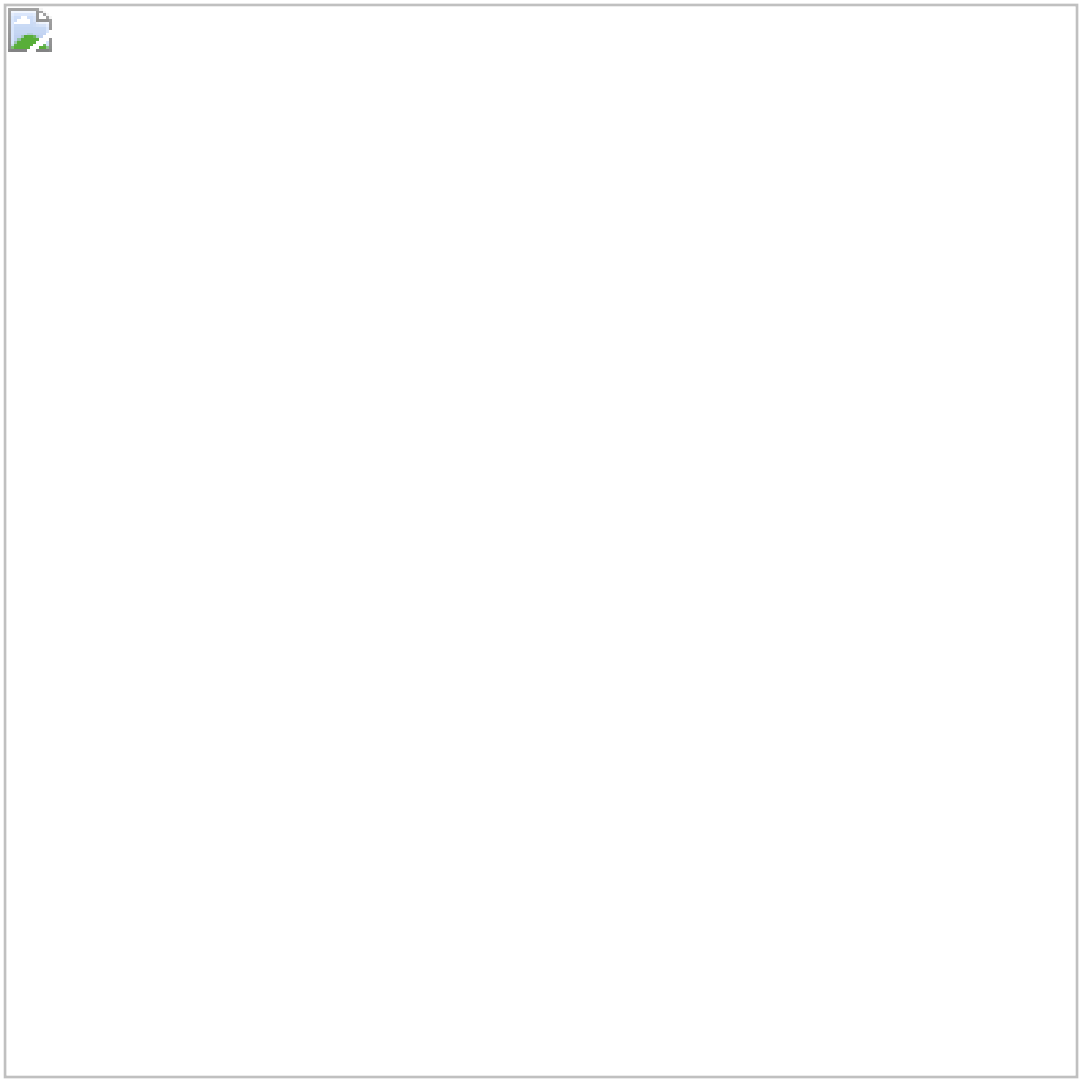

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What Affects Farmers' Ecocompensation Expectations? An Empirical Study of Returning Farmland to Forest in China

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Abstract

Ecocompensation projects (EPs) have two primary objectives: environmental protection and the livelihood maintenance of farmers. Farmers' ecocompensation expectations (FEEs) are a key factor that affects whether the design of ecological policy is targeted at practical problems. This article divides FEEs into three dependent variables and uses logistic regression and multiple regression models to analyze the influencing factors of FEEs. The results of a questionnaire survey based on 259 farmers in the area of Returning Farmland to Forest Project, with tropical and subtropical regions of China included, show that, first, farmers' willingness to participate in EPs is strong. Several indicators, such as policy cognition level, returned farmland area, and participation in other EPs, have been demonstrated to significantly affect farmers' willingness to participate. Second, the result of the contingent valuation method shows that farmers' expectations of compensation income are higher than the current standard. Farmers' returned farmland area, participation in other EPs, and degree of satisfaction with the policy effect are primary influencing factors. Third, farmers' expectations of compensation mode, such as employment opportunities, technical guidance, and ecological migration, are greatly improving. The choice of compensation mode is mainly affected by policy cognition level, current compensation mode for returning farmland, and degree of satisfaction with the policy effect. This study can provide a new perspective for the policy adjustment of eco-environmental protection and farmers' livelihood choices in the tropical and subtropical regions of China.

Keywords

farmers' ecocompensation expectations, willingness to participate, compensation income, compensation mode, eco-environmental protection

Introduction

For centuries, it was deeply entrenched in people's thinking that resources were unlimited and the environment had no value (Su & Shang, 2010). However, in the face of the developing dilemma caused by environmental problems and energy crises, maintaining a balanced ecosystem under the multiple objectives of economic development, energy structure adjustment and environmental protection has aroused great concern globally among policy makers (Sun, Li, & Wang, 2018; Sun, Wang, & Li, 2018). Ecocompensation is a type of restoration or reconstruction of ecological damage caused by economic and social activities (Allen & Feddema, 1996), which became an effective policy instrument for exploring ecological protection and economically and socially coordinated development (Liu et al., 2016; Pagiola, Rios, & Arcenas, 2008; Wang et al., 2016; Wei & Hou, 2015). Ecocompensation projects (EPs) have been carried out all over the world and have had an important impact on the protection of the eco-environment and farmers' choices of livelihood strategies (Dong & Wu, 2004; Li & Zhang, 2013; Yan & Wu, 2005; Zhang, Hua, & Zhang, 2018).

