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Forest tourism development conflict analysis under carbon peak and neutrality goals—Based on graph model for conflict resolution

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To achieve carbon peaking and carbon neutrality goals, maintaining forest savings has become the key. How to reduce the damage of forest tourism development to the environment, reconcile conflicts, and promote the orderly implementation of forest tourism projects while maintaining forest savings is an important prerequisite for the development and construction of forest tourism. First, we constructed a fundamental Graph Model for Conflict Resolution (GMCR) during forest tourism development under carbon peak and neutrality goals. From the perspective of the dynamic interaction of conflict analysis, this article explains the game behavior behind the conflict of forest tourism development. Next, we calculated the equilibrium solution of a three-party game which means tourism enterprises adopt compensatory strategies, local residents support forest tourism development, and the government supports tourism enterprises for development projects, develops an ecological compensation system, and strengthens supervision. It provides a set of systematic and effective conflict analysis tools for stakeholders of forest tourism development projects and provides decision-making and reference information for the formulation of similar environmental resource development policies.

KEYWORDS

forest tourism development, conflict analysis, graph model for conflict resolution, China, carbon peak and neutrality goals, game

1 Introduction

As the contradiction between environmental protection and social and economic development becomes more and more intense, the Kyoto Protocol, the Paris Agreement, and other conferences and agreements have emerged in order to reduce carbon emissions and seek sustainable development of the Earth's ecology (Ding and Wang, 2020). On 22 September 2020, at the General Debate of the Seventy-fifth United Nations General Assembly, General Secretary Xi Jinping proposed: "China's carbon dioxide emissions must reach the peak by 2030 and strive to achieve carbon neutrality by 2060" (Liu, 2020).

Making this major strategic decision demonstrates China's determination and efforts to deal with global climate issues and also provides a direction and a starting point for China to accelerate the construction of ecological civilization and high-quality development (Gao and Yu, 2021). Forests have a carbon sink function (Xi and Li, 2006), and forest carbon sinks are an important strategy for China to deal with global climate issues (Zhang and Chen, 2021). Therefore, the protection of forest deposits has received widespread attention. In addition to its ecological value, forest tourism resources can also provide tourists with economic values such as recreation and forest health. Therefore, forest tourism is welcomed by more and more tourists (Zhang, 2017). As a result, more and more tourism enterprises are interested in developing forest tourism resource projects in forest areas with conditions, which has brought considerable economic benefits to the local economy (Jia and Liu, 2020). However, forest tourism resources are very limited in their ability to decompose and purify waste and recover from ecological damage (Yang et al., 2011). Socio-economic development and changes in human activities can easily destroy forest resources, such as fires caused by changes in human activities (Pereira et al., 2005). The tourism activities of forest tourists will produce a tourism carbon footprint, and the development of tourism projects will also destroy forest tourism resources to a certain extent, resulting in a reduction in forest savings (Wang et al., 2018). At the same time, the forest tourism development process will encroach on cultivated land and woodland of local residents, and even force residents to leave their homes. Although tourism development can promote the development of the local economy, the intervention of external investors and the government may crowd out the interests of local residents. When local residents lose control over tourism, their ability to develop in other industries such as agriculture and fisheries will also be affected (Greenwood, 1972). As the literature (Lopes et al., 2015) found when studying how fisheries and tourism in southeastern Brazil interact with nature conservation, resources in a certain area are limited. To achieve non-conflicting use of environmental resources between tourism development and other industries, a fee for environmental services is needed. In addition, the external environmental costs, such as cultural invasion and environmental destruction caused by the influx of a large number of tourists, have increased residents' expenditures (Liu and Zhao, 2021). In practice, residents have not been compensated for the increase in external environmental costs, which has caused constant conflicts among many stakeholders in the process of forest tourism development (Yi, 2011). Faced with the demanding background of China's "dual carbon" goal, the conflict of forest tourism development needs further attention and resolution. The concept of conflict originates from sociology and reflects the most common phenomenon in social life, which refers to the way or process of fierce social interaction between individuals or groups (Chen, 2000), manifested in contradictions

or tensions in mutual relations and even confrontations behavior (Cornet, 2015; Xie, 2019). Under the background of the "dual carbon" goal, all kinds of social activities begin to emphasize low-carbon and environmental protection (Liu et al., 2020), and inappropriate forest tourism development will destroy local forest resources, reduce forest savings, and affect the normal life of local residents. Enterprises hope to develop forest tourism projects at the lowest cost, while local residents do not want forest tourism development to affect the local environment and residents' lives. On the one hand, the government hopes that enterprises will bring more economic benefits to the development of forest tourism projects; on the other hand, it also hopes to achieve the carbon emission reduction target, which leads to the conflict of interests between local residents, forest tourism development enterprises, and the government. If this conflict cannot be properly resolved, on the one hand, the local residents will not cooperate or even hinder the confrontation of project development, construction, and management, and the development of local forest tourism industry will be difficult to achieve; on the other hand, improper forest tourism resource development activities of enterprises, such as extensive development and blind occupation of land for development without reasonable planning, will damage local forest resources and ecological environment, reduce forest savings, and be not conducive to the realization of the "dual carbon" goal.

