

## Unraveling the Complex Relationships between Environmental Drivers and low-carbon tourism behaviors: A Structural Equation Modeling Approach in Guizhou Province, China

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**Abstract.** Understanding the role of environmental drivers, such as knowledge, awareness, concern, values, and responsibility, is crucial for promoting low-carbon tourism behavior and developing effective strategies for sustainable tourism management. This study investigates the role of environmental knowledge, awareness, concern, values, and responsibility in promoting low-carbon tourism behavior in Guizhou Province, China. Drawing upon the Stimulus-Organism-Response (SOR) model, the study proposes a theoretical framework linking environmental drivers to low-carbon tourism attitudes, intentions, and behaviors. Data were collected using a questionnaire survey conducted in 885 tourists visiting various scenic spots in Guizhou Province. Structural equation modeling was employed to test the hypothesized relationships. The results indicate significant positive effects of environmental knowledge, awareness, concern, and responsibility on low-carbon tourism attitudes, intentions, and behaviors, but a negative effect of environmental values on low-carbon tourism behavior. In addition, the study highlights the roles of low-carbon tourism attitudes and intentions as mediators of the relationships between environmental drivers and behaviors. The results offer valuable insights into the complex mechanisms through which environmental drivers influence sustainable tourism practices and provide practical implications for tourism management. Overall, the study has theoretical contributions to the SOR model and the low-carbon tourism literature, providing new directions for future research.

**Keywords:** Environmental Knowledge, Environmental Awareness, Environmental Concern, Environmental Values, Environmental Responsibility, Low-Carbon Tourism Attitude, Low-Carbon Tourism Willingness, Low-Carbon Tourism Behavior, Guizhou Province

## 1. Introduction

In consumer research, knowledge is considered to impact the decision-making process and consumers' evaluation of products/services (Alba & Hutchinson, 1987; Tantawi et al., 2009). Environmental knowledge empowers them to make informed decisions aimed at minimizing negative environmental impacts and encourages the adoption and advocacy of low-carbon tourism behaviors ((Lisa et al., 2006). A deep awareness of the environment equips consumers with the understanding of the environmental implications of tourism activities and the significance of sustainability, thereby shaping positive attitudes and intentions (Kousar et al., 2022). This perception makes consumers realize that their tourism behavior directly influences carbon emissions, resource consumption, and ecosystem conservation. Consumers' perception of the environment motivates them to be more willing to opt for low-carbon modes of transport, reduce energy usage, select eco-friendly accommodation, and support local communities (Gadenne & Mckeiver, 2009). They proactively seek out low-carbon tourism options and participate in environmental projects and initiatives. Consumers' environmental concerns heighten their sensitivity to environmental issues and drive them to adopt sustainable behaviors in tourism (Lisa et al., 2006). Clearly, consumers' environmental concerns play a pivotal role in shaping attitudes and intentions toward low-carbon tourism behaviors. When consumers' environmental values are high, they perceive environmental protection as a core value and personal responsibility, believing that tourism behavior should align with environmental protection (Verma et al., 2019). Consumers' environmental values prompt them to integrate environmental protection into their travel decisions and seek out destinations and service providers that prioritize environmental sustainability. They actively seek low-carbon tourism options and are willing to contribute personally to sustainable development (Dunlap et al., 1983). Using a sample of 445 members of a transport association in Switzerland, an empirical analysis for the utility of the extended attitudinal model revealed that including feelings of environmental responsibility considerably increased participants' eco-behavioral intentions (Kaiser et al., 1999). When consumers harbor a stronger sense of environmental responsibility, they acknowledge that their personal behavior impacts the environment and take responsibility for protecting it (Kautish et al., 2019).

Previous studies have emphasized mainly on the implementation and policy aspects of low-carbon tourism, such as carbon emission control and transportation mode change. Although such studies are valuable for the promotion and practice of low-carbon tourism, they do not provide sufficient insights to understand the motivations and psychological mechanisms of tourists when choosing low-carbon tourism. Therefore, first, based on stimulus-organism-response (SOR) theory, this study clearly defines the dimensions of drivers of low-carbon tourism and applies the deductive method to construct a theoretical model for the influence of drivers on low-carbon tourism behavior. Second, by applying multiple regression analysis, this study empirically analyzes the influence of drivers on low-carbon tourism behavior and verifies the relationship between drivers and low-carbon tourism behavior by using objective data. In summary, the objectives of this study include (1) verifying the relationship between drivers and low-carbon tourism behavior; (2) determining the influence of different dimensions of drivers on low-carbon tourism behavior; and (3) analyzing the mediating role of low-carbon tourism attitudes and intentions on the relationship between drivers and low-carbon tourism behavior.

The theoretical significance of this study is to deepen the understanding of the relationship between environmental drivers and consumer low-carbon tourism behavior, expand the relevant theoretical framework, and provide support for the development of sustainable tourism theory and practice. By constructing a model of the relationship between environmental drivers and low-carbon tourism behavior, this study provides a theoretical basis for the drivers of low-carbon tourism behavior, enriches, and expands the application of environmental drivers in the field of low-carbon tourism, and provides a new perspective for deepening the understanding of the drivers of low-carbon tourism behavior. In terms of practical significance, the study of the drivers and influence paths of low-carbon tourism behavior helps to promote the transition of tourism to low-carbon, reduce environmental impacts,

enhance the awareness of sustainable development, improve the competitiveness of the industry, and facilitate the formulation of policies.

The structure of the study is as follows: Section 2 reviews the literature and develops hypothesis. Section 3 presents the methodology. Section 4 discusses the study results. Section 5 presents managerial implications, and Section 6 presents the study conclusions.

## **2. Hypothesis Formulation and Theoretical Modeling**

### **2.1. Research Hypothesis**

#### **2.1.1. Environmental knowledge and low carbon tourism behavior and low carbon tourism attitudes and intentions**

Relevant studies have shown that environmental knowledge provides travelers with insights and perceptions of the environmental issues, allowing them to be aware of the environmental impacts of tourism activities, including carbon emissions, resource depletion, and ecological damage (Gunarathne, Kaluarachchilage, Rajasooriya, & Recycling, 2020). This knowledge enables them to better assess and understand their tourism behaviors and thus take appropriate low-carbon measures (Chang, Hernández-Díaz, & Lo, 2020). Furthermore, environmental knowledge enables tourists to understand the carbon emissions and energy consumption of different modes of transportation, make rational judgments, and choose low-carbon modes of transportation, such as public transport, cycling or walking, to reduce their carbon footprints (Abbas, Kousar, & Sustainability, 2021; Ahmed et al., 2022).

**H1:** Environmental knowledge has a positive effect on low-carbon tourism behavior.

Consumers' environmental knowledge profoundly affects their attitudes toward low-carbon tourism behavior. When consumers have sufficient environmental knowledge, they are more aware of the seriousness and urgency of environmental problems and recognize the impact of tourism behavior on carbon emissions and resource consumption (Ardoin, Bowers, & Gaillard, 2020). This knowledge fosters a positive attitude among them toward low-carbon tourism. Some scholars have found that when consumers have rich environmental knowledge, they are more likely to use public transportation, reduce energy consumption, choose environmentally friendly accommodations, and respect and protect the local natural environment. Their environmental knowledge provides them a deep understanding of the impacts of tourism behavior and environmental sustainability, which in turn motivates them to adopt positive low-carbon tourism behavioral intentions (Tamar, Wirawan, Arfah, & Putri, 2020). Accordingly, we propose the following hypotheses:

**H1a:** Environmental knowledge positively influences low-carbon tourism attitudes.

**H1b:** Environmental knowledge positively influences low-carbon tourism intentions.

#### **2.1.2 Environmental awareness and low-carbon tourism behavior, attitudes, and intentions**

It has been argued that when tourists' environmental knowledge and awareness are low, their environmental behavior is negative. Once they acquire environmental knowledge, this relationship is strengthened, which has a positive impact on their environmental behavior (Aman et al., 2021). Environmental awareness also promotes consumers to reduce wastage and conserve resources: environmentally conscious travelers tend to conserve resources and reduce wastage. They are likely to choose low-carbon hotels, ask for reduced water and energy consumption, avoid wasting food, and choose products that use renewable energy and sustainable materials (Ibnou-Laaroussi, Rjoub, & Wong, 2020; L. Wang, Wong, & Narayanan Alagas, 2020).

