

Does the livelihood capital of rural households in national parks affect intentions to participate in conservation? A model based on an expanded Theory of Planned Behavior

Abstract: The purpose of this research was to examine the motivations of rural farmers to participate in community conservation within national parks. An expanded version of the Theory of Planned Behavior was used to explore the impacts of economic and psychological factors on farmer willingness to engage in conservation efforts. In using the livelihood capital concept along with the TPB theory, structural equation modeling was applied to analyze survey data from rural residents within Nanling National Park, Guangdong, China. The attitudes of farmers about the development of the national park and subjective norms significantly affected willingness to participate in community conservation, and the willingness was directly influenced by financial, social, and institutional dimensions of livelihood capital. For certain dimensions of livelihood capital, attitudes and subjective norms mediated willingness to engage in conservation efforts, the affecting path being livelihood capital → subjective norms → attitudes → willingness to participate in community conservation. Perceived behavioral control had a positive moderating effect between attitudes and willingness. The findings help to explain the factors driving rural farmer willingness to engage in community conservation. Socio-psychological factors and institutional capital were particularly instrumental in affecting willingness. Overall, this research reveals how different types of livelihood capital influence community conservation among farmers and the importance of community conservation as a livelihood strategy option, as well as the psychological and economic factors of farmers in a changing institutional environment. Based on the findings, corresponding policy recommendations are presented to improve the effectiveness of community conservation policy, and also provide China's experience and reference for other developing countries to formulate targeted community conservation policies.

Keywords: Protected area; national park; sustainable livelihoods approach; livelihood capital; community conservation; Theory of Planned Behavior

1. Introduction

Globally, protected areas have made a significant contribution to the conservation of the world's biodiversity (Anderson & Mammides, 2020; Zeng et al., 2023), but nearly one-third of the world's protected areas are under extreme pressure from human activities (Jones et al., 2018). Particularly in developing countries with severe poverty and dense populations, it is difficult to balance farmers' own interests and environmental protection goals (Ward et al., 2018), resulting in frequent community conflicts, farmers' livelihood difficulties, failure to achieve environmental goals, and many other problems. How to guide communities to achieve equitable development and well-being while coping with the impacts of natural disasters and social change is a topic of concern in the global protection discourse. China plays a vital role in global ecological security and will soon build the world's largest national park system. The national conditions of a large population and small land area mean that China faces more complex and unique problems of community livelihood and sustainability (Li et al., 2021). How to establish a large-scale ecosystem complete coupling between man and nature in a developing country with a large population and guide communities to participate to achieve harmonious coexistence between humankind and the environment is a critical issue facing China's ecosystem and a common challenge facing global biodiversity protection (Zhang et al., 2023).

To meet these challenges, community conservation has become the mainstream means of managing protected areas, and the global conservation discourse has shifted from 'fortress conservation' to 'community conservation' giving us a new protection paradigm (He & Jiao, 2023). Community conservation (CC) is defined as biodiversity conservation efforts in which local people should be as involved as possible (Narayan et al., 2023). The central idea is "the coexistence of man and nature", and the core of its conservation strategy is to make local communities active stakeholders in nature conservation, emphasizing the adaptability and transformation of communities in the construction of nature reserves, and inspiring communities to carry out responsible resource management through institutional and economic incentives to reduce the pressure on ecosystems, realize the sustainable use of resources and equitable development of communities (Abe et al., 2022; Abukari & Mwalyosi, 2020; Cheng et al., 2019). Also, this includes the sustainable management of forests, grasslands and wildlife resources such as agriculture, animal husbandry, forestry and fisheries in and

1 around nature reserves.

2 The essence of community conservation is farmer livelihood decision-making behavior and sustainable
3 development of their livelihoods. Previous studies have focused on the socio-economic perspective (Kuang
4 et al., 2019). Individual characteristics, income, land, labor, and other farmer family characteristics are all
5 factors that affect farmer livelihood decisions, but it is difficult to summarize all the key factors. In recent
6 years, the commonly used Sustainable Livelihoods Framework (SLF) refines scattered social, economic,
7 cultural and other specific elements into structured livelihood capital (Serrat & Serrat, 2017), which reveals
8 the influence of different socio-economic factors on livelihood strategies (Brocklesby & Fisher, 2003; Singh
9 et al., 2021). However, research on livelihood capital is mostly conducted within an established framework,
10 rarely breaking through proposed capital types and the classical modeling methods are generally based on
11 the presupposed economic rationality of farmers. In the management of nature reserves with positive
12 externalities, the economic rationality of community farmers alone is not enough to explain how their
13 understanding and acceptance of community conservation, local knowledge and cultural customs of local
14 people will also affect the decision-making process (Meijer et al., 2015). Therefore, the study of farmer
15 production decisions from a social-psychological perspective can make up for the lack of social-economic
16 research. The Theory of Planned Behavior (TPB) analyzes the influence of behavioral intentions on decision
17 making from three aspects: farmers' attitudes, perceived social pressures, and judgment of the difficulty of
18 behavior, and is widely used in natural resource management decision-making involving multiple objectives
19 (Meijer et al., 2015). However, the main limitation of this theory is that it does not fully account for the
20 influence of the socio-economic base on subjective judgments.

21 To fill the above-mentioned knowledge gaps and to understand the farmers livelihood framework and
22 the drivers of community participation in national parks, this study established a theoretical framework
23 combining the SLF and the TPB model. It links the economic and psychological factors of farmer livelihood
24 decision-making, analyzes the influential factors and the decision-making in farmer community participation,
25 and verifies the model through empirical analysis. A rural community in Nanling National Park, Guangdong
26 Province, China was selected as a case study. The main purpose was to answer the following questions (1)
27 How does the level of livelihood capital of farmers around national parks affect their intention to participate
28 in community conservation? (2) What are the effects of subjective psychological factors on farmers'

participation in community conservation? (3) How do economic and psychological factors jointly influence farmers' decision making in national parks?

This research is expected to contribute to broadening the framework of farmers' livelihood capital in the context of national parks, and to reveal the effects of livelihood capital on farmers' decisions to engage in community conservation. It also examines how socio-economic and psychological factors jointly influence farmers' behavioral intentions. The major contributions of this study include: (1) combining the extended SLF and TPB theory to construct the theoretical framework of the drivers of farmer community conservation, and exploring the causal path of farmer community conservation jointly because of economic and psychological factors; (2) quantifying the applicability of the framework of community livelihood capital in China's National Parks by an empirical model, and the influences of different types of livelihood capital on farmer community conservation; (3) confirming the moderating effect of perceived behavioral control (PBC) in TPB theory and providing data support of China. The results of this study provide policy insights for China and other developing countries around the world to enhance community self-motivation and achieve sustainable livelihoods.

2. Literature review and research hypotheses

2.1. Literature review and proposed research model

2.1.1. Community involvement in national parks

The livelihoods of the vast majority of communities in and around national parks(NPs) are highly dependent on traditional agricultural activities(He & Jiao, 2022), which are closely tied to the natural environment, and can directly affect the establishment or even existence of NPs. Therefore, how to balance the sustainable development of NPs and community livelihoods is a common concern of scholars and managers (Li et al., 2021; Nepal & Weber, 1995). Community conservation(CC) is a modern conservation management intervention that was originally designed to address the social problems caused by protected areas(PAs) restricting human occupation or use of natural resources within their boundaries (Hayes, 2006; Narayan et al., 2023). CC is premised on the sustainable development of farmers' livelihoods, taking into account the spatial extent of NPs and biodiversity management needs, and seeks to reduce the constraints on farmers' livelihoods resulting from the construction of NPs by fully exploiting the multifunctionality of land

1 and natural resources in the projects (He & Wei, 2023). The key to CC is to engage collectively to minimize
2 the negative impacts of PA creation on community development by seeking optimal alternative livelihoods
3 for the community (Wondirad & Ewnetu, 2019). The meaning, scope, and spectrum of community
4 participation can vary depending on myriads of factors such as social, political, cultural, technological and
5 economic conditions (Tosun & Timothy, 2003; Wondirad & Ewnetu, 2019). All forms should attract the
6 active participation of local people and retain as much of the economic and environmental benefits in the
7 local area as possible to improve the economy and living standards of local people. CC not only supports
8 the long-term interests of farmers, but also helps to solve the problem of externalities in nature conservation
9 (He & Wei, 2022).

10 Rural livelihoods in developing countries are particularly vulnerable to multiple shocks and pressures,
11 which aggravate vulnerability and may lead to (over)dependence on natural resources (Mbiba et al., 2019).
12 The implementation of CC projects in developing countries is more difficult than in developed nations. The
13 degradation of ecosystem functions, loss of fauna and fragmentation of habitats caused by global climate
14 extremes in recent years have further increased the pressure on the design and implementation of CC projects
15 in developing countries (Roberts et al., 2020). Researches have shown that the poor implementation of CC
16 projects in developing countries is due to two main factors. On the one hand, the discrepancy between
17 international concepts of best practices in CC and local preferences for conservation objectives, and the lack
18 of adaptation of globalized policies to local contexts and new situations (Narayan et al., 2023; Temenos &
19 McCann, 2013), lead to situations in which CC projects in developing countries have an inability to balance
20 expert best-practice ideas with the practical experience of local people (Delay et al., 2022). On the other
21 hand, the variability in a range of natural factors, such as ecosystem type or climatic zone to which different
22 NPs belong, leads to different systems of CC projects (Abe et al., 2022). Therefore, the interventions and
23 specific objectives of CC based on NPs in developing countries, as well as of this type of collective projects,
24 should not rely too much on explicit theories of change, but rather utilize the overall social dynamics to
25 spontaneously change the communities themselves (Root-Bernstein, 2020).

26 Although scholars have conducted a great deal of research on CC, various social, economic, political
27 and cultural differences make the findings illuminating but inconclusive for developing countries. China, as
28 the largest developing country and one of the most biodiverse, is facing the daunting challenge of

1 harmonizing rural development with nature conservation (He & Wei, 2023). The construction of NPs will
2 have an impact on all interests of local farmers, and under the combined pressure of the deterioration of the
3 natural environment and the forced adjustment of production and life, rational planning and utilization of
4 their own livelihood capital endowments is the only way for farmers to achieve sustainable development (Yu
5 et al., 2020).

