



The Approaches to Realize Low-Carbon Tourism in Minority Areas of Hainan

—based on SWOT Analysis

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Abstract. This study focuses on the research of low-carbon tourism in eight ethnic minority settlements covered by Hainan Tropical Rainforest National Park. The development of a low-carbon tourism economy in Hainan's ethnic areas has advantages and disadvantages, as well as opportunities and challenges. Through SWOT analysis, this paper explores development strategies to promote the realization of a low-carbon tourism economy in the region.

Keywords: SWOT analysis, Hainan minority settlements, 8 cities and counties, low-carbon tourism

1 Introduction

Hainan is currently working on the application for the "Hainan Tropical Rainforest and Li Traditional Settlements" to be listed as a World "Dual Heritage." The "Hainan Tropical Rainforest and Li Minority Traditional Settlements"-Hainan Tropical Rainforest National Park covers eight ethnic minority inhabited areas: Dongfang City, Wuzhishan City, Ledong Li Autonomous County, Lingshui Li Autonomous County, Changjiang Li Autonomous County, Baoting Li and Miao Autonomous County, Qiongzong Li and Miao Autonomous County, and Baisha Li Autonomous County^① (hereinafter referred to as "the 8 counties and cities"). During the application process, these areas advocate for a low-carbon tourism. The 8 counties and cities have advantages and disadvantages in developing low-carbon tourism, while also facing opportunities and challenges. The article integrates previous research findings^{[1]. [2]} to establish a low-carbon tourism indicator system, measures the development level of low-carbon tourism in eight cities and counties, and proposes development strategies.

A measurement model of low carbon development level

In order to more accurately understand the development status of low-carbon tourism in 8 cities and counties, an evaluation index system for low-carbon tourism development level was based on DPSIR model.

^① Below, the abbreviation is Dongfang, Wuzhishan, Ledong, Lingshui, Changjiang, Baojing, Qiongzong and Baisha.

Table 1. Evaluation index system of low-carbon tourism and the coefficients of each variable

Target layer	Characteristic	The normative layer	Characteristic	Indicators layer	Characteristic	The coefficient of the indicator	
Tourism low-carbon development evaluation index system	A	Drive system (D)	Tourism industry drive (B ₁)	Annual per capita tourism income (YUAN)	C1	0.2440	
				Per capita consumption level of tourists (Yuan) (divided by the number of overnight stays)	C2	0.1006	
				Tourism revenue /GDP(%)	C3	0.2524	
			Environmental awareness raised (B ₂)	"Environmental protection" Baidu index average attention	C4	0.0042	
				"Environmental protection" Baidu index attention year-on-year average growth rate (%)	C5	-0.2533	
				GDP (100 million yuan)	C6	0.0467	
			Local economic drivers (B ₃)	Year-on-year GDP growth (%)	C7	-0.0635	
				Urbanization rate (%)	C8	0.2271	
				The ratio of the tertiary industry to GDP	C9	0.1274	
			Pressure system (P)	Economic scale pressure (B ₄)	growth rate of population (%)	C10	0.2740
					Overnight tourist growth rate (%)	C11	0.2563
					Tourist space density (people/cubic meter)	C12	0.2077
		Ecological and environmental pressure (B ₅)		Annual water consumption (100 million m ³)	C13	0.2240	
				Energy consumption per unit GDP (t standard coal / 10,000 yuan)	C14	0.1688	
				Water consumption per 10,000 yuan of GDP (cubic meters / 10,000 yuan)	C15	0.1256	
		Status system (S)	Ecological environment status (B ₆)	The ratio of meat to grain per capita	C16	0.1906	
				Average concentration of sulfur dioxide (μg/m ³)	C17	0.0966	
				Average PM10 concentration (μg/m ³)	C18	0.1929	
				Average PM2.5 concentration (μg/m ³)	C19	0.1569	
				Average concentration of nitrogen dioxide (μg/m ³)	C20	0.0809	
				Average concentration of carbon monoxide (mg/m ³)	C21	0.1609	
				Average ozone concentration (ug/m ³)	C22	0.2279	
				Number of days (days) when air quality reaches or is better than grade II land area covered with trees (%)	C23	-0.0047	
			C24	0.2771			

