Annual Review of Environment and Resources

Changing Human Behavior to Conserve Biodiversity

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Annu. Rev. Environ. Resour. 2024. 49:419–48

First published as a Review in Advance on August 21, 2024

The *Annual Review of Environment and Resources* is online at environ.annualreviews.org

https://doi.org/10.1146/annurev-environ-111522-103028

Keywords

behavioral science, communication, nudge, social marketing, social science, sustainability

Abstract

Conservation of biodiversity is above all else an exercise in human persuasion. Human behavior drives all substantive threats to biodiversity; therefore, influencing it is the only path to mitigating the current extinction crisis. We review the literature across three different axes to highlight current evidence on influencing human behavior for conservation. First, we look at behavioral interventions to mitigate different threats, from pollution and climate change to invasive species and human disturbance. Next, we examine interventions focused on different stakeholders, from voters, investors, and environmental managers to consumers, producers, and extractors. Finally, we review delivery channels, ranging from mass and social media to interventions involving changes to the physical environment or carried out in person. We highlight key gaps, including the lack of scale and robust impact evaluation of most interventions, and the need to prioritize behaviors, overcome the reproducibility crisis, and deal with inequality when designing and implementing behavior change interventions.

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LINKING BEHAVIOR TO BIODIVERSITY LOSS

Conservation of biodiversity is above all else an exercise in human persuasion. Across the more than 40,000 species currently listed as globally threatened, 98% are threatened exclusively by processes driven by human behavior (1). This figure goes up to 99% if we consider the drivers of species that have gone extinct since 1500 (1). It is therefore not surprising that the International Union for the Conservation of Nature (IUCN) describes direct threats to species as "the proximate human activities or processes that have impacted, are impacting, or may impact the status of the taxon" (2). Yet, conservation remains predominantly a natural science discipline, with the social and behavioral sciences playing a secondary role.

The links between human behavior and threats to biodiversity are often mentioned but rarely made explicit, possibly because many behaviors have indirect impacts on biodiversity (3). For example, by eating beef, people create a demand for red meat, which has deleterious but indirect impacts on biodiversity through methane emissions that contribute to climate change and habitat loss through deforestation. There are also more direct linkages, with the behaviors of a relatively small number of individuals having a large, direct impact on issues, from demand for threatened species (e.g., ivory or rhino horn), to habitat conversion for property development (e.g., many coastal habitats around the world), to agricultural practices, which, in many countries, are determined by a relatively small number of large landowners. Regardless of whether they have indirect or direct impacts, human behaviors and the social systems they are embedded in are the key drivers of biodiversity loss (**Figure 1**).

Despite the importance of human behavior to biodiversity loss, and the recognition of its importance two decades ago (4), conservation behavior change is tremendously under-researched and under-resourced (5, 6). We examine the literature on behavior change and biodiversity loss through three axes: threat processes, target stakeholders, and delivery channels. We follow this order because that is often how behavior change interventions are designed, with an initial emphasis on identifying the key threat to be tackled, followed by the selection of the most influential stakeholder and, lastly, the most suitable delivery channel or channels. Our goal is to allow those interested in specific threats, stakeholders, or channels to quickly identify relevant literature. From this literature, we identify key challenges to be addressed, which are summarized in the section titled Gaps and Ways Forward.

Behavioral sciences: investigate the cognitive, social, and environmental drivers and barriers that influence human behaviors

Multiple groups of stakeholders (i.e., any individual or group that may affect or be affected by conservation work) influence biodiversity through their actions (7) and have varying levels of influence over biodiversity depending on their proximity and the informal or formal power

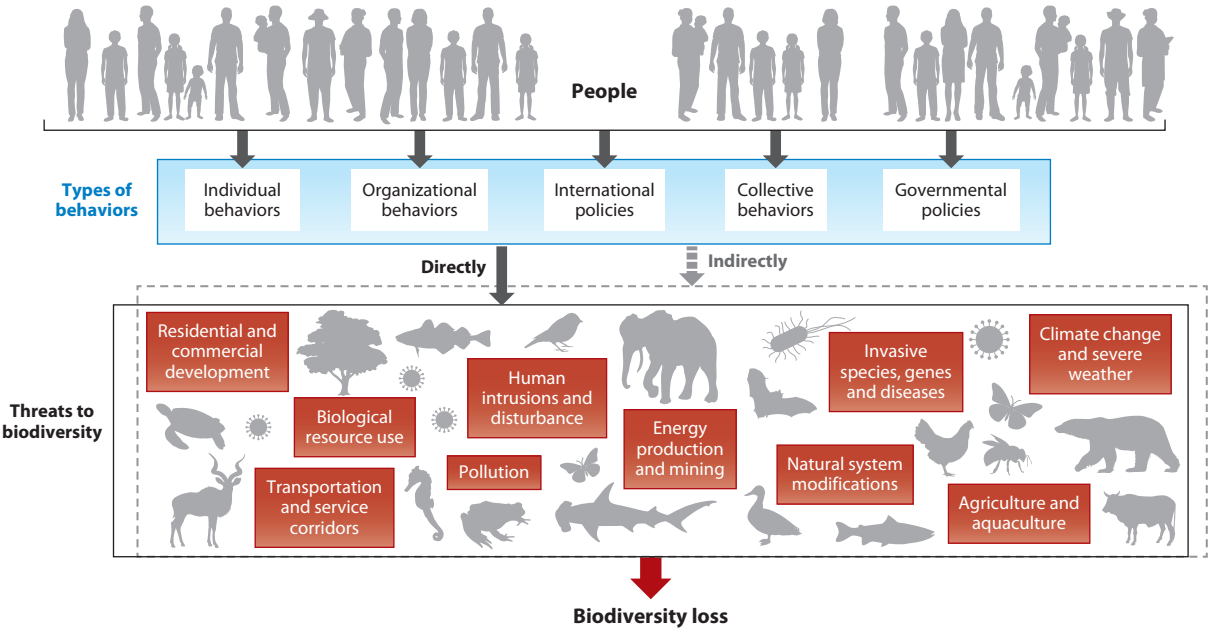

Figure 1

Conceptual framework illustrating the multilevel behavioral factors, from individual and group behaviors to governmental policies, that drive key threats to biodiversity and contribute to biodiversity loss.

they have in a system (8). Clearly, human behavior can also have positive impacts on biodiversity (examples of which include the actions around stewardship of many Indigenous peoples and local communities). However, we focus mostly on the behavioral impacts that have led to the different threat processes and are causing the fastest-moving mass extinction in the history of the planet.

We focus mostly on voluntary behavior change. We take a broad view of the term to include, for example, interventions that aim to change the physical environment or nudges that may not engage active decision making. In some contexts, we also mention interventions that use financial incentives or even coercion through regulation, when these delivery channels are a dominant part of the literature and mostly for comparative purposes.