6 The international experience of CC is not fully applicable to China. Combined with international
7 standards and based on China's conditions, the design of CC programs in the early stages of China's NP
8 construction mainly adhered to the following principles. First, the principle of compatibility between
9 farmers' livelihoods and ecological conservation goals should be considered. Second, there are projects that
10 can be scaled up and implemented, taking into account the criteria of diversifying farmers' livelihoods and
11 the international community's standards of participation. Third, support is offered for farmers in the form of
12 institutional measures such as ecological compensation and partial transfers of specialized funds. Taking into
13 account the realities of the initial stage of China's NP development, a CC project designed at this stage has
14 two main measures: one is to adjust farmers' livelihoods and gradually reduce their dependence on natural
15 resources for production and livelihood, which has already been implemented in China's NP pilots. For
16 example, in the Wuyi Mountain National Park, the administration encourages local farmers to grow tea
17 instead of traditional agricultural cash crops (He et al., 2022), but the specific livelihood adjustment program
18 varies under vulnerable contexts and institutional environments (He & Jiao, 2022). The other is to encourage
19 farmers to participate in ecological patrols, a measure that is scalable and replicable for farmers in other NPs.
20 The reason for this is that most NPs in China have a long history of PA development, local farmers are
21 familiar with the nature and content of ecological patrols, and the special financial support set up after the
22 establishment of the NPs can provide farmers with stable remuneration, which can to some extent offset the
23 economic losses caused by restrictions on farmers' livelihoods.

24 In China, the development of NPs is mainly a "top-down" government-led model, and farmers lack
25 "bottom-up" communication channels (Dong et al., 2021). However, they can decide whether to voluntarily
26 participate in CC projects based on their livelihoods and whether or not to voluntarily participate in CC
27 projects based on their livelihoods. Participation in CC is therefore a decision that involves not only
28 economical, but also psychological factors.

2.1.2 Applicability of the SLF and the inclusion of institutional capital in the context of NPs

The Sustainable Livelihoods Framework (SLF) proposed by the UK Department for International Development (DFID) consists of five components: vulnerability context, livelihood capital, structural and process transformation, livelihood strategies, and livelihood outcomes (DfID, 1999). The framework is based on the understanding and application of people's access to assets, typically including natural capital (NC), human capital (HC), social capital (SC), physical capital (PC) and financial capital (FC), and is now widely used and has become the classic paradigm for household livelihoods research (Ellis, 2000). The SLF provides a framework for understanding the livelihood processes and outcomes of rural households, which are built on capital endowments and influenced by vulnerability and transformational structures and processes (Guo et al., 2022).

Geographically, NPs coexisting with poverty-stricken areas, therefore the surrounding farmers are mostly poor subsistence farming households who depend on agriculture as their main source of livelihood, which means that they are more susceptible to a series of pressures and impacts such as climate change, political instability, and economic fluctuations (Wang et al., 2021). Under the pressure of fragile environmental impacts, farmers who rationally assess and optimally combine their household's capital endowment can maximize the strategic and risk-resistant capacity of their livelihood capital (Chen et al., 2014), leading to livelihood outcomes of increased income and well-being, reduced vulnerability, and more sustainable use and management of natural resources (Kuang et al., 2019). The literature suggests that farmers with more and diversified livelihood capital tend to be less vulnerable in the face of shocks and stresses (Blackmore et al., 2023).

The livelihoods framework has been widely used in various fields, but there are still some issues that deserve further attention and exploration. First, the five dimensions included in livelihood capital are presented in the context of Western societies, which means that they may not be applicable to all political-economic contexts, nor can they take into account time-varying trends and different institutional factors (He & Wei, 2023; Yu et al., 2020). Scholars have noted that, institutional capital (IC) refers to the formal and informal institutions that act as a resource element to participate in the sharing of benefits (Yu et al., 2020). Farmers' knowledge and familiarity with the institutions affects their access to non-farm income in terms of ecological relocation, subsidy payments and community participation (Dang et al., 2020; Qiu et al., 2022).

Therefore, to acquire a robust measurement of livelihood capital in the context of NPs, this research took institutional capital as another dimension of livelihood capital to explore the decision-making behavior of farmers. Second, while many studies have confirmed the important role of livelihood capital in transforming farmers' livelihoods and reducing poverty, they have all examined livelihood capital as a single variable. Some scholars have found that individual dimensions of livelihood capital have different ways of influencing farmers' decisions. For example, Wang et al. (2021) studied the influence of different types of livelihood capital combinations on farmers' livelihood vulnerability and confirmed that each type of livelihood capital has a different influence on farmers' livelihood decisions. Some scholars have also examined the role of social capital (Chen et al., 2014) and human capital in farmers' livelihood decisions. However, few scholars have explored the ways in which each dimension of livelihood capital influences farmers' decisions within the same research framework. Kuang et al. (2019) study showed that each dimension of livelihood capital plays an important role in adaptation strategies as farmers adjust their livelihoods in the face of climate change. How to improve livelihood outcomes and sustainability interventions are the focus of scholars, and the dynamics of livelihood capital tend to show non-linear outcomes over time, making it particularly important to understand the ways in which each type of livelihood capital influences farmers' behavior.

2.1.3 The feasibility and theoretical expansion of TPB in farmers' livelihood decision-making

The Theory of Planned Behavior (TPB) is derived from the Theory of Reasoned Action (TRA), proposed by Ajzen (1986; 1991), which argues that behavioral intention determines an individual's behavior, and that behavioral intention is the result of a combination of attitudes (ATT) and subjective norms (SN). The TPB theory is one of the most widely used frameworks for studying individual behavior, helping researchers pinpoint the antecedents to environmental behavior and then make interventions to address these elements (Liu et al., 2023). Yuriev et al. (2020) conducted an exhaustive review of the TPB model and found that it is applicable to different domains, sectors, and geographic contexts to understand human decision-making processes, especially the behavior of collective decisions such as green consumption and environmental protection, etc. (Tezeswi & MVN, 2022; Yeh et al., 2021). Therefore, the model is equally applicable in the livelihood decisions of farmers in NPs based on ecological conservation as an objective.

Current research has focused on testing the additive effects of the three factors in the TPB to validate what influences behavioral intentions and has established the relationship between attitude-intention-

behavior in the context of the TPB theory (Liu et al., 2023). However, in most studies, the proposed moderating effects of TPB on theory relationships are rarely tested, and especially the moderating effects of PBC are mentioned even less. The few studies that have tested the moderating effect of TPB have reported inconsistent results, with both significant and non-significant results in some studies examining the moderating effects of PBC on the attitude-intention and subjective norm-intention relationships, and even some studies suggesting that the moderating effect of PBC on subjective norms-intentions is negative. From a theoretical perspective, in Ajzen's original formulation of the TPB, PBC was hypothesized to moderate the effects of attitudes and subjective norms on intentions (Ajzen, 1985, 1991; La Barbera & Ajzen, 2021). PBC does not directly affect behavioral intentions; rather, it is expected to moderate the effects of attitudes and subjective norms on behavioral intentions (Hagger et al., 2022). The moderating role of PBC is also further discussed and confirmed in Ajzen's most recent study, where the strength of the association between attitudes and intentions increased with increasing scores on PBC, while the strength of the association between subjective norms and intentions decreased (La Barbera & Ajzen, 2021). For example, people are unlikely to form intentions to conserve energy simply because they believe they are capable of doing so, yet a sense of control may determine how and to what extent attitudes and subjective norms influence intentions to conserve energy. In existing studies of TPB, there is substantial heterogeneity in the moderating effects of PBC. Researchers have suggested that there is a moderating effect, and that the moderating effect can be variable depending on the research question, differences in research contexts, and the size of the research sample (Ajzen, 1991). The current findings and theoretical reasoning support the existence of a moderating effect of the TPB, and researchers suggest that research and discussion of the moderating effect should cover larger sample sizes and questions.

Farmers' participation in adaptation decision-making is complex (Kuang et al., 2019), and given the trend of mainstreaming biodiversity conservation in China, the uncertainty of rural livelihoods brought about by the vulnerability context of community economies deserves attention and exploration (He & Wei, 2023). Through a review of the literature, it was found that community participation is the best option for farmers' livelihood transformation and decision-making when they face the uncertain and fragile environment brought about by the development of NPs. In addition to assessing their own socio-economic circumstances, farmers' psychological factors are important factors that promote voluntary participation in community

conservation.

2.2. Research hypotheses

2.2.1. Effects of socio-economic factors on farmers

The SLF assumes that under different conditions, varying livelihood activities are combined and promoted to realize livelihood strategies, and the accumulation of livelihood capital is the basis for farmers to make adaptive changes in response to multiple shocks (Wang & Wang, 2024). Research has focused on how livelihood capital affects the ability of individual households and communities to sustain their livelihoods, especially in the face of various impacts and disturbances. The results show that the higher the level of livelihood capital, the stronger the intention to engage in pro-environmental practices. Households with varying levels of livelihood capital have different capacities to regain their original quality of life or production status when faced with changes in production or living conditions.

These differences influence farmers' ability to engage in community conservation. In rural areas with collective economies, livelihood capital influences the attitudes and behaviors of farmers (He et al., 2022). For example, farmers' attitudes towards organic rice production in Iran were negative due to their limited resources, and even under the leadership of local elite farmers, most farmers were unwilling to engage in organic production (Asadollahpour et al., 2016). Livelihood capital also influences farmers' ability to cope with changes in natural, social and economic conditions and their willingness to engage in community conservation. Therefore, the following hypotheses were proposed:

H1: Each type of livelihood capital has a direct, positive impact on farmers' intentions to participate in community conservation.

H2: Each type of livelihood capital has a direct, positive effect on community conservation attitudes of farmers.

H3: Each type of livelihood capital has a direct, positive impact on the subjective norms of farmers with regard to community conservation.