Target layer	Characteristic	The normative layer	Characteristic	Indicators layer	Characteristic	The coefficient of the indicator
				Net primary productive forces	C25	0.2376
				Number of national intangible cultural heritage projects (number)	C26	-0.0227
			Social impact (B ₇)	Number of provincial-level intangible cultural heritage projects (number)	C27	0.1092
				Third industry personnel (10,000)	C28	0.2265
				Total import and export volume (ten thousand yuan)	C29	-0.0423
		Impact system (I)		Residents' income level (ten thousand yuan)	C30	0.1880
				Graded rural homestay (home)	C31	0.2777
				Number of overnight visitors received (10,000)	C32	0.2238
			Industry impact (B ₈)	Number of tourist attractions by grade (number)	C33	0.0056
				Number of rural tourism sites (number)	C34	0.0783
				Room occupancy rate (%)	C35	0.2194
				Number of star hotels (no.)	C36	0.0451
			Environmental response (B ₉)	Safe disposal capacity of household garbage per capita (kg/person·d)	C37	0.3611
				Per capita annual sewage treatment (ton/person)	C38	0.2490
			Talents response (B ₁₀)	Per capita education expenditure (YUAN/person)	C39	0.2228
				Number of environmental protection training sessions (times)	C40	0.1316
		Response System (R)	Policy response (B ₁₁)	Number of environmental protection regulations and guiding documents issued (item)	C41	-0.0974
					Energy saving and environmental protection expenditure (ten thousand yuan)	C42

The evaluation index system uniformly adopts "Z-score standardization" for standardization. Considering that the lower the average concentration of gases involved in the state system, the better the state, negative values are assigned.

2 Principal Component Selection and Scores for Each Layer

Principal component analysis was conducted for each system within the criterion layer to select principal components. According to the principal component analysis results, the cumulative variance contribution rates of driving forces, pressures, state,

impacts, and responses are 92.07%, 96.20%, 90.19%, 93.91% and 93.69% . The principal component scores corresponding to driving force, pressure, state, influence and response can be obtained by multiplying the coefficients in each index layer with the standardized data of corresponding index layer variables.

After selecting the indicators, SPSS software was used to conduct correlation analysis on this indicator system and extract principal components. Since the first 3 principal components already explain 96.97% of the Low-Carbon Tourism Development in 8 cities and counties, only the first 3 principal components were selected.

As shown in Table 2 and previous discussions on pressure and status indicators, the four cities and counties, Wu Zhishan, Qiongzong, Baoting, and Baisha, as the central conservation area exhibit lower pressure levels and better status performance.

Table 2. Principal component scores of indicators in the criterion layer

Cities and counties	Drive system	Pressure system	Status system	Impact system	Response System
Wu Zhishan	1.083657	-1.02956	1.465895	0.497836	0.771496
Dongfang	0.284883	1.364717	-1.4955	-0.07776	-0.89605
Ledong	-0.66376	0.379832	-0.10049	-0.20031	-1.54115
Qiongzong	-1.33	-1.15362	0.385469	-0.66591	-0.21732
Baoting	0.112335	-0.57483	1.055956	0.091172	0.571691
Lingshui	1.505208	0.646611	-0.26706	2.42253	0.672129
Baisha	-0.76336	-0.74618	0.489237	-0.8383	-0.17975
Changjiang	-0.22897	1.113035	-1.5335b1	-1.22926	0.818959

