here, this view is supported by ecological knowledge, scholarly analysis, and judicial review—topics that have been discussed extensively elsewhere (e.g., Vucetich et al. 2006; Bruskotter et al. 2014, and references therein). While that statutory guidance is substantive, it also raises an important unanswered question: What constitutes a *significant* portion of range? We return to that question later.

Administrative Guidance

The Fish and Wildlife Service (FWS) is the agency responsible for administering the ESA. Important elements of that administration include deciding what species should be protected by the ESA (listing decisions) and when ESA protections are no longer required (delisting decisions). Delisting decisions are, in principle, to be guided by recovery plans, formal documents required by law that include measurable recovery criteria.

The FWS seems to have difficulty understanding what counts as an endangered species. One indication of misunderstanding is, for example, that recovery criteria for a large portion of recovery plans having been set at or below the existing population sizes (Tear et al. 1993). Another indication of misunderstanding is that a large portion of species that are native to the United States and that qualify as threatened by the IUCN criteria are not protected by the ESA (Harris et al. 2012). The concern is that the ESA's stipulation about what counts as a threatened or endangered species almost certainly represents a higher standard than the IUCN criteria for threatened.[4]

Political forces during the 2010s aimed at weakening the ESA (e.g., Palmer 2017) coincide with recent FWS policies that weaken its implementation. One relatively new policy (USFWS 2014) indicates: (1) that an endangered species should be delisted when it is no longer at risk of extinction—period, and (2) if low risk of extinction can be realized on even a tiny portion of historic range, then that would be sufficient. The FWS policy arrives at this conclusion by asserting that a portion of geographic range is "significant" only if that portion of range is necessary to prevent the species from being at risk of extinction.

The new policy has drawn severe criticism by environmental groups and is being litigated out of concern that it contradicts statutory requirements of the ESA (CBD 2014). That policy also seems at odds with earlier delisting decisions by the FWS (e.g., bald eagle, gray whale, brown pelican, and American alligator), where being geographically widespread seemed an important element of recovery.

This new policy is also based on the FWS's view that the legal concept of "not being at risk of extinction" should be equated with the scientific concept of "viability." Moreover, repetitious attempts to justify the policy are found in a series of peer-reviewed publications attempting to make a case that viability and the assessment of extinction risk—in the context of the ESA—should be determined by entirely scientific matters (Waples et al. 2007, 2015, and references therein). One shortcoming of those publications is their conflating the normative and descriptive elements of assessing extinction risk.[5] Scientific processes cannot intelligibly—by themselves—determine what counts as acceptable risk. In other words: while understanding the legal meaning of "endangered species" (which includes the phrase "is at risk of extinction") requires both normative and scientific considerations, there have been voices arguing, in effect, that this understanding depends only on scientific considerations. In any case, there is value in asking whether any common practice by conservation scientists offers insight about acceptable risk.

Common Practice of Experts

As described earlier, a common practice of experts is to consider extinction risk in terms of probabilities of extinction over specified periods of time. Moreover, a recent review of ESA recovery plans indicates a tendency to consider a species endangered if extinction risk exceeds 5 percent over 100-year period (Doak et al. 2015). This pattern may be interpreted as an emerging common practice.

Judging whether a 5 percent risk of extinction over 100 years is acceptable should be informed by comparing that statistic with the "natural" risk of extinction, that is, risk that would occur in the absence of "economic growth and development untempered by adequate concern and conservation"—as stipulated by the ESA (Sec 2(a)(1)). The best-available science indicates that this natural risk of extinction is approximately 1 percent for any 10,000-year period.[6] As such it appears that experts' common practice is at odds with the purpose of the ESA for accepting risk that is several orders of magnitude greater than what is mandated by the ESA.

There are two important explanations for why experts would develop a "common practice" that contradicts the ESA's mandate. First, the computation time required for calculating extinction risk over 10,000-year time frames is prohibitive. Second, 100-year time frames are appropriate for the most common and reliable application of population viability analyses, which is to assess the *relative* extinction risk of various conservation actions (McCarthy et al. 2003).[7]

One of the very few instances where a scientist explained the rationale for focusing on a particular time horizon is Gilpin (1987)—arguing for a 200-year time horizon because humanity's immediate challenge is to eke through the next two centuries while losing as few species as possible. More generally, the recovery criteria in recovery plans are typically developed by experts, yet are not accompanied by any explanation for why those criteria would count as meeting the legal standard of the ESA. The lack of explanation is troubling because the most important distinction between "expert judgment" and the judgment of non-experts is the capacity of an expert to provide robust justification for his or her judgment.