**H2:** Environmental perceptions have a positive effect on low-carbon tourism behavior.

When consumers possess deep knowledge of the environment, they are more aware of the environmental impact of tourism activities and the importance of sustainability, which positively shape their attitudes and intentions (Kousar, Afzal, Ahmed, & Bojnec, 2022). It makes them realize that their tourism behavior has a direct impact on carbon emissions, resource consumption, and ecosystem conservation. Consumers' environmental awareness increases their willingness to choose low-carbon

transportation options, reduce energy use, choose eco-friendly accommodations, and support local communities (S. Wang, Zhou, & Tian, 2022). However, some scholars disagree with this notion, arguing that in the era of information explosion, individuals may have access to a large amount of information about the environment and tourism, leading to information overload and cognitive dissonance, making their environmental cognition inadequate to help in the formation of positive low-carbon tourism awareness (GanLu, 2016). Therefore, to verify the relationship between environmental cognition and low-carbon tourism attitudes and intentions, the following hypotheses are proposed:

**H2a:** Environmental perceptions positively influence low-carbon tourism attitudes.

**H2b:** Environmental perceptions positively influence low-carbon tourism intentions.

### **2.1.3 Environmental Concerns and Low-Carbon Tourism Behavior and Low-Carbon Tourism Attitudes, Intentions**

Some scholars have found that deep concern for environmental issues leads individuals to exhibit environmentally responsible behavior (Malik & Policy, 2020). Research has shown that an individual's strong environmental concerns and way to respond to them shape their behavior. Scholars have reported multiple effects of environmental concerns on different low-carbon behaviors (Schultz et al., 2005). Environmentally concerned tourists not only adopt low-carbon tourism behaviors but may also actively support and promote sustainable tourism initiatives. They may influence others to promote greener practices in the tourism industry and local communities by sharing their eco-tourism experiences on social media, participating in environmental organizations, or joining environmental advocacy groups (Z. Wang & Phromphitakkul, 2022). Therefore, the following hypothesis is proposed:

**H3:** Environmental concern has a positive effect on low-carbon tourism behavior.

Consumers' environmental concerns have a significant impact on their low-carbon tourism behavioral attitudes and intentions. When consumers have strong concerns about environmental issues, they are more aware of the impact of tourism behavior on the environment (Rasheed, Bilal, Nabeel, Adeel, & Iqbal, 2019) and are willing to adopt low-carbon tourism behaviors for mitigating negative impacts (Cruz & Manata, 2020; Mostafa, 2007). Moreover, environmental concern stimulates their positive attitudes and intentions toward low-carbon tourism (Bilal, Adeel, Rasheed, Zhao, & Iqbal, 2019). They tend to choose sustainable modes of transportation, such as public transportation or bicycles, thereby indirectly reducing energy consumption and carbon emissions (Choi, Johnson, & Consumption, 2019). In addition, they are more likely to choose environmentally friendly accommodations, support local communities, and purchase environmentally friendly products. Consumers' environmental concerns make them more sensitive to environmental issues and motivate them to adopt sustainable behaviors in tourism. Therefore, the following hypotheses are proposed:

**H3a:** Environmental concerns positively influence low-carbon tourism attitudes.

**H3b:** Environmental concern positively influences low-carbon tourism intention.

### **2.1.4 Environmental values and low carbon tourism behavior and low carbon tourism attitudes and intentions**

Environmental values refer to the way a person perceives, evaluates, and values the environment (Layzer & Rinfret, 2019; Strang, 2020). Consumers' environmental values have a profound impact on their low-carbon tourism behavior (Szabo & Webster, 2021). Consumers are more likely to choose low-carbon travel when they place a high value on environmental protection, sustainable development, and social responsibility (Dunlap, Grieneeks, & Rokeach, 2019). Some scholars hold a different view, arguing that external factors may also affect the behavior of individuals, preventing their environmental values from being transformed into actual low-carbon tourism behaviors. For example, individuals may be influenced by the social environment, economic factors, cultural habits, etc., which cause them to deviate from the principle of environmental protection when opting for the mode of tourism (Li, 2023). Therefore, to verify the relationship between environmental values and low-carbon tourism behavior, the following hypotheses are proposed:

**H4:** Environmental values have a positive effect on low-carbon tourism behavior.

Consumers' environmental values have a profound impact on their low-carbon tourism attitudes and intentions. When consumers' environmental values are high, they regard environmental protection as a core value and personal responsibility, and believe that tourism behavior should be consistent with environmental protection (V. K. Verma, B. Chandra, & S. J. J. o. B. R. Kumar, 2019). This value fosters positive attitude and intention toward low-carbon tourism, promoting tourists to choose sustainable modes of transportation, such as public transportation or bicycles for reducing carbon emissions (Yuriev, Dahmen, Paillé, Boiral, & Guillaumie, 2020). Tourists with environmental values are also more likely to choose environmentally friendly accommodations, support local communities, and purchase environmentally friendly products. They incorporate environmental protection into their travel decisions and are more likely to choose destinations and service providers that emphasize environmental sustainability. They actively seek low-carbon travel options and are willing to make a personal contribution to sustainable development (Dunlap et al., 2019). Overall, consumers' environmental values play a key role in shaping attitudes and intentions toward low-carbon tourism, driving them to act in support of environmental protection and sustainable tourism. Therefore, the following hypotheses are proposed:

**H4a:** Environmental values positively influence low-carbon tourism attitudes.

**H4b:** Environmental values positively influence low-carbon tourism intentions.

### **2.1.5 Environmental Responsibility and Low-Carbon Tourism Behavior and Low-Carbon Tourism Attitudes and Intentions**

Consumers' sense of environmental responsibility is closely related to their low-carbon tourism behavior. Environmentally responsible consumers recognize their impact on the environment and are aware of their responsibility to take action to reduce carbon emissions and resource consumption (Bouman et al., 2020). This sense of responsibility motivates them to choose low-carbon tourism behaviors. They tend to use public transportation, reduce energy consumption, choose environmentally friendly accommodation, support local communities and environmental projects, and respect and protect the local natural environment (Onwezen, Antonides, & Bartels, 2013; Wan, Zhang, Cheung, & Qiping Shen, 2012). Consumers' sense of environmental responsibility drives them to adopt sustainable behaviors in tourism to protect the environment and create a more sustainable tourism environment for future generations (Severo, De Guimaraes, & Dellarmelin, 2021). Therefore, the following hypothesis is proposed:

**H5:** Environmental responsibility positively influences low-carbon tourism behavior

Consumers' sense of environmental responsibility has a significant impact on their low-carbon tourism attitudes and intentions. When consumers have a strong sense of environmental responsibility, they understand the impact of their personal actions on the environment and are willing to take responsibility for environmental protection (Kautish, Paul, & Sharma, 2019). This sense of environmental responsibility fosters positive attitude and intention toward low-carbon tourism. They tend to choose low-carbon modes of transportation, such as public transportation or walking, to reduce carbon emissions. In addition, they are more likely to choose eco-friendly accommodation, support local communities, and purchase eco-friendly products (Onwezen et al., 2013). Furthermore, the sense of environmental responsibility leads tourists to consider environmental impacts in their travel decisions and seek sustainable options. They are concerned about the environmental commitment of destinations and service providers and are more inclined to support initiatives that are dedicated to environmental protection and sustainable development (Szabo & Webster, 2020). Therefore, the following hypotheses are proposed:

