Factors influencing hikers' litter behavior in national park in China

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The implementation of the litter behavior initiative aims to mitigate the generation of litter by hikers within the hiking trails of China's national park. The present study employed the extended norm activation model (NAM) to examine the determinants of hikers' intention to engage in litter behavior within the context of Wuyishan national park. This analysis incorporated three supplementary explanatory variables, namely environmental knowledge, connectedness to nature, and pro-environmental behavior in everyday life. Additionally, three control variables were included, namely gender, age, and education. A survey was conducted by researchers at Wuyishan national park, with a sample size of 466 hikers. The data obtained from the survey was analyzed using the statistical technique known as structural equation modeling. The findings indicate that the NAM effectively captured hikers' litter behavior in national parks. Factors such as hikers' awareness of consequences, ascription of responsibility, personal norm, environmental knowledge, connectedness to nature, and pro-environmental behavior in everyday life were found to significantly influence hikers' intention to engage in litter behavior. The influence of age on hikers' intention was shown to be significant and positive, suggesting that older hikers exhibited a greater willingness to engage in litter behavior compared to younger hikers. In conclusion, the study provided practical recommendations for improving the management of hiker trash and promoting sustainable development inside national parks.

KEYWORDS

litter behavior, norm activation theory, China national park, influencing factors, Chinese hiker

1 Introduction

The primary purpose of designating national parks is to safeguard the ecological integrity of ecosystems, while also providing opportunities for recreation and fostering an appreciation for the natural world (Esfandiar et al., 2019). China's national parks are designated land or marine locations that are managed by the Chinese government. They intend to protect large-scale natural ecosystems with national representatives, as well as implement scientific protection and rational use of natural resources (Sun et al., 2020).

The phenomenon of urbanization, coupled with the rapid expansion of nature-based tourism in natural environments, has resulted in a significant increase in individuals' desire for outdoor recreational activities as an integral aspect of their lifestyles around the world (Tyrväinen et al., 2014; Eastabrook and Collins, 2020; Stanciu et al., 2022; Usmanova, 2022; Hansen et al., 2023). The emergence of several issues confronts park management, encompassing conflicts between humans and wildlife (Carius and Job, 2019; Huang et al., 2020; Mekonen, 2020), detrimental effects on natural resources (Brankov et al., 2019;

Dwiyahreni et al., 2021), inappropriate behaviors exhibited by visitors (Abrams et al., 2020; Esfandiar et al., 2020; Pearce et al., 2022; Fenitra et al., 2023), escalating demand for natural resources (Cui et al., 2021; Zoysa, 2022), and the accumulation of garbage caused by humans (Zhang and Wang, 2020; Baloch et al., 2023). One of the most obvious environmental effects of tourists in national parks is litter (Rodríguez-Rodríguez, 2012; Compa et al., 2022; Fenitra et al., 2023).

National parks are widely acknowledged for their significant contribution to the establishment and advancement of destinations centered around nature-based tourism (Winter et al., 2019). China's national parks that have been built so far span 230,000 square kilometers, China has plans to establish the world's most extensive national park system, encompassing around 10% of its total geographical area, in the forthcoming years. National parks attract more than millions of tourists and hikers every year, simultaneously, the preservation of the expansive and delicate natural expanse devoid of refuse poses a significant obstacle for management of national parks (Esfandiar et al., 2021). The existing body of literature pertaining to the effects of tourism reveals that the inappropriate disposal of litter has been found to have detrimental effects on the ecosystem (Rodríguez-Rodríguez, 2012; Compa et al., 2022; Ivanenko et al., 2022; Fenitra et al., 2023; Zhang et al., 2023). Wuyishan national park is the only place that was both in the first group of national parks and the first group of national forest trails in China. It is regarded as one of the five prominent mountains in China that is highly recommended for hikers.

In any case, limited research has been conducted on the phenomenon of litter in situations where individuals are not present at their place of residence. There is a paucity of research examining this particular form of litter behavior in the specific setting of a national park (Esfandiar et al., 2021). Because the variance in individuals' behavior can be attributed to the specific form of pro-environmental behavior (PEB) and the situational environment in which it occurs (Higham et al., 2016; Esfandiar et al., 2021). Moreover, In the majority of earlier studies, traditional visitors served as the research subject, but hikers have distinct characteristics, such as being better educated and more environmentally conscious (Farías Torbidoni, 2011). Furthermore, there are few articles has been conducted in Western cultures, most research on PEB take Western hikers as research subjects (Esfandiar et al., 2022).

