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Reconnecting People to Nature Across Society to Shape the Future of Biodiversity

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ABSTRACT

Halting biodiversity loss will require transformative change across society, involving coordinated shifts in values, norms, and behaviors among diverse societal actors. Although this loss arises from multiple factors, personal and direct experiences of nature (hereafter, personalized ecologies) can play an important role in societal change. They shape how people perceive biodiversity and their willingness to support conservation. To date, however, the implications of personalized ecologies for the future of biodiversity have largely been explored in relation to the general public, with far less attention paid to their relevance across other societal sectors. Here, we synthesize existing evidence to examine how personalized ecologies among multiple societal actors (including direct natural resource users, business leaders, policy makers, citizens, educators, scientists, and journalists) can shape biodiversity outcomes. We show that, whilst the underlying psychological and cognitive mechanisms may be broadly similar across different actor groups, their effects are likely expressed through sector-specific decisions and practices. Behavioral change in one actor group can propagate to others through interconnected social, economic, and institutional pathways, influencing biodiversity outcomes. In this sense, personalized ecologies can act as cross-sectoral drivers of biodiversity change. However, their transformative potential is unlikely to be realized within a single actor group alone; synergistic increases across multiple societal sectors may be needed to generate mutually reinforcing effects that support biodiversity conservation. Strengthening engagement with nature across society, and counteracting the ongoing “extinction of experience”, may therefore play an important role in enabling transformative change towards biodiversity conservation and long-term societal sustainability.

1 | Introduction

Global biodiversity loss is accelerating at an unprecedented rate, posing profound risks to ecosystem functioning, human well-being, and the long-term sustainability of societies (Diaz et al. 2006; Cardinale et al. 2012; Isbell et al. 2017; Blicharska et al. 2019). Addressing this crisis will require transformative change across society, involving not only technological and institutional solutions but also fundamental shifts in human values, norms, and behaviors (Diaz et al. 2019; Pascual et al. 2022; Larigauderie et al. 2025). Decisions and actions

made by people, individually and collectively, play a central role in shaping biodiversity outcomes (Nielsen et al. 2021; Gaston et al. 2023; Veríssimo et al. 2024). Across society, actors in different sectors influence biodiversity through diverse and interconnected pathways, including land- and seascape management and resource extraction by primary producers such as farmers and fishers; consumption patterns, lifestyle choices, and political preferences of consumers; and production systems, supply chains, investment decisions, and corporate governance of businesses (Nielsen et al. 2021; Veríssimo et al. 2024). The central role of human behavior in halting and

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reversing biodiversity loss is now widely recognized in international policy frameworks, including the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (IPBES 2024).

Whilst transformative change requires action at multiple societal levels, one important influence stems from an individual's direct and personal experiences of nature (personalized ecologies; Gaston et al. 2018; Soga and Gaston 2022; Gaston et al. 2023; Gaston 2024). A growing body of evidence indicates that people who have more frequent, diverse or emotionally engaging interactions with nature tend to hold more positive attitudes towards biodiversity and show a greater willingness to support, and engage in, conservation actions (e.g., Collado and Evans 2019; Křepelková et al. 2020; Martin et al. 2020; Richardson et al. 2020; Soga and Gaston 2023a, 2024a). These relationships are attributed to the ways in which experiences of nature foster positive emotions, attachment, and concern for the natural world, thereby motivating attitudes and behaviors supportive of biodiversity conservation (Soga and Gaston 2016, 2022). As recognition of, and empirical support for, this idea has increased, promoting experiences of nature has begun to feature more prominently in conservation strategies and policy initiatives, particularly in high-income countries (e.g., national biodiversity strategies in Japan [Government of Japan 2023] and the UK (e.g., Natural Resources Wales 2023; Natural England 2025)). However, these efforts face an important challenge: the ongoing global decline in people's everyday interactions with nature (i.e., the extinction of experience), which may erode societal understanding of humanity's dependence on biodiversity and weaken support for its conservation (Soga and Gaston 2016, 2023b; Gaston et al. 2023).

Despite this growing interest, the broader implications of personalized ecologies for the future of biodiversity remain insufficiently synthesized. Existing evidence is fragmented across disciplines and contexts, and the discussion has predominantly focused on the attitudes and behaviors of the general public (e.g., Soga and Gaston 2016; Richardson et al. 2022; Gaston et al. 2023; Garfinkel et al. 2024; Soga et al. 2025). Whilst citizens in general undoubtedly play a critical role in shaping biodiversity outcomes, the decisions of particular groups of actors matter. Farmers, fishers, and other natural resource users, as well as business leaders, educators, land managers, and policymakers, all exert substantial direct or indirect influence on biodiversity through distinct, sector-specific decision-making pathways (Nielsen et al. 2021; Verissimo et al. 2024). Considering these actors alongside the general public is therefore essential for developing a more comprehensive understanding of how people's direct engagement with nature may collectively shape biodiversity outcomes, and for identifying where interventions may be most effective.

