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Environmental interference

Karen Kovaka[1]

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Abstract
One of the guiding ideas in modern environmentalist thought is that we shouldn't interfere with nature. It's better to leave it alone. Many of the arguments offered in favor of this presumption against environmental interference are epistemic. One such argument focuses on ineffectiveness. It says that conservation interventions often do not accomplish their goals. A second argument says that well-intentioned interference in nature produces many harmful unintended consequences. I show that these arguments do not justify the presumption against environmental interference. Both arguments depend on stronger claims, such as the claim that conservation interventions do more harm than good overall. Yet, evidence-based conservation studies do not support the idea that conservation interventions generally do not work, or that they do more harm than good. These facts seriously undermine the presumption against environmental interference.

Keywords Evidence-based conservation · Environmental interference · Conservation interventions · Unintended consequences · Evidence synthesis

Introduction

One of the guiding ideas in modern environmentalist thought, both popular and academic, is that we shouldn't interfere with nature. It's better to leave it alone. This presumption against environmental interference appears in the work of celebrated nature writers. It influences policymakers, land managers, and researchers as they make conservation decisions. If you survey members of the public about conservation-motivated interventions such as geoengineering or genetic editing, they worry about the riskiness of such interventions, because they involve messing with nature (Kohl et al. 2019; Visschers et al. 2017).

At the same time, conservation science is more and more embracing the idea of interference in order to save nature. The term "intervention ecology" (Hobbs et al.,

✉ Karen Kovaka
kkovaka@ucsd.edu

[1] University of California, San Diego, USA

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2011) is now common in academic circles, and Emma Marris's (2011) book Rambunctious Garden brought this idea to broader audiences over a decade ago. As a result, both appeals to and rejections of the presumption against environmental interference are central to nearly every contemporary conservation debate: Should we step in and help threatened species move to new habitats? Can we slow the rate of global warming by geoengineering the atmosphere? Will genetic editing allow us to save endangered species or eradicate invasive ones?

The presumption against environmental interference raises many philosophical questions. Most importantly: Is it justified? Do we have good reasons for accepting it? Unfortunately, while many philosophers have assumed the presumption against environmental interference is true, fewer have defended or critiqued it. When philosophers have addressed it explicitly, they have tended to frame the issue in moral terms: Is it wrong to interfere with nature?

And yet, if you look at the broader discourse about environmental interference, many of the arguments people offer against it are epistemic, and even primarily moral arguments may incorporate epistemic claims (e.g. Jamieson 1996 against intentional climate change). One epistemic argument focuses on ineffectiveness. It says that conservation interventions often do not accomplish their goals. Attempts to eradicate invasive species, for example, fail all the time (Pluess et al. 2012). A second epistemic argument focuses on unintended consequences. It says that well-intentioned interference in nature produces many harmful unintended consequences. Even when we do manage to eradicate invasive species, conservation interventions can harm the native and endangered species they hope to protect (Kopf et al. 2017). These two arguments are epistemic because they base the case against environmental interference on what we know—or don't know—about the effects of interference. Despite their influence in discussions about environmental interference, these epistemic arguments remain largely unexamined by philosophers,[1] and they, rather than moral arguments, will be my focus here.

I will show that the epistemic arguments from ineffectiveness and unintended consequences do not justify the presumption against environmental interference. Even if we assume that conservation interventions often or even usually fail, and that they do produce many harmful unintended consequences, this does not mean the presumption against environmental interference is true. It depends on stronger empirical premises that cannot be defended at present. Further, evidence-based conservation studies do not support the idea that conservation interventions do not work, or that they do more harm than good. These facts seriously undermine the presumption against environmental interference.

[1] Two notable exceptions to this generalization are a pair of papers by Michael (2001, 2002) and a more recent critical discussion by Brister et al. (2021).

The presumption against interference

The presumption against environmental interference is hard to pin down, despite the fact that it suffuses so much of our reasoning and decision-making about environmental conservation. Many philosophers have spoken in general terms of the "the principles of noninterference and restraint that stand at the center of a great deal of environmental thinking" (Preston 2018, p. S42).[2] These characterizations convey the spirit of the presumption, but it needs to be made much more precise. As we try to clarify its meaning, we will see that the most generous interpretation of the presumption is as a family of hypotheses that are still in need of empirical testing and support.

A starting point for our discussion is the fact that the presumption against environmental interference aims to guide both our reasoning and decision-making about environmental conservation. Given that context, I will make three assumptions about environmental interference: that it is inevitable, variable, and sometimes innocuous. Interference is inevitable because there is no such thing as intervention-free environmental conservation. A principle that condemns all interventions is one that people who are serious about conservation cannot follow. Interference is variable because not all interventions are equal. Some are better than others. Some may be catastrophic if implemented. Others may be crucial conservation tools. If the presumption against environmental interference is to accomplish its aims, it should provide guidance about which interventions to try and which to avoid, given that variation. Finally, interference is sometimes innocuous. There are at least some conservation interventions that we have no reason to be worried about. It is notoriously difficult to say which interventions these are, but many instances of cleaning up litter and shoring up stream banks are likely suspects.