**H5a:** Environmental responsibility positively influences low-carbon tourism attitudes.

**H5b:** Environmental responsibility positively influences low-carbon tourism intentions.

### **2.1.6 Low Carbon Tourism Attitudes and Low Carbon Tourism Intentions and Low Carbon**

### Tourism Behavior

Research has shown that people with a positive attitude toward a particular thing are more likely to have a corresponding willingness to engage in practices aim at protecting it. Wanqing Lu (Social Scientist, 2019) studied residents' behavior in participating in sustainable heritage tourism based on the TPB model and found that attitude had the most significant effect on willingness. Some scholars have also raised objections, arguing that individual behavior is often influenced by social norms and group influence. Even if an individual holds an attitude in favor of low-carbon tourism, if there is a lack of culture and atmosphere in the surrounding environment that supports low-carbon tourism, the individual may be subjected to external pressures and change his or her original intention (Peng, 2016). Singh et al. (Singh & Gupta, 2013) studied the effect of individuals' environmental attitudes on their ecological behavior by interviewing 300 Indian residents and concluded that consumers' ecological behavior is influenced by their attitudes toward the environment, which can be used as a predictor of ecological behavior. Ma Ben et al. (Maben, 2016) found a positive correlation between conservation attitude and conservation behavior in a study of the conservation attitude and behavior of farmers. Lili Chen used Pearson's correlation analysis and structural equation modeling to study the relationship between different variables and low-carbon tourism behavior and concluded that low-carbon tourism willingness positively affects their low-carbon tourism behavior (Lili, 2018). Overall, low-carbon tourism attitudes may positively influence low-carbon tourism intentions and behaviors, while low-carbon tourism intentions may positively influence low-carbon tourism behaviors. Based on these observations, this study proposes the following hypotheses:

- H6:** Low-carbon tourism attitude has a positive effect on low-carbon tourism behavior.
- H7:** Low-carbon tourism intentions has a positive effect on low-carbon tourism behavior.
- H8:** Low-carbon tourism attitude has a positive effect on low-carbon tourism intentions.

### 2.2.Theoretical Model

Drawing from the aforementioned assumptions, this paper constructs a mediation model of environmental drivers influencing low-carbon tourism behaviors based on the SOR theoretical model, as depicted in Figure 1.

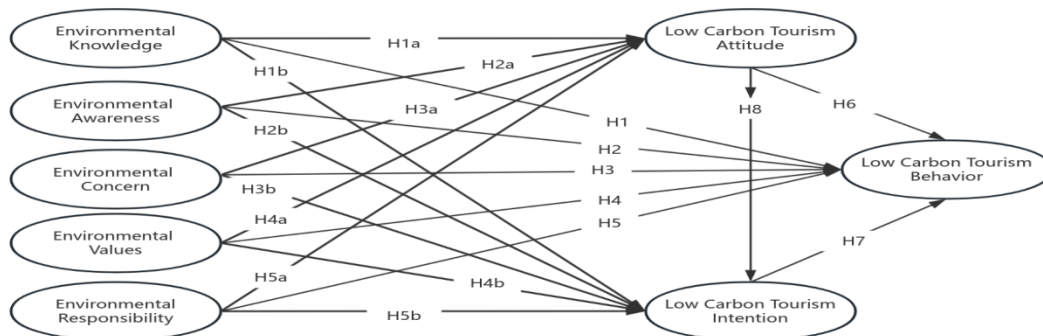


Fig. 1: Mediation model of environmental drivers influencing low-carbon tourism behaviors

## 3. Research methodology

### 3.1.Measurement of variables

To validate the proposed propositions, a 5-point Likert scale (1 = strongly disagree and 5 = strongly agree) was developed in this study. The five dimensions of environmental drivers, namely environmental knowledge, environmental awareness, environmental concern, environmental values, and environmental responsibility, were adapted from Kaiser, Gatersleben, Kaiser et al. scales (Gatersleben, Steg, & Vlek, 2016; Kaiser et al., 1999). These five dimensions consist of 10, 12, 5, 7, and 5 items, respectively. To measure the effect of stimuli on an individual's cognition or mood, Kuo et al. (Kuo & Dai, 2015) measured tourists' low-carbon tourism attitudes and intentions, both of which

consisted of four items. To examine tourists' low-carbon tourism behavior, 12 items from Feng et al. (Feng, 2022) were used in this study. According to the standard translation process, we first asked two professional English teachers to translate the original English version of the scale into Chinese language. We then consulted a specialized translation agency to translate it into English. Several experts involved in the translation completed the revision after many discussions on the ambiguity of the questionnaire

### 3.2. Pilot study

Due to differences in cultural backgrounds between China and the West, we assumed that some of the questions in the questionnaire may seem ambiguous to the participants, which necessitated a pretest procedure. The questionnaire comprised 37 observed variables. According to the principle, the sample size of the pretest survey was 3–5 times the number of questionnaire items, with more than 111 volunteers capable of meeting the standard. We conducted a pilot study in five tourist attractions: Huangguoshu Waterfall (5A), Guizhou Province; Qianling Mountain Park (4A), Guizhou Province; Datong Ancient Town (3A); Dahebao Hot Springs Tourist Area (2A), Liupanshui City, Guizhou Province; and ShuiCheng Iron Art Culture Park Scenic Spot (1A), Liupanshui City, Guizhou Province. These five scenic spots are all official scenic spots certified by the Ministry of Tourism of China, representing five levels of tourist attractions. Through a convenient sampling method and the distribution of online questionnaires, 151 tourists from each scenic spot were contacted on site, and 143 valid samples were finally obtained. The data were then analyzed using SPSS 27 for item analysis, reliability analysis, and validity analysis of the scales. The results showed that the reliability of the eight scales ranged from 0.76 to 0.85, indicating good reliability, and the factor loadings of the questionnaires were within the normal range of 0.58–0.90. We reviewed the questionnaires based on relevance and specificity. In addition, we modified the presentation of the five items in the scale, resulting in the final version of the questionnaire.

### 3.3. Sampling and survey process

We initially employed purposive sampling, targeting local and foreign tourists in Guizhou Province. The sampling process was stratified based on the number of A-class scenic spots in Guizhou Province. Due to the large amount of data, the sample size used in this study needed to be at least four to five times the total number of questions on the variables or items used in the study. Generally, the number of observations should be at least five times the number of variables to be analyzed, with a more acceptable ratio being 10:1 (Rahmiati et al., 2020). To ensure the final effective sample size, 900 questionnaires were distributed in this study. The questionnaire survey was conducted from October to November 2023 at various tourist attractions in Guizhou Province. Initially, 892 questionnaires were collected, resulting in a recovery rate of 99%. After data cleaning, 885 valid questionnaires were finally retrieved.

Due to a large number of tourists in Guizhou Province, first, we divided the sample into five levels according to the level of scenic spots: 5A, 4A, 3A, 2A and 1A. Second, we divided the quantities of the research objects according to the number of scenic spots in each level proportionally, as shown in Table 1.