In this review, we examine how personalized ecologies influence the future of biodiversity across multiple societal sectors. Specifically, we (i) propose a conceptual framework for understanding how personal experiences of nature shape biodiversity outcomes through different societal actors, both directly and indirectly; and (ii) synthesize existing evidence to assess what is currently known, and where major knowledge gaps remain

regarding these pathways for different actor groups. Because the relevant literature spans a wide range of disciplines, including conservation science, psychology, education, and business studies, and common terminology is often lacking, a formal systematic review was not feasible. Instead, we present a targeted narrative synthesis drawing on key empirical and conceptual studies to identify current insights, limitations, and priorities for future research and practice.

2 | Framework

Our framework builds on established ideas linking personalized ecologies to pro-biodiversity attitudes and behaviors, particularly the nature benefit hypothesis (Soga and Gaston 2022, 2023a). This hypothesis posits that experiences of nature foster affective connections (e.g., positive emotions, attachment) and cognitive connections (e.g., knowledge, awareness, concern) to the natural world, which in turn promote behaviors supportive of biodiversity conservation. Following Nielsen et al. (2021), we adopt a broad understanding of pro-biodiversity behavior that includes a wide range of decisions and actions that affect biodiversity, both directly and indirectly, including actions that influence the decisions and behaviors of others.

Building on the nature benefit hypothesis, we conceptualize personalized ecologies as shaping biodiversity outcomes through multiple societal actors whose decisions and actions collectively determine the future of biodiversity (Figure 1). Building on Nielsen et al. (2021) and Verissimo et al. (2024), we distinguish six key actor groups that influence biodiversity through distinct decision-making contexts, whilst acknowledging that this typology is not exhaustive and that other potentially influential actors (e.g., religious groups) are not explicitly included. These actors affect biodiversity via pathways that range from direct, on-the-ground management and resource extraction to more indirect influences mediated through governance, markets, education, knowledge production, information flows, and social norms. Personalized ecologies may therefore exert both direct and indirect effects on biodiversity (Figure 1). We acknowledge that the strength and relative importance of these pathways are likely to vary across socio-political and institutional contexts. Indeed, the extent to which pro-biodiversity attitudes and behaviors expressed by these actors translate into biodiversity outcomes may depend on broader social, political, and economic conditions (Ioannou and Serafeim 2012; Amano et al. 2018).

Below, we examine how personalized ecologies within each actor group shape behaviors towards nature, and how these behaviors in turn influence biodiversity outcomes. Whilst our primary focus is on personalized ecologies, we also consider closely related constructs, particularly affective and cognitive connections to nature, including a sense of oneness with nature and interest in nature (Ives et al. 2018; Soga and Gaston 2023b), which can function both as drivers and consequences of personalized ecologies (Soga and Gaston 2022). Given that empirical evidence directly linking personalized ecologies to conservation-relevant behaviors remains limited in some domains (see below), adopting this broader lens enables a more comprehensive assessment