2.2.2. Effects of psychological factors on farmers

Based on previous TPB studies, attitudes and social norms are positively associated with farmers' intention to participate in conservation activities such as grassland management (Borges et al., 2014), farm

food safety management (Rezaei et al., 2019) and soil management practices (Daxini et al., 2019). In general, the influence of TPB constructs on intentions varies depending on the behavior and context under study (Ajzen, 1991). Finally, although not applying the TPB, studies have also confirmed the importance of farmers' attitudes in their decisions to adopt various natural resource management practices (Zhang et al., 2016; Zhang et al., 2017). Based on the assumptions of the TPB and the above literature, the following hypotheses were proposed:

H4: Attitudes affect farmers' behavioral intentions to participate in community conservation.

H5: Social norms affect farmers' intentions to participate in community conservation.

2.2.3. Combined effects of socio-economic and psychological factors on farmers

According to the behavioral compatibility principle, the cognitive dissonance and persuasion theories, social norms affect behavioral attitudes and significantly influence behavioral intentions (Karimi & Saghaleini, 2021), which has been confirmed in numerous studies based on the TPB (Daxini et al., 2019; Yeh et al., 2021). When national parks are in the early stages of development, farmers' attitude towards community conservation is influenced by elite farmers in villages, elders, family members and friends. The external environment (i.e., SN) influences evaluative ATT. ATT also plays a mediating role in farmers' community conservation activities and ultimately influence their behavioral intentions. For farmers, livelihood capital is an objective factor that influences decisions about livelihoods and expectations about the economic and environmental benefits of their practices (Daxini et al., 2019). Based on H1-H3, the following hypotheses were proposed:

H6: Attitudes play an intermediary role in the impacts of livelihood capital dimensions on farmers' intentions to participate in community conservation.

H7: Social norms play an intermediary role in the impacts of livelihood capital on farmers' intentions to participate in community conservation.

H8: Attitudes and social norms play a continuous intermediary role between livelihood capital and community conservation participation intentions.

Perceived behavioral control is the perception of difficulty in performing a behavior (Ajzen, 1991). Behavioral control is influenced by farmers' perceptions of risk, family resources, and past experience (Asadollahpour et al., 2016; Kaufmann et al., 2009). A high level perceived behavioral control leads to

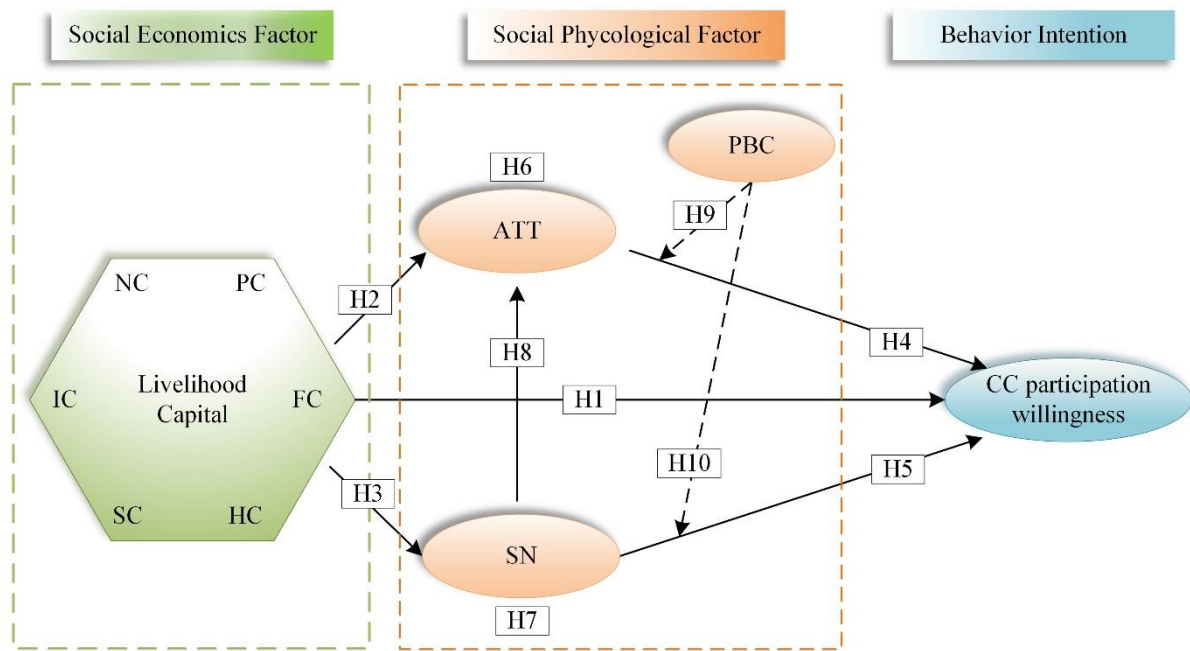
stronger behavioral intentions. For example, Terano et al. (2015) found that PBC was the main factor driving Malaysian farmers' intentions to engage in sustainable agricultural production. If people believe that they have little or no control over the consequences of their behavior due to environmental deficits, they will be less willing to engage, even if they have positive attitudes and social norms (Madden et al., 1992). PBC is also thought to facilitate the impact of attitudes and social norms on intentions (Ajzen, 2020). Farmers have different levels of perceived behavioral control during the development phases of national parks (Dong et al., 2021); those with more resources and less expected difficulties have more perceived behavioral control and stronger effects of attitudes and social norms on willingness to participate in community conservation. On this basis, the following hypotheses were proposed:

H9: Perceived behavioral control plays a regulatory role in the impact of attitudes on farmers' intentions to participate in community conservation.

H10: Perceived behavioral control plays a regulatory role in the impact of social norms on farmers' intentions to participate in community conservation.

2.3. Proposed research model

Based on the literature review, a research model composed of livelihood capital, attitudes (ATT), social norms (SN), perceived behavioral control (PBC), and behavioral intentions of community conservation (CC) was proposed and is shown in Figure 1. Previous studies have taken livelihood capital as a variable to explore its role in farmers' decision-making. This research divided livelihood capital into six types, namely, natural capital (NC), physical capital (PC), financial capital (FC), human capital (HC), social capital (SC), and institutional capital (IC). Each type of livelihood capital was treated as an independent variable and quantitative methods were used to explore the influence of each capital on livelihood decisions. Therefore, in the following data explanation, the notes below the tables explain the role of a single type of capital in the relationship paths for each hypothesis.



Note: NC: natural capital; IC: institutional capital; PC: physical capital; FC: financial capital; HC: human capital; SC: social capital; ATT: attitude; SN: social norms; PBC: perceived behavioral control; CC: community conservation

Figure 1. Proposed research model.

3. Research region and data collection

3.1. Overview of targeted area

This research was conducted in the proposed Nanling National Park in Guangdong Province, one of the second batch of pilot NPs under the National Park Spatial Layout Plan issued by the National Park Administration of China. The region has a large resident population and collectively owned land (Figure 2). With a long history of nature reserve development in this region, CC and nature conservation are well embedded in the minds and behaviors of local farmers. Therefore, the Nanling National Park community is a typical and representative case suitable for exploring CC implementation in South China's NPs, which have complicated land tenure, dense population, obvious human-land contradictions, and large areas of collectively-owned forest.

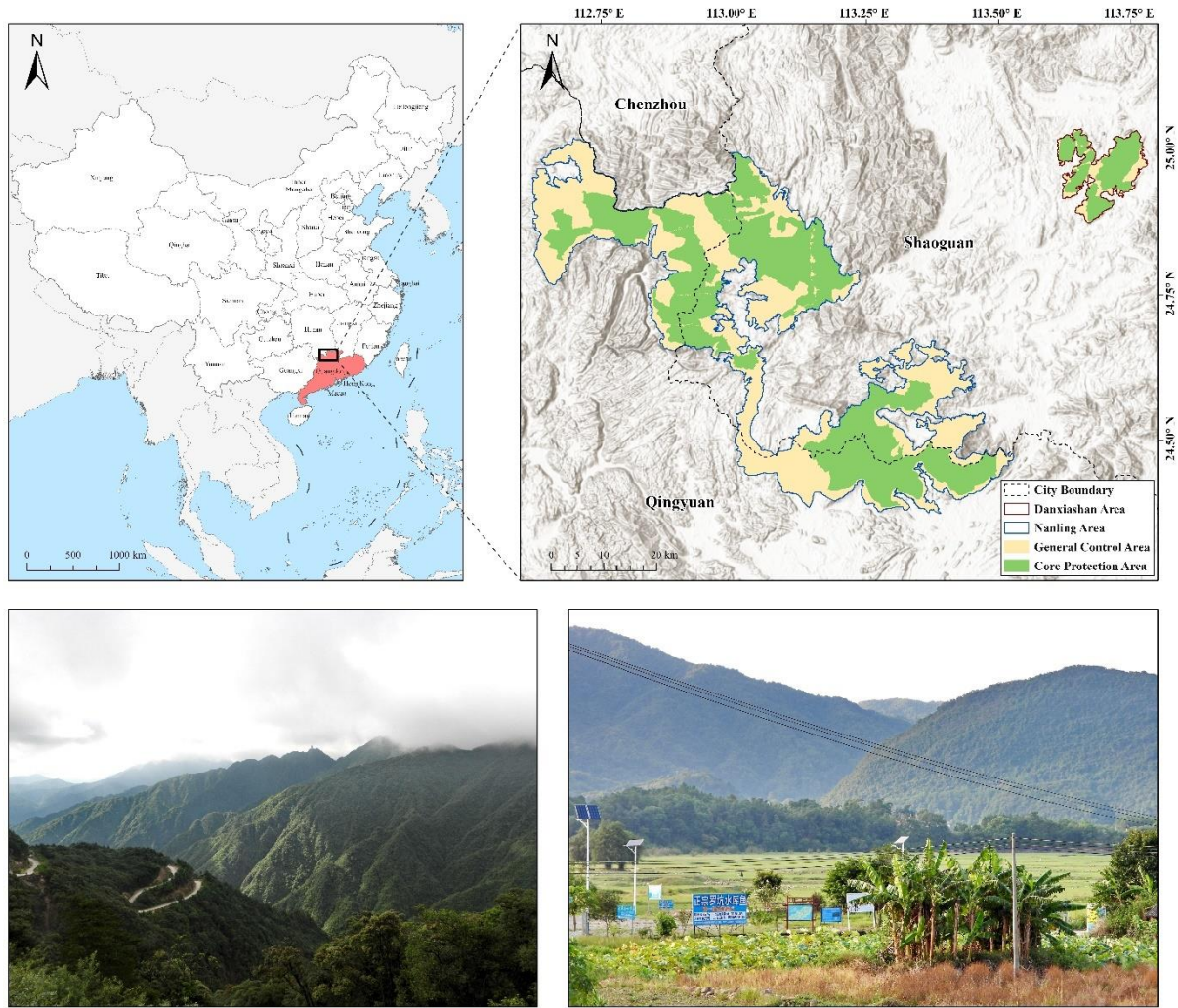


Figure 2. The location of proposed Nanling National Park.

