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Article

How forest bathing cultivates low-carbon tourism behavior through affective and cognitive pathways

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Abstract: Forest bathing (Shinrin-Yoku) is a form of mindful nature immersion that originated in Japan and has proven to be very beneficial physiologically and psychologically. Nevertheless, its potential to promote low-carbon tourism behavior due to psychological spillover effects has not been well investigated. This research examines how forest bathing motivations (Wellness/Egoistic and Nature/Biospheric) influence low-carbon tourism behavior and revisit intention through ecological awareness and connectedness to nature using an adapted value-belief-norm framework. Data were collected from 400 tourists who participated in guided forest bathing sessions at certified Shinrin-Yoku trails across four regions of Thailand between 1 February and 20 March, 2026. The sample consisted entirely of Thai domestic tourists, with 63.8 % being first-time participants. A cross-sectional, on-site survey design was employed. Data analysis was conducted using confirmatory factor analysis (CFA) and structural equation modeling (SEM) with AMOS 29. Common method bias was assessed using Harman's single-factor test, and all the hypotheses were supported. Wellness motivation had the strongest influence on connectedness to nature and directly impacted low-carbon tourism behavior, indicating a clear health-to-environment spillover effect. Furthermore, low-carbon tourism behavior significantly predicted revisit intention, suggesting that sustainable practices enhance future engagement. Overall, the model demonstrated excellent fit indices, confirming its robustness and validity. Low-carbon tourism behavior significantly predicted revisit intention. Forest bathing is an efficient avenue toward sustainable tourism behavior, irrespective of the initial motivation type. The results confirm the importance of affective and cognitive processes in facilitating environmentally responsible behavior and have practical implications for the development and policy of ecotourism.

Keywords: forest bathing; Shinrin-Yoku; low-carbon tourism; value-belief-norm theory; connectedness to nature; spillover effect; proenvironmental behavior; structural equation modeling

1. Introduction

Nature-based tourism has become increasingly popular as tourists seek meaningful experiences with natural ecosystems that promote leisure, conservation, and personal well-being [1]. The development of low-carbon and sustainable tourism is associated with this growth and is linked to the need to minimize environmental influence and enhance ecological stability and local people through responsible tourism [2]. However, the rapid growth of tourism has led to serious environmental problems, such as rising carbon emissions, habitat degradation, and biodiversity loss, which call for a change in visitor behavior toward more sustainable practices [3]. Forest bathing has become popular in this setting as a conscious nature-immersion technique that promotes people's profound engagement with forest ecosystems

through sensory experiences [4]. Forest bathing originated in Japan and has since become a wellness tourism and public health program worldwide, indicating that it is relevant and applicable worldwide [5]. Empirical data supporting the applicability of forest immersion as a therapeutic intervention include physiological and psychological benefits that include decreased levels of stress, increased mood, and improved cognition [6]. In addition to these health benefits, forest bathing is a life transformation experience that changes people's attitudes, feelings, and natural perceptions, which can result in long-term behavioral changes [7]. Such changes are particularly relevant in the context of green behavior, which refers to intentional actions aimed at minimizing the negative impact on the environment and maximizing sustainability [8]. The purpose of low-carbon tourist behavior, a particular type of ecologically responsible behavior, is to minimize carbon footprints through the use of ecologically friendly types of travel, such as sustainable transportation, energy efficiency, and environmentally friendly activities [9]. Psychological spillover effects can explain the transition to behavioral change, where a single enjoyable activity stimulates the following environmentally responsible activities. Both affective and cognitive pathways are involved in this process, and knowledge and feelings are important factors in determining sustainable behavior [10]. The affective route emphasizes emotional experiences such as relaxation and belonging to nature, fostering environmental stewardship, whereas the cognitive pathway highlights ecological awareness and knowledge, promoting sustainable behavior, responsible decision-making, and stronger connectedness to nature [11].

1.1. Research gaps and objectives

With respect to the environment–health connections, there is no empirical research on the relationship between wellness-motivated forest splashing and LCT behavior. The egoistic-to-environmental spillover mechanism is conceptually ignored in current VBN investigations, which focus mostly on biospheric value orientations [12]. This gap was also noted in previous research [13]. Although it has not been examined in a forest bathing SEM, the affective construct connectedness to nature (CNS) has been proposed as a potentially stronger mediator. This relationship is also reflected in the forest therapy conceptual model (FTCM) [14], which emphasizes interactions as the key element connecting forest exposure with human outcomes, which implies that it is affective engagement during the experience, rather than exposure, that leads to outcomes. The current research fills these gaps by empirically investigating the motivation for forest bathing and its nature-based impact on ecological awareness, which is related to natural connectedness, low-carbon tourism behavior, and revisit intention [15]. It explains how personal experiences with nature are converted into sustainable tourism behaviors via affective and cognitive connections to provide practical guidance to practitioners and policymakers. The research has the following four objectives:

- Explain levels of forest bathing motivations, ecological awareness, LCT behavior, and revisit intention;
- Examine the direct effects of motivational dimensions on LCT;
- Test a complete SEM with NEP and CNS as mediators; and

- Determine the most influential motivational dimension of LCT.

The remainder of this research is organized as follows: Section 2 reviews the relevant literature and theoretical background. Section 3 describes the research methodology and model development in detail. Section 4 presents the empirical results along with a discussion. Finally, Section 5 concludes the study and outlines future research directions.

2. Theoretical background and literature review

2.1. Low-carbon tourism behavior and influencing factors: Empirical evidence

Low-carbon tourist awareness, attitudes, and actions determine village development. Pearson correlation, interviews, and multivariate evaluation were performed for 828 questionnaires [16]. Improved eco-friendly practices were shown in the results; participation was lower because of increased expenses. Regional focus, reliance on personal reports, and a small research sample are limitations that impact the generalizability and dependability of the findings. The influence of urban forest attractiveness on visitors' pro-environmental and low-carbon behavior has also been examined, Structural equation modeling–partial least squares (SEM–PLS) was used to examine data from 615 individuals [17]. The findings demonstrate that infrastructure-based visual appeal, which is backed by information, improves motivation, experience, and eco-behavior. Perceived value and social responsibility affect travelers' low-carbon consumption habits has been investigated [18]. Travelers were surveyed using a questionnaire. The results show that perceived value has moderating effects on accountability, attitude, and conduct intention.

2.2. Value, satisfaction, and behavioral drivers in forest tourism studies

In an expanded VBN model, visitors' environmentally conscious behavior in forest parks is influenced by assigned value [19]. PLS–SEM was used for data analysis. According to the findings, behavior is strongly predicted by personal norms ($\beta = 0.426$), and ascribed value significantly improves behavior. Single-site emphasis, longitudinal data, and limited generalizability across various forest recreation contexts are some of the difficulties. Locals' and visitors' perceptions of value and satisfaction are examined by to understand their influence on environmentally responsible behavior [20]. Statistical tests such as regression and SEM were used to analyze the data. The findings show that occupation and education have substantial effects ($p < 0.05$), whereas behavior is positively influenced by satisfaction. The use of self-reported impressions, regional focus, and imprecise numerical values are some of the challenges that impede generalization. The residents' and visitors' perceptions of value and satisfaction affect eco-friendly behavior. Regression and SEM methods were used to analyze the data. The findings indicate that while gender has no effect, education and occupation have a significant effect on behavior ($p < 0.05$), and tourists' behavior is positively impacted by satisfaction. The use of self-reported impressions, geographical focus, and missing precise coefficients are some of the shortcomings [21].