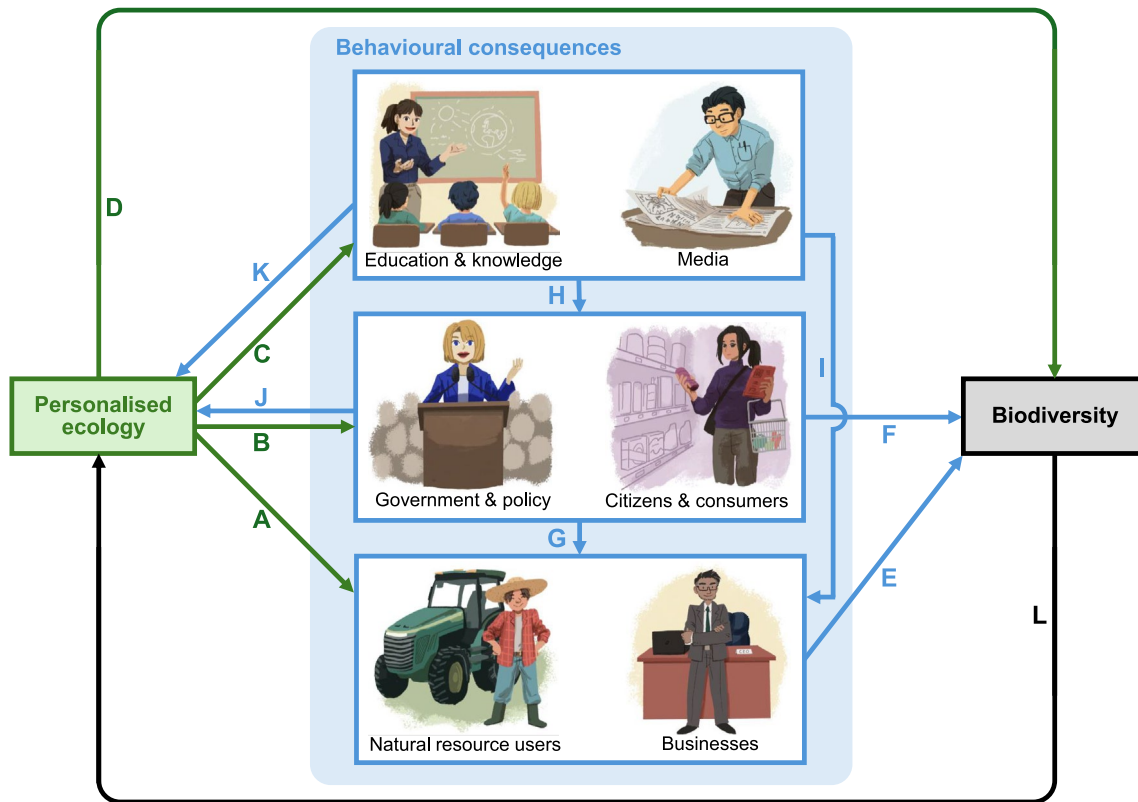


FIGURE 1 | Conceptual framework illustrating how individuals' direct experiences of nature (personalized ecologies) shape biodiversity outcomes through actor-specific behavioral pathways across six societal actor groups: Natural resource users; businesses; governmental and policy actors; citizens and consumers; knowledge and education actors; and media and communication actors. Actor groups are paired in the figure for visual simplicity, reflecting similarities in the general nature of the pathways through which personalized ecologies influence biodiversity within each pair. Personalized ecologies generate actor-specific behavioral consequences (Arrows A–C) and may also directly influence biodiversity (Arrow D). Natural resource users, businesses, governmental and policy actors, and citizens and consumers can affect biodiversity through direct actions (Arrows E, F). Governmental and policy actors, citizens and consumers, knowledge and education actors, and media and communication actors may also exert indirect influences on biodiversity mediated through other actors' behavior (Arrows G–I). Furthermore, governmental and policy actors, citizens and consumers, knowledge and education actors, and media and communication actors can enhance personalized ecologies by shaping opportunities, motivations, and capabilities for nature experiences (Arrows J, K). Changes in biodiversity resulting from these behavioral pathways can, in turn, influence individuals' personalized ecologies, forming a feedback loop (Arrow L). Arrow colors represent the primary source of each pathway: Personalized ecologies (green), actor behaviors (blue), and biodiversity change (black).

and reduces the risk of overlooking relevant insights within the wider literature.

3 | Pathways

Personalized ecologies can influence biodiversity outcomes through actor-specific behavioral pathways (Figure 1; Arrows A–C) and may also directly affect biodiversity (Arrow D). Natural resource users, businesses, governmental and policy actors, and citizens and consumers can influence biodiversity primarily through direct actions (Arrows E, F), whereas governmental and policy actors, citizens and consumers, knowledge and education actors, and media and communication actors can mainly exert indirect effects mediated through the behavior of other actors (Arrows G–I). These latter actor groups can also enhance personalized ecologies by shaping opportunities, motivations, and capabilities for nature experiences (Arrows J, K). Changes in biodiversity resulting from these pathways may, in turn, influence individuals' personalized ecologies, creating a feedback loop (Arrow L).

3.1 | Direct Natural Resource Users

Direct natural resource users (including farmers, foresters, fishers, and hunters) exert some of the most immediate influences on biodiversity through their resource management and extraction practices (Figure 1, Arrow E). Their decisions directly impact habitat structure, species composition, landscape heterogeneity, and key ecological processes from local to regional scales.

A growing body of evidence indicates that personalized ecologies play an important role in shaping how these actors perceive, value, and manage ecosystems. One important way in which personalized ecologies shape management decisions is through psychological connections to nature. Resource users with stronger emotional attachment to nature and greater interest in biodiversity are more likely to adopt biodiversity-friendly practices. Among farmers, for example, stronger emotional connections to nature have been associated with higher crop diversity, maintenance of vegetated field margins, reduced chemical inputs, increased structural complexity within agricultural landscapes, and greater uptake of soil and water conservation measures

(Ahnström et al. 2013; Teff-Seker et al. 2022; Mohammadi et al. 2026; Winkler-Schor et al. 2025; Figure 2a,b).

