Research Article

Green Mindfulness: A systematic review of the literature

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Keywords: Nature-based mindfulness; green mindfulness; attention restoration; stress recovery; ecocentric model.

Abstract. Introduction. *Humans possess an innate tendency towards life which, through fascination, facilitates the restoration of directed attention and stress recovery. Given the increasing urbanization, integrating Nature*

contact with mindfulness - a practice known for its analogous mental health benefits - is gaining attention. This systematic review investigates whether Nature-based mindfulness (Green Mindfulness) is synergistic, neutral, or antagonistic compared to indoor mindfulness or Nature exposure considered separately.

Methodology. *Following PRISMA guidelines, a systematic search on Google Scholar using the string "Nature-based mindfulness" AND (empirical OR experimental) was conducted, yielding 129 results. After screening, twenty empirical studies published in 2023–2024 were included, with only nine featuring a comparator activity in a real natural environment. Participants included adolescents and adults, healthy subjects, and those with mental/physical vulnerabilities. Outcomes included psychological (stress, anxiety, mood, Nature connectedness) and physiological (cortisol, heart rate) measures.*

Results. *All twenty studies reported positive effects on well-being and health. However, the comparative analysis of the nine controlled studies showed heterogeneous outcomes, indicating that Nature-based mindfulness is not unequivocally superior to comparison conditions, with results being synergistic, neutral, or even antagonistic depending on the variable. Specifically, antagonistic effects and neutral effects were observed for some variables.*

Discussion and Conclusions. *The field of Nature-based mindfulness is emerging and highly heterogeneous in activity design and reporting. The lack of superior efficacy in some studies suggests that formal, introspective mindfulness may impede the necessary sensory relationship with the environment. An ecopsychological perspective is proposed for future research, advocating for an ecocentric green mindfulness model that includes the locus Naturae (the place as a living presence) and an ecotuner (a specialized facilitator) to better capture and maximize the bi-directional, restorative effects of the human-Nature relationship.*

1. Introduction

Human beings exhibit an innate tendency to love life (Fromm, 1964; Wilson, 1984). According to E. O. Wilson, living creatures possess the capacity to elicit a broad spectrum of emotions, ranging from fear (or biophobia; Ulrich, 1993) to pleasure and the desire for connection (or biophilia; Wilson, 1993). In the latter scenario, the living creature exerts a fascination that is configured as a form of effortless attention. Fascination allows directed and sustained attention to restore (Kaplan, 1995) and facilitates recovery from a state of stress (Ulrich, 1984). Contact with Nature, when perceived as pleasant (Berto et al., 2022), therefore exerts a restorative effect on one's mental state, enhancing cognitive functions and facilitating emotional recovery from stress (Barbiero & Berto, 2021). This effect is conceptualized in established theories such as the Stress Recovery Theory (Ulrich, 1991) and the Attention Restoration Theory (Kaplan, 1995) and is consistent with naturalistic intelligence in the Theory of Multiple Intelligences (Gardner, 1999).

Biophilia is defined as "the innate tendency to focus upon life forms and all that reminds us of them, and in some cases to affiliate with them emotionally" (Wilson, 2002: 131). This tendency, which is genetically determined in Nature, held an adaptive value throughout human evolution, particularly during the long period of life as a hunter-gatherer in natural environments. In that context, the ability to acquire biophilic and biophobic schemes was crucial for survival (Barbiero & Berto, 2016, pp. 26-27). Although innate, biophilia does not manifest as a mere instinctive reflex but requires stimulation and development.

In the current historical and social context, where 58% of the global population resides in urbanized environments (Worldbank, 2024), the need arises to identify effective modalities to promote reconnection with Nature. Direct contact with natural environments is extensively studied for its beneficial effects on psychological and physiological well-being. Simultaneously, mindfulness, understood as intentional, non-judgmental awareness of the present moment, has demonstrated analogous positive effects on mental well-being and stress reduction. This practice, formally introduced with the Mindfulness-Based Stress Reduction (MBSR) program by Jon Kabat-Zinn in 1979 and followed by the Mindfulness-Based Cognitive Therapy (MBCT) program in the nineties (Segal et al. 2002), involves neural circuits associated with attention and emotional regulation, the same cognitive functions implicated in biophilia (Barbiero & Berto, 2016).

