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Dimensions and Mechanisms of Environmental Behavior Among Visitors to Nature-Based Destinations: A Case Study of Gunung Ciremai National Park, Indonesia

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ABSTRACT

Nature-based tourism in national parks (NP) plays a significant role in promoting environmentally responsible behavior (EB) among individuals. While studies on visitors' EB are increasing, research focusing specifically on visitors' EB in NPs within developing countries, such as Indonesia, remains limited. This study aims to identify factors shaping visitors' EB through an extended Theory of Planned Behavior (TPB) at Gunung Ciremai National Park (GCNP). To explore the dimensions and mechanisms of EB—categorized as environmentally conservative behavior (ECB), environmentally disturbing behavior (EDB), and environmentally radical behavior (ERB)—an extended TPB framework was utilized. TPB examines the relationships among the following latent variables: attitude toward behavior (ATB), subjective norm (SN), perceived behavioral control (PBC), environmental behavior intention (EBI), and environmental behavior (EB). Data were collected from 452 completed questionnaires at three nature-based destinations in GCNP. The study demonstrates clear evidence that the hypothesized relationships among ATB, SN, PBC, EBI, and EB were valid across different types of environmental behavior. The results highlight that these determinant factors work together in shaping visitors' environmental behavior based on TPB. However, their influence may differ depending on the specific type of behavior being considered. The study underscores the need for NPs managers to go beyond simply raising visitors' awareness of the importance of environmental conservation. Efforts should also focus on enhancing visitors' self-efficacy in performing environmentally responsible behaviors.

1. Introduction

National parks (NPs) are fundamental to global conservation initiatives, serving as vital refuges for biodiversity and offering a variety of indispensable ecosystem services. In addition to its function in conserving species and ecosystems, NPs provide essential opportunities for nature-based tourism, which is widely recognized as a sustainable approach to integrating conservation with socio-economic development (Kim et al. 2019; Nugroho and Numata 2021, 2022) and institutional backing for conservation at the local level (Salampessy et al. 2024). In Indonesia, NPs have been vigorously promoted as prime destinations for nature-based tourism (Wiratno 2018),

demonstrating their dual purpose of promoting environmental sustainability and community engagement. Research demonstrates that NPs attract a significant influx of visitors, creating alternative employment opportunities, supplementary income, and more sustainable living for local communities (Balmford et al. 2015; Nugroho and Numata 2021, 2022; Wiratno 2018). Furthermore, the immersive experiences offered by nature-based tourism cultivate a profound connection between visitors and the natural environment, thereby boosting their appreciation of ecosystem services and catalyzing greater support for conservation efforts (Smit et al. 2017; Zhang et al. 2023). The simultaneous advantages of economic empowerment and environmental concern underscore the need to promote and effectively manage NPs.

Although visitors are the catalyst for nature-based tourism and the central emphasis of services at tourism destinations, it is imperative to ensure that the sustainability of NPs resources is crucial. Studies have consistently shown that tourism activities can have adverse environmental impacts in these destinations. Prevalent problems include increased litter, overcrowding, pollution, and ecological degradation (Lee and Jan 2019; Nugroho and Numata 2022; Sharpley 2020). During their travels, visitors often exhibit environmentally responsible behavior (EB), which can influence the repercussions they experience. The tendency of an individual to engage in activities that benefit or protect the environment is a broad definition of environmental behavior (EB) (Larson et al. 2015; Paswan et al. 2017). Such behaviors can have a profound impact on the environmental conditions of tourism destinations (Rajapaksa et al. 2018; Wang et al. 2020). For example, Wang et al. (2020) found that tourists' behavior significantly influenced the environmental effects in Zhongshan scenic regions. Consequently, effectively managing visitors' EB is crucial for balancing public access to the natural resources of NPs with the preservation of their ecological integrity.

Earlier studies have been increasingly conclusive that the environment can be sustained by promoting higher levels of EB when evaluating nature conservation strategies (Liu et al. 2021; Nugroho et al. 2022; Varela-Candamio et al. 2018; Wang et al. 2020). A positive correlation exists between higher degrees of natural connection and higher levels of EB (Zhang et al. 2023). Despite the operationalization of EB remaining contested, a prior study by Wang et al. (2020) robustly delineated its components as environmentally disturbed behavior (EDB), environmentally conservative behavior (ECB), and environmentally radical behavior (ERB). ECB, analogous to pro-environmental behavior, refers to the activities individuals undertake to mitigate their adverse environmental impact (Rajapaksa et al. 2018; Wang et al. 2020). The EDB characterizes environmental stewardship as the visitors' commitment to reducing disruptive behaviors. ERB denotes the extent of visitor engagement in safeguarding the adjacent areas of tourism sites. Wang et al. (2020) utilized the Theory of Planned Behavior (TPB) to investigate the directional and causal mechanisms underlying visitors' EB decisions. Moreover, visitor-centered evidence-based management in NPs promotes the alignment of conservation priorities with recreational activities. This leads to more sustainable tourism practices and deeper visitor engagement, while reducing ecological damage (Cole and Daniel 2003; Jeong et al. 2021; Wang et al. 2023). These outcomes are becoming increasingly important as parks encounter heightened pressure from tourism, climate change, and shifting public expectations. While the study of Wang et al. (2020) is significant for elucidating visitors' EB in tourism destinations, research concentrating on visitors' EB while visiting NPs in developing countries, such as Indonesia, remains inadequately represented in the literature.