The norm activation model (NAM) is widely recognized as a highly influential theory in the realm of explaining the process and behavior of pro-environmental decision-making (Confente and Scarpi, 2021; Han, 2021; Mikuła et al., 2021; O'Connor and Assaker, 2021; Esfandiar et al., 2022; Gao et al., 2022; Sun et al., 2022). Nevertheless, the model fails to consider both voluntary and involuntary processes, which are crucial components of rational choice models. As a result, its adequacy is extensively doubted (Onwezen et al., 2013; Han, 2015; Shin et al., 2018). In order to address this issue, researchers have sought to increase the model's explanatory power by incorporating additional variables in various contexts. Within the context of the hospitality and tourism sector, previous studies have primarily concentrated on examining the extent of individuals' environmental consciousness or the frequency of their responsible actions in their day-to-day routines, alongside their consumption patterns while vacation (Han et al., 2010; Prud'homme and Raymond, 2013; Han and Hyun, 2018b). The acquisition of environmental knowledge by individuals has been found to have a

favorable impact on their behavior, hence indirectly influencing their intention to engage in pro-environmental actions (Chan, 2001; Yadav and Pathak, 2016; Arı and Yılmaz, 2017; Farrukh et al., 2022; Han et al., 2023). Customers who sense a strong connection to the natural environment are more likely to engage in environmentally sustainable consumption practices (Dutcher et al., 2007; Han and Hyun, 2017a). Furthermore, it should be noted that the samples included in this study exhibited heterogeneity, since they displayed distinct demographic characteristics. Socio-demographic characteristics are considered background variables which can affect intention (Senger et al., 2017; Hu et al., 2019). Early research indicated that women, individuals with advanced education, young adults with high income, married couples were more likely to have pro-environmental behavioral intentions (López-Mosquera et al., 2015; Ahmad et al., 2021). Individuals who possess higher levels of education or are younger in age exhibit a greater degree of care for the environment (Welsch and Kühling, 2010; Kautish and Sharma, 2020; Mónus, 2022). Therefore, in the context of hikers' litter management, three demographic variables (gender, age, and education) as control variables were considered in the extended NAM.

In order to address these research deficiencies, the extended NAM was employed to examine the determinants that influence hikers' litter behavior in Wuyishan national park, which was the first batch of national parks in China. The main aims and objectives of the study were the following: (1) What are the main factors impacts on hikers' litter behavior? (2) How much do they predict hikers' intention to participate in the litter behavior? (3) How does the proposed model improve the predictive power of the original NAM model for hikers' intention to participate in the litter behavior? Gaining insight into the underlying mechanism that drives the disposal behavior of hikers to national parks is of utmost importance in developing efficient and sustainable solutions for nature-based environments.

2 Materials and methods

2.1 Research hypotheses

2.1.1 Norm activation model

The notion of NAM, initially introduced by Schwartz (1977), encompasses three fundamental components that are crucial in predicting pro-social intentions and behaviors (Schwartz, 1977). Norm activation theory is mainly composed of three variables, awareness of consequences (AC), ascription of responsibility (AR), personal norm (PN), and behavioral intention (BI). AC refers to "whether someone is aware of the negative consequences for others or for other things one values when not acting prosocially" (De Groot and Steg, 2009). AR refers to the "feeling of responsibility for performing the specific behavior" (Onwezen et al., 2013). Personal norm is the "moral obligations to act in favor of the common good" (Steg et al., 2005). Many research have shown that AR, AC positively affected PN, and AR can be triggered by AC (Han, 2021; Mikuła et al., 2021; Esfandiar et al., 2022; Gao et al., 2022; Sun et al., 2022; Zhang et al., 2022; Fenitra et al., 2023). As a result, the following hypothesis is proposed in this study:

*H*1: AR has a positive influence on PN

H2: AC has a positive influence on PN

H3: AC has a positive influence on AR

H4: PN has a positive influence on BI

2.1.2 Environmental knowledge

Environmental knowledge (EK) encompasses a consumer's capacity to comprehend and grasp environmental concepts, challenges, and difficulties, and afterwards apply this understanding to shape their own behaviors (Han, 2021). Environmental knowledge refers to a general understanding of the natural environment and its main ecosystems in terms of facts, concepts, and relationships (Fryxell and Lo, 2003). The correlation between environmental knowledge and the inclination to engage in environmentally conscious behavior. The possession of environmental knowledge has a direct and beneficial impact on the intention of visitors to engage in pro-environmental conduct (Vagias et al., 2014). Furthermore, some studies have provided evidence to support the notion that possessing environmental knowledge yields favorable outcomes in terms of behavior. These behavioral changes, in turn, have an indirect impact on fostering pro-environmental behavioral intentions (Chan, 2001; Yadav and Pathak, 2016; Arı and Yılmaz, 2017; Farrukh et al., 2022).