3.2. Questionnaire design

The livelihood capital scale was designed in the research of Wang et al. (2021) and Yu et al. (2020). Institutional capital refers to public development and transfer payment policies, and other capitals that cannot be invested by farmers themselves but affect their independent use. The scale had a total of 16 measurement items, as shown in Table 2. The TPB scale was designed based on the research of Savari and Gharechae (2020) and Ajzen (2020), and adapted to the CC behavior of farmers. Based on the preliminary investigation of the current situation of Chinese NP communities and residents in Nanling National Park, the willingness of CC participation was divided into two questions according to what was discussed in 2.1.1, including willingness to adjust livelihoods and willingness to participate in local ecological patrols (to prevent illegal activities such as illegal hunting). Age, gender, and education were taken as control variables. Each

dimension of livelihood capital was designed into a single-choice question, and five-point Likert scales were used to measure attitudes (ATT), subjective norms (SN), PBC, and willingness to participate in CC.

3.3. Data collection

To ensure the accuracy and applicability of the scale, the investigation team went to the case site on Dec. 27, 2020, to distribute pre-survey questionnaires. The formal questionnaire was thereafter adopted and distributed randomly in 23 communities in the region between May and June 2021. Nanling National Park has a registered population of 8,134 and a permanent population of about 3,492. A simple random sampling method was adopted and considered the distribution of respondents' location, age, gender, and ethnic group when selecting potential interviewees. The interviews were conducted face-to-face, and each questionnaire took approximately 20-30 minutes to complete. The data were pre-processed to ensure validity, in particular by excluding outliers, using the mean substitution method for missing values, and applying logarithms to variables related to money. However, due to the high number of households that worked in urban areas or were absent during researcher visits, ultimately 340 valid forms were collected from the 393 questionnaires distributed, representing approximately 4.8% of the total sample.

Demographic information on the respondents and descriptive analysis is presented in Figure 3. Among the 340 respondents, there were more males (65.6%) than females (34.4%). In terms of ethnicity, there were slightly more minority people (54.1%) than Han people (45.9). In terms of age, those between 41-50 and 51-60 occupied the highest proportions at 30.9% and 22.4%, respectively. In terms of education level, those who held a junior high degree accounted for 41.2%, followed by those who has studied in elementary schools or below (30.5%) and those who had the senior high/technical secondary/vocational high school degree (17.1%). The respondents whose yearly income ranges were 10,000-40,000 yuan (46.2%) or 10,000 or below yuan (34.7%) made up the largest portion of the participants. The sample had the characteristics of older age, lower education, and lower income, reflecting the basic characteristics of the communities surrounding the national park. From the figure, the basic situation of farmers livelihood capital can be seen, where the average value of physical capital is the lowest and the average value of social capital is the highest.

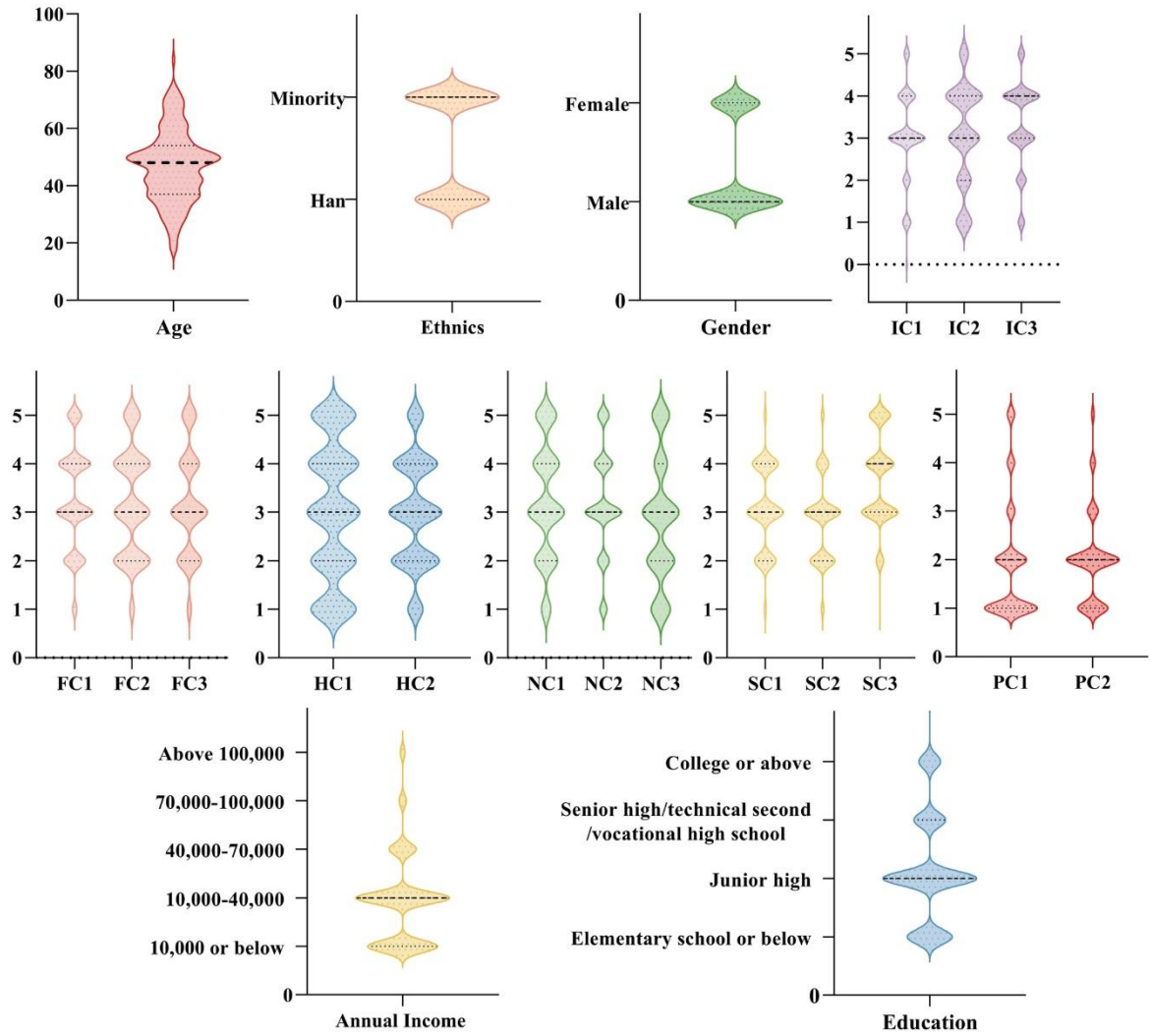


Figure 3. Descriptive statistics for the sample.

4. Results

4.1. Measurement model

Partial least squares structural equation model (PLS-SEM) was applied. Compared with the traditional covariance-based structural equation, PLS-SEM does not require the data to satisfy the normal distribution assumption, and it can also deal with complex models and limited sample size more effectively (Leguina, 2015; Hair Jr. et al., 2021). In addition, PLS-SEM is more suitable for exploratory research (Hair et al., 2011).

Consistent PLS bootstrapping was used to test the causal relationships of the studied hypotheses; Table 1, Table 2 and Table 3 show the results. First, all values of Cronbach's alpha (α) and composite reliability (CR) were higher than the threshold of 0.7. Only one was slightly below this rate, which suggests that the

measurement scale had good reliability and internal consistency. Second, convergent validity was used to test the measurements. The factor loading, AVE, and CR were used to assess convergent validity. As shown in Table 3, all the AVE values were above 0.5, and all the CR values were above 0.7, which supported convergent validity. In terms of discriminant validity, this study adopted the Fornell–Larcker criterion to test as shown in Table 3. The Fornell–Larcker criterion suggests that the square root of AVE should be higher than the correlation coefficient between constructs (Fornell & Larcker, 1981) and the results showed that all the variables have good discriminant validity. To avoid multicollinearity, the Variance Inflation Factor (VIF) of structural model was tested. All the VIF values were lower than five, a standard proposed by Hair Jr et al. (2017).

Table 1. Measurements, reliability and validity of social capitals.

Latent variable	Observed variable	Description	Factor loading	α
Natural capital (NC)	Average farmland area	The area of the contracted farmland (mu)	0.822	0.728
	Household-owned forest area	The area of the contracted forest (mu)	0.824	
	Household-owned water area	The area of the contracted water area (mu)	0.768	
Physical capital (PC)	Household-owned number of transport carriers	The number of transportation tools (including cars/minivans, small trucks, motorcycles/motorcycles, battery cars, bicycles/pedal tricycles)	0.830	0.785
	Household-owned homestead area	Area of homestead (km ²) 1=earthen-walled and tile-roofed house; 2=single-story brick house	0.864	
	Household housing structure	3=two-story house without indoor bathroom; 4=two-story house with indoor bathroom 5=three-story house and above	0.815	
Financial capital (FC)	Household annual income	Annual household income range (1=under 10,000 yuan; 2=10,000–40,000 yuan; 3=40,000–700,000 yuan; 4=700,000–100,000 yuan; 5=over 100,000 yuan)	0.895	0.752
	Household Insurance	Whether purchases commercial insurance, such as commercial medical insurance, motor insurance, property insurance, commercial life insurance, etc. (1=yes, 0=no)	0.895	
Human capital (HC)	Household labor physical health	Average health status of household members (1=very unhealthy to 5=very healthy)	0.885	0.722
	Household member education	Highest education level among family members (1= Elementary school or below; 2= Junior high; 3= Senior high/technical secondary/vocational high)	0.885	

Latent variable	Observed variable	Description	Factor loading	α
Social capital (SC)	Number of relatives or friends working in government offices or administration institution of Nanling National Park	school; 4= College or above)	0.818	0.733
		1=0,		
		2=1person,		
		3=2 people,		
Institutional capital (IC)	Relationship with relatives and friends	4=3 people, 5=4 people and above Score of relations relatives and friends (1=very estranged to 5=very close)	0.849	0.783
	Participation in collective affairs	Score of participation in collective affairs (1=very low to 5=very high)	0.755	
		2.578 1.209		
Institutional capital (IC)	Knowledge of village rules regarding resource conservation practices (e.g., social customs)	Score of understanding (1=don't know any at all to 5=know them well)	0.828	0.783
	Knowledge of formal resource conservation regulations (e.g., National Park regulations)	Score of understanding (1=don't know any at all to 5=know them well)	0.867	
	Ecological compensation income	Weather the farmers have ecological compensation income or not (1=yes, 0=no)	0.810	

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Table 2. Measurements, reliability and validity of TPB variables and CC willingness.

