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What's love got to do with it? A biophilia-based approach to zoonoses prevention through a conservation lens

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E.O. Wilson coined the term biophilia, defining it as an innate affinity to the natural world. The concept of nature connectedness is used in environmental psychology as a measure of feelings and self-perceptions of connectedness to nature. Researchers have found a wide variety of positive effects associated with nature connectedness, including better mental health and wellbeing, increased altruistic and cooperative behavior, and heightened empathy. When these feelings of empathy are directed toward nature and applied to conservation actions, they can overcome the effects of compassion collapse, a phenomenon observed to lower study participants willingness to engage in altruistic behavior when there are many or diffuse victims of a disaster. Biophilia is an important concept in conservation, but it has not been widely applied to zoonoses prevention. The public health community has often relied on fear-based (biophobic) messages, which can drive the very interactions they were intended to avoid (e.g., media reports of bat zoonoses leading to culling activities and destruction of bat habitat) and exacerbate the ecological drivers of spillover. Communication strategies rooted in biophilia may be more effective at generating empathy for both ecological and human communities, leading to greater willingness to leave zoonotic pathogen hosts and their habitats alone, further reducing spillover events and the ecological conditions that make spillover more likely. Given the intertwined nature of human and ecological health, it is critical that the conservation and public health communities speak in a unified voice.

KEYWORDS

biophilia, empathy, one health, zoonoses, communications

1 Introduction

There are few parables better known in ecological conservation than the time that conservationist Aldo Leopold killed a wolf. He was camped out on the rimrock of the western United States with a group of hunters eating lunch, watching what they took to be a doe fording the river below them. She climbed onto the bank and shook the water off her,

and it was only then that they realized their error. The animal was not a deer at all. She was a wolf with a dozen pups, who sprang playfully out of the willows. In response, the men grabbed their guns and fired. The old wolf went down and at least one pup was injured. The hunters approached the mother. Imagine Aldo Leopold kneeling, watching the "fierce green fire dying in her eyes"—what he must have felt. He describes a deeply transformative realization of something already known to the wolf and to the mountain that the wolf inhabits: that the mountain relies on the wolf as much as the wolf is dependent upon the deer for its survival, and that their continued existence and health is contingent upon these relationships. What changed in Leopold—and what, through his work, has changed in the way we think about conservation—was an unfolding sense of empathy and love toward life and the processes necessary to sustain it. The term for this is biophilia.

The word biophilia is derived from Latin roots and translates literally to "love of life." Its origin is sometimes traced back to the psychoanalyst Erich Fromm, who used it to describe a "passionate love of life and all that is alive" (Fromm, 1964) in contrast with what he called necrophilia, a psychopathological orientation toward death and destructiveness. It was E.O. Wilson, however, who introduced the term into the conservation lexicon, seemingly independent of Fromm, in the context of his biophilia hypothesis. He defined biophilia as an innate propensity and affiliation toward life and lifelike processes, concluding that "to the degree that we come to understand other organisms, we will place a greater value on them, and on ourselves" (Wilson, 1984).

All ecology is about relationships. As the poet Robinson Jeffers asked, "What but the wolf's tooth whittled so fine/The fleet limbs of the antelope" (Jeffers, 1965)? Evolution is the outcome of relationships between a species or organism and its environment. That these relationships are the organizing principle of ecosystems is evident from food webs to chemical and physical exchanges to the spread of diseases. Human history is rife with examples demonstrating our propensity (especially in Western industrialized nations) to view ourselves as separate from the Earth system. It is a fundamental reality of human existence, however, that we must live embedded in relationship with our ecological communities, and that these relationships are integral to the things that make us human and allow our biological existence. Whether we know it or not, and whether we act upon that knowledge or not, we are members of these communities every bit as much as a brown bat or a cedar tree.