Utilizing three nature-based destinations inside Gunung Ciremai National Park (GCNP) in West Java Province, Indonesia, the framework adapted from Wang et al (2020) was employed to look at the dimensions and mechanisms of visitors' EB. This research aims to determine the factors shaping visitors' EB through an extended TPB at Gunung Ciremai National Park (GCNP). We adapted the methodology of Wang et al. (2020) and applied it in the context of nature-based tourism destinations in national parks of developing countries, a task that, to our knowledge, has never been done previously. GCNP exemplifies a breakthrough model for community-based tourism in Indonesia (Wiratno 2018), characterized by its exceptional biodiversity (Adu et al. 2023; Kurniawan et al. 2023; Nasihin et al. 2024; Rozak and Gunawan 2015; Supartono et al. 2023), crucial role as a regional catchment area (Irawan et al. 2009), and robust integration of local community participation in conservation and sustainable management initiatives (Nugroho and Numata 2022; Pereira et al. 2023). Although EB has been widely studied in developed countries, national park contexts in developing countries, such as Indonesia, present distinct socio-cultural and institutional characteristics (Indrawan et al. 2014; Soehartono and Mardiastuti 2014). In contrast to countries with well-established environmental education and supportive infrastructures (Lee and Moscardo 2005), Indonesian parks often face challenges such as limited visitor supervision, insufficient interpretive programs, and community-dependent tourism management. These differences may influence visitors' awareness, perceived behavioral control, and actual pro-environmental actions, thus necessitating context-specific investigations. Therefore, this study may provide a better understanding of the directionality and underlying causal processes that determine tourists' EB in Indonesia's national park. Our study may contribute to enhancing the robustness of the relationship between the determinants of visitors' EB based on TPB tenets, while simultaneously facilitating the creation of policy and management decision-making frameworks to support the development of further nature-based tourism destinations in NPs.

2. Materials and Methods

2.1. Theoretical Frameworks

The Theory of Planned Behavior (TPB), formulated by Ajzen (1991) and grounded in the theory of reasoned action (TRA), posits that behavioral intention (BI) serves as the primary determinant of an individual's actual behavior. Attitude toward behavior (ATB), subjective norm (SN), and perceived behavioral control (PBC) are the three critical components that shape BI. ATB signifies the individual's comprehensive assessment of the behavior in question. SN denotes the perceived societal pressures that may promote or inhibit participation in the behavior. PBC refers to the perceived simplicity or complexity of executing an action, based on the individual's accessible opportunities, competencies, and resources.

Wang et al. (2020) classify environmental behavior (EB) into three distinct categories: environmentally radical behavior (ERB), environmentally conservative behavior (ECB), and environmentally disturbing behavior (EDB). ERB includes proactive measures for environmental protection, such as supporting conservation efforts, deterring harmful activities by others, and reporting environmental damage events. The ECB embodies a robust commitment to environmental stewardship, characterized by individuals who deliberately engage in sustainable practices, comply with regulations, conserve resources, and manage waste appropriately. Conversely, EDB indicates a lack of environmental responsibility, characterized by a disregard for

sustainable practices and an inability to inspire others to adhere to them. Finally, Wang et al. (2020) clarify that an individual's EB, which encompasses ecological, daily, and routine behaviors, is driven by environmental behavior intention (EBI) and perceived behavioral control (PBC), thereby expanding upon the concepts of the TPB. EBI is affected by ATB, SN, and PBC, thereby aligning with Ajzen (1991) theoretical framework. **Fig. 1** illustrates the conceptual framework of the study.

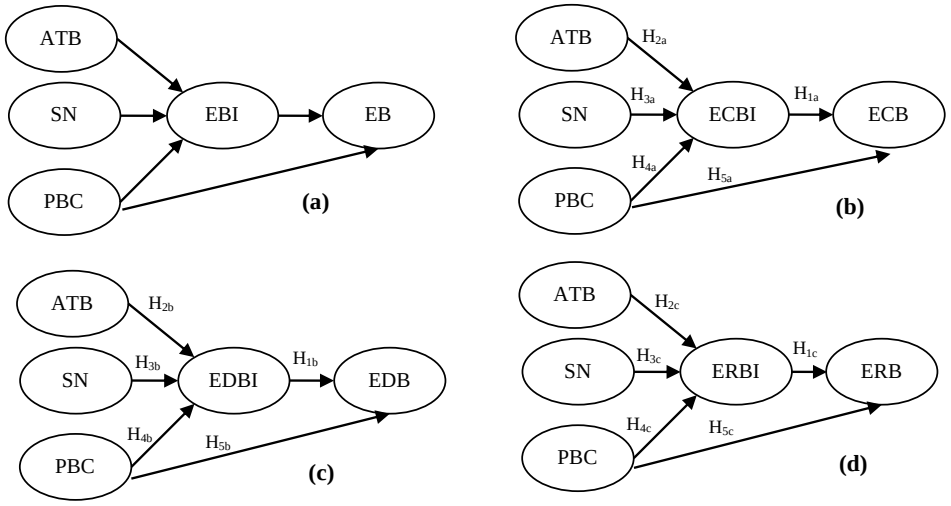

Fig. 1. (a) Original Theory of Planned Behavior conceptual framework by Ajzen (Ajzen 1991) and (b, c, d) the current research conceptual framework (Wang et al. 2020).

