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Nature Healing Mental Stress: What U.S. Healthcare Can Learn from Other Nations

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Abstract

The United States healthcare system lags many developed nations in healthcare access and practices, especially surrounding ecotherapy [1]. Ecotherapy is the practice of mindfulness in tandem with intentional immersion among natural spaces or with natural elements. Research from Asia, Europe and Canada indicate immense benefits from ecotherapy, or mindful nature immersion, as an effective treatment for burnout and stress. By adopting regular nature engagement, the U.S. could significantly improve mental health and reduce occupational stress. This literature review examines how nature immersion, especially with mindfulness, positively affects the brain and nervous system. Key components in nature are identified, such as negative ions, phytoncides, and fractal structures that specifically enhance cognitive, mental, and emotional health. Research suggests that practicing mindfulness in nature for at least 120 minutes weekly maximizes these benefits, highlighting the need for ecotherapy recognition in U.S. healthcare [2].

Keywords

ecotherapy, mindfulness, nature immersion, forest bathing, shinrin-yoku, negative ions, phytoncides, fractal structures, blue spaces, green spaces, mental health, cognitive health, emotional health, therapy, occupational stress, cognitive fatigue, mental wellness

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Abstract

The United States healthcare system lags many developed nations in healthcare access and practices, especially surrounding ecotherapy [1]. Ecotherapy is the practice of mindfulness in tandem with intentional immersion among natural spaces or with natural elements. Research from Asia, Europe, Australia, and Canada indicate immense benefits from ecotherapy, or mindful nature immersion, as an effective treatment for burnout and stress. By adopting regular nature engagement, the U.S. could significantly improve mental health and reduce occupational stress. This literature review explores how nature immersion, particularly when combined with mindfulness, positively impacts mental health on a biochemical level. Key components in nature are identified, such as negative ions, phytoncides, and fractal structures that specifically enhance cognitive, mental, and emotional health. Research suggests that practicing mindfulness in nature for at least 120 minutes weekly maximizes these benefits, highlighting the need for ecotherapy recognition in U.S. healthcare [2].

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Ecotherapy is the mindful practice of nature immersion that benefits emotional and mental wellness. The term "biophilia hypothesis," introduced in 1973 by Dr. Erich Fromm, suggests that humans have an inherent connection to nature, providing a theoretical foundation for ecotherapy's effectiveness [3]. Ecotherapy encompasses a variety of practices, such as Forest Bathing (Shinrin-yoku), outdoor yoga and meditation, wilderness adventures, and mindful engagement with natural water sources like waterfalls, lakes, and coastal areas. It is used in countries across Asia, Europe, Australia, and North America as an effective treatment for burnout and stress, as well as a tool for cognitive recharge in corporate retreats. With its low cost and wide-ranging benefits, ecotherapy also encourages environmental activism (DeVille) [4]. By adopting regular nature engagement, the U.S. could significantly improve mental health and reduce occupational stress. On a molecular level, research identifies key components of nature such as negative ions, phytoncides, and fractal structures and how they positively affect cognitive, mental, and emotional health. Studies indicate that practicing mindfulness for at least 120 minutes weekly in nature maximizes these benefits, underscoring the potential for integrating ecotherapy in U.S. healthcare systems [2].

In 1982, the director of Japanese Forest Agency, Tomohide Akiyama, termed the phrase Shinrin-Yoku (forest bathing) to describe intentional time spent in forested spaces [5]. Studies from Japan and Korea indicated that forest bathing provided significant benefits for improved mental health and cognitive function; subsequently, Japanese corporations adopted shinrin-yoku as corporate retreats to combat 'karoshi,' the Japanese term for 'death from overwork' [6]. This project reviews studies from Asia and Europe that investigate how exposure to nature's phytoncides, negative ions, and fractal structures can alleviate mental health symptoms such as depression, anxiety, and stress. By synthesizing existing research, this literature review

highlights three key natural elements that positively affect mental health on a biochemical level. The aim is to present ecotherapy as a scientifically validated intervention for addressing mental health challenges and stress-related symptoms, incorporating evidence-based mindfulness practices within natural environments that contribute to its efficacy.