Keeping these ideas in mind, let's ask why environmentalist thinkers have put so much emphasis on noninterference and restraint. It is certainly because they think interference is bad, but bad in what sense? Some hold that interference is bad by its very nature. For example, some have argued that interference necessarily embodies an immoral hubris (Kirkham 2006), is incompatible with natural authenticity (Elliot 1982), or reduces the value of nature (Katz 2014; Heyd 2005). One problem with such arguments is that they run afoul of the idea that interference is sometimes innocuous. They also imply that interventions, even when inevitable, are morally bad. Rather than denouncing interference entirely, I will draw on a different tradition, one that holds interference is bad because it tends to undermine widely held environmentalist values, such as the preservation of biodiversity.[3] On this view, even well-intentioned environmental interference tends to work against its own

[2] See also Tom Regan (1981, pp. 31–2) on "a principle of nondestruction, noninterference, and generally, nonmeddling" and Ben Minteer (2015, p. 16) on the "moral wisdom of ecological restraint.".

[3] The list of environmentalist values that interference may undermine is open-ended. The key point is just that, in cases where interference is proposed as a way of advancing environmental conservation, this view of the badness of interference says that interference is likely to have consequences that even those who advocate for it do not want.

goals—perhaps not always, but often—and this provides the basis for a presumption against it (see, e.g. the argument against intervening in nature to prevent wild animal suffering in Delon and Purves 2018).

On presumptions

Presumptions work by asymmetrically allocating the burden of proof (see discussion in Bodlović 2020). To hold a presumption against interference, then, is to evaluate proposals of interference more stringently than proposals of non-interference. It is to treat interventions as guilty until proven innocent, to take a default position against them.

Supports of the presumption have had little to say about how strong it should be, or of what is sufficient to overcome it. The presumption is certainly not a total prohibition on interference, but beyond that, a more concrete interpretation is lacking. On the picture I am developing, the question of how strong the presumption should be is related to just how self-undermining interference actually is. That is an empirical matter, and it gets to the heart of the epistemic arguments for the presumption, which we will examine in detail in Sects. "Epistemic arguments for the presumption" and "Assessing the effectiveness of interventions".

Setting aside the issue of strength for now, the most obvious interpretation of the presumption is as a principle that targets all interference categorically. That is, it tells us to adopt the same default position (weak or strong) with respect to all interference. But we should reject this obvious interpretation. There are two main reasons. First, this isn't what people mean when they endorse a presumption against interference. Second, and relatedly, this interpretation ignores the fact that interventions are variable with respect to their consequences. Some are harmful, some are helpful. Some are effective, some backfire. What we want is a principle that is sensitive to the variability of conservation interventions, not one that treats them all the same.

There are two ways we could revise the presumption to try to achieve this: we could reduce its scope from all interference to particular types of interference, or we could make the presumption scalar rather than categorical. Let's explore both options.

Distinguishing good and bad interference

A starting point for thinking about what human interference is comes from Mark Michael: "intentionally redirecting ecosystems, or purposefully altering them, causing them to go in a direction other than the one in which they would have gone had the intentional activity never taken place" (2002, p. 94). The this definition lumps together environmentally damaging activities such as logging with activities aimed at protecting or restoring nature, such as planting trees. The presumption against interference is only about the latter category of well-intentioned, or conservation-motivated, activities, so at a minimum we will limit ourselves to interventions of that sort.

This reduction in scope is still not enough: it does not yield a presumption that is sensitive to the variability of conservation interventions and which recognizes that some interventions are innocuous. What to do? We can try to deal with this overly broad definition in a variety of ways, but they raise new problems of their own. Consider two strategies: narrowing and naturalizing.[4]

The narrowing strategy involves adding criteria to what counts as interference so that innocuous conservation strategies are excluded from the category, and only worrisome or controversial ones remain. The challenge for this strategy is making a principled, non-circular separation between the innocuous conservation strategies and the worrisome ones. If we narrow the definition of interference to something like "intentionally redirecting ecosystems in ways that are risky or harmful or otherwise concerning," these qualifications build the badness of interference into the definition itself. Narrowing thus delivers us an unsatisfying principle that tells us environmental interference is bad because it is bad, and merely relocates the substantive debate about whether the presumption against interference is justified to the question of which conservation strategies count as interference in the first place. In order for narrowing to salvage the presumption, it has to devise a way out of this circularity.

One obvious route is to appeal to the concept of naturalness, rather than to concepts like risk or harm. This is the naturalizing strategy. Naturalizing involves saying that the presumption targets, not just any sort of environmental interference, but a specific sort: unnatural interference. The challenge then becomes explaining what is meant by 'natural' in a manner that avoids a series of well-known problems and pitfalls. 'Nature' has the dubious honor of being one of the most vexed concepts in environmental thought. There is so much disagreement about how to understand the idea that some thinkers have decided to give up on it entirely (e.g. Vogel 2002), while others have argued that the best we can hope for are many different definitions of naturalness which do not all align with one another (Siipi 2004, 2008). The essential problem is that humans are part of nature. Yet the function of the concept in environmentalist thinking is to set up nature as apart from or in contrast to the human world.

Environmental philosophers have spoken loudly and often about the hopelessness of salvaging the concept of nature from this basic difficulty, so I will not spend any more time on the issue here. While ideas about what is natural almost certainly explain the psychological appeal of the presumption against interference, there is no definition of the natural on offer that separates natural from unnatural interference in an acceptable way. Relatedly, ecological science no longer supports the idea there is a kind of a balance of nature which might ground naturalness judgments (Kricher 2009). In light of this, it is a bad idea to tie the fate of the presumption against interference to the fate of the benighted naturalness concept.