H5: EK has a positive influence on BI

2.1.3 Connectedness to nature

Connectedness to nature (CN) pertains to the degree to which an individual perceives themselves as being integrated within the natural world (Schultz, 2001). The literature on well-being and pro-environmental behavior generally recognizes connectedness to nature as a motivator of individual behavior (Martin et al., 2020; Pritchard et al., 2020). The inclination toward nature can be rationalized by a feeling of affiliation, which might ultimately inspire individuals to refrain from engaging in activities that have adverse effects on the natural environment (Hongxin et al., 2022). Those who consider themselves a part of it and connected to others may be motivated by a desire to avoid negative outcomes (Raymond et al., 2011), environmental responsibility in consumption situations (Han and Hyun, 2017a; Han, 2021).

H6: CN has a positive influence on BI

2.1.4 Pro-environmental behavior in everyday life

Pro-environmental behaviors in everyday life (PE) pertain to the eco-friendly activities that consumers engage in on a regular basis for the purpose of environmental preservation (Han, 2021). These environmentally friendly habits should be ingrained into daily life so that they become second nature (Steg and Vlek, 2009). Eco-friendly everyday activities play a crucial role in elucidating environmentally sustainable consumer behavior, as they directly influence consumer decision-making and behavior in favor of environmental sustainability (Han and Hyun, 2018a).

H7: PE has a positive influence on BI

2.1.5 Demographic variables

In prior research, gender, age, and level of education were the three demographic factors that were looked at most frequently to determine an individual's behavioral intention. Numerous studies have provided evidence indicating that while demographic parameters may exhibit statistical significance, their predictive capacity is often modest at most (Hornik et al., 1995). Nevertheless, a number of studies shown that demographic factors significantly enhanced the study model's capacity for accurate prediction (Pakpour et al., 2014). Due to the limited number of published studies examining visitor behavior pertaining to litter management, it is necessary to investigate the influence of demographic characteristics on hikers' behavior in the context of litter management at Wuyishan national park. This research is essential for developing tailored policies that cater to diverse visitor groups.

H8: Gender has a positive influence on BI

H9: Age has a positive influence on BI

H10: Education has a positive influence on BI

3 Data source and method

3.1 Study sites

The Wuyishan national park in China has been acknowledged as one of the four global sites of natural and cultural significance by the United Nations Educational, Scientific and Cultural Organization (UNESCO). As per the assessment conducted by the World Heritage Committee, Wuyishan national park is a landscape that has been conserved for a period exceeding 12 centuries. The region boasts a collection of noteworthy archeological sites and artifacts, encompassing the remnants of Seoul constructed during the first century, a multitude of temples, and the remains of academies associated with the development of Zhu Zi's Neo-Confucianism in the eleventh century. Furthermore, it serves as the birthplace of Neo-Confucianism throughout ancient times in China. Neo-Confucianism, as an influential doctrine, exerted its dominance over East and Southeast Asian nations for an extensive period, leaving a profound impact on global philosophy and politics.

The Wuyishan national park is located in Nanping City, Fujian Province, China. It encompasses a total area of approximately 1,280 km². Wuyishan national park is the only place that was both in the first group of national parks and the first group of national forest trails in China. The total length of the trail is about 1,160 km, of which 930 km are in Fujian, 138 km in Jiangxi, and 92 km in Zhejiang. It is one of the best national forest trails in China, all of which have abundant ecological resources, rare plants, and animal diversity. The constant increase in the number of visitors and hikers to Wuyishan national park can be attributed to the rapid expansion of the tourism

industry. Wuyishan national park has recently introduced five distinct hiking pathways catering to hikers, including the Jiuqu Slow Tour on the Shore, the Rock Bone Flower Slow Tour, the Dongtian Xianfu Slow Tour, the Wizard of Oz Slow Tour, and the Tianxin Asking Zen Slow Tour.

3.2 Survey design

A self-reported questionnaire was constructed and presented to hikers on-site at Wuyishan national park, drawing upon the existing literature on the norm activation model scales. The initial portion of the items was assessed using a 5-point Likert scale, with 1 representing strong disagreement and 5 representing strong agreement. This scale was employed to measure the constructs of awareness of consequences, ascription of responsibility, personal norm, environmental knowledge, connectedness to nature, and pro-environmental behavior in everyday life. Followed by AC1-AC3 measurement awareness of consequences, AR1-AR3 Attribution of measurement ascription of responsibility, PN1-PN3 measurement personal norm (Schwartz, 1977; Zhang et al., 2017, 2022; Han et al., 2021), EK1-EK4 measurement Environmental knowledge (Yadav and Pathak, 2016; Hu et al., 2018), CN1-CN3 measurement connectedness to nature (Han and Hyun, 2017a; Hongxin et al., 2022), PE1-PE3 measurement pro-environmental behavior in everyday life (Han and Hyun, 2017b; Hu et al., 2019). The second section of the study conducted consisted of BI1-BI3 (Esfandiar et al., 2021), which assessed the litter behavior of hikers in national parks. Participants were asked to rate their behavior on a 5-point Likert scale, with 1 indicating "never" and 5 indicating "always." The third section of the survey included questions aimed at gathering data on the sociodemographic profiles of participants, namely pertaining to their gender, age, education, and monthly income. The software of AMOS 24.0 and SPSS 23.0 was employed for data analysis.

