Article

Healthy by Nature: Policy Practices Aimed at Maximizing the Human Behavioral Health Benefits of Nature Contact

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Abstract

Research suggests that spending time in nature is associated with numerous human behavioral health benefits, including improved executive functioning abilities, enhanced recovery from stressful situations, better mental health, and better educational outcomes. Greener neighborhoods also tend to have positive population-level health outcomes. Although promising, much of this research has focused primarily on selective populations and fails to account for cultural differences in how "nature" is conceptualized. Therefore, challenges may arise as policymakers aim to implement nature-based policies in their communities, given the immense cultural diversity of the United States alone. Given this ever-present challenge in behavioral sciences, policy recommendations aim both to maximize benefits of nature contact and to employ a flexible equity lens that allow for differences according to community need.

Keywords

nature, health, human health, attention restoration theory, stress recovery theory

Tweet

Spending time in nature has been shown to improve behavioral health. However, both the research and practice of nature immersion need to be more diverse and just to ensure that interventions and policies are culturally relevant, adequate, and accessible to all communities.

Key Points

- Research shows that spending time in nature is associated with numerous individual behavioral benefits: improved mental health, enhanced stress recovery, and better executive functioning abilities.
- Community-level benefits to spending time outside include better social relationships, increased physical activity, and better educational outcomes.
- While these results are promising, much of the research has focused on White, Western populations and their conceptualizations of what nature is—a well-documented problem in all behavioral sciences—and a future challenge.
- Given the tension between the accumulating knowledge about the nature's benefits and the glaring lack of inclusion, our policy recommendations aim to maximize benefits for all by accounting for cultural differences.

The Science of Nature and Human Health

An emerging body of human behavioral science has documented the importance of spending time connected to

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nature. "Nature" can mean many things to different people (as discussed later), but for the purpose of clarity, the present manuscript operationalizes nature as interacting with living environments—whether natural (e.g., forests, oceans), cultivated (e.g., gardens), or virtual imitations of the former (e.g., photos, videos, virtual reality). Nature contact appears to provide several behavioral benefits—including improvements in cognitive abilities, recovery from stress, mental health symptomology, and educational outcomes. Yet—access to nature is not distributed equally across the United States, and the science has primarily been conducted on White, Western populations. Recommended policies aim both to maximize the benefits of this low-cost, effective wellbeing practice and also to account for a diversity of cultural perspectives in conceptualizations of what "nature" and "health" mean.

Cognitive Benefits

A wealth of experimental behavioral and neuroscientific data supports the idea that nature interaction can enhance attention, improve the ability to regulate emotions, and promote recovery from stress (Scott et al., 2021). On a behavioral level, randomized control trials demonstrate that, compared to control conditions, interacting with nature reliably improves all three core components of "executive functioning" (Stevenson et al., 2018), which underlies the ability to focus attention, inhibit unwanted behaviors and actions, and stay on task (Diamond, 2013). This is supported by converging neuroscience evidence that shows improved engagement of the brain's visual systems (Hopman et al., 2020) and evidence of more attentional resources in nature (LoTemplio et al., 2020). Executive functioning abilities also support regulation of emotion and stress, and so these brain regions may change in nature as well. Indeed, walks in nature can influence activity in regions of the brain associated with regulating stress and emotion (Bratman et al., 2015; Sudimac et al., 2022).

Physiological Benefits

Originating in East Asia with the cultural practice of forest bathing (also known as Shinrin-yoku), researchers across the globe have explored how spending time in natural environments can reduce stress. A large body of experimental evidence suggests that spending time in nature and proximity to green spaces can improve indices of physiological stress across a variety of measures, including cardiovascular (e.g., reductions in blood pressure and heart rate), endocrine (e.g., reductions in cortisol), and immune responses (e.g., increases in killer T-cell activity; for review see Twohig-Bennett & Jones, 2018). Similarly, spending time in nature can increase the body's calming, parasympathetic "rest and digest" response, as indexed by increases in vagally mediated heart rate variability in nature compared to non-natural environments (Cheng et al., 2021). Many of these studies demonstrate that nature not only reduces overall stress levels but also helps individuals recover more efficiently from stressful events—promoting better mental and physical health outcomes.

Mental Health Benefits

In addition to cognitive and physiological health, spending time in nature has a positive effect on human mental health. People experience improved mood, lower anxiety, less depression, and lower stress after spending time in nature compared to urban environments (Barnes et al., 2019; Trøstrup et al., 2019). Similarly, outdoor exercise tends to produce more positive mood, decreased anger, and improved self-esteem compared to indoor exercise (Thompson Coon et al., 2011). The amount of time one spends in nature is more meaningful in terms of reducing mental health distress than the kind of nature where one spends time (Shanahan et al., 2016).