It can be observed that, although the fascination exerted by living beings is fundamentally involuntary, and mindfulness requires a precise will and constant commitment to practice (Kabat-Zinn, 2003), both practices may offer very similar benefits at the cognitive and stress reduction levels. This theoretical reflection has led to the exploration of the interaction between two practices: contact with Nature and mindfulness. Although the literature on the integration of these approaches is still in an emergent phase, there is growing scientific interest in their potential synergistic effect.

1.1 Research question and objectives

Based on this premise, the research question of this work is the following: is mindfulness, practiced in Nature in contact with non-human living beings and defined in the literature as Green Mindfulness, synergistic, neutral, or antagonistic compared to the benefits of the practice when performed without the addition of the natural setting in an indoor environment?

The objective of the systematic review is to investigate whether mindfulness can amplify the restorative effects of natural experience, whether the two practices act independently, or whether the practice of mindfulness might undermine the effect of immersion in Nature.

In the analysis process, an operational distinction was adopted between classic mindfulness (practiced in natural settings but with an internal focus) and green mindfulness (characterized by a sensory attention directed towards the surrounding environment).

To operationalize the research question, studies were considered that measure psychological variables (emotional well-being, stress reduction), physiological variables (salivary cortisol, heart rate), clinical variables (symptoms of anxiety and depression), and Nature connectedness variables (sense of belonging and emotional affinity towards the natural environment). This approach allowed for a broad evaluation of the effects associated with the examined practices.

The PICO approach (Djernis et al., 2019) was adopted for defining the eligibility criteria of the studies included in the systematic review.

2. Methodology

This systematic review of the literature was conducted following the PRISMA protocol (Preferred Reporting Items for Systematic Reviews and Meta-Analyses; Moher et al., 2009), which is recognized and used in the scientific field to ensure

transparency, replicability, and methodological rigor. This approach involves four main phases: design, selection, data extraction, and critical review of the included studies.

2.1 Design

2.1.1 Selection Criteria

Population

Adults and adolescents (>12 years) with or without a diagnosis of mental or physical disorders were included.

Activities

Studies were considered eligible if they involved exposure to the natural environment - defined as urban, rural, semi-wild, and wild Nature (Barbiero et al, 2023) - in combination with guided mindfulness practices, understood as intentional attention directed to the present moment. In line with previous systematic reviews (Djernis et al, 2019), the criterion of non-judgmental attitude, frequently associated with the definition of mindfulness, was deliberately excluded to include studies that do not explicitly contemplate this metacognitive component. Studies analyzing the effect of exposure to virtual or indoor nature were also included. This choice allowed for the expansion of the investigation field and the consideration of a wider range of naturalistic experiences and contemplative practices.

Comparison

Study groups were compared with activities without exposure to Nature but with guided mindfulness (outdoors in an urban setting or indoors, with or without guided imagery of natural elements), or exposure to Nature but with non-active control conditions (e.g., exposure to a natural park without activity). Studies lacking a comparator or control group, or that involved the use of alternative comparators, were also included.

Outcome

All studies were included regardless of the outcomes measured. The variables under analysis primarily concerned psychological constructs associated with mental and emotional health, such as mood, anxiety, depression, and stress, in addition to cognitive dimensions like attention and level of mindfulness. Many studies also considered measures representing the relationship with the

environment, such as the sense of connection with Nature, and physiological measures such as heart rate and blood pressure.

Other Criteria

Only empirical studies with or without peer-review, reported in English, and relating to the last two years available at the time of the search: 2023 and 2024, were included.