Nudge: manipulation of the choice architecture where decisions are made to change someone's behavior, without changing incentives or reducing the number of choices available

Regulation: targeted rules, typically accompanied by some authoritative mechanism for monitoring and enforcing compliance

Behavioral interventions: campaigns or activities designed to affect the actions that individuals take with regard to the environment, here limited to noncoercive means

MITIGATING THREATS TO BIODIVERSITY

Below we discuss the literature on behavioral interventions targeting each of the drivers of biodiversity loss (**Figure 2**), based on the latest IUCN Threats Classification Scheme (2) (see the sidebar titled Drivers of Biodiversity Loss). We aim to showcase how behavior change interventions have been used to tackle the full range of threats faced by biodiversity. We found no relevant literature for the Energy Production and Mining threat category, so this threat is not included.

Residential and Commercial Development

Efforts to improve the development of residential and commercial areas for biodiversity have been primarily mandatory or regulatory in nature, rather than targeting voluntary behaviors. Many countries have local and national environmental regulations around construction and land development, and international bodies, such as the World Bank, have similar regulations (9). Additionally, conservation work on urban rewilding (e.g., through green corridors) and

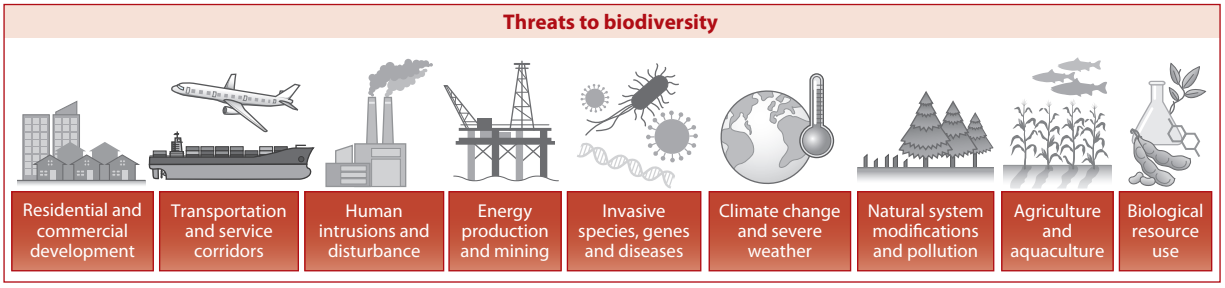

Figure 2

Key anthropogenic threats to biodiversity across various sectors and human activities as defined by the International Union for the Conservation of Nature Threats Classification Scheme (2).

wildlife-friendly cities (e.g., through regulating light pollution and abating bird–building collisions) is often implemented at government and industry levels, with changes enacted by both government and nongovernment actors (10–12).

There are, however, some efforts to target individuals' voluntary behavior, particularly through interventions promoting wildlife-friendly gardens. Some of these, like the Land for Wildlife program in Australia, with over 14,000 properties (13), have had widespread adoption but lack robust evaluation. The evaluation of 8 wildlife gardening programs across Australia, with 2,199 members, found that programs offering site assessments and native plants/vouchers were more effective at

DRIVERS OF BIODIVERSITY LOSS

The following drivers of biodiversity loss are based on the latest IUCN Threats Classification Scheme (2).

Agriculture and aquaculture: threats from farming and ranching as a result of agricultural expansion and intensification, including silviculture, mariculture, and aquaculture (includes the impacts of any fencing around farmed areas)

Biological resource use: threats from consumptive use of "wild" biological resources, including both deliberate and unintentional harvesting effects; also persecution or control of specific species

Climate change and severe weather: threats from long-term climatic changes that may be linked to global warming and other severe climatic/weather events outside the natural range of variation, or that can potentially wipe out a vulnerable species or habitat

Energy production and mining: threats from production of non-biological resources

Human intrusions and disturbance: threats from human activities that alter, destroy, and disturb habitats and species associated with nonconsumptive uses of biological resources

Invasive and other problematic species, genes, and diseases: threats from non-native and native plants, animals, pathogens/microbes, or genetic materials that have or are predicted to have harmful effects on biodiversity following their introduction, spread, and/or increase in abundance

Natural system modifications: threats from actions that convert or degrade habitat in service of "managing" natural or seminatural systems, often to improve human welfare

Pollution: threats from introduction of exotic and/or excess materials or energy from point and nonpoint sources

Residential and commercial development: threats from human settlements or other nonagricultural land uses with a substantial footprint

Transportation and service corridors: threats from long narrow transport corridors and the vehicles that use them, including associated wildlife mortality

recruiting participants who previously had no intention of creating a wildlife garden (14). Another smaller intervention targeting 55 home gardeners in New Zealand found that including social norms with feedback to gardeners during site visits led to positive behavior change (15). Because gardening is a set of behaviors, many of which require concerted effort, resources, and time, it follows that beyond small wins, such as increasing purchases of native wildflower seeds (16), most interventions striving for bigger change seem to use more personal and sustained involvement with individuals (15, 17). Further evaluation work is needed to assess whether and when such extensive efforts are most worthwhile.

Social marketing: combines ideas from commercial marketing and the social sciences to develop activities aimed at changing or maintaining people's behavior to benefit individuals and society as a whole

Agriculture and Aquaculture

Many behavior change interventions have targeted the overuse of agricultural chemicals, primarily pesticides and fertilizers. Huan et al. (18) documented a reduction in fertilizer and insecticide use in the Mekong Delta resulting from a multimedia campaign using persuasive and educational messages. Other studies have achieved comparable pesticide reductions using similar educational strategies, including multimedia messaging (e.g., 19) and farmer training schemes (20). In a meta-analysis of the adoption of farming practices to reduce chemical runoff, Liu et al. (21) found that education, incentive schemes, and social norms all drive adoption.

Sustainable management reduces the need for land conversion, and interventions have explored how to promote biodiversity-friendly approaches, including pasture use (22), conservation tillage (23), reduced soil disturbance (24), livestock management (25), and organic farming (26). In a meta-analysis of 146 studies examining the effect of interventions on the adoption of biodiversity-friendly agricultural practices, financial incentives, followed by peer-to-peer social influence, appear to be the most effective (27). However, in the European Union, the most common interventions used to promote pollinator conservation focus on restructuring the environment and education, which may be less effective (28).

Transportation and Service Corridors

Transportation behavior impacts biodiversity directly through wildlife–vehicle collisions. Wildlife-warning signage (29) and animal detection/warning systems (30) have been shown to be effective in reducing road collisions, although their impacts on driving behavior may attenuate rapidly with time (31). Similarly, navigational aids (e.g., signed buoys) were found to promote conservation-friendly boating behavior (32).

Looking at more indirect impacts, travel feedback programs, in which participants self-report travel behavior and receive tailored educational feedback, have been found to reduce car use and trip duration (33). More sustainable behavior by professional transport operators can also be elicited through feedback mechanisms such as digital fuel-efficiency devices that deliver prompts to bus drivers (34), truck drivers (35), and airline pilots (36).

