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EVALUATING THE SUSTAINABLE DEVELOPMENT POTENTIAL OF FOREST HEALTH TOURISM: A CASE STUDY OF CHONGQING

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Abstract

Amid population aging and rising health awareness, forest health tourism has driven the rapid development of forest health bases in China. While existing studies have assessed the suitability of forest health bases from the perspectives of the health market, health environment, and forest resources, the indicator systems remain insufficiently refined and largely neglect inter-dimensional coordination, thereby constraining their capacity to adequately reflect sustainable development potential(SDP). This study: (1) refines traditional suitability indicators and, based on the principle that development suitability and inter-dimensional coordination are equally important, constructs a SDP evaluation framework; (2) conducts an empirical investigation on 16 municipal-level and above bases in Chongqing and identifies several high-potential cases; and (3) employs grey relational analysis to show that High-SDP tiers are dominated by HE quality, Medium-SDP by HE-FR synergy, and Low-SDP by HM-HE interaction. The study provides both theoretical support and a practical tool for forest health base sustainable development.

Key Words: *Forest Health Bases, Development Suitability, Multidimensional Coordination, Sustainable development potential*
JEL classification: Z32

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Introduction

Good health and well-being have always been core human pursuits. However, accelerated industrialization and urbanization have increased non-communicable diseases and global aging, driving rising demands for healthcare and elderly care (Wu et al., 2025). In this context, the comprehensive health industry, including health tourism and senior care, has achieved rapid development (Doimo et al., 2020). As a vital branch, forest health tourism relies on natural ecological advantages to improve physical and mental well-being, emerging as a popular healthy lifestyle choice (Jiang et al., 2025).

Forest health bases serve as essential carriers for such tourism. Current relevant studies mainly focus on influencing factors and indicator construction, while sustainable potential assessment remains insufficient. Existing evaluation systems overly emphasize development suitability but ignore multidimensional coordination (Fei et al., 2023). Neglecting coordinated development triggers ecological damage, repetitive construction and operational dilemmas, restricting the long-term sustainable development of forest health bases.

This study evaluates the sustainable development potential of forest health bases. Balancing development suitability and multidimensional coordination, it establishes a practical and universal evaluation indicator system. Via empirical analysis, key influencing factors are identified to inform the construction and long-term sustainable development of forest health bases.

Literature Review and Evaluation System Construction

Connotation of Forest Health Tourism

Forest health tourism leverages forest ecological elements to boost human immunity, prevent disease, and improve physical and mental health (Satyawati et al., 2022). For example, forest ecosystems offer low-cost, noninvasive therapeutic effects with proven psychological and physiological benefits (Furuyashiki et al., 2019; Song et al., 2013), and forest exposure effectively lowers blood pressure, relieves stress, and strengthens immune function (Elsadek et al., 2019).

China's forest health industry has expanded rapidly, with growing numbers of forest health bases (Huang et al., 2019). Nevertheless, the

sector suffers from imperfect facilities, single products, and inadequate management systems, highlighting the necessity of scientific sustainable potential evaluation. Sustainable forest health development relies on coordinated market, environment, and resource optimization (Gao & Tang, 2025). Accordingly, this study defines the sustainable development potential of forest health tourism as balanced, coordinated, and synergistic industrial advancement based on rational forest resource utilization and multi-dimensional coordination.

Research Progress on Sustainable Development Potential of Forest Health Bases

Forest health tourism is an integrated sector that unites forestry, healthcare and tourism to improve human well-being. A dual-axis evaluation framework, including development suitability and multidimensional coordination, is critical for assessing its sustainable potential and identifying developmental bottlenecks (Shen et al., 2015). Rational potential evaluation also promotes efficient forest resource use and guides industrial sustainable development (Goffi et al., 2018). Based on previous indicator research and coordination theory (Liu et al., 2022), this study constructs a three-dimensional assessment system covering market, environment and forest resource sustainability (Wang et al., 2025; Yang et al., 2025; Yang & Du, 2025). Overall suitability is determined by integrated dimensional scores, while coupling coordination degree is adopted to quantify system balance and support coordinated sustainable development.

Construction of Comprehensive Evaluation System

A scientifically rigorous evaluation index system is critical for standardizing forest health base development and optimizing therapeutic effects. This study constructed a refined evaluation system covering three core dimensions: health market, health environment, and forest resources. The health market dimension includes population size, aging population, economic development level, per capita disposable income, scenic area resources, and number of tourists received. The health environment dimension comprises PM2.5, O₃, negative oxygen ion levels, surface water quality, climatic comfort, and average altitude. The forest resource dimension consists of forest area, percentage of forest cover, percentage of natural forests, stand density index, forest canopy density, and percentage of mature forests. It greatly improves assessment precision,

quantifies multidimensional coordination, and offers scientific guidance for rational base planning and efficient forest resource utilization.