Overall, the variables selected in the categories of driving forces, state, impact, and response are all positively oriented, meaning that higher values indicate better performance of the corresponding indicator in that region. Conversely, the variables selected for the pressure category are negatively oriented, indicating that higher values reflect greater pressure and poorer performance in the region. Therefore, when conducting principal component analysis for the target layer, the principal component scores of the pressure indicators are assigned negative values. Using the proportion of each principal component's corresponding eigenvalue to the total sum of eigenvalues of the extracted principal components as weights, the principal component scores was calculated as Table 3:

Table 3. Principal component scores of the target layer

City and County	Wu Zhishan	Dongfang	Ledong	Qiongzong	Baoting	Lingshui	Baisha	Changjiang
Principal component score of the target layer	1.212	-1.512	-0.714	0.455	0.831	0.011	0.405	-0.687

Since pressure and status indicators have the greatest impact on principal component scores, Wuzhishan, Baoting, Baisha, and Qiongzong score higher. Conversely, Changjiang and Dongfang, which show opposite performance in these two metrics,

have lower overall scores. Ledong stands out with all except pressure (which has a positive impact) having negative values, resulting in relatively low comprehensive scores. Lingshui's overall ranking is moderate, as its key influencing factors have relatively small absolute values, while other indicators with larger absolute values have minimal impact.

Table 4. Correlation coefficient matrix of DPSIR model indicators

	Drive system	Pressure system	Status system	Impact system	Response System
Drive system	1.00	0.27	0.06	0.81	0.50
Pressure system	0.27	1.00	-0.91	0.11	-0.20
Status system	0.06	-0.91	1.00	0.18	0.24
Impact system	0.81	0.11	0.18	1.00	0.25
Response System	0.50	-0.20	0.24	0.25	1.00

The correlation coefficient matrix among the indicators at the criterion level is shown in the table above. According to the causal chain of the DPSIR system, the positive correlation between the driving force indicators and the pressure indicators indicates that an increase in driving force will lead to greater ecological pressure. The negative correlation between the pressure indicators and the state indicators suggests that increased pressure will result in a deterioration of the ecological state. The positive correlation between the state indicators and the impact indicators demonstrates that an improvement in ecological state will have a positive effect on the economic and social environment. The impact indicators and the response indicators interact with each other. ^[3]Although it is known that they are positively correlated, it remains unclear whether the positive environmental impact drives the response, the response drives the environmental impact, or a positive feedback relationship exists. This requires further research to clarify. The correlation between the response indicators and the driving force, pressure, and state indicators reveals that an enhanced response will promote an increase in driving force, reduce ecological pressure, and improve the ecological state.

3 SWOT Analysis of Hainan's Development of Low-Carbon Tourism Economy

3.1 Advantages

Location Advantage.

The geographical advantages have facilitated resource complementarity and collaborative governance among eight counties and cities, enhancing their cohesion and coordination for low-carbon tourism development in the tropical rainforest region of

central Hainan Island, where was identified as a national key ecological function zone in the Major Function-Oriented Zone Planning in China. Especially, Wuzhishan, Baoting, Baisha, and Qiongzong, which are located in central mountainous areas of Hainan, rank in the top four based on the comprehensive score of principal component.

Resource Advantages.

Impact system represents that a favorable environment is one of the key factors for the development of low-carbon tourism economy (Table 1). Hainan is building an "national park" ecological tourism system to realize the value of ecological products in the national park. ^[4]Hainan Tropical Rainforest National Park is one of the most biodiverse regions in the world, located in central Hainan Island. The forest coverage within the park reaches as high as 95.86%. The planted forests mainly consist of economic and timber species such as rubber, eucalyptus, mahogany, Caribbean pine, and betel nut. The national park integrated by the 8 cities and counties.

The number of intangible cultural heritage has impact on low-carbon tourism economy shown in Table 1 due to the importance to the tourism development. There are numerous cultural heritages in the 8 cities and counties, particularly the traditional Li spinning, dyeing, weaving, and embroidery techniques, which were inscribed on the Representative List of the Intangible Cultural Heritage of Humanity in 2024. The tropical rainforest centered around Wuzhishan serves as a sanctuary for many globally endangered species and unique Hainan species, and is also where the Li people have long settled and created distinctive island tribal culture across eight counties and cities.^①

Advantages of Tourism Industry Development.