2.3. Empirical insights into forest tourism and low-carbon behavioral intentions

Using the SOR paradigm observed how perceived advantages affect forest tourists' intentions to use resources and maintain the ecosystem was investigated. SEM was used to analyze data from 436 tourists [22]. With significant chain mediation, perceived benefits had a significant effect on consumption intention ($\beta = 0.42$, $p < 0.001$). Self-perception bias, cross-sectional design, and a single-site sample are some of the drawbacks. The purpose of this research is to examine how tourists' environmental consciousness is influenced by their visual, emotional, and conative destinations, mediated by perceived destination value (PDV) and modulated by destination social responsibility (DSR) [23]. SEM and stepwise regression were used to evaluate the data from the five beaches in Karachi. ERB → affective image ($\beta = 0.28$, $p < 0.01$); ERB → conative image ($\beta = 0.32$, $p < 0.001$). Restrictions: data from a particular region, local responders, and only the summer. According to the SOR framework of tourism incentives affect forest medical tourism intention to behave, with attitude acting as a moderator and perceived value acting as a mediator [24]. SEM was used to evaluate survey data from 527 Chinese tourists. Behavioral intention was positively impacted by leisure motivation ($\beta = 0.28$, $p < 0.01$) and entertainment ($\beta = 0.35$, $p < 0.001$).

2.4. Theoretical framework: Adapted VBN-FB model

VBN theory for the forest bathing tourism context (VBN-FB) on the basis of the forest therapy conceptual model (FTCM), which identifies four essential components: humans (motivations), forests (environments), relationships (guided experience), and outcomes (behavioral and psychological) [25]. Two theoretical expansions are proposed beyond the original VBN. Egoistic Value Integration: To examine the influence of EGO on the relationship between health and nature, EGO is offered as a motivation for value integration. CNS is introduced as an affective mediator in addition to NEP to evaluate the notion from attention restoration theory that restoration in nature improves natural psychological connections [26]. This research breaks new ground by incorporating forest bathing into the modified VBN-FB model while analyzing both affective and cognitive routes simultaneously. Unlike conventional Value–Belief–Norm (VBN) applications in tourism, which predominantly emphasize biospheric values as antecedents of pro-environmental behavior, the present VBN-FB framework incorporates both egoistic and biospheric motivations simultaneously. This extension recognizes that participation in forest bathing is often initially driven by personal health and wellness benefits rather than environmental concerns. Furthermore, the model integrates both cognitive and affective pathways through the New Ecological Paradigm (NEP) and Connectedness to Nature (CNS), respectively. By examining these dual pathways concurrently, the proposed framework provides a more comprehensive explanation of how forest bathing experiences translate into low-carbon tourism behavior. This represents a meaningful theoretical advancement beyond existing VBN-based tourism studies that typically focus on cognitive mechanisms alone.

2.5. Hypothesis development

Through cognitive and affective pathways within a modified value-belief-norm framework, forest bathing incentives impact ecological awareness and a sense of connectivity to nature, which in turn shape low-carbon tourist behavior and revisit intention.

- H1a: BIO → NEP → Biospheric motivation positively enhances ecological awareness, strengthens pro-environmental beliefs and increases tourists' understanding of environmental sustainability.
- H1b: BIO → CNS → Biospheric motivation fosters emotional connectedness to nature, enhancing individuals' psychological attachment and concern toward natural environments.
- H1c: BIO → LCT → Biospheric motivation directly promotes low-carbon tourism behavior and encourages environmentally responsible actions during travel experiences.
- H2a: EGO → NEP → Egoistic motivation positively influences ecological awareness, as personal well-being interests increase the understanding of environmental benefits.
- H2b: EGO → CNS → Egoistic motivation strongly enhances connectedness to nature, as wellness experiences create deep emotional bonds with natural environments.
- H3a: NEP → LCT → Ecological awareness positively drives low-carbon tourism behavior by encouraging environmentally responsible decision-making and sustainable travel practices.
- H3b: NEP → Revisit → Ecological awareness increases revisit intention by reinforcing positive environmental attitudes and satisfaction with sustainable tourism experiences.
- H4a: CNS → LCT → Connectedness to nature positively influences low-carbon tourism behavior by strengthening emotional responsibility toward environmental conservation.
- H4b: CNS → Revisit → Connectedness to nature enhances revisit intention through emotional attachment and meaningful nature-based tourism experiences.
- H5: LCT → Revisit → Low-carbon tourism behavior strongly predicts revisit intention, as sustainable experiences increase satisfaction and future travel commitment.
- H6: EGO/BIO → (NEP/CNS) → LCT → Ecological awareness and connectedness mediate motivation effects, indirectly linking motivations to low-carbon tourism behavior.

3. Materials and methods

Relationships between forest bathing motivations, ecological awareness, and connectedness to nature and low-carbon tourism behavior were studied using a quantitative, cross-sectional approach. After the guided sessions, data were collected onsite through surveys of the participants. The measurement scales were validated, and the data were evaluated with the help of statistical methods, such as CFA and SEM,

to test the suggested framework. The research design, flow of the participants, forest bathing intervention, measurement model, and validation of measurement instruments and data analysis methods are shown in **Figure 1**.

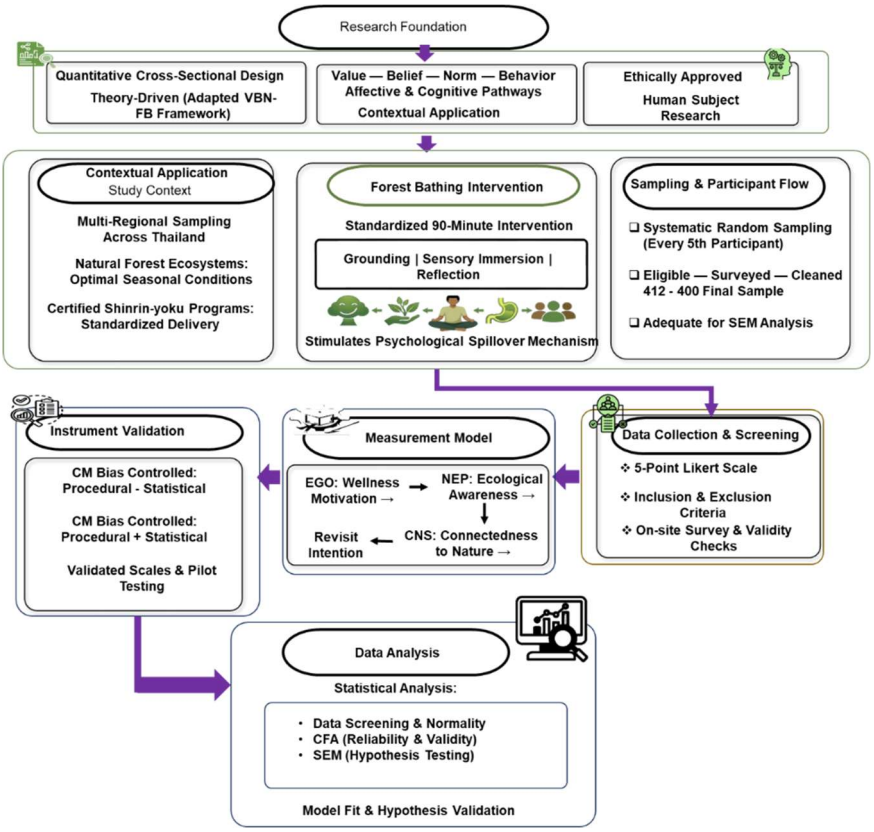

Figure 1. Methodological flow of forest bathing and low-carbon tourism.