Research Area and Methodology

Overview of the Study Area

As a key ecological barrier in the upper Yangtze River Basin, Chongqing has rich forest resources with a coverage rate of 55.06% in 2023, laying a solid foundation for diverse forest health services. Given the unbalanced site selection of forest health bases, this study proposes an integrated dynamic assessment framework. It couples development suitability with multidimensional coordination to guarantee long-term operational sustainability.

Evaluation Method

For targeted quantitative evaluation, comprehensive measurements covering market, environment and resource suitability as well as multidimensional coordination are required. The overall assessment workflow includes four core steps: suitability evaluation, coordination measurement, sustainable development potential quantification, and influencing factor analysis.

Empirical Evaluation Results

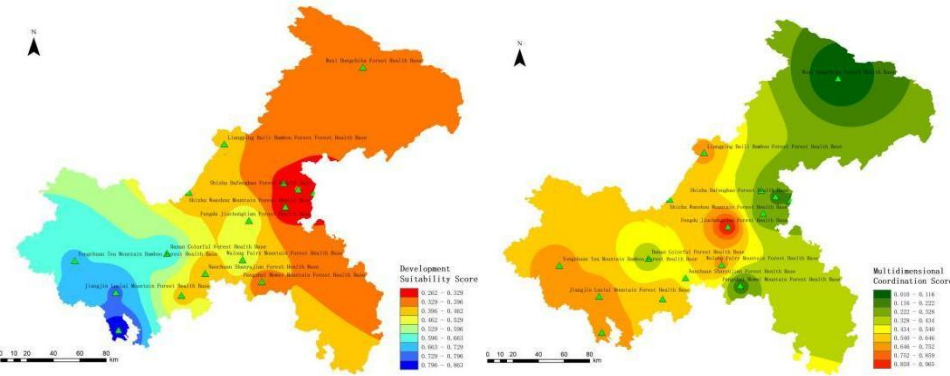
Assessment Results of Development Suitability

A linear weighting method was applied to calculate comprehensive development suitability scores for 16 Chongqing forest health bases. Using quantile classification of these scores the bases were grouped into high-, medium-, and low-development suitability tiers. High development suitability tier: Four bases achieved scores above 0.6. Medium development suitability tier: Eight bases scored between 0.35 and 0.6. Low development suitability tier: Four bases located in Shizhu County scored below 0.35. The evaluation revealed a distribution of 25% high-, 50% medium-, and 25% low-development suitability bases. While 75% of Chongqing's forest health bases demonstrate moderate-to-high developmental potential, results indicate opportunities for systemic optimization.

Assessment Results of Multidimensional Coordination

Based on the evaluation results, multidimensional coordination scores (MI) were calculated using the Coupling Coordination Degree Model (CCDM), and quantile classification was applied to group Chongqing’s forest health bases into high-, medium-, and low-coordination tiers. High multidimensional coordination tier: Six bases scored above 0.65, demonstrating balanced development across all dimensions with no significant deficiencies. Medium multidimensional coordination tier: Five bases scored 0.3–0.65, showing moderate coordination but with localized weaknesses in specific dimensions. Low multidimensional coordination tier: Five bases scored below 0.3, exhibiting multidimensional imbalances and overreliance on isolated strengths, which constrains sustainable development potential. The evaluation revealed a distribution of 37.5% high-coordination, 31.25% medium-coordination, and 31.25% low-coordination bases. While 68.75% of Chongqing’s forest health bases exhibit moderate-to-high multidimensional coordination, sustained efforts are required to optimize cross-dimensional synergies.

Figure 1: Spatial Distribution Scores for Development Suitability and Multidimensional Coordination



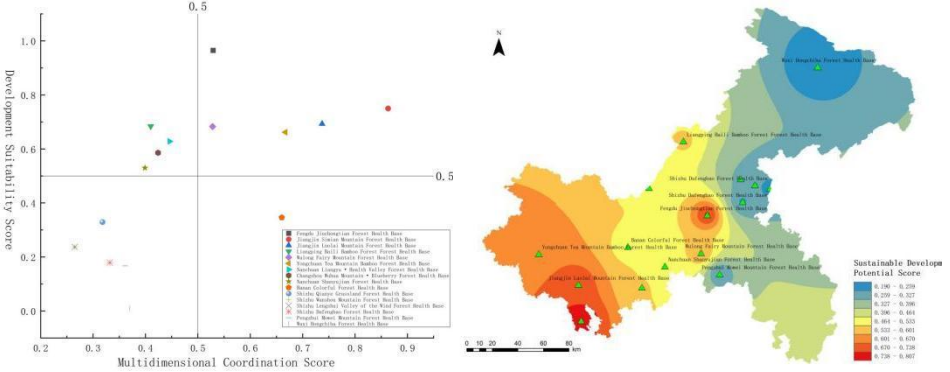
Source: Authors

Quantitative Evaluation Results of Sustainable Development Potential

A GE Matrix-based evaluation framework integrating three dimensions was applied to assess the sustainable development potential of 16 municipal-level forest health bases in Chongqing. High sustainable development potential tier: Five bases scored above 0.5 in both