The 8 cities and counties recognize the importance of developing low-carbon tourism economy and promote typical demonstration projects. Apart from Lingshui, the other seven cities and counties have built national forest villages. Among them, Baoting, Baisha, Wuzhishan, and Qiongzong are located in the central ecological core area, which is a key national ecological function zone for tropical rainforests and a central ecological conservation area of Hainan Province. The number of national forest villages in these four cities and counties also ranks among the top five in terms of the proportion of administrative villages. Driving force indicates that the level of regional economic development, tourism development capacity, and reception capacity have a decisive impact on the low-carbon economic development of local tourism. (Table 1).

^① Hainan Tropical Rainforest National Park. Introduction to Hainan Tropical Rainforest National Park [EB/OL]. <https://www.hntrnp.com/news/list-276.html>.

Most importantly, there are nine provincial-level eco-tourism demonstration zones in Hainan Province^①, of which eight cities and counties have seven, including two in Wuzhishan, none in Dongfang and Ledong, and one each in the remaining five cities and counties. Lingshui has launched the Nanwan Monkey Island Low-Carbon Tourism Demonstration Zone project on the basis of the provincial eco-tourism demonstration zone.

3.2 Analysis of Disadvantages

Local Economic Development.

The lower economic development levels of 8 cities and counties have a negative impact on local ecological environment. (Table 4) The driving force system also shows the importance of economic development level for low-carbon tourism. (Table 1) Except for the total GDP, per capita GDP, and economic density of Lingshui which performs reasonably well, the other 8 cities and counties rank lower compared with others within Hainan province.

The Ecosystem.

Hainan province, an important ecological conservation area and biodiversity hotspot in China, is a relative fragility of the island ecosystem. The island's organisms have poor resistance to invasive species and lack corresponding natural enemies to control them. ^② Resource endowments dictate that Hainan must push a resource-conserving and environmentally friendly tourism development. Additionally, regarding the central ecological core area, Hainan Province has strengthened the "maintenance of ecosystem continuity, integrity, and diversity" in Wuzhishan, Baoting, Qiongzong, and Baisha counties and cities, and since 2017, it has permanently halted the "development and construction of new real estate projects."

Environmental Problems.

The economic development and ecological environment facilities of the 8 cities and counties are relatively lagging behind those of other cities and counties in Hainan. According to *Hainan Provincial Ecological Environment Zoning Control Plan (2023 Edition)*, ^③the integrated development of the tertiary industry has not been fully realized, the efficiency of resource utilization is low, and problems such as agricultural non-point source pollution and industrial pollution exist to varying degrees.

Li Mengyao. The "marathon" of applying for World Heritage status has started! Hainan's project has been included in the tentative list of world heritage sites. Hainan Daily [N]. 2022-05-18 (A05 edition)

^② Niu Yong. Current situation and control measures of plant pests and diseases in Hainan artificial forest, *Tropical Agriculture*, 2007, (04):42-44.

^③ Hainan Provincial Department of Ecology and Environment. official announcement from Hainan Provincial Department of Ecology and Environment on the release of "Hainan Provincial Ecological Environment Zoning Control Plan (2023 Edition)"

A new form of Composite Tourism has not Yet Taken Shape.

Eight cities and counties whose resources are similar to some degree are dedicated to promoting the integrated development of industries due to their importance to tourism revenue. However, a composite tourism industry has yet to form, which to some extent leads to tourists' consumption mainly focusing on basic living needs, making it difficult for tourism revenue to achieve rapid growth. In 2023, compared to Hainan Province, which saw a year-on-year increase of 49.9% in the number of domestic and international tourists and 71.9% in total tourism revenue, the eight cities and counties' annual growth rate of tourist numbers and tourism revenue was lower than provincial average level. The industrial foundation for low-carbon tourism development needs further strengthening.

