Chapter 5: Connection with Nature in the US: Status and Trends

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Chapter Contents

Summary

People in the United States have held a wide variety of views regarding the relationship between people and nature. Whereas the original Indigenous populations of North America generally embrace a holistic view that sees humans as inseparable from the natural world, European settlers often viewed nature as a source of raw materials —lumber, minerals, meat and hides—to be exploited. The resulting damage to ecosystems, however, inspired new attitudes and social movements that saw nature as worth protecting—both as a source of benefits to humans and as valuable for its own sake. This diversity of ideas regarding how humans are connected to nature (or not) remains true in American society today.

This chapter assesses research on human connection with nature. It focuses on the ways in which, and the degree to which, people view themselves as either separate and disconnected from nature or as part of a reciprocal relationship with nature in which both people and the natural world benefit. These relationships come in many forms and are shaped by people's individual values and experiences as well as by their broader worldviews, cultural and religious backgrounds, and other factors. Because large-scale social shifts such as urbanization have reduced direct access to nature in daily life, more people now experience nature through recreational activities such as walking outdoors or birdwatching. In addition, movies, apps, and other forms of technology now provide indirect—but often quite valuable—ways of experiencing nature. Interactions with nature strengthen feelings of connection, creating a feedback loop that encourages further time spent with nature. Greater connection with nature can also inspire individual and collective action to protect nature, motivating people, groups, and institutions to work to preserve landscapes and ecosystems that may be at risk from climate change, human exploitation, and other threats. Human connection with nature has been scientifically studied for only 30 years, which limits our ability to draw longitudinal conclusions or speak definitively about the past.

Background

Human Connection to Nature

The ways people connect to the natural world are as rich and varied as the ways we connect with one another. We may feel attached to a single part of nature—such as a tree or a pet—or to something larger, like a species, a place, an ecosystem, or even the entire planet. Some of these relationships can be exploitative or centered mainly on human needs. However, many ways of connecting with nature are grounded in mutual support, allowing both people and the natural world to thrive. Connection to nature simultaneously promotes the well-being of both people and the planet. People who feel more connected to nature are more likely to take action to protect it (1–3) and tend to have better psychological well-being (see Ch. 13: Health and Well-Being) (4,5).

People's sustained awareness of the interrelatedness between themselves and the rest of nature is reflected in how they think, feel, and act. Strong connection with nature can take many forms and is more than simple contact with or superficial enjoyment of nature. It has been defined as "an enduring appreciation, empathy, and mindfulness of the intrinsic value and shared essence of all life" (6). It also includes worldviews that shape how people understand their place in nature. Some worldviews place humans outside of nature, while others, including those grounded in traditional or local ecological knowledge, emphasize that humans are part of a web of relationships with other living beings and with the land itself (7–9). These relational perspectives influence how people interpret their responsibilities to the natural world and how they behave within it.

Human–nature connection develops over time, especially during our early years, and can shift because of new experiences or education (10). Its expression also varies across cultures (11). Human–nature connection can show up in the way individuals understand their own relationship with nature and in the wider beliefs they hold about how all people are connected to the natural world (7,9). Although shaped by life experiences, this connection is often steady over time and reflects a deep, lasting sense of appreciation, awareness, and relationship with nature (10,12,13). Connection to nature can also be increased through both brief and longer-term experiences, as well as mindful attention (14–16).

Psychologically, human–nature connection includes cognitive, emotional, social, and cultural dimensions (6,17–21). The cognitive dimension involves our knowledge and beliefs about nature, the values we hold, and how we understand or conceptualize our relationship to the natural world. The emotional dimension encompasses feelings of attachment, awe, empathy, care, and concern. The social dimension reflects our sense of belonging within human communities that share similar ideas or values about nature. It can also extend to a sense of place within the natural world, a feeling of belonging with other living beings, or even a sense of kinship with lands, waters, and place.

These cognitive, emotional, and social elements vary both across cultures and within cultural groups. For example, many people from land-based cultures, including many members of Indigenous communities from the Americas and elsewhere, view plants as teachers or relatives and rely on oral histories to understand the relationships between people and the natural world (22). Cultures evolve as environmental and social conditions change (23,24). In turn, these varied connections shape how people behave and the decisions they make (25).

Connection with Nature Throughout US History

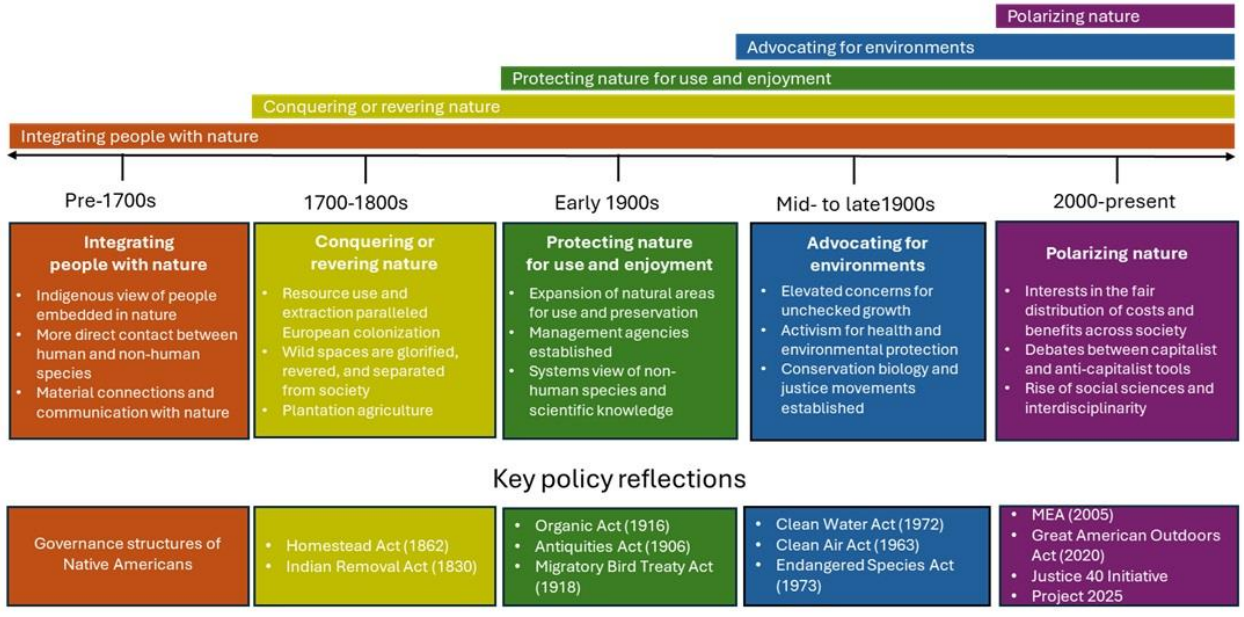
People have held, and continue to hold, a wide range of views on connections between humans and nature (Figure 5.1). Although certain views have been dominant at different times, there have always been multiple coexisting perspectives on how people connect to nature. The historical perspectives described here align closely with the human–nature relationship framings introduced in Chapter 3: Frameworks and Chapter 11: Culture. This

chapter, however, uses its own terminology to interpret patterns of connection because it emphasizes individual, personal connection with nature rather than the human–nature relationship at the collective level. Despite such differences, it is fully compatible with these other chapters and will be further harmonized with them in subsequent drafts.

Before Europeans arrived in North America, many Indigenous cultures emphasized reciprocal relationships with the natural world. People saw themselves as part of an interconnected system of human and nonhuman beings, rather than separate from or superior to nature (26–28). Their governance systems reflected this relational worldview (29). This period is represented as "integrating people with nature" in Figure 5.1, which aligns most closely with the "people with nature" framing used in Chapters 3 and 11.

In the 18th and 19th centuries (represented as "conquering or revering nature" in Figure 5.1), European settlers brought more extractive views shaped by ideas of dominion (30,31). This era was marked by laws and beliefs that justified westward expansion, land ownership, and the displacement of Indigenous Peoples, such as through the Indian Removal Act of 1830 and the General Mining Act of 1872 (32–34). At the same time, some Americans expressed deep emotional and spiritual ties to nature (35), seen in the Hudson River School of landscape painting (36) and in the writings of Romantic and Transcendentalist authors like Thoreau and Emerson (37,38), as well as Du Bois (39,40), who cast wild places as central to American identity (41). The chapter's representation of this era reflects variants of the "nature for people" and "nature for itself" framings used in Chapters 3 and 11.

Figure 5.1. Historical Trends in Connection with Nature



Diverse perspectives on human connections with nature have developed over time and are reflected in contemporary society.

Historical trends in how people have interacted with nature within the dominant US culture are reflected over five periods, including (1) integrating people with nature (pre-1700s), (2) conquering or revering nature (1700–1800s), (3) protecting nature for use and enjoyment (early 1900s), (4) advocating for environments (mid-to-late 1900s), and (5) polarizing nature (2000–present). Each of these temporal periods is described by its key characteristics and salient environmental policies. Figure original to The Nature Record.

By the late 19th and early 20th centuries, conservation centered on protecting some nature for human benefit (42) while also promoting the maximum sustainable extraction of natural resources (43,44). Simultaneously, preservation philosophies—often associated with John Muir—focused more on the intrinsic value of nature (45), even as Indigenous Peoples were excluded from their homelands to create National Parks, beginning with Yellowstone in 1872 (46,47). This marked the beginning of what is now called "fortress conservation," which is based on the idea that nature must be protected from humans (48). Ecological science emerged as a distinct discipline during this period (49), and federal agencies and environmental groups promoted both resource management and the protection of wildlands for public enjoyment (44,50,51). This period of time reflects both the "nature for itself" and "nature despite people" framings presented in Chapters 3 and 11.