3.3 Data collection

A preliminary evaluation was conducted to determine the validity and reliability of the survey. Prior to conducting the pre-testing phase, a group of five scholars critically examined the questionnaire in order to assess the logical coherence and validity of its items. The ideas provided resulted in the revision of multiple language errors. After that, a survey using a convenience sample of 40 samples was carried out, and a total of 32 legitimate samples were collected. In order to assure the representativeness of interviewees and the validity of questions, the pre-test involved the selection of interviewers who have engaged in hiking activities at Wuyishan national park during the past 2 years. This was done to ensure that the interviewees would be representative and that the questionnaires would be genuine. Subsequently, the items that were deemed ambiguous were modified subsequent to the administration of the pretest. The assessment of the survey's reliability was conducted by employing Cronbach's alpha coefficient (with a minimum threshold of alpha >0.70) and analyzing the item-total statistics. Following the assessment of dependability against the required criteria, a formal questionnaire was then developed.

The questionnaire was distributed to hikers by the systematic random sampling method in the Wuyishan national park. The formal

questionnaire was disseminated by a team of six investigators through an offline survey. These investigators were well trained and provided with information regarding the survey's purpose and underlying context. They ensured their proximity to the respondents in order to promptly address any inquiries they might have had. Additionally, a comprehensive explanation was given regarding the voluntary and non-obligatory nature of their participation, coupled with the assurance that all collected information would remain confidential and anonymous. The survey was carried out throughout the months of April and May in 2023. In order to encompass a diverse spectrum of hikers, the distribution of surveys was conducted on several days of the week as well as during holiday times. Questionnaires were disseminated to hikers at the trail rest point of the parks using a systematic sampling method, where every tenth hiker was selected to participate. If the survey results obtained from the sample are extrapolated to a population over 1 million, the study would require a minimum of 384 samples (Krejcie and Morgan, 1970), so a total of 500 questionnaires were distributed and 481 were collected. After conducting a thorough screening process to eliminate questions with inconsistent responses, incompleteness, and had the same score, a total of 466 valid questionnaires were identified. The calculated response rate of the questionnaire was determined to be 93.2%.

4 Results

4.1 Descriptive statistical analysis of the sample

Table 1 presents the demographic characteristics of the respondents. The findings from a total of 466 survey samples indicate that the respondents were predominantly male, accounting for 65.0% of the sample, while females constituted 35.0%. The age distribution of the respondents was concentrated within the range of 25–54 years, representing 82.2% of the sample. In terms of monthly income, the majority of the hikers reported earning between 3,000–9,000 RMB, accounting for 78.7% of the sample. Furthermore, a significant proportion of the hikers, specifically 79.2%, possessed a college degree or higher educational qualification.

4.2 Measurement model testing

Initially, the researchers employed a first order confirmatory factor analysis (CFA) to assess the measurement model using a maximum likelihood estimation method. This study has comprehensively verified the fit statistics of the model by selecting statistics such as $\chi^2/df = 1.658$, goodness of fit index (GFI) = 0.944, adjusted goodness of fit index (AGFI) = 0.925, comparative fit index (CFI) = 0.985, normed fit index (NFI) = 0.962, incremental fit index (IFI) = 0.985, root mean square error of approximation (RMSEA) = 0.038. Generally, if χ^2/df ranges from 1 to 3, if GFI, AGFI, CIF, NFI, and IFI are all above 0.9, indicating that the overall model fits well (Hu and Bentler, 1999). The current study utilized SPSS version 24.0 and AMOS version 23.0 software for the purpose of conducting data analysis. The Cronbach's α coefficient for the overall measurement scale was determined to be 0.954. Additionally, the Cronbach's α values for the individual measurement scales ranged

TABLE 1 Demographic data.

Demographic	Number	Percentage	Demographic	Number	Percentage
Gender			Education		
Male	303	65.0	Less than high school	31	6.70
Female	163	35.0	High school	26	5.60
			Junior college	40	8.60
			Undergraduate	183	39.30
			Master or above	186	39.90
Age (years)			Monthly income (RMB)		
18–24	58	12.40	Under 3,000	55	11.80
25–34	163	35.00	3,001–5,000	148	31.80
35–44	128	27.50	5,001–7,000	113	24.20
45–54	92	19.70	7,001–9,000	106	22.70
≥55	25	5.40	Over 9,001	44	9.40

from 0.786 to 0.969. These values surpass the recommended threshold of 0.7, indicating that the measurement scale exhibits strong reliability and internal consistency (Nunnally, 1978).

