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Fauna in decline: Management risks Response

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Young fishers in Burkina Faso.

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Fauna in decline: A big leap to slavery

THE POLICY FORUM by J. S. Brashares *et al.* ("Wildlife decline and social conflict," 25 July, p. 376) links environmental degradation to child slavery and human trafficking. However, the causal pathways between wildlife decline and social outcomes, especially child slavery, have not been empirically tested; it is likely that wildlife declines are only a tiny component of the causes of exploitative child labor and slavery.

While the linkages Brashares *et al.* diagram are all plausible, and some have abundant empirical support, we question the strength of association between the exploitation of global fisheries and child slavery. To claim or imply that resolving the global fisheries commons problem will mitigate such despicable social practices is dangerous.

Surtees (*1*) lists economic, political, legal, social, and individual characteristics as preconditions for child trafficking for forced labor and sexual exploitation. Noticeably absent in her report is any mention of a link between wildlife decline, or any form of environmental degradation, as a precondition for child trafficking.

Conservation goals have increasingly been tied to aspects of human well-being and social outcomes, but it is important not to overestimate the negative impacts of environmental degradation when they are likely to play a secondary role in driving social outcomes. Doing so risks exacerbating the very social problems they purportedly aim to tackle. There is no doubt that greater stresses on the environment put greater economic strains on families that rely heavily on the environment for their livelihoods, yet the evidence the authors cite is unsatisfactory and risks moving resources to combat child labor and slavery toward less effective programs. More effective ways to combat the exploitation of children could include better enforcing child labor laws, increasing educational opportunities and services, and increasing poverty reduction and family planning programs.

The scientific community has a responsibility to not overstate the potential impacts of the environment on social outcomes for another reason as well. Policy in democratic countries, and especially environmental policy, depends on public support. The public is increasingly wary of the political framing or spinning of issues by conflating environmental issues with other concerns, regardless of support.

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Fauna in decline: Management risks

IN THEIR POLICY FORUM "Wildlife decline and social conflict" (25 July, p. 376), J. S. Brashares *et al.* claim that a decline in the resource base will increase exploitation effort and slave labor. Using fisheries to illustrate this claim, the authors conjecture that a stock decline increases effort, which further degrades the stock. However, the contention that decreased stocks will increase effort is sharply contradicted by theoretical and empirical literature on open-access fisheries (*1*–*3*), as well as modeling of collapse in pre-modern wildlife-dependent societies (*4*). Although evidence from fisheries is limited, it appears that when stock declines, fishing effort declines as well (*2*, *3*, *5*–*8*).

Potential links between social conflict and resource degradation are not implausible. Globalization increases the potential value of natural resources in the absence of degradation. Unfortunately, without effective governance, globalization can also increase incentives for overexploitation and illicit activity (*9*, *10*). Brashares *et al.* rightly note that policies should look at underlying causes, and I agree with their endorsement of resource tenure (rules that govern access to resources) and international commitments to user rights for fishers. However, real-world resource management often falls short of providing user rights and full institutional reform. When fisheries are managed to stabilize or increase stocks without restricting access to the resource base, effort actually increases (*6*–*8*). If Brashares *et al.* are correct that lower stocks equate to higher effort, policies that improve biological stocks could indeed decrease effort and associated slave labor. However, if they are wrong, as the literature suggests, biological management alone could worsen labor outcomes.

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Response

THE DISCOMFORT EXPRESSED by Masuda and Scharks in linking wildlife declines to social conflict and Smith's concern about harvest effort increasing when wildlife declines reinforce the central message of our Policy Forum: Despite growing evidence of the importance of wildlife-society linkages, these connections are rarely incorporated in the work of researchers, policy-makers, or practitioners. We did not aim to test causal relationships or economic theories linking wildlife declines to child

slavery. Our primary goal was to illustrate the deep environmental roots of many types of social conflict and elevate the visibility of this oft-ignored driver of social unrest.

As we acknowledged in our Policy Forum, wildlife decline is only one of a number of drivers of social conflict. Yet, there is growing evidence that wildlife decline is in many cases far more than a "tiny component" of various forms of social injustice, including child labor. The fact that the fishing industry is a primary user of child and forced labor in many parts of the world has been well documented (*1*–*5*). The United Nations directly relates fish stock declines to exploitative labor practices, noting that decreasing fish stocks increases labor demand and makes workers more "vulnerable to human trafficking at sea" (*1*). UNICEF includes the loss of fishing livelihoods as a driver of child trafficking (*5*).

Millions of people rely directly on fisheries and terrestrial wildlife for their health, well-being, and livelihoods; to understand the ways in which wildlife decline is exacerbating labor exploitation and other social ills, we must address these links. Although fields such as political ecology have built a body of evidence over the past 30 years elaborating such connections, wildlife and society are still too often treated as separate spheres.

We do not call for policies that divert resources from other efforts to address social conflicts, as feared by Masuda and Scharks. Instead, we hope that by considering underlying drivers of social ills, including wildlife decline, policies and programs will extend beyond superficial treatment of proximate outcomes. Failing to recognize connections between wildlife decline and social injustice in the face of existing evidence will at best waste resources on inadequate efforts, and at worst exacerbate these problems through unintended consequences.

Smith argues that when populations of harvested wildlife decline, the effort expended by fishermen and hunters to collect these resources will decline. We question the logic of and evidence for this proposition at both the individual and aggregate levels. Evidence for individuals increasing effort in the face of wildlife decline is abundant in the literature and applies to harvests of whales, reef fish, cod, and terrestrial mammals (*6*–*9*). Theories from applied economics and governance reinforce this argument: The labor debt created by the increased effort required to harvest a declining resource often contributes to exploitative labor practices (*10*).