In the mid-20th century, concerns about pollution, ecological decline, and public health were raised by authors such as Rachel Carson (52) in response to unchecked industrial expansion (53). Landmark environmental laws such as the Clean Water Act (1972) were enacted (54,55), and increased mobility allowed more Americans to visit parks and public lands, although access was based on economic means (56) and access to transportation (57). New academic fields and areas of interest emerged, including the environmental justice movement—which exposed disparities in exposure to environmental harms (58)—and the discipline of conservation biology (59). This period is represented as "advocating for nature" in Figure 5.1, which most closely aligns with the "nature for people" framing in Chapters 3 and 11.

From the late 1990s into the early 2000s, conservation thinking emphasized human-centered frameworks (60). Valuing nature for its benefits to people became widespread in the US, as illustrated by the emergence of market-based environmentalism (61,62) and widespread adoption of the "ecosystem services" framework by federal natural resource management agencies (63). This gave way to more expansive definitions that strove to go beyond economic valuation and frame the co-benefits of nature as "nature's contributions to people" (64). More recently, relational perspectives that position humans as part of nature have begun to gain influence (65), supported by growing interdisciplinary work connecting conservation and social science (66). The contemporary environmental movement emphasizes inclusion, equity, and shared decision-making (67). Many Americans are increasingly aware of the interdependence between people and the natural world and the associated ethical responsibilities (68). Modern understandings of human–nature connection sometimes align with long-standing Indigenous values. (69). For example, there is growing interest in learning from Indigenous knowledge systems, as

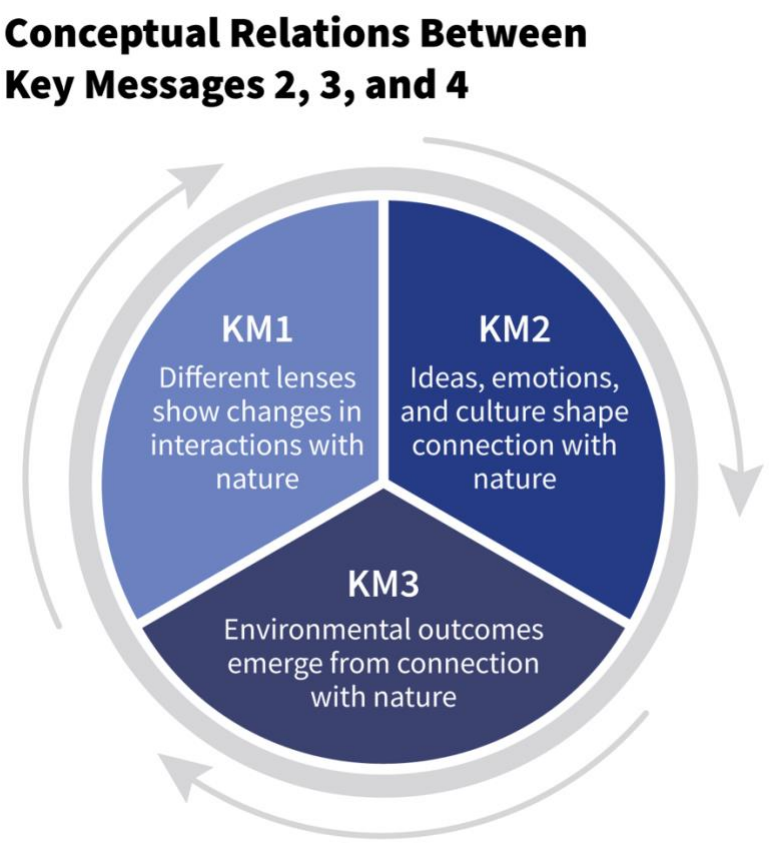
illustrated by co-management of protected areas such as Canyon de Chelly National Monument, Glacier National Park, and Haleakalā National Park, among others (70–72). This period is represented as "polarizing nature" in Figure 5.1 and most closely aligns with the "people and nature" framing presented in Chapters 3 and 11.

The historical eras referenced here follow the driver-based periods described in Chapter 9: Drivers. While this chapter emphasizes changes in individuals' connections to nature, Chapter 9 provides the broader context of social, economic, and ecological drivers shaping these shifts. For example, these trends coexist with declining everyday contact with nature and increasing cultural and political polarization (73). US residents report fewer recent nature-based experiences and lower feelings of connectedness compared to peers in many other countries (74). Although humans have an inherent interest in affiliating with nature (75), Americans have comparatively stronger tendencies to adopt worldviews that embrace mastery over nature, rather than stewardship, partnership, or participatory roles in resource conservation (76). Politically, the ongoing debates over major environmental laws, such as the Endangered Species Act (77,78), reflect how deeply divided public attitudes toward nature and environmental protection have become (73).

Chapter Roadmap

Interactions with nature are critical for building connection with it. Connection with nature, in turn, inspires action to protect nature—whether working as individuals, in groups, or through institutions. Here, we trace changes in Americans' interactions with nature that are relevant to their sense of connection (Figure 5.2). We then describe how different worldviews, feelings about nature, and cultural lifeways impact how interaction with nature translates into connection. Finally, we describe the consequences of connection to nature for how we treat and protect the natural world.

Figure 5.2. Conceptual Relationships Between Key Messages



This chapter's three Key Messages are interrelated.

Three Key Messages (KMs) about human connection with nature, which are sequentially presented and linked in different ways. The first KM highlights multiple lenses through which to view the changing ways in which people interact with nature, which ultimately both drive and reflect their connection with nature. The second KM describes how trends in connection with nature are filtered through cognition, affect, and sociocultural contexts. The final KM explores the consequences for individuals, collectives, and environmental conditions. Figure original to The Nature Record.

Key Message 5.1: The ways Americans interact with nature have shifted over time

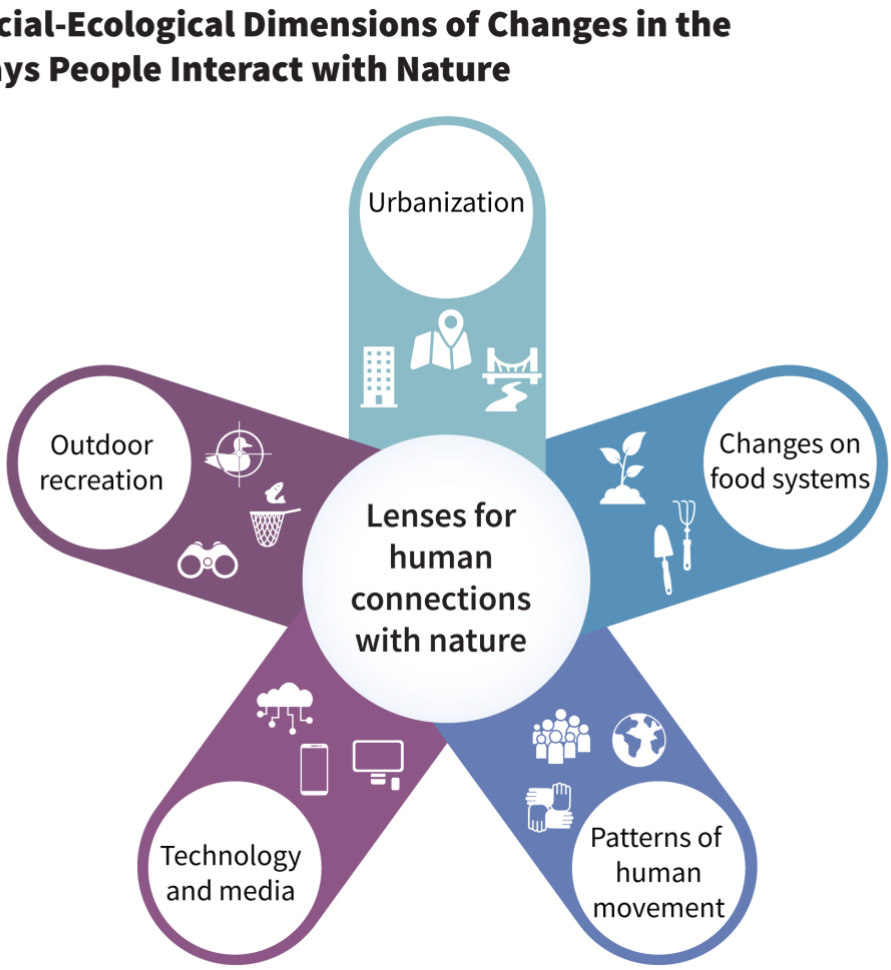
There are large-scale historical trends in how people living in the US interact with nature (very well established). As populations have shifted from rural areas to cities, and livelihoods centered in nature have declined, many people now have less direct experience with both natural and agricultural systems (virtually certain). Today, many people experience nature primarily through recreational activities, although opportunities to

interact with nature exist in urban communities and in many aspects of daily life (very well established). Immigrants to the US have brought their own perspectives and practices, while migration within the US has also reshaped Americans' relationship with nature (very well established). New technologies—from virtual reality to science apps—have both alienated people from nature and brought them closer to it (well established).

