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# How do intermediary organizations affect cultivated land conservation in China: the mediating role of land tenure stability

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Economic pressure frequently prompts farmers in developing regions to prioritize immediate financial returns over long-term land conservation. This study examines how land intermediary organizations affect Chinese farmers' willingness to conserve cultivated land. Using bounded rationality and property rights theories, we conducted quantitative research involving 564 farmers across five provinces in mainland China. The results show that intermediary organizations improve farmers' willingness to conserve land, mediated by land tenure stability. Notably, both human capital (education level) and social capital (village cadre status) negatively moderated the impact of intermediary organizations' involvement in farmers' willingness to conserve cultivated land. The results of this study indicate the necessity of improving land conservation practices, considering the role of institutional support and individual characteristics of farmers. In terms of policy implications, there is a need to adapt intermediary services to align with the capital levels of farmers, enhance the security of land-use rights by streamlining registration procedures, and implement targeted information systems and incentive schemes. Limitations of this study include its cross-sectional design and potential regional variations.

## KEYWORDS

land conservation, intermediary organizations, land tenure stability, human capital, social capital, farmer decisions

## 1 Introduction

Cultivated land plays a critical role in global food security, biodiversity, and societal well-being (Caldwell et al., 2022; Sandu et al., 2023). However, per capita cultivated land has significantly declined, exacerbated by rapid urbanization, with urban population growth projected to reach 68% by 2050 (Food and Agriculture Organization of the United Nations, 2023). China, in particular, has undergone rapid land-use transformations due to urbanization, with 4.7 million hectares of agricultural land converted for urban and industrial use between 2004 and 2013, leading to significant soil degradation (Li and Cao, 2021; Dong et al., 2022). The process of China's land development involves multiple stakeholders, including farmers (e.g., facing economic pressures that result in unsustainable practices) (Oyetunde-Uzman et al., 2021), local governments (e.g., prioritizing economic growth over land protection) (Yan et al., 2022), the central government (e.g., balancing multiple objectives through policies) (Gao

et al., 2021), intermediaries (e.g., bridging farmers and policies) (Rogers et al., 2021), and environmental protection organizations (e.g., advocating for sustainable practices) (Wang and Hu, 2024), each with conflicting interests. These stakeholders operate within China's unique land tenure system, which grants temporary land rights with transfer restrictions. This system has led to informal transactions and fragmented land ownership, creating vulnerabilities that hinder sustainable development (Guo and Liu, 2022).

Although macro-level factors, such as policy and urban expansion, are well documented (Shang et al., 2021; Cheng et al., 2022; Zhang et al., 2022; Xie et al., 2023), the micro-level mechanisms underlying cultivated land conservation practices remain understudied. In many developing countries, farmers' economic motivations, driven by a heavy reliance on cultivated land, often lead to land exploitation for immediate gains rather than prioritizing long-term preservation (Oyetunde-Uzman et al., 2021). Therefore, understanding the factors that drive farmers to exploit or conserve their land is crucial for designing effective interventions that promote sustainable land use.

Intermediary organizations play a vital role by facilitating interactions between farmers and other stakeholders and providing services such as information sharing and transaction support (Spulber, 1996; Hu and Xu, 2016; Rogers et al., 2021). Although some studies have noted their positive role in promoting sustainable agricultural methods (Deininger and Jin, 2009; Che, 2014), the specific mechanisms through which these organizations influence farmers' land conservation intentions, particularly in China's unique land use rights system, remain unclear. China's land system, which grants temporary rights with transfer restrictions, has led to informal transactions and fragmented ownership, creating vulnerabilities such as insecure rights and inefficient land use (Deng et al., 2006; Deininger and Jin, 2009; Zhou et al., 2020). Under these circumstances, intermediary organizations, such as cooperatives and legal institutions, are positioned to facilitate positive changes by streamlining transfer protocols and enforcing rights (Wang et al., 2019, 2021). However, the specific ways in which these organizations affect farmers' conservation behaviors in China require further investigation.

Based on Coase's property rights theory, the effectiveness of economic frameworks depends on the strength of negotiation and exchange mechanisms for property rights (Coase, 1960; Foss et al., 2021). In China, farmers tend to protect land with secure property rights more than those with temporary rights (Shang et al., 2021; Lu et al., 2022; Zhou et al., 2022). Secure property rights give farmers confidence in long-term planning and investments in land conservation, thus reducing the risk of arbitrary changes. Some scholars have noted that the affirmation of farmland rights enhances farmers' cultivated land protection behaviors and long-term land planning awareness (Zheng et al., 2021; Zheng and Qian, 2022). Furthermore, an increasing number of researchers are attempting to determine the internal mechanism between property rights and farmers' behavior using a bootstrap moderated mediation effect test (Jia and Lu, 2018). These studies show that secure property rights provide farmers with the confidence required for long-term planning and dedicated investments in land conservation, thereby mitigating the risk of arbitrary revocations or alterations.

Another crucial aspect to consider is the role of farmers' intellectual capital, including human and social capital, in the context of land conservation efforts. The lack of intellectual capital limits access to resources such as financial support, market information, and

technical tools, potentially hindering farmers' ability to protect cultivated land effectively (Yang et al., 2020; Zhou and Li, 2023). Research has shown that human capital (e.g., skills, knowledge, and experience) and social capital (e.g., networks and relationships) significantly influence behavior and decision-making in agricultural contexts (Morrison et al., 2011; Liu et al., 2020; Xu et al., 2021). Social capital facilitates knowledge exchange, innovation diffusion, and access to support mechanisms among farmers (Chen et al., 2023). It enhances farmers' engagement with intermediary organizations, potentially affecting their conservation attitudes (Cheevapattananuwong et al., 2020). Farmers with greater social capital may have stronger decision-making abilities regarding land conservation, potentially reducing their dependence on intermediaries. Therefore, it is valuable to understand how enhancing farmers' intellectual capital can shift their focus toward more sustainable long-term conservation practices.

To address these gaps in the current research, our study investigates the factors influencing farmers' willingness to engage in cultivated land conservation. This study contributes to the existing body of knowledge by examining how external institutional structures and individual-level factors jointly affect farmers' land conservation dedication. It focuses on the roles of intermediary organizations, land rights, and farmers' human and social capital within this framework. This study offers new insights into approaches for managing land resources and promoting sustainable practices, especially considering China's distinctive land ownership system. The results of this study have practical implications for shaping policies, advancing sustainable land management practices, and enhancing farmers' capacities for land conservation.