Personalized ecologies shape not only how people feel about nature, but also how they perceive environmental change and judge what conditions are acceptable or worth maintaining. Experiences of nature, particularly those accumulated earlier in life, shape perceptions of what constitutes “normal,”

“acceptable” or “desirable” environmental conditions and practices. As biodiversity and natural resources decline in many regions, this process can lead to a gradual erosion of expectations and accepted norms regarding the natural environment, a phenomenon known as shifting baseline syndrome (Pauly 1995; Soga and Gaston 2018). Empirical evidence suggests that such shifting baselines are widespread among farmers and fishers (see recent review by Soga and Gaston 2024b). This gradual

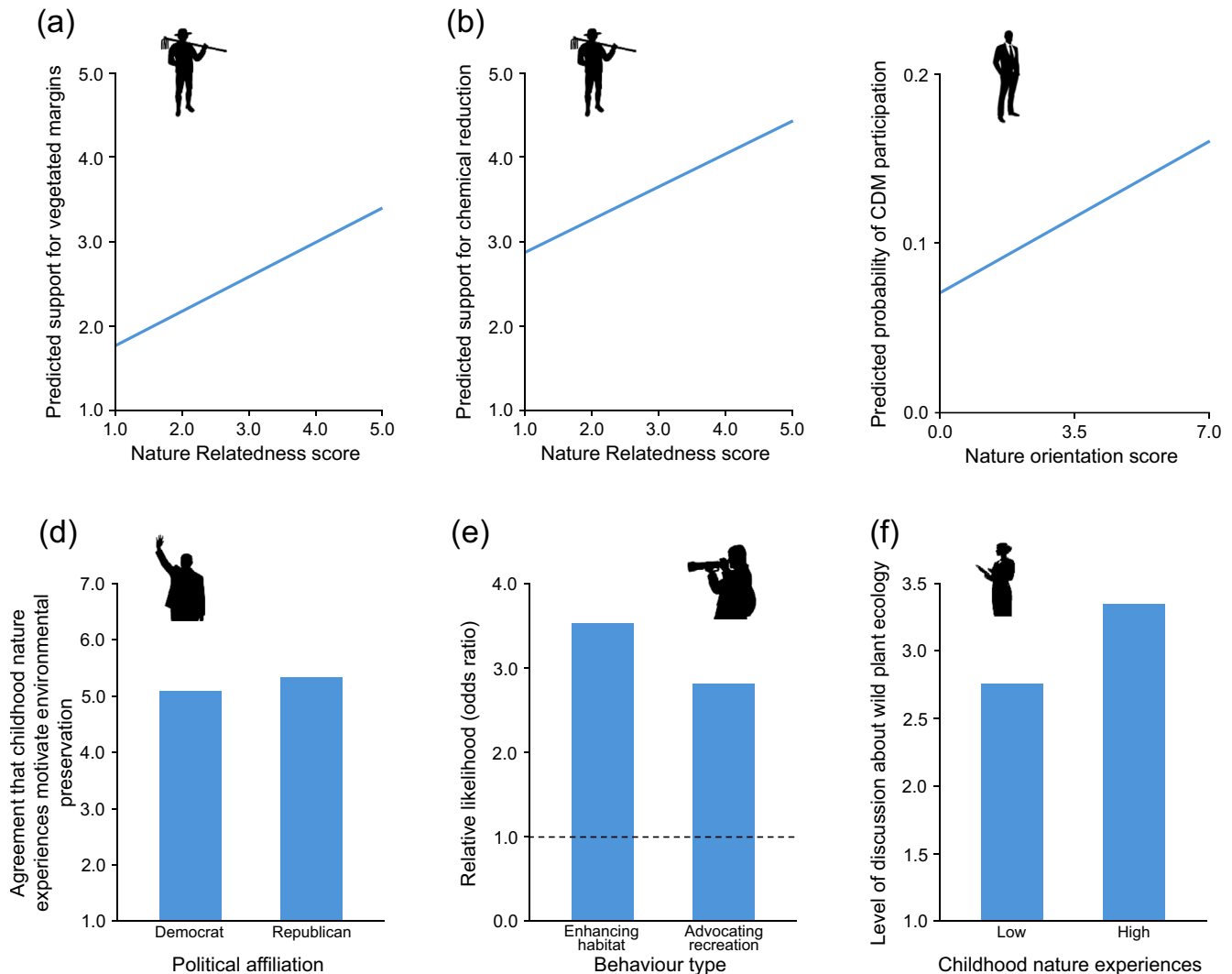


FIGURE 2 | Empirical studies examining associations between personalized ecologies, or related emotional and attitudinal factors, and biodiversity-related behaviors or behavioral intentions among (a, b) direct natural resource users; (c) businesses and corporate actors; (d) governmental and policy actors; (e) citizens and consumers; and (f) knowledge and education actors. (a, b) Farmers’ predicted support for (a) maintaining or regenerating semi-natural habitats with local vegetation along field margins and (b) reducing the use of environmentally destructive chemicals that harm local species in Israel, as a function of their emotional connectedness to nature measured using the Nature Relatedness Scale (Nisbet et al. 2009), with predicted values derived from linear regression models reported in Teff-Seker et al. (2022). (c) Predicted probability of a firm’s participation in the Clean Development Mechanism (CDM), a voluntary greenhouse gas mitigation programme in China, as a function of the CEO’s nature orientation score, estimated using firm-level ordinary least squares regression models reported in Zhi (in press). (d) Participants’ agreement (7-point scale ranging from 1 = strongly disagree to 7 = strongly agree) that childhood experiences with nature constitute a motivation for environmental preservation, shown separately for Democratic and Republican respondents in the US (Billet et al. 2024). (e) Relative likelihood of engaging in pro-biodiversity behaviors in the United States, specifically enhancing wildlife habitat on public lands and advocating for wildlife-related recreation, among birdwatchers compared with non-birdwatchers (Cooper et al. 2015). Relative likelihoods were calculated from odds ratios estimated using logistic regression models; a ratio of 1 indicates no difference between groups. (f) Frequency of discussing the ecology of wild plants among Japanese schoolteachers as a function of their childhood nature experience (low: Less than 1 month; high: More than monthly) in Japan (Yamanoi et al. 2021). Note: Panels a–c are constructed from reported regression coefficients in the respective studies, with predicted values derived from the original models whilst holding other covariates at their sample means.

cognitive erosion can undermine conservation by increasing tolerance for ecological degradation and redefining which states of nature are considered worth protecting, restoring, or recovering (Soga and Gaston 2018).