The failure of the narrowing and naturalizing strategies is instructive. It is going to be difficult, perhaps impossible, to proscribe the meaning of interference in a way that respects the variability of environmental interventions. Instead of continuing to

[4] For a related discussion of these two strategies, and a similar diagnosis of why they both fail, see Michael (2001).

try, I want to explore a different idea. What if we keep a broad understanding of interference,[5] but interpret the presumption as telling us to prefer less interference to more interference?

Minimizing interference

Suppose the presumption tells us, not to adopt the same initial attitude toward all interventions, but to prefer interventions that minimize interference.[6] This version of the presumption does not turn a blind eye to the variability of interference, or begrudgingly permit it as a last resort. Rather, it identifies a particular feature of conservation interventions—how much interference they involve—and advises that those that involve less interference are better, that is, more effective, than those that involve more interference. While no one in the literature has explicitly proposed this interpretation of the presumption against interference, it certainly captures the spirit of the idea while avoiding the downsides of treating all interventions as guilty until proven innocent.

But there is a massive caveat: it has to be feasible to conceptualize interference along such a scale, and to arrange conservation interventions (types, tokes, or both) along it. That means we would have to be able to answer questions like, which involves more interference: managing deer populations by reintroducing native predators like wolves, or by actively culling herds? What about assisting the migration of species whose habitat is threatened by climate change versus intensively managing that habitat in an effort to preserve it? Many people have strong—and conflicting—intuitions about such questions, and the answers are not at all obvious.

There is certainly a loose, intuitive sense in which some conservation interventions involve more interference than others. Spraying aerosols into the stratosphere to limit global warming appears to involve a lot of interference, while planting vegetation to control erosion involves less. But when we try to specify a scale of more-to-less interference, things quickly get complicated.

First, intuitions about naturalness may play a role in our intuitive judgments about the amount of interference different conservation interventions involve. Given the problems with that concept, we should be cautious about these judgments. Second, 'interference' is a complex concept with multiple independent axes. This means there are many possible scales for evaluating conservation interventions. Here are just a few: time scale, spatial scale, resource-intensiveness, the degree of desired change to some variable(s), the amount of disruptiveness to particular human or non-human communities, and the level of technology required. The fact that these dimensions are largely independent means actual conservation interventions will

[5] Adapting Michael's definition, but reducing its scope to conservation interventions alone: "intentionally redirecting or purposefully altering ecosystems *for the purpose of conservation*.".

[6] We could then interpret the presumption as applying to intervention types, token interventions, or both. For the sake of readability, I won't distinguish between these different potential interpretations in what follows.

involve lots of interference according to some scales, and not much at all according to others.

Perhaps some of these dimensions of interference are easy to eliminate from consideration. Interventions are not likely, for example, to be more effective when they occur on a smaller spatial scale, and less effective when they occur on a larger one. Still, even in a best-case scenario where we are able to whittle it down to a few dimensions that are candidates for arranging conservation interventions on a scale of more-to-less intervention, these remaining candidates will yield different arrangements. We will, in effect, be left with multiple versions of the presumption against environmental interference, and we will need to choose among them.

We are not in a position to make this choice now. The question is an empirical one: Which (if any) scales track the well-intentioned interventions that actually undermine environmental values?[7] So far, the discourse about the presumption against interference has asserted or rejected the idea that interventions, or an identifiable subset of interventions, are bad in this way, but no one—on either side of the debate—has specified versions of the presumption that are precise enough to test, much less explored the available evidence in a systematic way. Yet this is exactly what needs to happen in order to evaluate the presumption. Until this happens, the presumption against environmental interference remains a hypothesis—or set of hypotheses. For my money, the most promising of these hypotheses have the following form: Prefer conservation interventions that involve less interference, according to Scale X".[8]

This is a far cry from the more nebulous presumption against interference that we started with, but it is more charitable than the alternatives. Even though we have downgraded the presumption to a cluster of empirical hypotheses, we have achieved clarity on two important things: what these hypotheses mean and how they could guide our reasoning and decision-making about conservation. We can also begin to see how to evaluate these hypotheses in light of the empirical evidence.

Conservation scientists are very interested understanding which interventions work and why, so there is a lot of relevant evidence to explore. Unfortunately, conservation scientists have not specifically asked which scales of interference might serve as indicators of effectiveness, so there is also still a lot of work to do in order to apply the evidence to the question of whether we should accept any version(s) of the presumption against environmental interference. I will begin, but not complete, that work in the rest of this article. To do that, we should turn to the epistemic arguments people have offered in favor of the presumption against interference.

[7] The answer to this question might also vary across domains, so perhaps it will turn out that different versions of the presumption against interference are appropriate in different domains.

[8] Two examples of possible scales, though there are indefinitely many: the extent to which a conservation action (token or type) requires ongoing human action and management, or the degree of technological complexity it involves.

Epistemic arguments for the presumption

The academic and popular literatures about conservation interventions invoke the presumption against interference all the time. As Pulitzer Prize winner Elizabeth Kolbert puts it in her latest book *Under a White Sky*:

> The argument against such intervention is also compelling…The history of biological interventions designed to correct for previous biological interventions reads like Dr. Seuss's The Cat in the Hat Comes Back, in which the Cat, after eating cake in the bathtub is asked to clean up after himself:
> Do you know how he did it?
> WITH MOTHER'S WHITE DRESS!
> Now the tub was all clean,
> But her dress was a mess! (2021, p. 139)

Philosophers articulate similar ideas. For example, Ronald Sandler in his book *The Ethics of Species* writes:

> Unintended, unexpected, and uncontrolled by-products of environmental interventions have always occurred. Therefore, humility regarding our capacity to predict and control ecological systems has always been appropriate. But the distinctive features of global climate change raise the salience of humility, and warrant greater restraint with respect to how strongly we impose our designs and desires on ecological spaces and systems that are not already highly manipulated and engineered. (2012, p. 126).