Latent variable	Observed variable	Description	Factor loading	α
Willingness to participate in community conservation (CC)	Willingness to participate in ecological patrols	Score of willingness to participate in community conservation (1=very unwilling to 5= very willing to)	0.874	0.691
	Willingness to adjust livelihood		0.874	
Social norms (SN)	Most people who are important to me (family, friends, neighbors) believe that I should be involved in community conservation in Nanling National Park. Farmers around and like me believe that we should participate in CC in NPs. The leaders of our village all believe that we should participate in the community conservation of Nanling National Park. Other people's decision on whether to participate in community conservation of NP is important to me.		0.841	0.813
		Score of agreement (1=totally disagree to 5=totally agree)	0.828	
			0.769	
			0.762	
Attitudes (ATT)	The development of Nanling National Park is important.		0.811	0.722
	Villagers' participation in community conservation is necessary to achieve the ecological and environmental protection goals of Nanling National Park.	Score of agreement (1=totally disagree to 5=totally agree)	0.803	
	I will benefit from participating in the community conservation of Nanling National Park.		0.775	

Latent variable	Observed variable	Description	Factor loading	α
Perceived behavior control (PBC)	I think I should get involved in the community conservation of national parks.		0.693	0.821
	In the process of participating in community conservation, I can overcome the encountered difficulties.		0.808	
	I can decide on my own about whether to participate in the community conservation of the national park.	Score of agreement (1=totally disagree to 5=totally agree)	0.849	
	I have enough time to get involved in community conservation of the national park.		0.768	
	I can easily learn about the activities in the national park.		0.800	

Table 3. Discriminant validity.

	CR	AVE	FC	HC	IC	NC	PC	SC	SN	ATT	CC
FC	0.889	0.800	0.894								
HC	0.877	0.781	0.03	0.884							
IC	0.837	0.693	-0.036	0.031	0.833						
NC	0.844	0.645	-0.070	0.067	0.287**	0.803					
PC	0.874	0.698	0.105*	0.055	0.016	-0.042	0.835				
SC	0.849	0.654	0.035	0.056	0.056	0.183**	0.092	0.809			
SN	0.877	0.641	0.198**	-0.004	0.173**	0.142**	0.071	0.237**	0.801		
ATT	0.854	0.596	0.305**	-0.006	0.197**	0.254**	0.061	0.365**	0.599**	0.772	
CC	0.866	0.764	0.385**	-0.051	0.151**	0.116*	0.114*	0.291**	0.527**	0.713**	0.874

Note: ATT=attitudes; CC=community conservation willingness; FC=financial capital; HC=human capital; IC=institutional capital; NC=natural capital; PC=physical capital; SC=social capital; ATT=attitude; SN=subjective norms; CR is composite reliability; AVE is the average variance extracted. The diagonal is divided by the square root of AVE, and the lower triangle of statistics are Pearson correlation coefficients.

4.2. Structural model

4.2.1. Direct effect analysis

First of all, after taking gender, age, education and other related variables into control variables, different dimensions of livelihood capitals have different effects on farmers' willingness to participate in CC. Table 4 shows that H1f, H1s and H1i in Hypothesis H1 were supported, indicating that FC, SC, and IC directly affected farmer willingness to participate in CC.

Table 4. Direct effect influence paths I.

Hypothesis No.	Path	Coefficient	Confidence interval	Hypothesis result	Path	Coefficient	Confidence interval
H1n	NC→CC	0.039	(-0.034,0.130)	Rejected	Control variables		
H1f	FC→CC	0.378***	(0.281,0.461)	Supported	AGE→CC	-0.082	(-0.165,0.039)
H1p	PC→CC	0.054	(-0.020,0.139)	Rejected	EDU→CC	0.058	(-0.045,0.147)
H1h	HC→CC	-0.084	(-0.182,0.048)	Rejected	GEN→CC	0.044	(-0.039,0.136)
H1s	SC→CC	0.268***	(0.169,0.360)	Supported			

Hypothesis No.	Path	Coefficient	Confidence interval	Hypothesis result	Path	Coefficient	Confidence interval
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H1i IC→CC 0.154*** (0.071,0.235) Supported

Note: ***, ** and * refer to that it is significant at the level of 0.1%, 1% and 5% respectively ($p<0.001$, $p<0.01$, $p<0.05$). H1n is natural capital (NC), H1f is financial capital (FC), H1p is physical capital (PC), H1h is human capital (HC), H1s is social capital (SC), and H1i is institutional capital (IC) in Hypothesis 1. CC = willingness to participate in community conservation.

When ATT and SN were added into the model, the explained R^2 value of CC participation willingness was 0.572, indicating a satisfactory model explanatory effect (Hair Jr et al., 2021). With the entering of the mediators, the regression coefficients and significance of each dimension of livelihood capital for ATT and SN are shown in Table 5. The regression coefficients for FC on SN and ATT were 0.198($p<0.01$) and 0.203 ($p<0.001$) respectively, indicating the positive impact of FC on SN and ATT. SC had positive impacts on SN and ATT, and IC also had positive effects on SN. Therefore, hypothesis H2f, H2s, H3f, H3s and H3i were supported. Furthermore, the impact factors of SN and ATT on CC participation willingness were 0.157($p<0.01$) and 0.54($p<0.001$) respectively, indicating that SN and ATT had positive impacts on CC participation willingness, supporting H4 and H5.

Table 5. Path of direct effect influence II.

Hypothesis	Path	Coefficient	Confidence interval	Result
H2n	NC→ATT	0.128	(-0.051,0.121)	Rejected
H2f	FC→ATT	0.203***	(0.096,0.302)	Supported
H2p	PC→ATT	-0.006	(-0.086,0.076)	Rejected
H2h	HC→ATT	-0.036	(-0.125,0.046)	Rejected
H2s	SC→ATT	0.223***	(0.129,0.315)	Supported
H2i	IC→ATT	0.084(0.051)	(-0.008,0.177)	Rejected
H3n	NC→SN	0.072	(-0.021,0.172)	Rejected
H3f	FC→SN	0.198***	(0.09,0.302)	Supported
H3p	PC→SN	0.028	(-0.059,0.122)	Rejected
H3h	HC→SN	-0.031	(-0.139,0.081)	Rejected
H3s	SC→SN	0.210***	(0.096,0.313)	Supported
H3i	IC→SN	0.157**	(0.059,0.251)	Supported
H4	ATT→CC ($R^2 = 0.469$)	0.545***	(0.440,0.648)	Supported
H5	SN→CC ($R^2 = 0.117$)	0.157**	(0.063,0.251)	Supported
Control variables	AGE→CC	-0.076	(-0.147,0.064)	-
	EDU→CC	0.011	(-0.06,0.088)	-
	GEN→CC	-0.018	(-0.087,0.057)	-

Note: ***, ** and * refer to that it is significant at the level of 0.1%, 1% and 5% respectively ($p<0.001$, $p<0.01$, $p<0.05$). H2n is natural capital (NC), H2f is financial capital (FC), H2p is physical capital (FC), H2h is human capital (HC), H2s is social capital (SC), and H2i is institutional capital (IC) in Hypothesis 2. H3n is natural capital (NC), H3f is financial capital (FC), H3p is physical capital (PC), H3h is human capital (HC), H3s is social capital (SC), and H3i is institutional capital (IC) in Hypothesis 3. ATT=attitude; SN=subjective norms; CC = willingness to participate in community conservation.

4.2.2. Mediation effects

The results are shown in Table 6 for the mediating role of SN and ATT between the dimensions of livelihood capital and farming household willingness to participate in CC, and H6, H7 and H8 were partially

supported.

Table 6. Paths of mediating effect influence.

Hypothesis No.	Independent variable	Mediating variable	Dependent variable	Direct effect	Indirect effect	Overall effect	VAF	Hypothesis result
H6f	FC	ATT	CC	0.181***	0.111**	0.374***	29.68%	Supported
H7f		SN			0.031*		8.29%	Supported
H8f		SN→ATT			0.051**		13.64%	Supported
H6s	SC	ATT	CC	0.061	0.121***	0.269***	44.98%	Supported
H7s		SN			0.033*		12.27%	Supported
H8s		SN→ATT			0.054**		20.07%	Supported
H6i	IC	ATT	CC	0.034	0.046	0.111**	31.72%	Rejected
H7i		SN			0.025*		17.24%	Supported
H8i		SN→ATT			0.040*		27.59%	Supported

Note: ***, ** and * refer to that it is significant at the level of 0.1%, 1% and 5% respectively ($p < 0.001$, $p < 0.01$, $p < 0.05$). H6f is financial capital (FC), H6s is social capital (SC), and H6i is institutional capital (IC) in Hypothesis 6. H7f is financial capital (FC), H7s is social capital (SC), and H7i is institutional capital (IC) in Hypothesis 7. H8f is financial capital (FC), H8s is social capital (SC), and H8i is institutional capital (IC) in Hypothesis 8. CC = willingness to participate in community conservation.