Previous studies on conflicts in the field of tourism were mostly based on stakeholder theory. The contradictions and conflicts among stakeholders related to the tourism industry were mostly based on uneven distribution of interests and imbalance of the right structure. In the process of tourism development, the causes of conflicts are incompatible economic demand (Dredge, 2010; Li et al., 2020), differences in attitudes or values (Brown and Raymond, 2014), and unsound management systems (Ji et al., 2012). Literature (Zhang, 2013) uses the classical game method, and this study analyzed the game process between tourism enterprises and community residents and found that it is the contradiction caused by the difference in interest demands of both sides. Literature (Tang, 2020) points out that in the face of the conflict between enterprises and residents caused by an uneven distribution of interests, it is necessary to optimize the way of interest distribution and change the differences of interests to build a tourism interest community. From the perspective of decision-makers, there are mainly pairwise games between enterprises and residents, residents and tourists, governments and enterprises, and villagers and villagers (Tang, 2020). Some scholars have jointly considered the multiple subjects of local governments, tourism enterprises, and community residents. Others have also included tourists in the game category and constructed a multi-party game framework (Li and Zhao, 2020). In terms of methods, stakeholder analysis in the field of tourism is mainly based on classical game methods (Li et al., 2020), and some scholars conduct quantitative analysis based on data collection (Kuvan

and Akan, 2012; Nguyen et al., 2022). The contradictions of interest distribution and status differences among stakeholders in the existing literature have laid a theoretical foundation for this study. However, the core of the existing research is the balance of interest distribution, and there is less analysis based on the goal of low-carbon environmental protection and much less conflict analysis in the field of forest tourism. Graph Model for Conflict Resolution (GMCR) is an extension of Classic Game Theory and Partial Game Theory. It mainly conducts a formal and effective analysis of conflict behaviors between decision-makers to help decision-makers analyze the optimal decision plan (Fang et al., 1989). Graph Model for Conflict Resolution (GMCR) combines quantitative and qualitative analysis methods and uses set theory and graph theory to present the generation, development process, and final results of conflict behavior in social life in a mathematical modeling manner (Hou and Xu, 2016). Compared with game theory, the conflict analysis model requires less data and information and is more practical (Kilgour et al., 1987; Han et al., 2022).

Therefore, the study took the forest tourism development conflict as the research object to solve the conflict problem in the forest tourism development under the background of “dual carbon” through the Graph Model for Conflict Resolution (GMCR) and provided analysis tools and basis for decision-making for resolving the conflict between the various stakeholders in the forest tourism development. This article includes the following parts: First, based on the background of forest tourism development conflict, we clarified the main strategies, feasible states, and state transition diagrams of forest tourism development stakeholders. Second, we identified and ranked the preferences of different stakeholders. Third, based on strategy and preference information, software was used to solve the equilibrium solution of forest tourism development conflict. Fourth, we drew conclusions and put forward countermeasures and suggestions to solve the conflict of forest tourism development.

2 Research method

2.1 Graph Model for Conflict Resolution (GMCR)

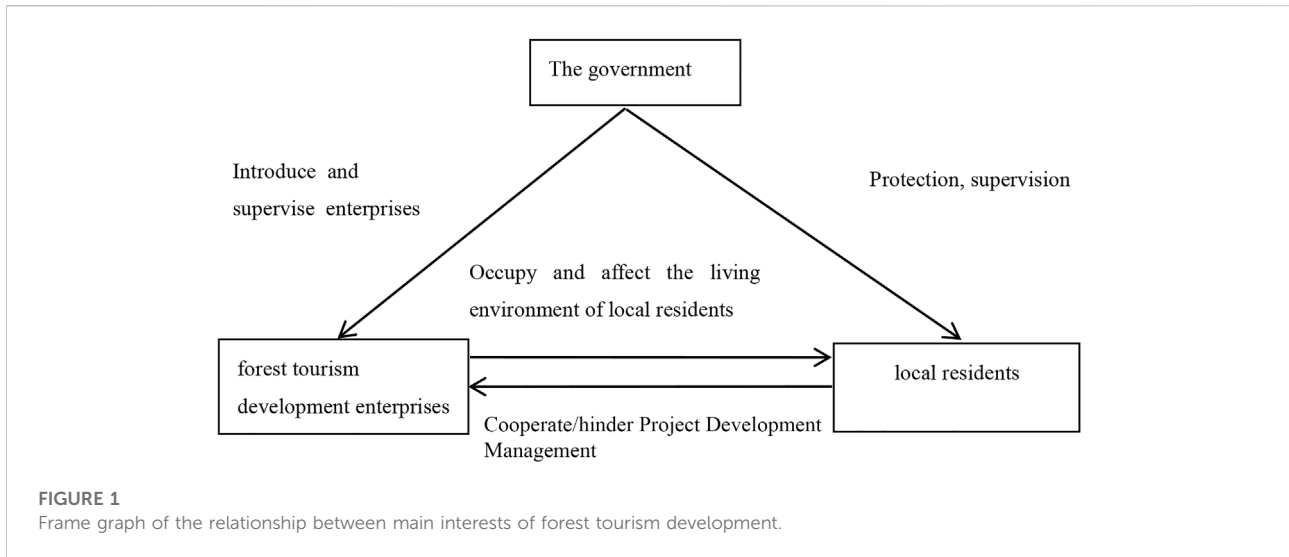
Forest tourism development involves multiple stakeholders. Considering that the information on different subjects is difficult to obtain in the actual development process, the lack of real data information leads to the reduction of the applicability of the quantitative model. Therefore, a more adaptable Graph Model for Conflict Resolution (GMCR) method is adopted. The model does not require complex data and can draw research conclusions by analyzing the preference information of various stakeholders, combining the dual advantages of qualitative and quantitative analysis. Decision-makers and