From a global perspective, Pagiola (2008) used Costa Rican payments for environmental services, and Hayes

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(2012) used Colombian EPs as examples to analyze the impact of EPs and underscore the special role of policy in assisting poor residents and protecting the environment. On this basis, Rudel, Perez-Lugo, and Zichal (2000) used the Puerto Rican forest conservation project, PerrotMaître (2006) used the Vittel Watershed water resources conservation project, and Turpie, Marais, and Blignaut (2008) used the water program in South Africa as examples to continuously expand the scope of the research. These studies further affirmed the significance of ecocompensation in promoting the sustainable livelihood of farmers and environmental protection.

With the ever-increasing shortage of resources, serious environmental pollution, and ecosystem degradation (Jiang, Chen, Chen, Xu, & Yang, 2018; Li, Sun, & Wang, 2019), Chinese government also has launched EPs such as natural forest protection, returning farmland to forest, sand control, and desert control (Duan, Shen, & Wen, 2018). The Returning Farmland to Forest Project (RFFP), with the largest investment and the highest number of participants among the EPs (Xu, Tao, & Xu, 2004; Yin, Liu, Zhao, Yao, & Liu, 2014), has had a drastic effect on a large scale.

Zhang, Song, and Chen (2018) indicated that RFFP creates a reverse transformation from human-dominated fields to natural land surfaces. Zhao, Bi, Zhang, and Wu (2011) further pointed out that there was great significance in implementing RFF policies to prevent the reversion of the returning land, protect the environment, and achieve sustainable development. Considering the differences in economic and cultural of different regions of China, Cao, Chen, and Liu (2009) focused on the perspective of policy cognition and investigated residents' attitudes toward environmental protection in six provinces (Henan, Hunan, Shanxi, Shanghai, Hubei, and Beijing) in China. The research showed that residents' attitudes play a crucial role in protecting and maintaining the sustainable development of the global environment. Feng and Xu (2015) analyzed farmers' willingness to participate in EPs in the three gorges reservoir area. The study found that the willingness of different individuals to participate in RFFP was obviously affected by social heterogeneity and regional differences. Wang, Hao, Zhai, and Liu (2017) took the nature reserves as examples and used the contingent valuation method (CVM) and regression models to analyze the expectations of farmers' continued participation in RFFP and the influencing factors.

Most existing literature emphasized that the researches on ecological problems have become imperative in the fragile eco-environment and farmers' livelihoods. Some scholars discussed the relationship between farmers' basic characteristics, natural capital, financial capital, and farmers' willingness to participate in EPs or farmers' expectations of compensation income (Duan et al., 2018; Liu & Zhao, 2011; Ren & Li, 2017). These studies mainly have three limitations: First, the dependent variable is measured only from a single dimension. Second, the relationship between the RFF policy and farmers' expectations is not clear and needs to be further clarified and analyzed. Third, the analysis of farmers' expected compensation mode is still at the descriptive statistical level, which is relatively simple and imprecise.

The RFFP, was piloted in 1999 and fully initiated in 2002, has lasted for nearly 20 years. It covers Hainan, Sichuan, Yunnan, Guangxi, Guizhou, Chongqing, and other tropical and subtropical provinces and cities. Considering the particularities of agriculture in subtropical and tropical regions, such as crop being planted up to 2 or 3 times each year, and the opportunity cost between RFF and farming, the study of farmers' willingness to participate in EPs and its influencing factors is of great significance, especially study the balance between eco-environmental protection and farmers' choices of livelihood. In the empirical investigation, the results of several semistructured interview with farmers show that there are still some problems in the implementation of RFF. First, government behavior still dominates in the current RFFP. A considerable number of farmers are not aware of the connotation and purpose of the ecocompensation policy, and farmers' participation is still passive. Second, there is still a substantial gap between the compensation standard and farmers' expectations. The implementation of compensation funds is not timely and sufficient, and the compensation standard still needs to be further improved. In addition, cash compensation is the most important compensation mode accepted by farmers, but it cannot meet farmers' diversified needs. Therefore, the practical problems found in the empirical investigation also urgently appeal to us to conduct in-depth and detailed research on the question of "what affects farmers' ecocompensation expectations" (FEEs).

On the basis of the existing literature, this study adds the variables that have been proved as control variables into the model. At the same time, this article selects the perspective of FEEs and introduces the RFFP into the model as an explanatory variable to investigate the effectiveness of the policy implementation from the perspective of policy design. Our article measures the dependent variables (FEEs) from a multidimensional perspective, including farmers' expectations of willingness to participate in EPs, farmers' expectations of ecocompensation income, and farmers' expectations of ecocompensation mode, which provide new complement to the existing literature. In addition, this article conducts an empirical study of returning farmland to forest area in China. It provides new insight into the policy adjustment of eco-environmental protection and farmers' choices of livelihood.

This article is organized as follows. The "Methods" section describes the independent variables and dependent variables that are used to construct the regression model. It is followed by "Results" and "Discussion" sections which present the main findings of the study and a thorough and detailed discuss on the findings. Finally, "Implications for Conservation" section is provided for policy recommendations.