3.3 Opportunity Analysis

Low-carbon Concept Leads the Way.

Issued in 2025, the Low Carbon Island Construction Scheme of Hainan focuses on reducing carbon emissions from various sectors, including tourism industry. Environmental issues have attracted the attention of 8 municipal and county governments, and the governments have done a good job in top-level design and constantly improved relevant systems and regulations, which is conducive to improving the level of local low-carbon development.

The Construction of National Ecological Civilization Demonstration Zones Provides Guidance for the Development of Low-Carbon Economy.

Hainan is currently undertaking the construction of a National Ecological Civilization Demonstration Pilot Zone. Baoting County and Changjiang County have been designated as provincial pilots, tasked with "conducting unified registration of all elements of natural resource assets, including water flows, forests, mountains, wastelands, tidal flats, and mineral resources with proven reserves, and issuing pilot work plans." The construction of the National Ecological Civilization Demonstration Zone provides guidance for low-carbon development in eight cities and counties.

Achievements Have Been Made in Sustainable Economic and Social Development.

Hainan Province has formulated a series of policies to strengthen green development and accelerate the establishment of a carbon footprint management system for characteristic products in the Hainan Free Trade Port, striving to be an outstanding performer in achieving dual carbon goals. Eight cities and counties have actively implemented these policy requirements and achieved significant results in low-carbon development.

3.4 Challenge Analysis

The Market Mechanism Needs to be Improved.

Hainan has yet to establish a legal framework that promotes the development of a low-carbon tourism economy. Research on the theoretical system of low-carbon tourism is insufficient, and a measurement index system for low-carbon tourism has not been established. This may lead to a lack of full recognition by the tourism industry of the significant economic and social value of a low-carbon tourism economy. After the pandemic, tourist demand has surged unprecedentedly, but most operators are still focused on pursuing economic benefits, neglecting social and ecological impacts. As a result, sustainable tourism development struggles to align with public needs, product supply, and the intrinsic motivation for environmental protection.

Certain tourism resource pricing mechanisms and ecological compensation mechanisms have yet to be established, which may result in underpriced offerings. Among the eight cities and counties, Wuzhishan City implemented an "ecological price" at the Yatai Rainforest Hotel.

An Inevitable Economic Development Stage.

According to the World Bank's income classification for high, medium, and low-income countries or regions in 2023: below \$1,145 is considered low-income, \$1,146 to \$4,515 is middle-low income, \$4,516 to \$14,005 is middle-high income, and above \$14,005 is high-income. In 2024, the per capita GDP of 8 cities and counties were \$5,903.9–9,885.6, placing them in the middle-high income region.

According to the environmental Kuznets curve, there is an inverted U-shaped relationship between economic growth and environmental pollution. In regions with moderate to high income levels, driven by heightened public environmental awareness and changes in economic structure, the relationship between the economy and environmental pollution may reach a turning point. According to the "dual carbon" goals, China aims to peak carbon emissions by 2030 and achieve carbon neutrality by 2060. Currently, eight cities and counties may be in or about to enter a peak period of environmental pollution, where end-of-pipe treatment is costly and may have limited effectiveness.

4 The Realization of Low-Carbon Tourism Economy

Development and protection are long-term contradictions that must be addressed in the construction of ecological civilization.^① To develop a low-carbon tourism economy, eight cities and counties must fully leverage their own advantages, seize opportunities, transform production methods, reduce pollutant generation intensity at the

^①Hainan Provincial Department of Ecology and Environment. Letter from Hainan Provincial Department of Ecology and Environment on the release of "Hainan Provincial Ecological Environment Zoning Control Plan (2023 Edition)" [EB/OL].https://hnsthb.hainan.gov.cn/xxgk/0200/0202/hjywgl/hjyxpj/202408/t20240809_3712607.html, 2024-08-13.

source, turn disadvantages into strengths, and convert unfavorable factors into favorable ones.