strategies, feasible states, state transition graphs, and preference information are the four core elements of the Graph Model for Conflict Resolution (GMCR) (Zhao et al., 2016). The construction of a basic diagram model of forest tourism development conflicts under the background of the “dual carbon” target needs to be based on the background of the conflict problem and reflect the aforementioned four core elements.

2.1.1 Conflict problem background

Forest tourism development is based on the development process that forest tourism resources provide consumers with forest-related tourism products (He, 2010). The forest tourism development conflict involves the three main stakeholders: the forest tourism development enterprise, local residents, and the government. Forest tourism development enterprises will occupy local residents' woodland, arable land, and houses when constructing facilities required for forest tourism projects and delineating tourism activities. Some residents may be forced to leave the long-term living environment. Furthermore, tourism development will destroy the local ecological environment to a certain extent and reduce local forest deposits. Economic losses and environmental losses coexist. In such a situation, it is inevitable for local residents to oppose and even confront the development activities of forest tourism enterprises when facing the infringement of forest tourism development on their own economic and environmental interests. The opposition from local residents is the core of forest tourism development conflicts. Adopting reasonable strategies to obtain support from local residents is the key to the implementation of forest tourism development projects.

For forest tourism development enterprises, facing the pressure of the “dual-carbon” target background, on the one hand, they can continue to adopt the traditional forest tourism development model, that is, non-protective development. The development cost of this development method is lower, but the protective use of the environment is ignored, which is more likely to conflict with local residents, causing resistance and non-cooperation from local residents, making it difficult to maintain development projects. On the other hand, forest tourism development enterprises can follow corresponding standards and adopt protective development strategies. The development of forest tourism products and the construction of tourism facilities on the premise of protecting the forest ecological environment and maintaining forest deposits will help to win the support of local residents and all walks of life, but at the same time, it needs to bear higher protection and development costs. It is contrary to the characteristics of the enterprise's purpose of profitability. In addition, forest tourism development enterprises can also adopt compensatory development to provide local residents and the government with a certain amount of economic compensation while carrying out forest tourism development and construction. On



the one hand, it makes up for residents’ sense of deprivation in the process of forest tourism development. On the other hand, local governments and residents can use this compensation income to repair the environmental damage caused by forest tourism development, to a certain extent, to meet the purpose of forest protection. The government must not only play the role of attracting investment to promote local economic development but also uphold the concept of ecological civilization, maintain the local ecological environment, and take the path of sustainable development. In addition, out of the need for political performance, the government is more inclined to place external industrial and commercial capital in places, use local characteristic resource development projects to revitalize the industry, and provide more employment opportunities and sources of income for the local area. Therefore, the government generally supports the development of forest tourism development projects. However, in view of the pressure of low-carbon environmental protection and the pressure of local residents, the government can adopt an ecological compensation system and strengthen supervision strategies to reconcile conflicts and promote the implementation of tourism development projects. In view of the background of the conflict issue, the excellent tourism development stakeholder relationship framework is summarized as shown in Figure 1.

2.1.2 Decision-makers and strategies

According to the description of the conflict background, the forest tourism development conflict under the “dual carbon” target background mainly includes three decision-makers. They are the forest tourism development enterprises (DM1), local residents (DM2), and the government (DM3).

(1) Main strategies of forest tourism development enterprises

Forest tourism development enterprises aim to maximize the profits of enterprises and obtain higher profits by vigorously developing forest tourism resources, developing forest tourism projects and tourism products, and promoting consumer consumption. At the same time, tourism enterprises also need to assume social responsibilities. They adopt pro-environmental behaviors and maintain good cooperative relations with local residents and governments based on the reputation mechanism and feasibility of the project. Therefore, the main strategies of forest tourism development enterprises are as follows.

The first is non-protective development. During the development and construction of forest tourism projects, planning, construction, operation, and management aimed at the lowest cost may pollute the local ecological environment, destroy forest resources, and affect the normal production and life of local residents.