Public Tolerance

To our knowledge, no sociological work has been conducted to understand the public's views on acceptable risk of extinction.

The most relevant sociological insights are broad public support for the ESA and a common belief the ESA should be strengthened. In particular, one study concluded that four of every five Americans are supportive of the ESA (Czech and Krausman 1997). That study also indicated that 49 percent

of respondents believed the ESA should be strengthened. Only 16 percent believed it should be revoked or weakened.

More recent polling suggests support continues to be high. One poll, conducted in 2011, indicates that approximately four of every five Americans are supportive of the ESA (Harris Interactive 2011). Another recent poll indicates that support for the ESA transcends political ideology, with self-identified liberals, moderates, and conservatives supporting the ESA at rates of 96 percent, 94 percent, and 82 percent, respectively (Tulchin Research 2015).

Convention on International Trade in Endangered Species (CITES)

CITES includes strong restrictions on trading specimens of species that appear in Appendix I of CITES. Appendix I is supposed to include "all species threatened with extinction which are or may be affected by trade." According to Article XV of CITES, a species is to be added or removed from Appendix I by a vote of the member parties after considering a proposal for addition or removal—a proposal that may be brought forth by any member party (CITES 2017). The criteria for listing—by which such proposals are to be compared—were based on IUCN Red List criteria and are essentially a less precise expression of those criteria (CITES 1994).

Acceptable risk of extinction in the context of CITES is determined essentially by the ability of a member party to convince a majority of other member parties—essentially an instance of political realism, opposed to political moralism.[8] While that approach may (or may not) be suitable given the context, our point is to highlight another invocation of acceptable extinction risk in policy that does not draw upon giving substantive attention to understanding what counts as acceptable risk.

The European Union's Habitat Directives

In Europe, the policy most concerned with stanching the loss of biodiversity is the European Union's Habitat Directives, which "direct Member States to take measures to reach or maintain the Favourable Conservation Status of natural habitats and species," where Favourable Conservation Status for a species is met:

> When population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis. (Epstein et al. 2016, 82, citing the Commission of the European Communities 1992)

Considerable attention is given to scientific and administrative elements of the Habitat Directives (e.g., Mehtala and Vuorisalo 2007; Louette et al. 2015). However, recent controversy over wolf conservation in Sweden indicates the greatest concerns may stem from its normative elements (Epstein et al. 2016).

PRIORITIZATION AND ACCEPTABLE RISK

NGOs devoted to conservation and government agencies charged with conservation are excruciatingly aware that lack of resources prevents fully advancing various and specific aims of conservation. That circumstance requires individual NGOs and agencies to prioritize efforts. That prioritization would include "explicitly accounting for the costs, benefits, and likelihood of success of alternative conservation actions" (Bottrill et al. 2008, 649). Botrill et al. (2008) and others have also indicated that an explicit accounting would involve determining which conservation projects are most efficient, where efficiency is equal to $(V \times B \times S)/C$ and C is the cost of the project, S is the probability of realizing the project's goal, given the expenditure of that cost, B is the benefit of the project to the particular object of conservation concern (say, an endangered species), and V is the overall value of this particular object of conservation concern. Understanding V requires making normative judgments. (See Vucetich et al. 2017 for details and critical caveats.)

An important element for developing justified prioritizations is ranking species' extinction risk, with tools such as the IUCN Red List criteria. However, ranking represents just one of several considerations for prioritizing conservation. Other important considerations include, for example, relative values of different species and likely conservation return for any given investment into the conservation of a particular species (Vucetich et al. 2017).

The normative claim that might arise from a policy—about what counts as acceptable risk—must be isolated from prioritization processes. This is so because determining that a species will not receive (adequate) conservation attention due to insufficient funds or infeasibility of its recovering is not the same as determining whether one has an obligation to give that attention in the first place. There are important signs that, at least, the FWS mishandles the distinction between these two processes (Nelson and Vucetich 2014; Evans et al. 2016).