State of Knowledge 5.1

The ways in which people in the US interact with the rest of the natural world have shifted over time, particularly since the onset of the Industrial Revolution. Because the field of environmental psychology is new, survey data reflect only relatively recent cognitive and emotional connections with nature. However, we can infer from published literature and our current understanding that people's interactions with nature affect and reflect their connection to nature (79). Importantly, human–nature connection has many dimensions, and there are many ways in which people maintain or establish these connections (see KM 5.2). Here, we focus on these changing factors that have affected Americans' interactions with and exposure to nature: increased urbanization, changes in food systems, human movement and settlement patterns, technological advancements, and outdoor recreation (Figures 5.3, 5.4). Each of these factors results from decisions in American society and, in turn, illustrates how human–nature relations are broadly perceived. These dimensions are interconnected and show substantive variation depending on where people live, their socioeconomic status, and their cultural backgrounds.

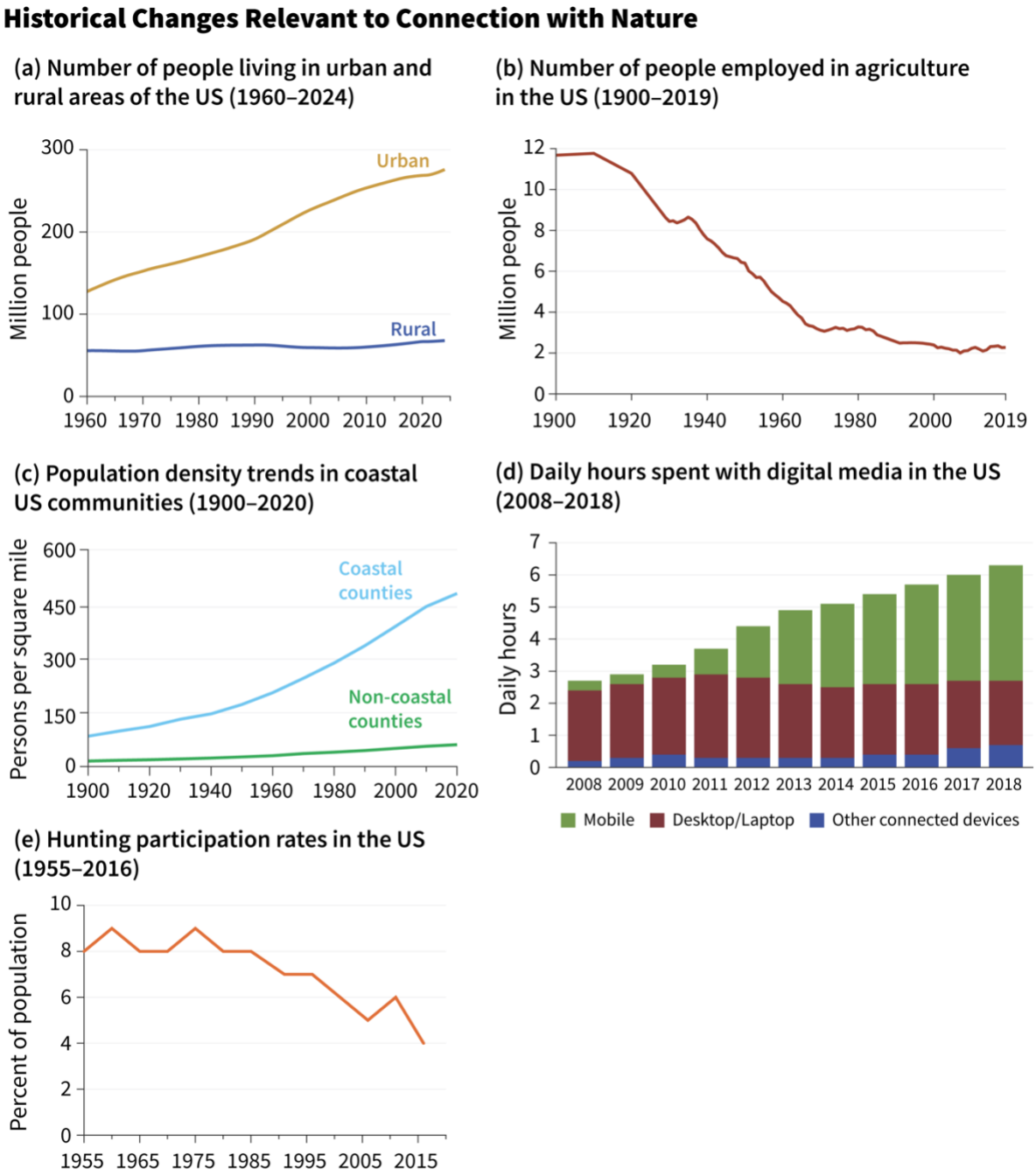
Figure 5.3. Social–Ecological Dimensions of Changes in the Ways People Interact with Nature



Changes in how people interact with nature can be understood through five interrelated themes, each offering a lens for viewing human connections with nature.

Five social–ecological dimensions of how human interactions with nature have changed over time in the US are shown. Each dimension—urbanization, changes in food systems, patterns of human movement, technology and media, and outdoor recreation—offers a lens, or a perspective, on changes in human connections with nature. Figure original to The Nature Record.

Figure 5.4. Historical Changes Relevant to Connection with Nature



Behaviors relevant to interaction with nature in the US have changed over time.

*Many factors can influence behaviors related to interactions with nature. (**a**) The number of people living in urban versus rural areas has increased in the US, which influences where and how often people interact with nature. (**b**) One specific change relevant to food production is the drastic reduction in the number of people employed in agriculture: since*

*the early 1900s, there has been a steep reduction in the number of people whose livelihood depends on direct interaction with nature. (**c**) More people are now living in coastal areas; coastal residents may have more positive interaction with nature through their jobs or recreational activities, or more negative interactions due to hazards such as hurricanes or coastal erosion. (**d**) The use of digital media, including mobile phones, desktop and laptop devices, and other ways of connecting to the Internet, has increased over time, which can impact how people interact with nature. (**e**) Finally, interaction with nature through consumptive outdoor recreation activities, particularly hunting, has declined over time on a per capita basis. Figure original to The Nature Record.*

Urbanization

Urbanization in the US shows clear patterns of human movement over time and diverse connections between people and nature. In 1945, 15 million acres of land were considered urban. By 2017, that amount had grown nearly fivefold to 74 million acres. The share of Americans living in cities has also increased over the past century (80), and fewer people now work in outdoor jobs (81). Consequently, more people experience nature through recreation rather than through daily work such as farming, fishing, or forestry (82). Spending time outdoors has become less common and often requires more deliberate effort (83).

Although agencies such as the National Park Service have focused on increasing human–nature connections in urban areas over the past two decades (84), green space and particularly urban tree cover in cities are decreasing (85). Marginalized and lower-income communities still have uneven access to nature-based resources (86,87). Trends in urbanization have led to changes in daily interactions with nature, greater distance to natural areas (88), and a reliance on intentionally designed, "packaged" nature-based experiences such as guided tours and themed activities. While people can experience nature in urban green spaces, they are less likely to encounter rich biodiversity in cities than in more rural areas (89). This trend, described as the "extinction of [nature] experience" (83,90), means people have become less aware of and connected to the natural world (91–94). This extinction of experience has consequences. For example, the psychological benefits of physical activity in natural environments (like city parks) are more beneficial than comparable activity in urban environments (like the city center) (95). These experiences differ among groups, highlighting inequalities in opportunities to interact with nature (86,96,97), which can lessen emotional connections and attachment to local environments (98).

Changes in Food Systems

American society has become increasingly disconnected from its food sources as industrialization and long supply chains have made food production less visible (99). Today, food in American grocery stores travels, on average, more than 1,000 miles before it reaches consumers (100), in part due to the shift from subsistence to local and regional farming and then to large-scale industrial agriculture (101). Only 2% of the US labor force

works in agriculture, compared to 40% in 1900 (102,103). As a result, many Americans do not know how crops are grown or how livestock are raised (104,105). This growing gap can create a sense of alienation from natural systems and a loss of basic understanding about where food originates (99). Most people become aware of food systems only when food safety crises occur (106,107).

Tools for measuring peoples' understanding of food systems are still being developed, making it hard to track changes over time or differences among groups (108–110). A growing 21st-century movement toward sustainable, local, and regenerative food systems is working to rebuild connections between people and their food (111). This movement emphasizes public health, local sourcing, environmental care (such as minimizing carbon emissions through plant-based diets (112)), and hands-on engagement with food production (113). Knowledge about local food production can reinforce environmental values (114), and garden-based learning can enhance connection with nature and local communities (115–119), which in turn can influence dietary choices (120).

Patterns of Human Movement

Immigration is a defining feature of the US and a potentially important mechanism for injecting new cultural ideas about how people interact with nature (121). Immigrant communities bring place-based traditions into new environments (122), especially when they have access to spaces like gardens (123). For example, some immigrants grow and harvest plants for food and medicine (124): Russian immigrants forage for mushrooms (125), while Mexican immigrants grow and consume chiles (123). Similarly, recent immigrants to the US often engage in fishing to procure food (126). Emigration can also affect connections with natural areas by disrupting how people feel connected to a place (127). For example, despite the forced removal in the mid-1800s of about 60,000 Indigenous Peoples belonging to Five Tribes from southern to western states in what is known as the Trail of Tears, the emigrants were able to develop strong connections to their new lands (128). The descendants of slaves from western African countries who are part of the Gullah-Geechee and Gullah communities in the southeastern US have also maintained a rich oral tradition that helps them preserve local knowledge about grass harvesting and basket-weaving (129,130). Often people who immigrate to the US become attached to their new country and exhibit improved mental health, social welfare, and sense of belonging as connections to their new places increase (131–133). This relationship is especially pronounced when there are opportunities for social bonding, exemplified by the Mexican immigrant and Latinx communities that often convene in outdoor spaces for family-based nature activities (134–136).