After watching the fire in the eye of dying wolf go out, Aldo Leopold wrote how something changed inside him. He said he learned to "think like a mountain." It was a moment of empathy and compassion for the dying wolf and, through it, an understanding of the way the wolf and the mountain rely on each other—the mountain providing habitat to the wolf, and the wolf regulating the deer population so that the mountain is not browsed to death—and of his own place within that matrix. This experience led him to profess a new environmental ethic, advocating for the expansion in scope of the communities we love from the familial and national into the ecological (Leopold, 1947). Through the connection he felt with the dying wolf, Aldo Leopold transformed himself from a man possessed by a fear-based (biophobic) impulse toward destruction into a man driven by a biophilic sensibility, from revulsion to the love of a species.

In this Perspective, I perform an investigation of biophilia through the lens of conservation psychology. I define biophilia as an experience of connectedness to nature, which leads to feelings of empathy, compassion, love, and other affinities toward the natural world. In keeping with the "Preventing Zoonoses. Promoting Biophilia" theme for this Research Topic, I discuss the ways in which typical public health communications may encourage biophobia, potentially leading to destructive acts that exacerbate the ecological drivers of zoonotic spillover. I examine the utility of a biophilic approach to zoonotic disease risk mitigation and discuss how public health and conservation messaging can be unified and made more effective through the perspective of biophilia.

2 The psychology of biophilia

Biophilia is actualized as a sense of connection to nature or, more deeply, the self as an aspect of nature—nature here being defined as the external physical world of flora, fauna, abiotic components and the flows of energy and nutrients through these interconnected systems. In environmental psychology, nature connectedness refers to subjective feelings of relatedness to the natural world (Martin et al., 2020). Numerous studies have shown that nature connectedness is associated with a number of positive effects on mental health and wellbeing (Grinde and Patil, 2009; Bratman et al., 2012; Capaldi et al., 2014; Kaplan Mintz et al., 2021; Pouso et al., 2021), early childhood development (Collado and Staats, 2016; Duron-Ramos et al., 2020; De La Osa et al., 2024), that it promotes prosociality, or cooperative and altruistic behaviors (Reddon and Durante, 2019; Pirchio et al., 2021; Gu et al., 2023), and generates pro-environmental behaviors and sentiments in children (Soga et al., 2016) and adults (Alcock et al., 2020; Barragan-Jason et al., 2022).

Mayer and Frantz (2004) developed a 14-point Connectedness to Nature scale (CNS), which assessed participants through a survey on their feelings of interrelatedness and belonging to nature. Models such as CNS (Martin and Czellar, 2016), the Extended Inclusion in Nature Scale, which uses spatial metaphors to assess participants feelings of self-inclusion in nature, and the Dispositional Empathy with Nature scale (Tam, 2013), have found predictable correlations between feelings of relatedness and belonging to the natural world with support for environmental and pro-conservation behaviors. Together, these models reveal how feelings of connectedness increase empathy, the role empathy plays in increasing pro-conservation attitudes, as well as how identity and behaviors are shaped (especially in childhood) through contact with nature (Mayer and Frantz, 2004).

Empathy is "an emotional state triggered by another's emotional state or situation, in which one feels what the other feels or would normally be expected to feel in his situation" (Hoffman, 2008). In human relationships empathy promotes prosocial behaviors and attitudes toward their human peers (Telle

and Pfister, 2016). Empathy toward nature plays an important role in mediating pro-conservation behaviors (Mayer and Frantz, 2004; Tam, 2013), but the effect of empathy has its limits.

Large-scale disasters have been counterintuitively shown to lower compassionate and altruistic responses to suffering, a phenomenon called compassion collapse (Cameron, 2017). The effects of compassion collapse have been primarily studied in relation to human suffering, showing, for example, that donations decrease during disasters involving numerous unrelated victims versus an individual or a group that can be perceived as an individual unit, such as a family (Smith et al., 2013). Compassion, and the altruistic behavior associated with it, begins to collapse even after increasing the number of victims from just one to two (Cameron, 2017).

There are two primary explanations for why compassion collapse occurs: a) the capacity account, which suggests that compassion is a limited emotional resource that is depleted by exposure to mass suffering, and b) the motivational account, which suggests that compassion is a motivated response (i.e., a person chooses to act compassionately or not) and that exposure to mass suffering triggers an avoidance response, aimed at protecting oneself from the anticipated emotional cost of feeling compassion (Cameron, 2017).