4.3 Structural model testing

The results of the overall fit index of the measurement model after modification shown that $\chi^2/df = 2.973$, GFI $= 0.904$, AGFI $= 0.878$, CFI $= 0.951$, NFI $= 0.928$, IFI $= 0.951$, RMSEA $= 0.065$. In general, the criteria of reference were that the Chi/df was under 3, RMSEA was under 0.08, GFI, CFI, IFI, TLI, and NFI were above 0.09, indicating that the overall model fits well (Hu and Bentler, 1999). Although the AGFI is less than 0.9, but it still acceptable (Marsh et al., 1998). The loading values for each latent variable range from 0.687 to 0.828, all of which surpass the standard threshold of 0.60. Additionally, the composite reliability (CR) values fall between 0.758 and 0.871, exceeding the recommended threshold of 0.60. The average variance extracted (AVE) values range from 0.511 to 0.628, surpassing the minimum criterion of 0.50. These results indicate that the convergence validity is satisfactory (Fornell and Larcker, 1981; Hair, 2009), the results showed that the reliability and the convergent validity was sufficient (Table 2). The results of the path analysis indicate a statistically significant relationship between the latent variables. The discriminative validity table (Table 3) demonstrates that the square root of the average variance extracted (AVE) values of the latent variables exceed the correlation coefficients among the different latent variables. This indicates that the discriminant validity is valid and aligns with the established reference standard (Fornell and Larcker, 1981). Overall, the measuring model exhibited satisfactory levels of reliability, convergent validity, and discriminant validity. Furthermore, the obtained data was found to be suitable for application within the measurement model.

4.4 Correlation analysis

The study used the hierarchical regression to assess the predictive power of the extended NAM. In Model 1 (Table 4), the three control variables (gender, age, and education) were collectively able to explain 1.8% of the variance in BI ($R^2 = 0.018$, $F = 2.839$, $P < 0.05$). The findings of this study corroborated a prior investigation, which demonstrated that demographic factors exerted notable effects on individuals' intention. However, it is important to note that the explanatory capacity of these variables was rather limited (Hornik et al., 1995). The impact of age was found to be statistically significant, with a β coefficient of −0.087 ($P < 0.05$), the β value was lower than zero, meaning that its impact on BI was negative, suggesting that there is a tendency for older hikers to exhibit higher levels of ecological intention. Nevertheless, the variables of gender and education did not exhibit statistical significance at the predetermined significance level of 0.05.

In Model 2, the inclusion of three additional variables, namely AC, AR, and PN, was observed. The level of explanatory power achieved in the study was 62.6% ($R^2 = 0.626$, $F = 128.195$, $P < 0.001$). The observed increase in the explanatory power of Model 2 was found to be statistically significant ($\Delta R^2 = 0.608$, $\Delta F = 125.356$, $\Delta P < 0.001$). To clarify, when demographic variables are controlled for, the independent variables of AC, AR, and PN demonstrate a statistically significant increase in the amount of variance in BI that can be explained, accounting for 62.6% of the total variance. The most significant contribution was observed from PN, with a beta coefficient of 0.475 and a $p < 0.001$. The impact of AC and AR on the dependent variable BI was found to be statistically significant, with β values of 0.276 ($P < 0.001$) and 0.209 ($P < 0.001$) respectively, suggesting a positive influence. There has been an decreased in the explanatory capacity of age, shifting from −0.087 to −0.023. At the same time, the explanatory power of gender and education also declined from 0.150 and −0.054 to −0.069 and −0.002, respectively. It is worth noting that when all three demographic factors were controlled for, their combined influence did not yield any statistically significant negative effects.

In Model 3, the researchers introduced the independent variables of PE, CN, and EK, resulting in an increase of 3.8% in the explained variance of BI. The observed increase in the Model 3 was found to be statistically significant ($\Delta R^2 = 0.038$, $\Delta F = −25.05$, $\Delta P < 0.001$). The findings suggest that the inclusion of the extended NAM in Model 3 significantly explained a considerable proportion of the variability

TABLE 2 Results of the confirmative factor analysis.