4.1 Advantage-Opportunity (SO) Strategy is a Strategic Model That Uses Internal Advantages and External Opportunities. it is an Ideal Strategic Model

Making use of the Advantages of Location and Improve the Systems and Mechanisms for Coordinated Regional Development.

Firstly, based on the "*Hainan Ecological Environment Zoning Control Plan (2023 Edition)*," among the eight cities and counties, Lingshui, Ledong, and Baoting are located in the "Sanya Economic Circle" within the "third level," Dongfang and Changjiang are situated in the "World-Class Coastal City Belt," while Wuzhishan, Baisha, Qiongzong, and Baoting belong to the "Central Ecological Conservation Area." Environmental protection efforts should be carried out differently according to the ecological environment control requirements proposed in the plan, which include "three poles, one belt, and one area." Secondly, relying on the integrated development mechanism of local governments "parks" and "lands," a provincial coordination mechanism for national park work has been established. [5] Additionally, strengthening the deep connection from Lingshui's seaside to Baoting and Wuzhishan, creating a mountain-sea tourism cluster characterized by "mountain-sea linkage and fast travel with leisurely tours" and enhancing the alignment of regional low-carbon tourism support mechanisms can help eliminate institutional and systemic gaps between cities and counties, avoiding redundant construction and resource waste.

Using Policy Advantages to Promote High-Level Protection.

High-quality development and high-level protection complement each other and enhance each other's effectiveness. High-level protection is a crucial support for high-quality development. Only through high-level protection can we achieve eco-priority and green, low-carbon high-quality development. Wuzhishan and Taikoo Coca-Cola have joined hands with the China Green Foundation to build a "carbon-neutral estate" in Maodao Township and a national "zero-carbon village" in Maona Village; Dongfang focuses on high-value-added green and low-carbon industries, aiming to create large-scale port-industry clusters; Ledong strives to become a "National Ecological Civilization Demonstration County", a "Green Low-Carbon Circular Development Demonstration Base" and an "Innovation Base for the Conversion of Two Mountains"; Qiongzong, as part of the third batch of national low-carbon city pilots, is advancing low-carbon development with the goal of reaching peak emissions by 2025, emphasizing innovation in key areas such as "establishing a low-carbon rural tourism development model and exploring low-carbon poverty alleviation models and systems"; Baoting is vigorously promoting the construction of the China-Europe (Baoting) Green Digital Innovation Cooperation Zone and building the "China Natural Oxygen Bar"; Lingshui is accelerating the completion of key tasks for low-carbon development in seven major areas, including the Xin Village Tanka

Cultural Tourism Zone and the Perfume Bay Vitality Sports and Leisure Tourism Zone; Baisha is developing tea carbon label products and establishing the province's first "Two Mountains Platform"; Changjiang is leveraging its advantages as the largest clean energy supply base in the province and the world's first land-based commercial modular small reactor to promote the construction of a "waste-free city".

Making use of Resource Characteristics to Support and Guide Green Production and Consumption.

The *"Carbon Emission White Paper of Slender West Lake Scenic Area"* published in 2022, points out that low-carbon tourism mainly includes two aspects: the low-carbonization of tourism consumption and production. In the process of product development and sales, resource conservation and low emissions should be considered.

4.2 Advantage-Challenge (ST) Strategy Refers to the Use of its Own Advantages to Avoid or Mitigate the Negative Impact Caused by External Challenges

Building a Low-Carbon Tourism Index System to Measure the Degree of Low-Cannibalization of Tourism Resources.

The *"Research on Carbon Status and Carbon Reduction Pathways in Chinese Scenic Areas"*, supported by the Energy Foundation and coordinated by Carbon Trace (Beijing) Technology Co., Ltd., points out that promoting unified accounting of carbon emissions data will be an inevitable path and urgent task for future low-carbon tourism. Eight counties and cities should combine assessment and measurement results to provide scientific evidence for problem-solving and policy adjustments.