Table 1 Summary of sample size for scenic area classification in Guizhou Province

Serial number	Scenic Area Level	Number of Scenic Area Levels	Sample Size
1	5A	8	12
2	4A	133	207
3	3A	375	582
4	2A	47	73
5	1A	7	11
total		570	885

### 3.4. Data analysis

We conducted data analysis using SPSS 27 and AMOS 24 software. SPSS was utilized for basic data analysis, while AMOS facilitated structural equation modelling (SEM), allowing for the retention of complete variable information and the evaluation of the proposed model. The analysis proceeded in several stages. First, descriptive statistical, reliability, and validity analyses were performed using SPSS software. Second, the fit between variables was tested through validated factor analysis (CFA) using AMOS. Third, SEM was employed to validate the research model and hypotheses. To further explore the influence path of the relation between variables, we utilized 5,000 sub-samples. A 95% confidence level was set to determine the significance of the mediating role of low-carbon tourism attitude and willingness.

## 4. Results

### 4.1. Demographic information

The demographic information of the 885 participants is summarized in Table 2. Of the total participants, 349 (39.4%) were men and 536 (60.6%) were women. The age distribution of the tourists primarily ranged from 20 to 60 years, encompassing 88.3% of the surveyed population. In terms of occupational distribution, tourists in Guizhou Province have diverse occupations, with students, government workers and others accounting for 22.0%, 30.4% and 47.6% respectively. In terms of educational level, the majority of the participants possessed qualifications higher than bachelor's degree, constituting 54.1%. Regarding household income, 307 (34.7%) participants reported a monthly income exceeding 5,000 yuan, 465 (52.5%) participants reported the income of 2000–5000 yuan per month, and 113 (12.8%) participants reported a monthly income of less than 2000 yuan.

Table.2: Participant demographic information(N=885)

Item	Category	Count	Percentage (%)
Gender	Male	349	39.4
	Female	536	60.6
Age	<20	88	9.9
	20-40	497	56.2
	41-60	284	32.1
	>60	16	1.8
Career	Student	195	22.0
	National staff	269	30.4
	other	421	47.6
Educational Level	undergraduate or higher	479	54.1
	Primary and above	386	43.6
Address	Below elementary school	20	2.3
	Guizhou Province	370	41.8
	Other provinces	515	58.2
Economic Situation	>5000	307	34.7
	2000-5000	465	52.5
	<2000	113	12.8

### 4.2. Reliability analysis

Reliability denotes the consistency or stability of the measurement outcomes, indicating how a scale yields similar results upon repeated measurements. This research utilized Cronbach's alpha coefficient to assess the internal consistency of the questionnaire and that of each item. Additionally, it evaluated the internal consistency among variables within the same factor and across the entire scale. Although

no uniform standard exists, most scholars have considered an alpha coefficient exceeding 0.8 indicative of high reliability, while values falling between 0.7 and 0.8 have been deemed acceptable. Reliability is considered average for values between 0.6 and 0.7, poor between 0.5 and 0.6, and if the value is below 0.5, reconsideration of the questionnaire organization is warranted. Table 3 provides the alpha reliability values for the five environmental drivers, low-carbon tourism attitudes, low-carbon tourism intentions, and low-carbon tourism behaviors

All measures exhibited high Cronbach's alpha coefficients. A Cronbach's alpha value of  $\geq 0.6$  is considered as proof of the reliability of the scale, indicating its feasibility for use in research. Since these values for all the measures in this study were above 0.8, they were considered reliable for testing the hypotheses of this study.

Table.3: Confidence analysis table

Sr.No	Study variables	Number of items	Cronbach's Alpha reliability
1	Environmental Knowledge	5	0.916
2	Environmental Awareness	5	0.913
3	Environmental Concerns	4	0.863
4	Environmental Values	4	0.884
5	Environmental Responsibility	5	0.883
6	Low-Carbon Tourism Attitudes	4	0.874
7	Low-Carbon Tourism Intentions	3	0.845
8	Low-Carbon Tourism Behavior	6	0.937

### 4.3. Validity analysis

#### 4.3.1. Convergent validity

Combined reliability (CR) serves as a discriminatory criterion for assessing the intrinsic quality of a model, gauging whether all items measuring each latent variable consistently elucidate that latent variable. Convergent validity of each dimension is assessed through the average variance extracted (AVE) value, a common metric for evaluating the convergent validity of a scale. The AVE value directly reflects the proportion of variance in the measured variable attributable to the latent variable, with higher AVE values indicating a greater percentage of explained variance and less relative measurement error.

Table.4: Cluster validity and content validity analysis table

Enterprise	AVE	CR
Environmental Knowledge	0.687	0.916
Environmental Awareness	0.677	0.913
Environmental Concerns	0.612	0.863
Environmental Values	0.655	0.884
Environmental Responsibility	0.602	0.883
Low Carbon Tourism Attitudes	0.634	0.874
Low Carbon Tourism Intentions	0.582	0.847
Low Carbon Tourism Behavior	0.718	0.938

The model's AVE and CR test outcomes reveal that each factor's CR exceeded 0.7, indicating consistent explanatory power of all measured items within each latent variable. Additionally, AVE values surpassing 0.5 indicated strong convergent validity. Table 4 illustrates that the scale utilized in this study exhibits robust convergent validity.

### 4.3.2. Discriminant validity

In this study, the relation between variables was assessed using Pearson correlation analysis, along with taking the square root of the AVE values. Table 5 demonstrates that the mean values of the four dimensions—environmental knowledge, environmental awareness, environmental values, and low-carbon tourism behavior—were notably high, exceeding 0.8. The mean values of environmental concern, environmental responsibility, low-carbon tourism attitude, and low-carbon tourism willingness were below 0.8, indicating relatively low levels. Most variables exhibited significant correlation, with all dimensions displaying significant positive correlations ( $p < 0.001$ ).

Table.5: Discriminant validity Scale

	EK	EA	EC	EV	ER	LCTA	LCTI	LCTB
EK	0.829							
EA	0.346**	0.823						
EC	0.409**	0.316**	0.782					
EV	0.26**	0.123**	0.264**	0.809				
ER	0.404**	0.296**	0.407**	0.203**	0.776			
LCTA	0.399**	0.345**	0.493**	0.316**	0.406**	0.796		
LCTI	0.551**	0.21**	0.414**	0.357**	0.452**	0.204**	0.763	
LVTB	0.518**	0.381**	0.507**	0.253**	0.491**	0.53**	0.522**	0.847

Note: The lower left data are correlation coefficients and the diagonal data are AVE square root values

As indicated in Table 5, the AVE square root value of each variable is greater than the correlation coefficient between any two variables, which satisfies the criteria for evaluating discriminant validity, indicating that the discriminant validity between any two variables is good, suggesting that the scale has good discriminant validity.

### 4.4. Confirmatory factor analysis

Confirmatory factor analysis (CFA) is a statistical technique used to assess whether the relation between a factor and its corresponding observed variables aligns with the researcher's theoretical expectations. Larcker (1981) provided a systematic framework for CFA within SEM. Standardized factor loadings exceeding 0.5 suggest that each observed variable explains the latent variable well. Furthermore, t values and p values are primarily used for assessing significance. P values below 0.05 indicate that standardized factor loadings are significant.