Biological Resource Use

Biological resource use encompasses the procurement and use of nature by those who directly interact with and use a resource, and those at the other end of a sometimes-global trade chain. As exemplified by consumer-end interventions for illegally traded wildlife, most related efforts targeting human behavior are not evaluated (37). However, this trend across resource use interventions appears to be changing (38–40). For example, a recent evaluation of a social marketing intervention in São Tomé, West Africa, documented a decrease in sea turtle egg consumption and adult sea turtle poaching, despite challenges in assessing attribution (41). Additionally, in Brazil, Indonesia, and the Philippines, 41 standardized interventions combining a small-scale fisheries management

approach and locally tailored campaigns were implemented (42). An evaluation found that impacts varied, but communities were already supporting the intervention and changing their fishing behaviors even before any long-term benefits of the fisheries management approach materialized.

Biological resource users, who are often at the far end of global trade chains, require different interventions than those who are in closer proximity to the resource in question. To improve such interventions, conservationists have carried out controlled tests of various tactics, e.g., on use of bear bile in China (43) and palm oil in Spain and Poland (44), as well as real-world interventions. For example, an intervention with longitudinal data in Australia found that an interactive tiger exhibit influenced zoo guests to change their palm oil consumption (45).

Human Intrusions and Disturbance

Human intrusion and disturbance of wildlife negatively impact biodiversity (see, e.g., 46), and a range of interventions have tried to reduce or mitigate these impacts. Many of these have focused on modifying the behavior of tourists and recreational land users using passive messaging (47), with mixed impacts on visitor behavior (48). However, messaging can be effective when targeted toward visitor priorities (49), when combined with social marketing campaigns (50), or when using nontraditional communications channels [e.g., interactive or video messaging (51)]. More broadly, attributing the cause of biodiversity loss to direct human intrusion, such as overextraction, poaching, or pollution, can increase support for conservation policies as well as donations (52, 53).

People also create indirect disturbances for wildlife, for example, through nocturnal light pollution. McDonald et al. (54) showed that social norms for reducing light pollution can increase respondents' behavioral intentions to engage in similar behaviors, although Kamrowski et al. (55) found that high awareness of a local light-reduction campaign did not substantially alter behavior. Emerging evidence shows that making explicit the role of indirect human disturbances in causing zoonotic spillovers that ultimately threaten human well-being can also increase support for pro-conservation policies in some affected areas (56). There is little evidence about whether species-specific conservation policies systematically differ between populations close to the source of outbreak and those further away.

Natural System Modifications

Natural system modifications are typically due to systemic land use practices and therefore are more often addressed through regulation. However, changes to land manager and decision-maker behavior could change social norms and decrease local-scale threats. For example, in the realm of water management, interventions are needed to reduce unlawful water usage and wastage, particularly by land managers (57). Although water conservation awareness campaigns and noncompliance reporting have been suggested to lead to decreases in these disruptive behaviors, there is little literature empirically demonstrating success. The emerging field of socio-hydrology aims to explore this further using an approach grounded in community equity (58).

Invasive Species, Genes, and Diseases

Some research has explored the role of human behavior in managing invasive species, although these interventions typically have focused on the management of individual animals, rather than strategic prevention of novel biological invasions (59, p. 176). Behavior change interventions focused at the level of individual animals have included persuasive messaging and campaigns for domestic and feral animals, such as dogs and cats, particularly on islands like Australia and

New Zealand (60). One study indicated that messages focused on wildlife protection and benefit to cats increased owner motivation and responsiveness to messaging, which in turn increased both cat containment intentions and actual behavior (61). Another key topic in invasive management is preventing the unintentional introduction of non-native plants in protected areas. Field experiments have shown that interventions such as foot-stamps on the ground increased the likelihood of tourists cleaning their footwear before hiking, although effectiveness varies according to prior knowledge (62).

Pollution

Literature on the use of behavioral interventions to mitigate pollution impacts is limited. For example, nudges have been used in the context of water-pollution mitigation (e.g., 63, 64). Peth et al. (64) found that nudges could lead to reduced use of nitrogen fertilizer, which often results in water pollution through nitrogen runoff, although there was high heterogeneity in the results, with some nudges increasing nitrogen use in some groups. Nudging frameworks are also prominently used to mitigate air pollution (65). For example, Meleady et al. (66) conducted experiments using information to encourage car drivers to stop engines idling at rail crossings. They found that showing self-surveillance messages, e.g., "think of yourself," effectively increased the likelihood of drivers turning off idling engines, although a common nudge intervention using images of "watching eyes" did not prove effective.

More recently, plastic pollution has gained increased visibility. Historically, many scholars conducted evaluations of messaging campaigns designed to reduce plastic litter in various settings, including natural areas (e.g., 67, 68). More recently, several similar interventions have explored mechanisms to reduce the consumption of single-use cutlery. He et al. (69) used a mobile food delivery platform in China to assess green nudge impacts. They found that the green nudge interventions on the app reduced the number of orders that requested single-use cutlery, while maintaining business performance by the food delivery company. An analysis of 65 papers and 50 plastic campaigns identified information, motivation, and opportunity as three necessary elements to effectively shift consumers toward sustainable use of plastic (70).

Climate Change and Severe Weather

There is a large body of literature on interventions to change climate behaviors, although it focuses predominantly on WEIRD (Western, educated, industrialized, rich, and democratic) populations (71, 72). The biggest thematic areas with strong evidence for behavior change tend to be energy and water conservation and waste behaviors like recycling (72). Many household behaviors have a low behavioral plasticity, and behavioral interventions may benefit from being combined with alternative strategies, such as financial incentives or regulations (73).

Common behavioral interventions in this area include education, such as visiting households to discuss the benefits of recycling and local recycling service (74); demonstrations to model a desired behavior, such as conspicuously disposing of food waste in appropriate receptacles in a restaurant (75); feedback, such as home energy reports featuring personalized energy use feedback (76); and goal setting, such as asking energy consumers to set a specific energy-saving goal (77). Social norm interventions are also widely used, as normative beliefs predict a variety of climate-related behaviors (78). However, using a mixture of different approaches in one intervention may be the most successful (72), e.g., using normative feedback comparing participants' performance with those of their peers (79, 80).

Incorporating individuals' social networks and local knowledge into community-led climate initiatives shows a lot of promise in scaling up the transition toward a low-carbon economy

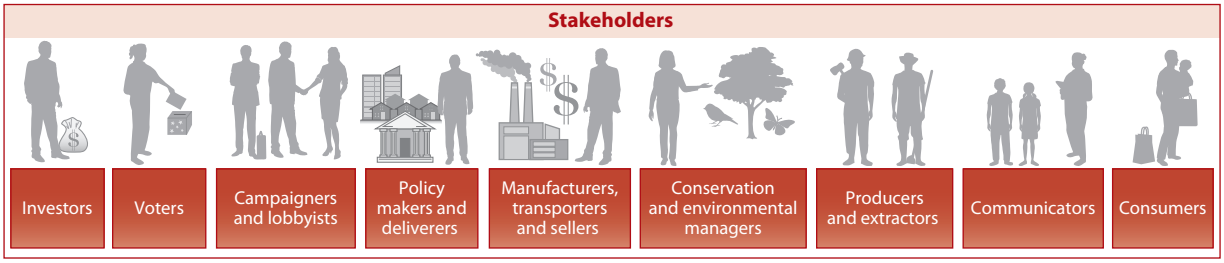

Figure 3

Key stakeholder groups that both influence and are impacted by decisions and actions related to biodiversity and its conservation, as defined by Nielsen et al. (7).