## 2 Theoretical framework and hypothesis development

### 2.1 Theoretical framework

Farmers often struggle to balance their immediate agricultural needs with long-term land conservation (Oyetunde-Uzman et al., 2021). Herbert Simon's Bounded Rationality Theory suggests that in land conservation, farmers' choices are limited by cognitive constraints, leading them to make decisions that seem best within these limits rather than the most optimal ones (Simon, 1955, 1957). Intermediary organizations play an important role in this context helping to reduce cognitive limitations by providing farmers with the necessary knowledge and resources, enabling them to make informed decisions regarding land conservation. However, land tenure remains an important issue. The Property Rights Theory shows that uncertain land tenure, especially when based on informal agreements without legal support, significantly affects farmers' conservation decisions (Klein et al., 1978; Bell and Parchomovsky, 2004). Even with better knowledge from intermediary organizations, perceived instability in land tenure may cause farmers to focus on immediate agricultural needs rather than long-term land health. Although intermediary organizations aim to improve decision-making by addressing cognitive limitations, farmers' confidence in their land tenure is a key factor in land conservation (see Figure 1). The relationship between immediate economic considerations and uncertainty of informal land rights forms the core of this study. We examine whether informal land

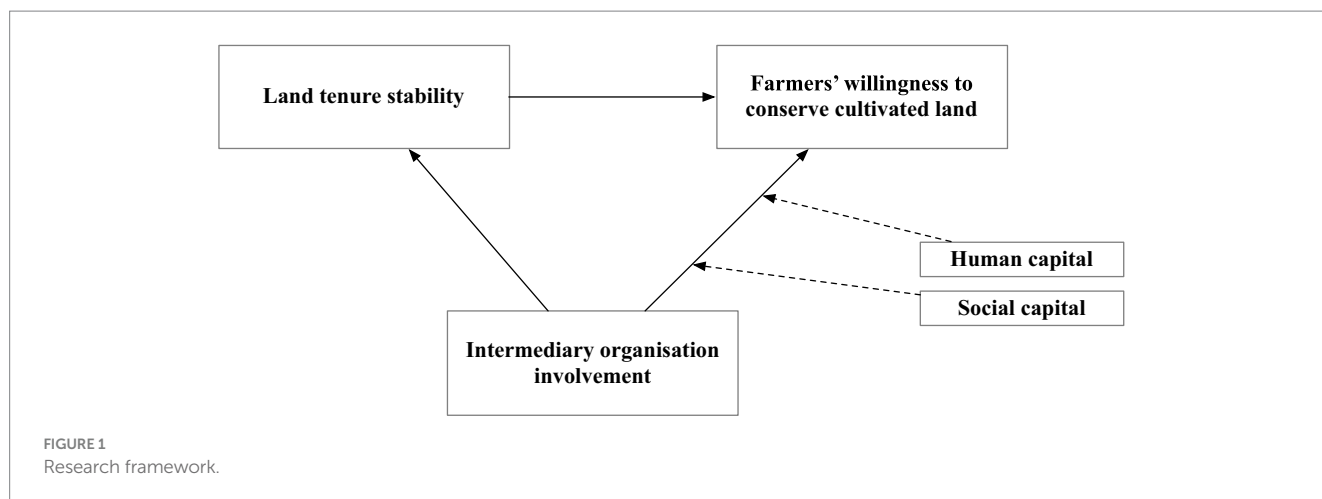


FIGURE 1  
Research framework.

rights might shift the balance toward short-term gains, overshadowing the need for ongoing land conservation.

## 2.2 Hypothesis development

### 2.2.1 The influence of intermediary organization involvement on farmers' willingness to conserve cultivated land

The theory of bounded rationality posits that farmers' decision-making processes are constrained by several factors, including limited information, cognitive limitations, and time pressure (Simon, 1955, 1957). Intermediary organizations, including crop advisors, cooperatives, and agricultural socialized services, help overcome these constraints by providing essential information, facilitating interactions, and offering support during land transactions (Spulber, 1996; Hu and Xu, 2016; Rogers et al., 2021). Intermediary organizations serve as conduits between two or more parties, facilitating communication, knowledge transfer, and resource sharing (Ramirez et al., 2018).

Specifically, crop advisors act as trusted information sources, improving farmers' knowledge and confidence in their conservation efforts (Eanes et al., 2019). They may also influence government regulations or provide training programs to equip farmers with the skills required to adopt sustainable practices (Bessy and Chauvin, 2013). By mitigating the risks associated with agricultural practices, crop advisors can help increase farmers' willingness to engage in sustainable management practices. Cooperatives help build social capital, foster collaboration, and increase efficiency in land use (Ran et al., 2023). By enhancing community collaboration and providing platforms for knowledge exchange, cooperatives can strengthen farmers' understanding of land use and conservation, thereby supporting collective efficiency in conservation efforts. Socialized agricultural services promote specific conservation techniques, such as soil testing, that enhance land quality (Cheng et al., 2022). They also disseminate information on optimal practices, market trends, and crucial environmental regulations, promoting the adoption of conservation techniques (Coggan et al., 2013). By integrating these forms of support—trusted information, community collaboration, and technical assistance—intermediary organizations create an enabling environment for land transition and sustainable land

management. Consequently, intermediary organizations effectively bridge information gaps, reduce cognitive limitations, and foster farmers' confidence and willingness to engage in long-term conservation. Therefore, we propose the following hypothesis:

*Hypothesis 1:* The involvement of land intermediary organizations has a positive impact on farmers' willingness to conserve cultivated land.

### 2.2.2 The mediating role of land tenure stability

Land tenure stability refers to the assurance of rights and the substance of rights related to land ownership and use (Arnot et al., 2011). In China, the current land transfer models often lack standardized contracts that adequately protect land recipients (Zhou, 2023). Intermediaries can improve formal land tenure security by helping farmers review and amend nonstandard contracts. Research indicates that land tenure conflicts in peri-urban areas stem primarily from conflicts of interest (55.3%), power struggles (23.8%), and legal framework issues (20.9%) (Dadashpoor and Ahani, 2019). Intermediaries, acting as liaisons between stakeholders, can help resolve disputes by providing clear information (Coggan et al., 2013), thus reducing land-use conflicts and stabilizing tenure by addressing power imbalances and conflicting interests.

Policymakers have long prioritized securing land tenure to ensure and develop more productive agriculture (Alban Singirankabo and Willem Ertsen, 2020). Research has shown that secure tenure encourages farmers to invest in conservation practices by providing long-term benefits (Tesfaye et al., 2023). In regions prone to land disputes, land tenure stability can reduce risks and motivate farmers to adopt sustainable practices (Liu and Luo, 2018). Studies indicate that China's Land Transfer Service Center, as an intermediary organization, has helped market China's land-leasing industry by enticing landowners to enter long-term contracts with major operators in exchange for monetary rent (Fan et al., 2024). This shows that land intermediaries can effectively protect the legitimate rights of land acquirers through legal contracts that specify the duration and usage of land. When land buyers clearly understand their land conservation rights, they can conserve their assets more effectively. This finding suggests that intermediaries' involvement in land transfers can clarify land usage rights and improve land stability, potentially influencing buyers' willingness to conserve land. Despite extensive research

linking land tenure and conservation, the mediating role of land tenure in the relationship between intermediary organizational involvement and the willingness to conserve cultivated land has not been thoroughly examined. Thus, we posit:

*Hypothesis 2:* Land tenure stability mediates the relationship between intermediary organizational involvement and farmers' willingness to conserve cultivated land.

### 2.2.3 The moderating role of human capital

Human capital refers to the specific knowledge, skills, and abilities possessed by individuals (Hoang-Khac et al., 2022). It results from investments in education, health, and vocational training, affecting how farmers perceive and interact with external entities, such as intermediary organizations, and influencing their willingness to conserve cultivated land (Kan et al., 2022). Existing research has found that farmers with better education and training are more likely to appreciate the role of these organizations in supporting conservation efforts (Wang et al., 2020; Hoang-Khac et al., 2022; Kan et al., 2022). Farmers with higher human capital process and apply information from intermediary organizations more effectively, leading to improved land conservation outcomes (Liu and Luo, 2018). Additionally, family capital, which includes human capital, has been found to significantly affect farmers' participation in land transfer and conservation initiatives (Xu et al., 2021). However, the relationship between human capital and the impact of intermediary organizations may be more complex than initially thought. Although farmers with higher levels of human capital might be more capable of understanding and implementing conservation practices, they may be less dependent on external support. Their increased ability to access and process information independently could reduce the relative impact of intermediary organizations on their decision-making processes. By contrast, farmers with lower levels of human capital may benefit more from the support and guidance provided by intermediary organizations. Such farmers may have a greater need for external assistance to understand complex land management practices and evaluate the long-term benefits of conservation efforts. Therefore, we propose:

*Hypothesis 3:* The level of human capital of farmers moderates the relationship between intermediary organizations' involvement and farmers' willingness to conserve cultivated land.