Methods

Variable Selections

Dependent variables. Referring to the research framework of Wang et al. (2017) and Pi, Zhang, and Xia (2018), and the problems found in the empirical investigation, our article uses the expectations of farmers' willingness to participate in EPs, the expectations of farmers' ecocompensation income, and the expectations of farmers' ecocompensation mode as dependent variables to design the indexes and items.

Independent variables. The independent variables of this article are divided into four parts, which are the farmer's basic characteristics, the farmer's resource stock, the family income, and the current participation situation in EPs. The sustainable livelihood analysis framework of the United Kingdom (Department for International Development, 1999) presents the main factors affecting farmers' sustainable development, including human capital, physical capital, financial capital, natural capital, and social capital. Based on this framework, Ren and Li's (2017) proved the significant influence of householder's age, family size, relocation policy, and family cultivated land area on the farmer's willingness to participate in RFFP. Liu and Zhao (2011) verified the relationship between the householder's educational background, annual nonfarm income, and the satisfaction of farmers' compensation for returning farmland. Duan et al. (2018) analyzed the effects of householders' health status, identity, and cultivated land area on farmers' income for sloping land conversion program. Therefore, our article adds these proven variables as control variables (farmers' basic characteristics, resource stocks, and family income) into the model. About the participation situation in EPs, this article introduces RFFP as an independent variable; some indicators, such as returned farmland quality, returned farmland area, and returned farmland management and maintenance, refer to the existing literature (Duan et al., 2018; Ren & Li, 2017). In addition, the empirical investigations of FEEs find that farmers' policy cognition and degree of satisfaction are important to the FEEs. Therefore, we increase indicators such as the policy cognition level, current compensation mode, current compensation income, degree of satisfaction with the compensation, and degree of satisfaction with the policy effect, which are used to describe the current participation situation in EPs.

Model Construction

The purpose of this article is to explore the relationship between the RFFP and the FEEs. Referring to the existing research, we use three subdependent variables to evaluate the FEEs and establish the total measurement model as follows:

$$Y_i = \alpha + \sum_{i=1}^{n} \beta_i \bullet X_i + \mu \tag{1}$$

In Equation (1), Y_i ($i = 1, 2, 3$) represents the expectations of farmers' willingness to participate in EPs, the expectations of farmers' ecocompensation income, and the expectations of farmers' ecocompensation mode, respectively. X_i is an independent variable, including the farmer's basic characteristics, family income, resource stocks, and participation in RFFP. β_i is the regression coefficient, which indicates the degree and direction of the effect of X_i on Y_i. The key parameters concerned in our article are between the RFFP and the FEEs. α is a regression intercept, and μ is a random error.

The expectations model of farmers' willingness to participate in EPs. The logistic regression model requires dependent variables to be qualitative variables, and Y_1 is a binary variable, including "participation" and "nonparticipation," wherein willingness to participate is 1 and being unwilling to participate is 0. Therefore, we choose a binary variable logistic regression model to depict the relationship between the expectations of the willingness to participate and its influencing factors. Then, we set up the logistic regression equation:

$$Y_1 = Logit\left(\frac{P_i}{1 - P_i}\right) = \alpha + \sum_{i=1}^{n} \beta_i X_i + \mu \tag{2}$$

In Equation (2), P_i represents the probability that farmers are expected to participate in EPs, and $1–P_i$ represents the probability that farmers will not participate. β_i indicates the percentage of change in "willingness to participate" (logarithmic likelihood ratio [LR]) caused by one unit of change in X_i.

The expectations model of farmers' ecocompensation income. The CVM evaluates respondents' preferences for public goods or services and their willingness to pay for ecological protection through questionnaires based on preset questions (Zhao & Yang, 2006), including participants' maximum (WTP) for the use of public goods and the

minimum willingness to accept (WTA) for the eco-environment (Portney & Paul, 1994). In this article, we use the WTA in the CVM to calculate the expected income of farmers' ecocompensation. The formula and model are as follows:

$$E(WTA) = \sum P_i A_i$$
$$Y_2 = WTA = \alpha + \sum_{i=1}^{n} \beta_i X_i + \mu \quad (3)$$

where WTA is the expectations of farmers' ecocompensation, which is a dependent variable. $E\ (WTA)$ represents the average WTA value, P_i is the distribution probability of farmers who choose i bidding interval, and A_i is the expected bid value of ecocompensation.

The expectations model of farmers' ecocompensation mode. Farmers' expected ecocompensation mode is a disordered multicategory variable, so we adopt a disordered multiclassification logistic model to analyze the influencing factors of farmers' expected ecocompensation mode. The specific model based on cash compensation is as follows:

$$Y_3 = Logit\left(\frac{P_i}{P_1}\right) = \alpha + \sum_{i=1}^{n} \beta_i X_i + \mu \quad (4)$$

In Equation (4), P_i represents the probability of the expectations of farmers' ecocompensation mode. P_1 to P_5 indicate the probability that the compensation is expected to be cash, material object, employment opportunities, technical guidance, ecological migration, and $P_1 + P_2 + P_3 + P_4 + P_5 = 1$. β_i indicates the probability of farmers choosing other compensation modes due to the change of X_i in one unit compared with cash compensation.

Data Collection

Participatory rural appraisal was internationally launched in the 1990s and has been widely used in rural social survey research. Participatory rural appraisal is a method that emphasizes farmers' participation in the whole process, making it different from traditional top-down survey methods (Chambers, 1994). It includes direct observation, household survey, community meetings, questionnaires, and semistructured interviews (Li, Cui, & Li, 2000). Combined with the purpose of this article, we select farmers in tropical and subtropical regions of China in the RFFP as an investigation object from June to September 2018. The survey adopts a random sampling method and comprehensively applies household surveys, questionnaires, and interviews to obtain the farmers' basic characteristics, current participation situation in EPs, and so on. A total of 514 questionnaires and 502 valid questionnaires were collected, and the effective recovery rate was 97.7%. Of the respondents, 259 households participate in RFFP, and 243 households do not participate. The basic information of the sample is shown in Table 1.