Improvements in Neighborhood Public Health Outcomes

Beyond the benefits that individuals experience, nature can improve the health of the entire communities by enhancing health-promoting aspects of neighborhoods. Physically, neighborhood nature can provide recreation, exercise, and active transportation opportunities, which is associated with improvements in cardiovascular health, obesity prevention, and diabetes management (Kondo et al., 2018; Rojas-Rueda et al., 2019). It can also increase human exposure to biodiversity and diversify the microbiome to support the human immune system (Egorov et al., 2016). Moreover, nature provides multiple ecosystem services essential for a healthy urban environment, such as reductions in air and noise pollution, mitigating heat stress and risks related to floods, all of which are associated with chronic diseases, injuries, and mortality (Egorov et al., 2016; Kondo et al., 2018). Socially, nature contact can foster social cohesion, civic engagement, and a sense of community, which can buffer against stress, loneliness, and violence (Markevych et al., 2017).

Educational and Proenvironmental Benefits

Nature exposure is also associated with academic benefits for youth, such as improved academic performance (Berezowitz et al., 2015; Wu et al., 2014) and greater creativity (Neville et al., 2023). Exposure to nature also has been associated with proenvironmental behaviors (Rosa & Collado, 2019). For example, a study in England found that outdoor recreation was a significant predictor of proenvironmental behavior such as recycling, buying local produce, walking/cycling, and volunteering for environmental organizations (Alcock et al., 2020).

Research Disparities Inhibit More Thorough Nature and Human Health Understanding

For years, research on human behavior was based on "convenience sampling" of populations that were convenient for researchers to access—predominately among undergraduate students in North America, Europe, and Australia. These Western, Educated, Industrialized, Rich, and Democratic (WEIRD) societies (Henrich et al., 2010) are nonrepresentative of either the United States or the globe, making generalization across cultures in *any* behavioral science challenging. Unfortunately, although there are many promising health benefits to spending time in nature, the scientific evidence on this topic also suffers from a lack of ethnic/racial and cultural diversity.

Research on ethnic/racial sociodynamics is extensive (e.g., Baldassarri & Abascal, 2020). Yet, as a recent meta-analysis demonstrates, this body of scholarship is predominantly missing in research of nature's effects on human mental health (Gallegos-Riofrío et al., 2022a; Gallegos-Riofrío et al., 2022b). This lack of inclusion limits practical applications of nature interventions in the United States—particularly to racially and ethnically minoritized groups. Troublingly, most studies on nature and mental health do not even report their participants' ethnicity/race (Gallegos-Riofrío, Arab, et al., 2022; Gallegos-Riofrío, Zent, 2022), making generalizability of the existing findings challenging. At the same time, and perhaps as a result, research also does not consider cultural differences in how "nature" is conceptualized. For example, Roberts (2022, p. 2) writes: [It] "is easy to forget that nature is intrinsically a part of our being" upon reflecting on the nuanced relationships that Black communities in the United States have to land, primarily due to the long-standing history of racial violence, segregation, and exclusion in natural spaces.

Future evidence must account for such human variability, which requires critical engagement with issues around ethnicity/race, wealth, power, and historical reparation. Research priorities should include addressing the over-representation of WEIRD societies in population sampling and their methods (Gallegos-Riofrío, Arab, et al., 2022; Gallegos-Riofrío, Zent, 2022), understanding the sociocultural factors shaping nature preferences and experiences (Frumkin et al., 2017; Tomasso et al., 2021), and the nexus between residential segregation and culturally safe access to nonhuman nature (Bratman & Olvera-Alvarez, 2022). Research should also incorporate other ways of knowing about nature and health—for example, various indigenous groups' knowledge about relationships between humans, nature, and health (Gallego-Riofrío et al., 2022b).