Methodology

Scholarly works on ecotherapy have been collected over several years. An initial search on Google Scholar identified relevant articles, which were then downloaded and reviewed from the online libraries of Palo Alto University and the University of the Pacific. Keywords and phrases used for searches included "ecotherapy," "biophilic theory," "biophilic hypothesis," "forest bathing," "shinrin-yoku," "phytoncides and mental health," "negative ions and mental health," "fractal structures and mental health," "healing components of nature/green spaces/forests/blue spaces," and "mindfulness practice."

Inclusion Criteria: Studies published since 2019 that directly examined outcomes associated with exposure to nature and nature-immersion experiences, including studies from countries outside the United States. The reason to limit studies within the past five years is to underscore the current, active and relevant research dedicated towards the positive impact of ecotherapy. There was no date restriction applied to the historical data used to define terms like mindfulness practice, the biophilia hypothesis, ecotherapy, and forest bathing.

Exclusion Criteria: Studies about exposure to nature published prior to 2018 except when defining origin of practice or theory; single-case studies (n=1) or those that identify too specific a population that cannot be generalized to everyone. For instance, studies focused on forest bathing among colon cancer survivors were excluded, as well as studies whose abstracts

did not align with the literature review and objectives. Studies that did not provide full text were not included in the literature review.

Both platform search methods prioritized publications from 2019 onward, ensuring inclusion of the most relevant and up-to-date research in ecotherapy and current therapeutic modalities. This time frame also helps eliminate outdated theories, promoting a focus on modern developments in the field. The emphasis on negative ions, phytoncides, and fractal structures enhances the understanding of key natural elements that positively influence mental wellness. Full-text availability was crucial for both inclusion and exclusion criteria, ensuring the accuracy of data and supporting a thorough literature review. Google Scholar searches initially explored broader categories (e.g., ecotherapy, mindfulness, biophilic theory) to provide historical context and highlight the longevity of practice and theory. In contrast, the university database searches concentrated on peer-reviewed articles and studies from specific geographic regions where ecotherapy is actively implemented, ensuring the validity and reliability of the research findings.

Collected data were systematically organized and analyzed to identify common themes and outcomes related to ecotherapy's effectiveness. Both international and domestic studies were considered to reflect the diverse cultural practices of ecotherapy, such as Shinrin-Yoku (forest bathing) in Japan and Korea. Historical data on the defining aspects of ecotherapy and its theoretical origins were included to provide a comprehensive understanding of the evolution and impact of ecotherapy practices. As a result, no date restrictions were applied to these searches.

Mindfulness and Stress-Reduction

Mindfulness is defined as being aware of the present moment. In therapy, mindfulness is the practice of being in the moment without judgement, the latter as a tool to reduce negative thoughts and increase feelings of acceptance about “what is.” The practice of mindfulness-based

interventions (MBIs) originates from Buddhism [7], founding current day therapeutic approaches such as Mindfulness-Based Stress Reduction (MBSR) and Mindfulness-Based Cognitive Therapy (MBCT), which are central to interventions like Dialectical Behavior Therapy (DBT) and Acceptance and Commitment Therapy (ACT). Mindfulness practiced in a nature-rich environment, abundant in biological and visual stimuli, embodies one of the core principles of ecotherapy [8]. Intentional focus on the five senses acts as a grounding technique in MBI, an evidence-based practice used in multiple modalities that help ameliorate depressive and anxious symptoms [9].

Key Ecological Components of Nature that Promote Mental Wellness

A study conducted at the University of Sheffield in the United Kingdom examined the impact of mindfulness-based stress reduction (MBSR) exercises while in natural environments for reducing stress-related symptoms [10]. The results showed that participants who exercised MBSR in an outdoor nature setting experienced a significant decrease in stress and depressive symptoms over participants who used MBSR indoors or in a built outdoor setting [10]. Researchers from the department of neuroscience at the University of Leicester in the United Kingdom indicated numerous benefits from their study of outdoor talk therapy [11]. Reported outcomes that included clients enjoying an egalitarian setting of nature, an enriched therapeutic relationship, and reduced discomfort of having therapy in a closed room. Nature immersion as a supplement to mindfulness is a key factor that significantly enhances talk therapy [11]. The following three elements, commonly found in natural spaces used for conducting ecotherapy, may be key to understanding why nature immersion enhances mental well-being.