The second is protective development. Based on the natural environment and socio-economic status of the forest area, under the scientific guidance of ecology, landscape science and ethics, planning, construction, operation, and management are carried out on the basis of not damaging the local forest ecology and not affecting the daily life of local people. Clean energy, energy-saving products, and environmental protection products should be used in the development and construction process, and the generated waste should be disposed of harmlessly.

The third is compensatory development. On the basis of non-protective development, the local government and residents should be given certain economic compensation. On the one hand, the exclusion psychology of local residents can be reduced. On the other hand, the government can use this economic compensation to restore the damage and pollution caused by the development of forest tourism projects.

The fourth is abandoning development. If the forest tourism development enterprise receives strong opposition from

residents, when the conflicts between the parties are difficult to reconcile, and the cost-benefit ratio of the forest tourism development project is too low, the enterprise will choose to abandon the development, that is, to cancel the local forest tourism development project.

(2) Main strategies of local residents

For local residents, the process of forest tourism development will bring a sense of deprivation to local residents. Their original living environment will be changed. Traditional ecological resources and cultural awareness will also be impacted by outsiders, which destroys their traditional living habits. Forestry products that could originally bring economic benefits will also be restricted and will not be able to obtain benefits within a certain period of time. Therefore, the main strategies of local residents are as follows.

The fifth is opposing the development of forest tourism. Convey dissatisfaction and opposition to the government and enterprises about the messages that forest tourism development enterprises and forest tourism projects do not cooperate or even hinder the construction and management of forest tourism development projects.

(3) The main strategy of the government

For the government, the development of forest tourism is an important opportunity to develop the multi-functional value of rural forest areas and revitalize the forest industry (Li, 2019). The public choice theory believes that from a certain perspective, the government can be regarded as an economic man with certain self-interested behavior motives and certain profit-seeking characteristics (Qiao and Wang, 2002). Therefore, it is an inevitable choice for the government to promote the development of forest tourism. In reality, the government is often the promoter of tourism development and the introduction of forest tourism development enterprises. However, the government also needs to assume social responsibilities. Protecting the ecosystem of forest areas and maintaining forest savings are also responsibilities that the government cannot ignore. Therefore, the main strategies of the government are as follows.

The sixth is supporting the development of forest tourism by tourism enterprises. Strengthen the comprehensive compensation system for forest ecological benefits, formulate preferential policies for tax reduction and exemption based on preferential investment policies and preferential policies for the establishment of forest tourism construction projects, strengthen forest tourism publicity, and increase public opinion support.

The seventh is formulating an ecological compensation system and strengthening supervision. Amplify a comprehensive compensation system for forest ecological benefits, preferential policy for investment, preferential policy

for tax reduction and exemption, preferential policy for project approval of forest tourism construction projects, public opinion and consumption-oriented support, and so on. Formulate the ecological compensation and economic compensation system and management measures for forest tourism development, clarify the liability and scope of compensation, clarify the scope of ecological and social responsibilities that enterprises should undertake, and set up a special project management team to supervise the planning, construction, operation, and management activities of enterprises, and supervise enterprises to implement the economic compensation to residents and local governments.

2.1.3 Feasible state

According to the aforementioned analysis, the three main decision-makers of forest tourism development have a total of seven strategies, and the corresponding decision-makers of each strategy have two attitude expressions, including "Y" and "N", which are represented by different decision-makers. The situation is obtained by different decision-making attitudes of different decision-makers. Graph Model for Conflict Resolution (GMCR) calls this situation a state (Kilgour et al., 1987). Based on this, there are a total of 2^7 states of forest tourism development conflicts, but not all states are feasible in reality. For example, forest tourism development enterprises cannot choose between protective and non-protective development strategies at the same time. There is another category that no matter what the residents and the government choose, forest tourism development enterprises will abandon the development of forest tourism. Eliminating the infeasible states, it is as shown in Table 1 that there are 19 feasible states of forest tourism development conflicts. The "-" in S19 means that no matter what strategy other decision-makers adopt, forest tourism development enterprises will choose to give up development.

2.1.4 State transition graph

State transition refers to the fact that decision-makers adjust their own strategies to make their own decision-making state change without considering the other decision makers' changing strategies. The state transition graph reflects the game interaction process of decision-makers (Zhao et al., 2016). According to the feasible state table, the state transition graph of the forest tourism development conflict under the "dual carbon" goal is drawn, as shown in Figures 2–4. The circles in the figure represent the feasible states. The arcs connect different feasible states, and the arrows of the arcs indicate the transition direction of the states (Zhao et al., 2016; Zhang et al., 2019).

2.1.5 Preference information

The strategic priority ranking method is used to rank the state preferences of forest tourism development conflicts (Fang et al., 2003a). The option prioritization requires that prior to ranking, a corresponding set of preference statements should be

TABLE 1 Feasible state.