The current study formulates the following hypotheses. Initially, it is posited that visitors' environmental behavioral intention (EBI) exerts a positive and significant impact on diverse forms of environmentally responsible behaviors: ECB (H_{1a}), EDB (H_{1b}), and ERB (H_{1c}). Secondly, visitors' ATB is expected to exert a positive and significant effect on their ECBI (H_{2a}), EDBI (H_{2b}), and ERBI (H_{2c}). Third, visitors' subjective norms (SN) are predicted to have a positive and significant effect on their ECBI (H_{3a}), EDBI (H_{3b}), and ERBI (H_{3c}). Fourth, visitors' perceived behavioral control (PBC) is expected to have a positive and significant impact on their ECBI (H_{4a}), EDBI (H_{4b}), and ERBI (H_{4c}). Finally, it is posited that visitors' PBC exerts a direct and significant positive influence on their ECB (H_{5a}), EDB (H_{5b}), and ERB (H_{5c}). These hypotheses aim to elucidate the psychological factors that influence visitors' engagement in environmentally responsible behaviors.

2.2. Study Area

The current research employs Ipukan, Curug Putri, and Tenjo Laut as the locations for nature-based tourism analysis. They are situated within the utilization zone of Gunung Ciremai National Park (GCNP). They are administratively located in the village of Cisantana, West Java Province, Indonesia. The central point coordinates of Cisantana village are roughly 6°56′55″ S, 108°26′34″ E (**Fig. 2**). Cisantana serves as a buffer village of Gunung Ciremai National Park (GCNP). It is considered one of the most visited nature-based tourism sites among 51 neighboring communities of GCNP (BTNGC 2018). Nature-based tourism destinations in GCNP offer a diverse range of flora, wildlife, a unique landscape, and multiple forest-based ecosystem services (Nugroho and Numata 2021; Rozak and Gunawan 2015). GCNP has also been acknowledged as

a model for nature-based tourism development within Indonesia's national parks (Nugroho and Numata 2022; Wiratno 2018).

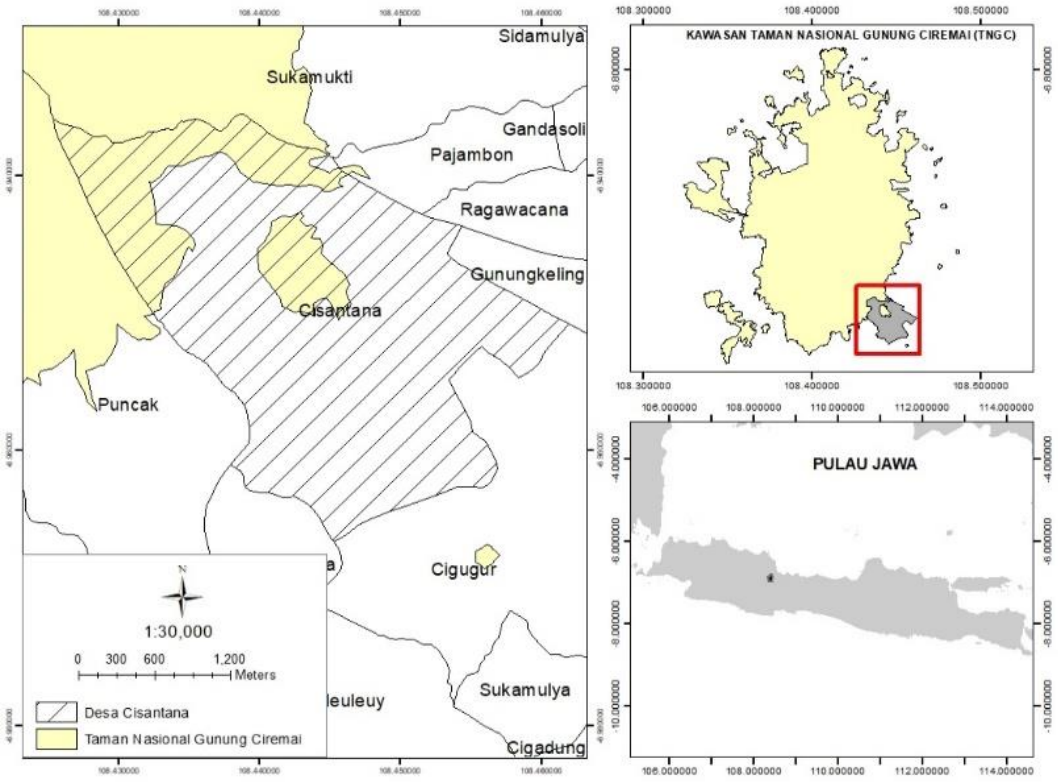

Fig. 2. Research site in Cisantana Village of GNCP, West Java.

