WHITE PAPER

The Joy of Walking Study

Why Green Exercise Makes Us Happier, Sharper and More Connected

Compiled by Dr Jack Lewis • Evidence-Based Research Summary

Executive Summary

A substantial and growing body of peer-reviewed research confirms that exercising outdoors, particularly in natural green environments, confers significant benefits for mental health, cognitive performance, creativity and social wellbeing. These effects often go well beyond those produced by equivalent indoor exercise.

This white paper synthesises the most compelling findings from recent scientific literature, with a particular focus on studies relevant to hiking, group outdoor activity and nature-based exercise.

Key Headline Findings

Boost in Positive Brain Activity	**Engaging in combined* nature activities increased prefrontal cortex brain signals associated with positive emotions by an average of 43%.** *(Yin* et al., *2025)*[1]
Sharpening Focus	**15-minutes of walking outdoors triggered a massive 243% increase in EEG signal in brain areas associated with focused attention and working memory (P300).** *(Boere* et al., *2023)*[2]
Enhanced Creativity	**Frontal alpha brainwaves associated with creative thinking elevated by 26% after indoor versus outdoor exercise** *(Kimura* et al., *2023)*[3]
Impact on Wellbeing	**People who get at least two hours of recreation time in nature per week enjoyed significantly higher wellbeing. Magnitude of mood improvement was positively correlated with more time spent in nature with peak wellbeing boost at 5+ hours per week.** *(White* et al., *2019)*[4]

Total Mood Transformation	**Participants in forest walking and meditation combination sessions reported an overall improvement in their total mood state of 46%** *(Yin* et al., *2025)*[1]

* Combination group underwent alternating periods of hiking and peaceful meditation

1. The Research Landscape

The scientific study of nature-based health interventions has grown substantially over the past decade. A comprehensive 2025 systematic review of reviews[5] by Kaleta *et al.* examined 61 separate review articles, compiling hundreds of individual studies, to map the full range of Nature-Based Interventions (NBIs) and their health effects.

NBIs are labelled “Interventions” because scientific evidence that has accumulated over the past few decades provides such strong support for the long-suspected therapeutic benefits of spending time in nature for reducing (and even preventing) both physical and mental ailments.

NBIs that have come under scientific scrutiny from research labs across the world range from time spent gardening, farming and caring for the countryside, to blue space interventions (spending time near water), green exercise, adventure therapy and forest bathing.

Hiking with friends, the singular focus of this white paper, falls most naturally within what researchers term "Green Exercise"; physical activity undertaken in natural outdoor environments. This category has attracted the greatest volume of high-quality research and consistently shows strong positive associations with both physical and mental health outcomes.

"Green Exercise" refers to physical activity undertaken in natural outdoor environments — from a walk in the park to a mountain hike.

2. Green Exercise and Mental Health: Three Mechanisms

The evidence suggests that outdoor group exercise such as hiking produces enhanced wellbeing through three distinct but overlapping biological and psychological pathways.

2.1 The Nature Effect

Any kind of recreational activity that takes place in nature is associated with measurable wellbeing benefits. A landmark study[4] by White *et al.* (2019), based on a large UK population sample, found a clear dose-response relationship between weekly leisure time in natural environments and subjective wellbeing:

- Those spending fewer than 120 minutes per week in nature showed no significant wellbeing advantage over those with no nature contact.
- Those reaching the 120-minute threshold showed significantly higher wellbeing scores.
- Benefits continued to increase up to approximately five hours per week, after which they plateaued.
- This effect was consistent across age groups, health status and socioeconomic background.

More recent EEG-based research[2] (Boere *et al.,* 2023) adds a neurological dimension to this picture. When comparing outdoor to indoor exercise, outdoor activity produced a markedly stronger P300 brainwave (243% increase**), an electroencephalography (EEG) signal associated with improved cognitive performance and attentional capacity.