The survey shows that the proportion of males among the respondents is higher than that of females, which is in line with the current rural context in which males are the backbone of the family. The differences in average age, health, and education level between returning and nonreturning households are small. However, there are obvious differences in the area of family cultivated land, family housing, family annual income, household non-agricultural annual income, and policy cognition level. The respondents' basic statistical profiles are shown in Online Appendix A.

Descriptive Analysis

Farmers' cognition of ecocompensation policy. Farmers' policy cognition level of EPs directly affects the possibility of their participation and affects the implementation effect of the policy. In this article, we use the Richter five-level scale to measure farmers' familiarity with the policy for RFF and other EPs, and the investigation finds that the level of familiarity with the policy is higher among families returning farmland than it is among families not returning farmland. Returning farmers have a certain degree of understanding of the policy, and farmers who "know" and "know very well" account for 76.1% of the total number of those returning farmland, showing that the RFF policy has become a popular policy since its implementation 20 years ago. However, only 11.2% of nonreturning farmers reach the level of "knowing" about the ecocompensation policy, while "do not know very well" accounts for 36.6% and "do not know" accounts for 25.9% of the respondents (Online Appendix A). This result indicates that the familiarity of nonreturning farmers with the ecocompensation policy still needs to be improved, and the government needs to continue to strengthen the policy propaganda directed toward these farmers.

Farmers' participation in EPs. The average returned area of the 259 households is 3.54 mu (1 mu = 666.7 m^2; Table 1), and 38.6% of them are above the average, but the current returned area is smaller than that of the initial period. These data are proportional to the increasing depletion of land resources. Among the interviewed farmers, 59.9% consider the quality of the returned farmland good, 35.5% consider it average, and 4.6% consider it to be poor. The proportion of farmers maintaining and managing the returned

Table 1. Variable Design and Descriptive Statistics.

Variable	Definition of variable	Returning households *M*	Nonreturning households *M*
Dependent variable			
Farmers' expectations of willingness to participate in EPs	Willing to participate = 1 Not willing to participate = 0	0.79	—
Farmers' expectations of ecocompensation income	Unit: yuan	316.51	—
Farmers' expectations of ecocompensation mode	Cash = 1 Material object = 2 Employment opportunities = 3 Technical guidance = 4 Ecological migration = 5	2.07	—
Farmer's basic characteristics			
Sex	Male = 1 Female = 0	0.76	0.16
Age	Unit: year	49.68	46.00
Health status	Health = 1 General = 2 Disease = 3	1.45	1.28
Educational background	Primary and below = 1 Junior secondary = 2 High school and above = 3	2.15	2.27
Householder identity	Village cadres = 1 Others = 0	0.17	0.06
Family size	Unit: person	4.75	3.98
Receiving nonreimbursable assistance or not	Yes = 1 No = 0	0.23	0.12
Relocation policy	Yes=1 No=0	0.13	0.07
Farmer's resource stock			
Family cultivated land area	Units: mu (1 mu=666.7 m^2)	6.13	3.00
Family housing	Units: number	4.74	2.88
Family income			
Annual household income	Unit: yuan	26,385.76	60,392.89
Annual nonfarm income of household	Unit: yuan	10,879.26	45,245.78
Current participation situation in EPs			
Policy cognition level	Do not know = 1 Do not know very well = 2 Generally = 3 Know = 4 Know very well = 5	4.00	2.28
Returned farmland area	Units: mu (1 mu = 666.7 m^2)	3.54	—
Returned farmland quality	Good = 1 Average = 2 Poor = 3	1.45	—
Returned farmland management and maintenance	Yes = 1 No = 0	0.80	—
Current compensation mode for returning farmland	Cash = 1 Material object = 2 Employment opportunities = 3 Technical guidance = 4 Ecological migration = 5 Cash and material object = 6 Cash and technical guidance = 7 Cash and material object and technical guidance = 8	3.29	—
Current compensation income for returning farmland	Unit: yuan	1,387.16	—
Degree of satisfaction with the compensation for returning farmland	Satisfied = 1 Dissatisfied = 0	0.76	—
Degree of satisfaction with the policy effect	Very unsatisfied = 1 Unsatisfied = 2 General = 3 Satisfied = 4 Very satisfied = 5	3.71	—
Participation in other EPs	Unit: item	2.74	0.25
Sample size		259	243

Note. EPs = ecocompensation projects.

farmland is 79.5%. That is, whether due to objective reasons or subjective consciousness, farmers are actively maintaining the ecological balance and protecting the ecological environment. However, considering the sustainability and systematicness of RFF, it is necessary to pay attention to the farmers (20.5%) who have not managed and protected the returned farmland (Online Appendix A). In addition, 89.2% of returning households participate in other EPs, and 12.8% of nonreturning households also participate in such projects. Therefore, farmers' participation in EPs is a manifestation of their enhanced ecological consciousness.