Negative Ions: Negative air ions (NAIs) are airborne molecules found in natural environments such as beaches, forests, highlands, waterfalls, lakes, and rivers, especially after

weather events like rainfall or lightning storms. These microscopic, invisible, tasteless, and odorless particles are emitted near moving water sources and forests and are absorbed through proximity to these sources [12]. Exposure to negative ions from nature improve mood and alertness [13]. Positively charged air ions, known as cations, commonly originate from air pollution or particle-heavy emissions from technological environments [14]. Prolonged exposure to these ions can lead to symptoms such as fatigue, respiratory irritation, and joint pain [12]. In contrast, negatively charged air ions (NAIs) are considered beneficial to health [15].

A 2023 literature review by researchers at Hainan Medical University and China Medical University explored the effects of NAIs on various aspects of human health, including cardiovascular, respiratory, neurological, and emotional functions, finding improvements in depressive scores, asthma, cognitive tasks, and autonomic nervous system function, though no effect on metabolism [12]. Conversely, researchers Kühn and Gallinat from Germany questioned whether the mental health benefits associated with natural settings are due to molecular effects or socioeconomic and cultural factors [16]. Their findings indicated that urban residents with minimal green spaces had higher amygdala reactivity and lower prefrontal cortex processing, while those in affluent areas with more green spaces had better mental health outcomes. Both studies also noted that time of day and year influence the efficacy of NAIs, with early morning, late evening, summer, and autumn exposures showing the highest positive impact on mood and wellness.

Phytoncides: Phytoncides, volatile organic compounds emitted by plants in forest environments, are primarily found in remote green spaces [17]. Monoterpenes, a type of phytoncides, are essential oils with distinct scents that act as natural insecticides and positively influence cognitive and mental health by activating the brain's olfactory senses [18]. Since 1982,

studies from Japan show that shinrin-yoku, or forest bathing, improves cognition and reduces occupational stress [5]. Dr. Qing Li's extensive research highlights the benefits of phytoncide inhalation, including increased natural killer (NK) cell production and reduced adrenaline levels, leading to its recognition as a scientific treatment for stress in Japan [5] [19] [20]. South Korean research also indicates that repeated forest bathing, especially through walking and meditation, significantly lowers anger and depression [21]. An Italian pilot study found that higher exposure to forest volatile organic compounds (VOCs) correlates with reduced anger, anxiety, and confusion than participants exposed to less dense forested areas [22]. Additionally, researchers Lew and Fleming from Canada suggest that phytoncides can enhance immunotherapy by reducing cortisol-induced stress and promoting NK cell production [23].

Fractal Structures: Fractal structures, though less studied, are a promising and unique component in understanding the ecological-biological relationship for stress-related symptoms. These repetitive, multi-scaled patterns found in nature are experienced through sight [24]. Dr. Richard Taylor, a physicist from London who is a current researcher at the University of Oregon, coined the term "fractal fluency" after discovering a universal eye reaction in humans and primates when viewing fractal structures in nature. His subjects reported reduced stress and increased calmness by up to 60%, highlighting nature's long-standing role in art, gardens, and design to evoke aesthetic calm [25].

Incorporating aesthetically pleasing gardens and nature views with fractal structures is highly desirable in urban and suburban planning [3]. Research shows that affluent neighborhoods with abundant nature score highest in emotional regulation and reduced mental symptoms [26]. A Romanian study found that hospital patients who visited green spaces experienced significant improvements in spiritual and physiological symptoms [27]. This study also explored

aromatherapy, reduced sound pollution, nature sounds, and edible plants, indicating that the benefits may not be attributed solely to fractal structures.