Direct resource users are often assumed to be the societal actors most closely connected to nature, given their direct dependence on ecosystems for livelihoods (Altieri 2004). However, these relationships appear to be changing. Technological intensification, mechanization and automation, particularly in agriculture and fisheries, have altered how natural resource users interact with ecosystems, in some cases reducing direct, sensory and experiential engagement with nature (e.g., increasing use of tractors and other vehicles with cabins that are better sound proofed, air conditioned and often with audio systems can reduce direct sensory interactions of farmers with nature; increasing use of remote sensing, automated machinery and decision-support systems can reduce the time farmers and their advisers spend observing crops, soils and associated organisms in situ; Daum 2025). As such transitions in farming and other resource-use systems are occurring rapidly across many regions, understanding how they affect the quantity and quality of personalized ecologies, and how this in turn influences management decisions, seems to be an important direction for future research.

3.2 | Businesses and Corporate Actors

Businesses and corporate actors influence biodiversity through their production systems, supply chains, investment decisions, and corporate governance structures (Figure 1, Arrow E). Collectively, corporate activities shape land use, resource extraction, pollution, and habitat transformation from local to global scales.

Within corporate settings, decisions relevant to biodiversity are often concentrated among senior executives and other key leaders or managers, but are also shaped by a broader network of actors within and around firms. These include investors and financial actors, whose expectations can influence corporate environmental priorities, as well as employees involved in sustainability, environmental compliance, research and development, product and technology development, procurement, and supply-chain management. As a result, personalized ecologies across these individuals may collectively shape how firms perceive their dependence on ecosystems, evaluate environmental risks, and respond to expectations around biodiversity responsibility. Detachment from direct experiences of nature may reduce the salience of biodiversity loss, encouraging the undervaluation of ecosystem dependencies, the externalization of ecological costs, and a focus on short-term financial performance over long-term environmental risk.

Although empirical evidence remains limited, emerging studies suggest that personalized ecologies among corporate leaders and other influential business actors can shape firm-level environmental behavior. For example, research in China indicates that chief executive officers (CEOs) with stronger preferences for nature are more likely to lead firms that engage in substantive environmental actions, including participation in voluntary

and costly initiatives and achieving greater reductions in carbon emissions (Zhi *in press*; Figure 2c). Likewise, CEOs operating in regions with higher surrounding green coverage (i.e., greater exposure to nature) are more likely to translate characteristics such as long-term orientation and ethical concern into stronger engagement in green innovation (Jiang et al. 2025). These findings highlight how individual-level experiences of nature can scale up to influence organizational behavior, even within highly institutionalized corporate contexts.