2.3. Questionnaire Development

A questionnaire was developed to assess the dimensions of the EB and the sociodemographic characteristics of visitors. A structured questionnaire is divided into two sections, as suggested by Asih (2023), following earlier studies conducted by Wang et al. (2020). The observable variables are sourced from previous studies (Kim and Koo 2020; Lee and Lee 2017; Wang et al. 2020). The initial questionnaire survey included 9 latent variables and 37 questionnaire items. The questionnaire comprised nine latent variables: attitude toward behaviour (n = 4), subjective norms (n = 3), perceived behavioural control (n = 4), environmental conservative behavioural intention (n = 5), environmental disturbing behavioural intention (n = 4), environmental radical behavioural intention (n = 4), environmental disturbing behavioural (n = 5), environmental conservative behavioural (n = 4), and environmental radical behavioural (n = 4). Responses on a five-point Likert scale varied from 1 (strongly disagree) to 5 (strongly agree). The final section of the questionnaire solicited information regarding the respondent's gender, age, level of formal education, occupation, frequency of visits to nature-based destinations, and personal monthly income. The final feature of the survey inquired about the respondent's gender, age, level of formal education, occupation, frequency of visiting nature-based destinations, and monthly income.

2.4. Survey Procedures

The questionnaires were delivered face-to-face during June and July of 2022. Direct face-to-face interviews enable interviewers to identify and persuade respondents to participate, thereby

enhancing cooperation and communication, and achieving a higher response rate (Sperber et al. 2023). While this approach effectively increases participation and allows for immediate clarification of survey items, we acknowledge its limitation in terms of population representation, as it does not employ probabilistic sampling. Therefore, the findings are not intended to be statistically generalizable to all visitors but rather to provide insight into patterns and tendencies among actual site users during the survey period.

To strengthen validity, data collection was conducted across different days and time slots over a two-month period (June–July 2022) to capture a range of visitor profiles and behaviors. The interview period concluded once a sufficient sample size was reached for robust statistical analysis and no major variation in response trends was observed, indicating an approach toward response saturation. Kline (2011) recommends a minimum sample size of 200 for SEM to ensure robust and reliable model estimation. This ensures that the collected data reflects a diversity of site visitors while maintaining practical feasibility.

Five undergraduates majoring in forestry sciences were trained to encourage respondent participation, conduct interviews, administer the survey questionnaire, and collect data. The interviews were conducted at the tourist site. Respondents were selected through convenience sampling based on accessibility, availability during designated periods, and willingness to participate. Only individuals aged 17 years or older, representing various visitor groups, were approached, informed about the study's purpose, and invited to participate voluntarily. Finally, all questions were posed to the intercepted visitors by the interviewers.

2.5. Data Analysis

The current study utilized subsequent analyses, including descriptive analysis, confirmatory factor analysis (CFA), and structural equation modeling (SEM). First, before undertaking the analyses, the data have been analyzed for suitability and applicability. Since questionnaires with unanswered questions were eliminated, only questionnaires with all questions answered would be used for later analysis. We employed descriptive statistics to characterize respondent characteristics, including the mean and standard deviation. Second, we assessed the composite reliability of the generated measurement model, the average variance extracted (AVE), and the factor loadings. Next, confirmatory factor analysis (CFA) was utilized to clarify the hypothesized relationships between the observed variables and the latent variables. Next, the structural correlations between latent variables were examined using SEM. Using the maximum likelihood (ML) technique, all SEM parameters were determined. Under the assumption of multivariate normality for the observable variables, the ML technique estimates parameters with exceptional efficiency and consistency (Savalei 2014). Finally, we used the lavaan package, ver. 0.63, for Windows (Rosseel 2012) to analyze the generated structural model, including its directions and significance of the relationship between latent variables.

3. Results and Discussion

3.1. General Results

The current study collected 452 valid questionnaires. A slight majority of respondents were male (51.77%), predominantly aged 17 to 25 years (64%), and primarily high school graduates (55.53%). Among the respondents, 72.17% were students, and 88.27% reported a monthly income

of IDR 4,000,000 (approximately $ 258.50). Additionally, most respondents (66%) reported visiting nature-based destinations twice per month, highlighting a strong engagement with nature-oriented activities.

The initial questionnaire included 37 observed variables and nine latent variables. Among these, attitude toward behavior (ATB), subjective norm (SN), perceived behavioral control (PBC), and environmental conservative behavioral intention (ECBI) recorded the highest average values. Scores for environmental disturbing behavioral intention (EDBI), environmental radical behavioral intention (ERBI), environmental conservative behavior (ECB), environmental disturbing behavior (EDB), and environmental radical behavior (ERB) were 4.20, 4.0, 3.90, 4.20, 3.80, 4.10, 4.10, 4.10, 4.10, and 3.70, respectively. Standard deviations for ATB, SN, PBC, ECBI, EDBI, ERBI, ECB, EDB, and ERB ranged from 0.55 to 0.69, reflecting moderate variation in responses (**Table 1**).

Furthermore, the reliability analysis demonstrated robust internal consistency, as indicated by Cronbach's alpha values exceeding 0.5 for all latent variables. These results demonstrate that the latent constructs are reliable, which supports the study's solid technique and the validity of the insights gained from the data (Taber 2018).