3.1. Research design and ethical approval

Research adopts a quantitative, cross-sectional onsite survey design to examine the relationships among forest bathing motivations, ecological awareness, natural connectedness, and low-carbon tourism behavior using the modified VBN-FB model [27]. This approach ensures ecological validity by capturing tourists' immediate postexperience perceptions, minimizing recall bias and accurately reflecting behavioral intentions. The research was ethically examined and given green light by the University of Phayao Human Ethics Committee (HREC-UP-HSS 2.1/045/69; approved 23 January 2026). The collection began on 1 February 2026 and concluded on 20 March 2026—a 7-week collection period. The dry season in Thailand (average 1833 °C based on latitude and elevation) during February–March will be the dry season in all four collection regions, offering certified Shinrin-Yoku programs at full capacity with numerous scheduled sessions per week, which can provide an adequate pool of participants to reach the target sample of $N = 400$.

3.2. Study sites

Four certified Shinrin-Yoku program sites in each of the major geographic regions of Thailand were sampled:

- Doi Suthep-Pui National Park Forest Bathing Trail, Chiang Mai Province (North);
- Khao Yai National Park Nature Wellness Center, Nakhon Ratchasima Province (Central)—a UNESCO World Heritage site and the largest national park in central Thailand;
- Khao Sok National Park Rainforest Therapy Trail, Surat Thani Province (South), host one of the world's oldest rainforests (approximately 160 million years); and
- Namtok Phlio National Park Forest Bathing Trail, Chanthaburi Province (East)—a royal forest reserve with established nature wellness activities.

Compared with single-region designs, a multiregional sample strategy improves the results' external validity and geographic representation [28]. A Shinrin-Yoku program with trained guides licensed by the Forest Therapy Society of Thailand or other reputable organizations is offered at each of the four locations. Locations were selected to ensure consistent guided forest bathing programs, as structured implementation enhances benefits and standardizes experiences across sites.

3.3. Data collection procedure

The data collection period started on 1 February and ended on 20 March 2026 and was carried out as onsite surveys administered immediately after the guided forest bathing sessions. The respondents were made aware of the purpose of the research and provided their consent before they participated in the research. The institutional review board (HREC-UP-HSS 2.1/045/69) gave ethical approval (approved 23 January 2026).

3.4. Measurement of variables

Research has validated assessment scales to measure significant constructs to guarantee validity and reliability. Established tools tailored to guide forest bathing experiences were used to measure forest bathing motives, ecological awareness, closeness to nature, low-carbon tourist behavior, and the intention to return.

Forest Bathing Motivation: Forest bathing motivation encompasses egoistic (wellness, stress relief) and biospheric (appreciation of nature) motivation, which encompasses intrinsic and extrinsic motivation factors that drive tourists to participate in forest immersion experiences.

Ecological Awareness (NEP): Ecological awareness, represented by the NEP scale, indicates people's environmental beliefs, values and knowledge about human-nature relations and affects their attitudes toward sustainable and low-carbon tourism behavior.

Connectedness to nature (CNS): The CNS construct, as an affective concept that denotes emotional attachment to nature, was assessed. The items that measured affective mechanisms under the framework of VBN-FB assessed how much people felt inspired and a part of nature when they went through forest bathing.

Low-Carbon Tourism Behavior (LCT): Low-carbon tourism behavior is a kind of green travel behavior that comprises waste management, energy management, and green travel transportation as a means of reducing the environmental impact of travel.

Revisit Intention: Revisit intention refers to the propensity of tourists to revisit forest bathing sites in the future; it reflects their satisfaction and interest in the activity and the connection between sustainable tourism behavior and motivation, ecological awareness and connection with nature.

3.5. Forest bathing intervention protocol

Each of the participants underwent a standardized minimum 90-min guided Shinrin-Yoku session before the administration of the surveys. The protocol of the program was the same as that at all the sites and consisted of three consecutive stages on the basis of the existing guidelines on forest bathing [29]. Phase 1—Arrival and Grounding (15 min): guided deep breaths and body-scan mindfulness at an entry point into the forest and a transition between urban stimulation and forest awareness. Phase 2 involved a 60-min slow, guided walk (~1–1.5 km) with sensory invitations, encouraging participants to mindfully engage sight, sound, smell, touch, and taste in silence. Phase 3 involved a 15-min guided sharing circle in a silent clearing with reflection, journaling, and stillness, emphasizing mindfulness and distinguishing forest bathing from physical forest activities.

3.6. Sample collection

The target population included adult tourists (≥ 18 years) who completed a certified guided forest bathing session at one of the four study sites. Eligibility criteria followed established forest bathing research protocols [30,31]

3.6.1. Inclusion criteria

The following standards were used to choose participants:

- People who took part in Shinrin-Yoku (guided forest bathing) sessions on approved pathways.
- Visitors who are at least 18 years old guarantee their capacity to give informed permission.
- Those who finished the entire forest bathing session, allowing for precise evaluation of postexperience perceptions.
- Visitors from within Thailand who traveled during the time of data collection.
- Those who gave their informed consent and were willing to engage voluntarily.

3.6.2. Exclusion criteria

The following individuals were not included in the research:

- Individuals who did not finish the forest bathing experience.
- Individuals who answered the questionnaire inconsistently or incompletely.
- Foreign visitors to minimize cultural prejudice and preserve sample homogeneity.
- People who have previously worked as professionals or experts in forest therapy have an impact on reactions that go beyond ordinary visitor experiences.

3.6.3. Sampling procedure

Systematic random sampling was employed: every 5th participant exiting the designated session endpoint was invited to participate. During the 7-week data collection period (1 February–20 March 2026), an average of 18–22 participants per session, 3–4 sessions per week, across 4 sites yielded an estimated population pool of approximately 1500–2500 eligible participants. The response rate was approximately 27 % of eligible invitees, yielding 412 completed questionnaires. After the removal of incomplete responses (n = 12, 2.9 %), the final analytic sample was N = 400. The participant flow is shown in **Figure 2**.

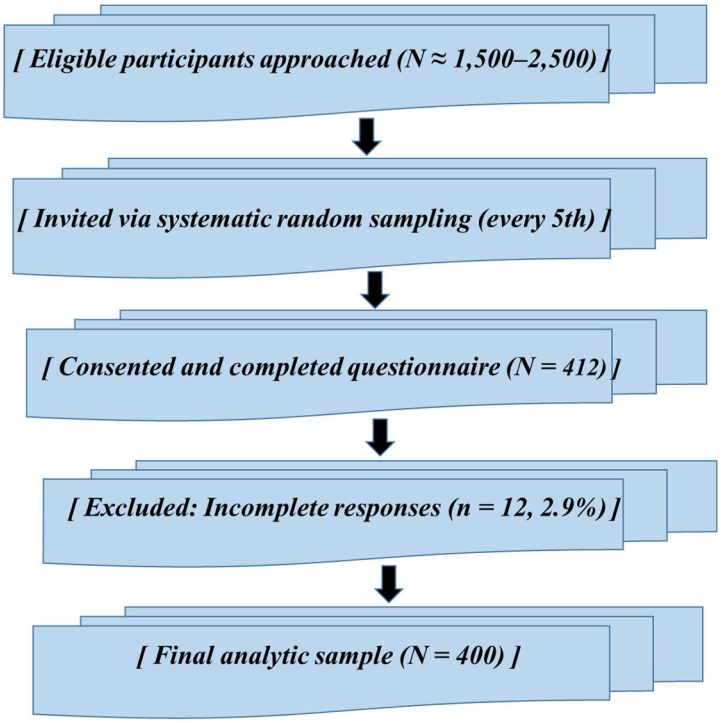

Figure 2. Participant flow and sample attrition across four regional sites (data collection: 1 February–20 March 2026).