Expanding the Demonstration Effect and Promote the High-Quality Development of Tourism Industry.

Qin Haoet al. (2022) found that there is a positive coupling between Hainan's tourism economy and ecological environment, which to some extent validates the positive role of developing low-carbon tourism in Hainan for the development of the tourism industry and ecological construction.^[6]It is necessary to fully leverage the demonstration effect of provincial ecological tourism demonstration zones, promoting quality improvement and efficiency enhancement in local tourism, and creating model counties and cities for low-carbon tourism in Hainan.

Integrating Resource Advantages.

Tourism resources and ecosystems in ethnic regions are fragile. Increasing investment and cooperation in low-carbon economic and technological development, cross-regional collaboration relies on the unique resource advantages of each city or county, to share characteristic resource while avoiding homogeneous resource competition and achieve mutual benefits and win-win outcomes.

4.3 The Disadvantage-Challenge (WT) Strategy is a Defensive Technology Aimed at Reducing Internal Disadvantages and Avoiding External Environmental Challenges

Carrying out GEP Accounting and Promote the Value Transformation of Resources and Ecological Products.

As the renowned economist Posner, who excels in property rights theory, puts it as follows: unclaimed resources are prone to uncontrolled use and waste. By defining property rights, all tourism resources can be effectively utilized. Therefore, the ecological environment should be included in the public management scope of the government, with reasonable pricing for tourism resources. This will create a new environmental protection mechanism that combines government and market forces through price and compensation mechanisms, ensuring that the market accurately reflects the scarcity of tourism resources. Development and protection should be given equal importance, enhancing the authority of management and the efficiency of environmental management.

Eight cities and counties should explore reforms in the property rights system of tourist attractions, clarifying the operating rights, ownership, and management rights of tourism resources. They should construct an optimized model for allocating tourism resources. GEP accounting should be conducted according to actual needs, along with pilot projects for natural resource asset inventory and value accounting. At the same time, a system for applying the results should be established. In line with the requirements of the "Hainan Province Implementation Plan for Establishing and Improving the Mechanism for Realizing the Value of Ecological Products," efforts should be made to gradually establish and improve mechanisms for ecological product investigation and monitoring, decision-making for ecological project development, and protection and compensation for ecological products. Innovative models for economic development oriented towards the environment should also be established, guiding social capital to invest in the development and operation of ecological products, converting the functional quantity of ecological products and services into economic value, and promoting the accounting and conversion of ecological value.

Strengthening Carbon Emission Supervision and Improve Incentive Mechanisms.^[7]

Currently, the evaluation of tourism development focuses more on economic benefits and has not specifically calculated carbon emissions related to the tourism industry. This has led to a situation where development outweighs protection, hindering the growth of low-carbon tourism. Eight cities and counties should establish a low-carbon tourism development evaluation system based on their own circumstances. By conducting surveys on current tourism carbon emissions, they can develop quantified and detailed industry standards for carbon reduction and implement corresponding reward and punishment mechanisms based on statistical results.

Building an Extended Producer Responsibility System for Tourism and Optimize the Structure of Tourism Industry.

The sustainable development of tourism requires long-term vision and systematic thinking. It should not only stay at the level of "end governance", but focus on "source prevention and control". This means that we need to change the existing production mode and consumption mode, and promote the transformation and upgrading of the tourism industry.

The extended producer responsibility system in tourism refers to the extension of producers' responsibilities for tourism products to the final stage of their product life cycle. This requires producers to consider the environmental impact at every stage, including raw materials, production processes, selection of travel routes, use of tourism products, and disposal.^① They should encourage scenic areas to innovate low-carbon tourism formats, enriching their low-carbon tourism products and services throughout the travel process, from accommodation to dining, sightseeing, and shopping, enhancing visitors' low-carbon experience.