Constructs and scale items	Factor loading	CR	AVE
The behavior helps to eliminate the unpleasant smell of litter, reduce the number of harmful organisms such as flies and mice, and reduce the spread of disease (EK1)	0.739	0.871	0.629
The behavior helps to reduce the health damage of wild animals caused by eating litter (EK2)	0.811		
I think bringing self-generated litter down the mountain is good (EK3)	0.828		
I think no trash in hiking trails is beneficial (EK4)	0.792		
I have often do the litter behavior in the everyday life (PE1)	0.761	0.813	0.59
I sort litter in the everyday life (PE2)	0.821		
I will stop when I see people littering in the everyday life (PE3)	0.723		
I often feel a sense of oneness with the natural world around me (CN1)	0.775	0.794	0.562
I think of the natural world as a community to which I belong (CN2)	0.777		
I feel as though I belong to the Earth as equally as it belongs to me (CN3)	0.695		
Hikers' litter have negative impacts on natural environment (AC1)	0.739	0.763	0.517
Hikers' litter have negative impacts on wild animals and plants (AC2)	0.727		
Hikers' litter lead to water pollution (AC3)	0.691		
Every hiker is jointly responsible for litter in this national park (AR1)	0.687	0.758	0.511
Every hiker is partly responsible for litter in this national park (AR2)	0.732		
Every hiker must take responsibility for litter problems in this national park (AR3)	0.724		
I feel guilty for not doing litter behavior (PN1)	0.767	0.802	0.574
I think litter behavior is a moral obligation (PN2)	0.765		
Litter behavior is part of my ethics (PN3)	0.741		
I am willing to participate in litter behavior currently (BI1)	0.727	0.779	0.54
I am plan to participate in litter behavior currently (BI2)	0.720		
I am willing to ask my relatives and friends to participate in litter behavior currently (BI3)	0.758		

observed in BI. The analysis revealed that the model accounted for 66.4% of the observed variance ($R^2 = 0.664$), indicating a substantial relationship. Furthermore, the statistical analysis demonstrated that this relationship was statistically significant ($F = 100.306$, $P < 0.001$). In the context of controlling demographic variables, it was seen that the impacts of AC, AR, PN, PE, CN, and EK were all statistically significant. The corresponding β values were found to be 0.152 ($P < 0.01$), 0.129 ($P < 0.01$), 0.365 ($P < 0.001$), 0.123 ($P < 0.01$), 0.120 ($P < 0.01$), and 0.163 ($P < 0.001$). The most significant contribution in Model 3 is attributed to PN. All of the β values exhibited a positive impact on BI, as they were bigger than zero. Nevertheless, the control factors of gender, age, and education did not yield any statistically significant results. The $β$-values for these variables were −0.050, −0.035, and −0.015, respectively. Therefore, the hypotheses H1, H2, H3, H4, H5, H6, and H7 were all found to be supported. However, the hypothesis H8 and H10 were rejected, whereas hypothesis H9 received some support.

5 Conclusion and discussion

5.1 Conclusion

A sustainable increase in tourism that is based on nature requires environmentally conscious actions, which are both an essential practice and a predictor of this expansion (Esfandiar et al., 2020). This research enhances the existing literature by providing useful insights into the factors that affect the litter behavior of hikers in Wuyishan national park. The results show that using the sample of hikers in the Wuyishan national park, NAM demonstrated significant explaining capacity on hikers' litter behavior.

EK, CN, PE all influence hikers' litter behavior. EK play most important effect on BI, PE play the second important, and the CN is the least important. The control variables of gender, age, and educational level were no significant, besides age partly influence the hikers' litter behavior.

5.2 Discussion

Within the realm of national parks and similar nature-centric environments, the NAM hypothesis has been formulated as a means to examine the phenomenon of littering among hikers. This study demonstrated that the NAM is better suited for interpreting the pro-social or pro-environmental aspects of activities, as litter behavior is regarded as a form of pro-social behavior (Zhang et al., 2017). PN had the highest level of influence as a direct indicator of hikers' litter behavior. Numerous research have provided evidence about the significance of personal moral norms in elucidating individuals' intentions and behavior toward pro-environmental actions (López-Mosquera et al., 2014; Han and Hwang, 2016; Meng et al., 2022). Based on the results of this study, the presence of an individual's

TABLE 3 Test of discriminant validity of the study constructs.

Constructs	PE	CN	EK	AC	BI	AR	PN
PE	**0.769**						
CN	0.492	**0.750**					
EK	0.524	0.389	**0.793**				
AC	0.615	0.593	0.509	**0.719**			
BI	0.624	0.589	0.569	0.663	**0.735**		
AR	0.546	0.547	0.469	0.649	0.619	**0.715**	
PN	0.579	0.553	0.511	0.610	0.728	0.574	**0.758**

The numbers in the diagonal row (bold) are the average variance extracted by each latent construct. The numbers above diagonal are the squared correlation coefficients between the constructs.
AR, ascription of responsibility; PN, personal norm; AC, awareness of consequences; EK, environmental knowledge; CN, connectedness to nature; PE, pro-environmental behaviors in everyday life; BI, behavioral intention.