3.7. Measures and instrument development

The measurement questions used to evaluate important constructs, such as egoistic and biospheric motives, ecological awareness, closeness to nature, low-carbon tourism behavior, and revisit intention, are shown in **Table 1**. To provide consistency and clarity, three statements tailored to the forest bathing environment are used to operationalize each component. The questionnaire was structured, and the responses were recorded on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Table 1. Measurement items for forest bathing and low-carbon tourism constructs.

Construct	Item code	Statement
Egoistic Motivation (EGO)	EGO1	Forest bathing is undertaken to improve personal health and overall well-being.
	EGO2	Forest bathing helps reduce stress and enhances mental relaxation.
	EGO3	Participation in forest bathing is mainly driven by personal benefits.
Biospheric Motivation (BIO)	BIO1	Participation in forest bathing reflects concern for protecting the natural environment.
	BIO2	A sense of responsibility exists for preserving forests and natural ecosystems.
	BIO3	Motivation for forest bathing is driven by concern for nature and sustainability.
Ecological Awareness (NEP)	NEP1	Humans must live in harmony with nature to ensure environmental sustainability.
	NEP2	Environmental problems are serious and require immediate attention.
	NEP3	Human activities are causing significant harm to the natural environment.
Connectedness to Nature (CNS)	CNS1	A strong emotional connection to nature is experienced during forest bathing.
	CNS2	A sense of belonging is felt when engaging with natural environments.
	CNS3	Nature is considered an important part of identity and daily life.
Low-Carbon Tourism Behavior (LCT)	LCT1	Environmentally friendly transportation options are preferred during travel.
	LCT2	Efforts are made to minimize the carbon footprint during tourism activities.
	LCT3	Eco-friendly practices are followed while visiting natural destinations.
Revisit Intention	RI1	There is an intention to revisit the forest bathing destination in the future.
	RI2	The destination will be recommended to others who value nature.
	RI3	Future participation in similar forest bathing experiences is likely.

3.8. Bias assessment

Potential common method bias was addressed through both procedural and statistical controls [32]. Procedurally, different response scale anchors were used across sections (frequency, importance, agreement), and instructions were provided in each section, emphasizing that there were no right or wrong answers. Harman's single-factor test revealed that the first unrotated factor explained 40.1 % of the total variance below the 50 % threshold, confirming that common method bias is not a significant concern [33].

3.9. Data analysis

The data analysis was conducted in five consecutive stages using IBM SPSS Statistics 29 and AMOS 29. Initially, data screening was performed, where the missing data rate was identified as 1.8 % (less than 2 %) and addressed using expectation maximization (EM) imputation. The Mahalanobis D^2 test indicated no significant multivariate outliers ($p > 0.001$ critical value [34]). Furthermore, Mardia's coefficient of multivariate kurtosis (18.4) confirmed that the assumption of normality was acceptable for maximum likelihood estimation. Descriptive statistics were then calculated to highlight the key features of the information. Confirmatory factor analysis (CFA) was then used to evaluate the robustness of the assessment. The average variance extracted (AVE > 0.50), normalized factor loadings (> 0.70), and composite reliability (CR > 0.70) were used to establish converging reliability, and the Fornell–Larcker criterion was used to confirm discriminatory reliability [24].The

greatest probable estimator with all the data were then used in the SEM research, and the modeling fit was evaluated using the cutoff values of $\chi^2/df < 3.0$, RMSEA < 0.08, CFI > 0.95, and GFI > 0.90. Finally, 5000 samples were used in a bootstrap mediation method test with 95 % CI bias removal for secondary impacts [35].

4. Results and discussion

4.1. Respondent profile

The demographic profiles of the 400 respondents based on sex, sampling location in four national parks in Thailand, and frequency of forest bathing are provided in **Table 2** and **Figure 3**. According to the results, there was diversity in terms of research locations; most participants were females, and many were new visitors. The entire sample pool consisted of Thai nationals, indicating the local nature tourism market in Thailand from February to March (dry season). Most participants fell into the age groups of 36–45 (37.3 %) and 26–35 years (32.5 %), which indicates the working-age category, matching the leading egoistic motives (stress reduction).

Table 2. Demographic profile of respondents (N = 400; Data collected: 1 February–20 March 2026)

Category	N	Percentage %
Gender		
Male	179	44.8
Female	211	52.8
Other/Not specified	10	2.5
Age group		
18–25 years	13	3.3
26–35 years	130	32.5
36–45 years	149	37.3
46–55 years	64	16.0
56–65 years	43	10.8
Over 65 years	1	0.3
Education		
Below bachelor's degree	74	18.5
Bachelor's degree	286	71.5
Master's degree or above	40	10.0
Nationality		
Thai (domestic tourist)	400	100.0
Forest bathing frequency		
First time	255	63.8
Occasional (1–2 times/year)	104	26.0
Regular (3–5 times/year)	34	8.5
Frequent (>5 times/year)	7	1.8
Data collection site		
Doi Suthep-Pui NP, Chiang Mai (North)	118	29.5

Table 2. (*Continued*).

Category	N	Percentage %
KhaoYai NP, NakhonRatchasima (Central)	102	25.5
KhaoSok NP, Surat Thani (South)	96	24.0
NamtokPhlio NP, Chanthaburi (East)	84	21.0

Note. NP = National Park. The percentages may not sum to 100 % because of rounding.

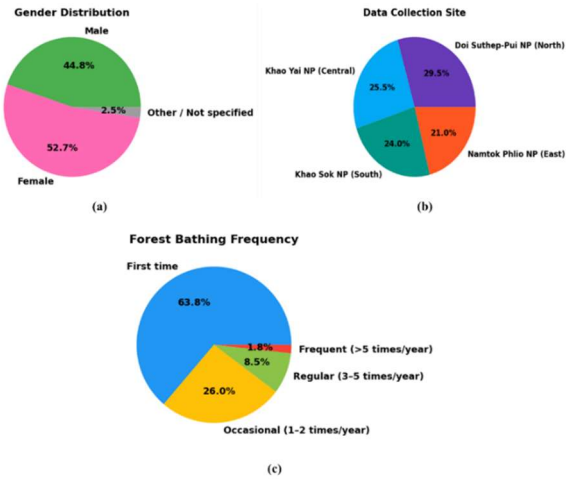

Figure 3. Respondent profile **(a)** sex distribution of forest-hailing participants, **(b)** data collection sites across national parks, and **(c)** forest biting frequency among participants.

4.2. Descriptive statistics

The data in **Table 3** and **Figure 4** indicate that the mean wellness motivation (EGO) was the highest (M = 4.50–4.56; overall 4.54), as it has a strong health-driven intent, whereas nature motivation (BIO) was lower (M = 2.93–2.99; overall 2.965). LCT (M = 4.31–4.49) and revisit intention (M = 4.30–4.33) were high. This pattern of wellness dominance is consistent with the previous results. The reliability of all the scales was excellent (α = 0.929–0.969).

Table 3. Descriptive Statistics and Internal Consistency (N = 400).