Farmers' perceptions of satisfaction with EPs. Farmers' perceptions of satisfaction with ecocompensation result from a kind of psychological process in which farmers compare the current government compensation standard with their own expectations. Compensation mode and compensation income are the main factors influencing farmers' perceptions of policy satisfaction. In terms of compensation mode, the compensation for farmers' participation in EPs mainly includes cash, material object, employment opportunities, technical guidance, and ecological migration. The number of farmers receiving cash compensation accounts for 44.0% of the total respondents, the numbers of farmers who choose compensation through material object account for 11.6%, and the ratio of cash and material object is the highest (27.8%). Employment opportunities, technical guidance, and ecological migration compensation only account for 2.3%, 4.6%, and 1.5% of the total, respectively (Online Appendix A), given that these compensation modes have not been fully implemented in practice. This failed implementation may be because some farmers have not solved their basic livelihood problems at present and lack long-term vision and strategic vision to cultivate their own sustainable development ability. In terms of compensation income, the average compensation income is 1387.16 yuan per year (Table 1), but 48.6% of the farmers still receive below average levels of compensation, which is mainly proportional to the decreasing returned area. In addition, using the current national subsidy standard for RFF at 1,500 yuan/mu (3 times in 5 years, with an average of 300 yuan/mu/year) as a reference (Zhang, 2018), 76.1% of the farmers believe that the compensation standard is in line with their expectations. However, 23.9% of the farmers believe that the current subsidies cannot meet their expectations (Online Appendix A). Among the farmers whose expectations are inconsistent with the current standard, approximately 45.2% of the respondents believe that the compensation standard should be further improved. This perception is mainly related to farmers' age, health, and income. That is, the older householders' age, the worse the farmers' health status, and the lower the farmers' total income, the more difficult it is for them to maintain and guarantee the quality of life, so they have higher expectations for compensation income.

Farmers' perceptions of policy effects. We use the Richter five-level scale to investigate the effect of the policy. According to the statistical results of farmers' environmental satisfaction with the EPs, the average satisfaction level of farmers is as high as 3.71 (Table 1), and the combined proportion of "satisfied" and "very satisfied" is 67.2%, indicating that most farmers have a positive attitude toward the ecological protection of RFF. However, 19.7% of the farmers do not understand the true purpose of the policy and are still passive about engaging with the program (Online Appendix A). In addition, a significant proportion of nonreturning households indicate that they do not care about the ecological effects of the policy and even doubt its ecological protection function, which is also an important reason why they are unwilling to participate in EPs. For EPs aimed at promoting sustainable development, the long-term ecological benefit is more valuable and meaningful. Therefore, it is necessary to guide farmers to grasp the true purpose of the policy by helping them to better understand the policy.

Results

Results of Farmers' Willingness to Participate in EPs

This article uses maximum likelihood estimation to estimate the expected model of the willingness to participate in EPs. Model I mainly analyzes the relationship between participation in RFFP and farmers' willingness to participate in EPs. Model II introduces the basic characteristics, resource stocks, and income as control variables on the basis of Model I and analyzes the net effect of the policy. In the logistic regression, all the indicators are considered explanatory variables, and then, the factors that significantly affect the expectations of farmers' willingness to participate are obtained by the "*inclusion-exclusion*" screening method.

The sample size of the expectations model of farmers' willingness to participate in EPs is 259. The LR of the Model I regression is 200.16, the p value is 0.000, and the pseudo R^2 is 0.7625. The LR of the Model II regression is 224.37, the p value is 0.000, and the pseudo R^2 is 0.8548. It shows that the Models I and II as a whole fit the data very well. We also use *robust standard error estimation* to test the rationality of the model. In addition, the joint significance of the explanatory variables is tested by the *Wald test*. The results show that the $Wald\chi^2$ of Model I is 32.04, and the $prob \geq \chi^2$ is 0.0000, the $Wald\chi^2$ of Model II is 20.14, and the $prob \geq \chi^2$ is 0.0171, indicating that the two models fit well. The

estimation results of the binary logistic regression model are shown in Table 2.

Our results show that the farmers' consciousness of ecological protection is gradually improving and that farmers' willingness to participate in EPs is stronger than it was before. The returned farmland area, returned farmland quality, current compensation mode for returning farmland, degree of satisfaction with the compensation for returning farmland, degree of satisfaction with the policy effect, and participation in other EPs pass the significance test. However, three indexes of policy cognition, returned farmland management and maintenance, and compensation income fail to pass the test. On the basis of the six significant regression results of Model I, we find that, after adding the health status of the household and family cultivated land area as controlling variables, the policy cognition of returning farmers passes the 10% significance test.

In addition, to test the robustness of the binary logistic regression model, we use binary probit model to reestimate the relationship between the variables. The results of significance and coefficient symbol are consistent with the logistic model (Table 2), which verified the previous results. That is, the binary logistic regression model is robust. The results of the robustness test are shown in Online Appendix B.

Results of Farmers' Ecocompensation Income Expectations

We carry out a multiple linear regression analysis of farmers' ecocompensation income expectations using the stepwise regression method. The sample size of the expectations model of farmers' ecocompensation income is 259. First, to eliminate skewness and make the regression results more revealing, we conduct a logarithmic transformation in the data processing of the annual income, the compensation income of returning farmland, the nonagricultural income, and so on. Second, based on the current compensation standard, we divide the sample into two groups: high expectations group and low expectations group. Then, Models III, IV, and V, respectively, includes farmers' basic characteristics, resource stocks, and income and studies the impact of farmers' participation in RFFP on their income expectations under different control conditions. Model VI presents the relationship between variables after including all control variables. The regression results of the farmers' expectations for ecocompensation income are shown in Table 3.

Table 3 shows that the returned farmland area, the degree of satisfaction with policy effect, and farmers' participation in other EPs pass the significance test and have a positive impact on farmers' ecocompensation income expectations after adding control variables. Family size, cultivated land area, and annual income are significantly associated with farmers' income expectations, which further verify the views of existing literature. However, policy cognition level, current compensation income, and degree of satisfaction with compensation do not pass the significance test.

In the model construction process, we conduct a *multicollinearity test* and *heteroscedasticity test*, indicating that the overall model is significant. To check the

Table 2. The Estimation Results of Binary Logistic Regression Model on Factors Influencing of Farmers' Willingness to Participation in Ecocompensation Projects.