Table 1. The latent variables' measurement outputs

Latent variables	Value			
	Mean	STD	Cronbach's alpha	Criteria
Attitude toward behaviour (n = 4)	4.20	0.62	0.86	Good
Subjective norms (n = 3)	4.00	0.68	0.76	Acceptable
Perceived behavioural control (n = 4)	3.90	0.63	0.78	Acceptable
Environmental conservative behavioural intention (n = 5)	4.20	0.55	0.82	Good
Environmental disturbing behavioural intention (n = 4)	3.80	0.69	0.78	Acceptable
Environmental radical behavioural intention (n = 4)	4.10	0.60	0.71	Acceptable
Environmentally disturbing behavioural (n = 5)	4.10	0.58	0.83	Good
Environmental conservative behavioural (n = 4)	4.10	0.62	0.74	Acceptable
Environmental radical behavioural (n = 4)	3.70	0.75	0.80	Acceptable

Notes: STD = standard deviation, n = number of questions, Kaiser-Meyer-Olkin (KMO) test for sampling adequacy = 0.908; p = 0.000.

3.2. Measurement Model Assessment

The measurement model of this investigation includes nine latent variables. The preliminary confirmatory factor analysis (CFA) of the first hypothesis model indicated that the model failed to achieve the acceptable fit indices. To enhance the model and confirm its validity, 24 items were retained which were three items for attitude toward behavior (ATB), two for subjective norm (SN), three for perceived behavioral control (PBC), three for environmental conservative behavioral intention (ECBI), three for environmental disturbing behavioral intention (EDBI), two for environmental radical behavioral intention (ERBI), three for environmental conservative behavior (ECB), three for environmental disturbing behavior (EDB), and two for environmental radical behavior (ERB).

Table 2 illustrates that the composite reliability (CR) values obtained from the CFA analysis surpass the recommended threshold of 0.6, ranging from 0.723 to 0.858. This indicates that each latent variable exhibits robust internal consistency (Taber 2018). Additionally, the factor loadings for all latent variables exceeded the minimum threshold of 0.5, ranging from 0.708 to 0.852. This suggests that each latent variable has a significant explanatory power. Furthermore, the average

variance extracted (AVE) values exceeded the prescribed AVE threshold of 0.5 (Cheung et al. 2024), ranging from 0.545 to 0.668. The findings verify the robustness of the measurement model, as each latent variable demonstrates sufficient reliability and validity.

Table 2. Measurement model assessment results: factor loadings, average variance extracted (AVE), and composite reliability

Variable	Factor Loading	CR	AVE
Attitude Toward Behavior (ATB)			
- For me, taking care of the environment in GCNP is wise behavior	0.756	0.858	0.668
- For me, taking care of the environment in GCNP is pleasant behavior	0.852		
- For me, taking care of the environment in GCNP is a useful action	0.841		
Subjective Norms (SN)			
- People whose opinions I hold in high regard, expecting me to conserve the environment in GCNP	0.742	0.723	0.566
- My colleagues will engage in environmental protection initiatives at GCNP	0.763		
Perceived Behavioral Control (PBC)			
- In GCNP, it is quite simple for me to conserve the environment	0.710	0.791	0.558
- No one can prevent me from getting involved in efforts to protect the environment in the GCNP	0.775		
- The decision to be involved in protecting the environment in GCNP is entirely my own	0.755		
Environmentally Conservative Behavioral Intention (ECBI)			
- I am willing to dispose of my garbage properly when traveling in the GCNP	0.708	0.782	0.545
- I want to help maintain the quality of the local environment	0.740		
- I want to accept the control policy of not entering the protected area	0.765		
Environmentally Disturbing Behavioral Intention (EDBI)			
- I do not want to litter in the GCNP	0.739	0.797	0.567
- I do not want to disturb animals during my visit to the GCNP	0.794		
- I did not want to damage the plants during my visit to GCNP	0.724		
Environmentally Radical Behavioral Intention (ERBI)			
- I am interested in contributing to the management of GCNP for environmental protection initiatives	0.739	0.747	0.597
- I would choose to participate in volunteer environmental protection activities at GCNP	0.805		
Environmental Conservative Behavior (ECB)			
- I disposed of the garbage properly during my visit to a tourist attraction in GCNP	0.716	0.815	0.595
- I have helped to maintain the quality of the environment in the GCNP	0.749		
- I have complied with the rules not to enter protected areas in the GCNP	0.844		
Environmental Disturbing Behavior (EDB)			
- I do not litter in the GCNP	0.779	0.789	0.555
- I do not disturb animals during my visit to the GCNP	0.751		
- I did not damage the plants during my visit to GCNP	0.703		
Environmental Radical Behavior (ERB)			
- I have been involved in volunteer activities aimed at protecting the environment in the GCNP	0.822	0.769	0.625
- I have tried to prevent other tourists from damaging the environment in the GCNP	0.758		

Notes: CR = composite reliability, AVE = average variance extracted.