Worries about ineffectiveness and unintended consequences are clearly at the forefront here. Even Sandler, whose larger case against interventionism is in large part moral, bases his conclusion that we should show "greater restraint" on skepticism that we are able to control the effects of even our conservation-motivated interventions. In his view, the fact that interventions are so often ineffective is part of what makes them morally dubious. Let's grant this skepticism for now and assume the following two claims are true:

(1) *Ineffectiveness*: On balance, conservation interventions do not have their intended effects.
(2) *Unintended consequences*: On balance, conservation interventions have harmful unintended consequences that outweigh their good consequences.

Defenders of the presumption against interference, Sandler included, argue as if the truth of one or both of these claims is sufficient to justify the presumption against interference. But this is too quick. Arguments of this sort depend on additional empirical claims. To see this, let's first consider the version of the presumption I developed in Sect. "The presumption against interference": Prefer conservation interventions that involve less interference, according to Scale X."

Does the truth of either, or both, the ineffectiveness or unintended consequences claims mean that we should prefer smaller conservation interventions to larger ones?

No. These claims only support the conclusion that we should prefer smaller conservation interventions if they are combined with one of two additional ideas:

(3) *Interference tracks success*: The more interference a conservation intervention involves, the more likely it is to fail to have its intended effects and/or to produce bad unintended consequences that outweigh its good consequences.
(4) *Interference tracks uncertainty*: The more interference a conservation intervention involves, the worse we are at predicting whether it will succeed or fail and/or have bad unintended consequences that outweigh its good consequences.

If it is true that interference tracks success, then the presumption against interference steers us toward interventions that are more likely to succeed and away from interventions that are less likely to succeed. If it is true that interference tracks uncertainty, then then the presumption against interference steers us toward interventions whose effects we have a better chance of predicting. Notice, though, that the claims about ineffectiveness and unintended consequences are independent of the claims about interference tracking success or uncertainty. The fact that interventions mostly fail or produce bad unintended consequences does not mean that the pattern of their failures, or our ability to predict those failures, correlates in any way with our choice of interference scale.[9] So, how plausible is it that certain interference scales track either success or uncertainty?

Whether the interference tracks success is an empirical claim. Unfortunately, we have no evidence that speaks to this claim, because no one has determined which of the many ways of thinking about how much interference a conservation intervention involves are appropriate and relevant, much less classified actual interventions according to this schema and checked to see if there is in fact a relationship between success and an interference scale. The idea that interference tracks success is still just a conjecture, and not a well-formulated one. The same points are true of the claim that interference tracks our ability to predict interventions' effects. Until we have a clear understanding of the relevant interference scales, we cannot determine whether the claims that interference tracks success or uncertainty are true. And if we cannot evaluate them, we should not accept arguments that depend on them.

What if you are not convinced that the best formulation of the presumption against interference is the scalar one? Even so, the basic point—that the ineffectiveness and unintended consequences claims are not sufficient to justify the presumption against interference—is also true of other versions of the presumption against interference. Here is why.

We can divide any possible version of the presumption into two categories: categorical versions, which tell us to take the same stance or attitude toward all interventions, and versions that advise us to discriminate among different intervention options according to some rule. Categorical versions, that is, formulations of the

[9] The claims about interference tracking success and uncertainty are also compatible with the claims about ineffectiveness and unintended consequences being false; the interference-tracking claims may be true even if interventions nearly always succeed or rarely produce harmful unintended consequences.

presumption that tell us "never intervene," or "only intervene after exhausting all other possibilities," or "think long and hard about intervening" might be justified by the ineffectiveness and unintended consequences claims alone. But as I have already noted, they are unacceptable in light of the inevitability, innocuousness, and variability of interventions. If we want a useful guide to reasoning and decision-making, they do not provide it.

That leaves us with versions of the second type. These versions, which provide us a rule for determining which interventions to try or not try, will all assume some particular relationship between the effectiveness of interventions and whatever it is that the rule counsels. That relationship may not be that interference tracks success or uncertainty, but whatever it is, it will be independent of the ineffectiveness and unintended consequences claims, for the same sorts of reasons that the idea that interference tracks success is independent of these claims. Further, any claim that there is a connection between the effectiveness of interventions and whatever it is that the rule counsels will probably be on shaky empirical ground, just like the claims that interference tracks success or uncertainty.

Assessing the effectiveness of interventions

The arguments I have made so far target the connection between empirical claims about the ineffectiveness of interventions and the presumption against environmental interference. We've seen that these empirical claims are insufficient to justify the most generous interpretations of the presumption. Still, it seems like it matters whether these claims are true. If conservation interventions often do not work, or often have harmful unintended consequences, then we want to know! That's because these claims would still vindicate the fundamental idea motivating the presumption, which is that our overall attitude toward conservation interventions should not be one of confidence, optimism, or trust. Let's call this *intervention skepticism*, the view that we should have little confidence in the effectiveness of conservation interventions.[10] Perhaps the presumption against interference is not the best application of this idea, but intervention skepticism would still be highly relevant to conservation reasoning and decision-making.