US coastal communities illustrate how migration to new areas can affect people's interaction with nature. About 40% of the US population now lives in coastal areas, and this share has been steadily increasing for decades as people move toward the coasts in search of jobs and recreational or scenic amenities (137). Coasts have always played an important role in American culture through practices such as fishing and trade (138,139);

however, an increasing number of Americans rely on these settings for their well-being and quality of life (140). Studies have shown that living on or even visiting coastlines and other forms of greenspace is correlated with better self-reported mental health (see Ch. 13: Health and Well-Being) (141). However, coastal areas and the people who depend on them are also on the front lines of climate change (142). These regions face threats such as coastal erosion, hurricanes, sea level rise, saltwater intrusion, harmful algal blooms, and oil spills (140,143). Coastal communities are thus a key exemplar of how exposure to "blue spaces" such as coasts, lakes, and rivers has both advantages and disadvantages (141), how climate change is affecting this balance (140), and how migration trends come with trade-offs (144). Trends in coastal migration may reverse as coastal residents are forced to retreat in the face of climate-driven disasters (145), with subsequent influences on the landlocked areas to which they migrate (146). As Americans continue to move to new geographic areas, the ways they interact with nature will change as well.

Technology and Media

Modern technology and entertainment have profoundly changed how Americans interact with nature (147) and thus shape and reflect human–nature connection (148). Technological advancements have allowed us to access and exploit natural resources (149). Technological innovations have increased the efficiency of catching fish even as fish populations decline (150); similarly, forestry has become more mechanized (151). Modern coal mines are highly mechanized, increasing both safety and productivity (152), but the larger scale of operations also causes greater environmental damage (153). Likewise, new technology enabling unconventional oil and gas extraction makes "energy sprawl" (land required for new energy production) the largest driver of land-use change in the US, leading to increasing rates of greenhouse gas emissions (154). While renewable energy sources, such as wind and solar, largely avoid issues of sprawl because they can operate in the same location indefinitely (154), there are potential impacts on natural habitats (155). Technology has also made farming in the US much more industrialized than it was even 50 years ago (156). Whether this increase in mechanization has influenced connection to nature among people who work in these fields is understudied, but it has contributed to a decrease in the number of people whose livelihoods depend on direct interaction with nature (81). Moreover, the mechanization of extractive industries has contributed to shifting baseline syndrome—a slow degradation of what is considered acceptable or "normal" over time (157)—due to a "loss of memory of past environmental degradation" (158). For example, many fish populations (159) and even the size of fish (160) have declined markedly over time, yet these diminished conditions are now often considered the norm (161). Despite new technologies being developed to exploit natural resources in the quest to meet demands for more energy and food, people grapple with their desire to remain connected to nature and engage in sustainable practices (162). Reimagining the role of technology to support or increase people's interactions with nature may help some find a compromise between valuing the role of technology and the importance of connecting to nature (163).

More recently, entertainment technology has increasingly shaped interactions with nature (148). Since 1988, a significant increase in electronic media such as video games and home movies has been linked to a decline in visits to US National Parks (164). Virtual experiences have become substitutes for physical interactions with green spaces, benefiting people who cannot access the outdoors (165,166) and allowing people to visit remote land- and seascapes (167,168). However, these experiences have also shifted some interactions with nature from direct, extended physical experiences to curated, digitally mediated brief experiences (165). This shift may be more important than urbanization as an explanation of trends in interactions with nature (169,170). However, while increased screen use among children can prevent connection with nature, especially in rural contexts (148), it can also facilitate engagement (163,171,172). Nature-based apps can enhance positive shared experiences among parents and children (171). Digital platforms, such as Merlin and iNaturalist, also facilitate contact with nature in many US adults (173), and community science can increase connection with nature (174,175). Similarly, watching nature videos can increase nature connectedness and pro-environmental attitudes by inspiring awe (176) and can also increase donations that support protection of wildlife and the environment (177).

Outdoor Recreation

Human–nature interactions are facilitated by time spent outdoors (178,179). Since 1960, Americans have been increasingly engaged in outdoor recreation (180), and these nature-based activities have increased connection with nature (181,182). During the COVID-19 pandemic, outdoor recreational experiences also increased. People visited parks more often (183–186), seeking nature-based experiences. For example, visitation to parks and protected areas in New England increased by about 61% in the summer of 2020 (186). Recreational angling and license sales also increased early on in the pandemic (187,188). In 2022, 148.3 million people (45% of US residents) engaged in wildlife watching, 14.4 million went hunting, and 39.9 million went fishing. These individuals collectively spent almost $395 billion on outdoor recreation activities (189)

Outdoor activities allow people to interact with nature in both consumptive (e.g., fishing and hunting) and nonconsumptive (e.g., hiking and wildlife viewing) ways (190–192), although more Americans engage in nonconsumptive than consumptive activities. Birdwatching is a growing hobby, with approximately 3 in 10 Americans participating in 2024 (189). Conversely, American participation in fishing has declined over the past five decades from approximately 11% to 9% of the population (189), with significant regional differences (193). Prior to the COVID-19 pandemic, there was a long-term trend in decreased hunting in the US (194). Historically, revenue generated from sales of hunting and fishing licenses has increased along with the US population and helped fund conservation. However, recent declines in the popularity of consumptive recreation have raised concerns about conservation funding and motivated widespread campaigns to encourage these activities and increase license sales (195,196). It is not clear why

consumptive recreation is declining, but it may be related to increases in indoor activities, virtual entertainment, and urbanization (197).

Engagement in outdoor recreation activities is associated with pro-environmental behaviors that are intended to benefit the environment. For example, people who engage in activities involving wildlife are four to five times more likely to engage in conservation-related behaviors than those who do not (190). However, not all experiences are the same. For example, hunters who engage in "canned hunts" of farm-bred wild animals may not show the same level of stewardship as more conventional hunters (192). Likewise, people with more fishing experience show higher levels of pro-environmental behaviors such as catch and release (198,199) and minimizing the spread of aquatic invasive species (200–202).

Outdoor recreation can be affected by environmental changes. For example, climate change and other drivers can alter air quality (203), affect the spread of disease (see Ch. 13: Health and Well-Being), and shift the distribution and abundance of wildlife (see Ch. 8: Terrestrial Ecosystems). Each of these changes can influence how, when, and whether people interact with nature. For example, an increase of 400,000 visitor-days in public campsite cancellations in the western US is attributed to smoke from wildfires during the period 2008–2017 (204). However, in some national parks, smoke did not discourage park visits, despite the increased health risk (205). Changes in the distribution of different species can have both positive and negative effects on people's interactions with nature (206). Human–wildlife overlap in the landscape is increasing due to both climate change and development (207). Most often, these impacts are negative. For example, in many parts of the US, coyote populations have increased in urban areas, often creating conflicts with people and their pets (208). However, some positive impacts can also occur. For example, in Alaska, the northward range expansion of moose has provided a new food source for Arctic communities (209). Environmental changes can also influence livelihoods (see Ch. 12: Economy) and, as discussed above, may influence interactions with nature (210). For example, lobsters have declined or disappeared in New York and Connecticut in response to warming waters but have increased in abundance in Maine as the species range generally has moved northward (211).

In sum, people spend less time in nature than they once did. Factors like increased urbanization and technological advances, human movement within the US, and changes in food systems and outdoor recreation have exerted both positive and negative effects on how people perceive and interact with the natural world. This has resulted in dramatic changes in how Americans interact with nature.

Description of Evidence Base

A person's cognitive and emotional connection to nature is influenced by many factors, and there are multiple ways in which people make these connections. Disciplines that informed this chapter—such as environmental psychology, conservation psychology, outdoor recreation, and the human dimensions of natural resources—were established

only in recent decades, so empirical data on trends in human–nature connection are not available for periods prior to the 1960s. Inferences about earlier phases in human–nature connection were made using what we now understand to be the current relationship between the facets discussed and people's connection to nature. Data on increased urbanization (80,212) and the industrialization of food systems (99,101–104,111,156) are common throughout many studies and are supported by extensive data sets, making the assessed trends in these factors *virtually certain*. Increased use of technology (147–152,164,170)is also *very well established* in the academic literature. However, the impacts of these changes on people's interactions with nature (both positive and negative) are still an active area of study, so trends were considered to be *well established* but not certain because some factors may not have been considered in this analysis. Similarly, the finding that perceptions of nature vary among cultures is *well established* (74,121,213). The ways in which immigrants maintain their cultural identities centered on nature when in a new environment has strong support, but evidence of their adopting more mainstream cultural expressions of connection to nature are also evident (131,132). Whether that understanding is transmitted to other Americans is less well studied (122,127). Thus, relevant trends in immigration were considered *well established* but in need of further study. While significant data on trends in outdoor recreation exist, especially across industry reports and gray literature (82–84,86), the types of activities and regional differences in trends vary widely. Although the supply and demand of outdoor recreation experiences in the US were systematically tracked by the National Survey of Recreation and the Environment from 1960 to 2014, these longitudinal data are no longer collected. Likewise, current trends in outdoor recreation are available in the Statewide Comprehensive Outdoor Recreation Plans, but these databases are not currently integrated or universally accessible. There is a lack of research about how human–nature connection is changing over time in outdoor recreation contexts at the national level, leading to the finding that national trends are *well established*.