3.3. Structural Model

Our structural models demonstrate satisfactory model fit indices, as shown in **Tables 3–5**. The structural model met the required fitness criteria. **Fig. 3** illustrates the structural relationships and their influence on environmental conservatism (ECB). The results indicate that attitude toward behavior (ATB) ($\beta = 0.682$, $p < 0.001$), subjective norm (SN) ($\beta = 0.667$, $p < 0.001$), and perceived

behavioral control (PBC) (β = 0.636, p < 0.001) all have direct, positive, and significant effects on environmental conservative behavioral intention (ECBI). Additionally, ECBI exerted a direct, positive, and significant effect on environmental conservative behavior (ECB) (β = 0.665, p < 0.001). However, PBC's direct effect on ECB was positive but insignificant (β = 0.084, p > 0.05). As a result, hypotheses H_{1a}, H_{2a}, H_{3a}, and H_{4a} were supported, while H_{5a} was not.

Table 3. Fit indices for the environmental conservative behavior (ECB) model

Fit indices	CFI	X^2/df	IFI	PGFI	NFI	RMSEA	SRMR
Value	0.937	4.676	0.937	0.633	0.913	0.073	0.047
Criteria	> 0.9	1-5	> 0.9	> 0.5	> 0.9	< 0.08	< 0.05

Notes: X^2 = model chi-square, CFI = comparative fit index, IFI = incremental fit index, PGFI = Parsimony goodness-of-fit index, SRMR = standardized root mean square residual, RMSEA = root mean square error of approximation.

Table 4. Fit indices for the environmental disturbing behavior (EDB) model

Fit indices	CFI	X^2/df	IFI	PGFI	NFI	RMSEA	SRMR
Value	0.937	3.851	0.938	0.585	0.917	0.079	0.049
Criteria	> 0.9	1-5	> 0.9	> 0.5	> 0.9	< 0.08	< 0.05

Notes: X^2 = model chi-square, CFI = comparative fit index, IFI = incremental fit index, PGFI = Parsimony goodness-of-fit index, SRMR = standardized root mean square residual, RMSEA = root mean square error of approximation.

Table 5. Fit indices for the environmental radical behavior (ERB) model

Fitting Indicator	CFI	X^2/df	IFI	PGFI	NFI	RMSEA	SRMR
Value	0.970	2.645	0.970	0.525	0.953	0.06	0.045
Criteria	> 0.9	1-5	> 0.9	> 0.5	> 0.9	< 0.08	< 0.05

Notes: X^2 = model chi-square, CFI = comparative fit index, IFI = incremental fit index, PGFI = Parsimony goodness-of-fit index, SRMR = standardized root mean square residual, RMSEA = root mean square error of approximation.

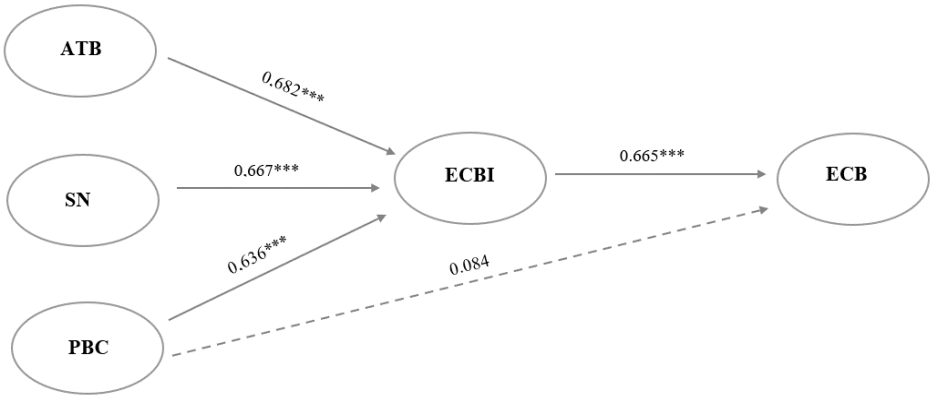

Fig. 3. Standardized output from environmental conservative behavior (ECB) model (*** p < 0.001).

Fig. 4 depicts the structural path and its impact on environmental disturbing behavior (EDB). The findings reveal that environmental disturbing behavioral intention (EDBI) has a direct, positive, and significant impact on EDB (β = 0.703, p < 0.001). Furthermore, the direction and effects of ATB (β = 0.634, p < 0.001), SN (β = 0.591, p < 0.001), and PBC (β = 0.463, p < 0.001) all have direct, positive, and significant effects on EDBI. However, PBC's direct effect on EDB

was positive but insignificant (β = 0.083, p > 0.05). Therefore, hypotheses H_{1b}, H_{2b}, H_{3b}, and H_{4b} were supported, while H_{5b} was not.

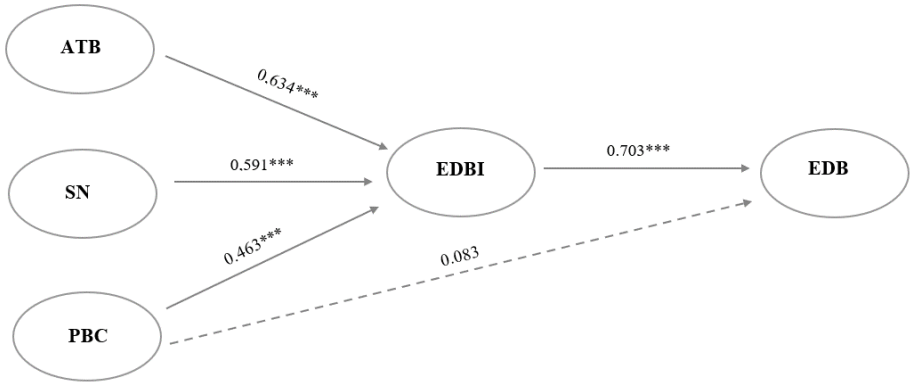

Fig. 4. Standardized output from the Environmental Disturbing Behavior (EDB) model (*** p < 0.001).