So let's turn away from the presumption against interference and toward the idea of intervention skepticism. Is this view supported by the evidence available to us from conservation science?[11] In order to answer this question, we first need to understand what the evidence is.

[10] I am borrowing this phrasing from Jacob Stegenga (2018), who defends an analogous thesis, which he calls *medical nihilism*, the idea that we should have little confidence in the effectiveness of medical interventions. I will save the term *conservation nihilism* for a different thesis.

[11] While relevant evidence may come from other sources as well, conservation science is the key body of evidence we should consult.

Evidence in conservation science

People who work in conservation science tend to agree that it does not have a track record of producing high-quality evidence (Sutherland et al. 2004). The field is young, founded in the 1980s, which according to many means its theoretical foundations are still in development(see, e.g. Balmford and Cowling's (2006) reflections on its 20th anniversary). At the same time, it tackles complex and controversial questions, often with sparse resources. All of this means that conservation practitioners end up making decisions on the basis of poor evidence (Pullin et al. 2004). Fortunately, the last twenty years have seen a recognition of this problem and a movement to solve it (e.g. Kareiva and Marvier 2012). This movement, known as evidence-based conservation, is modeled on the analogously named evidence-based medicine movement.

Evidence-based conservation addresses many aspects of the scientific process, including study design and data collection and reporting. What is important for our purposes, however, is the way evidence-based conservation handles evidence synthesis, that is, integrating information from different studies in order to create an overall picture of the scientific evidence about a particular issue. Imagine a practitioner trying to decide whether to use controlled burning to manage a tract of land. It won't be feasible for them to read through all of the published studies about controlled burning, much less to sift through the evidence and decide which evidence is relevant to their particular decision, or how to weight evidence from different sources. What they need is a synthesis of the evidence that does this for them. But conducting a responsible evidence synthesis is no easy matter, precisely because it involves a series of choices about what evidence to include and how to weight and combine it.

In response to this challenge, the evidence-based conservation movement has adapted and refined a number of evidence synthesis techniques and best practices especially for use in the conservation sciences. None are perfect, but they are improvements in that they attempt to be comprehensive and transparent. Compared to traditional reviews of a body of evidence, these approaches, known as systematic reviews, specify clearer research questions, commit to a full exploration of relevant literature, and set their search and analysis protocols in advance. Within these parameters, systematic reviews may vary a quite a bit. The research questions they set out to answer may be broad or narrow; they may include many or few primary studies; their analysis methods may be qualitative or quantitative.

When it comes to assessing intervention skepticism, systematic reviews are our best source of evidence.[12] I do not say they are our only source of evidence, and it is important to acknowledge that sometimes, even the best available evidence is not very good—we'll explore that possibility in a little while. Even so, systematic

[12] In making this claim, I am taking a position in a small but lively philosophical debate about the epistemology of evidence synthesis. Among others, Jacob Stegenga (2011, 2018) does not agree that systematic reviews are the best kind of scientific evidence. For responses, see Holman (2019) and Fletcher (2022).

reviews are where we should look to answer our questions about conservation interventions.

Reviewing the systematic reviews

There is a small set of systematic reviews about the effectiveness of conservation interventions. With one exception, no review asks about the effectiveness of all interventions; instead, they ask about the effectiveness of certain intervention types, such as species translocations, or about the effectiveness of interventions in a particular domain. Domains are determined in different ways. Some studies focus on interventions on certain taxa, or in specific geographical regions, or those with a particular purpose, such as controlling invasive species. Below I summarize three examples of these domain-specific reviews before discussing the more general one.

(1) *Species translocations:* In this study (Novak et al. 2021), a research team looked at all of the recorded, conservation-motivated translocations of endangered species in the United States. A translocation includes: (a) moving members of a species around within their native range, (b) reintroducing members of a species to a part of their native range from which they have been eradicated, and (c) introducing members of a species to an area outside of their native range. Novak et al. considered interventions on over 1000 species. In a search of both the published and unpublished literature, they found only one translocation with recorded damaging unintended consequences. At the same time, they found that hundreds of these translocations furthered the conservation goals of preventing extinctions and supporting population growth.

(2) *Species introductions and eradications:* Pearson et al. (2022) surveyed the global literature on intentional introductions and eradications of entire species via five intervention types: assisted migration, rewilding, biological control, species removal, and gene drives. They were particularly interested in documenting cases in which unintended effects arose from these interventions. "Unintended effect," in their review, just means "not part of the management objective," and is not necessarily negative or harmful Pearson et al. examined 172 different cases. Authors of the primary studies reported outcomes, whether intended or unintended, in 111 of them. In half the cases, primary studies reported only intended effects; in one quarter of the cases, primary studies reported a mix of intended and unintended effects; in 10% of the cases, authors reported only unintended effects.

(3) *Ecological restoration:* Our last example is also global. Jones et al. (2018) examined efforts to repair ecosystems damaged by human activities such as mining, logging, and agriculture. The authors asked how much and how quickly 400 different ecosystems recovered under both "passive" restoration (leaving a damaged ecosystem to recover on its own) and "active" restoration (any intervention aimed at helping the ecosystem recover). They found that while few ecosystems had recovered completely, that is, to their baseline state, basically all had recovered to some extent. They also found that the extent and rate of ecosystem

recovery was similar for passive and active restoration. The authors note that while this could be because leaving ecosystems alone is just as effective as intervening, it's more likely that practitioners choose active intervention at sites that they have good reason to think won't recover well if left alone.