personal moral obligation emerged as a noteworthy determinant in shaping their inclination toward engaging in litter behavior during hiking activities. The subsequent factor that exhibited a stronger impact on hikers' inclination toward engaging in litter behavior was AC. This highlights the significance of the attitude-behavior consistency construct in assessing hikers' individual norms and, consequently, their propensity to engage in litter behavior (Van der Werff et al., 2019; Meng et al., 2020; Esfandiar et al., 2021). AR and AC are believed to be more reliable predictors of behavior than environmental stimuli since they originate from within humans and come before them (Kim et al., 2003; Zoltan and Masiero, 2012). When formulating a theoretical framework for understanding pro-social behaviors in the context of litter behavior, it is crucial to first address problem awareness and personal norms that encompass a sense of obligation toward altruistic deeds. This will assist researchers in the tourist sector in enhancing their ability to stimulate hikers' inclination to engage in environmentally harmful behavior, specifically littering.

CN is a significant factor in predicting pro-environmental behavior at the individual level, since individuals' emotional connection to nature influences their inclination to engage in environmentally friendly actions (Arendt and Matthes, 2016). In line with this perspective, the findings of the present study provide empirical evidence supporting the notion that individuals' emotional affinity toward nature, sometimes referred to as connection, exerts a substantial influence on their engagement in pro-environmental actions (Wilson, 2017). Schultz's postulation regarding the cognitive representation of self to nature, specifically CN, and its role in promoting individuals' intentions to engage in protective behaviors toward the natural environment, lends credence to the present study (Schultz, 2002). The hikers' recognition of their dependence on the natural environment serves as a driving force for them to exhibit environmental consciousness, hence impacting their disposal habits with regards to litter. To promote responsible litter behavior among hikers, it is advisable for national parks to provide information and emphasize the possible advantages of outdoor activities for the natural environment, ecosystem, and animals. The current study offers empirical evidence to support the notion that hikers' decision-making regarding litter behavior remains significant and positively influenced by their willingness to make sacrifices for the natural environment and their sense of connectedness to nature. This relationship holds true even when considering other cognitive and affective factors within a comprehensive conceptual framework. The utilization of these variables should be actively employed as catalysts for decision-making

and behavior pertaining to litter while constructing a conceptual model or theory associated with this subject matter.

PE was identified as one of the most critical factors in determining hikers' propensity to engage in litter behavior. The findings of this study align with other research that highlights the importance of daily environmentally conscious behaviors in the process of making purchasing decisions. These results underscore the value of everyday eco-friendly actions and emphasize that their importance cannot be exaggerated (Untaru et al., 2016; Han and Hyun, 2018b). There is an implicit necessity to promote eco-friendly behaviors among travelers in their daily lives to optimize their litter management practices in national parks. The results of our study offer significant empirical support for the notion that promoting regular participation in conservation activities has a positive impact on individuals' propensity to engage in litter behavior. This conclusion holds considerable implications for both academic researchers and practitioners in the field. Hence, it is imperative for national park management to proactively explore efficient strategies to promote consistent adoption of litter-free practices among existing and prospective hikers. One effective approach is to communicate to individuals that the potential advantages of engaging in everyday conservation actions for both themselves and society are likely to exceed their first perceptions.

EK had significantly positive influences toward the hikers' litter behavior. The result, which was in line with what had been found in other studies, demonstrated that environmental sensitivity can be directly improved by increasing visitors' level of environmental literacy (Vagias et al., 2014). Hence, it is imperative for relevant administrative departments to enhance hikers' theoretical understanding of the consequences of litter on the environment and society. Additionally, they should also provide hikers with practical knowledge regarding emerging environmental initiatives. These efforts can effectively foster a positive mindset toward responsible behavior, consequently influencing hikers' intentions to refrain from leaving litter on mountains.

Regarding demographic characteristics, the age, gender and education of hikers were shown to have no significant effects on their desire to engage in litter behavior. It was shown that although age initially affects hikers litter behavior, but the effect was not statistically significant in the extended NAM, the result was opposite with some research (Hu et al., 2019; Ahmad et al., 2021). One reason may be that the proportion of elderly people in the sample is not large, because hiking is a physical sport, and most of them are young and

TABLE 4 Hierarchical regression analysis.