Fig. 5 illustrates the structural path and its impact on environmental radical behavior (ERB). The results indicate that environmental radical behavioral intention (ERBI) had a direct, positive, and significant effect on ERB (β = 0.492, p < 0.001). The direction and effects of ATB (β = 0.301, p < 0.001), SN (β = 0.553, p < 0.001), and PBC (β = 0.640, p < 0.001) all had direct, positive, and significant effects on ERBI. However, PBC's direct effect on ERB was positive but insignificant (β = 0.005, p > 0.05). Consequently, hypotheses H_{1c}, H_{2c}, H_{3c}, and H_{4c} were supported, while H_{5c} was not.

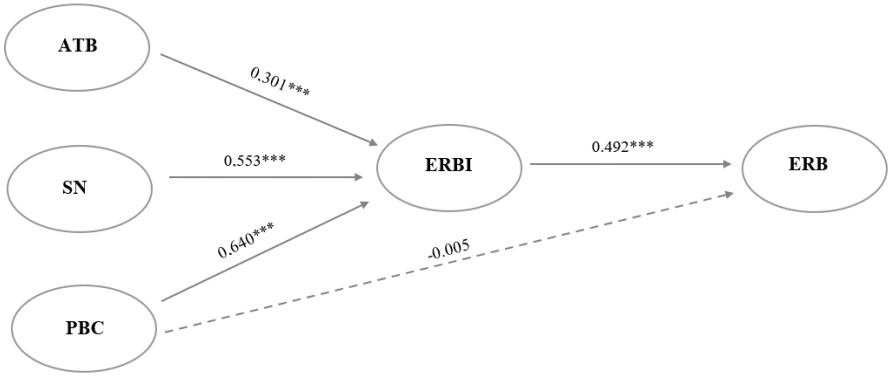

Fig. 5. Standardized output from Environmental Radical Behavior (ERB) model (*** p < 0.001).

Fig. 3 illustrates the dimensions and mechanisms of Environmental Conservative Behavioral Intention (ECBI). The significant, positive relationship between ATB, SN, PBC, and ECBI supports the foundational principles of the TPB, which asserts that attitudes, social norms, perceived behavioral control, and self-efficacy are critical predictors of behavioral intentions (Ajzen 1991). In this study, ATB (β = 0.682), SN (β = 0.667), and PBC (β = 0.636) were all found to have strong and direct effects on ECBI, suggesting that visitors' attitudes toward environmental conservation, the influence of their social circles, and their perceived ability to act pro-environmentally all play a significant role in determining their intentions to engage in sustainable behaviors. These findings are consistent with those of Kotyza et al. (2024), who discovered that positive attitudes and perceived control significantly enhance pro-environmental intentions in various contexts, including tourism. Our findings are closely tied to the specific socio-ecological context of Cisantana Village, one of 54 buffer zone communities surrounding GCNP. The village

fosters community-based conservation norms and pro-environmental attitudes by leveraging its natural tourism potential through a community cooperative that collaborates with NPs authorities (Nugroho and Numata 2021, 2022; Pereira et al. 2023). This cooperative also generates socio-economic benefits. At a broader landscape scale, GCNP has effectively maintained its diverse biodiversity and preserved its forest canopy (Kurniawan et al. 2023; Rozak and Gunawan 2015; Supartono et al. 2023). Visitors' perceptions of behavioral control and normative commitments toward conservation practices are likely to be enhanced by these tangible environmental outcomes. Additionally, the direct and positive correlation between ECBI and ECB serves to substantiate the notion that behavioral intentions are robust predictors of actual behavior, a conclusion that aligns with the research conducted by Wang et al. (2020). This implies that initiatives to influence the environmental intentions of visitors, whether through educational campaigns or normative influences, could directly lead to more sustainable behaviors, including waste reduction, the preservation of protected areas, and participation in conservation activities. For example, the implementation of environmental education programs at CBT sites within GCNP, such as wildlife monitoring, tree planting, and waste management training, can foster a sense of responsibility and direct visitor involvement, thereby strengthening their environmentally responsible behavior (EB).