2.2 Selection

2.2.1 Data Source

The database queried for the search was Google Scholar, a search engine specialized in academic literature that allows access to a large body of publications through keywords.

2.2.2 Search Strategy

Based on the research questions, several key terms were tested for use in the database querying strategy to intercept relevant studies related to green mindfulness and Nature immersion.

To circumscribe the search to studies that actually dealt with mindfulness in the natural environment, exact strings were used; specifically, three distinct queries were performed using the terms: "green mindfulness", "nature mindfulness", and "Nature-based mindfulness". Analysis of the results showed that the term "green mindfulness" was frequently employed in reference to environmental awareness and ecological themes (Ho, 2022; Chen et al., 2014; Chen et al., 2015; Thampanichwat, 2023), diverging from the operational definition adopted in the present study. Conversely, the expression "Nature-based mindfulness" proved to be more consistent with the review's objective, as it was used to describe mindfulness practices conducted in natural settings or with natural elements. Based on these considerations, the complete string used for the search strategy was:

"Nature-based mindfulness" AND (empirical OR experimental)

The consultation was conducted on Google Scholar in the period between January 7 and January 13, 2025, searching for all studies from 2023 to the date of consultation.

2.3 Data extraction

The selected studies were coded based on geographic origin and type of comparison: active control group, passive control group, passive Nature control group, and no control group. Further coding concerned the characteristics of the participants, categorized by age groups and the type of target population for the activity, specifying the presence or absence of specific mental health vulnerabilities.

The natural environment was classified into four categories, based on population density: urban Nature (over 500 inhabitants/km^2), rural (between 500 and 10 inhabitants/km^2), semi-wild (between 10 and 2 inhabitants/km^2), and wild (less than 2 inhabitants/km^2), according to the classification proposed by Barbiero (2021).

Health-related outcomes were divided into psychological and physiological measures. Psychological measures included mental health measures such as depression, stress, anxiety, mental well-being, measures of Nature connectedness, and mindfulness measures related to cognitive constructs like attention. Physiological measures included parameters such as heart rate, blood pressure, and salivary cortisol levels.

Finally, mindfulness was coded into two types (Djernis et al., 2019): green mindfulness, characterized by simultaneous attention to the inner world and the surrounding natural environment through sensory perceptions, to experience a state of co-presence to oneself and the external natural context; and classic mindfulness, characterized by attention focused predominantly on the inner world and articulated in formal practices (guided meditation) and informal practices (present moment awareness during daily activities).

3. Results

3.1 Outcomes of the database search

The search strategy led to the identification of 129 publications. Following the screening of the abstracts, 90 records were excluded as they were not relevant to mindfulness in Nature (k = 9), not quantitative (k = 20), literature review articles (k = 21), theoretical contributions, projects, or protocols (k = 27), not in English (k = 5), or inaccessible dissertations (k = 9).

The full texts of the 39 remaining articles were then examined. Of these, 19 were excluded because they did not relate to a natural environment (k = 5), were exclusively correlational studies (k = 5), were duplicates (k = 1), were studies

without any activity (k = 4), focused on the validation or design of measurement instruments (k = 3), or lacked information regarding the setting (k = 1).

In total, 20 independent studies were included in the review (Figure 1).