Decision-makers	Strategies	S ₁	S ₂	S ₃	S ₄	S ₅	S ₆	S ₇	S ₈	S ₉	S ₁₀	S ₁₁	S ₁₂	S ₁₃	S ₁₄	S ₁₅	S ₁₆	S ₁₇	S ₁₈	S ₁₉
Forest tourism development enterprises (DM1)	1. Non-protective development	Y	N	N	Y	N	N	Y	N	N	Y	N	N	Y	N	N	Y	N	N	—
	2. Protective development	N	Y	N	N	Y	N	N	Y	N	N	Y	N	N	Y	N	N	Y	N	—
	3. Compensatory development	N	N	Y	N	N	Y	N	N	Y	N	N	Y	N	N	Y	N	N	Y	—
	4. Abandoning development	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y
Local residents (DM2)	5. Opposing the development of forest tourism	N	N	N	Y	Y	Y	N	N	N	Y	Y	Y	N	N	N	Y	Y	Y	—
Government (DM3)	6. Supporting the development of forest tourism	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	—
	7. Formulating an ecological compensation system and strengthening supervision	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	—

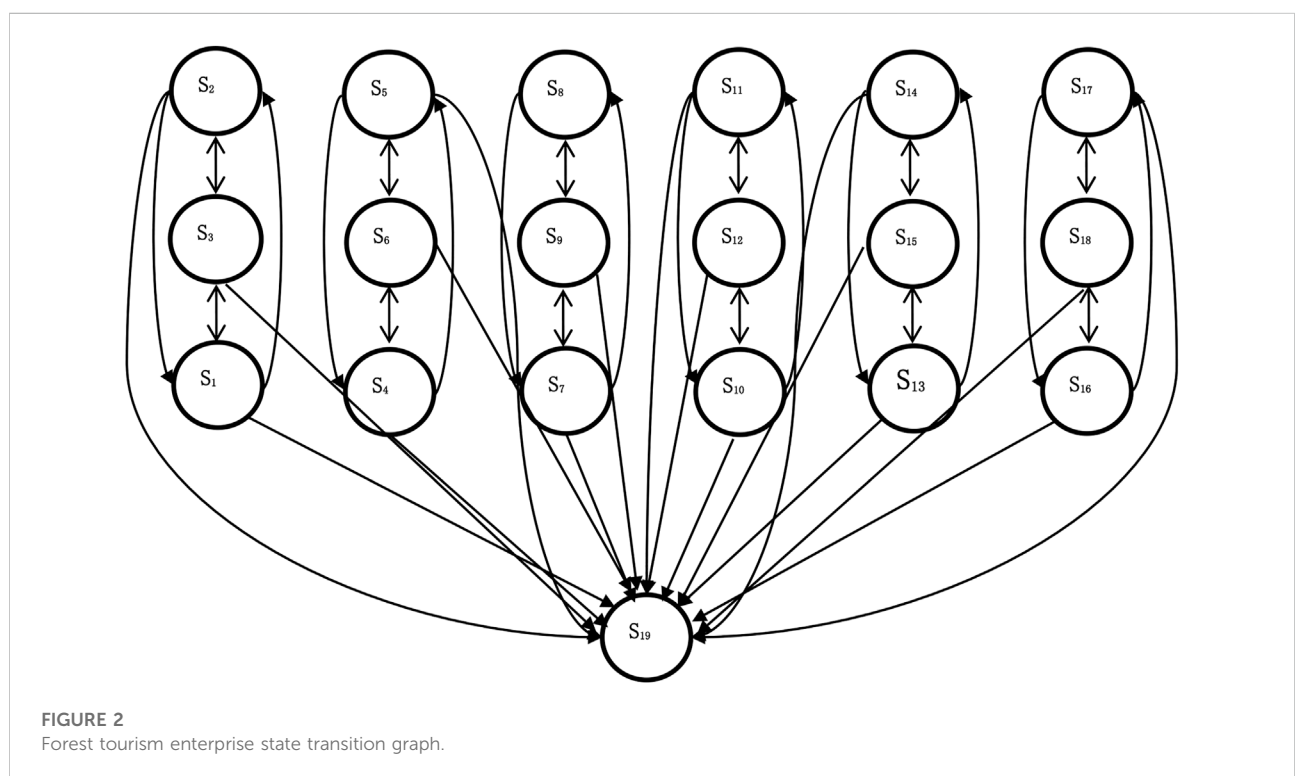


FIGURE 2 Forest tourism enterprise state transition graph.

given according to the specific preference information of each decision-maker, and the decision maker's preference sequence can be obtained based on the preference statement information (Fang et al., 2003b). According to the analysis background of forest tourism development conflicts, the preference statement information of forest tourism development enterprises, local residents, and governments in forest tourism development conflicts can be obtained through analysis, as shown in Table 2.

From the preference statement information in Table 2, according to the strategic priority ranking method, the state preference sequence of the tripartite decision-makers involved in forest tourism development conflicts is as follows.