At the aggregate level, harvesters in some systems may stop hunting or fishing if resources decline below a threshold level, but there is overwhelming evidence that overall effort can, and has, increased in many cases where stocks were diminished (*11*). Studies have shown that individuals who lack access to alternative livelihoods are unlikely to exit a declining fishery (*6*), and global fishing effort has grown 10-fold since 1950, while total catch has declined (*12*). As Donald Kennedy recently summarized, "Declines in the fish population encourage…larger, longer-range, and higher-capacity vessels. That further intensifies the pressure on the resource, so the process has its own positive feedback" (*13*).

We agree with Smith that increases in harvest effort following wildlife declines will be stronger in contexts characterized by "poverty and institutional failure." Such situations represent the norm in many regions of a world where nearly 3 billion people live in situations of poverty and weak governance (*14*, *15*).

The interplay between wildlife decline, harvest effort, and the demand for slave labor is an underappreciated social-environmental problem for which the drivers and outcomes are poorly understood. While we disagree with Smith about how harvest effort commonly adjusts to wildlife scarcity, we agree that gaining a better understanding of the complexities of these relationships is a critical step in addressing social conflict related to wildlife decline. We also emphasize that many of the outcomes we outlined in our Policy Forum (such as political stability and regional violence) operate independently of the labor issue that concerns Smith.

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Fauna in decline: Beyond extinction

IN THEIR REVIEW "Defaunation in the Anthropocene" (25 July, p. 401), R. Dirzo *et al.* confuse two separate processes that are important to conservation biology, extinction, and population decline. Traditionally, when species are referred to as extinct, it means they no longer have living members. The IUCN made a modification when it recognized "extinct in the wild" to be applied to species that existed only in captivity. Biodiversity loss or gain is usually quantified in terms of species numbers. Unlike extinction, in the case of a population collapse (a 90% decline), there can still be hope for recovery.

Most extinctions have occurred on oceanic islands or in restricted freshwater locations, with very few occurring on Earth's continents or in the oceans. The world's greatest conservation problem is not species extinction, but rather the precarious state of thousands of populations that are the remnants of once widespread and productive species.

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The Wyoming toad (*Bufo baxteri*) has been categorized as extinct in the wild since 1991.

PHOTO: SARA ARMSTRONG/WIKIMEDIA COMMONS

Fauna in decline: The community way

CURRENT CONSERVATION STRATEGIES to mitigate the impact of climate change on terrestrial biodiversity rely heavily on capture, transfer, and release of single species (single-species translocation), despite the fact that ecological interactions between species are likely to be the first component of the ecosystem to be impacted by climate change (*1*) before any population or species goes extinct. In their Review ("Reversing defaunation: Restoring species in a changing world," 25 July, p. 406), P. J. Seddon *et al.* analyzed conservation translocations and emphasized the need for "more intensive forms of threatened species management." To conserve functioning ecosystems, management tools should focus on conserving whole communities rather than single charismatic species.

Ecosystem-scale translocation is one way to accomplish this goal: Aboveground and belowground elements of a functioning terrestrial ecosystem (including vegetation and topsoil) are carefully collected and moved together. Small-scale examples of ecosystem-scale translocation have been applied for 30 years for the purpose of ecological restoration under the name of habitat translocation or vegetation direct transfer (*2*–*5*). The strategy has proven successful in conserving plant, invertebrate, and microbial communities as well as ecosystem functions (*5*–*9*). By moving subsets of ecosystems from climatically unstable regions to more stable ones (*10*), ecosystem-scale translocation provides an opportunity to conserve mature and complex ecosystems threatened by climate change.

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Boreal forest in Yukon, Canada.

PHOTO: THINKSTOCK

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Fauna in decline: Protect forests now

THE SPECIAL SECTION on Vanishing Fauna (25 July, p. 392) did an excellent job of highlighting the continuing global biodiversity erosion crisis ("Defaunation in the Anthropocene," R. Dirzo *et al.*, Reviews, p. 401) and progress in combating the crisis by using restoration techniques and translocation of animals ("Reversing defaunation: Restoring species in a changing world," P. J. Seddon *et al.*, Reviews, p. 406). However, the most effective, resource-efficient, and safe opportunities for slowing defaunation continue to be overlooked. We must maintain the world's last large remaining areas of intact habitat, including primary forest areas that remain mostly free of large-scale human development.

These primary forest areas have recently been mapped (*1*, *2*) and include the boreal forest regions of Canada, the United States, and Russia, and the tropical forests of the Amazon Basin, Congo Basin, and parts of Indonesia and Papua New Guinea. Canada's boreal forest accounts for approximately 25% of the world's remaining intact primary forest (*1*). Initiatives in Canada by provincial, indigenous, and federal government entities as well as industry have rapidly pushed forward the levels of protection, successfully setting aside about 450,000 km^2 of primary forest for conservation purposes over the past 15 years (*3*). Perhaps the greatest leaders in this effort have been indigenous communities and governments, who have developed comprehensive land-use plans and new management models for their ancestral lands that balance conservation and development (*4*).

Protecting the world's still-intact ecosystems, including primary forest, avoids the necessity for costly, difficult, and untested approaches to restore and translocate species and environments (*5*). All nations should be focused on protecting intact ecosystems now rather than hoping to restore them later.

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ERRATA

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Fauna in decline—Response

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