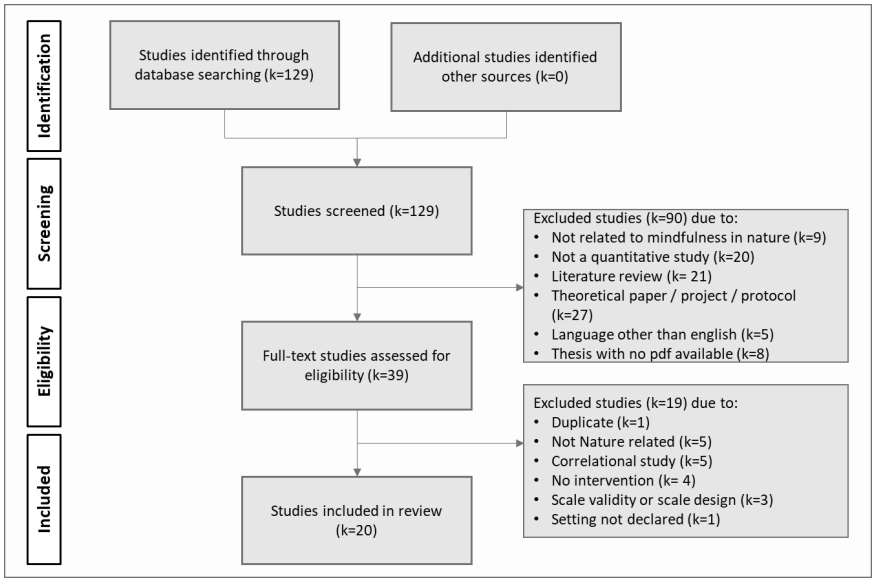

Figure 1. Flow chart of literature search.

3.2 Characteristics of the studies

Among the selected studies, the geographic distribution showed a prevalence of research conducted in Europe (n = 10), followed by Asia (n = 5), the United States (n = 3), and Australia (n = 2).

Regarding the type of experimental comparison, the majority of studies included a control group or a comparison with another type of activity. Specifically, nine studies compared mindfulness activities in a natural environment with analogous activities lacking Nature exposure (active control); two studies utilized non-active control groups (passive control); and one study included both active and passive controls. Eight studies did not include any control group.

Relative to the participants' age range, five studies involved adolescents (aged between 13 and 20 years), eight studies included young adults, predominantly

university students (aged between 20 and 30 years), while the remaining seven studies concerned adults over 30 years of age.

Concerning the vulnerability characteristics of the target population, fourteen studies involved healthy subjects with no declared vulnerabilities. Four studies included participants diagnosed with mental health disorders, such as depression and anxiety; one study involved individuals with multiple vulnerabilities, and one study concerned subjects with physical vulnerabilities, specifically Post/Long-COVID symptoms.

The activities were conducted in various types of natural environments: seven studies took place in urban Nature settings, six in natural parks or forests (semi-wild environments), while other studies included sessions in multiple environments (two in both urban and rural settings, one in rural and woodland environments). Finally, four studies exclusively utilized virtual natural environments through videos, simulations, or guided imagery.

Among the selected studies, nineteen reported effects on variables related to mental health, such as anxiety and depression. Indicators of Nature connectedness were detected in nine studies, while ten studies evaluated measures of cognitive constructs, among which eight explicitly considered mindfulness. Four studies included physiological measures, including cortisol levels and heart rate.

The table - reported in Appendix A - presents the characteristics of the studies included in the analysis, describing them in relation to the population involved, the type of comparison adopted, the metrics (outcomes) measured, the data collection time points, and the environmental setting in which the activities were conducted.

3.3 Characteristics of the activities

The activities exhibited a marked heterogeneity in terms of duration, structure and contents, presence of a comparison group, as well as the quantity and type of mindfulness, and the choice of the natural environment.

Among the studies included in the review, sixteen involved direct contact with real natural environments, while four studies focused exclusively on virtual Nature experiences, realized through audiovisual content, virtual reality (VR) simulations, or guided visualizations. Considering the objective of this work, which aims to explore modalities for reconnection with the natural environment in urbanized contexts and to promote the development of biophilia, the studies on virtual Nature (NV cluster) were classified separately, and the attention was

primarily oriented towards research involving direct contact with real Nature as a central element of the activity.

The analysis of the sixteen studies in real Nature revealed that nine (Cluster 1) included a control group or an alternative activity for comparison, while seven (Cluster 2) did not include any comparative condition. Among the nine studies with a comparison, three (Cluster 1A) provided a comparative activity performed in a natural environment, four (Cluster 1B) had other types of comparison, and two (Cluster 1C) had passive control.