(81, 82). Practitioners can form community groups with local organizations and individuals and encourage independent projects such as food-growing schemes or recycling collections (82; **https://www.cagoxfordshire.org.uk**). These groups can go on to become self-sufficient, such as Sustainable Hockerton, which established its own community-funded renewable energy project to provide an ongoing income stream (83). Even when community groups do not become self-sustaining, they may still lead to a range of climate mitigation outcomes. For example, the UK Communities Cutting Carbon scheme led to the installation of solar panels and the repair of sustainable technology (82).

One final area where there has been growing research interest is climate-friendly diets, given the impact of diets on global greenhouse gas emissions (84). Again, informational interventions have proven to be effective, reducing meat consumption for more than three years (85). Manipulating the choice architecture of dietary decisions is another option, such as simply increasing the number of vegetarian options available in a restaurant setting (86).

INFLUENCING CONSERVATION STAKEHOLDERS

Below we discuss the literature on behavioral interventions targeting each of the stakeholder groups associated with biodiversity loss (7) (**Figure 3**) to showcase how behavior change interventions have been used to influence the full gamut of human groups relevant to biodiversity conservation.

Investors

Ultimately, many of the decisions that impact biodiversity are economic ones, so investors must be included in the discussion surrounding biodiversity-friendly behavior change. Investors have the power to shape corporate behavior, exemplified by SeaWorld's response to *Blackfish*, a documentary on the negative impacts of captivity on orcas held in SeaWorld's facilities. In response to the documentary, SeaWorld's share price dropped 45% in a 12-month period (87); the corporation responded by centering conservation in their messaging and ceasing their orca-breeding program (88).

The influence of biodiversity goals on investor decisions is little understood, but a range of studies have explored the role of corporate sustainability and pro-environmental behavior on investors' decisions. Unfortunately, laboratory experiments suggest that environmental or sustainability information has little or no impact on investment decisions (89–91). However, a natural experiment on the collective behavior of US mutual fund investors, who are responsible for more than $8 trillion in mutual fund assets, showed that investors treat sustainability as a positive attribute and allocate more money to sustainable funds (92). Following the publication

of sustainability information and ratings on Morningstar (a leading financial research website), investors reduced investment in the least sustainable funds by $12–15 billion and increased investment in the most sustainable funds by $24–32 billion, demonstrating the impact of easy access to sustainability information on investor behavior (92).

Voters

Various interventions leverage social networks and pressure in political organizing, such as deep canvassing (93). For example, Green & Gerber (94) found that a get-out-the-vote campaign in which individuals encouraged friends to vote increased turnout in the 2018 US midterm elections. Conservationists could use similar approaches to campaign for people to vote specifically for politicians with a track record of protecting biodiversity.

More generally, low public support of conservation policies and laws may be a barrier to effective implementation. A lack of public acceptance can even result in widespread outrage, anger, and protest, as seen in the *gilets jaunes* protests in France (95). Behavioral researchers have therefore evaluated when people find policy interventions acceptable, for example, by focusing on policy-specific beliefs. Studies have found consistently that perceived policy effectiveness can increase public support; meanwhile, some policies, such carbon or meat taxes, can be perceived as unfair, which in turn can reduce policy support (95). Others point out that low levels of trust, more generally and toward specific parties—like scientists, government, and industry—reduce policy acceptability (96). This mistrust may be exacerbated as the public sees a rise in fossil fuel subsidies targeting industry, unless it is supported by alternative efforts such as revenue recycling (97).

Campaigners and Lobbyists

While there is growing research on how misinformation and disinformation spread by vested interests and lobby groups can deter conservation action among the public (98), or indeed how the public can be nudged to decipher such false information (99), there is far less research on how to change the behavior of lobbyists themselves.

Litigation may not typically be considered a behavioral intervention, but a growing number of climate litigation cases aim to hold various lobbyist groups, including fossil fuel companies, to account. At the time of writing, an estimated 500 climate litigation cases have been filed around the world since 2020, and such legal action poses a growing risk for the fossil fuel industry and other companies, as well as governments (100). Apart from imposing real financial costs on companies, there are also significant reputational costs that can result in reduced sales. For instance, Barrage et al. (101) found that consumers reduced their purchase of BP products after the company pleaded guilty to illegal conduct leading to and after the 2010 *Deepwater Horizon* disaster. However, the authors also show that BP's advertising may have dampened changes in consumer behavior. Therefore, the extent to which litigation leads to behavior change over time is unclear.

Other softer approaches focus on encouraging voluntary efforts like information disclosures, such as carbon credits or certification through eco-labels. Unfortunately, emerging evidence shows that estimated impacts from such voluntary projects may be overestimated. For example, West et al. (102) examined the impacts of 27 forest conservation projects in 6 countries and found that most projects have not reduced deforestation, and that reductions were substantially lower than claimed for projects that did. Others suggest that disclosures can act as a form of carbon- and greenwashing, when companies deliberately or selectively communicate information not matched with actual environmental impacts (103). However, we found no documented examples of behavioral interventions targeting lobbyists.

Policymakers and Deliverers

Policymakers must deal with competing interests and values from multiple stakeholders and lobbyists, which may leave biodiversity loss low down on their priority lists. Furthermore, they also face trade-offs across the type of policy instrument that can be used, because conservation policy interventions that can shape behavior range from harder laws and regulations to softer approaches like nudges (104). For instance, Hagmann et al. (105) found that policy makers are more likely to prefer a green energy default nudge over a carbon tax—although the latter can be perceived as more effective—because the former imposes a lower cost.

One example of a successful behavioral intervention aimed at policymakers is the coordinated campaign to protect the EU Natura 2000 directives (106). It featured allies from various backgrounds to reduce psychological distance for politicians from different regions and broke the status quo by demonstrating that not all farmers, businessmen, etc., consider Natura 2000 a "hindrance of development."

However, research from historical social movements demonstrates the need for grassroots organizations to explicitly target the elite sectors that can force politicians to confront the climate and ecological emergency (107). Public opinion is rarely sufficient to create political change. For conservationists to change politicians' behavior, a systematic campaign on direct action may be needed, which imposes direct costs on elite decision makers, is sustained, and encompasses a range of tactics (107).

Manufacturers, Transporters, and Sellers

There is limited work on how conventional behavioral interventions like green nudges can improve firm performance at the macrolevel. However, there have been attempts to evaluate environmental policies such as carbon pricing and regulations targeting polluting manufacturing firms, such as oil refineries and steel and cement works. Calel & Dechezleprêtre (108), for example, found that the EU Emissions Trading System increased low-carbon innovation among regulated firms by as much as 10%. However, Green (109) points out that carbon pricing has modest effects on reducing emissions (between 0% and 2% per annum) with considerable variation across sectors, and that carbon taxes may be more effective than trading schemes.