SN and ATT played a mediating role between livelihood capital dimensions and willingness to participate in CC in certain paths. The mediating effect of $FC \rightarrow ATT \rightarrow$ willingness to participate in CC was 0.119 ($p < 0.01$), and $FC \rightarrow SN \rightarrow$ willingness to participate in CC was 0.031 ($p < 0.05$). The remote mediating effect of $FC \rightarrow SN \rightarrow ATT \rightarrow$ willingness to participate in CC was 0.051 ($p < 0.01$), while the direct effect of FC on CC participation willingness was 0.181 ($p < 0.001$), indicating that ATT and SN had a partial mediating effect between FC and CC participation willingness, and FC influenced the ATT of farmers through SN, and finally positively affected the willingness to participate in CC.

The mediating effect of $SC \rightarrow ATT \rightarrow$ willingness to participate in CC was 0.121 ($p < 0.001$), and $SC \rightarrow SN \rightarrow$ willingness to participate in CC was 0.033 ($p < 0.05$). The remote mediating effect of $SC \rightarrow SN \rightarrow ATT \rightarrow$ willingness to participate in CC was 0.054 ($p < 0.01$), while the direct effect of SC on willingness to participate in CC was 0.061 ($p > 0.05$, confidence interval including zero). This indicated that ATT and SN were fully responsible for the mediation between SC and willingness of farmers to participate in CC, and SC affected ATT through SN, and finally showed a positive effect on willingness to participate in CC.

The mediating effect of $IC \rightarrow SN \rightarrow$ willingness to participate in CC was 0.025 ($p < 0.05$); the remote mediating effect of $IC \rightarrow SN \rightarrow ATT \rightarrow$ willingness to participate in CC was 0.040 ($p < 0.05$), and the direct effect of IC on willingness to participate in CC was 0.034 ($p > 0.05$), indicating that SN played a complete mediating role between IC and willingness to participate in CC, and IC influenced ATT through SN and positively affected willingness to participate in CC.

The f^2 index in PLS was used to determine which mediating variable had the most effect on the willingness of farmers to participate in CC(Hair Jr et al., 2023). When ATT were included in the model, the explained R^2 of willingness to participate in CC is 0.562. After removing ATT from the model, the result became 0.407, therefore, the actual mediating effect of ATT was 0.354. Repeating these steps, the actual effect of SN was 0.032. Compared to SN, ATT had a greater mediating effect on willingness to participate in CC.

4.2.3. Moderating effect

The moderating effect of PBC was tested by constructing the interaction term between variables. The results showed that the interaction term of ATT and PBC had a significant impact on willingness of CC participation($p<0.05$). This indicated that PBC had a positive moderating effect between ATT and willingness to participate in CC, supporting H9. However, the interaction term of SN and PBC had no significant effect on willingness to participate in CC($p>0.05$), indicating that PBC had no moderating effect between SN and willingness to participate in CC. Hypothesis H10 was not supported by empirical data.

A slope test was applied to illustrate the moderating effect of PBC (Figure 4). The values of the moderator and independent variables are plus or minus one standard deviation. A higher level of PBC leads to stronger effect on willingness to participate in CC. To measure the moderating effect, the size of the effect on the dependent variable was calculated as the actual effect of the moderating interaction according to the method suggested by Hair Jr et al. (2017). The results showed that the actual effect value of the interaction term between ATT and PBC on CC participation willingness was 0.034. According to Wong (2016), the moderating effect was relatively high.

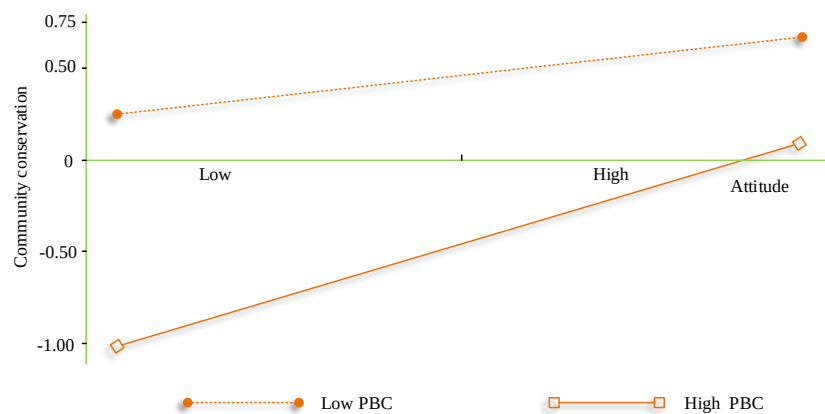


Figure 4. Slope test of moderating effect of PBC.

5 Discussion and conclusions

5.1. Discussion

5.1.1 Rethinking about the new livelihood framework in the context of a national park in China

This research establishes the framework of livelihood capital in national park community in China, and confirm institutional capital as the sixth dimension(He & Wei, 2022; He et al., 2020), exploring the diversity of effects of types of social capital on farmers' CC willingness. Financial capital, social capital and institutional capital have a direct impact on CC. This is a supplement to the research of Wang et al. (2021) and Kuang et al. (2019), which further shows that the mechanism of different types of capital on farmers' participation in decision making is different, and our research reasonably explains the mechanism and influence path of the difference. In the research it was found that after a long process of protected land construction from protected areas to national parks, traditional industries are still an indispensable strategy for livelihood of China's national park but face political risks. Under the “strict protection” of national parks, the use of natural capital such as land and forest in the core areas of national parks is restricted, which will gradually become ecological areas according to law and compliance. Because of the significant overlap between poverty-stricken areas and China’s national parks, communities face more severe problems of hollowing out and aging, and the level of physical capital is low or even scarce. When farmers need to make adaptive changes in the face of external shocks brought about by the construction of national parks, they cannot directly transform capitals to resist shocks.

Financial capital facilitates resisting risks, and the guarantee of non-agricultural employment income is the principal driver of farmer CC willingness. Non-institutionalized cooperation and social capital in relationship networks affect farmer resource acquisition and factor allocation behaviors, especially in China's rural societies with such close internal relationships. Institutional capital cannot be allocated by farmers themselves, but it affects the use of independent capital. The China National Parks system is still being gradually improved and updated, and the understanding of relevant policies and regulations determine whether farmers can reasonably gain more benefits during livelihood transformation. The SLF framework is helpful in understanding the dynamic process of establishing community resilience and the drivers of livelihood decisions. The liquidity and transferability among different dimensions of livelihood capital varies, so farmers need to measure how to combine the optimal capital mix to realize livelihood transformation. The

livelihood capital sources also have practical significance for the formulation of national park policies. The promotion of agricultural intensification, the development of green industries and the establishment of national park brands all need the support of the community and are based on livelihood capital endowments. Incentive capital policies can improve farmers' attitude toward ecological protection measures and promote their autonomy in CC. The formulation of ecological compensation programs, giving emphasis to standardization among elite farmers, and establishing an effective and transparent communications should be the main measures for management institutions to ensure a balance between ecological goals and social welfare, and the fair development and well-being of communities.

5.1.2 The TPB model and the livelihood decision-making mechanism of farmers in national parks

Based on the TPB model, this study discusses the psychological drivers of farmers' community participation. The results show that attitude and subjective norms play an intermediary role between livelihood capital and community participation willingness, and PBC plays a regulatory role before attitude and community participation willingness. Community participation, as a way designed by national park management agencies for farmers' livelihood diversity, depends on their subjective judgment as subjects, implementers, and decision makers. This study confirms that socio-psychological factors influence the decision making under the economic rationality of farmers.

This research quantitatively analyzed the factors influencing farmers' attitudes; however, attitudes and perceptions of national parks are subjective and psychological, and the deep-rooted reasons for differences are important. It was found that in the protracted process of building protected areas, conservation ideas and concepts are being integrated into local knowledge, culture and consciousness of locals. Most farmers recognize and have positive attitudes toward ecological conservation goals. The differences in attitudes toward national parks are mainly due to the uncertainty of future livelihoods and the lack of knowledge about national parks. The concerns about the future environment and livelihood make some emotionally and attitudinally opposed to the establishment of national parks. Others who support national parks say that their positive attitude towards park management is more influenced by the perception of livelihood resource dependence than the benefits they get from parks, as found in Nepal and Spiteri's (2011) research. Positive attitudes and perceptions are not necessarily consistent with conservation behavior. While benefits alone can lead to positive attitudes, sustainable alternative livelihoods consistent with ecological goals are what

farmers expect from national parks. However, in the absence of alternative livelihoods and support systems, they lack the confidence to overcome difficulties encountered during national park development.

Perceived behavioral control moderates attitudes in farmers' community conservation willingness but had no significant moderating effect on social norms and community conservation participation. The research shows that farmer perceptions of risk and its controllability can positively adjust the influence of economic uncertainty on livelihood decision-making. When farmers believe that the higher the controllability of risk, the more positive their attitude towards community participation and the greater the influence of capital on livelihood decision-making. This conclusion compensates for the limitations of the study by La Barbera & Ajzen (2020; 2021), which refers only to the European region. This phenomenon is particularly applicable in Chinese rural communities, which are guided by collective culture. Although social norms determine the willingness of individuals with the guidance of collective culture, the influence of social norms gradually decreases with the increase of perceived behavioral control (La Barbera & Ajzen, 2021).

5.1.3 Connotation and significance of community conservation in national parks of China and incentive mechanism

This study interprets the connotation of CC in the initial stage of China's national park construction, emphasizing the use of local wisdom and knowledge to design the content of CC projects in an orderly manner (Narayan et al., 2023). The intensity, scale and trends of traditional practices around the world are increasingly being scrutinized to determine whether they are meeting conservation objectives.