CONCLUSION AND RECOMMENDATION

Conservation is the maintenance and restoration of ecosystem health and population viability. Conservation competes severely with other human

interests—some of those interests are matters of social justice, others less so, but still no less influential. The adjudication of those conflicts depends critically on an adequate understanding of what conservation is. As such, shortcomings in our collective ability to adequately answer the question, "What is an endangered species?" are problematic, and problematic for policies aimed at protecting biodiversity.

A robust answer to that question would benefit greatly from philosophic analysis whose outcomes are reflective of sentiments of thoughtfully engaged citizens (Daniels 2016). The philosophic analysis would, at a minimum, likely require:

1) Admitting nonhuman species—or at least the individual constituents of a species—as subjects of social justice. To be a subject of social justice means to be owed treatment that is fair and with at least concern for the subject's welfare. This admittance would be required insomuch as these nonhumans possess intrinsic value.
2) Framing discussion in terms that are congruent with the acknowledged instrumental values of a species. For example, if a species is valuable to ecosystem health, then the question about endangerment should be framed in terms of extent of geographic range.
3) Framing discussion in a manner that does not betray scientific complexities or exclude the vast majority of citizens from meaningful participation in the discussion. More specifically, that is, framing the discussion in terms of: what portion of a species historic range should be occupied, where historic range represents range at the time when humans began to treat the species unfairly.

The reflective aspect of answering the question would be greatly facilitated by:

1) Sociological research that elucidates more precisely: (i) what value people do or do not see in various nonhuman species and why, (ii) what people think about the portion of historic range that a species should occupy, and (iii) how and why the public's support for the ESA is high (see the Public Tolerance subsection earlier).
2) Conservation leaders in government and elsewhere taking a strong leadership role in creating a conversation about the key question, "What is an endangered species?" That leadership could, for example, take the form of roundtables and commissions. Another example of such leadership would be development of educational materials enabling citizens to understand and reflect upon the question. Ultimately, the purpose of such efforts would be developing dialogue that aimed for a common understanding of the *reasons* why any particular extinction risk should be judged acceptable or not.

At present this most basic question about the purpose of conservation is being addressed almost exclusively by an extremely elite group of technical experts whose capacity for handling normative issues may be meager.

NOTES

1. The statistic is based on the useful assumption that time to extinction is exponentially distributed. With the mean time of an exponentially distributed random variable one can calculate the probability of extinction for any specified period of time.

2. "Take" is a legal term, "mean[ing] to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."

3. Within the context of the European Union's Habitat Directives, some European countries take 2003 as the point in historic time to which conservation standards are based (McConville and Tucker 2015).

4. The Red List explicitly limits its concern to species "at risk of global extinction" and is explicitly not concerned with "depleted species" (Mace et al. 2008), that is, species greatly reduced (in number or distribution) but as yet with a low risk of global extinction. Depleted species appear roughly analogous to the ESA's legal definition of an endangered species.

5. Superficially, Waples's view might seem consistent with the ESA mandate that listing and delisting decisions be based "solely on the basis of the best scientific . . . data available." However, a proper reading of the ESA is that science shall be the sole basis for determining whether any particular species does or does not meet the (normative) conditions of endangerment—as stipulated by the legal definition of an endangered species.

6. See note 1 and associated text.

7. An important application of viability analyses involves estimating extinction risk for a population under difference scenarios, say conservation plan A and plan B. The result of such an analysis might, for the sake of illustration, be a 2.5 percent chance of extinction over 100 years under plan A and a 29 percent chance of extinction under plan B. For such analysis, the focus is often not on the *absolute* values (2.5 percent and 29 percent), but rather on the *relative* values (i.e., plan A involves much less risk than plan B).

8. We use the phrase political realism to refer, roughly, to the notion that public decisions are (or should be) resolved by various agents exercising power and persuasion. We used the phrase political moralism to refer roughly to the notion that public decisions should be governed by some set of *a priori*, moral-philosophic principles. See also Williams (2005).

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