Nature and Aging

The lack of inclusion in the nature and health research has not only been limited to ethnicity, race, wealth, and power but also to age. Although much of the research on nature and health has focused on younger adults, many older adults experience some facet of pathological aging that could likely be improved with exposure to nature (Klompmaker et al., 2022). One of the greatest benefits of nature therapy is the continuum of experiences that are available to expose someone to nature based on their needs, limitations, and mobility issues. Simply being present in nature can be therapeutic to those with severe physical and cognitive limitations. Incorporating therapeutic elements of design in nursing homes has been described as a "silent partner in caregiving," and when these elements include nature, significant effects on health and wellbeing are observed (Magnussen et al., 2021; Noell, 1995). For those able to engage to a greater degree with nature, horticultural therapy has been shown to have positive effects on healthy and pathologically aging older adults and caregivers (Ascencio et al., 2019). Benefits include improved quality of life, reduced anxiety and depression, and improved physical and cognitive effects (Nicholas et al., 2019). These benefits have been observed not only for outdoor activities but also when poor weather, limited outdoor space, or limited mobility of participants required the outdoors to be brought indoors (Sefcik et al., 2022).

Virtual reality (VR) nature therapy is also showing great promise for older adults in residential settings. Nature-based VR applications provide a rare opportunity for some older adults to visit nature in the safety of their rooms. VR applications can also be combined with natural props to include tactile experiences. While nature-based VR research for older adults is in its infancy, research to date indicates improvement in mood, feelings of joy and relaxation, and diminished anxiety after viewing synthetic nature (Sadowski & Khoury, 2022). The importance of nature exposure research on older adults grows as populations age, life expectancies increase, and physical and cognitive health attenuate at global levels.

Access to Nature

Research investigating inequities associated with access to green space in the United States has found disparities across socioeconomic status, race, and ethnicity (Klompmaker et al., 2023; Williams et al., 2020). In the present paper, "access" is operationalized in two ways: physical proximity and the barriers that may prevent individuals and communities from meaningfully engaging with the space. For example, public transportation access to large parks is higher in Whiter neighborhoods (Park et al., 2021). Further, an investigation of the perceived safety of green spaces in five major U.S. cities found that communities of color and low-income communities disproportionately lack access to "safe" parks (Williams et al., 2020). While physical proximity and perceived safety are components of "access," other barriers may prevent individuals (or communities) from accessing space. Characteristics such as financial accessibility (Hong & Anderson, 2006), diverse representation

(Armstrong & Greene, 2022), and culturally relevant/inclusive outreach (Lundin & Bombaci, 2022) are also components of access for a variety of minoritized social identities, such as communities of color, women, and LGBTQ+ communities.

Benefits of Nature Contact to Traditionally Excluded Populations

While there is less research on traditionally excluded populations (i.e., non-WEIRD), and disparities in access to nature for many of these groups, some research suggests that underserved populations may also benefit disproportionately from this contact (Mitchell & Popham, 2008). One notable case example includes the extremely nature-deprived settings of correctional facilities—in which live 2.3 million incarcerated adults and 50,000 incarcerated youth in the United States alone (Nadkarni & Morris, 2018). Early research that documented positive responses to nature exposure in nature-deficit environments (e.g., hospitals, Ulrich, 1984) inspired scientists to provide exposure to incarcerated people directly, by engaging "incarcerated citizen scientists" to rear animal and plant species for ecological restoration activities (Kaye et al., 2015) and virtually with nature videos in solitary confinement cellblocks (Nadkarni et al., 2017, 2021).

Nature contact contributed to a calmer, safer prison settings (Relf & Dorn, 1995), provided a sense of environmental contributions and prosocial behavior (Norton & Holguin, 2011), fostered pursuits of curiosity and learning (Ulrich & Nadkarni, 2009), and enhanced vocational skills that can reduce recidivism and increase the probability of postrelease employment (Davis et al., 2013). Inmates participating in virtual nature experiences reported feeling significantly calmer, less irritable, and more empathetic, and they committed 26% fewer violent infractions compared to those who did not watch the videos. Prison staff corroborated these findings (Nadkarni et al., 2017). These promising results from work with incarcerated people underscore the potential of nature immersion as a strategy to improve the wellbeing of other traditionally excluded population when equity and justice are cornerstones of the research process.

Summary and Future Directions

Spending time in nature can improve both individual and community health and wellbeing. At the individual level, nature contact can boost cognitive functioning, improve mental health, promote stress recovery, enhance learning outcomes, and foster proenvironmental behaviors. At the community level, green neighborhoods can improve health outcomes by promoting healthy exercise behaviors, fostering healthy social relationships, and providing environmental services such as reductions in noise pollution, environmental cooling, and improved air quality.