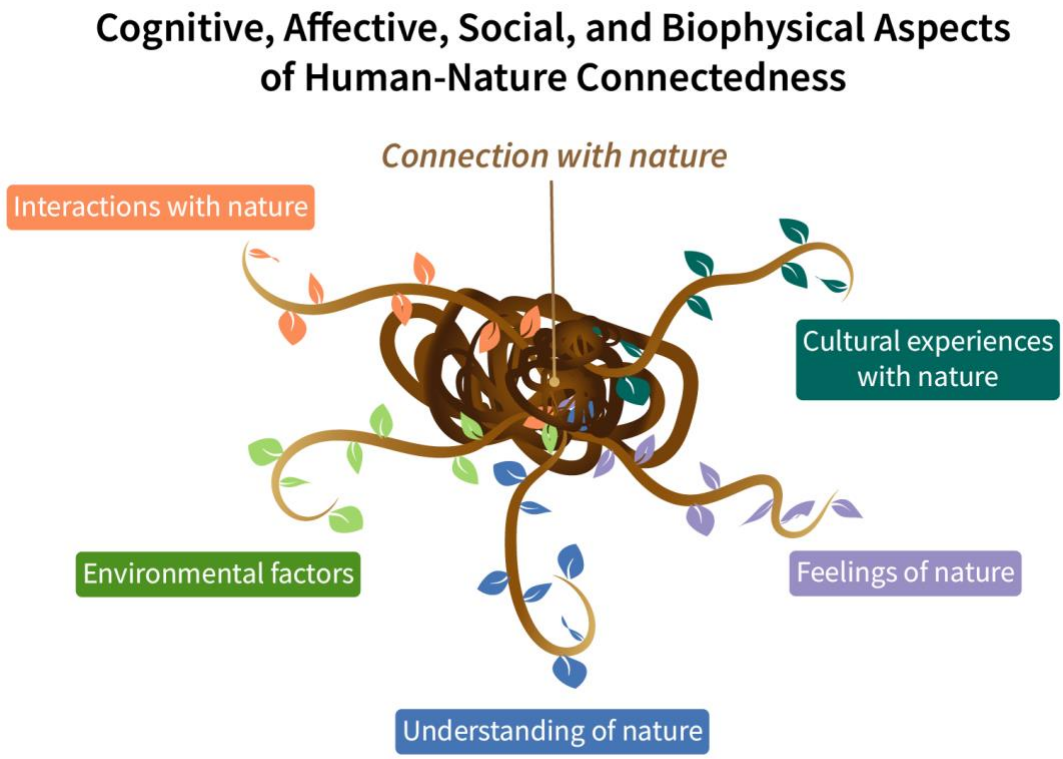
Key Message 5.2: People's ideas, emotions, and cultural traditions shape how their interactions with nature lead to feelings of connection with nature

Interactions with nature tend to strengthen people's feelings of connection to the natural world (well established), which then encourages even more interactions with nature (well established). How people understand their relationship with nature matters: Seeing humans as part of nature is linked to stronger connection (well established), while seeing humans as separate is linked to weaker connection (established but incomplete). Critical to these understandings are emotions and cultural factors (well established). Positive feelings, like awe, support greater connections with nature, while negative feelings, like fear, can weaken connections (well established). Worldviews rooted in relationships with places support higher connection to nature (well established), although some belief systems may weaken it (established but incomplete).

State of Knowledge 5.2

Feelings of connectedness to nature are influenced by five key factors: interactions with nature, environmental factors, understandings of nature, feelings about nature, and cultural experiences with nature (Figure 5.5).

Figure 5.5. Factors That Influence Connection with Nature



Connection with nature is influenced by the interrelationships among five main factors.

Five predominant factors in peoples' connection to nature—interactions with nature, environmental factors, understanding of nature, feelings of nature, and cultural experiences with nature—are woven together and support one another. If one factor is removed, it will affect the integrity of the weave. Figure original to The Nature Record.

Interactions with Nature

People who interact more with the natural world typically feel more connected to nature (74,182,214–219), and this is especially true when the interaction involves active engagement with and deliberate attention to nature (220–223). For example, walking through a forest is likely to increase feelings of connection with nature, but walking through the same forest while deliberately identifying the similarities and differences between

individual trees, or actively working on a conservation project to help preserve the forest, is likely to increase feelings of connectedness even more. Interactions with nature during childhood, especially unstructured, spontaneous exploration of natural places, lead to stronger connection with nature in adulthood (218,224–226).

It is important to acknowledge that historically, some Americans were prohibited from spending time in some outdoor spaces. For example, African Americans were banned from entering national parks and forests in some southern US states until the middle of the 20th century, a legacy of slavery (227). Today, many Black people continue to feel unsafe in public natural spaces due to anti-Blackness embedded in American culture (228,229). While Indigenous Peoples have also been forced from natural spaces in part through the creation of some state and national parks, connection to nature remains high, particularly when Indigenous Peoples are connected to their Tribal communities (230,231).

Environmental Factors

Environmental factors also impact how people connect with nature, particularly as our world experiences the impacts of climate change (see Ch. 10: Climate Change) and other factors (see Ch. 9: Drivers) (232). As extreme weather events (e.g., heat waves, flooding, drought) are becoming more common (233,234), these events can spark other environmental concerns, such as air, water, and soil pollution (203,235,236). Connection with nature can facilitate resilient responses to extreme weather and resulting concerns (74,237). This may be because people who are more connected to nature are more aware of environmental impacts, better able to anticipate change, more psychologically resilient, and feel a stronger sense of collective responsibility (238–240).

In a changing world, people's interaction with nature is affected, and this, in turn, can shape how people are connected to nature. For example, people's connections to nature influence how they make sense of nature (i.e., their ecological worldviews), their emotional attachments to nature (i.e., feelings), and how they determine the importance of nature to their social lives (i.e., culture).

Understanding of Nature

The way people relate to and understand the natural world depends heavily on their ecological worldviews—their general beliefs and (often unstated) assumptions about how people and nature are related (241–243). These worldviews, which can influence connection with nature (244), arise in part from knowledge but also depend on personal experience, formal education, and shared stories, beliefs, practices, and norms (245–247). For example, some people have a human-centered worldview and tend to see humans as separate from and superior to the rest of nature (248–250). People with this worldview tend to value nature primarily for its usefulness to humans and prioritize human well-being over that of other natural systems. These worldviews are linked to weaker connection with nature (248–250). In contrast, others have a more relational worldview: They see humans as one part of a larger natural system with reciprocal relationships and impacts between

people and nature (248–250). People with this worldview tend to recognize the intrinsic value of natural beings and ecosystems and recognize that human welfare depends on nature. These worldviews are linked to stronger connections with nature (249–251). Relational worldviews have long been an important part of traditional knowledge systems in North America, and this continues to be true (Box 5.1) (26,130).

Box 5.1. Connection with Plant Relatives

Talon and Nettle started to get to know one another in 2014 when Talon was a child attending an Indigenous STEAM camp (science, technology, engineering, art, and math) designed to cultivate youth kin relations with nature (i.e., build human–nature connection) (Figure 5.6). The camp was designed by Dr. Megan Bang, a professor at Northwestern, but also drew on the wisdom and efforts of intergenerational community members, researchers, and community-based organizations. Many people know Nettle as the Stinging Nettle plant that can live in many ecosystems but is more commonly found in the understory of riparian communities, where water and land meet. Nettle provides food to many different animals, including Deer and humans, as well as shelter for small animals including birds like Grouse, and can live in areas heavy with contaminants. Human people use Nettle leaves for food and medicine and Nettle stalks to make cordage. Nettle also produces a chemical that can cause severe itching.

Figure 5.6. Talon and Nettle

Talon connects with nature through harvesting Nettle.

Talon, an Indigenous child, interacts with Nettle. Talon came to view this plant as a relative during a camp for Indigenous children. Reprinted from McDaid Barry et al. 2023 (252).

At first, seven-year-old Talon was cautious when he interacted with Nettle, moving his hand away quickly as though he had touched a hot stove. However, after three years of learning about Nettle, including how to use Sword Fern compresses to relieve the discomfort of Nettle's stings, Talon's relationship with Nettle changed. Talon began to see Nettle as his plant relative. Along with his campmates, he learned how to identify Nettle when they saw him in the forest and developed a sense of curiosity to get to know Nettle better. He learned about Nettle's habits, and what Nettle liked and disliked. When Talon was ten, he wanted to harvest Nettle. In an act of respect, he first offered Tobacco to Nettle as a gift. He lamented that he had not given Nettle water the first time he harvested him, but the following year reminded his human friends that giving water is the same as giving thanks. He made sure not to harvest too much, so that Nettle wouldn't be lonely. Over three years, Talon's curiosity about his plant relatives shifted from hesitancy to true connection through respect, kinship, and caregiving. Talon sees Nettle as a relative and learns from elders and peers how to interact with him (252).