Two main types of activity emerged: single-session activities and structured programs. Single-session activities (k = 7) had a duration between 5 and 30 minutes and were primarily directed at healthy subjects. The four studies conducted in virtual Nature are also included in this group. Structured programs (k = 11) involved subjects in multiple sessions, generally on a weekly basis, and were aimed at both vulnerable populations and healthy subjects. The duration of the individual sessions varied from less than 30 minutes (k = 3) to 1–3 hours (k = 8).

Regarding the mode of delivery, in six studies, sessions were conducted through individual self-administration via audio guides or videos (including the virtual Nature studies). In the remaining fourteen studies, the activities were conducted in a group setting and led by a facilitator.

Regarding the qualifications of the facilitator, only six studies explicitly reported the professional training of the responsible figure (e.g., psychotherapists, ecotherapists, educators, forest bathing specialists). In four studies, the activity was conducted directly by the author, in two cases an *ad hoc* developed audio support was used, while in the remaining two studies, no information was provided in this regard.

Finally, concerning group size, in six cases it was defined *a priori* (from 3 to 30 participants), in five cases it coincided with the total number of participants, while in three studies it was not specified.

3.4 Outcomes

The analysis of the examined studies indicates that mindfulness activities in a natural environment produce statistically significant improvements across various variables related to human well-being and health. However, based on the examination of the nine studies that compare with a control group or with other types of activity, the efficacy of green mindfulness is not unequivocally superior

to Nature immersion or compared to other indoor or urban activities. The comparative studies show heterogeneous outcomes: in some cases, the activity is significantly more effective, in others neutral, and sometimes even less effective compared to the comparison.

The analysis of the dependent variables shows:

- Synergistic and neutral results for Nature connectedness and mindfulness
- Inconsistent outcomes for well-being
- Predominantly synergistic effects on mood, with one neutral case
- Mostly neutral, but not homogeneous, results for depressive symptoms

Among the comparative studies, it is interesting to cite the cases with antagonistic effects and neutral effects. Regarding the two studies that reported antagonistic effects, in the first (Simpattanawong, 2024), a comparison was conducted between a mindfulness practice in an urban park and a walking mindfulness session along a central street in Bangkok. Contrary to the initial hypotheses, the reduction in heart rate and blood pressure was significantly greater in the urban walking mindfulness condition. In the second study (Stephenson, 2023), conducted on British adolescents with depressive symptoms, a course of ecotherapy in natural environments was compared with a group psychotherapy pathway conducted indoors. Also in this case, in contrast to expectations, the group that participated in the indoor psychotherapy showed superior improvements in terms of well-being and anxiety reduction compared to the group subjected to the activity in local parks and woodlands. Regarding the two studies with neutral effects, in the first (Schaller & Karing, 2024), a comparison was conducted between three experimental conditions - app-guided mindfulness performed indoors, forest immersion, and the combination of app-guided mindfulness in the woods. Contrary to the research hypothesis, the combination of the mindfulness app in a natural environment did not show additional benefits compared to the individual activities across all variables examined (mindfulness, life satisfaction, stress, depression, anxiety). In the second case (Owens et al., 2024), a meditation activity with visualization of natural environments, guided by pre-recorded audio and performed indoors, was compared with one performed outdoors. Contrary to expectations, the improvement in mental health and Nature connectedness recorded in both groups was not significantly different.

4. Discussion

From the examination of the one hundred and twenty-nine articles identified on Google Scholar related to experimental studies on "Nature-based mindfulness" published between 2023 and 2024, we identified twenty empirical studies on mindfulness in Nature; among these, the studies conducted in a real natural environment and with a comparison activity totaled nine. All studies report positive effects, but the comparative analysis does not allow for definitive conclusions regarding the superiority of Nature-based mindfulness over other activities.