While these results are encouraging, there is currently a significant lack of empirical research on how nature contact affects BIPOC (Black, Indigenous, and People of Color) communities. Therefore, a major direction of future research is to prioritize racially, ethnically, and culturally diverse samples. The use of culturally safe and sensitive methods to study nature and human health is crucial. Efforts are underway to ensure that the tools researchers use to study nature and wellbeing in culturally diverse groups are valid, effective, and sensitive (Gallegos-Riofrío, Arab, et al., 2022; Gallegos-Riofrío, Zent, 2022).

Future work is underway to determine the most effective applications of nature and human health. Currently, the research has occurred on a variety of environment types and with different exposure lengths. Due to logistical ease, much of the current nature intervention research has focused on short (1–2 hours or less) visits to nearby natural areas. Far fewer studies have examined longer doses or systematically compared longer (multiday) visits to short visits. Furthermore, few studies have examined the duration of benefits following different lengths of nature exposure. This "dose-response" science is an important direction for future research, as it is possible that there is a point at which benefits diminish. For example, some research on parasympathetic nervous activity suggests that longer (>2 hours) exposures can *decrease* parasympathetic activity (Scott et al., 2021; for review see Cheng et al., 2021), at least in the short term. Therefore, in the absence of additional findings, practitioners should prioritize providing opportunities for regular, routine use of nearby nature over extremely long dosages of nature to improve health outcomes.

The significant variability in how researchers define nature (Bratman & Olvera-Alvarez, 2022) and the lack of research directly comparing different exposure lengths somewhat limit the "policy readiness" (Ijzerman et al., 2020) of nature and human health in certain contexts. Researchers are currently investigating which nature interventions work best and for whom they work best. Given current limitations in knowledge about nature and wellbeing in *every* context, nature-based interventions should not substitute for regular medical treatment or mental health treatment. However, enough evidence suggests that time in nature may serve as a supplemental health-promoting intervention. Below are recommendations that can be safely implemented, given both the knowledge and the gaps in knowledge.

Policy Recommendations for Promoting Human–Nature Contact

Given the substantial health and wellbeing benefits that communities may receive from nature contact, our policy recommendations aim at multiple societal levels (i.e., local, state, and federal). Given the aforementioned limitations on population sampling in the research, justice and equity lenses must

be applied at every step and should be central to each decision. In addition, diverse representation from communities where policies are being considered must be present in leadership and decision-making. Nature immersion has the potential to improve health equity but only if policy changes incorporate diverse voices and truly engage with communities to understand their needs. Straying from this equity-based philosophy risks policy failure.

General Recommendations

Invest in the Agency of Communities to Break Down Barriers to Accessing Wellbeing in Nature

Given the broad range of human and cultural experiences in the United States alone, activities or practices that work in one neighborhood or community may not work in another. While understanding the unique needs of a particular group, those implementing policy should remember the power of community agency and resilience—often community members know exactly what they need. Therefore, investing in flexible, community-based approaches can leverage community agency to understand local needs. For example, one community may be interested in outdoor recreation but lack equipment or skillsets—and therefore decide to invest in initiatives to provide equipment and training. Another community may decide community gardens are more important. Policymakers should therefore provide ample opportunities for local community members to engage in decision-making (e.g., town halls) and, when appropriate, directly fund preexisting community initiatives and groups that aim to improve nature access and contact.

Create Public Programming

Culturally relevant public programming outdoors is one of the most effective ways to promote human–nature contact. Examples include guided nature walks, outdoor fitness classes (yoga, tai chi), community gardening, service projects, youth events, and outdoor concerts. To broaden participation, events need be accessible to all individuals regardless of income or ability and welcoming and inclusive to the targeted communities. These goals require long-term planning and collaboration to establish trusting relationships. Leveraging work already underway by trusted organizations in this space raises the potential for equitable action that connects local needs to resources.

Recommendations for Land Management

Natural Areas and Green Spaces Built With and For Every Community

It is possible to envision a world in which *everyone* has safe access to nearby nature and feels welcome and affirmed in these spaces. As previously discussed, disadvantaged communities and communities of color have less access to nature, both due to physical proximity and invisible barriers such as perceived lack of safety. Therefore, prioritization of new parks should be given to neighborhoods highest in need. Crucially, the design of these new parks should be centered on the needs of local communities, which will require long-term engagement with local partners across sectors. For example, some communities may prefer challenging trails for exercise, while others may prefer access to picnic locations. These needs should be assessed *before* breaking ground. Additionally, potential negative impacts such as gentrification and subsequently displacement should be carefully considered (Gould & Lewis, 2016). Useful toolkits on park creation exist for community leaders, such as the Pocket Park Toolkit by the Trust for Public Land.