[END BOX 5.1 HERE]

Feelings of Nature

Emotions can impact relationships with nature, including emotions considered positive (e.g., awe, love, hope, comfort) and negative (e.g., sadness, guilt, anger). Such emotions can shift depending on context or can be persistent over time (253,254). For example, people may feel afraid at the sight of a spider they did not expect to see; this may be fleeting and not have a big impact on their overall connectedness with nature. Other people may have a persistent fear of spiders that causes them to avoid places where they expect spiders to live. Importantly, experiences in nature that evoke positive emotions can strengthen connectedness with nature (10,255–258). This person with a persistent fear of spiders might become less afraid over time following more experiences in natural spaces where they feel safe. Education can also play a role, through learning environments where young people spend time in nature doing activities they enjoy with people they care about (10,252,259–262).

People can simultaneously experience both positive and negative emotions related to nature (253,254). One might feel awe at the beauty of and love for land that has been turned into pasture and simultaneously feel sad that this land is no longer the oak savannah it once was. In fact, those who feel greater connection with nature will more often experience emotions like love for nature, though this can also be a precursor for anger, anxiety, or depression when thinking about environmental problems (255,263).

Individual and community identities can be interdependent with the natural world (262,264–267)—an indicator of having a strong nature connection (191,268–272)—and loss of connection with nature can have dire emotional consequences. For example, fishing communities on the Gulf of Maine suffered pervasive psychological distress and social disruption in the wake of the cod fishery collapse (269). For many Indigenous people, emotions related to nature connection may be particularly salient. However, land

dispossession and environmental degradation caused by settler colonialism have led some Indigenous people to feel less connected to their traditional homelands. This, in turn, can give rise to negative emotions like grief, hopelessness, and anger (262–267). For example, individuals in Inuit communities have struggled emotionally with land dispossession and changing lands and waters, but they cope by maintaining connections with nature through engaging in cultural land-based practices with community members and family (267).

Cultural Experiences with Nature

People's worldviews and their attachment to place are shaped by their interactions with one another (273–275). Cultural experiences with nature increase people's attachment to places, further reinforcing their positive connections with nature (276,277). Place attachment can develop through social connections or biophysical settings, which collectively shape one's environmental identity (274,278,279). For example, someone who spent childhood holidays on Cape Cod may continue to have positive associations with that environment, even if they currently live in Los Angeles. When people value places and find them meaningful, they may feel more attached to and concerned for these places.

Moreover, there is a positive relationship between place attachment and pro-environmental behaviors, especially when connected to livelihoods, especially in collectivist communities and for tourists (277,282–284). However, place-attachment may result in neutral or negative environmental behaviors, especially when residents feel content with the current environmental state, or environmental threats are not apparent to them (279). For example, the time spent in a place can impact people's levels of attachment (285,286), and how attached they are to a place may determine their commitment to engage in pro-environmental behaviors, such as not littering (287).

In general, Indigenous worldviews are rooted in the inherent interconnectedness of all living things, human and "more-than-human," an alternative term for non-human that was coined by an American philosopher who integrates American and Asian environmental philosophies (9). How Indigenous Americans connect to nature has been described in a multitude of ways, including biophilia, the love of the living world (288,289), or kin-centric ecology, viewing humans as part of a larger family of diverse living organisms (26). In Native Hawaiian communities, for example, connection to the land (known as Aina) is imperative for physical and mental health (290). Likewise, for the Inuit, social identity and relationships with lands, waters, and human community ensure high connection with nature, combatting negative impacts associated with environmental degradation (267). Acknowledging Indigenous worldviews about the relationship of humans with nature is important because it informs policy that is culturally relevant (291).

People's connection with nature may also be shaped by their religious affiliations and spiritual identities; some refer to this as the religious environmental paradigm (292–294). Yet different religious traditions describe connection with nature in varying ways. The Abrahamic religions (Christianity, Judaism, Islam) tend to use a dominion framework and

call for stewardship practices (295). Dominion beliefs refer to having control over nature and can either promote or counter beliefs about stewardship (295–297). For those following Asian religious beliefs (e.g., Buddhism, Confucianism, Hinduism, Jainism, Sikhism, and Taoism), framings involving harmony and symbiotic relationships are common (293,298), and the separation of humans and nature is less common. Moreover, those who believe in reincarnation are more likely to be eco-centric (299,300). In fact, across a broad spectrum of faiths, following traditional religious practices can help immigrants to the US maintain their connection with nature (131,301,302).

Description of Evidence Base

The finding that interactions with nature can strengthen people's feelings of connection to nature is *well established*, based on a large and growing number of experimental and quasi-experimental studies that demonstrate a causal link between interactions and connection (274,276,278,279,284). Numerous high-quality correlational and observational studies show that individuals who feel more connected to nature are, in turn, more likely to interact with nature, making this finding *well established*. Available evidence unequivocally shows that individuals who perceive humans as separate from and superior to nature are less connected to nature, hence this association is *well established*, although the correlational nature of the evidence currently prevents causal conclusions from being drawn. Conversely, observational and correlational evidence also shows that seeing humans as part of nature is associated with stronger connection to nature; however, because this is a relatively new area of empirical study, it is deemed *established but incomplete*. Correlational and observational studies support the finding that emotions are critical to human-nature connections. This literature shows that it is *well established* that positive emotions can support greater connection with nature while negative emotions can weaken this connection. Studies on the relationship between cultural factors and people's connections with nature consist of studies comparing cultural groups, as well as studies looking at variability within cultural groups. The finding that cultural factors are critical to the ways humans connect with nature is *well established* in this literature based on both correlational and observational studies. These studies find that different cultural conceptions of human–nature relationships shape human–nature connectedness. Relatedly, correlational and observational studies have *well established* that worldviews that center close, equitable human–nature relationships support stronger human–nature connections. The contrary—such as worldviews that center human domination over nature—has been shown by some correlational and observational studies to weaken human–nature connection. However, this is *established but incomplete* because some studies suggest there may be mechanisms other than worldviews at play, and the term worldviews is not always defined or conceived of in the same way in the literature. More generally, the evidence base for this section is expansive and is primarily drawn from correlational surveys and observational studies with human participants (282,297,303,304). Gathering experimental evidence for causal relations between cognitive, sociocultural, and emotional factors does not lend itself to experimental manipulation, both on ethical and theoretical grounds (e.g., (240,263,305)). Nevertheless,

the evidence clearly attests to the importance of ideas, feelings, and cultural traditions in determining how Americans' interactions with nature lead to connections to nature.

Key Message 5.3: Peoples' connections to nature influence how they treat it

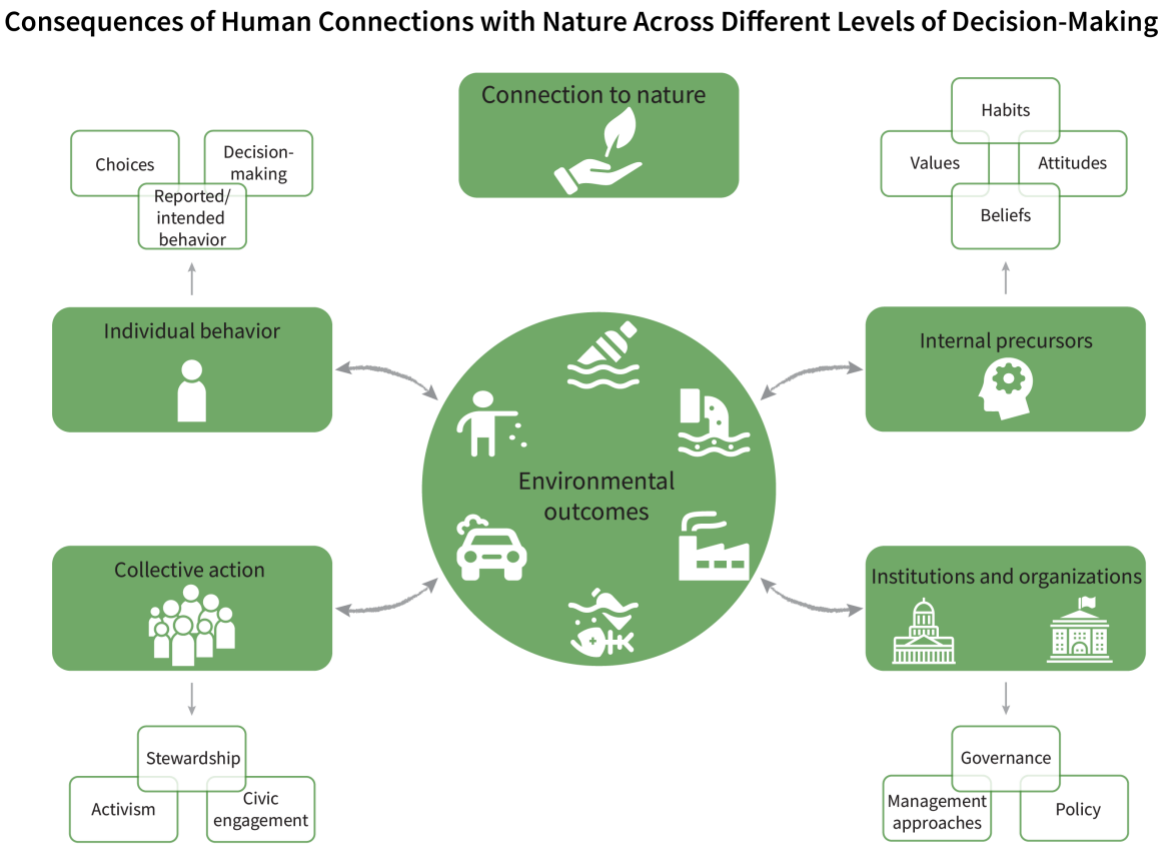
Individuals with strong connections to nature tend to take action to protect the environment (very well established) and to support environmental policies (established but incomplete). Connection with nature also strengthens motivations to participate with others in environmental activism, civic engagement, and stewardship of landscapes and ecosystems (established but incomplete). People's relationships to nature are shaped by their personal, cultural, and political identities, which influence the types of collective actions they undertake (established but incomplete). Connection with nature influences the assumptions, goals, and other attributes of resource-management institutions and organizations (very well established). Changes in human–nature connection result in transitions in existing resource-management institutions and organizations under certain conditions, including the presence of an enabling policy environment, availability of resources, perceived crisis, and recognition of windows of opportunity for change (established but incomplete).