- (1) Preference sequence of forest tourism development enterprises (DM1)

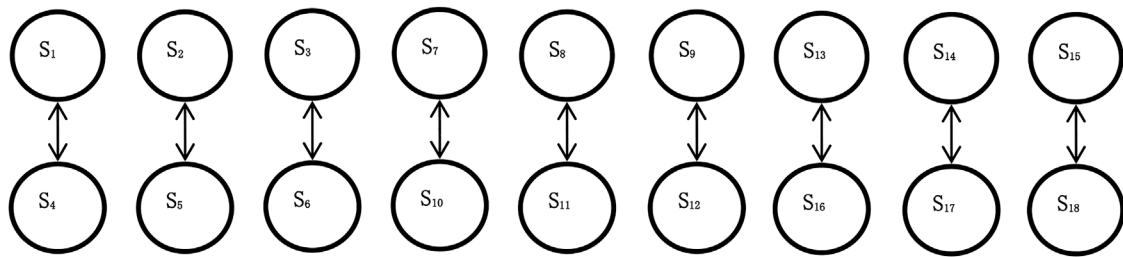


FIGURE 3
Local residents' state transition graph.

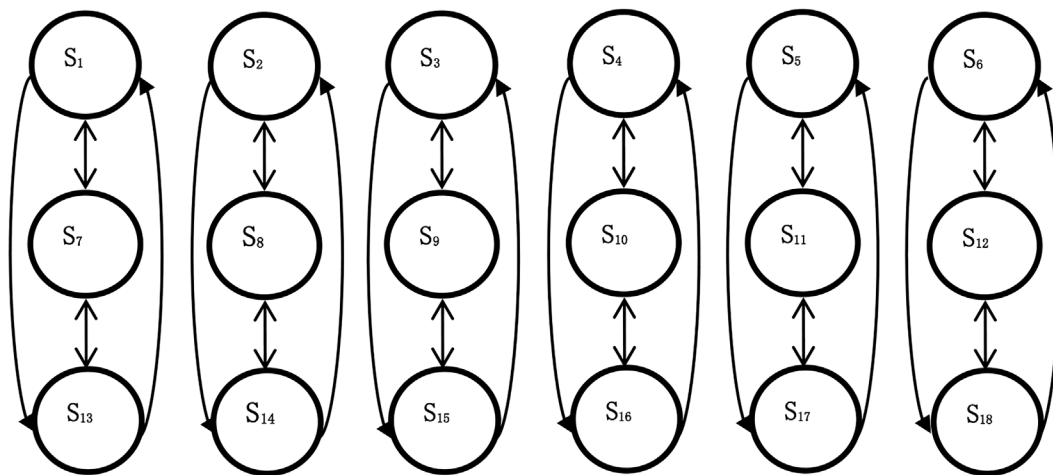


FIGURE 4
Government's state transition graph.

$S7 > S13 > S9 > S15 > S1 > S3 > S10 > S16 > S12 > S18 > S4 > S6 > S8 > S14 > S2 > S11 > S17 > S5 > S19$.

(2) Preference sequence of local residents (DM2)

$S14 > S17 > S8 > S2 > S5 > S11 > S15 > S18 > S3 > S9 > S6 > S12 > S19 > S16 > S13 > S4 > S10 > S7 > S1$.

(3) Preference sequence of government (DM3)

$S8 \≻ S14 \≻ S11 \≻ S17 \≻ S5 \≻ S2 \≻ S18 \≻ S15 \≻ S6 \≻ S3 \≻ S9 \≻ S12 \≻ S19 \≻ S13 \≻ S16 \≻ S4 \≻ S10 \≻ S1 \≻ S7$.

The result of the preference sequence shows that decision-makers related to forest tourism development prefer self-interested behavior. Compared with protective development or compensatory development, forest tourism development

enterprises are more inclined to non-protective development with lower cost, while local residents are more inclined to forest tourism development enterprises to adopt protective development, and the second-best is to take compensation. The government hopes that forest tourism development enterprises will adopt protective development and that local residents can support the implementation of forest tourism development projects. Because the preferences of various stakeholders are heterogeneous and opposite, it will inevitably lead to the emergence of conflict in forest tourism development.

3 Stability analysis

Stability analysis refers to the final result obtained through conflict analysis of each decision maker's game. Through the software GMCRII, the decision maker's equilibrium strategy

TABLE 2 Preference statements and implications of decision-makers in forest tourism development.