Table.6: Table of factor loading coefficients

Factor	Measurement term	Non-standard load factors	Standard load factor	standard error	z (C.R.)	P
Environmental Knowledge	EK1	1.0	0.782			
	EK2	0.998	0.825	0.037	26.751	***
	EK3	1.07	0.857	0.038	28.041	***
	EK4	1.002	0.826	0.037	26.773	***
	EK5	1.063	0.852	0.038	27.847	***
Environmental Awareness	EA1	1.0	0.839			
	EA2	1.008	0.831	0.034	29.617	***
	EA3	0.983	0.813	0.034	28.672	***
	EA4	1.0	0.798	0.036	27.874	***
	EA5	0.989	0.832	0.033	29.694	***
Environmental Concern	EC1	1.0	0.805			
	EC2	0.98	0.769	0.041	23.723	***

	EC3	1.0	0.788	0.041	24.408	***
	EC5	0.992	0.767	0.042	23.657	***
Environmental Values	EV1	1.0	0.791			
	EV2	1.053	0.813	0.041	25.371	***
	EV3	1.073	0.831	0.041	26.0	***
	EV4	1.056	0.802	0.042	24.998	***
	ER1	1.0	0.754			
Environmental Responsibility	ER2	1.099	0.828	0.045	24.536	***
	ER3	1.083	0.758	0.048	22.375	***
	ER4	1.053	0.767	0.047	22.645	***
	ER5	1.023	0.771	0.045	22.775	***
	LCTA1	1.0	0.79			
Low Carbon Tourism Attitude	LCTA2	0.971	0.775	0.041	23.92	***
	LCTA3	1.006	0.799	0.041	24.79	***
	LCTA4	1.022	0.821	0.04	25.544	***
	LCTI1	1.0	0.776			
Low Carbon Tourism Intention	LCTI2	0.991	0.805	0.042	23.656	***
	LCTI3	0.963	0.718	0.046	21.047	***
	LCTI4	0.929	0.749	0.042	22.009	***
	LCTB1	1.0	0.878			
Low Carbon Tourism Behavior	LCTB2	0.997	0.864	0.028	35.528	***
	LCTB3	0.995	0.84	0.03	33.687	***
	LCTB4	1.013	0.796	0.033	30.511	***
	LCTB5	0.855	0.843	0.025	33.882	***
	LCTB6	1.012	0.859	0.029	35.152	***

Note: \*\*\*P < 0.01, \*\*P < 0.05

The factor loading coefficients presented in Table 6 reveal that the standardized factor loading of each questionnaire item exceeded 0.5. This suggests that each item can explain its dimension well.

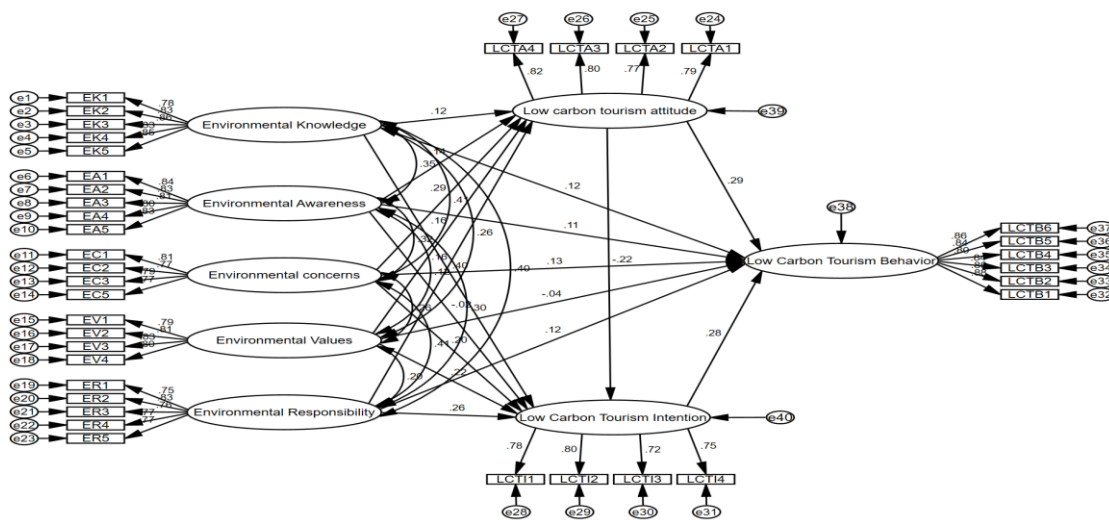
The validated factor analysis (CFA) results indicated that the measurement model was acceptable. Consequently, SEM using AMOS was employed to evaluate the fit of the structural model. Fit indices for the path analysis are presented in Table 7, adhering to the recommended empirical guidelines for fit assessment (Fornell & Larcker, 1981).

Table.7: Validation factor analysis table

Normative	CMIN/DF	GFI	RMSEA	CFI	NFI	IFI
desirable value	<3	>0.9	<0.08	>0.9	>0.9	>0.9
measured value	<5	>0.8	<0.10	>0.8	>0.8	>0.8
fitted value	1.12	0.961	0.012	0.997	0.968	0.997

Table 7 demonstrates the fit metrics for the models examined. The model's CMIN/DF ratio stood at 1.12, falling within the acceptable range of 1–3. The RMSEA value is 0.012, falling within the acceptable range of less than 0.08. Furthermore, the GFI, CFI, NFI, and IFI metrics exceeded 0.9. In conclusion, the metrics meet the criteria, indicating a well-fitted model.

### 4.5. Structural equation modelling analysis



### 4.6. Hypothesis analysis

This study employed SEM in AMOS to conduct path analysis. The results, as depicted in Table 8, indicate that the relations tested through path hypothesis were significant. Environmental knowledge significantly positively affected low-carbon tourism behavior ( $\beta = 0.12, p < 0.01$ ); environmental awareness significantly positively affected low-carbon tourism behavior ( $\beta = 0.11, p < 0.01$ ); environmental concern significantly positively affected low-carbon tourism behavior ( $\beta = 0.13, p < 0.01$ ); environmental values significantly negatively affected low-carbon tourism behavior ( $\beta = -0.04, p < 0.01$ ); and environmental responsibility significantly positively affected low-carbon tourism behavior ( $\beta = 0.12, p < 0.01$ ). Therefore, hypotheses H1, H2, H3, and H5 were supported, Thus, the higher the environmental knowledge, environmental awareness, environmental concern, and environmental responsibility, the stronger is the low-carbon tourism behavior . while H4 was not valid , indicating that environmental values do not have a significant effect on low-carbon tourism behavior

Furthermore, low-carbon tourism attitudes were significantly positively affected by environmental knowledge ( $\beta = 0.12, p < 0.01$ ); environmental awareness ( $\beta = 0.14, p < 0.01$ ); environmental concern ( $\beta = 0.29, p < 0.01$ ); environmental values ( $\beta = 0.16, p < 0.01$ ); and environmental responsibility ( $\beta = 0.16, p < 0.01$ ). Therefore, hypotheses H1a, H2a, H3a, H4a, and H5a were validated.the higher the environmental knowledge, environmental awareness, environmental concern, environmental values, and environmental responsibility, the greater the low-carbon tourism attitude.

In addition, low-carbon tourism intention was significantly positively affected by environmental knowledge ( $\beta = 0.40, p < 0.01$ ); environmental concern ( $\beta = 0.20, p < 0.01$ ); environmental values ( $\beta = 0.22, p < 0.01$ ); and environmental responsibility ( $\beta = 0.26, p < 0.01$ ), as did environmental values ( $\beta = 0.22, p < 0.01$ ) and the sense of environmental responsibility ( $\beta = 0.26, p < 0.01$ ). However, environmental awareness negatively affected low-carbon tourism intention ( $\beta = -0.02, p < 0.01$ ); These results validated hypotheses H1b, H3b, H4b, and H5b, Hence, the higher the environmental knowledge, environmental concern, environmental values, and sense of environmental responsibility, the greater is the low-carbon tourism intention . but not hypothesis H2b, indicating that environmental awareness has no significant effect on low-carbon tourism intention.