While compassion collapse has primarily been studied in relation to human suffering, it may also hold true for conservation-oriented behaviors. Markowitz et al. (2013), found that across three different studies, compassion collapse played a predictable role in determining willingness of participants to devote both time and money to environmental causes. Participants took more compassionate action in response to the suffering of small populations of animals or singular animals, such as a named polar bear, than they did large populations. There was, however, one important caveat to these findings: they only held true among participants who did not self-identify as environmentalists. Markowitz et al. (2013) speculated that this may be because environmentalists perceived the animal subjects of the study as part of their in-group, therefore bypassing the motivated response to avoid the cost of compassion.

This suggests that compassion—and behaviors associated with compassion, altruism, and empathy—may be in part motivated by feelings of connectedness. Nature connectedness might lead to such a wide variety of prosocial and pro-environmental outcomes precisely because it situates people in broader communal relationships with places and other-than-human beings.

Currently, a number of compounding, large-scale anthropogenic factors are influencing ecological and climatic systems across the planet. These include, but are not limited to, mass extinction (Cowie et al., 2022), climate change (Intergovernmental Panel on Climate Change et al., 2023), habitat loss (Soulé et al., 2005), invasive species (Crystal-Ornelas and Lockwood, 2020), and the "trophic downgrading" of the planet through the extirpation and extinction of large-bodied, apex predators (Estes et al., 2011). In concert, these factors have degraded ecosystem resilience and may ultimately result in irreversible changes to the structure and functioning of ecosystems worldwide. The daily barrage of bad news about increases in the severity and frequency of wildfires, the spread of zoonotic diseases, or countless other signs of rapidly changing times may be a factor in our collective inaction due to compassion collapse.

3 Discussion: biophilia and zoonotic disease risk

Biophilia is seldom directly attributed to the success of any particular conservation project. However, building affinity and positive sentiment towards species—keystone attitudes of biophilia—is a common strategy in conservation work. Pride campaigns are a central principle in the work of Rare, which were first implanted in successful efforts to preserve the St. Lucia parrot (*Amazona versicolor*) through the use of a mascot (Butler et al., 2013). Other conservation success stories based on generating affinity and public sentiment include giant pandas (*Ailuropoda melanoleuca*; (Ma et al., 2016)), great white sharks (*Carcharodon carcharias*; (Apps et al., 2018)), and migratory birds (Wheeler and Bonfield, 2005). The strategy of generating biophilic sentiments towards species and habitats may be of similar benefit in addressing the intersection of conservation and zoonotic disease risk mitigation, where public messaging tends to focus more on aversion than affinity.

The One Health model provides an interdisciplinary framework for zoonoses prevention, but most implementations of it are relegated to research. In a series of 41 semi-structured interviews with One Health professionals, Pepin et al. (2024) found several significant barriers to operationalizing One Health principles, including a lack of cross-sector integration and a belief that One Health is nothing more than a "popular buzzword" that puts undue pressure on the public health sector to solve problems with established and effective solutions.

It is the siloed nature of the public health and conservation sectors that ultimately drive these perspectives. This disconnect may conceal ways in which today's public-health solutions—even those that are well-established and effective—might become tomorrow's conservation problem or vice versa. If we recognize that human, animal, and environmental health are intertwined, then working at cross-purposes in this way only serves to frustrate the achievement of long-term solutions in both sectors.

In contrast to biophilia, negative sentiments toward nature, manifesting as either a generalized aversion or as fear or revulsion directed at specific types of organisms (e.g., arachnophobia), are termed biophobia. When Aldo Leopold killed a wolf, he was participating in the biophobic culture of his time. Wolves have a long history of being demonized. In the United States, at least since the 1800s, wolves have been hazed, shot, tortured, and exterminated until, by the mid-twentieth century, wolves had either been extirpated or reduced (Lopez, 1979) into such low numbers that they were no longer effectively regulating deer and elk populations through predation, reducing landscape-level resilience (Eisenberg et al., 2013).