### 2.2.4 The moderating role of social capital

In agriculture, social capital, including farmers' social networks, trust, and participation (Guo et al., 2023), is crucial for knowledge exchange and innovation diffusion (Hansen and Greve, 2015). Research highlights its importance in land protection and food security (Morrison et al., 2011; Cheevapattananuwong et al., 2020), with strong social networks facilitating access to information and resources that motivate land conservation (Liu et al., 2020; Ren et al., 2022; Chen et al., 2023). In this context, the involvement of intermediary organizations could stimulate farmers' enthusiasm for conservation through mechanisms such as ecological compensation (Wang et al., 2020). The effectiveness of socialized agricultural services provided by these organizations is closely tied to farmers' social capital (Cheng et al., 2022). Specifically, groups with higher social capital, such as village cadres, possess significant advantages in terms of

resources and social networks compared with ordinary villagers. With enhanced access to information and stronger relational ties, these individuals are likely to have accumulated more experience and judgment in agricultural production and management. Consequently, they may demonstrate stronger decision-making abilities regarding land conservation. Unlike farmers with lower levels of social capital, these individuals may be less dependent on intermediary organizations' involvement when making informed decisions about land conservation.

Considering the above, we propose the following hypothesis:

*Hypothesis 4:* The level of social capital of farmers moderates the relationship between intermediary organizations' involvement and farmers' willingness to conserve cultivated land.

## 3 Methodology

### 3.1 Data collection

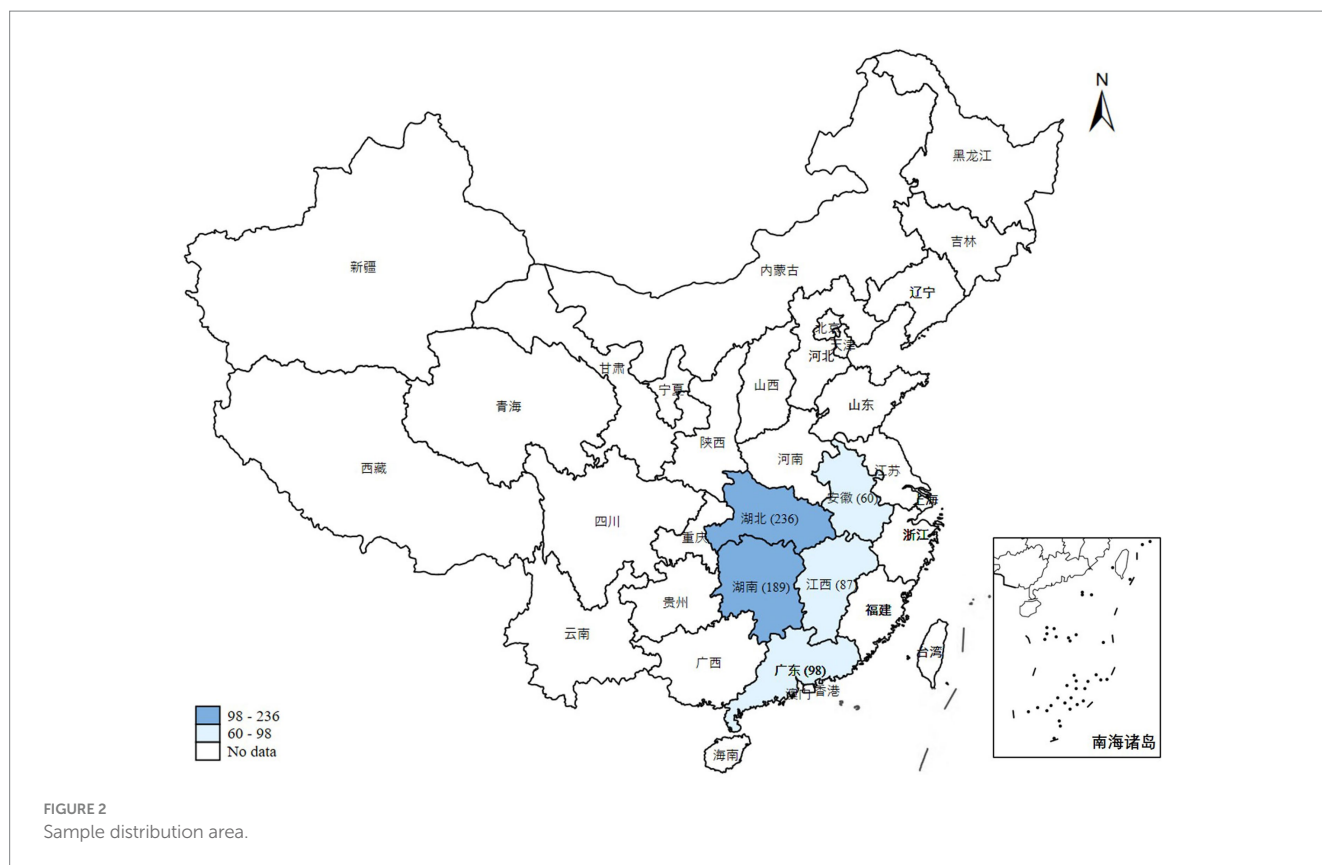
This study focused on rice planting plots in five major double-season rice-producing provinces in South and Central China: Guangdong, Anhui, Hunan, Hubei, and Jiangxi (Figure 2). These provinces were selected because of their significant agricultural contributions and diverse economic profiles. Anhui is a central agricultural contributor to the Yangtze River Delta, Jiangxi boasts consistently high grain production, and Hunan leads in national rice and rapeseed yields. Hubei stands out for its export-centric agricultural commodities, and Guangdong's strong agricultural performance in 2021 further justifies its inclusion.

This study was conducted in two phases. First, a pre-test in December 2022 involved a random selection of farms in Guangdong Province to assess the reliability and validity of the questionnaire. Subsequently, a large-scale survey was conducted from February to March 2023 across all five provinces. We used a multistage random sampling method. For each province, we selected 1–2 cities; for each city, 1–2 counties; for each county, 1–2 towns; and for each town, 1–2 villages. Within each village, 30–55 farmers were randomly selected based on population size. Data were collected through one-on-one questionnaire interviews. We collected 564 valid questionnaires, covering 3,922 land plots. Our in-depth analysis focused on 670 transferred plots. Given the varied methodologies that farmers may adopt during plot transfers and the inherent fluctuations in land tenure stability, our investigative strategy prioritized granular, plot-specific insights into overarching, farmer-centric information. Each participant received a RMB 50 subsidy after completing the survey and signed an informed consent form.

### 3.2 Measures

#### 3.2.1 Dependent variable

The conservation of cultivated land quality is closely linked to farmers' input decisions. In extensive management modes, the excessive use of fertilizers, pesticides, and herbicides often leads to the depletion of soil fertility and the degradation of soil structure. By reducing the use of these chemicals, farmers can contribute to the conservation and preservation of cultivated land, promoting



sustainable agricultural practices (Shang et al., 2021). Therefore, we used the transferees' willingness to reduce the use of these three inputs as a proxy for their intentions to conserve cultivated land. Specifically, we used three 0–1 dummy variables to ask respondents whether they would be willing to reduce the input of nitrogen fertilizers, pesticides, and herbicides, where 1 indicated “yes” and 0 indicated “no”. We then constructed a multi-categorical variable for cultivated land conservation intention (ranging from 1 = very unwilling to 4 = very willing) based on the sum of the values of the three dummy variables.