State of Knowledge 5.3

The choices we make impact the environment—whether directly or indirectly—and are shaped by many factors: how we think and feel, how we interact with others, and how the systems and institutions we are part of operate (Figure 5.7). Choices are guided by what we know, believe, and value, which influences everyday habits, civic and social involvement, and economic decisions. While individual choices matter, people working together in communities and institutions can make a much bigger difference by influencing policy and helping to drive systemic change.

The choices people make are the direct result of things like habits and forming an intention to act in a certain way (306–310). Intentions and habits are in turn shaped by a range of factors including what people know, believe, and value; what others around them believe and do; how worried they are about potential negative outcomes to themselves, others, and the natural world; and how capable they feel to take actions that will make a difference (306,308,309,311). The strength of a person's connection to nature influences these factors. This means that there are many ways that connection to nature can shape how people act toward the environment.

Figure 5.7. Consequences of Human Connections with Nature Across Different Levels of Decision-Making



Connection with nature is linked with environmental outcomes through a range of factors.

This figure represents the different ways in which connection to nature can result in environmental outcomes. Connection with nature influences individual behavior and collective action through internal precursors such as values, attitudes, habitats, thoughts, and experiences. These internal processes inform the choices made by individuals, such as choosing to recycle. Individual and collective behaviors in turn can shape environmental outcomes by acting through institutions and organizations. In these ways, people's connection to nature influences how they treat it. Figure original to The Nature Record.

Individual-Level Decision-Making and Actions That Benefit the Environment

People who feel a strong connection to nature make decisions and take actions that benefit the environment more frequently than those who feel less connected (1–3,312,313). This holds true in the US and around the world (1–3,312,313). Children and adolescents who feel a strong connection to nature also tend to act in ways that benefit the environment (3,314,315). This strong relationship between nature connection and pro-

environmental behavior holds up no matter how you measure connection to nature (1,2,316,317).

Nature connection influences a wide range of individuals' thoughts, feelings, and behaviors. People who are strongly connected to nature support policies that protect the environment (318,319), are more willing and likely to engage in everyday behaviors like recycling (1), and are more willing and likely to join others to protect the environment (e.g., participating in demonstrations (1)). Increases in connection to nature can result in more environmentally protective behaviors (2,316,320,321). Spending time in nature, watching nature videos, or hearing nature sounds can also increase a person's tendency to protect the environment, probably because it increases connection to nature (322–327).

In summary, connection to nature and protecting nature are reliably associated in many cultures and at every age, across many kinds of protective behavior (2): People who experience nature are more likely to protect nature (322,325,327–330).

Collective Actions That Benefit the Environment

Collective actions that benefit the environment are socially coordinated and culturally embedded actions that emerge when groups are organized around a shared concern for nature. These actions include civic and community efforts such as environmental activism, stewardship, advocacy, volunteering, and participation in public awareness or education events (331–333). While most individual environmentally relevant choices occur privately, collective actions take place in public settings and can influence infrastructures, policies, and social norms at scales that individuals alone cannot achieve.

Connection to nature supports collective environmental engagement by fostering shared values, a sense of social identity, and beliefs about what groups can accomplish together (334–336). People who feel connected to nature tend to identify with others who share that concern, forming the social and emotional foundations for coordinated action. Stronger connections to nature are associated with greater likelihood of participating in activism, community restoration projects, and civic environmental initiatives (2,337). For example, there is a meaningful but modest link between feeling connected to nature and joining public activities such as volunteering, donating, or protesting (2). Strengthening people's connection to nature can increase willingness to engage in collective efforts (338), but there is not enough research to determine whether this pattern holds in US contexts.

Box 5.2. Third-Grade Lessons and Collective Action

Youth who spend time with nature tend to develop strong emotional ties to the environment. These early experiences do not need to be elaborate. Simple activities can help children develop the sense of empathy, responsibility, and agency that supports environmental action. For example, during a unit on interdependent relationships in ecosystems, a third-grade class in Tempe, Arizona begins each day by checking on milkweed plants in the schoolyard pollinator garden near the playground (Figure 5.8).

Students watch caterpillars appear, observe them feeding on the leaves, forming chrysalides, and later emerging as monarch butterflies. The changes are gradual but noticeable, prompting questions about life cycles, habitats, and the conditions needed for survival.

Figure 5.8. Youth Engagement with Nature

Learning about interdependence in nature can enhance children's connections to the outdoors.

Students interact with nature in school by studying the life stages of monarch butterflies (egg, caterpillar, pupa, and adult). This interaction with nature can inspire youth to be more observant of and curious about their natural surroundings. Such inspiration can be the catalyst for individual decisions, like pursuing an ecology degree, as well as for collective action, like volunteering with a trail maintenance crew or encouraging family members to care for outdoor spaces. These decisions and actions reflect caring about the natural environment, which stems from developing a connection with nature. Photo credits, clockwise from top left: photo by Joanna Gilkeson/USFWS via Flickr; photo by Rhododendrites via WikiCommons (CC-by-4.0); photo by Grayson Smith/USFWS via Flickr; photo by Rhododendrites via WikiCommons (CC-by-4.0).

The activity is brief, but it shapes how students think and feel. They begin paying closer attention to the pollinator garden around the milkweed and then to the larger schoolyard, pointing out trampled stems, nearby litter, and other insects they had not noticed before. Some students remind peers to avoid disturbing the area. Others talk about the caterpillars and butterflies at home, pointing out where milkweed grows (or does not) in other areas and asking caregivers questions about their own home gardens.

Later in the year, when the school shares information about a community cleanup, several families of third graders participate because the children express interest in helping care for outdoor spaces. For some adults, this is their first involvement in a local environmental activity. What began as observing milkweed and caterpillars in a single pollinator bed helped cultivate habits, emotions, and a sense of responsibility that extended beyond the schoolyard.

This scenario illustrates how everyday experiences with nature can influence children's feelings and actions, shape conversations within families, and in some cases, lead to broader community engagement (339,340).

[END BOX 5.2 HERE]

Much of what we know about links between connection with nature and collective action comes from research conducted outside the US (e.g., (341–343)), which makes it difficult to determine how well the findings apply within US social, cultural, and institutional contexts. Nevertheless, studies conducted across multiple world regions show broadly similar patterns (2), suggesting that some aspects of the relationship between human–nature connection and public engagement may generalize across contexts. Evidence also varies because studies differ in how they define and measure collective action and the factors that shape it. In addition, while peoples' connection to nature reliably predicts environmental concern and emotional engagement, participation in collective activism depends on additional factors, including political engagement, and people's beliefs in what groups can accomplish together (335,344).

Institutions and Organizations

Institutions and organizations play a critical role in shaping how people connect with nature. Through organizations and institutions, people make and carry out policies and collective decisions that influence social–ecological systems. While individual actions matter, institutions can amplify or constrain actions by establishing the rules, norms, incentives, and opportunities through which environmental decisions are made. At the institution or organization level, the influence of connection with nature plays out differently than at the individual level. Institutional behaviors are shaped by the distribution of values and priorities within the broader population (345,346). The dynamics are also shaped by power, which affects whose voices are heard and whose are overlooked (347–349).

Institutions reflect the beliefs held by a group of people about their environment at a given point in time. To ensure sustainable human–nature relationships, effective institutions are essential in providing information, incentives, resources, and opportunities for collective action across scales (350,351). Whereas conventional approaches to nature conservation in the US have largely relied on private and public institutions (and often to the neglect of communities), other approaches to managing nature integrate diverse types of institutions and organizations (352,353).

In the US, changes in how nature is valued are closely linked to how institutions function (354). When people view nature as less of a resource for human use and more as having intrinsic value, institutional goals and practices also change (354,355). Greater interaction with nature, through experiences such as nature-based tourism, recreation, and environmental educational programming, tends to reinforce these value shifts (354,356). In turn, these changes in values are reflected at the institutional level, impacting how ecosystems are managed (357–359). For example, beginning in the early 1900s, the US Forest Service pursued a management policy that prioritized maximum timber production over any other forest benefit (360,361). This continued despite the introduction of new approaches in the 1960s that began to consider other forest benefits (360). However, since the 1990s, the US Forest Service has embraced an ecosystem-based approach to managing forests that recognizes the dynamic and complex relationships between forest ecosystems and human societies. This approach acknowledges the interdependence of human and natural systems and aims to foster resilience of these systems in the face of ecological challenges such as climate change (359,362). This shift in forest governance has been attributed to changes from human-centered to nature-centered values, highlighting the negative impacts of some management strategies. Ecosystem-based management integrates diverse stakeholder perspectives and knowledge that supports collaborative governance, ensuring the ability to respond to emerging challenges (358,359,363,364).