Decision-makers	Statements	Explanation
Forest tourism development enterprise (DM1)	-4	Do not want to give up on development
	-2	Do not want protective development
	-5	Do not want local residents to oppose the development of forest tourism
	6	Hoping that the government will support the development of forest tourism
	1	Hoping for non-protective development
	-7	Do not want the government to formulate an ecological compensation system and strengthen supervision
	-3	Do not want to make compensatory development
Local residents (DM2)	2	Hoping that forest tourism development enterprises will carry out protective development
	-1	Do not want forest tourism development enterprises to carry out non-protective development
	-4	Do not want forest tourism enterprises to give up development
	3	Hoping that forest tourism development enterprises will carry out compensatory development
	7	Hoping that the government will develop an ecological compensation system and strengthen supervision
	-5IF2	If the forest tourism development enterprise conducts protective development, they will not oppose the development of forest tourism
	5IFF1	If and only if a forest tourism development enterprise conducts non-protective development, it is opposed to forest tourism development
Government (DM3)	2	Hoping that forest tourism development enterprises will carry out protective development
	-1	Do not want forest tourism development enterprises to carry out non-protective development
	-4	Do not want forest tourism enterprises to give up on development
	3	Hoping that forest tourism development enterprises will carry out compensatory development
	6IF2	Supporting forest tourism development if forest tourism development enterprises carry out protective development
	7IF1	Develop an ecological compensation system and strengthen supervision if forest tourism development enterprises conduct non-protective development
	7IF3	Develop an ecological compensation system and strengthen supervision if forest tourism development enterprises carry out compensatory development

results under the four basic stability definitions (Nash, GMR, SMR, and SEQ) are obtained (Wu et al., 2015), as shown in Table 3.

In Table 3, it refers to (Zhao et al., 2016) the use of symbols in conflict stability analysis, if a decision-maker meets a certain stability definition requirement, it uses " $\sqrt{\quad}$ " to indicate stability. If all decision-makers meet all stability definition requirements in a certain state and the state is stable, then the state is an equilibrium solution under the definition of stability. It is represented by "E" in this study and marked with "*" in the table.

In the process of forest tourism development, tourism enterprises do not want to give up development, nor do they want to adopt higher-cost protective development, and local residents will oppose forest tourism development only when tourism enterprises conduct non-protective development, and the government is committed to balancing the contradiction between the two and achieve regional economic benefits. Therefore, the state between the three will be transferred, and finally, the equilibrium state of S15 will be reached. From the analysis results in Table 3, it can be seen that the state S15 meets the four stability definition

requirements (Nash, GMR, SMR, and SEQ) and achieves an equilibrium state (Wu et al., 2015). Therefore, S15 is the equilibrium solution for the forest tourism development enterprise, the local residents and the government after the conflict game, and it is the optimal choice obtained by each decision-making party after the game. State S15 indicates that forest tourism development enterprises adopt compensatory development, local residents support forest tourism development, and the government supports tourism enterprises forest tourism development, formulates an ecological compensation system, and strengthens supervision. From the preferences of enterprises and residents, it can be seen that both are self-interested actors, and they are more inclined to adopt strategies that are more beneficial to themselves. The low-cost self-interested strategies adopted by enterprises, such as non-protective development, will deprive and encroach on local residents' reasonable rights. Therefore, the core motivation for forest tourism development conflict is the self-interested behavior preference of the conflicting parties. Although the government is also the subject of self-interest to a certain extent, the government is also the subject of altruistic behavior at the same

TABLE 3 Stability analysis results of forest tourism development conflict.

State	Nash				GMR				SMR				SEQ			
	DM1	DM2	DM3	E	DM1	DM2	DM3	E	DM1	DM2	DM3	E	DM1	DM2	DM3	E
S1		√	√		√	√	√	*	√	√	√	*	√	√	√	*
S2						√	√			√	√					
S3	√	√			√	√	√	*	√	√	√	*	√	√	√	*
S4			√		√	√	√	*	√	√	√	*	√	√	√	*
S5		√				√	√			√	√			√		
S6						√	√			√	√			√	√	
S7		√	√		√	√	√	*	√	√	√	*	√	√	√	*
S8						√	√			√	√					
S9	√	√			√	√	√	*	√	√	√	*	√	√	√	*
S10			√		√	√	√	*	√	√	√	*	√	√	√	*
S11		√				√	√			√	√			√		
S12	√				√	√	√	*	√	√	√	*	√	√	√	*
S13		√	√		√	√	√	*	√	√	√	*	√	√	√	*
S14			√			√	√			√	√				√	
S15	√	√	√	*	√	√	√	*	√	√	√	*	√	√	√	*
S16			√		√	√	√	*	√	√	√	*		√	√	
S17		√	√			√	√			√	√			√	√	
S18	√		√		√	√	√	*	√	√	√	*	√	√	√	*
S19																

time, and government behavior has significant external characteristics. From the analysis process of forest tourism development conflict, it can be seen that, on the one hand, the government supports the forest tourism development projects of tourism enterprises, which is self-interested. By formulating an ecological compensation system and strengthening supervision, it has a strong tendency for altruistic behavior. The government formulates an ecological compensation system and strengthens supervision can prompt enterprises to adopt a compromised development strategy and then guide the behavior of local residents, making the final state a stable state S15. In this state, the conflicting parties become the main body of mutually beneficial behavior, which not only preserves their own interests but also maximize comprehensive benefits through mutual benefit.