Discussion

The extensive, multicultural research on nature immersion as a treatment for stress-related symptoms is invaluable. The U.S. healthcare system could greatly benefit by adopting nature immersion practices used globally. This review examines three nature components that scientifically relate to wellness and symptom reduction. For the purposes of this literature review, the primary natural environments examined include forested areas, locations with abundant natural water sources, and nature immersion settings intentionally designed using biophilic principles. While other natural spaces, such as snowy landscapes (white spaces), deserts, flatlands, prairies (brown spaces), and volcanoes (red nature), are undoubtedly evocative [28], they were not the primary focus of this search. Instead, blue and green spaces—those depicting water and plant life—remain central to ecotherapy research and practice [28]. Natural phenomena rich in negative ions, such as lightning storms, are common in deserts, flatlands, and rural landscapes [12]. However, the key distinction between an ideal ecotherapy environment and one that is simply abundant in negative air ions (NAIs) lies in the human capacity for tolerance and enjoyment, which is essential for sustained immersion to fully benefit from ecotherapy practices.

Negative ions offer diverse opportunities for ecotherapy, accessible regardless of ecological specifics or disabilities. Combining findings from Xiao et al. with German research, it is evident that regular exposure to negative air ions (NAI) improves cognitive function and calms stress-related responses [12] [16]. The Chinese study suggests a causal link between NAIs and mental wellness, while the German study indicates a possible correlation.

Phytoncides in forests are gaining attention for nature immersion healing. Forest bathing (shinrin-yoku) is becoming popular in the West but remains underutilized as a healthcare alternative for mental health. The studies from Asia and Italy indicated a positive correlation between phytoncide concentrations and mental and physical health benefits, suggesting smaller green spaces may not be as effective as larger forests. Not all U.S. states have national forests; however, parks and public natural areas can be found in all fifty states. Research shows that exposure to larger natural environments offers significant health benefits, highlighting the importance of prioritizing environmental conservation and advocacy efforts.

Fractal structures, implemented through art, houseplants, and urban gardens, benefit those who are visually able. Recreational and holiday associations, like vacations and weddings, enhance the sensory input and may influence universally positive impressions of celebration and respite. Dr. Taylor's research on eye movement and nature's fractal structures offers a new understanding of ecotherapy's neurophysiological impact [25]. Further research is needed, but fractals appear to promote inclusivity, universality, and calming of the sympathetic nervous system.

Conclusion

This review advocates for the adoption of ecotherapy in the U.S. as a scientifically supported mental health practice. Evidence suggests that practitioners who are skilled in mindfulness and trained as ecotherapy guides can enhance the effectiveness of nature-based prescriptions for individuals seeking support with mental and cognitive health. Moreover, a deeper understanding of the scientific principles underlying ecotherapy can bolster confidence in its efficacy and encourage greater use of mindful nature immersion as a remedy for cognitive fatigue, as well as mental and emotional stress. By integrating ecotherapy and nature-based talk

therapy with a licensed mental health professional, patients can gain valuable scientific insights and develop independent coping strategies for managing stress and promoting overall mental well-being.

Countries in Europe and Asia are at the forefront of research and practice in the evidence-based science of ecotherapy. Researchers in Italy highlighted that limited access to rich blue and green spaces can hinder the availability of ecotherapy for populations with restricted natural surroundings [22]. Nevertheless, enhancing urban environments with gardens, greenery, nature sounds, water fountains, and landscape artwork can provide some of the therapeutic benefits of ecotherapy when natural outdoor spaces are not accessible [3].

According to the American Public Health Association, the United States ranks 34th among high-income countries in terms of overall health, while Italy, Japan, South Korea, and Spain—countries with significant research and practice in ecotherapy—rank higher. The U.S. faces mental and physical health crises that are less pronounced in other developed nations. Ecotherapy offers a cost-effective and scientifically supported treatment that benefits human mental and physical health while potentially promoting environmental well-being [22]. The Australian Counseling Association recognizes the benefits of ecotherapy as well as the impact of climate distress caused by climate change and is committed to climate-related social justice advocacy among Australia's counseling profession to address the impact of climate change on mental health [29]. Currently, research is limited regarding the impact of environmental advocacy from ecotherapy, but promising observations occurred in a study by occupational therapists in Ireland who found that participants who engaged in nature therapy not only experienced mental health improvements but also developed greater enthusiasm for community gardens and their outdoor surroundings [30]. Further research is indicated to understand the

benefits of ecotherapy as an extension of treatment for mental health in the United States, and its potential impact with environmental advocacy.

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