### 3.2.2 Independent variable

This study uses intermediary organizations' involvement in cultivated land transfer as the independent variable, denoted by 1 for participation and 0 for non-participation. According to previous research by Ramirez et al. (2018), an intermediary is an individual or entity that connects land transferors and transferees. This intermediary can be a village collective, village sage, or intermediary company that facilitates organization, coordination, and communication during cultivated land transfer. If any of these parties participated in the transfer, an intermediary was assumed to be involved. Conversely, if the land transferor and the transferee negotiate directly, we assumed that no intermediary was involved.

### 3.2.3 Mediating variable

This study examines how the involvement of intermediary organizations in cultivated land transfers affects the willingness to conserve land by promoting land tenure stability. Previous research suggests that the duration of cultivated land transfers serves as an

indicator of land tenure stability. It has been reported that rational agricultural operators consider both the transfer duration and payback period when determining the necessary measures to conserve cultivated land (Brinkley, 2012). Consequently, we selected the duration of cultivated land transfer as a continuous variable reflecting the stability of land tenure as the mediating variable.

In general, a contract with an undefined or uncertain duration implies a greater expectation of instability than a short-term contract with a clearly defined term. If the contract term is not specified or uncertain, it may be considered to have a duration of zero (Brousseau et al., 2002). Consequently, we set the variable to zero for plots without a predetermined transfer duration, as these plots can presumably be retained at any time, indicating a lack of stability in land tenure and a high level of uncertainty regarding the transfer duration. For plots with an established transfer period, the duration was measured in years for the lease term.

### 3.2.4 Moderating variables

Considering that intermediary organizations' involvement in land transfer may have varying degrees of influence on land conservation willingness for farmers with different levels of human and social capital, it is necessary to further analyze whether human capital and social capital play a moderating role in the influence path. Education enhances farmers' human capital (Luh and Wei, 2019). Regarding social capital, rural elites—particularly those with higher relational and resource advantages than ordinary villagers—often include village cadres with political identities, who are a significant segment of these elites (Feng et al., 2023). The role of village cadres is twofold: they reflect personal abilities and often constitute a form of social capital

within economic activity. Family members' roles can also indicate farmers' social capital, with village cadres being among the most influential figures in rural society. This dual aspect of their identity—personal competency and social leverage—positions them as vital elements of the rural structure, transcending personal capabilities to embody a broader spectrum of social capital. Therefore, this study selects the number of years of schooling of the householder and whether there are village cadres in the family as moderating variables to test whether the effect of intermediary involvement in land transfer on the conservation intention of transferred land varies with differences in human and social capital.

### 3.2.5 Control variables

To ensure that the impact of various factors on the intention to conserve cultivated land was accurately assessed, we selected control variables from four perspectives, as previously identified in research conducted by Potts et al. (2006) and Yin et al. (2022). To control for the influence of farmers' levels of cognition regarding production inputs on their willingness to reduce output, we included their understanding of the effects of fertilizers, pesticides, and herbicides. Age was selected as an individual characteristic for inclusion in the analysis. In addition, we included family characteristics, such as the working experience of family members and the number of agricultural laborers. Furthermore, we considered plot characteristics, such as plot size, type, soil quality, traffic conditions, and whether the plot was contiguous or cold-waterlogged.

Since the mediated variable was set to 0 for plots without a predetermined transfer duration, there was a possibility of bias in the regression analysis due to omitted variables and inaccurate value assignments. To mitigate this issue, we included duration as a control variable. Plots with a predefined transfer duration were assigned a value of 1, whereas those without a predefined duration were assigned a value of 0. Additionally, we incorporated a province dummy variable into the regression model to account for variability across provinces. Details of the variables and descriptive statistical analyses are presented in Table 1.

## 3.3 Econometric model

The three-step approach, involving constructing three linear models and examining the significance of each regression coefficient, is the most widely used method for assessing mediation effects (Baron and Kenny, 1986). However, this approach is only effective when both the mediated and dependent variables are continuous. As a result, the conventional three-step approach was not suitable for assessing the mediation effect of transfer duration because our mediated variable was continuous, while the dependent variable was ordinal. To address this, we adopted cumulative logistic regression instead of linear regression, as recommended in previous studies (Orsini et al., 2007; Adeleke and Adepoju, 2010), when the dependent variable was cultivated land conservation intention. Moreover, we utilized a 0–1 dummy variable to include the independent variable directly in the OLS model (Maddala, 1971).

Scholars have frequently used either the product of coefficients method or the difference of coefficients method to assess the degree of the mediation effect. Based on prior research, the product of coefficients method is more appropriate for mediation models with an

ordinal dependent variable (Adeleke and Adepoju, 2010). Therefore, the product of the coefficient method was used to estimate the mediation effect.

This study proposes that intermediaries can affect transferees' intentions to preserve cultivated land through the mediating mechanism of land tenure stability. To evaluate and quantify this mediating mechanism, a three-step approach was used to construct the following equation:

$$Y' = \text{Logit}P(Y > j | X) = \ln \frac{P(Y > j | X)}{1 - P(Y > j | X)} = i_{1j} + cX + \lambda_1 \text{Control} + e_1 \quad (1)$$

$$M = i_2 + aX + \lambda_2 \text{Control} + e_2 \quad (2)$$

$$Y'' = \text{Logit}P(Y > j | M, X) = \ln \frac{P(Y > j | M, X)}{1 - P(Y > j | M, X)} = i_{3j} + c'X + bM + \lambda_3 \text{Control} + e_3 \quad (3)$$

In Equations 1–3,  $Y$  represents cultivated land conservation intention,  $X$  represents intermediary participation,  $M$  represents transfer duration as a mediator, and Control represents the control variables that may impact  $Y$ . Equation 1 illustrates the total effect of intermediary participation on conservation intention, expressed by the coefficient  $c$ . Equations 2, 3 depict the mediating mechanism through which intermediary participation influences conservation intention, where the coefficient  $a$  of  $X$  represents the impact of intermediary participation on the mediator, and the coefficient  $b$  of  $M$  represents the impact of the mediator on conservation intention. The direct effect of intermediary participation on conservation intention is demonstrated in Equation 3 by coefficient  $c'$ .

Since we have employed linear regression in Equation 2 and cumulative logistic regression in Equation 3, the scales of coefficients  $a$  and  $b$  are not uniform and comparable. Therefore, the degree of the mediation effect cannot be directly described by the product of  $a$  and  $b$  (Adeleke and Adepoju, 2010; Iacobucci, 2012). Similarly, the scales of coefficients  $c$  and  $c'$  are different because the independent variables in Equations 1, 3 have varying impacts on the conditional probability of the dependent variable's value (Adeleke and Adepoju, 2010).

To standardize the scale of the coefficients, we calculated the corresponding standard errors after standardizing each coefficient (MacKinnon and Dwyer, 1993; MacKinnon, 2012). Additionally, we employed the Sobel test statistic,  $Z = ab / SE(ab^{std})$  to evaluate the significance of the mediating effect. The proportion of the mediation effect to the total effect was determined using the formula  $ab^{std} / (ab^{std} + c'^{std})$ .

In addition, this study introduces the interaction terms of "Education" and "Intermediary participation," "Village cadre" and "Intermediary involvement," which are, respectively, introduced into the model separately. The following models were used to test the moderating effects:

$$Y = i + cX + \beta_1 A + \beta_2 X \cdot A + \lambda \text{Control} + e_4 \quad (4)$$

TABLE 1 Definition and assignment of variables.