Variables	Model 1		Model 2		Model 3			
	β	t-value	β	t-value	β	t-value	Tolerance	VIF
Gender	0.150	1.656	−0.069	−1.218	−0.05	−0.912	0.956	1.046
Age	−0.087*	−2.090	−0.023	−0.894	−0.035	−1.398	0.863	1.159
Education	−0.054	−1.381	−0.002	−0.072	−0.015	−0.632	0.893	1.120
AC			0.276***	6.467	0.152**	3.424	0.412	2.430
AR			0.209***	4.603	0.129**	2.882	0.490	2.041
PN			0.475***	12.337	0.365***	9.190	0.482	2.073
PE					0.123**	3.328	0.505	1.978
CN					0.120**	3.370	0.558	1.791
EK					0.163***	4.252	0.605	1.653
Model summary								
F	2.839		128.195		100.306			
R²	0.018		0.626		0.664			
ΔF	2.839		125.356		−25.05			
ΔR²	0.018		0.608		0.038			

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

AR, ascription of responsibility; PN, personal norm; AC, awareness of consequences; EK, environmental knowledge; CN, connectedness to nature; PE, pro-environmental behaviors in everyday life; BI, behavioral intention.

middle-aged people. Other reason possible that hikers are a group that attaches great importance to environmental protection (Farías Torbidoni, 2011), and there is no gap in litter behavior based on age. Gender had insignificant impacts on their intention, this observation aligns with the outcomes of the investigation (Pazokinejad and Salehi, 2014; Shafiei and Maleksaeidi, 2020). It was different from than some research found that females is higher than that of males for environmental behavior (Torgler and Garcia-Valiñas, 2007; Xiao and Hong, 2018; Hu et al., 2019). Maybe it's because hikers are a group that attaches great importance to environmental protection, they are better educated and more environmentally conscious (Farías Torbidoni, 2011). They value the natural environment and landscape of destinations and support nature conservation (Collins-Kreiner and Kliot, 2017; Lin and Lee, 2020). education had insignificant impacts on their intention, It was different from than some research (Sarvestani, 2012; Cai et al., 2017). We assume that this phenomenon was caused by the fact that the hikers had met the threshold education level, hence the influence of education was not significant. Moreover, More affluent individuals may also exhibit a greater desire for a pristine environment and reduced ecological harm (Fan et al., 2013).

5.3 Implications

This study represents one of the initial endeavors to investigate the litter behavior of hikers within China's Wuyishan national park. This inquiry serves to show the theoretical contributions made to the current literature. A comprehensive analysis of several preceding scholarly articles reveals that hikers exhibit a proclivity toward endorsing environmental preservation and derive pleasure from the natural surroundings and topography of their chosen hiking locations. This study showed greater detail for hikers' litter behavior, and it showed that hikers cherish the surroundings and terrain of

their destinations (Collins-Kreiner and Kliot, 2017; Lin and Lee, 2020). To put it another way, the behavior of littering hikers is mostly driven by an internal demand because hikers have a profound love of environment and a desire to protect it. The motivation for a hiker's PEB stems from an intrinsic desire rather than being solely driven by the act of showcasing their affinity for the natural environment. Hikers, as individuals, place great importance on the preservation and appreciation of the pristine landscapes found within national parks. This finding is derived from previous research that conducted a comparison between the environmentally conscious intents of tourists from local and non-local origins. The study concluded that the NAM model shown greater suitability in explaining the behaviors of non-local tourists (Li and Wu, 2019).

The establishment of national parks is done with the intention of preserving the natural environment, and the conservation efforts of particular nations are an essential component of the protection of the planet's ecosystems. In addition to this, national parks serve the purpose of national nature education. Through this, hikers gain an understanding of the significance of protecting the ecological environment and the diversity of plant and animal life, which in turn encourages them to not litter (Bushell and Bricker, 2017; Klein and Hilbig, 2018; Esfandiar et al., 2022). In light of the increasing number of individuals engaging in hiking activities, it is imperative for national parks to offer a diverse range of strategies and initiatives aimed at effectively influencing visitors' litter disposal practices. National parks should offer educational programs focused on the functioning of ecological systems. In addition, it is imperative for these parks to enhance the dissemination of environmental conservation information and provide practical guidelines for effective environmental preservation. Furthermore, the necessity of establishing national parks has the potential to facilitate the dissemination of information through informal communication channels, consequently

enhancing hikers' perception of their environmental consciousness and obligation.

5.4 Limitations and future research

Notwithstanding the unique viewpoint offered by this study regarding the examination of electroreceptor bands among hikers in China's Wuyishan national park, it is imperative to acknowledge certain constraints that necessitate further inquiry. These shortcomings call for further inquiry. To begin, there are five national parks in China, but the subject of this study is only a hiker in Wuyishan national park. Because of this, the findings of this study may not be applicable to other national parks. Furthermore, the researchers did not take into account the influence of incentives in their research. In the future, study could concentrate on the various ways in which different incentives have an effect on hikers' litter behavior regarding their actions. In conclusion, we advocate for additional research on the litter behavior of Chinese hikers, particularly the site-specific sorts of litter they leave behind in natural settings.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found at: 10.6084/m9.figshare.23943201.

Author contributions

HS: Conceptualization, Data curation, Formal analysis, Writing – original draft, Writing – review & editing. FY: Investigation, Methodology, Writing – original draft. WG: Funding acquisition, Project administration, Writing – original draft.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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