Previous studies have found that the implementation of community conservation is often not smooth and even conflictual (Redpath et al., 2013). Livelihood outcomes are not always consistent with environmental goals, and inappropriate policy formulation can exacerbate community conflicts and even be counterproductive to achieving environmental goals (Nepal & Spiteri, 2011). The same issues were found in this research. For example, the demarcation of core protected areas of the national park did not take into account the actual production and living spaces of farmers, and the compensation details were not formulated and implemented in a timely way. The cash crops planted by the farmers could not be harvested and caused significant economic losses, which caused negative feelings toward the national park. The deep-rooted reasons may be a neglect of local culture and knowledge, conflicts with power relationships rooted in social and cultural history, changing attitudes and values, and project concepts. It needs to be recognized that such

conflicts and disputes are long-standing and need to be resolved through consultation. Therefore, in the national park community conservation projects in China, there must be an awareness of the symbiotic relationship between national parks and communities. Involving local communities in the management and decision-making processes of protected areas and making them partners in conservation rather than spectators, not only reduces the frequency of community conflicts, but also increases the scope and effectiveness of management measures.

In addition, the establishment of appropriate incentives and systems is a necessary condition to ensure the sustainability of CC in a project. As direct beneficiaries, community members can benefit directly from the protection of national parks through direct economic incentives, and thus have a stronger motivation and sense of responsibility to maintain and monitor the sustainable use of natural resources. Based on common conservation goals and activities, internal exchanges and cooperation have been strengthened, and a strong social network and trust have been established. The establishment of social capital and the normative recognition of collective action are important resources for communities to cope with future environmental challenges, and also the main way for communities to increase their self-reliance(He & Wei, 2023). Managers should make the policy-making process more transparent and fairer so that the protection measures better reflect the broad social will, and actively seek to build a sustainable protection incentive strategy to deal with the development risks when the community assumes the responsibility of protection.

5.2. Conclusion

Protecting the ecological environment of protected areas and promoting the sustainable livelihoods of local communities are basic requirements for the sustainable development of national parks. This research introduced the institutional perspective into the measurement of livelihood capital, integrating the "from-top-to-bottom" characteristics of China's national park administration system (taking public control, collective ownership, and collectivism as core national values). A new perspective for studying the roles and activities of farmers in a national park is offered on the basis of SLF and TPB, realizing the livelihood drive for resources is a premise of community participation, and the rules of benefit-sharing must be aligned with community ecological knowledge through consultation. Livelihoods and self-driven development are realities and the future of national park communities.

1 There are three main research limitations, implications for management, and future research directions.
2 First, the role of livelihood capital characteristics and personal preferences in choices of livelihood strategy
3 must be considered. The choices of alternative livelihoods is not a single binary proposition. The
4 understanding of livelihood decisions in the SLF framework is dynamic and fluid. Future research, must
5 give more attention to the influence and changes in multiple factors, guiding farmers to negotiate and adapt
6 to continual revisions of systems and regulations, so as to achieve the goals of fair community development
7 and the effective combination of ecological goals and livelihood protection. The diversity of communities
8 must also be taken into account to formulate and implement policies in the most appropriate order and
9 timeframes. In particular, attention is needed for the methods of transforming traditional agricultural
10 production and the application of local knowledge in the design of green industries, recognizing the impacts
11 of culture on farmer perceptions and behavior in realizing the coupling of diversified livelihood strategies
12 and ecological protection.

13 Second, the influence of psychological factors and emotional support in livelihood choices in the
14 development of national parks should be emphasized. This research found that the conservation culture and
15 consciousness inherited by the communities around the protected area regulate the livelihood behavior of
16 farmers, and also directly affect livelihood choices. The informal system of traditional culture has a strong
17 influence on the decision-making of rural people. However, the analysis of individual attitudes and
18 perceptions deserves further scrutiny. Variations in community participation in project design caused by
19 cultural differences can be better articulated and the deep-rooted causes of community conflicts and
20 contradictions can be identified through in-depth interviewing. A diachronic research method is needed in
21 future to continuously inform community conservation and practices of national parks.

22 Third, there needs to be a greater focus on the multi-level development of livelihood diversification
23 goals to enhance the synergies of ecological protection and community livelihood sustainability. The public
24 welfare of national parks should not only be reflected in ecological functions, but also social contributions.
25 Widespread community engagement enhances the development of participatory projects, guides existing
26 community organizations (village committees, cooperatives, etc.) and elites, and can play a crucial role in
27 community participation. Integrating local natural and economic development conditions, organizing
28 researchers such as universities and scientific research institutions to recommend higher value-added tertiary

products, supporting resident participation through curriculum training, government acquisition, stock dividends, and other means are initiatives worthy of greater future consideration. Also, fostering local cultural industries, guiding communities to preserve and advance local cultures and traditions, developing cultural industries will build farmers' cultural self-confidence, while strengthening cultural identification and place attachment. To be most effective, communities require step-by-step guidance to build resilience in the face of many external events and changes.

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References

- Abe, H., Mitsui, S., & Yamano, H. (2022). Conservation of the coral community and local stakeholders' perceptions of climate change impacts: Examples and gap analysis in three Japanese national parks. *Ocean & coastal management*, 218, 106042. <https://doi.org/https://doi.org/10.1016/j.ocecoaman.2022.106042>
- Abukari, H., & Mwalyosi, R. B. (2020). Local communities' perceptions about the impact of protected areas on livelihoods and community development. *Global Ecology and Conservation*, 22, e00909.
- Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In *Action control: From cognition to behavior* (pp. 11-39). Springer.
- Ajzen, I. (1986). Dispositional prediction of behavior in personality and social-psychology. *Bulletin of the British Psychological Society*,
- Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, 50(2), 179-211.
- Ajzen, I. (2020). The theory of planned behavior: Frequently asked questions. *Human Behavior and Emerging Technologies*, 2(4), 314-324.
- Anderson, E., & Mammides, C. (2020). The role of protected areas in mitigating human impact in the world's last wilderness areas. *Ambio*, 49(2), 434-441.
- Asadollahpour, A., Najafabadi, M. O., & Hosseini, S. J. (2016). Modeling behavior pattern of Iranian organic paddy farmers. *Paddy and water environment*, 14, 221-229.
- Blackmore, I., Iannotti, L., Rivera, C., Waters, W. F., & Lesorogol, C. (2023). A formative assessment of vulnerability and implications for enhancing livelihood

sustainability in Indigenous communities in the Andes of Ecuador. *Journal of Rural Studies*, 97, 416-427.

Borges, J. A. R., Lansink, A. G. O., Ribeiro, C. M., & Lutke, V. (2014). Understanding farmers' intention to adopt improved natural grassland using the theory of planned behavior. *Livestock Science*, 169, 163-174.

Brocklesby, M. A., & Fisher, E. (2003). Community development in sustainable livelihoods approaches—an introduction. *Community development journal*, 38(3), 185-198.

Chen, H., Wang, J., & Huang, J. (2014). Policy support, social capital, and farmers' adaptation to drought in China. *Global Environmental Change*, 24, 193-202.

Cheng, T.-M., Wu, H. C., Wang, J. T.-M., & Wu, M.-R. (2019). Community Participation as a mediating factor on residents' attitudes towards sustainable tourism development and their personal environmentally responsible behaviour. *Current Issues in Tourism*, 22(14), 1764-1782. <https://doi.org/10.1080/13683500.2017.1405383>

Dang, X., Gao, S., Tao, R., Liu, G., Xia, Z., Fan, L., & Bi, W. (2020). Do environmental conservation programs contribute to sustainable livelihoods? Evidence from China's grain-for-green program in northern Shaanxi province. *Science of The Total Environment*, 719, 137436.

Daxini, A., Ryan, M., O'Donoghue, C., & Barnes, A. P. (2019). Understanding farmers' intentions to follow a nutrient management plan using the theory of planned behaviour. *Land Use Policy*, 85, 428-437. <https://doi.org/https://doi.org/10.1016/j.landusepol.2019.04.002>

Delay, E., Ka, A., Niang, K., Touré, I., & Goffner, D. (2022). Coming back to a Commons approach to construct the Great Green Wall in Senegal. *Land Use Policy*, 115, 106000.

DFID, U. (1999). Sustainable livelihoods guidance sheets. *London: DFID*, 445.

Dong, Q., Zhang, B., Cai, X., & Morrison, A. M. (2021). Do local residents support the development of a national park? A study from nanling national park based on social impact assessment (sia). *Land*, 10(10), 1019.

Ellis, F. (2000). *Rural livelihoods and diversity in developing countries*. Oxford university press.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of marketing research*, 18(1), 39-50.

Guo, A., Wei, Y., Zhong, F., & Wang, P. (2022). How do climate change perception and value cognition affect farmers' sustainable livelihood capacity? An analysis based on an improved DFID sustainable livelihood framework. *Sustainable Production and Consumption*, 33, 636-650.

Hagger, M. S., Cheung, M. W.-L., Ajzen, I., & Hamilton, K. (2022). Perceived behavioral control moderating effects in the theory of planned behavior: A meta-analysis. *Health Psychology*, 41(2), 155.

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet.

1 *Journal of Marketing theory and Practice*, 19(2), 139-152.

2 Hair Jr, J., Hair Jr, J. F., Sarstedt, M., Ringle, C. M., & Gudergan, S. P. (2023).
3 *Advanced issues in partial least squares structural equation modeling*. saGe
4 publications.

5 Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2021). *A primer on*
6 *partial least squares structural equation modeling (PLS-SEM)*. Sage publications.

7 Hair Jr, J. F., Sarstedt, M., Ringle, C. M., & Gudergan, S. P. (2017). *Advanced*
8 *issues in partial least squares structural equation modeling*. saGe publications.

9 Hayes, T. M. (2006). Parks, people, and forest protection: an institutional
10 assessment of the effectiveness of protected areas. *World development*, 34(12), 2064-
11 2075.

12 He, S., & Jiao, W. (2022). Adapting traditional industries to national park
13 management: A conceptual framework and insights from two Chinese cases. *Journal of*
14 *Cleaner Production*, 367, 133007.

15 He, S., & Jiao, W. (2023). Conservation-compatible livelihoods: An approach to
16 rural development in protected areas of developing countries. *Environmental*
17 *Development*, 45, 100797.
18 <https://doi.org/https://doi.org/10.1016/j.envdev.2022.100797>

19 He, S., Su, Y., & Cheng, H. (2022). Coordinating community resource use and
20 conservation: An institutional diagnostic practice in the Wuyishan National Park.
21 *Journal of Environmental Management*, 317, 115508.