development suitability and multidimensional coordination, demonstrating robust cross-dimensional synergies essential for long-term sustainability. Medium sustainable development potential tier: Four bases achieved multidimensional coordination scores >0.5 but development suitability scores <0.5 , indicating localized weaknesses in market positioning, environmental optimization, or resource utilization. Low sustainable development potential tier: Six bases scored <0.5 in both metrics, constrained by fragmented advantages in isolated dimensions and systemic inefficiencies in cross-dimensional alignment.

Figure 2: Development Suitability-Multidimensional Coordination Matrix and Spatial Distribution for Sustainable Development Potential



Source: Authors

Analysis of Influencing Factors of Sustainable Development Potential

Based on the sustainable development potential evaluation results, this study identifies key factors influencing sustainable development potential enhancement across high-, medium-, and low-tier forest health bases in Chongqing. In the high-potential tier, two bases are primarily influenced by forest resources, two by health environment, and Wulong Fairy Mountain Forest Health Base is most influenced by the health market. In the moderate-potential tier, three bases are primarily influenced by health environment, and two by forest resources. In the low-potential tier, five bases are primarily influenced by health market factors, and Wuxi Hongchiba by health environment.

Conclusion

Based on the principle that development suitability and multi-dimensional coordination are equally important, this study optimizes traditional

evaluation criteria and constructs a sustainable development potential (SDP) evaluation system consisting of three dimensions and 18 indicators. An empirical study was conducted using 16 forest health bases in Chongqing. The main conclusions are as follows: (1) By introducing the coupling coordination degree model and GE matrix, and using the formula $SDP = (DI+MI)/2$, this framework addresses the limitation of previous research that overemphasizes suitability while neglecting coordination, providing a theoretical tool for site selection and dynamic evaluation. (2) The empirical results show spatial differentiation: 31.25% of bases have high SDP, 31.25% medium, and 37.5% low. High-potential bases are concentrated in Jiangjin, Fengdu, and Yongchuan, while low-potential ones are mostly in remote mountainous areas. Some national-level bases, such as Banan Colorful Forest, show limited advantages. Overall, Chongqing is transitioning from traditional forest tourism to specialized forest health services. (3) Using grey relational analysis, the study finds that the health environment most significantly impacts high-SDP areas; both health environment and resources affect medium-SDP areas; and health market and environment influence low-SDP areas.

However, this study has limitations, including the use of alternative indicators due to data constraints, reliance on cross-sectional static data, and a superficial analysis of driving factors. Future research should optimize the indicator framework, integrate diversified empirical models, and expand the scope with time-series data and regional comparisons to formulate more differentiated development paths.

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Appendix: Sustainable Development Potential Evaluation Results of Forest Health Bases in Chongqing

Potential Classification	Base Name	Development Suitability	Multidimensional Coordination	Sustainable Development Potential
High Potential Tier	Jiangjin Simian Mountain Forest Health Base	0.863	0.750	0.807
	Fengdu Jiuchongtian Forest Health Base	0.529	0.965	0.747
	Jiangjin Luolai Mountain Forest Health Base	0.737	0.693	0.715
	Yongchuan Tea Mountain Bamboo Forest Health Base	0.667	0.662	0.665
	Wulong Fairy Mountain Forest Health Base	0.528	0.683	0.605
Moderate Potential Tier	Liangping Baili Bamboo Forest Forest Health Base	0.410	0.684	0.547
	Nanchuan Liangyu • Health Valley Forest Health Base	0.446	0.628	0.537
	Changshou Wuhua Mountain • Blueberry Forest Health Base	0.424	0.586	0.505
	Banan Colorful Forest Health Base	0.660	0.346	0.503
	Nanchuan Shanyujian Forest Health Base	0.399	0.530	0.464
Low Potential Tier	Shizhu Qianye Grassland Forest Health Base	0.318	0.329	0.323
	Pengshui Mowei Mountain Forest Health Base	0.361	0.167	0.264
	Shizhu Dafengbao Forest Health Base	0.332	0.179	0.256
	Shizhu Wanshou Mountain Forest Health Base	0.265	0.237	0.251
	Shizhu Lengshui Valley of the Wind Forest Health Base	0.262	0.212	0.237
	Wuxi Hongchiba Forest Health Base	0.370	0.010	0.190