Informative as these examples are, they do not cover the full range of conservation interventions. For comprehensive coverage, we can look to Langhammer et al's (2024) review of "the full suite of conservation actions and intervention types" (p. 1). No other published study of conservation interventions combines the following three features:

(1) *Scope*: the review encompasses the literature published between 1890 and 2019, and interventions falling into 7 general categories:

   a. establishment and management of protected areas,
   b. policy and restoration measures for reducing habitat loss and degradation,
   c. sustainable use of species,
   d. sustainable management of ecosystems,
   e. control of pollution,
   f. eradication and control of invasive alien species, and
   g. climate change adaptation.

(2) *Quantitative analysis*: the review is a meta-analysis, meaning it uses statistical methods to pool measures of the effectiveness of the different interventions it considers.
(3) *Counterfactual, or quasi-experimental, design*: the review limits itself to published studies that include information about how the state of the site or system in question in the absence of the focal intervention. A total of 186 individual studies meet this and other criteria, encompassing 665 different intervention trials.

This study finds that "across a full suite of conservation actions and intervention types, multiple levels and metrics of biodiversity, and over a century of action, conservation has improved the state of biodiversity—or at least slowed its decline—compared with no conservation action" (pp. 3–4).

These reviews represent the larger literature[13] in that they all conclude that where we have evidence, it indicates interventions are effective more often than not. Another common theme in these reviews is the limitations of the evidence. The consequences of many interventions—intended and unintended—just aren't recorded.

I do not offer this extremely general characterization in order to gloss over the many serious questions we can ask about the designs of these systematic reviews,

[13] For another well-respected, but methodologically different, approach to reviewing the effectiveness of conservation interventions that comes to similar conclusions, see the 1000 + page book *What Works in Conservation* (Sutherland et al. 2018).

and about the quality of the primary studies on which they are based. It is vital to ask these questions! The characterization I have given here is the starting point, not the ending point, of our analysis of what the evidence from conservation science says about the ineffectiveness and unintended consequences claims.

Intervention skepticism in light of the evidence

Our goal is to assess the intervention skepticism thesis in light of the evidence from conservation science. Our first step in doing that was to learn what the evidence is. But that is only a start. Now we can ask, how strongly does the evidence speak for, or against, intervention skepticism? And the answer to that question depends on how we answer three further questions[14]:

(1) *Plausibility*: How plausible is intervention skepticism, even before we consider our evidence?
(2) *Evidential expectations*: How similar is the evidence we have to the evidence we would expect to find if intervention skepticism were true?
(3) *Overall evidential probability*: How likely is it we would find this evidence whether or not intervention skepticism is true?

The first question is important because the effect of the evidence on our belief is both a matter of the evidence and how likely we think the thesis is even before factoring in the evidence. The more likely we think intervention skepticism is, the stronger the evidence needed to change our mind.

The second question and third questions are important because they get at issues of evidence relevance and quality. To see why, let's imagine a best-case evidential scenario. A land manager wants to know if approving more controlled fires in their district will create more nesting sites for a threatened bird species. They consider a systematic review about the effects of other controlled fires on other bird habitats. This review will strongly support the idea that controlled burns will have the effect the land manager desires if it shows that similar burns in similar systems have increased the number of the same sorts of nesting sites the land manager is concerned about. This is the kind of thing that should be true in a world where it's also true that more controlled fires in the manager's district will create more nesting sites. Finding the evidence that you expect to find if the hypothesis you are investigating is true speaks for that hypothesis, and, crucially, the more confident you are that such evidence does exist if your hypothesis is true, the more strongly that evidence speaks for your hypothesis. By the same token, finding evidence that is unlikely to exist if your hypothesis is true speaks against your hypothesis.

Returning to our example, suppose the systematic review the land manager is considering also shows that nesting site numbers also increase in systems without

[14] This, of course, is a Bayesian argument stated in qualitative terms. The idea of using Bayes Theorem comes from Jacob Stegenga (2018) use of the same framework to evaluate the medical nihilism thesis.

controlled burns. This fact speaks against the idea that controlled burns will have the effect the land manager desires. Why? Because it suggests that the evidence showing more nesting sites would exist whether or not controlled burns have the desired effect. If so, then even though the evidence does speak for this hypothesis, it speaks for the alternative hypothesis just as well. So, the strength of evidential support for a hypothesis is (a) proportional to how probable the existence of that evidence is, assuming that the hypothesis is true, but (b) inversely proportional to how probable the existence of that evidence is overall.

Now we can connect all of this back to the intervention skepticism thesis. Let's consider the questions of plausibility, evidential expectations, and overall evidential probability one by one.

Plausibility

Even before we consider the evidence from conservation science, intervention skepticism is not a plausible idea. That's because if it is true, it pushes us toward a much more radical and unattractive view—what we might call *conservation nihilism*, the idea that nature would be better off than it is now if we ceased all conservation interventions. Let me explain.

Sometimes conservation just involves designating a protected area or species to be free from human intervention, but not usually. Not even United States wilderness areas are managed purely in accordance with this vision, despite the wording of the Wilderness Act and its famous definition of wilderness as "untrammeled by man." The vast majority of environmental conservation work consists of getting rid of unwanted species, helping threatened species breed, moving populations of animals and plants from one place to another, shoring up riverbanks, redirecting stream flows, cleaning up polluted sites, setting fires, placing tarps over glaciers to slow their melting, and countless other activities that count as interventions on any non-circular or non-naturalized understanding of the concept so far devised.