Biophobia can also be generated by public-health communications. For example, well-intentioned public-health messaging has suggested a link between bats and the COVID-19 pandemic, causing vitriol and suspicion to be heaped upon bat

colonies and their habitats. More broadly, the COVID-19 pandemic exposed the public to a litany of news stories and public health warnings about the dangers of disease spillover through wildlife trade and "wet markets" (Aguirre et al., 2020; MacFarlane and Rocha, 2020; Lin et al., 2021), contributing to increased biophobic behaviors (Soga et al., 2021).

Bats are a reservoir for a number of pathogens deemed to be of high concern by the World Health Organization, including henipiviruses, filoviruses, and coronaviruses (Ruiz-Aravena et al., 2022), such as SARS-CoV-2, which causes COVID-19. There are legitimate reasons for people to adopt avoidant behaviors to minimize the risk of exposure to pathogens shed by infected wildlife. However, when this avoidance is rooted in biophobia, it may create a recursive feedback loop in which aversion leads to feelings of disconnection, leading to a loss of familiarity and knowledge of nature and thus greater avoidance or even persecution of bats to annihilate the fear trigger. This vicious cycle of biophobia could lead to or contribute to decreased motivation and willingness to engage in conservation actions that actually reduce zoonoses outbreak risk (Soga et al., 2023).

Moreover, these biophobic responses may generate the opposite response than intended, such as in Cuba, South America, Africa, and Asia, where media reports linking bats and COVID-19 drove local citizens to participate in culls, or an Indonesia where public health guidance explicitly asks residents to kill bats (Anderson and Reaser, 2024). These culls not only resulted in the death of bats and destruction of bat habitat but increased the public's exposure to them and their habitats (Anderson and Reaser, 2024).

The destruction of bats and bat colonies increased internationally during the pandemic (Soga et al., 2023). Ironically, such actions can have the unintended effect of increasing human-bat conflicts by forcing bat populations to rely on human infrastructure, creating more opportunities for spillover events (Frick et al., 2020). Loss of biodiversity and the loss of functional diversity through land-use changes (Platto et al., 2021; One Health High-Level Expert Panel et al., 2023), such as conversion of forest to agriculture and construction of human infrastructure (White and Razgour, 2020; Plowright et al., 2021; Marie and Gordon, 2023) can all significantly increase zoonotic pathogen spillover (Reaser et al., 2021), particularly in instances that allow small-bodied mammals (e.g., bats) to continue to thrive in the absence of dedicated habitat, increasing the potential for human-wildlife interactions (Glidden et al., 2021).

While nature exposure may lead to either biophilia or biophobia (Figure 1), depending on the context of the exposure, the feedback loop created by disconnection and aversion is a major barrier to generating biophilic sentiments. This may particularly be a problem among populations who live largely disconnected from the natural world, such as those in cities or whose wealth insulates them from the environment. Direct nature exposure, which may lead to biophilic sentiments, typically must be chosen. However, educational opportunities to develop natural intelligence (Barbiero, 2018), social-media marketing campaigns (Reaser et al., 2024), and art (Beaumont, 2024) all provide opportunities for reaching nature averse demographics.

But this raises an additional, vital question: how do we encourage nature connection and empathy in situations that require communications about disease risk, resulting in cautious behavior, without simultaneously generating biophobia and all of its negative consequences? In the public health field, human health is naturally prioritized, and public health officials may lack the ecological education needed to ensure that human health communications do not cause greater environmental harm. A One Health approach to zoonotic disease risk mitigation takes into account the interconnectedness of human, animal, and environmental health and acknowledges, for instance, that the health of bats and bat habitat is directly tied into the health of human communities. It is imperative that our models of disease risk mitigation include broader conservation objectives to reduce disruption of species and habitats that may harbor known or unknown diseases. Fostering sentiments of biophilia and the conservation behaviors that biophilia promotes should a priority in any One Health approach to zoonotic disease risk mitigation.