Variables	Definition and measurement	Mean	Std. dev.	Min.	Max
<b>Dependent variable</b>					
Willingness to conserve	Willingness to reduce production inputs (e.g., fertilizer/ pesticide/ herbicide): 1 = very unwilling; 2 = relatively unwilling; 3 = relatively willing; 4 = very willing	2.575	1.124	1	4
<b>Independent variable</b>					
Intermediary organization involvement	1 if intermediary participated in the transfer, 0 otherwise	0.042	0.200	0	1
<b>Mediated variable</b>					
Transfer duration	Agreed-upon transfer duration (year)	0.861	3.158	0	50
<b>Moderating variable</b>					
Education	Years of schooling of the householder (year)	6.909	2.912	0	15
Village cadre	1 if there are village cadres in the family, 0 otherwise	0.039	0.193	0	1
<b>Control variables</b>					
Duration definition	1 if the transfer duration is defined, 0 otherwise	0.209	0.407	0	1
Fertilizer cognition	Cognition of the specific effects of various fertilizers: 1 = very unclear; 2 = general; 3 = very clear	2.482	0.662	1	3
Pesticide cognition	Cognition of the specific effects of various pesticides: 1 = very unclear; 2 = general; 3 = very clear	2.372	0.732	1	3
Herbicide cognition	Cognition of the damage to the local ecology caused by herbicide: 1 = very unclear; 2 = general; 3 = very clear	2.276	0.656	1	3
Age	Real age of the householder (year)	55.48	8.242	34	85
Working experience	1 if the family members are involved in remunerative agricultural work, 0 otherwise	0.139	0.346	0	1
Agricultural laborer	Number of agricultural laborers in a household	1.828	0.575	0	4
Plot size	Area of plot (hm <sup>2</sup> )	2.102	15.86	0	173.4
Plot type	1 = flat paddy field; 2 = hilly paddy field; 3 = dry land	1.370	0.636	1	3
Soil quality	1 = very good; 2 = normal; 3 = very poor	1.804	0.660	1	3
Traffic condition	1 = by the roadside; 2 = away from the roadside but accessible to machines; 3 = inaccessible to machines	1.593	0.583	1	3
Contiguous plot	1 if the plot is contiguous with the farmer's own lands, 0 otherwise	0.254	0.435	0	1
Cold waterlogged paddy	1 if the plot is cold waterlogged paddy field, 0 otherwise	0.101	0.302	0	1

$$Y = i + cX + \beta_3B + \beta_4X \cdot B + \lambda Control + e_5 \tag{5}$$

In Equations 4–5, A and B are the variables for years of education and status of village cadres, respectively. X·A and X·B are the interaction terms of intermediary participation, years of education, and village cadre status, respectively.

## 4 Results

### 4.1 Statistic results

Before conducting the model analysis, we first observed the impact of intermediary organizations' participation on farmers' willingness to conserve their cultivated land (Table 2). Table 2 indicates that when intermediary organizations are involved in land transfer, except for the willingness to reduce fertilizer inputs, which does not increase significantly, the probability of farmers' willingness to reduce herbicide inputs increases from 52.0 to 78.6%, the probability of farmers' willingness to reduce pesticide inputs increases from 54.5 to 64.3%, and the index of farmers' willingness to conserve cultivated land increases from 2.561 to 2.893. This situation indicates that intermediary organizations participating in land transfers can effectively enhance farmers' willingness to conserve their cultivated land.

### 4.2 Estimate results

#### 4.2.1 Main analysis

The statistical results concerning the factors influencing cultivated land conservation intentions, including those obtained from the ordered logit and OLS models, are displayed in Table 3. To evaluate the mediation effect of transfer duration, we first investigated the relationship between intermediary participation and cultivated land conservation intentions in Model 1. Subsequently, we regressed the independent variable on the mediator in Model 2. Finally, we included intermediary participation, transfer duration, and cultivated land conservation intention in Model 3 to test the mediation effect.

The coefficients demonstrating the effect of intermediary participation on conservation intentions were significant and positive in both Models 1 ( $b = 2.883, p < 0.01$ ) and 3 ( $b = 2.938, p < 0.01$ ). This indicates that intermediary participation has a direct and positive impact on conservation intentions, thus supporting H1. These results support the notion that intermediaries increase transferees' confidence in obtaining long-term returns, thereby motivating farmers to conserve their cultivated land. Additionally, we examined the average

marginal effect in Table 4 and observed a 36.51% reduction in the likelihood of being "very unwilling" and a 39.21% increase in the probability of being "very willing" with the involvement of intermediaries. Similar results are demonstrated for the average marginal impact of intermediary participation and transfer duration in Model 3.

Table 3 also reveals that the relationship between intermediary participation and conservation intention was mediated by the influence of transfer duration. In Model 2, the coefficient demonstrating the effect of intermediary participation on transfer duration was significant and positive ( $b = 5.269, p < 0.01$ ), as was the coefficient of the effect of transfer duration on cultivated land conservation intention ( $b = 0.092, p < 0.01$ ). These results suggest that intermediary participation helps address the issues of high unpredictability and short transfer duration, thereby increasing the stability of land tenure.

It should be emphasized that the inclusion of the duration definition in Model 2 can obscure the effect of intermediary participation on transfer duration, as it significantly impacts transfer duration. Therefore, the duration definitions were excluded from Model 2 as control variables. The selected control variables may differ theoretically because the dependent variable in Model 2 differs from those in Models 1 and 3. Furthermore, if there is a strong connection between the independent and mediating variables, multicollinearity problems could occur when they are concurrently included in the model using a stepwise regression strategy. Therefore, the variance inflation factor (VIF) was used to identify the multicollinearity of the variables. Table 5 demonstrates that each variable's variance expansion factor is less than 3, suggesting that multicollinearity has no effect on the regression results in Table 3.

The specific test findings for the mediation effect are presented in Table 6, where the standardization of all coefficients and accompanying standard errors and statistics are produced (MacKinnon and Dwyer, 1993; MacKinnon, 2012). The standardization methods are as follows:

$$a^{std} = a \cdot \frac{SD(X)}{SD(X)}, \quad b^{std} = b \cdot \frac{SD(M)}{SD(Y)}$$

The Sobel test statistic  $Z = \frac{ab}{SE(ab^{std})} < 1.96$ , with a 95% confidence interval of (0.016, 0.083), supports Hypothesis 2 by demonstrating that the association between intermediate organizational involvement and farmers' motivation to protect cultivated land is mediated by land tenure stability. In other words, by extending transfer tenure, the intermediary organizations can assist

TABLE 2 Comparison of cultivated land conservation intention with or without intermediary organization involved in transfer.

	With intermediary organization				Without intermediary organization			
	Willingness to conserve	Fertilizer decrease	Pesticide decrease	Herbicide decrease	Willingness to conserve	Fertilizer decrease	Pesticide decrease	Herbicide decrease
Mean	2.893	0.464	0.643	0.786	2.561	0.495	0.545	0.520
Std. dev.	1.227	0.508	0.488	0.418	1.119	0.500	0.498	0.500



TABLE 3 Determinants of cultivated land conservation intention.