An emerging body of work has also evaluated the effects of pro-environmental management practices, via providing information and nudges, on employee motivations and behavior. For instance, in the transport sector, feedback on fuel use and performance can increase fuel conservation behaviors among airline pilots and truckers (36, 110). Studies also show that workplace initiatives can also create positive behavioral spillover effects across contexts, where employees also report undertaking conservation behaviors at home (111). However, for habitual behaviors such as employee commuting, nudges have often proved ineffective (112, 113). This is unsurprising, because such travel habits often are determined by infrastructure availability, cost, and city design in addition to behavioral factors (113, 114).

There have been efforts to influence behavior by adopting eco-labeling schemes across the supply chain. However, evidence of these labels' impact on behavior, business, and the environment is limited (115, 116). Most evaluations have focused on whether consumers buy eco-labeled products and the impact of better product design, for example, by using well-designed eco-labels, such as those with a traffic-light design (117) or appealing to green identity (118). Such labels are necessary to ensure transparency in the environmental footprint of the products (119). However, there is also evidence that eco-labels may reduce the purchase of green products if they are perceived as poorer quality (120), and that consumers may unintentionally increase resource use due to rebound and moral licensing effects (121). Multiple, poorly defined and unverified

eco-labels can also induce confusion in the consumer by obscuring the true environmental impact and reducing consumer trust, and act as greenwashing (114).

Producers and Extractors

Farmers are likely the most targeted type of producers, facing interventions with a variety of asks, such as increasing wildlife habitat (122), decreasing pesticide use (123), and mitigating climate impacts (124). A major driver to this literature has been evaluations of various payments for ecosystem services (PES) schemes implemented in countries all over the world (e.g., 125), although examples also exist of nonfinancial programs (126).

Regarding extractors, fishers have been the group most often targeted by behavior change interventions, with some of the first examples of global-scale behavioral interventions in conservation targeting this group (42). These have focused chiefly on small-scale fisheries in nations with long coastlines and highly biodiverse marine environments, such as the Philippines and Indonesia (42, 127). These programs have had mixed findings, with social and biological outcomes often uncorrelated.

Limited literature focuses on timber and wood extractors, mostly on fuelwood collection by households (128). DeWan et al. (128) found initial evidence of reduced deforestation as a result of a social marketing campaign around the conservation of the golden snub-nosed monkey, which aimed to drive adoption of fuel-efficient stoves.

Hunters have also received limited attention in the literature in terms of interventions focused on voluntary change. This is exemplified by issues such as the use of lead ammunition, where voluntary change is often perceived as challenging, placing the focus on coercive regulations like bans (129). Exceptions to this focus on regulation include Steinmetz et al. (130), who documented reductions in wildlife poaching following community outreach in Thailand. Saypanya et al. (131) followed a mixed approach, combining social marketing and law enforcement, and documented increased community reporting of wildlife poaching of tiger prey species in Lao People's Democratic Republic.

Conservation and Environmental Managers

Influencing and supporting conservation managers to make more effective conservation decisions has long been a focus of conservation research (132). Conservation manager is a broad term that covers a wide spectrum of stakeholders engaged in site-based conservation of lands and seas, including private landowners and First Nation and Indigenous groups. Generally, conservation managers seek to reduce and mitigate the impacts of drivers of biodiversity loss, as well as restore and enhance biodiversity in a specific location.

Given the breadth of these communities, and their direct influence on biodiversity, surprisingly little research reports behavioral interventions targeting conservation managers. Multiple studies demonstrate that provision of information is ineffective at changing management actions, as managers often rely on heuristics to make decisions (133, 134). And although there is extensive research on the behavior of private land conservation managers, these have been primarily explorative studies examining participation or management decisions through ex post evaluation (135).

There are exceptions. For instance, Niemiec et al. (136) found that incorporating behavioral interventions into an invasive species outreach program on private lands increased peer-to-peer recruitment and coordination. The interventions included increasing communication among community members, engaging in collective goal setting and public commitment making, and creating awareness of actions through yard signs and postcards. Metcalf et al. (137) tested the efficacy of nudges and microtargeting, tailoring a message to increase its salience for individuals

based on demographic, behavioral, and psychological information, to increase participation in a riparian conservation program. The microtargeting message increased response by 66% over the control group, whereas the normative message increased response by 23%.

Communicators

Although discussion of communication's role in addressing biodiversity loss is increasing (138), there appears to be limited literature focused explicitly on influencing the role of communicators themselves. One exception seems to be around climate change. Weathercasters have been the focus of interventions to communicate the geographical and temporally proximate impacts of climate change; they have been targeted to enhance their prominence as a trusted source and increase the saliency of climate change in their reporting (139). Recent evidence largely from Europe shows increased inclusion of climate scientists, especially when covering extreme weather events (140).

Consumers

Regarding interventions focused directly on the consumers of biodiversity, one area that has received much attention historically is the trade of large-bodied mammal parts for nondietary purposes, such as elephant ivory in mostly Asian countries. The literature on interventions addressing ivory has focused mostly on understanding the impacts of coercive interventions such as the ivory international trade ban, with controversy remaining around the conclusions (141). Interventions aimed more specifically at consumers have been poorly documented in the literature; Thomas-Walters et al. (142) found that demand reduction efforts in Japan played a minor role in decreasing the ivory market, compared to the economic recession and Convention on International Trade in Endangered Species of Wild Fauna and Flora trade ban.

In the last decade, topics such as wild meat consumption in lower-income countries have also gained more prominence, both on land (143) and at sea (41). Chaves et al. (143) found a decrease in consumption of wild mammals and birds, but not river turtles, as a result of a social marketing campaign in the Brazilian Amazon. Thomas-Walters et al. (41) documented a decrease in sea turtle poaching, likely a result of changes in regulation and enforcement as well as a social marketing campaign.

Seafood consumers have also received particular attention, this time mostly in Europe and North America (37). Starting in the 1990s with the dolphin-safe label, several seafood certification schemes have emerged (144, 145). In parallel, many interventions have focused on sustainable purchasing of seafood, from traditional mass media campaigns and cookbooks meant to inform consumers of alternative recipes, to fish consumer guides available through various online and offline channels (144). Surprisingly, the trade in timber, which in financial terms represents most of the wildlife trade, has been largely absent from the literature on behavioral interventions. The exception to this is Belinga et al. (146), who looked at the impact of a media campaign on intentions to purchase timber in Cameroon and found an increased intention to purchase legally sourced timber as a result of a media campaign. More broadly, consumers are also often the focus of interventions around energy conservation, waste management and, to a lesser extent, transportation and water conservation (72).

CHANNELS TO DELIVER CHANGE

Here we review the literature around behavioral interventions for biodiversity conservation using different communication channels and delivery modes (147) (**Figure 4**). It is challenging to extricate the effects of the delivery method versus, for example, the appropriateness of the campaign or target audience selection in securing the desired outcome. The following section nevertheless

Figure 4

Key communication channels to deliver behavioral interventions in the context of biodiversity conservation are disseminated and implemented as defined by Balmford et al. (147).

aims to synthesize the currently available information. The goal is to showcase the wide variety of formats that behavior change interventions can take.