Scale/Item	M	SD	Min	Max	α (Scale)
Connectedness to Nature (CNS)	4.551	0.735	1.00	5.00	0.947
CNS1	4.58	0.79	1	5	
CNS2	4.57	0.81	1	5	
CNS3	4.51	0.79	1	5	
CNS4	4.55	0.77	1	5	
Wellness Motivation (EGO)	4.540	0.730	1.00	5.00	0.959
EGO1	4.56	0.79	1	5	
EGO2	4.55	0.79	1	5	
EGO3	4.53	0.81	1	5	
EGO4	4.50	0.83	1	5	

Table 3. (*Continued*).

Scale/Item	M	SD	Min	Max	α (Scale)
EGO5	4.54	0.79	1	5	
EGO6	4.55	0.80	1	5	
Nature Motivation (BIO)	2.965	1.399	1.00	5.00	0.960
BIO1	2.98	1.45	1	5	
BIO2	2.93	1.47	1	5	
BIO3	2.99	1.44	1	5	
Ecological Awareness (NEP)	3.177	0.263	2.60	4.13	0.969
NEP1–NEP15	3.25–3.88	0.98–1.51	1	5	
Low-Carbon Tourism Behavior (LCT)	4.384	0.730	1.00	5.00	0.929
LCT1	4.49	0.90	1	5	
LCT2	4.45	0.92	1	5	
LCT3	4.38	0.96	1	5	
LCT4	4.46	0.91	1	5	
LCT5	4.33	0.89	1	5	
LCT6	4.34	0.88	1	5	
LCT7	4.31	0.91	1	5	
LCT8	4.34	0.91	1	5	
LCT9	4.36	0.93	1	5	
Revisit Intention	4.323	0.918	1.00	5.0000	0.966
REV1	4.30	0.98	1	5	
REV2	4.33	0.98	1	5	
REV3	4.33	0.93	1	5	
REV4	4.33	0.96	1	5	

Note. Scale M and SD computed from composite means. NEP items are reverse-scored [8] before the composite is computed. α = Cronbach's alpha. Bolded rows indicate scale-level statistics.

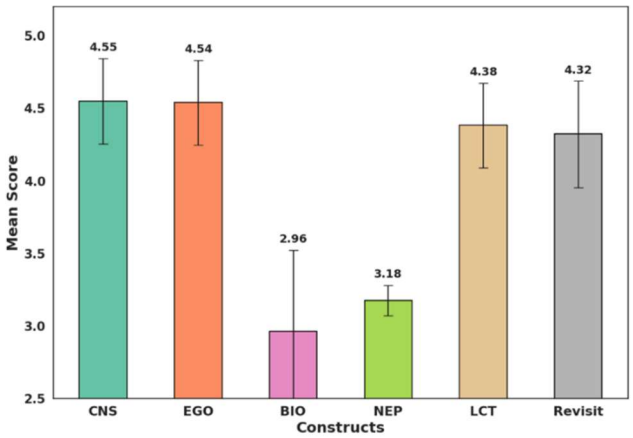

Figure 4. Mean scores and standard deviations of key research constructs

4.3. Measurement model (CFA)

The CFA results confirmed excellent measurement model fit: χ^2= 540.191, relative χ^2 = 1.642, GFI = 0.914, AGFI = 0.894, NFI = 0.955, TLI = 0.979, CFI =

0.982, RMSEA = 0.040, and RMR = 0.044. The standardized factor loadings ranged from 0.81 (NEP1) to 0.95 (BIO3), all of which were significant at $p < 0.001$, as illustrated in **Table 4.** The measurement and structural model outcomes of the modified value–belief–norm framework for forest bathing behavior are shown in **Figure 5**. Relationships between CNS, EGO, BIO, NEP, LCT, and revisit intention are depicted. Strong measurement reliability is confirmed by standardized loadings, and structural routes show important direct and indirect effects. The robustness of the suggested theoretical model in describing sustainable tourist behavior is supported by the model fit indices (CFI, TLI, RMSEA, and GFI), which show outstanding goodness-of-fit.

Table 4. Integrated measurement and structural model results of forest bathing and low-carbon tourism behavior.

Construct/path	Item/relationship	Standardized loading
Connectedness (CNS)	CNS1	0.89
	CNS2	0.96
	CNS3	0.90
	CNS4	0.86
Wellness (EGO)	EGO1	0.89
	EGO3	0.88
	EGO5	0.88
	EGO6	0.87
Biology (BIO)	BIO1	0.95
	BIO2	0.94
	BIO3	0.95
Ecological Awareness (NEP)	NEP1	0.81
	NEP3	0.82
	NEP5	0.85
	NEP6	0.86
	NEP7	0.86
	NEP9	0.85
	NEP11	0.82
	NEP13	0.82
	NEP15	0.82
Low-Carbon (LCT)	LCT5	0.83
	LCT6	0.83
	LCT7	0.91
	LCT8	0.91
Revisit (REV)	REV1	0.93
	REV2	0.94
	REV3	0.92
	REV4	0.91

Note: Standardized loadings above 0.70 indicate strong construct reliability. Structural paths represent hypothesized relationships. Model fit indices demonstrate acceptable to excellent fit, confirming the adequacy of the measurement and structural model.

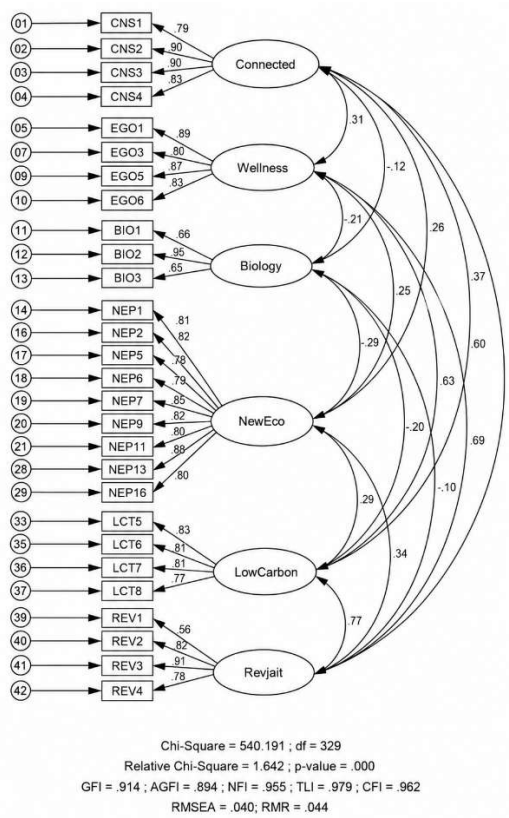

Figure 5. Confirmatory factor analysis (CFA) model with standardized factor loadings and model fit indices.

The structural correlations between important constructs, such as CNS, EGO, BIO, NEP, LCT, and revisit intention, are shown in **Table 5**. The standardized path coefficients indicate the extent and direction of the influence of a variable and highlight significant positive and negative effects in the modified VBN-FB model that explains low-carbon tourism behavior.

Table 5. Structural model path coefficients and standardized loadings.

Construct/path	Item/relationship	Standardized loading
Structural model	CNS → EGO	0.81
	EGO → BIO	-0.24
	BIO → NEP	0.25
	EGO → NEP	-0.20
	CNS → LCT	0.26
	NEP → LCT	0.29
	LCT → Revisit	0.77
	CNS → Revisit	0.67
	EGO → Revisit	-0.20
	BIO → Revisit	-0.16

Note: Standardized path coefficients indicate relationship strength; positive values indicate direct effects, and negative values indicate inverse effects; all paths are statistically significant at $p < 0.05$.