However, change is hard. Challenges to these new approaches include failure of decision-makers to recognize complexity, resistance from interest groups benefitting from current policies, institutions' limited capacity, and lack of well-developed methods for collecting information and implementing policy locally and nationally (365–368). Hence, there are opportunities for these limitations to be addressed by enhancing background knowledge and refining management tools to ensure that, as policies shift, they continue to reflect individual- and community-level beliefs about human–nature connections (369–371).

Box 5.3. The Northwest Forest Plan

The Northwest Forest Plan illustrates that shifts in how nature is valued can influence institutional decision-making and governance at large scales, providing an example of how human–nature relationships can be reflected in policy design, management goals, and collaborative governance structures.

The Northwest Forest Plan was adopted in the Pacific Northwest in 1994 as a response to conflicts over the decimation of old-growth forests that served as habitat for the northern

spotted owl (372,373). Triggered by shifts in societal values towards greater appreciation of the intrinsic value of nature, new insights on human–nature connectedness from emerging scientific disciplines, and awareness of the shortfalls of solely emphasizing timber production, the plan sought to promote coordination among federal agencies in the management of 10 million hectares of federal land with the goal of protecting forests, wildlife, and water resources while also stabilizing local economies and providing opportunities for human connection with nature (374–376).

The plan has succeeded in protecting old-growth forests from timber harvesting and contributed positively to watershed conditions and a wide range of positive outcomes, such as improved water quality, camping and hunting opportunities, salmon productivity, and carbon sequestration (373,376). However, outcomes also illustrate the challenges of translating human–nature values into effective governance. Despite shifts toward ecosystem-based management, the plan has faced limitations related to institutional capacity, leadership, and coordination across land ownership, highlighting that value change alone may be insufficient to ensure desirable ecological and social outcomes (355,365,373,376–378). As such, there have been calls for the recognition of the complexity of forest ecosystems, as well as the use of adaptive, integrative, and collaborative approaches in the implementation of the plan (376–378). Together, these outcomes and challenges highlight both the potential and the limits of institutional change when governance efforts seek to reflect values about human–nature relationships.

[END BOX 5.3 HERE]

Description of Evidence Base

Multiple lines of evidence demonstrate associations between connection to nature and how we treat the environment. Whenever possible, we relied on literature reviews and meta-analyses. Evidence comes from several countries, including both industrialized and developing nations, as well as individualistic and collectivistic ones. Samples from the US are well-represented in this literature.

The evidence for how human–nature connection relates to collective environmental engagement is limited in scope, which contributes to the *established but incomplete* confidence rating. Research on public and collective environmental action is sparse (1,379), and few studies focus specifically on public-sphere participation. In addition, studies suggest that the link between feeling connected to nature and taking part in activism may work largely, if not entirely, through other factors such as shared identity or a sense of what groups can achieve together (e.g., (2,336,341). The finding that connection with nature influences the assumptions, goals, and other attributes of resource management institutions and organizations is assessed as *very well established*, based on evidence from published studies that illustrate that resource management institutions and organizations tend to reflect prevailing values, beliefs, norms and other dimensions of human–nature connection in a given societal context. The effect of changes in human–nature connection on transitions in existing resource-management institutions and

organizations under certain conditions—including the presence of an enabling policy environment, availability of resources, perceived crisis, and recognition of windows of opportunity for change—is assessed as *established but incomplete*, because existing research highlights the factors that enable the transition process, but a coherent generalizable theory on transitions in resource governance systems is yet to be formulated.

Environmental Justice and Equity Highlights

The US is a culturally rich and diverse country. People's age, livelihoods, geographic locations, and cultural contexts all shape their nuanced connections with nature (13). Connection with nature may look very different in different places, from dogsledding in Alaska, to birding in Southeastern Arizona, to snorkeling with sea turtles on Maui, to hiking in Rocky Mountain National Park, to clamming in New England, to managing North Dakota farmlands for duck hunting. For this reason, it is important to acknowledge the multitude of ways that people interact and connect with nature across the US. Indeed, nature can be defined broadly. When urban ecosystems are not identified as nature, they may be overlooked (380–382), and the value of urban green spaces to community members may be undervalued, despite their importance in promoting connection with nature among people living in cities (383–385).

Not all people have the same access to nature, due to residential segregation, racial discrimination, age, language, or economic and historical barriers (87,88,386). For example, from 2000–2011, Hispanic Americans across economic levels lived in communities with a decreasing amount of green space, compared to non-Hispanic White Americans (97). This is relevant because limited access to natural spaces can affect people's connection with nature, as well as impact their mental and physical health (387). While minoritized communities may value natural spaces, they may hesitate to interact with more remote natural spaces due to concerns about safety (228,388). Ensuring that national parks are safe places that acknowledge people's cultural heritage may increase visitation by racial and ethnic minorities, especially Black and Asian Americans (229). Despite evidence that such concerns do not necessarily signal weaker connections to nature (389), Americans systematically underestimate the environmental concern and connections with nature of minoritized groups and overestimate it for wealthy white Americans (390,391). Such misperceptions can influence research, policy, and decision-making, potentially increasing existing disparities in access to natural spaces.

Finally, both scientists and policymakers are increasingly recognizing that humans and nature represent a single intertwined social–ecological system (392–394). It's important to acknowledge that this perspective aligns with millennia-old traditional ways of knowing that have been practiced by Americans who maintain traditional ecological knowledge, including immigrants with land-based worldviews, Indigenous communities, and descendants of enslaved people who have maintained traditional knowledge (26,130).

Emerging Issues

While there is strong evidence that humans' connection with nature is affected by people's formative experiences and worldviews, and that it also drives people's motivations to protect the natural world, there are opportunities for more research that would strengthen our understanding of connection with nature. Given that connection with nature has not been tracked over extended periods, claims about trends should be made cautiously. The peer-reviewed literature focuses on recent decades, and the current literature tends to focus on cross-sectional studies. Longitudinal studies are scarce. Because researchers use different instruments, scales, and study designs to measure connection with nature, synthesizing trends remains difficult (395). Still, reviews suggest that despite these differences, the measures often capture similar aspects of human–nature connection (316).

Although a strong link between connection with nature and acting to protect the environment is widely observed, it is still unclear whether increasing connection with nature actually leads people to protect the environment more. Most studies demonstrating a relationship between connection with nature and nature-protective behaviors are correlational. Some experiments support the idea that connection with nature causes increased protection of the environment (2,316,320,321), but these have yet to be confirmed in the US population. Most experimental studies assess the impact of short interventions, including virtual exposure (e.g., videos, nature sounds), direct exposure to nature, nature-based mindfulness, and reflective exercises that prompt individuals to consider their relationship with nature. Although several studies report positive effects, some show null or inconsistent findings.

In a rapidly changing environment, as Americans experience and respond to issues related to global climate change, understanding how the changing climate impacts connection with nature is important because it helps explain people's motivation to engage in individual and collective pro-environmental behaviors, which in turn impacts how institutions behave. For example, as extreme weather increases, people may choose or need to spend less time in nature. This could lead to a decrease in connection, which could lead to a decreased awareness of threats to nature and a motivation to protect nature. However, most research linking climate change to connection with nature has been conducted outside of the US context (e.g., (396–398)).

Not all Americans respond to environmental changes in the same way. Other opportunities for study include examining connection to nature within different populations in the US, and assessing the comparability, relevance, and limitations of current measures in different settings (399). There are also gaps in research on eco-anxiety and its impact on connection with nature across US communities (400,401), as well as other underlying cognitive, emotional, and cultural dispositions that influence connection with nature (402). Connection with nature is a personal and holistic concept, so qualitative approaches to exploring how people's connection to nature changes over time may be informative. In

addition, as demographics in the US change, ongoing research could ensure that assessments of people's knowledge, beliefs, and behaviors associated with connection with nature and environmental actions remain relevant and accurate. A broader mix of study approaches would create opportunities to build connections across studies, while also drawing attention to nuance when connecting and synthesizing findings.

There are also opportunities to identify existing data that might help researchers describe human connection with nature in ways that capture the many dimensions described above. For example, tracking the types of majors that college students enroll in across US campuses and how those prepare students for environment-related jobs might be informative. There are also opportunities to investigate how marginalized communities in the US connect with nature (including descendants of slaves, refugees, immigrants, Indigenous peoples, inhabitants of US territories, and those living in rural and remote areas) to provide a richer perspective on the many ways Americans interact with and appreciate the natural world. Future studies could also examine how connection to nature, or lack thereof, can influence collective environmental action differently in different communities within the US.

Finally, while there is strong evidence that interventions (such as experiences in outdoor environments) can make people feel more connected with nature, more research across diverse populations and over longer periods of time could reveal how persistent these effects are in shaping how people think, feel, and behave. An important distinction in this work is between simply being exposed to nature and actively engaging with it, as these different experiences may influence feelings of connection in different ways.

At the same time, current research has focused on nature connection, so studies on nature disconnection could be informative (403). As researchers examine the impact of interventions on Americans' connection with nature, they should also consider the role of technology, such as nature apps, as our society increasingly becomes dependent on such advances (404). There is an opportunity for research linking connection with nature to transitions in the governance mechanisms responsible for enhancing resilient social–ecological systems across multiple scales, as much of the existing research focuses on the individual level to the neglect of regional landscapes (20,21,405).

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