In Person

Social influence, for example, through norms, personal contact, and networks, can promote (or undermine) the adoption of conservation-friendly behaviors. Such in-person, peer-to-peer influence has been widely shown to promote uptake of target conservation behaviors, including through public pledges (148) or participatory peer learning (149). Some of this effect is driven by the social influence of individuals who may be opinion leaders (150), trusted individuals (151), or people with culturally valued social attributes [e.g., age, sex, or wealth attributes (25)]. One example of this is religion. McKay et al. (152) demonstrated the value of religious sermons in increasing community prioritization of conservation activities. Other authors have shown that belief in supernatural beings such as deities can reinforce sustainable community management of resources (153), and that engaging audiences through religious institutions can promote uptake of conservation initiatives (see 154). Cultural and religious taboos are also thought to contribute to conservation outcomes in many places. For example, Andriamalala et al. (155) used social marketing to reinforce the applicability of local laws around fishing, with increased positive attitudes toward local customary law and self-reported decrease in use of destructive fishing methods.

Radio

Radio is a viable vehicle for reaching wide-ranging audiences and has been used by governments and nongovernmental organizations to promote social and environmental change (156). Several conservation efforts have used radio in some form to influence human attitudes, knowledge, and behavior, often as a complement to other mediums (131), though it can also be the main mode of intervention (127, 157). Unfortunately, few documented radio-based interventions focused on biodiversity efforts for conservation have been robustly evaluated.

Before–after/control–impact (BACI): research design that involves measurement of a variable of interest (e.g., recycling rates) at a site or sites before and after an intervention, in comparison to one or more control sites

One radio-focused intervention that was evaluated with a matched before–after/control–impact (BACI) design found that conveying educational conservation messages through a Tanzanian radio show did not appear to reduce demand for bushmeat (127). By contrast another study, though without a control group, found that 62 radio-based campaigns to reduce contamination of local water sources in Latin America were thought to influence proper recycling of batteries and reuse of plastic bottles/bags (158). And in Kenya, radio programs addressing urban environmental challenges in informal settlements were thought to influence behavior around water treatment, waste disposal, cleanup projects, and rainwater harvesting (159). Additionally, a weekly environmental radio program in Uganda found that listeners actively participated in and

contributed to the campaign's tree planting objectives (157). Finally, among the multipronged campaigns in which radio was one of many components, a campaign in Lao People's Democratic Republic was shown, through an unmatched controlled design, to be effective at reducing direct killing of tigers and their prey, though how much the radio contributed to this effect is unclear (131).

Television

Because a person's feelings and behaviors toward the environment are associated with their total exposure to wildlife media (160), television-based interventions may support pro-environmental change. Specifically, both documentaries and movies are increasingly used as platforms to communicate conservation messages (161), and their potential impacts have been explored by conservationists (e.g., 88, 162–164). For example, following the original broadcast of popular Japanese cartoon series *Kemono Friends*, Fukano et al. (161) found that the public directed more donations to featured species than those not featured. Furthermore, such media has been linked to increased awareness, interest, and information-seeking behaviors regarding species and environmental topics (161, 163) and even underpinned significant organizational changes at SeaWorld (88).

However, it may also risk unsustainable levels of visitor pressure (165), and its potential role in illegal trade of featured species has been discussed (see 166). Additionally, documentaries have shown considerable biases and inaccuracies when representing certain habitats and taxa (see 165, 167).

Print

Interventions that commonly include print materials, such as Rare's Pride campaigns, have often successfully disrupted target behaviors [e.g., overfishing and illegal hunting (168)]. Much research has addressed how print media should be designed to influence audiences. For example, there has been particular focus on using photographs [often used to communicate environmental concerns (169)]. Although some studies demonstrate no significant differences between the influence of various images on donation behavior (169, 170), others suggest that use of negative imagery depicting harmed wildlife has the greatest benefit for pro-environmental action (171). In addition, Abrams et al. (172) recommended that print materials emphasize the personal benefits of performing pro-environmental behaviors, to sidestep a need for audiences to already be like-minded and motivated to comply with environmental messages. Yet, other evidence shows that signage appealing to the benefits available to self or others has similar effects on behavioral intentions to support threatened species (173). Finally, conservationists have been urged to collaborate with producers of print media to provide content with increased diversity of taxa, alongside more emphasis on the value of biodiversity and the need to protect it (174, 175). This is because poor availability of information about species, coupled with biased depictions of them, can affect knowledge and concern about biodiversity (174, 175). Indeed, educating local reporters about the complexities of human–leopard conflict has resulted in less-sensationalized newspaper headlines, plus more informative and nuanced content (176).

Online Advertising

Online advertising is continually evolving, with examples ranging from adverts displayed on websites such as search engines (e.g., promoted Google results), online classifieds, and social media, to email and mobile phone adverts (e.g., push notifications). The two main forms of social media advertisement are news feed adverts (i.e., unsubscribed-to sponsored posts intermix with genuine content) and sponsored content (e.g., when a subscribed-to influencer promotes products within

their post/video). Conservationists make extensive use of sponsored and non-sponsored social media, little of which has been evaluated (177). One of the few examples is the success of a social media campaign promoting fishing tournaments for invasive lionfish in Florida, which doubled participation and resulted in ten times more lionfish removed than previously (177). Conservation research around social media metrics, hashtags, and advert optimization is increasing (178–180). One study used randomized BACI designs through Facebook to test the effect of different focal species on donations (181). Though no species elicited regular donations, wild dogs were more successful than elephants in driving online traffic.

There is also a burgeoning use of online advertising beyond social media. A country-level intervention in Singapore to reduce saiga horn usage involved spreading news articles via promoted Google results, native adverts (e.g., suggested news articles), and sponsored in-feed Facebook posts (182). Though frequency of high-level users specifically did not decrease, the target audience overall did reduce their saiga horn usage and attributed these changes to the intervention (38). A campaign in Thailand to reduce ivory and tiger purchases involved promoting Google results that emphasized that illegal wildlife trade is risky and enforcement officers are monitoring online purchases (183). The overall impact of these deterrence ads is unclear, but individuals exposed to the ads decreased their intention to buy ivory.

Mobile Games

With billions of players worldwide, the gaming industry boasts a massive and diverse audience (184), providing an opportunity for conservationists to reach new segments of the population and advance environmental outreach. Digital gaming could deliver education and behavior change; improve fundraising; and promote research, monitoring, and planning (185). Unlike the passivity of viewing traditional wildlife media, active engagement with conservation-focused games could elicit affective responses that manifest commitments to protect the natural world (186). Current empirical research prioritizes use of mobile games—the dominant approach to gaming (187)—but evidence is limited, and their overall impact signifies an environmental value–behavior gap (186). *Save the Purple Frog* has been shown to improve learning about species but failed to move conservation attitudes or behaviors (188). Additionally, *Wildeverse* has performed comparably to documentaries in driving environmental knowledge and attitudes but failed to generate donations for conservation efforts (184). These findings may support concerns that gaming results in slacktivism [i.e., play could lead to a false belief that this alone is enough to support conservation efforts (184, 186)] and worsens human–nature disconnect (186).