	Model I		Model II	
Variable	Coefficient	z value	Coefficient	z value
Policy cognition level			−1.468*	−1.82
Returned farmland area	0.653*	1.85	1.118**	2.17
Returned farmland quality	2.058***	2.92	1.666**	1.96
Current compensation mode for returning farmland	−0.248*	−1.82	−0.461**	−2.11
Degree of satisfaction with the compensation for returning farmland	−2.778***	−3.02	−4.119***	−2.81
Degree of satisfaction with the policy effect	2.763***	4.87	3.976***	3.97
Participation in other EPs	1.175***	3.67	2.091***	3.59
Health status			2.249***	2.78
Family cultivated land area			−0.785**	−2.11
Constant	−10.59***	−4.35	−7.352*	−1.86
Sample size	259		259	
Log likelihood	−31.168		−19.063	
Likelihood ratio	200.16***		224.37***	
Pseudo R^2	.7625		.8548	
Waldχ^2	32.04***		20.14**	

Note. EPs = ecocompensation projects.
*, **, and *** indicate significant at 10%, 5%, and 1% probability level, respectively.

Table 3. The Estimation Results of Multivariate Linear Regression Model on Factors Influencing of Farmers' Ecocompensation Income.

	Model III		Model IV		Model V		Model VI	
Variable	Coef.	*t* Statistic	Coef.	*t* Statistic	Coef.	*t* Statistic	Coef.	*t* Statistic
Returned farmland area	0.034**	2.36	0.059***	3.28	0.048***	3.11	0.058***	3.26
Degree of satisfaction with the policy effect	0.130***	4.22	0.128***	4.19	0.116***	3.74	0.118***	3.85
Participation in other EPs	0.051**	2.28	0.056**	2.52	0.052**	2.38	0.060***	2.75
Family size	–	–	–	–	–	–	0.044**	2.27
Family cultivated land area	–	–	–0.040**	–2.29	–	–	–0.040**	–1.98
Annual household income	–	–	–	–	–0.087**	–2.52	–0.080**	–2.08
Constant	–0.233**	–2.32	–0.085	–0.71	0.627*	1.76	0.528	1.45
Sample size	259		259		259		259	
F	22.44***		18.43***		18.77***		13.92***	
Adj R^2	.1996		.2127		.2160		.2310	

Note. EPs = ecocompensation projects.
*, **, and *** indicate significant at10%, 5%, and 1% probability level, respectively.

robustness of regression results, we choose the logit model to reestimate the relationship between the variables. The results show that, besides the reduction of the significant level of farmers' participation in other EPs, the action direction of other variables maintain a good consistency with multiple linear regression model, indicating that this model has good robustness. The comparison of the robustness test and Model VI is shown in Online Appendix C.

Results of Farmers' Ecocompensation Mode Expectations

To accurately identify the influence of farmers' EPs participation on their expectations of the ecocompensation mode, we use Stata 15.1 to carry out a disordered multiclassification logistic regression (Table 4). The sample size of the expectations model of farmers' ecocompensation mode is 259. The *LR* of the regression model is 162.91, the corresponding *p* value is 0.000, the pseudo R^2 is 0.2566, and the *log likelihood* is –235.9322, which indicates that overall, there is good model fit. In addition, we use *robust standard error estimation* to test the rationality of the model, and the model passes the *multicollinearity test*, *heteroscedasticity test*, and *Wald test*. Table 4 provides the variable coefficients and relative risk ratio to examine the effect of each independent variable on the dependent variable. At the same time, we calculate the average marginal effects of the independent variables on the selection probability of farmers' ecocompensation mode, which provides a deep analysis of the internal mechanism of independent variables acting on the dependent variable (Table 5).

According to Tables 4 and 5, the policy cognition, current compensation mode for returning farmland, current compensation income for returning farmland, degree of satisfaction with the compensation, and degree of satisfaction with the policy effect have a significant influence on the choice of different compensation modes, and their marginal effects pass through different significance levels. In addition, although participation in other EPs has a significant impact on farmers' ecological migration compensation, its marginal effect is not obvious.

To test the robustness of the multiclassification logistic regression model, we reestimate the model using a multinomial probit regression method. The results show that the coefficient of the degree of satisfaction with policy effect in the core variable is changed from –0.088 to 0.006, but it is consistent with the direction of relative risk ratio. It is mainly caused by the calculation difference of different methods, which can be neglected. The coefficients of other variables do not change significantly, and the symbols are consistent with the original model results. In terms of significance, although the significance levels of variables are different, it is consistent with the previous results as a whole. The results of this estimation method further verify the robustness of the conclusions of this article (Online Appendix D).

Discussion

Analysis of Farmers' Willingness to Participate in EPs

Considering the diversity of farmers' participation in EPs, including in tropical and subtropical areas of China, the EPs in our article include returning farmland to forest, grassland, wetland, desert, and water flow. Of the 259 returning households, 79.5% of the respondents will continue to participate in EPs, and 20.5% will no longer participate. Furthermore, farmers' levels of willingness to continue participating are divided into 20%, 40%, 60%, 80%, 100% and account for 3.9%, 11.2%, 23.8%, 34.0%, and 27.1%, respectively, showing that farmers' willingness to continue participating in EPs is relatively strong. However, 36.6% of the nonreturning

Table 4. The Estimation Results of Disordered Multiclassification Logistic Regression Model on Factors Influencing of Farmers' Ecocompensation Mode.