Model	(1)	(2)	(3)
	Willingness to conserve	Transfer duration	Willingness to conserve
	Ologit	OLS	Ologit
Intermediary organizational involvement	2.883***(0.931)	5.269***(1.094)	2.938***(0.933)
Transfer duration			0.092***(0.025)
Duration definition	-1.433***(0.300)		-1.984***(0.356)
Fertilizer cognition	0.575***(0.165)	0.387**(0.189)	0.539***(0.168)
Pesticide cognition	-0.247*(0.149)	-0.079(0.175)	-0.238(0.150)
Herbicide cognition	2.047***(0.216)	-0.201(0.412)	2.084***(0.216)
Age	0.009(0.012)	-0.030**(0.014)	0.012(0.012)
Education	-0.095**(0.040)	-0.002(0.073)	-0.100**(0.040)
Village cadre	1.478***(0.394)	0.147(0.537)	1.522***(0.394)
Working experience	-1.086***(0.219)	-0.226(0.258)	-1.059***(0.219)
Agricultural laborer	0.272*(0.164)	-0.109(0.251)	0.277*(0.166)
Plot size	-0.021***(0.007)	-0.008(0.006)	-0.019***(0.007)
<b>Plot type</b>			
Hilly paddy field	0.516**(0.220)	0.377(0.301)	0.498**(0.221)
Dry land	-0.421*(0.228)	0.906(1.011)	-0.505**(0.233)
<b>Soil quality</b>			
Normal	-0.189(0.180)	0.236(0.316)	-0.214(0.181)
Very poor	0.286(0.256)	-0.499(0.332)	0.313(0.257)
<b>Traffic condition</b>			
Away from the roadside but accessible to machines	-0.703***(0.189)	-0.330(0.246)	-0.707***(0.191)
Inaccessible to machines	-0.725**(0.342)	-0.346(0.321)	-0.738**(0.340)
Contiguous plot	0.417*(0.213)	0.120(0.237)	0.431**(0.215)
Cold waterlogged paddy	1.406***(0.425)	1.467***(0.488)	1.355***(0.414)
Constant		2.783**(1.309)	
Province	Control	control	control
Observations	670	670	670
Pseudo- $R^2$	0.199		0.204
Adjusted- $R^2$		0.140	

Robust standard errors are indicated in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

TABLE 4 Marginal effect of intermediary participation and transfer years on cultivated land conservation intention.

	(1)				(2)			
	Very unwilling	Relatively unwilling	Relatively willing	Very willing	Very unwilling	Relatively unwilling	Relatively willing	Very willing
Intermediary organizational involvement	-0.3651	-0.0992	0.0722	0.3921	-0.3718	-0.0959	0.0740	0.3936
Duration definition					-0.0116	-0.0030	0.0023	0.0123

TABLE 5 VIF value of variable multicollinearity diagnosis.

Variable	VIF	1/VIF
Intermediary organization involvement	1.820	0.549
Transfer duration	1.520	0.659
Education	1.350	0.740
Village cadre	1.090	0.919
Duration definition	1.840	0.545
Fertilizer cognition	2.170	0.462
Pesticide cognition	2.150	0.465
Herbicide cognition	1.270	0.787
Age	1.320	0.757
Working experience	1.300	0.771
Agricultural laborer	1.100	0.912
Plot size	1.520	0.658
<b>Plot type</b>		
Hilly paddy field	1.300	0.771
Dry land	1.200	0.833
<b>Soil quality</b>		
Normal	1.400	0.716
Very poor	1.610	0.620
<b>Traffic condition</b>		
Away from the roadside but accessible to machines	1.330	0.753
Inaccessible to machines	1.210	0.826
Contiguous plot	1.180	0.846
Cold waterlogged paddy	1.290	0.773
Mean	VIF	1.450

TABLE 6 Results of Sobel test.

	Variable	(1)	(2)	(2)
Standardized	Intermediary organizational involvement	0.303	0.334	0.301
	Duration definition			0.148
Standard error	Intermediary organizational involvement	0.098	0.069	0.095
	Duration definition			0.040
Sobel test	$ab^{std}$		0.04933	
	$SE(ab^{std})$		0.01696	
	Z		2.91	
	Mediation effect		14.1%	

the transferees in obtaining more precise estimates of their future earnings and securing land rights, which will encourage them to take better care of the cultivated land and use fewer pesticides, fertilizers, and herbicides. The proportion of the mediation effect to the total effect was 14.1%.

#### 4.2.2 Robustness checks

To examine the robustness of our results, we conducted a sensitivity analysis to assess the impact of using an alternative dependent variable and a mediation test method. First, we constructed an alternative dependent variable by including farmers' willingness to

TABLE 7 Robustness test by replacing dependent variable.

Variable	(1)	(2)	(3)
	Willingness to conserve	Transfer duration	Willingness to conserve
Intermediary organization involvement	2.942***(0.853)	5.269***(1.094)	2.976***(0.855)
Transfer duration			0.073** (0.033)
Control variables	Control	Control	Control
Province	Control	Control	Control
Constant		2.783**(1.309)	
Observations	670	670	670
Pseudo- $R^2$	0.160		0.163
Adjusted- $R^2$		0.140	

Robust standard errors are indicated in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

apply pesticides with low residues and toxicity, in addition to their intention to reduce the use of fertilizers, pesticides, and herbicides. This new variable was transformed into an ordered dummy variable with five categories (1 = very unwilling, 2 = relatively unwilling, 3 = general, 4 = relatively willing, and 5 = very willing) to better represent the dependent variable and maintain accuracy. Table 1 presents the regression results obtained by using the new dependent variable. We used the Sobel test to assess the mediation effect and found it significant, accounting for 11.4% of the total effect.

Second, scholars have suggested using ordered logistic regression instead of common linear regression to test the mediating effect of categorical variables (Iacobucci, 2012). However, the test statistics and approaches used to unify the coefficient scales differ. To ensure the validity of our test for the mediation effect and to verify whether our hypothesis holds true, we used the Iacobucci (2012) method as a replacement for our original approach. We transformed regression coefficients  $a$  and  $b$  into  $Z_a$  and  $Z_b$  with the same scales. We then employed the Sobel test to assess the significance of  $Z_a \times Z_b$ , resulting in a mediation effect size of  $Z_a \times Z_b = 17.57$  and a test statistic

$$Z = \frac{Z_a \times b}{SE(Z_a \times b)} = \frac{Z_a \times Z_b}{\sqrt{Z_a^2 + Z_b^2 + 1}} = 2.87 > 1.96. \text{ Therefore, the mediation}$$

effect was significant.

Third, to assess the impact of different estimation models and dependent variables on our results, we further estimated and adjusted the baseline regressions using OLS and the ordered probit model with different dependent variable measurements (Tables 7–9). Table 8 presents the baseline regressions estimated using the ordered probit model. We used an ordered probit model with the dependent variable replaced by a five-level variable representing cultivated land conservation intentions (see Appendix 1). Our study estimates the baseline regressions using OLS (see Appendix 2). Finally, we used ordinary least squares (OLS), with the dependent variable replaced by a new five-level variable. Overall, the results of our robustness checks were consistent with our main findings (see Appendix 3).

#### 4.2.3 The moderating effect of human capital and social capital

As can be seen from the regression results in Table 9, the interaction term coefficient between intermediary participation and

years of education is negative at the 5% significance level, indicating that with an increase in farmers' years of education, the positive promoting effect of intermediary participation in land transfer on the willingness to conserve land weakens, supporting H3. In addition, the interaction coefficient between intermediary participation and village cadre status was also significantly negative at the 5% level; that is, the positive impact of intermediary participation on the willingness of farming households with village cadres to conserve land was less than that of farming households without village cadres, supporting H4.