The structural equation model's goodness-of-fit indicators, including the χ^2 degrees of freedom and relative fit metrics, are shown in **Table 6**. With high values for GFI, NFI, TLI, CFI and χ^2/df within acceptable bounds, the results show excellent model fit. The model's robustness and appropriateness in explaining correlations among the research project constructs are further supported by low RMSEA and RMR values.

Table 6. Model fit indices for the structural equation model.

Construct/path	Item/relationship	Standardized loading
Structural model	CNS → EGO	0.81
	EGO → BIO	-0.24
	CNS→ BIO	-0.12
	BIO → NEP	-0.20
	EGO → NEP	0.25
	CNS → LCT	0.67
	CNS →NEP	0.26
	NEP → LCT	0.29
	LCT → Revisit	0.77
	CNS → Revisit	0.58
	EGO → Revisit	0.60
	BIO → Revisit	-0.16

Note: Model fit indices indicate good fit; values meet the recommended thresholds, confirming the adequacy and reliability of the structural model and data.

Table 7 and **Figure 6** illustrate correlations among CNS, EGO, BIO, NEP, LCT, and revisit intention, highlighting strong positive, moderate, and negative relationships. The CR scores for all the constructs were greater than 0.93, while their AVE scores were higher than 0.69, indicating that convergent validity is clearly satisfied beyond the Fornell & Larcker criteria of a CR score greater than 0.70 and an AVE score greater than 0.50. The discriminant validity test also passed, as indicated below:

Table 7. Construct reliability, validity, and Fornell–Larcker criterion matrix.

Construct	CR	AVE	Cronbach's alpha	CNS	EGO	BIO	NEP	LCT	Revisit
CNS	0.937	0.789	0.947	**0.888**					
EGO	0.932	0.774	0.937	0.808	**0.880**				
BIO	0.963	0.896	0.960	-0.123	-0.241	**0.946**			
NEP	0.953	0.693	0.954	0.257	0.246	-0.204	**0.833**		
LCT	0.927	0.761	0.936	0.672	0.695	-0.199	0.294	**0.872**	
Revisit	0.960	0.856	0.966	0.588	0.605	-0.162	0.342	0.769	**0.925**

Note. Bold diagonal values (marked *) = √AVE. ** $p < 0.01$; * $p < 0.05$. Discriminant validity is confirmed when each diagonal value exceeds all corresponding off-diagonal values in its row and column

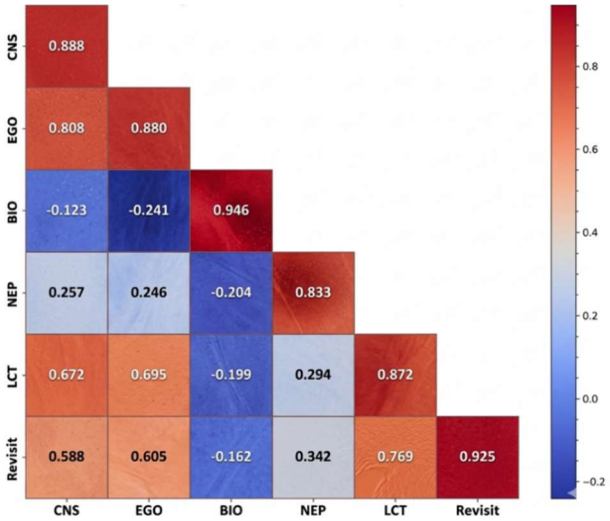

Figure 6. Correlation heatmap of theVBN-FB model variables

4.4. Structural model and hypothesis testing

The associations between wellness EGO, BIO, NEP, CNS, LCT, and revisit intention are depicted in the structural equation model shown in **Figure 7**. Standardized path coefficients highlight affective and cognitive processes and show both direct and indirect effects. The measurement items substantially strain the corresponding structures. The robustness and validity of the suggested VBN-FB framework in understanding sustainable tourist behavior are confirmed by the model fit indices, which show good fit. Key fit indices support the figure's strong model adequacy. Good model parsimony is indicated by the chi-square value ($\chi^2 = 546.908$) and the relative chi-square ($\chi^2/df = 1.642$). While the root mean square error of approximation (RMSEA = 0.040) shows little error, the comparative fit index (CFI = 0.982) surpasses the suggested criteria.

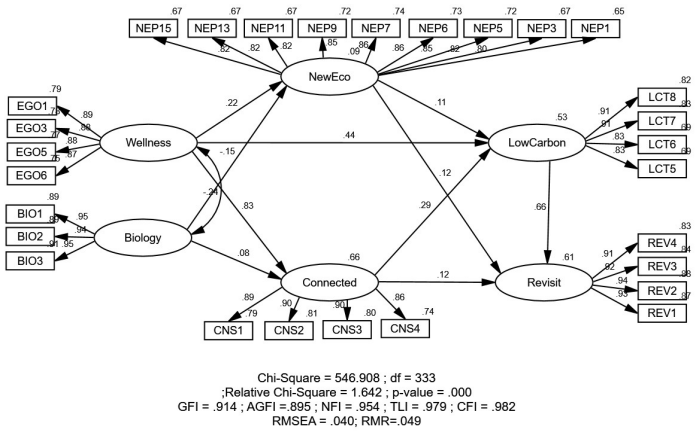

Figure 7. Structural equation model (SEM) with standardized path coefficients (β).

5. Discussion

Forest bathing motivations enhance ecological awareness and natural connectedness, promote low-carbon tourism behavior through affective and cognitive pathways, and support the adapted VBN framework and sustainable tourism

development. This research requires empirical validation in certain tourism situations, although a thorough scoping review is offered. Its applicability in understanding real-time behavioral spillage in natural environments where tourists visit is restricted since it fails to examine the experience of tourism activities such as forest bathing [36]. Although it primarily uses controlled experimental conditions, the study focuses on cognitive thinking as a moderator. It is not relevant to immersive settings, such as forest bathing and nature-based behavioral change, since it does not consider real tourism experiences [37]. It is a visual stimulus study, which is not based on real-life events, although it involves comparisons of different environmental exposures. Describe that this constrains ecological validity and is incapable of capturing the effects of behavior such as low-carbon tourism acts because of immersive engagement with nature. This research emphasizes the assigned value and broadens the VBN paradigm but overlooks emotive experience factors such as a feeling of connection with the natural world. Additionally, Han et al. [38] mentioned do not examine psychological spillover processes that connect motives to more general sustainable tourism behaviors. This research potentially overlooked inherent motives and emotional pathways in favor of extrinsic incentives such as prizes [39]. By ignoring experiential factors such as forest bathing, knowledge of naturally occurring pro-environmental behavior without extrinsic reinforcement mechanisms is limited [40]. This research focuses on intention rather than actual conduct, albeit it addresses perceived value and tourism motives. Additionally, its explanatory value for sustainable behavioral outcomes in immersive contexts is limited by its lack of integration of ecological awareness and connectedness to nature. By incorporating experience forest bathing into an adapted VBN framework, behavior can be recorded in real time, affective-cognitive pathways can be identified, and intrinsic incentives can be connected with genuine low-carbon tourism behavior; this research overcomes previous constraints. The results validate that, within the modified value-belief-norm paradigm, forest bathing considerably influences low-carbon tourism behavior via both affective and cognitive pathways. Health-related experiences can promote environmental stewardship through psychological spillover, as evidenced by wellness-driven motives emerging as a major motivator. Ecological consciousness and a sense of connection to the natural world are important mediators that support pro-environmental behavior and the desire to return. The findings encourage the incorporation of experiential nature-based tourism into sustainability strategies and policy formulation by demonstrating that even egoistic aims can result in sustainable outcomes. One of the most notable findings of this study is the identification of a health-to-environment spillover mechanism. Participants initially motivated by wellness and stress reduction subsequently demonstrated stronger ecological awareness, greater connectedness to nature, and higher levels of low-carbon tourism behavior. This finding suggests that environmental stewardship may emerge even when environmental protection is not the primary motivation for participation. Such evidence expands current understanding of behavioral spillover within tourism settings and highlights the potential of wellness-oriented nature experiences as indirect pathways toward sustainability outcomes.