Empirical research on biodiversity-related behavior among corporate decision-makers remains limited. However, corporate decisions can exert extensive direct and indirect influences on biodiversity across global supply chains, production networks, and financial systems, giving businesses a potentially far-reaching role in shaping biodiversity outcomes (Lenzen et al. 2012). Moreover, frameworks such as the Taskforce on Nature-related Financial Disclosures are creating expanding opportunities and expectations for businesses to engage in biodiversity-related action (Linsley et al. 2023). Given this, an important direction for future research is to investigate the factors shaping biodiversity-related decision-making and perceptions of biodiversity risk and responsibility within corporate settings, and to clarify the extent to which personalized ecologies contribute to these processes relative to other organizational, economic, and institutional drivers.

3.3 | Governmental and Policy Actors

Governmental and policy actors (including public officials, regulators, policy advisors, conservation NGOs involved in policy advocacy and implementation) shape biodiversity outcomes primarily through laws, incentives, planning frameworks, and public investment. Their influence is largely indirect (Figure 1, Arrow G), operating through institutional and regulatory mechanisms that structure the actions of other societal actors. They can, however, also have direct impacts, for example, through the management of protected areas and creation of ecological corridors or wetlands through public works (Arrow F). At broader governance scales, intergovernmental science-policy bodies such as IPBES (Ruckelshaus et al. 2020) may also play a crucial role by shaping biodiversity agendas, assessment frameworks, and policy priorities across multiple countries, whilst integrating expertise and perspectives from diverse societal sectors.

Personalized ecologies among policy actors may shape how biodiversity loss is perceived, how environmental issues are prioritized within policy agendas, and the political willingness to pursue ambitious conservation targets. Reduced direct engagement with nature may weaken sensitivity to ecological change and diminish emotional concern, potentially contributing to lower ambition in environmental policymaking.

Evidence directly examining the role of personalized ecologies in biodiversity policymaking remains limited. Nonetheless, existing research suggests that personal experiences of nature can shape how public officials and politically engaged actors interpret environmental issues and support conservation action. Studies of politically active individuals and civil servants indicate that childhood nature experiences are important

drivers of pro-environmental commitment and engagement (e.g., Hsu 2017; Billet et al. 2024; Figure 2d). Evidence from the climate domain further suggests that heightened environmental concern (potentially rooted in such experiential foundations) can influence how political actors perceive collective support and allocate attention to environmental issues. For example, individuals expressing stronger concern about climate change perceive greater collective willingness to contribute to climate action (Fang et al. 2025). Likewise, highly salient climate-related events translate into increased political attention only among parties for whom environmental protection constitutes a core ideological priority (Wappenhans et al. 2024). An important direction for future research is therefore to examine more systematically how policymakers' own personalized ecologies shape biodiversity-related agendas, ambition levels, and regulatory design.

3.4 | Citizens and Consumers

Citizens and consumers influence biodiversity both directly (through activities such as conservation volunteering and community-based stewardship) and indirectly through consumption choices, voting behavior, and the formation of social norms (Figure 1, Arrows F, G).

The role of personalized ecologies among citizens has received substantial scholarly attention (Shwartz et al. 2012; Soga and Gaston 2016; Richardson et al. 2022; Gaston et al. 2023; Butler et al. 2024; Garfinkel et al. 2024; Soga et al. 2025). A large body of research suggests that direct and emotionally engaging experiences of nature are associated with a wide range of pro-environmental behaviors, including recycling, energy conservation, green purchasing, support for conservation policies, and participation in conservation volunteering (Cooper et al. 2015; Collado and Evans 2019; Křepelková et al. 2020; Hoover 2021; Soga and Gaston 2023a; Soga and Gaston 2024a, Soga and Gaston 2024b; Figure 2e). These associations are mediated through multiple mechanisms, including increased biophilia (an affective affinity for, and emotional connection to, nature) and reduced biophobia (fear, aversion, or discomfort towards nature), as well as enhanced ecological literacy and a stronger sense of social connectedness and collective responsibility (Gaston et al. 2023).

Importantly, the influence of citizens' personalized ecologies likely extends beyond individual behavior. Consumer preferences shape production practices among farmers and businesses; voting behavior influences the priorities and incentives faced by political actors; and social norms affect the ambition of policy goals and regulatory standards. In this way, personalized ecologies among citizens can cascade across other societal sectors, indirectly shaping biodiversity outcomes by altering the social, economic, and political contexts within which other actors operate (Figure 1, Arrow G).

3.5 | Knowledge and Education Actors

Knowledge and education actors (including schools, universities, and research institutions) influence biodiversity indirectly

by shaping environmental knowledge, values, skills, and future decision-makers (Figure 1, Arrows H, I).