If intervention skepticism is true, then we should have little confidence in the effectiveness of most of these interventions. On one interpretation, this means that while some of these interventions may be effective, we should think their total effects are harmful. Since conservation activity mostly consists of interventions, then stopping all conservation activity would be better than continuing with it. Some may sympathize with this view, but for most of us, it will be unacceptable. Environmental conservation activities are imperfect, but the world is better than it otherwise would be because of them.

Perhaps the combination of the non-interventionist aspects of environmental conservation with those few interventions that are effective means that conservation activity is a net positive. If so, one could still think intervention skepticism is probably true without having to agree that the cessation of all conservation activity would be better than continuing with it as it is. But even granting this point, the intervention skeptic is pushed toward the claim that ceasing all conservation interventions is preferable to continuing with them as they are.

Or, perhaps most intervention types are ineffective, but the good consequences of the few effective types are great enough to outweigh the bad consequences of the

many ineffective types. This is a way of avoiding the skeptical conclusion about the total effects of conservation interventions, but there is a problem. Why would it be that the effects of interventions are net-positive, even though most types of intervention are ineffective? The reason has to be either that the good consequences of effective interventions are better than the bad consequences of ineffective interventions, or that effective intervention types are implemented more often than ineffective ones. It would be simple to show that one or both of these claims were true if we knew how to distinguish between effective and ineffective interventions, but we do not. The whole point of a thesis like intervention skepticism is to equip us with an accurate overall attitude toward interventions, precisely because most of the time, we do not know which ones are effective and which are not. Intervention skepticism is a substitute for this very ability.

We are left, then, agreeing that it is better to have the full set of conservation interventions, imperfect as they are, than to have none of them at all. Against that backdrop, one can take the position that conservation is effective, but this position is less plausible than alternative views, according to which we should have some, or a great deal of, confidence in the effectiveness of conservation interventions. Even the view that we should remain undecided about the effectiveness of conservation interventions is less paradoxical than intervention skepticism.

Evidential expectations

So much for the plausibility question. Now we move to the question of evidential expectations. The evidence I have reviewed says that conservation interventions tend to be effective. If intervention skepticism were true, this is not the evidence we would expect. That much is obvious.

But our question is one of degree: how far off is the evidence we have from the evidence we would expect? The strongest evidence for intervention skepticism would be high quality systematic reviews of high quality primary studies showing that (a) the desired effects of conservation interventions rarely occur, and (b) these interventions have harmful unintended consequences most of the time. On the other hand, the strongest evidence against intervention skepticism would be systematic reviews that left no doubt about the success and benefits of conservation interventions. The actual evidence, while closer to the latter than the former scenario, is mixed. Recall that Pearson et al. (2022) found some unintended effects of interventions in over one-third of the cases they considered, while Jones et al. (2018) found that interventions aimed at ecosystem restoration achieve partial, but rarely complete, recovery, and similar recovery rate and extent for both passive and active restoration techniques. The Langhammer et al. (2024) meta-analysis found that conservation interventions performed worse than doing nothing in 21% of cases.

We also have to acknowledge that our ability to answer the question of evidential expectations is limited. Whether the evidence we do have is "diagnostic" of intervention skepticism depends on how good the evidence is, and there are important and unresolved issues here. To name just a few: Some, perhaps many, of the primary studies on which systematic reviews are based are not of high quality. What counts as an unintended consequence is not well or consistently defined, and it is

unclear how thorough researchers are in their attempts to identify unintended consequences. Primary studies are biased toward specific taxa and geographic regions, so even when they are of high quality, the resulting evidence base is not representative. Finally, systematic reviews try to combine and compare the results of studies which are very different from one another, both in terms of their study systems and in terms of their study designs and metrics. Whether and when these attempts at synthesis actually succeed is, to a large extent, an open question.

But none of these concerns changes the fact that the evidence we do have is much more like the evidence we would expect if intervention skepticism were false than the evidence we would expect if it were true. Concerns about evidence quality do not reverse this. At most, they could lead us to say that we just don't know what the answer to the question of evidential expectations is. In that case, we would conclude that the evidence doesn't speak strongly for or against intervention skepticism, and the answer to the plausibility question would carry more weight in our overall assessment of the thesis.

Overall evidential probability

The fact that we are not finding the evidence we would expect to find if intervention skepticism is true could also be neutralized if the overall probability of finding this evidence is very high. If our investigations are likely to turn up this evidence no matter what, then it cannot be said to speak for or against intervention skepticism. So, we must ask, is there a reason to worry that the evidence we have is evidence we would find under any circumstances, including if intervention skepticism is true?

The primary reason this would happen is if our mechanisms of gathering and analyzing data are biased toward finding a particular result, independent of what is actually true. There is, for example, some concern that this goes on in biomedical research: that due to the influence of the pharmaceutical industry, research methods are biased toward finding that new drugs are effective, even if they are not (Stegenga 2018). This particular worry is less applicable to the case of environmental conservation, since it is not typical for powerful financial interests to fund studies about the effectiveness of interventions.[15] Still, there are related concerns that we should take seriously.