4.4 The Strategy of Disadvantage-Opportunity (WO) is to use External Opportunities to Make Up for Internal Disadvantages and Gain Advantages

Improving the Tourism Ecological Compensation Mechanism to Stimulate Endogenous Impetus.

By establishing and perfecting the ecological compensation mechanism, local residents are required to make economic compensation for the loss of ecological environment caused in the process of tourism consumption and development, internalize the economic external cost of tourism ecological environment, and stimulate the endogenous motivation for low-carbon tourism operation and consumption.

Hainan should improve the mechanism for realizing the value of national park ecological products, promote integration between parks and the 8 cities and counties, ensuring that ecological benefits serve the people; enhance the application of GEP calculation results, compile a list of ecological products, and turn the application of GEP calculation results into a hallmark brand for realizing the ecological value of Hainan Tropical Rainforest National Park; leverage the resource characteristics of different areas in eight cities and counties to create differentiated scenic spots, avoiding homogenized competition; promote industrial integration, enhancing the premium value of agricultural and forestry products through the branding of national parks.

Expanding Funding Channels and Break Through the Bottleneck of Low-Carbon Development.

In terms of funding sources, it is necessary to establish and improve the financial security mechanism for a low-carbon tourism economy. While increasing government investment, market funds should be explicitly introduced as a means to encourage

^① Xu Jian. Research on China's circular economy and related legislative systems [D]. Harbin Engineering University, 2006

private capital to enter the field of tourism ecological construction, thereby broadening channels for funding sources. In terms of compensating investors, methods such as financial compensation, tax reduction, intellectual compensation, and policy compensation should primarily be adopted.

Building a Community of Co-Governance and Comprehensively Promote the Integration of National Park and Community.

Eight cities and counties are located within national park, and the construction of a national park community should be advanced with a systemic perspective. The community governance community, as an intrinsic logic for the harmonious coexistence of humans and nature in national parks, advocates for harmonious development relationships among people, society and nature, providing new research ideas for the transition to sustainable eco-tourism communities. Hainan has established a community coordination zone committee. This further optimizes the communication and coordination mechanisms between national park management institutions and local governments, effectively addressing conflicts and issues in the integration of "park" and "region". At the same time, it plays a positive role in encouraging and guiding residents within national park to deeply participate in park construction. Hainan should improve community participation mechanisms, establish a community governance liaison meeting system, optimize the governance pattern of "park-region linkage," enhance the effectiveness of community collaborative governance, promote environmental improvements and sustainable development of protected area communities, and stimulate enthusiasm for multi-channel participation in joint construction and management.

5 Conclusions

First, Regional development is differentiated. Ecological core counties such as Wuzhishan, Baoting, Baisha, and Qiongzong boast robust ecological foundations and minimal environmental pressures, whereas Dongfang and Changjiang confront relatively greater ecological pressures and transformation challenges. Overall, the eight counties still face shortcomings in economic drivers and tourism industrialization levels, which constrain the endogenous growth of low-carbon tourism.

Second, a multi-dimensional SWOT integration strategy should be adopted. The SO strategy leverages geographical, resource, and policy advantages to develop a low-carbon tourism cluster integrating mountain and coastal areas. The ST strategy focuses on establishing low-carbon tourism evaluation metrics, leveraging the demonstration zone's leadership to avoid homogenized competition. The WO strategy capitalizes on external opportunities to enhance ecological compensation and financing channels, while deepening community co-governance. The WT strategy drives industrial green transformation through GEP accounting, strengthened carbon regulation, and the implementation of an extended producer responsibility system.

Third, achieving the objectives hinges on systemic governance and value transformation. It is imperative to maintain a balance between high-level conservation and

high-quality development, refine the mechanisms for realizing the value of ecological products, and establish a collaborative governance framework involving multiple stakeholders—government, enterprises, communities, and the public—to ultimately achieve a win-win outcome in ecological protection, cultural preservation, and sustainable development. This constitutes a long-term systemic endeavor that requires integrated application of institutional, technological, and model innovations.

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