4 Conclusion and recommendations

To achieve the “dual carbon” goal, maintaining the amount of forest savings is the key. How to reduce the environmental damage caused by forest tourism development, reconcile conflicts, and promote the orderly implementation of forest tourism development projects while maintaining forest savings is the important premise of the development and construction of forest tourism. Graph Model for Conflict Resolution (GMCR) is introduced into the research field of forest tourism development

conflicts under the background of “dual carbon” goals, and Graph Model for Conflict Resolution (GMCR) method is used to analyze and solve the conflicts between stakeholders on forest tourism development and construction. In this study, we constructed a basic graph model of forest tourism development conflicts under the background of “dual carbon” goals and obtained a balanced solution to the game among all parties in the conflict. That is, forest tourism development enterprises choose compensatory development strategies, local residents choose to support forest tourism development strategies, and the government select to support forest tourism development projects of tourism enterprises and formulate ecological compensation systems and strengthen supervision. At this time, all parties to the conflict have maintained their own interests to a certain extent. The conflict situation has been eased, and a stable development and construction environment has been provided for the implementation of forest tourism development projects. At the same time, it also provides the basis to achieve the “dual carbon” goal, maintain forest savings and realize the protection of forest tourism resources in the development. Based on the theory of Graph Model for Conflict Resolution (GMCR), the research framework of forest tourism development conflict is constructed. Based on the perspective of conflict game theory, the interest game behavior and interaction process among decision-makers in forest tourism development are simulated to explain the ecological compensation system and

supervision mechanism of forest tourism development, which provides decision-making and reference information for similar environmental resource development policies.

According to the conflict analysis of forest tourism development, facing the background of the “dual carbon” target, the following suggestions are made.

First, the government should play a leading role in reconciling conflicts. According to the analysis of the aforementioned forest tourism development conflicts, it can be seen that, on the one hand, the government is an important subject in the game of interests and has a certain degree of self-interested behavior motivation. But on the other hand, the government will also play an important role in coordinating forest tourism development conflicts between forest tourism development enterprises and local residents to a certain extent. Therefore, facing the background requirements of the “dual carbon” goal, the government should play its leading role to coordinate the interests and interactions of all parties in the process of forest resource development and guide conflict situations to a cooperative situation. 1) The government should formulate a complete forest tourism development ecological compensation system and establish a complete supervision and management mechanism to supervise and manage tourism enterprises, restrict their occupation of natural resources and the living environment of local residents, and promote enterprises to adopt a compromise development strategy can also ensure the interests of local residents, make the final state of the game move to a stable state, and provide a guarantee for the joint realization of the “dual carbon” goal. 2) The government should do a good job in public services and market publicity, provide the necessary support for tourism enterprises, and promptly intervene in conflicts and disputes in tourism development. The government strengthens publicity to guide corporate behavior for eliminating environmental damage and enhances corporate responsibility for resources and the environment. The government should guide the biased perception of local residents and allow them to see that the development of forest tourism can be developed under protection and it can bring employment opportunities and channels for increasing income.

Second, tourism enterprises should cultivate their own environmental sensitivity. 1) If an enterprise adopts a low-cost self-interest strategy, it will deprive and encroach on the reasonable rights and interests of local residents. Therefore, tourism enterprises should take the initiative to learn, understand China’s “dual-carbon” target requirements, and enhance the level of awareness of carbon compensation. Tourism enterprises take the initiative to assume environmental responsibilities in the process of forest tourism development and construction, pay attention to social reputation, and pay attention to environmental protection in development and construction and actively coordinate the relationship with local residents. Tourism enterprises build a good external environment in the development and construction of forest tourism, thereby reducing the possibility of conflicts with local residents and the government. 2) Tourism enterprises

should discover business opportunities from environmental protection. Tourism enterprises should pay attention to the development trend of eco-tourism and consumers’ demands for pro-environmental behaviors. While adopting protective development, they should also transform marketing logic, locate eco-tourism groups, and turn the cost of protective development of forest resources into operating advantages, thereby reducing conflict problems brought about by enterprises pursuing economic benefits.

Third, local residents should actively participate in and strengthen the alliance to enhance their right to speak. To a certain extent, tourism development competes with local residents for limited survival resources, which is the source of conflict between enterprises and residents (Shen and Wen, 2021). In order to resolve conflicts and reduce the negative effects of conflicts, local residents should actively participate in the decision-making and management process of forest tourism development in the face of forest tourism development and construction. 1) Local residents can use collective land and public forest resources and space to jointly develop forest tourism projects with tourism enterprises in the form of shares, turning conflicts into endogenous economic benefits, and transforming conflicting positions into common interests with the enterprise to resolve conflicts. 2) Residents should strengthen their alliances, enhance their voices, and participate in the development construction and management of forest tourism to restrict the non-protective behavior of enterprises and urge the development activities of tourism enterprises to meet their own development expectations.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary Material; further inquiries can be directed to the corresponding authors.

Author contributions

RZ and QC wrote the draft of the manuscript. RZ and YS contributed to data curation and analysis. QC and DK contributed to manuscript revision. All authors approved the submitted version.

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Conflict of interest

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

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