The analyzed studies present a remarkable variability in terms of duration, content, and delivery of the activities. The description of the protocols is often cursory and rarely includes the scripts used. Information about the facilitators is limited, except in cases of structured activities such as forest bathing or ecotherapy. Finally, the description of the natural environment is generally lacking in detail, although it is recognized as a setting favorable to restoration and well-being.

In some cases, the environmental context seems to be substantially irrelevant (Schaller & Karing, 2024; Owens et al., 2024). This effect could be attributed to the tendency of formal mindfulness to promote introspection and to encourage the individual's attention to be focused internally at the expense of connection with the surrounding environment. In this regard, Djernis et al. (2019) highlight that open-monitoring meditation is particularly suitable for natural environments, as it allows the meditator to sustain attention on the present moment spontaneously and effortlessly thanks to awareness being open to the entire field of sensory experience, unlike concentrative meditation.

In cases of antagonistic effect (Stephenson, 2023; Simpattanawong, 2024), it could be hypothesized that the participants' greater familiarity with the comparison activity setting contributed to the better efficacy in that context, negatively influencing the perception of the activity in the natural environment, which was perceived as less habitual or comfortable.

5. Conclusions and implications for future research and practical application

From the examination of the twenty articles included in the literature review, it emerges that a field of study dedicated to Nature-based mindfulness is developing in the scientific literature, although it is still in its infancy and undergoing definition. Previous systematic literature reviews suggest certain

elements; Djernis et al. (2019) suggest that an aspect requiring further investigation is to establish whether certain types of mindfulness are more suitable than others to be practiced in natural environments, and whether this depends on the characteristics of the natural environment and the other components of the activity. Among the studies examined, Stephenson states that further research is needed to understand the type and amount of Nature exposure necessary to maximize treatment benefits (Stephenson, 2023).

Overall, in all the examined studies, Nature is fundamentally considered an alternative setting that offers interesting elements for sensory focus and mindfulness practices in general; the natural environment involved in the activity seems to be regarded as an inert element that remains in the background, whose influence on the activity is to be measured, much like any independent variable. The role of the natural environment as a living presence and the relationship between the human being and Nature, which is the main focus of ecopsychology, appears to be entirely absent. From the perspective of ecopsychology, the synergistic, neutral, or antagonistic effects found could also be due to the level of relationship established between participants, facilitator, and the specific place involved in the activity. In this interpretation, the cases of neutral effects could indicate that concentration mindfulness activities would prevent participants from opening up to a deep, sensory relationship with the surrounding environment. The cases of antagonistic effects could suggest that it is necessary to encounter, know, and establish a relationship with the place involved in the activity as a prerequisite for the activity itself.

The integration of an ecocentric perspective could represent a relevant methodological evolution in the field of scientific research on Nature-based mindfulness. Such an approach implies moving beyond a view focused exclusively on the effects of the activity on participants, in favor of a circular and reciprocal perspective where the bidirectionality of influences between human beings and the natural environment is recognized. From this viewpoint, reciprocity could be understood as human action aimed at protecting and supporting ecological successions.

An experimental design with an ecopsychological key should include three fundamental elements: the place where the activity is located, conceived as locus Naturae; the conductor as a facilitator of reconnection with Nature; and the mindfulness practice as ecocentric green mindfulness. The *locus Naturae* or *genius loci* of a place is the active and characterizing presence of that place and encompasses the totality of biotic and abiotic components present (Barbiero, 2021). Considering the place as *locus Naturae* means establishing a relationship

with this presence both in the preparatory phase and during the activity itself. To conduct the activity and facilitate the encounter between the participants and the *locus Naturae*, the role of the conductor as an ecotuner, a professional figure with specific training in ecopsychology, is essential (Danon, 2019). Finally, ecocentric green mindfulness practices differ from traditional mindfulness practices due to their dual focus: attention is directed both to the self and to the "I-Thou" relationship with the *locus Naturae*. These practices allow Nature to exert a restorative effect on the human psyche.

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