The model results were consistent with these expectations. To some extent, both human and social capital weakened the positive impact of intermediary participation on the willingness to conserve land. Rural households with fewer years of education and no village cadres in their families were more seriously affected by information asymmetry and lacked the ability to evaluate the stability and security of the plots. In this case, intermediary organizations have more obvious functional advantages in providing information and improving supervision, which can help enhance farmers' long-term operational expectations of plots and encourage them to take conservation measures. However, farmers with higher human or social capital, due to their strong information-searching ability, transaction negotiation ability, and awareness of property rights, can more effectively safeguard their own interests in land transfer and form future investment return expectations; thus, the comparative advantages of intermediary organizations are not as apparent.

## 5 Discussion

### 5.1 Theoretical implications

This study emphasizes the necessity of strengthening land tenure stability to optimize the efficacy of intermediary interventions, which can be achieved by considering both bounded rationality theory (Simon, 1955, 1957) and property rights theory (Klein et al., 1978; Bell and Parchomovsky, 2004). Farmers face a number of challenges, including cognitive and information constraints and land tenure uncertainty. Intermediary organizations seek to address these issues by assisting farmers in overcoming cognitive constraints through reliable information and technical support. However, the efficacy of

TABLE 8 Determinants of cultivated land conservation intention (oprobit model).

	(1)	(2)	(3)
	Willingness to conserve	Transfer duration	Willingness to conserve
Model	Oprobit	OLS	Oprobit
Intermediary organizational involvement	1.633**(0.678)	5.269***(1.094)	1.672**(0.691)
Transfer duration			0.054***(0.017)
Duration definition	-0.857***(0.189)		-1.175***(0.226)
Fertilizer cognition	0.274***(0.096)	0.387**(0.189)	0.254***(0.097)
Pesticide cognition	-0.135(0.085)	-0.079(0.175)	-0.133(0.085)
Herbicide cognition	1.098***(0.102)	-0.201(0.412)	1.116***(0.103)
Age	0.005(0.007)	-0.030**(0.014)	0.006(0.007)
Education	-0.038*(0.021)	-0.002(0.073)	-0.041**(0.021)
Village cadre	0.624**(0.262)	0.147(0.537)	0.641**(0.266)
Working experience	-0.619***(0.131)	-0.226(0.258)	-0.602***(0.131)
Agricultural laborer	0.176*(0.092)	-0.109(0.251)	0.182**(0.093)
Plot size	-0.012***(0.004)	-0.008(0.006)	-0.011***(0.004)
<b>Plot type</b>			
Hilly paddy field	0.296**(0.124)	0.377(0.301)	0.283**(0.125)
Dry land	-0.295**(0.133)	0.906(1.011)	-0.349***(0.133)
<b>Soil quality</b>			
Normal	-0.051(0.108)	0.236(0.316)	-0.071(0.108)
Very poor	0.191(0.152)	-0.499(0.332)	0.199(0.152)
<b>Traffic condition</b>			
Away from the roadside but accessible to machines	-0.381***(0.109)	-0.330(0.246)	-0.379***(0.109)
Inaccessible to machines	-0.382*(0.207)	-0.346(0.321)	-0.387*(0.207)
Contiguous plot	0.205*(0.118)	0.120(0.237)	0.213*(0.119)
Cold waterlogged paddy	0.772***(0.221)	1.467***(0.488)	0.753***(0.223)
Constant		2.783**(1.309)	
Province	Control	control	control
Observations	670	670	670
Pseudo- $R^2$	0.188		0.192
Adjusted- $R^2$		0.140	

Robust standard errors are indicated in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

the intervention is contingent on land tenure security. The dual theoretical approach elucidates why farmers may experience difficulties in making conservation-focused decisions and provides a framework for enhancing their capacity to adopt sustainable practices by improving their knowledge and securing land tenure.

More specifically, regarding Hypothesis 1, the results demonstrate that the involvement of intermediary organizations exerts a positive influence on farmers' willingness to conserve cultivated land. This is corroborated by the considerably positive coefficients observed in Models 1 ( $b = 2.883, p < 0.01$ ) and 3 ( $b = 2.938, p < 0.01$ ). Our findings are consistent with those of previous studies on the role of intermediaries in sustainable agricultural practices (Eanes et al., 2019; Cheng et al., 2022; Ran et al., 2023). We extend previous research by

quantifying its impact and demonstrating its consistency across different models. The strong positive coefficients in both models indicate that intermediaries play a critical role in overcoming the cognitive limitations described by the bounded rationality theory. This is likely achieved by providing information, reducing uncertainty, and supporting decision-making in agricultural environments.

Regarding Hypothesis 2., the findings demonstrate that land tenure stability acts as a mediator in the relationship between intermediary organizational involvement and farmers' willingness to conserve cultivated land. The Sobel test statistic ( $z = 2.91$ ) and 95% confidence interval (0.016, 0.083) provide evidence supporting this mediation effect. Our findings establish a link between the bounded rationality theory proposed by Simon (1955, 1957) and property rights

TABLE 9 Moderating effect of human capital and social capital.

	Moderating variable: education		Moderating variable: village cadre	
	(1)	(2)	(3)	(4)
Intermediary organization involvement	2.813*** (0.846)	11.287*** (4.219)	2.957*** (0.845)	3.320*** (0.767)
Intermediary organization involvement × Education		−0.831** (0.339)		
Intermediary organization involvement × Village cadre				−4.242** (2.161)
Education		−0.076** (0.036)	−0.064* (0.034)	−0.089** (0.036)
Village cadre	0.547* (0.329)	0.767** (0.356)		0.984*** (0.327)
Control variables	Control	Control	control	control
Provincial effect	Control	Control	control	control
Observed value	670	670	670	670
Pseudo-R <sup>2</sup>	0.157	0.163	0.158	0.163
Prob> chi <sup>2</sup>	0.000	0.000	0.000	0.000
Wald test	302.22	313.51	294.64	340.32

theory. The mediating role of land tenure stability indicates that intermediary organizations assist in overcoming cognitive limitations by providing information and enhancing farmers' perceptions of long-term land rights. Although intermediary organizations can provide legal, financial, and technical assistance (Rogers et al., 2021; Shang et al., 2021), land tenure stability is a key factor that allows farmers to fully utilize this support (Alban Singirankabo and Willem Ertsen, 2020; Tesfaye et al., 2023). This study offers a quantitative perspective on the importance of tenure security in conservation decisions. It contributes to the ongoing discussion on how institutional support leads to behavioral change in agricultural settings, suggesting that theories of intermediary effectiveness should consider both direct and indirect pathways of influence.

Hypothesis 3, which proposed that the level of human capital moderates the relationship between intermediary organizations' involvement and farmers' willingness to conserve cultivated land, was supported ( $\beta = -0.831$ ,  $p < 0.05$ ). Our findings are not entirely consistent with previous studies. For instance, studies conducted by Wang et al. (2020), Hoang-Khac et al. (2022), and Kan et al. (2022) suggested that farmers with higher levels of education are more likely to value and effectively utilize the support provided by intermediary organizations. Liu and Luo (2018) posit that elevated human capital leads to more effective processing and utilization of information from intermediaries. Our results indicate that farmers with higher human capital may rely less on external support when making land conservation decisions, suggesting a complex relationship between human capital and the effectiveness of external interventions. This outcome may be influenced by the unique characteristics of rural China, where more educated farmers often have better access to non-agricultural income sources and broader social networks (Chaudhuri et al., 2021). These farmers might possess a broader understanding of market turbulence and land use, making them more confident in managing land conservation without relying heavily on intermediary organizations. Moreover, China's land tenure system, which grants only temporary land rights, may incentivize educated farmers to pursue independent strategies rather than depend on

external support, which they may perceive as unreliable or ineffective in navigating bureaucratic complexities.