Connect Climate, Biodiversity, and Equity Pursuits

New parks are important opportunities to address not only human health needs but also biodiversity and climate resilience. As such, parks should support native plants and local biodiversity and consider adaptation to climate hazards. New parks should be strategically established in areas with high levels of air pollution and urban heat island effects, to counteract the negative human health effects of a changing climate. Finally, it is also crucial that cultural sensitivity be incorporated into these projects, again leveraging current work and trusted local partners.

Conserve Preexisting Public Lands

It is essential that regulations are put in place to protect and conserve public lands to ensure that individuals can continue to access the human health benefits these lands provide. This can include policies to reduce habitat destruction and fragmentation, prevent the spread of invasive species, limit resource extraction, and improve environmental monitoring of these spaces. In addition, policies should be implemented to promote sustainable use of public lands, such as low-impact recreation and ecotourism, and transit to promote usability. It is important that this work is accomplished with and by local communities and that it acknowledges the history and colonization of the land.

Recommendations for Education

To promote human–nature contact among young people, it is essential to integrate nature into both formal and informal education. Several model examples exist—for example, the National League of Cities and the Children & Nature Network are currently partnering with school systems and local municipalities nationwide to connect school children to nature. This group has already issued comprehensive toolkits for institutions to promote childhood nature contact

including (a) green schoolyards, (b) creating natural early childhood playscapes, (c) creating opportunities for nature-based after school and summer programs, and (d) culturally inclusive youth programming in local green spaces. To ensure that nature is accessible to all students, schools should work with local communities and partners to understand inequities and barriers and then work to provide the supports that are needed.

Recommendations for Healthcare

Train Healthcare Workers to Use Nature as a Supplement for Wellbeing

Many individuals look to their healthcare providers for wellness strategies. However, barriers exist for healthcare providers to issue recommendations about park prescriptions (Besenyi et al., 2020), such as lack of information about nature's benefits, or local natural areas and preexisting community initiatives. Therefore, communities should invest in resources to train healthcare trainees in this topic, provide continuing education for existing healthcare practitioners, and connect healthcare centers to relevant community nature programming. Park prescription programs such as the Appalachian Mountain Club's Outdoors Rx or the nationally active Parks Rx initiative exemplify the merger of public health goals, outdoor nature contact, medical practice, and public land availability to achieve results.

Integrate Nature Contact into Long-Term Care Facilities

"Secure outside activity space" has been listed by professionals serving those with Alzheimer's disease and related dementias as a top priority for elements in the physical design of residential care communities for over two decades. This, paired with research suggesting widespread benefits from exposure to nature in older adults, suggests that increased use of nature-based therapies for healthy older adults and those with pathological aging is warranted (Keane et al., 2003, p. 15). Therefore, safe and accessible nature, such as VR technologies and healing gardens, should be implemented whenever possible in senior and other long-term care facilities.

Expand Capacity of Other Practitioner Organizations

While traditional healthcare and mental healthcare is a resource for some, many do not have access to healthcare or do not trust their healthcare providers. Therefore, investments should be made in expanding the capacity of other community practitioners that are focused on some aspect of human wellbeing in nature, such as local outdoor recreation or environmental youth development groups. Training organizations and their staff to leverage science to increase their impact is the key for harnessing the potential of nature to help address health inequities. Funding should be directed toward increasing the capacity of these other on-the-ground practitioners.

Recommendations for Federally Funded Research

Close the Research Gaps

Federal funding mechanisms are needed to fill the various research gaps that establish nature contact as a public health priority. To date, research has overlooked certain demographics, variances in urban nature availability, and dose-response associations between nature connection and health. New and continued research needs to help understand many nuances and unanswered questions of how outcomes vary among different groups nature-based environments. Longitudinal research is needed to quantify and qualify results and change through time, preferably done in close collaboration with practitioners so that science draws on realistic conditions of how individuals connect with nature in routine ways. Finally, as discussed, culturally sensitive methods are critical, and community-based research efforts should be prioritized.

Access to Evidence-Based and Culturally Relevant Information for All

Recent efforts to make federally funded research publications open-access are laudable. However, they do not address other access issues, such as highly technical and jargon-laden language. Therefore, social science and health communications strategies are needed to craft messaging campaigns that provide information about the use of nature as an agent of health and wellbeing. Campaigns should work with trusted community organizations to target underserved groups and non-English-speaking groups. Ideally, everyone should have easy-to-understand access to knowledge about how nature benefits health, where and how to access nature, about environmental injustice issues, and where and how to voice their needs.

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