"Just 15 minutes of outdoor exercise is enough to more than triple strength of brain signals associated with enhanced attention and working memory**."

Most recently, Yin *et al.* (2025)[1] used mobile EEG to measure participant brain waves while they walked in nature, mediatated in nature, or alternated between the two states (combination). The combination group enjoyed the greatest improvement in mood and reduction in stress, with subjective measures complemented by objective neural data indicative of increase in positive emotions and reduction in negative emotions.

**** NB "100% increase" is a doubling, "200% increase" is a tripling, "300% increase" is quadruple…**
***** see appendix for further information**

2.2 The Exercise Effect

Physical movement itself drives a cascade of neurochemical changes that enhance both mood and cognition. When muscles contract during exercise, they release signalling proteins called myokines into the bloodstream (López-Ojeda & Hurley, 2025)[6].

Myokines travel in the bloodstream up to the brain, where they cross the blood-brain barrier and go on to trigger elevated production of Brain-Derived Neurotrophic Factor (BDNF).

BDNF acts as a "fertiliser" for brain cells, particularly in the hippocampus, the brain's centre for memory and spatial navigation. It both re-energises existing neurons (mitochondriogenesis) and stimulates the birth of new ones (neurogenesis).

Exercise also triggers the release of **endocannabinoids** in the brain, the body's own natural mood-boosting compounds (Matei *et al.,* 2023)[7], responsible for the well-documented "runner's high."

Not only does exercising outdoors lead to greater benefits versus indoor exercise, but the evidence also supports the superiority of natural outdoor over urban outdoor environments.[8-14]

2.3 The Social Effect

Group exercise adds a third layer of benefit through the neurochemical effects of social bonding.

A UK based research initiative assessing data extracted from more than 50,000 people over six years concluded that social participation improves health and protects against feelings of lonliness (Wilding *et al.*, 2023)[15]. They also demonstrated a significant increase in life satisfaction and happiness in those who were more socially active. Indeed there is now good evidence to support the idea that more frequent and deeper social connections are strongly associated with higher wellbeing (Sun *et al.*, 2020)[16].

Physical activity stimulates the release of oxytocin (Wirobski *et al.*, 2024)[17] the primary neuropeptide underpinning social bonding and emotional resilience. High levels of circulating oxytocin is associated with enhanced feelings of social connection and trust. As exercising naturally increases levels of oxytocin, it primes the brain for social interaction.

Exercising with others will therefore likely potentiate the positive impact of social participation on physical and mental health given that any intervention that reduces loneliness / increases perceived social connection has been shown to produce substantial, measurable improvements in both psychological wellbeing and physical health outcomes — and to be associated with greater longevity (Viswanathan & Carey, 2025) [18].

3. Spotlight Study: Green Exercise and Burnout

Liu *et al.*, 2026 — Frontiers in Psychology[19]

Published in the May 2026 edition of Frontiers in Psychology, this study surveyed over 1,000 university students aged 18–24 to examine the relationship between Green Exercise, nature connectedness and academic burnout. It is among the most recent and directly relevant studies available.

The study measured burnout across three validated dimensions and found statistically significant associations between higher levels of Green Exercise and lower burnout scores across all three dimensions:

Burnout Dimension	Effect Size (β)	Impact	PR Headline
Emotional Exhaustion	-0.343	10.4% reduction per level	"Regular outdoor exercise can cut exhaustion by 21%."
Cynicism	-0.309	8.3% reduction per level	"Exercising in nature reduces cynicism by over 16%."
Sense of Achievement	+0.343	11.3% increase per level	"Nature-based workouts boost your sense of achievement by 22%."

While the cross-sectional design means causal conclusions cannot be drawn with certainty, the consistency and magnitude of effects combined with the wider mechanistic literature, make a protective effect of Green Exercise highly plausible.