Variable	Probability of choosing material object compensation	Probability of choosing employment opportunities compensation	Probability of choosing technical guidance compensation	Probability of choosing ecological migration compensation
Policy cognition level				
Coef.	–0.727 (–1.22)	–0.597* (–1.83)	–0.937** (–2.40)	0.680 (1.28)
RRR	0.483 (0.288)	0.551* (0.179)	0.392** (0.153)	1.973 (1.049)
Current compensation mode for returning farmland				
Coef.	–0.177 (–1.00)	–0.057 (–0.65)	–0.218** (–1.99)	0.010 (0.07)
RRR	0.838 (0.149)	0.944 (0.824)	0.804** (0.882)	1.010 (0.136)
Current compensation income for returning farmland				
Coef.	0.000 (0.33)	0.000 (1.27)	0.001** (2.00)	0.001** (1.96)
RRR	1.000 (0.001)	1.000 (0.000)	1.001** (0.005)	1.001** (0.007)
Degree of satisfaction with the compensation for returning farmland				
Coef.	2.401* (1.93)	0.306 (0.58)	0.875 (1.35)	–1.221 (–1.62)
RRR	11.031* (13.752)	1.359 (0.716)	2.399 (1.558)	0.295 (0.223)
Degree of satisfaction with the policy effect				
Coef.	–0.088 (–2.21)	0.605** (2.42)	0.708** (2.42)	0.521 (1.49)
RRR	0.916 (0.379)	1.831** (0.456)	2.029** (0.594)	1.684 (0.589)
Participation in other EPs				
Coef.	–0.158 (–0.57)	0.178 (1.12)	0.096 (0.54)	0.498** (2.02)
RRR	0.854 (0.233)	1.195 (0.191)	1.101 (0.198)	1.646** (0.406)
Householder identity				
Coef.	0.404 (0.44)	–0.393 (–0.64)	0.862 (1.42)	1.454** (1.98)
RRR	1.497 (1.381)	0.675 (0.412)	2.367 (1.432)	4.280** (3.149)
Family size				
Coef.	–0.118 (–0.41)	–0.381** (–2.19)	–0.143 (–0.71)	–0.573** (–2.10)
RRR	0.888 (0.257)	0.683** (0.119)	0.866 (0.176)	0.564** (0.154)
Receiving nonreimbursable assistance or not				
Coef.	–0.278 (–0.19)	–1.100 (–1.41)	0.178 (0.19)	–2.484** (–2.22)
RRR	0.757 (1.112)	0.333 (0.260)	1.194 (1.135)	0.083** (0.935)
Relocation policy				
Coef.	0.050 (0.04)	1.095** (2.04)	0.318 (0.46)	0.582 (0.77)
RRR	1.051 (1.186)	2.988** (1.606)	1.374 (0.954)	1.790 (1.354)
Family cultivated land area				
Coef.	–0.927** (–2.21)	–0.141 (–0.83)	–0.147 (–0.75)	0.072 (0.24)
RRR	0.396** (0.166)	0.868 (–0.148)	0.864 (0.169)	1.075 (0.328)
Annual household income				
Coef.	–0.000 (–0.50)	–0.000 (–0.25)	–0.000** (–2.01)	–0.000 (–1.52)
RRR	1.000 (0.000)	1.000 (0.000)	1.000** (0.000)	1.000 (0.000)
Constant				
Coef.	1.884 (0.32)	–0.202 (–0.07)	2.062 (0.65)	–4.989 (–1.15)
RRR	6.577 (38.169)	0.817 (2.260)	7.861 (24.983)	0.007 (0.030)
Sample size	259			
Log likelihood	–235.932			
LR chi^2 (84)	162.91***			
Pseudo R^2	.2566			
Waldχ^2	57.06**			

Note. The probability of choosing the material object, employment opportunities, technical guidance, and ecological migration compensation with the reference of cash compensation. RRR = Relative risk ratio; LR = likelihood ratio.

*, **, and *** indicate significant at 10%, 5%, and 1% probability level, respectively. The data in the right parenthesis of the coefficient are *z* statistic value; the RRR value in the right parenthesis is the standard error.

households still have no intention to participate, and only 4.5% of these farmers have a strong intention to participate. This result may be because of the optimization of the land opportunity cost due to the pressures of achieving a livelihood. On the other hand, the result may be related to farmers' skepticism about the fairness and transparency of the policy implementation (Online Appendix A).

Table 5. Average Marginal Effects of Independent Variables to the Expectations of Farmers' Ecocompensation Mode.

Variable	Pr ($y_3 = 1$)	Pr ($y_3 = 2$)	Pr ($y_3 = 3$)	Pr ($y_3 = 4$)	Pr ($y_3 = 5$)
Policy cognition level	0.084*	–0.006	–0.063*	–0.071**	0.055*
Current compensation mode for returning farmland	0.029**	–0.006	–0.007	–0.019**	0.003
Current compensation income for returning farmland	–0.000**	–0.000	–0.000	–0.000**	–0.000**
Degree of satisfaction with the compensation for returning farmland	–0.085	0.085**	0.011	0.051	–0.062
Degree of satisfaction with the policy effect	–0.115***	–0.003	0.060**	0.042*	0.017
Participation in other EPs	–0.026	–0.011	0.019	–0.005	0.023
Sample size	259				

Note. EPs = ecocompensation projects.
*, **, and *** indicate significant at 10%, 5%, and 1% probability level, respectively.

The expected model of farmers' willingness to participate in EPs mainly considers farmers' livelihood capital as a controlling variable to study the influence of farmers' current participation in RFFP on their willingness to participate in EPs. The influence of independent variables on dependent variables is related to the coefficient. Negative significance indicates that the fewer (lower) independent variables, the stronger is the farmers' willingness to participate in EPs. Conversely, positive significance indicates that the more (higher) the independent variables, the stronger is the farmers' willingness to participate in EPs.