6. Conclusion

Forest bathing promotes low-carbon tourism through increasing ecological awareness and emotional connection with nature. Regardless of its original cause, it has a health-to-environment spillover effect, which enhances sustainable habits and the desire to revisit, offering valuable information for the development of ecotourism and environmental policy. Forest bathing in Thailand is effective at encouraging low-carbon tourism behavior through the development of ecological awareness and the experience of connectivity with nature through the use of both affective and cognitive channels. It has a strong health-environment spillover effect, irrespective of the cause. The positive effect of sustainable tourism practices on ensuring ecotourism and affecting ecotourism policy in Thailand is evidenced by the significant increase in revisit intention. The comparative fit index (CFI = 0.982), Tucker–Lewis index (TLI = 0.979), and normed fit index (NFI = 0.954) all exceeded the 0.90 benchmark, and the root mean square error of approximation (RMSEA = 0.040) indicated a very good fit, confirming the robustness and validity of the proposed model. The structural model showed an excellent overall fit, with key indices meeting the suggested thresholds.

7. Practical implications

As an ecotourism operator, the standardized intervention protocol offers an evidence-based blueprint: the combination of wellness (Phase 1 grounding) and nature-bonding (Phase 2 sensory invitations) components has the greatest increase in CNS and, consequently, LCT spillover. Moreover, CNS effects may be prolonged by post-session eco-pledge activities or natural gratitude journals [41]. In the case of national park authorities in Thailand, the certification of forest bathing trails as low-carbon access zones (nonmotorized access, local food supply, zero-waste policies) builds upon the LCT behavioral priming found here. With respect to policymakers, international evidence in conjunction with the current results indicates the inclusion of forest bathing in national wellness tourism development models as a twofold functional tool: interventions aimed at the prevention of public health and the behavioral change mechanism of sustainability [42]. Tourism authorities may also consider integrating certified forest bathing programs into national sustainable tourism strategies. Because forest bathing simultaneously supports public health objectives and environmentally responsible behavior, it offers a cost-effective mechanism for achieving multiple Sustainable Development Goals (SDGs), including good health and well-being (SDG 3), responsible consumption and production (SDG 12), and climate action (SDG 13). Destination managers can therefore position forest bathing not only as a wellness product but also as a behavioral intervention that promotes sustainable tourism practices.

8. Limitations and future directions

The present research is subject to five limitations. First, the cross-sectional nature of this research and its relatively short seven-week duration make it impossible to infer causality; future longitudinal approaches involving before-and-after data collection are needed. Second, all the collected data were self-reported; future work must

incorporate behavioral data through methods such as transport logs, waste management, and carbon footprints. Third, the all-Thai sample restricts generalizability; future comparative studies across multiple countries are needed, especially in light of the underrepresentation of the Asia-Pacific region in the comprehensive literature review. Fourth, the homogenous national tourism sample indicates that the motivation types for international tourists could differ and affect spillover. Fifth, unknown moderating factors, including session duration, guide certification, forest biodiversity, and seasonal climate conditions, are likely to moderate the EGO → CNS path; future factorial studies are needed. Future research should further investigate the durability of behavioral spillover effects through longitudinal designs that monitor participants over extended periods following forest bathing experiences. Researchers may also incorporate objective behavioral indicators, including transportation choices, energy consumption patterns, and carbon footprint assessments, to validate self-reported measures of low-carbon tourism behavior. Additionally, comparative studies involving international tourists would provide valuable insights into potential cultural differences in the relationship between forest bathing motivations and sustainable tourism behavior.

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Ethical Considerations: Research was considered and accepted by the University of Phayao Human Ethics Committee, Thailand (HREC-UP-HSS 2.1/045/69, approved 23 January 2026). Data collection started on 1 February 2026. All these procedures were performed in accordance with the 1964 Helsinki Declaration and subsequent amendments. All the participants provided written informed consent before the questionnaires were administered. They were told that their involvement was voluntary, that the data would be anonymized and that the data would be utilized in the research only and that they could pull out at any point in time without penalty. There were no monetary incentives.

Informed consent statement: Informed consent was obtained from all subjects involved in the study.

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Conflict of interest: The author declares no conflicts of interest.

References

1. Wang Y, Zhao R, Yan Z, et al. A comparative study of environmental responsibility behavior in ecotourism from the perceptions of residents and tourists: A case of Qilian Mountains National Park in China. PLOS ONE. 2023; 18(2): e0281119. doi: 10.1371/journal.pone.0281119