Hypothesis 4, which proposed that the level of social capital moderates the relationship between intermediary organizations' involvement and farmers' willingness to conserve cultivated land, was supported ( $\beta = -4.242$ ,  $p < 0.05$ ). The positive influence of intermediaries was weaker among farmers with high levels of social capital, such as village cadres, indicating that farmers with robust social networks and elevated community influence are less dependent on intermediary assistance for conservation-related decisions because they already possess superior access to information, resources, and social support. The result corroborates previous studies that have emphasized the significance of social capital in enhancing access to information and resources, which in turn fosters conservation behaviors (Morrison et al., 2011; Cheevapattananuwong et al., 2020). This is similar to the findings of Liu et al. (2020), who demonstrated that social networks facilitate land conservation efforts by enhancing access to knowledge and fostering collaboration. However, our study extends these findings by demonstrating that farmers with more robust social networks may be less reliant on intermediary organizations. This challenges the traditional view that intermediaries universally enhance conservation behavior among all farmers. Conversely, farmers with lower levels of social capital—those lacking strong networks or leadership roles—derive greater benefits from the involvement of intermediary organizations, as these entities help provide essential support, resources, and information. This aligns with the findings of Cheng et al. (2022), who highlighted the value of socialized agricultural services in promoting conservation among farmers with limited support networks. The multifaceted role of social capital revealed by our findings adds a new perspective to the literature, suggesting a potential substitution effect between intermediary support and social capital. Specifically, when social capital is high, the need for intermediary involvement diminishes; whereas for farmers with lower levels of social capital, intermediary organizations become indispensable for promoting conservation engagement.

## 5.2 Practical implications

The findings of this study indicate the potential of intermediary organizations and government policies to enhance land conservation efforts. First, intermediary organizations must adapt their support to align with the human and social capital levels of the farming communities they serve. It is imperative that farmers with lower educational levels receive fundamental training in conservation practices. Conversely, those with higher levels of education may derive greater benefits from specialized, in-depth training (Liu et al., 2021). Intermediaries should also capitalize on social capital by collaborating with community leaders, cooperatives, and local associations to disseminate information and promote sustainable land management practices (Ren et al., 2022). Collaboration among farmers, local officials, and conservation experts should be facilitated to ensure that conservation plans are locally relevant and effective. Government support is also essential, as policymakers must recognize the role of intermediaries and provide the necessary resources, such as financial support and regulatory facilitation, to enhance their effectiveness (Huber-Stearns et al., 2013; Schomers et al., 2015).

Second, land tenure stability is crucial to the relationship between intermediary involvement and farmers' willingness to conserve cultivated land. Consequently, it is evident that government action is essential. Governments should enhance land tenure security by streamlining registration procedures, clarifying land use rights, and providing legal assistance to farmers (Deininger and Feder, 2009; Deininger and Jin, 2009). This approach has shown similar outcomes in Ethiopia, where a simplified land registration process led to enhanced tenure security and increased agricultural productivity (Tesfaye et al., 2023). The establishment of local land tenure information centers could also facilitate access to information regarding farmers' rights and guidance on securing their tenure.

Third, this study demonstrates the impact of information on farmers' willingness to conserve land. To facilitate informed decision-making, organizations should develop integrated information systems that combine land-use data, conservation practices, and market information (Vk et al., 2019). Implementation of user-friendly mobile applications can effectively provide timely information to farmers and intermediaries. However, considering our findings on the differential impact of intermediaries based on human and social capital, these information systems should be designed with varying levels of detail to cater to the diverse needs of different farming groups.

Finally, it is vital that policymakers recognize the diverse roles of intermediaries within farmer groups. Support for intermediaries, including funding and training programs, should be designed to enhance their efficacy, particularly among farmers with low levels of human and social capital. Local governments could collaborate with intermediaries to develop targeted incentive programs that reward conservation practices (El Bakali et al., 2023), focusing on reaching and motivating farmers who might otherwise lack the resources or networks to engage in conservation efforts.

## 5.3 Limitation

This study had several limitations. First, the cross-sectional design may have constrained our capacity to investigate the causal relationships between intermediary involvement and farmers' conservation intentions.

Second, although our study included five principal double-cropping provinces in southern and central China (Guangdong, Anhui, Hunan, Hubei, and Jiangxi), this geographical restriction may have affected the broader applicability of our findings. China's vast territory encompasses diverse regions characterized by varying levels of economic development, local governance structures, regulatory environments, and intermediary organizational competencies. Regional differences could influence farmers' conservation decisions in ways that our study may not have fully captured. Third, our study treated intermediary organizations as a homogeneous group, potentially overlooking the differences in effectiveness among various types of intermediaries. Intermediary organizations include cooperatives, government agencies, and nongovernmental organizations (NGOs), each of which may play different roles and have various impacts on promoting land protection, which presents an area for future research to address.

## 6 Conclusion

This study examined the impact of intermediary organizations on farmers' willingness to conserve farmland in mainland China using data from 564 samples. The results show that intermediaries have a direct positive influence on farmers' willingness to conserve land during the transfer process. Moreover, intermediaries help increase the stability of land tenure, which further strengthens farmers' commitment to conservation. However, the effectiveness of intermediaries is moderated by farmers' human and social capital levels, suggesting that the influence of intermediaries is more pronounced among farmers with lower educational levels and weaker social networks. These findings highlight the need for customized intermediary interventions and targeted policies to optimize conservation outcomes in diverse farming communities.

## 6.1 Recommendation

Considering the findings and design of this study, the following recommendations are proposed for future research. First, future research should consider utilizing a longitudinal research design to ascertain the causal relationships between intermediary involvement and farmers' conservation intentions more accurately. A longitudinal study can facilitate tracking changes over time, thereby enabling an understanding of the evolving impact of the intermediary and the manner in which farmers' conservation intentions evolve in conjunction with their engagement with the intermediary organization. Second, it would be beneficial to extend the geographical scope of this study to encompass a more expansive area of China to address the issue of geographical limitations. For instance, the scope of the study could be expanded to encompass regions with varying degrees of economic development, ranging from highly industrialized coastal areas to less developed inland provinces. It would be beneficial to verify these findings in different countries, although different land systems may yield different results. Therefore, it is essential to examine how different policy environments affect the role and effectiveness of intermediary organizations in promoting land protection. Furthermore, an analysis of the changes in the effectiveness of intermediary organizations before and after major policy changes could be conducted. Third, the impact of various intermediary strategies, including trust-building mechanisms,

information dissemination techniques, and resource allocation methods, on farmers' conservation inclinations should be examined in greater depth. Research could also focus on the effectiveness of user-friendly mobile applications in supporting informed decision-making and conservation planning among farmers and intermediaries. Fourth, considering the rapid evolution of agricultural technology, future research should investigate how intermediaries can leverage technology to promote conservation practices, including digital platforms, remote sensing technology, and innovative financial mechanisms. Fifth, a comparative analysis assessing conservation inclinations across different generational cohorts, notably Generation Y and Generation Z, may offer insights into the evolving perceptions and cognitive effects of land conservation activities.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

This study was reviewed and approved by the departments of South China Agricultural University (No.: skzx2019018). Written informed consent was obtained from all participants before their participation in the survey. All procedures performed in this study were in accordance with the institutional research guidelines and regulations.

## Author contributions

JCa: Conceptualization, Funding acquisition, Investigation, Writing – original draft. JCh: Conceptualization, Writing – original draft, Writing – review & editing. RW: Data curation, Methodology,

Writing – review & editing. RO: Writing – review & editing. BN: Visualization, Writing – review & editing.

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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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## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fsufs.2024.1485376/full#supplementary-material>

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