Table.8: Path factor analysis table

Hypotheses	Pathway	$\beta$	SE	t (C.R.)	P
H1	EK→LCTB	0.119	0.04	3.189	**
H2	EA→LCTB	0.11	0.028	3.623	***
H3	EC→LCTB	0.126	0.038	3.412	***
H4	EV→LCTB	-0.041	0.03	-1.328	0.184
H5	ER→LCTB	0.122	0.039	3.489	***
H1a	EK→LCTA	0.124	0.04	3.21	**
H2a	EA→LCTA	0.142	0.032	3.997	***
H3a	EC→LCTA	0.289	0.04	7.073	***
H4a	EV→LCTA	0.157	0.032	4.514	***
H5a	ER→LCTA	0.164	0.041	4.25	***
H1b	EK→LCTI	0.402	0.034	9.916	***
H2b	EA→LCTI	-0.02	0.025	-0.574	0.566
H3b	EC→LCTI	0.203	0.033	4.895	***
H4b	EV→LCTI	0.22	0.026	6.268	***
H5b	ER→LCTI	0.26	0.033	6.63	***
H6	LCTA→LCTB	0.289	0.04	7.461	***
H7	LCTI→LCTB	0.282	0.054	6.711	***
H8	LCTA→LCTI	-0.224	0.034	-5.32	***

#### 4.7. Mediation effect analysis

We used the bootstrap method with the bootstrap sample size set at 2000. We conducted the mediation effect test at 95% confidence level. Following Preacher Z et al., a bootstrap confidence interval not encompassing 0 indicates the existence of the corresponding indirect, direct, or total effect. The results of the mediating effects test are presented in the table 9\10\11.

##### 4.7.1. Analysis of the mediating effect of low-carbon tourism attitude

Table.9: Analysis table of the mediating effect of low-carbon tourism attitude

path relationship	direct effect	indirect effect	Bias-corrected(95%)		P
			Lower Bounds	Upper Bounds	
EK-->LCTA --> LCTB	0.127(0.001)	0.038	0.012	0.074	0.004
EA--> LCTA--> LCTB	0.103(***)	0.038	0.019	0.065	0.001
EC--> LCTA--> LCTB	0.129(***)	0.086	0.053	0.131	0.001
EV-->LCTA--> LCTB	-0.040(0.184)	0.044	0.021	0.073	0.001
ER-->LCTA--> LCTB	0.135(***)	0.052	0.025	0.091	0.001

The direct effects of EK, EA, EC, ER, and low-carbon tourism behavior are 0.127, 0.103, 0.129, and 0.135, respectively. The corresponding indirect effects are 0.038, 0.038, 0.086, and 0.052, all with a significance level of  $P < 0.05$ . Furthermore, the 95% confidence intervals do not encompass 0, indicating that low-carbon tourism attitudes play a significant mediating role. This suggests that EK, EA, EC, and ER can impact low-carbon tourism behavior directly, as well as through low-carbon tourism attitudes, thus indicating a partially mediating role for low-carbon tourism attitudes in these relationships.

Regarding the indirect effect ( $\beta=0.044$ ,  $P < 0.05$ ) and the direct effect ( $\beta=-0.040$ ,  $P > 0.05$ ) between EV and LCTB, it is evident that EV does not directly influence low-carbon tourism behavior but affects it solely through LCTA. Therefore, in the path EV-->LCTA--> LCTB, LCTA plays a fully mediating role, establishing the mediating effect.

**4.6.2. Analysis of the mediating effect of low-carbon tourism intentions**

Table.10: Analysis table of the mediating effect of low-carbon tourism intention

path relationship	direct effect	indirect effect	Bias-corrected(95%)		P
			Lower Bounds	Upper Bounds	
EK-->LCTI --> LCTB	0.127(0.001)	0.121	0.08	0.172	0.001
EA--> LCTI--> LCTB	0.103(***)	-0.005	-0.022	0.014	0.534
EC--> LCTI--> LCTB	0.129(***)	0.059	0.032	0.1	***
EV-->LCTI--> LCTB	-0.040(0.184)	0.06	0.033	0.093	0.001
ER-->LCTI--> LCTB	0.135(***)	0.081	0.05	0.129	***

The direct effects of EK, EA, EC, EV, ER, and LCTB were 0.127, 0.103, 0.129, -0.040, and 0.135, respectively, all  $P < 0.05$  except for EV, suggesting that EK, EA, EC, and ER can directly influence low-carbon tourism behavior, while EV does not have a direct relationship with low-carbon tourism behavior. The corresponding indirect effects are 0.121, -0.005, 0.059, 0.060, and 0.081, all  $P < 0.05$  except for EA, indicating that, except for EA, the other environmental drivers EK, EC, EV, and ER can influence LCTB through LCTI.

From the above, it can be seen that EK, EC, and ER can influence LCTB both directly and through LCTI. Therefore, LCTI plays a partly intermediary role in the path of EK, EC, and ER affecting LCTB. EV cannot directly affect LCTB but only through LCTI, indicating that LCTI plays a fully mediating role in the EV --> LCTI --> LCTB path, with a significant mediating effect. EA can directly affect LCTB but cannot influence LCTB through LCTI, making the EA --> LCTI --> LCTB path invalid, with the mediating effect not being significant in the EA and LCTI paths. LCTB does not mediate the relationship between EA and LCTI.

**4.6.3. Analysis of the Chain Mediating Effect of Low-Carbon Tourism Attitudes and Low-Carbon Tourism Intention**

Table.11: Chain mediation effect analysis table

path relationship	direct effect	indirect effect	Bias-corrected(95%)		P
			Lower Bounds	Upper Bounds	
EK-->LCTA--> LCTI--> LCTB	0.127(0.001)	-0.008	-0.019	-0.003	0.003
EA-->LCTA--> LCTI--> LCTB	0.103(***)	-0.008	-0.017	-0.004	***
EC-->LCTA--> LCTI--> LCTB	0.129(***)	-0.019	-0.033	-0.01	***
EV-->LCTA--> LCTI--> LCTB	-0.040(0.184)	-0.01	-0.019	-0.004	0.001
ER-->LCTA--> LCTI--> LCTB	0.135(***)	-0.011	-0.024	-0.005	***

The direct effect coefficients for EK, EA, EC, EV, ER, and LCTB were 0.127, 0.103, 0.129, -0.040, and 0.135, (all  $P < 0.05$  except for EV), suggesting that EK, EA, EC, and ER have direct impacts on LCTB. The corresponding indirect effect coefficients were -0.008, -0.008, -0.019, -0.010, and -0.011, (all  $P < 0.05$ ), indicating that the mediated effects are present.

From the above results, it is evident that EK, EA, EC, and ER can influence LCTB both directly and through the chain mediation of LCTA and LCTI, signifying that LCTA and LCTI play a partial mediating role in the relationship between these environmental drivers and LCTB. On the other hand, EV does not have a direct impact on LCTB but affects it through the chain mediation of LCTA and LCTI, thereby demonstrating that LCTA and LCTI play a fully mediating role in the relationship between EV and LCTB. In conclusion, all the mediating effects described above are valid.

## 5. Discussion and Insights

### 5.1. Discussion of key findings

Through the validation of SEM and path analysis, this study confirmed the significant positive impact of environmental knowledge, awareness, concern, values, and responsibility on low-carbon tourism attitudes. This is consistent with the findings of previous studies (Bilal et al., 2019; V. K. Verma, B. Chandra, & S. Kumar, 2019; S. Wang et al., 2022; Weina & Yanling, 2022), which reaffirmed that environmental drivers significantly and positively influence low-carbon tourism attitudes and that the improvement of environmental drivers can encourage tourists to develop positive low-carbon tourism attitudes. Positive low-carbon tourism attitudes were found to have a positive impact on the emergence of low-carbon tourism behavior, which is consistent with the findings of Singh et al. (N. Singh & Gupta, 2013). Consumers' eco-behavior is influenced by their attitudes toward the environment, and thus, environmental attitudes can be used as the predictor of eco-behavior. That is, tourists with positive low-carbon tourism attitudes are more likely to develop low-carbon behaviors while traveling.

we confirmed that the four environmental drivers, namely environmental knowledge, environmental concern, environmental values, and environmental responsibility, can form positive low-carbon tourism intentions, which is consistent with the findings of previous studies (Choi et al., 2019; DeChano, 2008; Dunlap et al., 2019; Mostafa, 2007; Onwezen et al., 2013). Furthermore, we confirmed that low-carbon tourism intention can contribute to low-carbon tourism behavior, and positive low-carbon tourism intention can be successfully transformed into low-carbon tourism behavior, which is consistent with the findings of Lili (Lili, 2018). That is, the higher the environmental knowledge, environmental awareness, environmental values, and sense of responsibility among tourists, the easier it is for them to form positive low-carbon tourism intentions. However, the empirical results showed that environmental cognition has no positive influence on low-carbon tourism intention, which is inconsistent with previous results (S. Wang et al., 2022). There is a difference between environmental cognition and low-carbon tourism intention; environmental cognition is the tourist's cognition of the environment, and although it can affect the low-carbon tourism intention to a certain extent, a series of steps are needed to transform cognition to intention (Fang, 2021). That is, environmental cognition has no positive contribution to low-carbon tourism intention.