2. Wan S, Liu L, Chen G, et al. Low-carbon transformation of tourism in characteristic towns under the carbon-neutral goal: A three-dimensional mechanism analysis of tourists, residents, and enterprises. Sustainability. 2025; 17(11): 5142. doi: 10.3390/su17115142
3. Monaco S, Sacchi G. Traveling the metaverse: Potential benefits and main challenges for tourism sectors and research applications. Sustainability. 2023; 15(4): 3348. doi: 10.3390/su15043348
4. Guardini B, Secco L, Moè A, et al. A three-day forest-bathing retreat enhances positive affect, vitality, optimism, and gratitude: An option for green-care tourism in Italy? Forests. 2023; 14(7): 1423. doi: 10.3390/f14071423
5. Kil N, Kim JG, Thornton E, Jeranek A. Psychological and physiological health benefits of a structured forest therapy program for children and adolescents with mental health disorders. International Journal of Mental Health Promotion. 2023; 25(10): 1117–1125. doi: 10.32604/ijmhp.2023.022981
6. Naik S, Chanda RS, Paliwal M. Encouraging sustainable travel choices through behavioral interventions to reduce tourists' carbon footprints. Discover Sustainability. 2025; 6(1): 1320. doi: 10.1007/s43621-025-02233-2
7. Richardson M, Hunt A, Hinds J, et al. A measure of nature connectedness for children and adults. Sustainability. 2022; 14(16): 9945. doi: 10.3390/su14169945
8. Hassan TH, Fazia C, Abdelmoaty MA, et al. Sustainable pathways: Understanding the interplay of environmental behavior, personal values, and tourist outcomes in farm tourism. Discover Sustainability. 2024; 5(1): 153. doi: 10.1007/s43621-024-00354-8
9. Chang IH, Hsiao YC. How does environmental cognition promote low-carbon travel intentions? The mediating role of green perceived value and the moderating role of electronic word-of-mouth. Sustainability. 2025; 17(4): 1383. doi: 10.3390/su17041383
10. Keela M, Chang HY, Liao SY, Hsieh CM. Determinants of forest travelers' environmentally responsible behaviors and willingness to pay. Forests. 2025; 16(12): 1811. doi: 10.3390/f16121811
11. Khiaolek K, Damrongsak D, Wongsapai W, et al. Gap analysis and development of low-carbon tourism in Chiang Mai Province toward sustainable tourism goals. Sustainability. 2025; 17(19): 8889. doi: 10.3390/su17198889
12. Wu Z, Liang Y, Zhang Y, Chen T. Employing a "we"-based VBN model to gauge Chinese tourists' intentions to support low-carbon tourism. Acta Psychologica. 2022; 230: 103761. doi: 10.1016/j.actpsy.2022.103761
13. Chhajer R, McEwan K. Examining the impact of a forest bathing intervention on well-being in urban youth: A field experiment from India. Acta Psychologica. 2025; 261: 105961 doi: 10.1016/j.actpsy.2025.105961
14. Vermeesch AL, Ellsworth-Kopkowski A, Prather JG, et al. Shinrin-Yoku (forest bathing): A scoping review of the global research on the effects of spending time in nature. Global Advances in Integrative Medicine and Health. 2024; 13: 1–20. doi: 10.1177/27536130241231258
15. Lin MTB, Zhu D, Liu C, Kim PB. A meta-analysis of antecedents of pro-environmental behavioral intention of tourists and hospitality consumers. Tourism Management. 2022; 93: 104566. doi: 10.1016/j.tourman.2022.104601
16. Lin HH, Ling Y, Chen IS, et al. Can low-carbon tourism awareness promote rural and ecological development, create safe leisure spaces, and increase public happiness? Water. 2022; 14(21): 3557. doi: 10.3390/w14213557
17. Rahmafitria F, Kaswanto RL. The role of eco-attraction in the intention to conduct low-carbon actions: A study of visitor behavior in urban forests. International Journal of Tourism Cities. 2024; 10(3): 881–904. doi: 10.1108/IJTC-07-2023-0138
18. Li H, Qu P, Luo F. Impact of tourists' perceived value and sense of social responsibility on the low-carbon consumption behavior intention: A case study of Zhangjiajie National Forest Park. Forests. 2022; 13(10): 1594. doi: 10.3390/f13101594
19. Han C, Xu Z, Zhang Y, Li Y. Extending the value–belief–norm model with assigned value: A study on visitors' pro-environmental behavior in forest ecosystems of national parks. Forests. 2026; 17(3): 381. doi: 10.3390/f17030381
20. Wang X, Kim J, Kim J, Koh Y. Application of natural-resource-based view to nature-based tourism destinations. Sustainability. 2024; 16(6): 2375. doi: 10.3390/su16062375
21. Yang Y, Sun X, Hu L, et al. How ski tourism involvement promotes tourists' low-carbon behavior? Sustainability. 2023; 15(13): 10277 doi: 10.3390/su151310277
22. Zhou B, Liu S, Yu H, et al. Perceived benefits and forest tourists' consumption intention: Environmental protection attitude and resource utilization attitude as mediators. Forests. 2022; 13(5): 812. doi: 10.3390/f13050812
23. Aziz S, Niazi MAK. Understanding environmentally responsible behavior of tourists at coastal tourist destinations. Social Responsibility Journal. 2023; 19(10): 1952–1977. doi: 10.1108/SRJ-10-2022-0412

24. Zhao Y, Yang J, Song J, Lu Y. The effects of tourism motivation and perceived value on tourists' behavioral intention toward forest health tourism: The moderating role of attitude. Sustainability. 2025; 17(2): 713. doi: 10.3390/su17020713
25. Vermeesch AL, Ellsworth-Kopkowski A, Prather JG, et al. Shinrin-Yoku (forest bathing): A scoping review of the global research on the effects of spending time in nature. Global Advances in Integrative Medicine and Health. 2024; 13: 1–20. doi: 10.1177/27536130241231258
26. Miola L, Cellini N, Bellini S, Pazzaglia F. Beyond nature: Investigating the restorative properties of environments through the comparison of historical, modern urban, and natural image exposures. Journal of Environmental Psychology. 2026: 102920. doi: 10.1016/j.jenvp.2026.102920
27. Chhajer R, McEwan K. Examining the impact of a forest bathing intervention on well-being in urban youth: A field experiment from India. Acta Psychologica. 2025; 261: 105961 doi: 10.1016/j.actpsy.2025.105961
28. Paletto A, Baldessari S, Barbierato E, et al. A quantitative literature review on forest-based practices for human well-being. Forests. 2025; 16: 1246. doi: 10.3390/f16081246
29. Li Q. Effects of forest environment (Shinrin-yoku/forest bathing) on health promotion and disease prevention. Environmental Health and Preventive Medicine. 2022; 27: 43. doi: 10.1265/ehpm.22-00160
30. Subirana-Malaret M, Miró A, Camacho A, et al. A multicountry study assessing the mechanisms of natural elements and sociodemographics behind the impact of forest bathing on well-being. Forests. 2023; 14(5): 904. doi: 10.3390/f14050904
31. Siah CJR, Goh YS, Lee J, et al. The effects of forest bathing on psychological well-being: A systematic review and meta-analysis. International Journal of Mental Health Nursing. 2023; 32(3): 1038–1054. doi: 10.1111/inm.13131
32. Su K, Ren J, Cui C, et al. Do value orientations and beliefs play a positive role in shaping personal norms for urban green space conservation? Land. 2022; 11(2): 262. doi: 10.3390/land11020262
33. Luong TB. Adapting values–beliefs–norms (VBN) and value–identity–personal norm (VIP) models into ecotourism intention: A case study of Cat Tien National Park, Vietnam. International Journal of Geoheritage and Parks. 2024; 12(4): 621–635. doi: 10.1016/j.ijgeop.2024.11.008
34. Li Y, Song M. The influence of tourist–environment fit on environmental responsibility behavior: A moderated mediation model. Forests. 2024; 15(10): 1726. doi: 10.3390/f15101726
35. Tang H, Hu D, Long Y, Zhao Y. The pro-environmental behavioral intention of villagers in rural tourist destinations under China's environmental remediation policy. Scientific Reports. 2023; 13(1): 13906. doi: 10.1038/s41598-023-39998-3
36. Dreijerink L, Handgraaf M, Antonides G. Spillover effects in environmental behaviors: A scoping review about its antecedents, behaviors, and consequences. Current Psychology. 2025. doi: 10.1007/s12144-025-07431-9
37. Spaccatini F, Riva P, Richetin J, et al. From past to present (for a better future): The moderating role of cognitive mindset on spillover effects in environmental behaviors. Current Psychology. 2023; 42(18): 15858–15873. doi: 10.1007/s12144-022-02917-2
38. Han C, Xu Z, Zhang Y, Li Y. Extending the value–belief–norm model with assigned value: A study on visitors' pro-environmental behavior in forest ecosystems of national parks. Forests. 2026; 17(3): 381. doi: 10.3390/f17030381
39. Zhang M, Tang Z, Wang P. Do rewards increase tourists' willingness to engage in low-carbon behavior? Sustainability. 2025; 17(3): 829. doi: 10.3390/su17030829
40. Zhao J, Weng L. The impact of tourists' perceived value on environmentally responsible behavior in an urban forest park: The mediating effects of satisfaction and subjective well-being. Forests. 2024; 15(10): 1730 doi: 10.3390/f15101730
41. Samus A, Dickinson KJM, Freeman C, van Heezik Y. How to increase nature connectedness? Effectiveness and mechanisms of a gratitude journal intervention. People Nat. 2024; 6(6): 2399–2417. doi:10.1002/pan3.10735
42. Baldessari S, Paletto A, Di Domenico G, Di Stefano V, Sacchelli S. Key features for forest bathing development: A Q-methodology study applied in Italy. Journal of Forest Science. 2025; 71(7): 347–357. doi:10.17221/37/2025-JFS.