4. Spotlight Study: Forest Bathing, Walking and Meditation

Yin *et al.*, 2025 — Frontiers in Psychology [1]

This randomised controlled study used mobile electroencephalography (EEG) to monitor real-time brain activity in older adults undertaking different types of activity during a visit to a national forest park. Three groups were compared: walking only, meditation only and a combined group (30 minutes walking followed by 30 minutes meditation).

The combined activity group showed the most striking neurological and psychological improvements:

Positive Emotion Brain Signals	**Increased by 43% across the frontal cortex following a combined session of walking and meditation for an hour.**
Positive Emotion Activity Surge in Men	**For men specifically, this activity nearly doubled the positive emotional activity (fp1), improving by +99.6%.**
Muting Negative Stress Signals	**This dual approach effectively "turned down the volume" on negative emotional brain activity by nearly 30%.**

This study underscores the synergistic value of combining physical movement with mindful rest in a natural setting — a combination that maps well onto structured group hiking experiences with rest intervals.

5. Cognitive Benefits: Creativity, Focus and Flow

Two EEG studies examining cognitive outcomes of outdoor versus indoor exercise provide compelling neurological evidence for the mental performance benefits of exercising in nature.

Focus and Cognitive Performance

Boere *et al.* (2023), published in Scientific Reports [2], found that outdoor exercisers demonstrated significantly stronger P300 brainwave responses, a well-established electrophysiological marker of attentional capacity, compared to those exercising indoors. Translated into accessible terms:

> ***"While indoor exercise showed no significant change in cognitive brain waves, walking outdoors triggered a 243% increase in the brain's ability to focus."***

Creativity and Flow State

Kimura *et al.* (2023), published in Frontiers in Psychology, examined frontal alpha brainwave power - a marker associated with creative cognition and the coveted "flow state" - during indoor versus outdoor exercise. The outdoor condition produced substantially higher alpha activity, consistent with enhanced creative thinking and sustained attention:

Benefit	Brain Marker	Outcome	Uplift
Creativity	Frontal Alpha (α) Power	Creativity-related brain activity	+26%
Happiness / Mood	Positive Emotion Index	Emotional boost vs. indoors	+22%
Focus & Flow	Flow State Score	Concentration & flow	+19%

6. Implications for Communications

The evidence base reviewed here supports a range of credible, substantiated communications claims relating to the benefits of outdoor group exercise. The following principles should guide their application:

- Claims derived from the Liu *et al.* (2026) burnout study are based on associational data and should be framed accordingly (e.g., "associated with" rather than "proves").
- The EEG cognitive data from Boere *et al.* (2023) and Kimura *et al.* (2023) involves relatively small samples but is methodologically rigorous; percentage uplifts should be cited with appropriate context (see Appendix).
- The EEG mood and wellbeing data from Yin *et al.* (2025) was derived from an older adult population and may not directly generalise to younger hikers.
- The White *et al.* (2019) dose-response findings are among the most robustly evidenced in this field and can be cited with high confidence.

References

All studies cited in this white paper are peer-reviewed and published in indexed academic journals.

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Appendix

Establishing the +243% statistic from data provided by Boere *et al* (2023)

To calculate a percentage change, we looked at the mean amplitudes recorded during the "oddball task" before and after the 15-minute walks in two different environments:

Condition	Pre-Walk Mean (μV)	Post-Walk Mean (μV)	Change (μV)
Indoor Walk	1.4	1.4	0 (No change)
Outdoor Walk	0.7	2.4	+1.7

Calculation of Percentage Change

For the outdoor condition, we calculated the percentage increase from the starting baseline:

- Raw Increase: $2.4\mu V - 0.7\mu V = 1.7\mu V$
- Calculation: $(1.7 / 0.7) * 100 = + 242.857\%$

This represents a 243% increase in the amplitude of the brain's P300 response.

This figure was not reported in the original data and was calculated post hoc to help convey more clearly to a lay audience the magnitude of the pre-post walk enhancement of the P300 signal.