Even so, conservationists are encouraged to understand and collaborate with the gaming industry and learn from its successes (185, 189). For example, students show more engagement and learning when Pokémon species are used to teach important real-world ecological interactions (190). Therefore, conservationists have been advised to build upon the popular mobile game *Pokémon Go*, a game that conveys natural history concepts to millions of players (189). Ultimately, with increasing urbanization, financial costs, safety concerns, and the diminishing populations of species, it is no longer feasible to rely solely on direct engagement with nature to engender pro-environmental attitudes and behaviors. The potential impacts of digital gaming as a behavioral intervention to advance conservation efforts warrant more investigation (184–186, 188).

Policy

Government and organizational policies can influence widespread behavior change for the benefit of biodiversity conservation, often acting as meta-interventions that create the conditions for the use of other delivery channels. The least intrusive policies use education and outreach to

BEYOND KNOWLEDGE AND AWARENESS

The need to influence people has been a significant aspect of conservation work for several decades. However, the focus has often been on raising awareness, improving knowledge, and changing attitudes. Although these factors may be important in certain contexts, a significant body of work suggests that changes to awareness, knowledge, or attitudes seldom lead to changes in behavior. Indeed, although influencing these attributes may be necessary, these changes are only initial steps in bringing about behavioral change. True conservation gains and the mitigation of extinction rates can be realized only when change occurs tangibly in the real world. Therefore, emphasizing awareness, knowledge, attitudes, or other intangible indicators to understand or change behavior can be a distraction. These indicators are easier to influence but frequently are not directly related to behavioral change itself. As a result, they may create an illusion of progress.

encourage or discourage certain behaviors. A review of 105 environmental education studies found many programs achieve changes in knowledge and attitudes (191). Whether this pro-environmental awareness results in behavioral change is less clear, as captured by the "environmental attitude-behavior gap" (see the sidebar titled Beyond Knowledge and Awareness) (192). A similar strategy is to use eco-labels and certification schemes to inform consumers about the environmental impacts of their purchasing, such as organic agriculture or sustainable forestry or fishing. This information could affect behavior in a variety of ways (193), and there is evidence that eco-labels do influence consumer decisions (194). However, sellers must be fully transparent and responsible when implementing such schemes (see the sections titled Manufacturers, Transporters, and Sellers and Campaigners and Lobbyists).

Often, policies use incentives (carrots) or punishments (sticks) to change behavior. Incentive-based mechanisms allow stakeholders to choose whether or how much to change their behavior based on the economic incentives they face. These incentives include taxes and fees, tradable permits, subsidies, and reduced market frictions. By altering the economic benefits and costs of behavior change, incentive-based policies can induce individuals, businesses, and organizations to act in ways that conserve biodiversity. Incentive-based policies have gained prominence in addressing conservation challenges, particularly through PES schemes. A recent analysis found 120 biodiversity and habitat PES programs in 36 countries (195). However, there is evidence that incentivizing behavior change, particularly through monetary payments, can lead to "crowding out" intrinsic motivations for conservation (196).

A contrasting policy approach is direct regulation, which mandates behavior change and then sanctions noncompliance. Regulation is often used when the potential costs of inaction are high (i.e., extinction). Again, there is theoretical and empirical evidence that regulatory policies (e.g., the Endangered Species Act) can create perverse incentives, where landowners may destroy habitat to preempt regulation (197). This private information is unobservable to policymakers (also known as information asymmetry) and is a key challenge in designing effective and efficient policies for protecting habitat and species.

Both incentive-based and regulatory policies may benefit from a more thorough and nuanced understanding of human decision making and behavior (198). For one, the acceptability of conservation policies is subject to perceptions about benefits, costs, and fairness (199). Accounting for other factors that influence behavior, such as the choice environment and default settings, has been shown to affect policy-relevant behavior (200). A growing body of evidence shows how conservation auctions can address information asymmetries and agglomeration bonuses can leverage prosocial coordination (201).

Physical Environment

Impact evaluation: provides information about the observed changes produced by an intervention, both intended and unintended, and establishes causal attribution

Behavior is influenced by the context in which it occurs, and the physical environment is thought to have substantial impact on individuals' behavioral choices. Changing the cues for behavior in small-scale physical environments can have substantial influence on behavior (202). For example, creating an opt-out default setting for hotel towel replacement, whereby visitors needed to place a physical card in bathrooms when they wished for towels to be replaced, substantially increased towel reuse (203). Numerous behavioral nudges have targeted these microenvironment features with a view to promoting sustainable behavior (see, e.g., 202).

Modifications to the physical macroenvironment (i.e., changes to physical or organizational structures and facilities) are also thought to meaningfully influence behavior, often by making certain behaviors accessible or inaccessible. Although there is little available literature exploring this approach from a conservation perspective, in a review of organizational environmental sustainability efforts, Young et al. (204) found that companies' environmental infrastructure could positively impact behaviors within the organization. For example, thorough integration of recycling bins into an office building significantly improved the recycling habits of employees (205). Similarly, a review of organizations that incorporated facilities to encourage sustainable employee travel (e.g., reduced access to car parking, benefits for ride-sharing and cyclists, or company shuttle buses) reported an overall 18% decline in commuting by car (206).

GAPS AND WAYS FORWARD

The sections above review the existing literature on behavior change in the context of biodiversity conservation. Although much has been done, future work needs to tackle key challenges. We recommend the following strategies.

Prioritize Behaviors

With nearly every human decision having some impact on biodiversity, it is clear that we need to identify which behaviors are most relevant to conservation (7, 207). This prioritization must consider the ease and cost of influencing a behavior, as well as the impact of the behavior on biodiversity. Obtaining standardized information about different behaviors in formats that allow for comparisons will be challenging. Developing unifying metrics to allow prioritization should be a key objective.

Consider Inequalities

A key part of maximizing the efficacy of behavior interventions is to target sectors, products, groups, and individuals with the highest ecological impact. Since 1990, the bottom 50% of the world's population has been responsible for only 16% of all emissions growth, whereas the top 1% has been responsible for 23% of the total (208). These current and historical inequalities affect people's capability to reduce emissions while meeting basic health, livelihood, and energy needs, and many conservation hotspots are in poorer and more vulnerable regions. Furthermore, lack of perceived fairness can undermine support for environmental policies.

Measure Impact

Across the different sections, we found a consistent lack of robust impact evaluation. This is concerning because without a clear sense of what works, precious resources may be invested in activities that may not help, or may even worsen, the status of biodiversity. Only an evidence-led approach to behavior change can help deliver its benefits and overcome the suspicion that exists

in many quarters, where work of this kind is not seen as rigorous or research intensive. This also explains the limitations found in some sections in terms of available literature, where behavior change interventions are not documented at all.

Broaden Thematic Focus

The broad scope of this review along three axes has highlighted several important gaps in the literature. In terms of delivery modes, even for established channels of communication (e.g., TV or radio) the literature was limited. Given the widespread use of these channels, this is likely another reflection of the gap between the interventions that are implemented in the field and those few that are reported in the literature. There were also clear literature gaps regarding stakeholders not directly involved in the commodity chain: Groups such as investors or policy makers have received very limited attention, and others, such as campaigners and communicators, have been studied only in the context of climate change. In relation to threats, there was significant heterogeneity, with natural system modifications (e.g., fire management) having barely any relevant literature, and no relevant literature around energy production and mining processes.