In educational settings, teachers' own personalized ecologies can influence whether and how children are exposed to nature-based learning opportunities. Educators with stronger connections to nature are not only more willing to incorporate outdoor and experiential learning into their teaching but also more likely to do so in practice, fostering early-life engagement with biodiversity (Barrable and Lakin 2020; Yamanoi et al. 2021; Anđić and Mažar 2023; Figure 2f). Although these experiences have been widely in decline (Soga, Gaston, and Kubo 2018; Imai et al. 2019; Okui et al. 2021), they are known to shape children's emotional responses to nature, ecological understanding, and conservation-oriented attitudes (Soga et al. 2016; Hosaka et al. 2017; Chawla 2020), with potential long-term implications for biodiversity conservation.

Within research institutions, concerns have been raised that ecologists and environmental scientists are becoming increasingly disconnected from direct engagement with nature (Rafiq et al. 2024; Soga and Gaston 2025a, 2025b; Ramirez 2026). This trend likely reflects a combination of social, institutional, and technological factors, including time constraints, changing work-life expectations, heightened safety and compliance requirements, reduced access to field sites, and growing reliance on large datasets and remote sensing technologies (see Soga and Gaston 2025a, 2025b). Whilst reductions in fieldwork may confer environmental benefits by lowering ecological footprints, especially when field activities require extensive travel, they may also entail costs for knowledge generation and training (Soga and Gaston 2025a, 2025b). Indeed, reduced field engagement can influence the development of ecological understanding, the framing of research questions, and the transmission of field-based skills and values to future generations of scientists (Soga and Gaston 2025a, 2025b).

3.6 | Media and Communication Actors

Media and communication actors (including journalists and documentary makers) influence biodiversity outcomes indirectly by shaping how citizens, businesses, and policymakers understand, emotionally respond to, and socially frame nature and biodiversity (Figure 1, Arrow H, I).

Although empirical evidence remains limited, the personalized ecologies of media professionals may influence biodiversity through two major pathways. First, personal experiences of nature can shape which environmental topics media actors choose to cover and how prominently nature features in media outputs. For example, a study conducted in Europe found that journalists' personal experiences at the coast were among the strongest drivers of engagement with marine environmental issues (Pinto and Matias 2023). Whilst media coverage does not directly affect biodiversity, it can contribute to conservation outcomes by shaping public concern, social norms, and collective priorities. Indeed, nature documentaries and, increasingly, animated films and series that foreground environmental themes have been shown to shape viewers' emotions, knowledge, and conservation attitudes at

large scales (e.g., Arendt and Matthes 2016; Fernández-Bellon and Kane 2020; Fukano et al. 2020).

Second, limited direct engagement with nature among content producers may reduce familiarity with organisms and ecosystems, increasing reliance on simplified or inaccurate portrayals. Such representations can contribute to and reinforce misunderstandings of wildlife (e.g., by exaggerating perceived risks to people) and may amplify excessive fear of nature among audiences (Gore et al. 2005). For example, organisms such as spiders are often portrayed in a sensationalized manner in news media, and misinformation about them has been shown to spread widely, potentially contributing to exaggerated fear and negative attitudes (Mammola et al. 2022). Because elevated biophobia has been associated with reduced public support for conservation and, in some cases, greater tolerance of extermination behaviors (Soga et al. 2023; Jensen et al. 2025; Date et al. 2026), these processes may ultimately hinder biodiversity conservation efforts.

4 | Feedback Loops

Changes in behaviors towards nature arising from personalized ecologies can, in turn, reshape personalized ecologies through both direct and indirect pathways, creating feedback loops that may reinforce or erode human-nature interactions over time (Figure 1).

Direct feedback occurs when societal actors directly reshape the environmental, social, or cultural conditions that influence other people's opportunities, motivations, and capabilities to engage with nature (Figure 1, Arrows J, K). In most cases, such feedback is likely to be reinforcing, particularly when societal actors actively promote opportunities and motivations for nature engagement. Governmental and policy actors can enhance personalized ecologies by creating and maintaining accessible green spaces, supporting outdoor recreation programmes, and implementing policies that facilitate engagement with nature. Citizens and consumers can likewise influence personalized ecologies through social transmission processes, including family activities, peer influence, and community participation, which shape social norms, motivations, and opportunities for nature engagement (Soga, Yamanoi, et al. 2018; Van Truong et al. 2023; Soga and Gaston *in press*). Knowledge and education actors can further strengthen personalized ecologies, particularly among children, by providing environmental education and outdoor learning experiences that foster ecological understanding and motivation to engage with nature (Yamanoi et al. 2021). Media and communication actors can also stimulate interest and motivation by increasing the visibility, emotional salience, and perceived value of biodiversity, for example, through documentaries and other forms of environmental storytelling (Freytag et al. 2024). However, negative feedback may arise in some contexts. For example, increased enthusiasm for nature-based recreation may lead to overuse of popular natural areas, resulting in overcrowding and ecological degradation, thereby reducing the quantity and quality of personalized ecologies. Likewise, stronger pro-biodiversity attitudes may sometimes

generate stricter conservation regulations or access restrictions that inadvertently constrain opportunities for nature engagement.