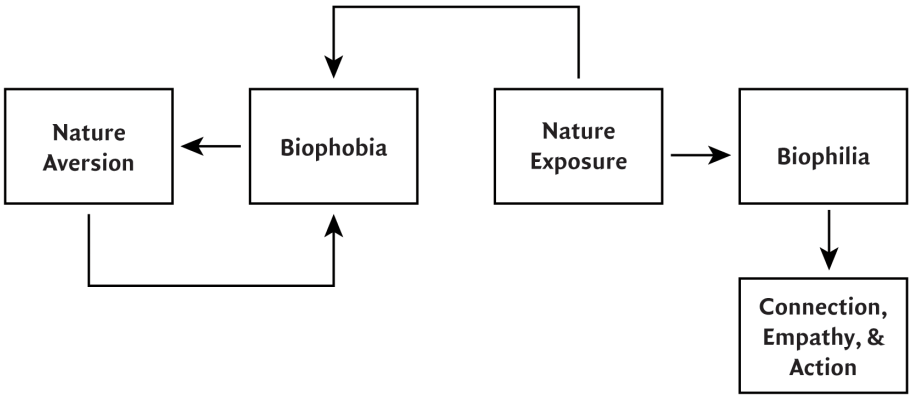

FIGURE 1
A conceptual framework of biophilia and biophobia. The arrows represent the development of sentiments and affinities as a result of nature exposure, leading to either 1) biophobia and nature aversion, potentially creating a vicious cycle (Soga et al., 2023), or 2) biophilia and nature connection, empathy, and action.

This same dilemma plays out frequently in conservation. For example, sentiments of biophilia may drive people to visit US National Parks. Yellowstone National Park hosted 4.5 million visitors in 2023 (US National Park Service, 2024). However, public use of these parks require infrastructure, such as buildings, roads, trails, and other land-use changes, which may result in loss of landscape connectivity, suppressed fire regimes, erosion, and changes to animal behavior, such as predator-prey dynamics, which may have wide-spread consequences within local food webs (Eisenberg et al., 2013). Perturbations such as these potentially alter ecosystems to an extent that they may function less resiliently than the unaltered predecessor ecosystem. Additionally, wildlife encounters in public parks can often be fatal to visitors. Without vigilant management of such a system, it is as possible to love nature to death than it is to fear it to death. The public health sector could draw on conservation messaging as a model in striking an appropriate balance between generating biophilia and risk-averse behavior.

The public health community is right to be concerned that fostering an affiliation between bats and humans, or any species at risk of spreading zoonotic pathogens, may drive an increase in interactions with pathogen hosts. But spreading biophobia can demonstrably have the same effect. Fear and affiliation are both drivers of interaction. Biophilia is more than mere affiliation, though. It is an active relationship in which a person comes to recognize themselves as part of the natural world, resulting in deeper empathy—a feeling of connectedness between the self and other—for natural systems and the organisms that compose them. This has the benefit of promoting both prosocial and pro-conservation behaviors, which may drive people to consider both the ecological impacts and the human health impacts of their actions.

One Health provides a framework for interdisciplinary engagement between the conservation and public health communities, but in practice their messaging remains fragmented, leading to confused priorities and competing messages. Ultimately, the public health and conservation communities want the same thing: a happier and healthier world. A coordinated communication strategy designed to meet both public health and conservation objectives could be a powerful and effective tool for mitigating zoonotic risk. Messaging rooted in biophilic empathy and oriented to the wellbeing of both the human and non-human communities could effectively encourage people to love and respect wildlife by leaving them alone.

Aldo Leopold recognized that wolves and the mountain where the wolves reside depend upon each other for their existence. He urged people to "think like a mountain," meaning to take the wider context into account. Similarly, a vision unified by biophilic sentiments and the understanding that environmental health and human health are dependent upon each other might act as the bridge between these silos. Leopold came out of his experience, articulating a Land Ethic that declared, "A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise" (Leopold, 1947). This same ethic of biophilia, recognizing that humans are part of the biotic community, might serve as well to guide communications at the interface of conservation and public health. We might adopt it before we watch some other fierce green fire in the world go out.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

Author contributions

JRK: Conceptualization, Investigation, Writing – original draft, Writing – review & editing.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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