Finally, we confirmed that the four environmental drivers, namely environmental knowledge, environmental awareness, environmental concern, and environmental responsibility, can directly influence low-carbon tourism behavior, which is consistent with the findings of previous studies (Aman et al., 2021; Bouman et al., 2020; Chang et al., 2020; Malik & Policy, 2020). However, environmental values cannot be translated into actual low-carbon tourism behavior, and individuals may be influenced by the factors such as social environment, economic factors, and cultural habits, leading them to deviate from environmentally friendly principles when choosing travel methods (Li, 2023). Therefore, low-carbon tourism behavior can only be established in the presence of low-carbon tourism attitudes or intentions.

In summary, promoting low-carbon tourism behaviors requires the joint efforts of governments, schools, and educational institutions. Tourists' environmental awareness, attitudes, and sustainable eco-friendly behaviors can be fostered through regular lectures on environment; creation of educational brochures, websites, and promotional videos showcasing examples of sustainable tourism; and dissemination of knowledge through social media.

### 5.2. Implications

The theoretical contribution of the study is fourfold. First, it establishes a research framework based on the literature review to clarify the relationship between environmental drivers and low-carbon tourism behaviors. It clarifies the significance of the drivers of low-carbon tourism behaviors and provides direct evidence for the influence of environmental drivers on low-carbon tourism behaviors. Second, this

paper demonstrates the mediating role of low-carbon tourism attitude and low-carbon tourism intention in the influence of environmental drivers on low-carbon tourism behaviors through SOR theory. Third, a more comprehensive classification of environmental drivers from five aspects, namely knowledge, awareness, concern, values, and responsibility, enriches our understanding of these drivers of low-carbon tourism behaviors and sheds light on the influencing factors of low-carbon tourism behaviors in the context of sustainable development. Finally, this study provides academic significance in the content of China to study the influence of these environmental drivers under the influence of Chinese and Western cultures. Tourism management in China is different from that in the West, and the findings of this study empirically demonstrate that the influence of drivers on low-carbon tourism behaviors varies across different cultural contexts in the East and the West.

This paper also has several practical contributions. For government administrators and tourism practitioners, exploring the mechanisms by which drivers influence low-carbon tourism behaviors will help them rethink how to promote tourists to develop low-carbon tourism behaviors, ensuring that the drivers can play a positive role in low-carbon tourism behaviors and minimize negative environmental impacts. The results of the study can also help tourism consumers in understanding low-carbon tourism more deeply, thereby improving their own low-carbon tourism behaviors. Upon perceiving the stimuli brought by the drivers, tourists can assess the situation and take targeted low-carbon measures, as well as reduce some unnecessary environmentally damaging behaviors, reduce waste, or improve pro-environmental behaviors to reduce the carbon emissions generated during the travel process.

### **5.3.Recommendation**

Based on the findings, the following recommendations are proposed for future research to enhance the understanding of the impact of environmental drivers on low-carbon tourism behavior:(1) Explore additional environmental drivers beyond those already studied, such as social influence, cultural background, and economic factors, to comprehensively grasp the formation mechanisms of low-carbon tourism behavior. (2) Employ longitudinal research designs to track changes in individuals' environmental knowledge, attitudes, and behaviors over time, establishing clearer causal relationships and uncovering the long-term effects of environmental drivers on low-carbon tourism behaviors. (3) Compare the effects of environmental drivers on low-carbon tourism behavior across different geographical and cultural contexts to develop targeted low-carbon tourism promotion strategies considering the influence of these contexts on environmental knowledge and values. (4) Delve deeper into the factors influencing low-carbon tourism attitude and willingness to enhance the conversion rate of low-carbon tourism behavior.

By following these suggestions, future research can gain a more comprehensive understanding of the influence mechanism of environmental drivers on low-carbon tourism behavior, providing specific and in-depth support for promoting low-carbon tourism practices and sustainable tourism development.

## **6. Conclusions and Research Limitations**

This study sheds light on the crucial role of environmental drivers in promoting low-carbon tourism behavior in Guizhou Province, China. The findings indicate that environmental knowledge, awareness, concern, and responsibility positively influence tourists' attitudes, intentions, and behaviors related to sustainable tourism practices. The study also highlights the complex interplay between these variables, with low-carbon tourism attitudes and intentions serving as mediators in the relationships between environmental drivers and behaviors. These results have important theoretical and practical implications. From a theoretical perspective, the study contributes to the advancement of the SOR model in the context of low-carbon tourism, providing empirical evidence for the links between environmental stimuli, organisms, and responses. The findings also extend the understanding of the psychological mechanisms underlying sustainable tourism behavior, emphasizing the importance of considering multiple environmental drivers and their interactions. From a practical perspective, the study offers

valuable insights for tourism managers and policy-makers seeking to promote low-carbon tourism. The results suggest that fostering environmental knowledge, awareness, concern, and responsibility among tourists can be an effective strategy for encouraging sustainable tourism practices. Tourism managers can design targeted educational programs, communication campaigns, and on-site interventions focusing on these key environmental drivers to stimulate positive attitudes and intentions toward low-carbon tourism among tourists.

However, the study has some limitations. The cross-sectional design and the self-reported data used in the study may prevent the establishment of causal relationships and control for potential biases. Future research can employ longitudinal designs and objective measures of low-carbon tourism behavior to provide robust evidence for the proposed relationships. Additionally, the study focuses on a specific geographical context (Guizhou Province) and a limited set of environmental drivers, which may affect the generalizability of the findings to other contexts and variables. Despite these limitations, this study contributes significantly to the low-carbon tourism literature by providing a comprehensive framework for understanding the role of environmental drivers in promoting sustainable tourism behavior. The findings offer a foundation for future research and inform the development of effective strategies for managing low-carbon tourism destinations.