Scale-Up Interventions

Although the global scale of the extinction crisis is widely evidenced, and the need for societal-scale change recognized, there are few examples of large-scale (e.g., multicountry) behavior change interventions that aim to promote biodiversity conservation. This disconnect means that although there are certainly examples of behavior change interventions contributing to the delivery of societal-scale transformation in sectors like public health or international development, such behavioral interventions in the context of biodiversity conservation continue to play a rather limited role. The challenges around scaling up interventions are partially related to the more limited nature of the funding for biodiversity conservation when compared to fields such as international development or public health. Another key barrier is our lack of understanding of whether the impact of different kinds of intervention can vary across distinct social, institutional, and cultural contexts. This is, of course, also a function of how much resourcing is available for biodiversity conservation compared to, say, areas where large-scale behavior change interventions are often carried out, as was evidenced by the recent COVID-19 pandemic.

Tackle the Reproducibility Crisis

The behavioral and social sciences are grappling with a reproducibility crisis (209), challenging some of the established findings in the field (e.g., priming; 210). This has led to concerns about the validity and generalizability of behavioral science results. Factors likely contributing to replicability issues include publication bias, p-hacking, small sample sizes, the misuse of statistical methods, and lack of study participant diversity (see 211 for details). Undiscerning use of behavioral science research in conservation contexts may result in the employment of non-replicable findings and thus ineffective conservation interventions or even perverse outcomes. Conservation behavior change should embrace open science principles by preregistering studies, using open-source statistical modeling software, calculating and reporting effect sizes in addition to p-values, and using large sample sizes when possible.

POST-2020

The last decade saw the inclusion of behavioral insights in biodiversity conservation at a pace faster than at any time since the field started 50 years ago, a trend that coincided with the expansion of the social sciences in the field more broadly. It was only natural, therefore, to see Resolution

064, "Promoting conservation through behaviour-centred solutions," approved by the 2020 World Conservation Congress, a sign of broad support across governments and civil society. Yet, this resolution is nonbinding, and the apparent groundswell did not reach the Kunming-Montreal Global Biodiversity Framework, adopted in December 2022. This framework, part of the Convention on Biological Diversity that binds 196 countries, is expected to be the major policy framework guiding biodiversity conservation in the current decade. With the previous Global Biodiversity Framework having a target specifically focused on awareness, there was the opportunity to be more ambitious and feature behavior change as part of one of the targets for the first time. Yet, these ambitions were thwarted. Just one target, Target 16, had any mention of behavior, and this only in the context of sustainable consumption. Only time will tell whether we have reached a turning point in the adoption of behavioral change approaches in the context of biodiversity conservation, but clearly, considerable work remains be done.

SUMMARY POINTS

1. Human behavior is at the crux of all major threats to biodiversity, and influencing it is the only way to curb the ongoing extinction crisis.
2. When it comes to threats, climate change has been the focus of most research, with a surprisingly limited amount of literature on key threats such as invasive species, natural system modifications, or transportation, and virtually no literature at all on energy production and mining.
3. Behavioral change research has focused on a large diversity of stakeholders, but the attention given to specific groups varies considerably. Supply-chain stakeholders, such as consumers, producers, and extractors, have had more research than stakeholders who indirectly influence biodiversity threats, such as investors, voters, communicators, campaigners, and lobbyists.
4. Behavioral interventions to support biodiversity conservation have used a large diversity of delivery modes, from social and mass media to modifications to the physical environment. There is some evidence around the potential of more established media such as radio and TV, but digital channels and in-person delivery modes have only nascent evidence bases.
5. The dominant theme across the three axes of this review was the absence of robust evaluation, limiting our ability to draw comprehensive conclusions about successful threat reductions, stakeholders, or delivery channels, in both absolute and relative terms. Additional challenges, such as the limited scale of the interventions that have been evaluated, further hinder progress.

FUTURE ISSUES

1. The behavioral contexts and intervention types that are more conducive to achieving and sustaining behavioral change over the long term.
2. The causal links between changes in specific human behaviors and impacts on biodiversity, particularly when there are time lags involved in the biological responses.

3. The characteristics of behavioral interventions that enable the potential scaling-up of impactful interventions to reach larger proportions of their target audiences.
4. How and when digital technologies such as virtual reality can help to cultivate empathy and environmentally responsible behaviors regarding biodiversity.
5. The false dichotomy between individual and systemic action, as both are necessary to tackle the climate and ecological emergency, and how to promote both without reducing demand for the other.
6. More data-driven ways to identify and prioritize behaviors that will have the most positive impact per unit of cost for future interventions.
7. Behavioral research beyond populations in Western, educated, industrialized, rich democracies to ensure interventions remain relevant in diverse cultural contexts.

DISCLOSURE STATEMENT

D.V. does consultancy work on behavioral science for biodiversity conservation nongovernmental organizations. The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

AUTHORSHIP STATEMENT

D.V. and L.T.-W. conceptualized the article. All authors contributed to the literature review and drafting of the article. Revisions were made by D.V. and L.R.P., with contributions from L.T.-W., K.B., H.D., M.J.S., and H.B.F.

ACKNOWLEDGMENTS

We thank Isa Pinho for the support in the compiling of this article, Sarah Markes for the initial conceptual design of the figures, and Kristian Steensen Nielsen for feedback on an early draft. The IUCN SSC CEC Taskforce thanks Zoomarine Portugal for the support.

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RELATED RESOURCES

Center for Behavior and the Environment: **https://behavior.rare.org/resources**. Online center focusing on translating science into practice and leveraging behavioral insights and design thinking approaches to tackle environmental issues. Led by Rare, a US-based conservation nongovernmental organization.

Change Wildlife Consumers: **https://www.changewildlifeconsumers.org**. An online platform with multiple guidance documents and a community of practice focused on behavior change to reduce demand for illegally traded wildlife products. Led by TRAFFIC, a UK-based conservation nongovernmental organization.

Conservation Social Science Partnership: **https://consosci.org**. A global community of nongovernmental organizations, social science practitioners, and researchers who seek to address critical gaps in social science capacity, implementation, and accessibility in conservation.

International Social Marketing Association: **https://isocialmarketing.org**. Global network advancing social marketing practice, research, and teaching to address complex social and environmental issues. Currently includes six regional member associations.

IUCN SSC CEC Behavior Change Taskforce: **https://www.conservationbehaviourchange.org**. Group of specialists in behavior change convened by the Commission for Species Survival and the Commission on Education and Communication of the International Union for Conservation of Nature.

Social Marketing @ Griffith: **https://www.griffith.edu.au/griffith-business-school/social-marketing-griffith/resources**. Center on the use of social marketing for social and environmental good, based at Griffith University, Australia.

UN Behavioural Science Group: **https://www.uninnovation.network/un-group-pages/behavioural-science**. Brings together more than 1,000 UN colleagues from 60+ UN entities and 110+ countries interested in the application of behavioral science, as well as several thousand non-UN observers.