22 He, S., & Wei, Y. (2022). Measuring the conservation attitudes of local farmers
23 towards conservation easements in the Qianjiangyuan National Park. *Global Ecology*
24 *and Conservation*, 36, e02123.

25 He, S., & Wei, Y. (2023). Why Agree to a Forest Easement? Perception of the
26 Residents about the Adaptation of the Conservation Easement in Qianjiangyuan
27 National Park. *Forests*, 14(5), 872.

28 He, S., Yang, L., & Min, Q. (2020). Community Participation in Nature
29 Conservation: The Chinese Experience and Its Implication to National Park
30 Management. *Sustainability*, 12(11), 4760. [https://www.mdpi.com/2071-](https://www.mdpi.com/2071-1050/12/11/4760)
31 [1050/12/11/4760](https://www.mdpi.com/2071-1050/12/11/4760)

32 Jones, K. R., Venter, O., Fuller, R. A., Allan, J. R., Maxwell, S. L., Negret, P. J., &
33 Watson, J. E. (2018). One-third of global protected land is under intense human pressure.
34 *Science*, 360(6390), 788-791.

35 Karimi, S., & Saghaleini, A. (2021). Factors influencing ranchers' intentions to
36 conserve rangelands through an extended theory of planned behavior. *Global Ecology*
37 *and Conservation*, 26, e01513.

38 Kaufmann, P., Stagl, S., & Franks, D. W. (2009). Simulating the diffusion of
39 organic farming practices in two New EU Member States. *Ecological Economics*,
40 68(10), 2580-2593.

41 Kuang, F., Jin, J., He, R., Wan, X., & Ning, J. (2019). Influence of livelihood
42 capital on adaptation strategies: Evidence from rural households in Wushen Banner,

China. *Land Use Policy*, 89, 104228.

La Barbera, F., & Ajzen, I. (2021). Moderating role of perceived behavioral control in the theory of planned behavior: A preregistered study [<https://doi.org/10.1002/jts5.83>]. *Journal of Theoretical Social Psychology*, 5(1), 35-45. <https://doi.org/https://doi.org/10.1002/jts5.83>

Li, B., Zhu, Y., Liu, W., Li, S., Fu, M., Ren, Y., Cai, X., & Li, J. (2021). Pilot areas for national park system in China: Progress, problems and recommendations. *Biodiversity Science*, 29(3), 283.

Liu, Y., Cai, L., Ma, F., & Wang, X. (2023). Revenge buying after the lockdown: Based on the SOR framework and TPB model. *Journal of Retailing and Consumer Services*, 72, 103263.

Madden, T. J., Ellen, P. S., & Ajzen, I. (1992). A comparison of the theory of planned behavior and the theory of reasoned action. *Personality and social psychology Bulletin*, 18(1), 3-9.

Mbiba, M., Collinson, M., Hunter, L., & Twine, W. (2019). Social capital is subordinate to natural capital in buffering rural livelihoods from negative shocks: Insights from rural South Africa. *Journal of Rural Studies*, 65, 12-21.

Meijer, S. S., Catacutan, D., Sileshi, G. W., & Nieuwenhuis, M. (2015). Tree planting by smallholder farmers in Malawi: Using the theory of planned behaviour to examine the relationship between attitudes and behaviour. *Journal of Environmental Psychology*, 43, 1-12. <https://doi.org/https://doi.org/10.1016/j.jenvp.2015.05.008>

Narayan, T., Sherub, S., & Root-Bernstein, M. (2023). A culturally appropriate redesign of the roles of protected areas and community conservation: understanding the features of the Wangchuck Centennial National Park, Bhutan. *Biodiversity and Conservation*, 32(2), 609-634. <https://doi.org/10.1007/s10531-022-02515-5>

Nepal, S., & Spiteri, A. (2011). Linking livelihoods and conservation: an examination of local residents' perceived linkages between conservation and livelihood benefits around Nepal's Chitwan National Park. *Environmental Management*, 47, 727-738.

Nepal, S. K., & Weber, K. W. (1995). Managing resources and resolving conflicts: national parks and local people. *International Journal of Sustainable Development & World Ecology*, 2(1), 11-25. <https://doi.org/10.1080/13504509.1995.10590662>

Qiu, H., Su, L., & Tang, J. (2022). Effects of environmental regulation on rural livelihood diversification: Evidence from pastoral China. *Journal of Rural Studies*, 95, 26-39.

Redpath, S. M., Young, J., Evely, A., Adams, W. M., Sutherland, W. J., Whitehouse, A., Amar, A., Lambert, R. A., Linnell, J. D., & Watt, A. (2013). Understanding and managing conservation conflicts. *Trends in ecology & evolution*, 28(2), 100-109.

Rezaei, R., Safa, L., Damalas, C. A., & Ganjkanloo, M. M. (2019). Drivers of farmers' intention to use integrated pest management: Integrating theory of planned behavior and norm activation model. *Journal of Environmental Management*, 236, 328-339.

- 1 Roberts, C. M., O'Leary, B. C., & Hawkins, J. P. (2020). Climate change mitigation
2 and nature conservation both require higher protected area targets. *Philosophical*
3 *Transactions of the Royal Society B*, 375(1794), 20190121.
- 4 Root-Bernstein, M. (2020). Tacit working models of human behavioural change I:
5 Implementation of conservation projects. *Ambio*, 49(10), 1639-1657.
- 6 Savari, M., & Gharechae, H. (2020). Application of the extended theory of
7 planned behavior to predict Iranian farmers' intention for safe use of chemical fertilizers.
8 *Journal of Cleaner Production*, 263, 121512.
9 <https://doi.org/https://doi.org/10.1016/j.jclepro.2020.121512>
- 10 Serrat, O., & Serrat, O. (2017). The sustainable livelihoods approach. *Knowledge*
11 *solutions: Tools, methods, and approaches to drive organizational performance*, 21-26.
- 12 Singh, S., Singh, R., Singh, S., & Singh, R. (2021). Investigation of Livelihoods
13 Asset Pentagon: The SLF Core. *Simulating Climate Change and Livelihood Security: A Western Himalayan Experience, India*, 177-193.
- 14 Temenos, C., & McCann, E. (2013). Geographies of policy mobilities. *Geography*
15 *Compass*, 7(5), 344-357.
- 16 Terano, R., Mohamed, Z., Shamsudin, M. N., & Latif, I. (2015). Factors
17 Influencing Intention to Adopt Sustainable Agriculture Practices among Paddy Farmers
18 in Kada, Malaysia. *Asian Journal of Agricultural Research*, 9, 268-275.
19 <https://doi.org/10.3923/ajar.2015.268.275>
- 20 Tezeswi, T., & MVN, S. K. (2022). Implementing construction waste management
21 in India: An extended theory of planned behaviour approach. *Environmental*
22 *Technology & Innovation*, 27, 102401.
- 23 Tosun, C., & Timothy, D. J. (2003). Arguments for community participation in the
24 tourism development process. *Journal of Tourism Studies*, 14(2), 2-15.
- 25 Wang, F., & Wang, Y. (2024). How geographic accessibility and rural governance
26 mitigate the impact of multiple risks on rural households' well-being: Evidence from
27 the Dabie Mountains in China. *Journal of Geographical Sciences*, 34(6), 1195-1227.
- 28 Wang, W., Lan, Y., & Wang, X. (2021). Impact of livelihood capital endowment
29 on poverty alleviation of households under rural land consolidation. *Land Use Policy*,
30 109, 105608. <https://doi.org/https://doi.org/10.1016/j.landusepol.2021.105608>
- 31 Ward, C., Stringer, L. C., & Holmes, G. (2018). Protected area co-management
32 and perceived livelihood impacts. *Journal of Environmental Management*, 228, 1-12.
- 33 Wondirad, A., & Ewnetu, B. (2019). Community participation in tourism
34 development as a tool to foster sustainable land and resource use practices in a national
35 park milieu. *Land Use Policy*, 88, 104155.
- 36 Wong, K. K.-K. (2016). Mediation analysis, categorical moderation analysis, and
37 higher-order constructs modeling in Partial Least Squares Structural Equation
38 Modeling (PLS-SEM): A B2B Example using SmartPLS. *Marketing Bulletin*, 26(1), 1-
39 22.
- 40 Yeh, S.-S., Guan, X., Chiang, T.-Y., Ho, J.-L., & Huan, T.-C. T. (2021).
41 Reinterpreting the theory of planned behavior and its application to green hotel
42

1 consumption intention. *International Journal of Hospitality Management*, 94, 102827.

2 Yu, P., Zhang, J., Wang, Y., Wang, C., & Zhang, H. (2020). Can tourism
3 development enhance livelihood capitals of rural households? Evidence from
4 Huangshan National Park adjacent communities, China. *Science of The Total
5 Environment*, 748, 141099.

6 Yuriev, A., Dahmen, M., Paillé, P., Boiral, O., & Guillaumie, L. (2020). Pro-
7 environmental behaviors through the lens of the theory of planned behavior: A scoping
8 review. *Resources, Conservation and Recycling*, 155, 104660.

9 Zeng, W., Tang, H., Liang, X., Hu, Z., Yang, Z., & Guan, Q. (2023). Using
10 ecological security pattern to identify priority protected areas: A case study in the
11 Wuhan Metropolitan Area, China. *Ecological Indicators*, 148, 110121.

12 Zhang, W., Wilson, R. S., Burnett, E., Irwin, E. G., & Martin, J. F. (2016). What
13 motivates farmers to apply phosphorus at the “right” time? Survey evidence from the
14 Western Lake Erie Basin. *Journal of Great Lakes Research*, 42(6), 1343-1356.

15 Zhang, X., Geng, G., & Sun, P. (2017). Determinants and implications of citizens’
16 environmental complaint in China: Integrating theory of planned behavior and norm
17 activation model. *Journal of Cleaner Production*, 166, 148-156.

18 Zhang, X., Liao, L., Huang, Y., Fang, Q., Lan, S., & Chi, M. (2023). Conservation
19 outcome assessment of Wuyishan protected areas based on InVEST and propensity
20 score matching. *Global Ecology and Conservation*, 45, e02516.