First, there may be incentives that work against publishing failed interventions, just as scientists in other disciplines face barriers to publishing experiments with negative results. Such publication bias is common across the sciences, including in conservation science. Fortunately, however, the evidence-based conservation movement has also taken steps to correct for publication bias. For example, the journal Conservation Evidence makes a point of publishing negative results. Nearly one-third of all the studies of interventions published in that journal during its first ten years in existence reported failures rather than successes (Spooner et al. 2015). Evidence-based conservation also encourages evidence syntheses to consider unpublished studies, often called "grey literature," in part because they can be a good

[15] Though it is all too easy to imagine a future in which this changes!

source for reports of intervention failures. More specifically, Langhammer et al. (2024) conducted a statistical analysis to assess the probability of publication bias in their results, and found that it was minimal.

Second, other types of study bias might contribute to findings that conservation interventions tend to be effective. Analyses of the Conservation Evidence database, which contains over 5800 publications that have tested the effectiveness of interventions, have found severe bias along a number of dimensions: studies are biased toward particular parts of the globe, toward particular taxa, and toward particular intervention types (Christie et al 2021; Junker et al. 2020). But while all of these types of bias are likely to produce a skewed picture of conservation interventions overall, there is no particular reason to think that these biases contribute to overestimating intervention success.

These concerns about bias are important, and I think we should increase our estimate of total evidential probability in light of them. But this revision does not suggest that we should accept intervention skepticism—it should only temper our rejection of it.

Alternatives to the presumption

My case against the presumption against environmental interference is now complete. Once we articulate the presumption in a way that is relevant for conservation reasoning and decision-making, we see that the epistemic arguments given in its favor fail on two fronts. They depend on hidden premises which are presently untestable, and they take it for granted that conservation interventions are generally ineffective, when in fact the evidence from conservation science speaks against such intervention skepticism.

The process of undermining the presumption has done more than give us some reasons to reject it. It has also highlighted a few key ideas which are valuable starting points for developing alternatives to the presumption. I will briefly develop four of those ideas here.

Beyond interference scales

The idea of a scale that capture how much interference an intervention involves, while central to the presumption against interference, need not be central to the project of developing heuristics for conservation reasoning and decision-making. It may be that other concepts are better proxies for intervention success. For example, are interventions on targets that are better understood (scientifically) more effective than those on targets that are less well-understood? Does the ability to test an intervention on a controlled and limited scale correlate with effectiveness? Do "one and done" interventions work better than those that require ongoing human involvement?

These are just a few examples. We can treat any dimension along which conservation interventions vary as an independent variable and then ask whether it predicts effectiveness, harmful unintended consequences, etc. We are then presented with the

question of how to efficiently search a vast hypothesis space so as to find the relationships which best serve our needs. The available evidence might suggest some promising hypotheses. So might the broader environmentalist literature, or analyses of relevant historical examples.

Finer-grained generalizations

Whatever hypotheses we develop, they should be more fine-grained than the presumption against interference. Our discussion of the idea of minimizing interference already gave us a variety of more fine-grained versions of the presumption. That discussion also brought up additional ways in which generalizations about conservation interventions might need to be limited: Some generalizations may only apply to particular classes of intervention, or to particular domains. While there is something valuable about extremely general principles—they always apply—this value comes at a cost when general principles also admit of many exceptions. In such cases, finer-grained generalizations are preferable, as long as they have fewer exceptions.

Bringing the evidence to bear

Of course, we also have to know what the true finer-grained generalizations are, which brings us to the third point. There is a two-way street connecting empirical work and conceptual work. As a result, people trying to develop heuristics and principles for environmental conservation should be strategic in how they bring evidence to bear.

On the one hand, empirical work forms the evidence base relevant to developing and evaluating generalizations about the effectiveness of conservation interventions. Empirical researchers can and should adjust the evidence they collect so as to be more helpful to this project. For example, rather than primarily considering the effectiveness of particular types, or interventions in particular domains, more studies could treat abstract features of interventions like the ones I've discussed here as independent variables.

On the other hand, people engaged in conceptual work can and should develop generalizations about the effectiveness of conservation interventions that are feasible to operationalize. Since these generalizations are really just hypotheses which need to be put to the test, they should be expressed in terms that lend themselves to empirical evaluation.

"It works in general" versus "It works for me"

The project I have outlined—developing and testing generalizations that can serve as good guides to conservation reasoning and decision-making—is a daunting one. And it is made even more daunting by the fact that even if we had these generalizations in hand, it is far from clear what it would mean to apply them responsibly. The reason, of course, is that there is a big difference between deciding that an intervention works in general, and deciding that it is likely to work in any particular case

(Cartwright 2012). For some conservation reasoning and decision-making, the generalizations are enough, but there are also many situations for which we want and need additional tools.

Conclusion

In addition to the programmatic recommendations, this paper has two more immediate upshots. First, no one should accept the presumption against environmental interference on the basis of the arguments I have criticized here, because those arguments fail. Other arguments in favor of the presumption, particularly moral ones, may still succeed. Yet even moral arguments in favor of the presumption sometimes make empirical claims about ineffectiveness or unintended consequences. To the extent that such arguments rely on intervention skepticism, they fail as well.

Second, neither institutions nor individuals should appeal to intervention skepticism as a reason for adopting a particular policy, supporting a particular course of action, or taking a particular attitude toward proposed conservation interventions. This has revisionary implications for environmentalist discourse and action across many domains—from academic philosophy to nature writing to policy making. Much of conservation still defaults to precaution, restraint, and inaction when it comes to proposed interventions, especially novel ones (Brister et al. 2021). Such default attitudes are at odds with the available evidence. It is time to imagine different ways of relating to environmental interference.

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