However, the insignificant effect of PBC on actual ECB (β = 0.084) contrasts with some previous findings. According to Ajzen (1991), perceived control over a behavior should significantly influence its actualization, especially when the behavior is perceived as difficult or resource-dependent. The absence of a significant relationship in this study suggests that while tourists may feel they have the ability to act pro-environmentally in theory, practical barriers (such as lack of infrastructure or awareness) may prevent them from engaging in these behaviors. This finding aligns with (Kotyza et al. 2024), who noted that perceived control may not always translate into action, particularly in situations where individuals perceive external constraints. (Nugroho and Numata 2022; Pereira et al. 2023; Supartono et al. 2023). Indeed, current conditions in GCNP and Cisantana Village exemplify these ongoing challenges. While GCNP has effectively preserved its forest cover through active collaboration with community cooperatives, the supporting infrastructure required to facilitate sustainable visitor behavior—such as adequate waste management systems, informational signage, and designated walking trails—remains limited and requires further development. Similarly, although Cisantana Village has proactively advanced community-based ecotourism by managing multiple natural attractions through cooperatives, it continues to encounter difficulties in consistently implementing environmental education initiatives for visitors.

For EDB, the study found that EDBI had a significant and positive effect on actual EDB (β = 0.703). This result supports the literature on the TPB, where behavioral intentions are predictive of disruptive behaviors such as littering, noise pollution, and damage to natural resources (Rajapaksa et al. 2018). Based on the substantial effects of ATB (β = 0.634), SN (β = 0.591), and PBC (β = 0.463) on EDBI, it is evident that visitors' intentions to engage in harmful environmental activities are influenced by both internal and external factors. Specifically, the probability of engaging in disruptive behaviors, such as congestion, pollution, or environmental degradation, can be increased by attitudes toward the behavior, social norms, and perceived behavioral control. The findings are in agreement with those of Wang et al. (2020). Therefore, it is recommended that efforts to influence the environmental behavior of visitors should concentrate on identifying the primary role of attitudes and subjective norms in shaping their behavior at nature-based destinations. The positive and significant effect of PBC on EDBI indicates that visitors who

perceive themselves as having control over their surroundings, even when this control manifests in adverse acts (e.g., excessive waste disposal or violation of NPs rules), are more inclined to partake in such behavior. This discovery highlights the importance of regulating perceptions of control and mitigating the sensation of empowerment that can lead to disruptive behaviors. Again, the negligible direct influence of PBC on actual EDB (β = 0.083) suggests that, although visitors may perceive a degree of control, they may not translate this control into actions that disrupt the environment. This finding supports prior studies indicating that perceived behavioral control does not consistently result in significant or beneficial environmental actions, particularly when individuals do not perceive their actions as having an impact (Kotyza et al. 2024; Yuriev et al. 2020).

Our findings indicate that ERBI exerted a significant and positive effect on actual ERB (β = 0.492), suggesting that individuals' intentions to participate in extreme environmental actions, such as activism or protest, are robust predictors of their behaviors in tourism contexts. The pronounced influences of ATB (β = 0.301), SN (β = 0.553), and PBC (β = 0.640) on ERBI indicate that visitors' environmental attitudes, perceptions of social pressures, and sense of control over environmental outcomes significantly contribute to the promotion of radical environmental behaviors. These findings align with other research that has highlighted the significance of these characteristics in encouraging individuals to participate in environmental campaigns or undertake more radical actions to protect the environment (Wang et al. 2020). Notably, while PBC exerted a significant impact on ERBI, its direct effect on ERB was favorable yet statistically negligible (β = 0.005). This suggests that while visitors may have a strong desire to engage in radical environmental behavior, external factors, such as a lack of resources or organizational opportunities, may hinder their ability to actualize these intentions. This finding corroborates the findings of Kotyza et al. (2024), who suggest that perceived control is essential for engaging in moderate behaviors. However, it may be less relevant for more radical actions that typically require collective mobilization or institutional support.

4. Conclusions

This research employs the Theory of Planned Behavior (TPB) to identify key psychological and social factors affecting tourists' environmental behaviors within the setting of nature-based tourism in Indonesian national parks (NPs). The findings demonstrate that visitors' attitudes toward behavior (ATB), subjective norms (SN), and perceived behavioral control (PBC) are robust predictors of their intentions regarding pro-environmental behaviors (ECB), disruptive behaviors (EDB), and radical behaviors (ERB), with significant correlations identified. Intentions were regularly converted into actual environmental behaviors, whereas the direct impacts of perceived behavioral control (PBC) were minimal and non-significant, underscoring practical impediments to action. These findings validate the relevance of an expanded TPB model for understanding environmental behavior in NPs of developing nations. The results highlight the necessity for NPs management to cultivate favorable visitor perceptions, utilize social impacts via community involvement, and augment perceived control by implementing obvious and pragmatic infrastructure enhancements. Future research should examine how contextual elements, including NPs characteristics and cultural influences, shape environmental behaviors, thereby enhancing conservation efforts.

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Author Contributions

P.N.: Conceptualization, Methodology, Software, Validation, Formal Analysis, Resources, Data Curation, Writing – Review and Editing, Supervision, Funding Acquisition; S.S.M.A.: Methodology, Investigation, Data Curation, Writing – Original Draft Preparation.

Conflict of Interest

The authors declare no conflict of interest.

Declaration of Generative AI and AI-Assisted Technologies in the Manuscript Preparation

During the preparation of this work, the authors used ChatGPT (OpenAI) to paraphrase passages and enhance the overall clarity of the manuscript. After using this tool, the authors carefully reviewed and edited all content as needed and take full responsibility for the accuracy and integrity of the publication.

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