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## References

- Ahmad, Z., Hassan, N. M., Khattak, M. N., Moustafa, M. A., & Fakhri, M. (2021). Impact of Tourist's Environmental Awareness on Pro-Environmental Behavior with the Mediating Effect of Tourist's Environmental Concern and Moderating Effect of Tourist's Environmental Attachment. *Sustainability*, 13.
- Alba, J. W., & Hutchinson, J. W. (1987). Dimensions of Consumer Expertise | Journal of Consumer Research | Oxford Academic. *Journal of Consumer Research*, 13(4), 411-454.
- Ardoin, N. M. B., Alison W.Gaillard, Estelle. (2020). Environmental education outcomes for conservation: A systematic review. *Biological Conservation*, 241.
- Bartels, J., & Onwezen, M. C. (2014). Consumers' willingness to buy products with environmental and ethical claims: the roles of social representations and social identity. *International Journal of Consumer Studies*, 38(1), 82-89.
- Bouman, T., Verschoor, M., Albers, C. J., Böhm, G., & Steg, L. (2020). When worry about climate change leads to climate action: How values, worry and personal responsibility relate to various climate actions. *Global Environmental Change*, 62.
- Chang, S. H., Hernández-Díaz, R. J., & Lo, W. S. (2020). The Impact of Low-Carbon Service Operations on Responsible Tourist Behavior: The Psychological Processes of Sustainable Cultural Tourism. *Sustainability*, 12.
- cheng, L. (2018). Research on the Influence Mechanism of Low-Carbon Tourism Behavior of Tourists in Ecotourism Scenic Spots and Guidance Strategy. South China Agricultural University.
- Dunlap, R. E., Grieneeks, J. K., & Rokeach, M. (1983). Human Values and Pro-Environmental Behavior.
- FengCheng. (2022). Impacts of Climate Change on Low-Carbon Tourism Behavior - The Case of Wulingyuan World Natural Heritage Site.

- Fornell, C., & Larcker, D. F. (1981). Structural Equation Models with Unobservable Variables and Measurement Error: Algebra and Statistics. *Journal of Marketing Research*, 18(3), 382-388.
- Foth, M., & Hearn, G. (2007). Networked individualism of urban residents: discovering the communicative ecology in inner-city apartment buildings. *Information Communication & Society*, 10(5), 749-772.
- Frick, J., Kaiser, F. G., & Wilson, M. (2004). Environmental knowledge and conservation behavior: exploring prevalence and structure in a representative sample. *Personality & Individual Differences*, 37(8), 1597-1613.
- Frønes, I. (2016). The Absence of Failure: Children at Risk in the Knowledge Based Economy. *Child Indicators Research*.
- Gadenne, D. L., & Mckeiver, K. C. (2009). An Empirical Study Of Environmental Awareness And Practices In Smes. *Journal of Business Ethics*, 84(1), p.45-63.
- Gatersleben, B., Steg, L., & Vlek, C. (2016). Measurement and Determinants of Environmentally Significant Consumer Behavior. *Environment and Behavior*, 34(3), 335-362.
- Heo, J., & Muralidharan, S. (2019). What triggers young Millennials to purchase eco-friendly products?: the interrelationships among knowledge, perceived consumer effectiveness, and environmental concern. *Routledge*(4).
- Hu Bin, Y. F., Yuanbin Xiong. (2014). Driving factors and formation mechanism of tourists' willingness to participate in low-carbon tourism: an explanation based on the Theory of Planned Behavior. *Business economics and management*(8), 9.
- Kaiser, Florian, G., Ranney, Michael, Hartig, Terry, Bowler, Peter, & A. (1999). Ecological behavior, environmental attitude, and feelings of responsibility for the environment. *European Psychologist*.
- Kautish, P., Paul, J., & Sharma, R. (2019). The Moderating Influence of Environmental Consciousness and Recycling Intentions on Green Purchase Behavior. *Journal of Cleaner Production*, 228(AUG.10), 1425-1436.
- Kousar, S., Afzal, M., Ahmed, F., & Bojnec, T. (2022). Environmental Awareness and Air Quality: The Mediating Role of Environmental Protective Behaviors. *Sustainability*, 14.
- Kuo, N.-W., & Dai, Y.-Y. (2015). Predicting Low-Carbon Travel Behavior. In *Strategic E-Commerce Systems and Tools for Competing in the Digital Marketplace* (pp. 95-116).
- Lisa, M., & DeChano. (2006). A Multi-Country Examination of the Relationship Between Environmental Knowledge and Attitudes. *International Research in Geographical and Environmental Education*, 15(1), 15-28.
- Lv, W. (2019). A Study of Residents' Sustainable Heritage Tourism Participation Behavior - Based on the Theory of Planned Behavior Perspective. *social scientist*(12), 12.
- Ma Ben, J. S., Huimin Ding. (2016). A Study on Conservation Attitudes and Behaviors of Farmers in Protected Areas Based on Conservation Perception Perspective. *Resource Science*, 38(11), 10.
- Malik, M. I., Ahmad, M., Hussain, A., Saleem, F., & Malik, S. (2020). Renewable Energy Products and Customer's Purchase Intentions having Environmental Concern. *International Journal of Energy Economics and Policy*, 10(6), 14-21.
- Mohamad, A. A., Ramayah, T., & Lo, M. C. (2020). Sustainable Knowledge Management and Firm Innovativeness: The Contingent Role of Innovative Culture. *Sustainability*, 12.

- Rahmiati, F., Othman, N., Bakri, M., Ismail, Y., & Amin, G. (2020). Tourism Service Quality and Tourism Product Availability on the Loyalty of International Tourists. *The Journal of Asian Finance, Economics and Business*.
- Ru, H. W., Shanyong. (2019). Young people's behaviour intentions towards reducing PM2.5 in China: Extending the theory of planned behaviour. *Resources, Conservation and Recycling*, 141.
- Singh, N., & Gupta, K. (2013). Environmental attitude and ecological behaviour of Indian consumers. *Social Responsibility Journal*, 9(1), 4-18.
- Singh, S. K., Giudice, M. D., Chierici, R., Graziano, D., & Phillips, F. (2020). Green innovation and environmental performance: The role of green transformational leadership and green human resource management.
- Su, J. (2019). Impact of tourism resource development based on low-carbon mode: a case study of Guizhou ethnic areas. *Ecological Processes*, 8(1).
- Szabo, S., & Webster, J. (2020). Perceived Greenwashing: The Effects of Green Marketing on Environmental and Product Perceptions. *Journal of Business Ethics*(4).
- Tamar, M., Wirawan, H., Arfah, T., & Putri, R. P. S. (2020). Predicting pro-environmental behaviours: the role of environmental values, attitudes and knowledge. *Management of Environmental Quality An International Journal*, ahead-of-print(ahead-of-print).
- Tantawi, P. I., O Shaughnessy, N. J., Gad, A. R., & Ragheb, M. A. S. (2009). Green Consciousness of Consumers in a Developing Country: A Study of Egyptian Consumers. *Contemporary Management Research*, 5(1).
- Verma, V. K., Chandra, B., & Kumar, S. (2019). Values and ascribed responsibility to predict consumers' attitude and concern towards green hotel visit intention. *Elsevier*.
- Wan, C., Cheung, R., & Shen, G. Q. (2012). Recycling attitude and behaviour in university campus: a case study in Hong Kong. *Facilities*, 30(13/14), 630-646.
- Wang, L., Wong, P. P. W., & Narayanan, E. (2020). Antecedents of green purchase behaviour: An examination of altruism and environmental knowledge. *International Journal of Culture Tourism and Hospitality Research*, 14(1), 63-82.
- Wang, S., Lin, S., & Li, J. (2018). Exploring the effects of non-cognitive and emotional factors on household electricity saving behavior. *Energy Policy*, 115(APR.), 171-180.
- Wang, Y. (2012). A Study of Low-Carbon Tourism Intentions Based on the Theory of Planned Behavior.
- Yuriev, A., Dahmen, M., Paillé, P., Boiral, O., & Guillaumie, L. (2019). Pro-environmental behaviors through the lens of the theory of planned behavior: A scoping review. *Resources Conservation and Recycling*, 155(April).
- Dunlap, R., & Jones, R. (2002). Environmental concern: Conceptual and measurement issues. In *Handbook of environmental sociology*, ed. R. Dunlap and W. Michelson. London: Greenwood.
- Kuo, N.-W., & Dai, Y.-Y. (2015). Predicting Low-Carbon Travel Behavior. In *Strategic E-Commerce Systems and Tools for Competing in the Digital Marketplace* (pp. 95-116).