Indirect feedback arises when changes in biodiversity, resulting from human decisions and actions, alter the conditions that shape nature experiences (Figure 1, Arrow L). Species abundance and richness influence what nature people encounter in their everyday environments, affecting the quantity and quality of these experiences (Gaston 2024). Empirical evidence suggests that declines in species abundance reduce daily encounters, leading to diminished familiarity, knowledge, and recognition of species (e.g., Imai et al. 2019; Härtel et al. 2025). Beyond shaping opportunities for engagement, biodiversity change may also influence motivation by altering the attractiveness of natural environments. The decline of culturally important, charismatic or locally distinctive species, for example, may reduce visitation, recreational use and experiential engagement, further contributing to the erosion of personalized ecologies.

5 | Implications

Our synthesis suggests that personalized ecologies have broader and more far-reaching implications for the future of biodiversity than have previously been thought. Rather than operating solely through changes in the attitudes and behaviors of the general public, personal experiences of nature appear to influence biodiversity outcomes across multiple societal sectors, each characterized by distinct decision-making contexts. Whilst the underlying psychological and cognitive mechanisms (such as emotional attachment, concern, knowledge, and shifting baselines) may be broadly similar across actors, the pathways through which personalized ecologies influence biodiversity, the temporal scales over which their effects operate, and the extent to which those effects can be empirically detected are likely to differ substantially among sectors. Their consequences for biodiversity are therefore likely to be expressed in strongly sector-specific ways.

At the same time, however, our review highlights substantial knowledge gaps in the existing literature. For several actor groups with disproportionate influence on biodiversity outcomes, such as policymakers, corporate leaders, and media professionals, empirical research on the role of personalized ecologies remains sparse. Even within better-studied sectors, research has often focused on a narrow subset of actors. Addressing these gaps will be essential for fully assessing the collective importance of personalized ecologies and for identifying where interventions are likely to yield the greatest benefits for biodiversity conservation.

These insights carry important implications for conservation policy and practice. Efforts to counter the extinction of experience have primarily focused on reconnecting citizens with nature (Shwartz et al. 2012; Soga and Gaston 2016; Richardson et al. 2022; Gaston et al. 2023; Garfinkel et al. 2024; Soga et al. 2025). Whilst such efforts remain essential, our synthesis suggests that reversing societal disconnection from nature will require broader structural approaches that extend across multiple sectors. Indeed, our framework suggests that coordinated

action across sectors can generate synergistic benefits for biodiversity; conversely, concentrating primarily on a single sector, such as the general public, is unlikely to produce transformative conservation outcomes.

More fundamentally, conservation strategies may benefit from recognizing that personalized ecologies and biodiversity influence each other through two-way interactions and reinforcing feedback. Interventions that protect and restore biodiversity can simultaneously strengthen personalized ecologies by enhancing opportunities and motivations for nature experiences. In turn, stronger personalized ecologies may help build enduring societal support for biodiversity conservation, creating positive feedback that sustains conservation gains over time. In particular, interventions delivered through the education and communication sectors to strengthen personalized ecologies may be especially important because their effects can persist over long timeframes and extend across wide audiences by shaping enduring attitudes, values, and behavioral tendencies towards nature (Ardoin et al. 2020; Fernández-Bellon and Kane 2020). Conservation discourse has traditionally focused on technical solutions, management interventions, and quantitative targets for biodiversity protection. Whilst these remain essential, giving greater consideration to the ways individuals experience and act for nature may enhance the long-term effectiveness and resilience of conservation efforts.

6 | Conclusions

Based on the available evidence, this review suggests that personal and direct experiences of nature are an important factor in fostering societies that support biodiversity conservation and in responding to ongoing biodiversity loss. As demonstrated across multiple societal sectors, personalized ecologies shape how people perceive, value, and act upon biodiversity, with effects that extend beyond the everyday lifestyle choices and private actions of individual citizens. Of course, this does not mean that strengthening personalized ecologies is a silver bullet for addressing the biodiversity crisis. Rather, we argue that it should be pursued alongside existing structural, technological, and institutional approaches, including policy interventions, social marketing initiatives, and environmental education. Given that experiences of nature also provide a wide range of benefits for human health and well-being, promoting personalized ecologies may contribute not only to the future of biodiversity but also to a more sustainable future for human societies.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

No new data were generated or analyzed in support of this research.

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