According to Table 2, the impact of farmers' policy cognition on the willingness to participate in EPs is inconsistent with the expected direction. Generally, the more farmers pay attention to the policy, the more likely they are to positively respond to the policy and participate in EPs. Although the farmers' policy cognition passes the 10% significance test, it has an obvious difference from the actual situation, and its influence on farmers' willingness requires further testing. The returned farmland area is significant at the 5% level, indicating that the more farmland is returned, the higher the enthusiasm of farmers to participate in EPs. A possible reason for this result is that material rewards can stimulate farmers to participate in EPs. There is a significant negative correlation between the quality of the returned farmland and the dependent variable at the 5% level. This result may be because the poorer the quality of the land, the lower is the farmers' income from the land, and therefore, the more inclined they are to participate in EPs, which is the choice stemming from the farmers' comprehensive comparison of the land use value. The significant coefficient of the current compensation mode for returning farmland is negative, which may be because the ecocompensation provided by the country cannot meet the farmers' needs, resulting in a decline in farmers' participation. The degree of satisfaction with the compensation for returning farmland passes the 1% significance test, and the direction is negative. That is, the higher the degree of satisfaction with returning farmland is, the lower farmers' willingness to participate in EPs is. The main reason for this result is that farmers' livelihood options become increasingly diversified, and they are willing to try multiple livelihood modes to avoid the livelihood instability caused by a single mode. The degree of satisfaction with the policy effect and participation in other EPs are directly proportional to farmers' willingness. The more farmers participate in EPs, the more they agree with the policy significance, and the more they tend to improve their willingness to participate. The possible reason for this result is that farmers' awareness of ecological protection gradually increases.

Analysis of Farmers' Ecocompensation Income Expectations

The expected income of farmers' ecocompensation is 316.51 yuan/mu/year (Table 1), which is higher than the current compensation standard for RFF (average 300 yuan/mu/year). Among the surveyed farmers, 47.5% hope to further improve the ecocompensation standard, which indicates that solving the livelihood problem is always the primary point of farmers' livelihood choices. However, under the condition of maintaining the current compensation standard, most farmers are still willing to continue to participate in EPs, indicating that the policies are more attractive to farmers or may benefit from the improvements of farmers' ecological protection consciousness.

According to Table 3, it is undeniable that control variables (farmers' basic characteristics, resource stocks, and income) have an important impact on farmers' ecocompensation income expectations. For example, the relationship between family size, cultivated land area, and annual income and compensation income expectation is also verified in this article. Larger families have higher expectations of ecocompensation income. The possible reason for this result is that the instability of agricultural production makes it impossible for farmers to rely on agriculture to increase their income in the

short term, and the heavy family burden increases the probability of farmers relying on external assistance. However, the cultivated land area and annual income are inversely proportional to farmers' income expectations. The larger the farmer's cultivated land, the less dependent on farmland subsidy income; the more the family's annual income, the less dependent on ecocompensation income. That is to say, farmers think other income sources, such as farming or working, can bring more benefits than compensation income from returning farmland. Our survey finds that the returned farmland area, the degree of satisfaction with policy effect, and farmers' participation in other EPs are directly proportional to the expected income of farmers' ecocompensation. That is, the larger the area of farmer's returning farmland, the more the number of EPs that farmers participate in, the higher the expectation of compensation income, which is in line with the actual situation. The degree of satisfaction with the policy effect is significantly positively related to farmers' ecocompensation income expectations, which may be because farmers have obtained substantial profit from RFF, so they are willing to continue to participate in EPs. Farmers also hope that the benefit can continue for a long time.

Analysis of Farmers' Ecocompensation Mode Expectations

The diversification of ecocompensation modes can improve farmers' enthusiasm for participating in EPs and is a beneficial measure to improve farmers' livelihoods. At present, although the government provides several compensation modes for farmers, the combination of cash and material object compensation is as high as 83.4%, which provides material benefits to farmers in the short term. However, as an important project that takes ecological protection and farmers' livelihood into account, it is necessary to transform the current "*blood transfusion*" mode into a "*hematopoietic*" mode of poverty alleviation.

According to the results of farmers' ecocompensation mode expectations, the proportion of those choosing cash compensation is relatively high, reaching 57.9% (Online Appendix A), but the importance of farmers' expectations of cash and material object compensation has decreased by 20.5%. Although cash compensation is still the first choice for farmers, the demand for other compensation modes such as employment opportunities, technical guidance, and ecological migration has increased by 14.7%, 7.4%, and 6.6%, respectively, and the increase in the demand for employment opportunities is particularly pronounced. Therefore, farmers pay more attention to their sustainable development after solving their basic survival problems, which is consistent with the current pro-poor policies of the "*hematopoiesis*" mode advocated by China's government. This result provides new guidance for policy formulation and direction for the national ecocompensation policy.

Table 4 shows that policy cognition has a significant influence on farmers' employment opportunities and technical guidance, and the marginal effect of employment opportunities compensation is significant at the 10% level (Table 5). Generally, the higher the level of farmers' policy cognition is, the more attention they pay to the multiple compensation modes. Compared with cash and material object compensation, at present, farmers are more likely to receive compensation through employment opportunities and technical guidance. However, affected by the transparent status of current policy implementation, farmers are skeptical about whether the policy can provide employment opportunities and technical guidance to meet their own needs, so there is a significantly negative correlation between policy cognition and compensation mode. The current compensation mode for returning farmland has a significant effect on the compensation mode of technical guidance, and the marginal effect is significant at the 5% level (Table 5). Therefore, although farmers hope to try a variety of compensation modes, only 4.6% of them participate in technical guidance. In addition, restricted by farmers' education level, their age, the training of teachers, training mechanisms, and investment and so on, there are many difficulties in the technical support of farmers, which lead to a greater risk of farmers choosing the skill guidance compensation mode. The current compensation income for returning farmland has a significantly positive effect on technical guidance and ecological migration, and its marginal effect is significant at the 5% level (Table 5). The higher the compensation income is, the more obvious the benefits of the RFFP, and the more the family's economic burden may be alleviated. Thus, farmers are more willing to try or prefer participating in other compensation modes after their economic prosperity is achieved. The degree of satisfaction with the compensation for returning farmland has a significant positive effect on the material object compensation mode, and its marginal effect is significant at the 5% level (Table 5). The implication is that the higher farmers' degree of satisfaction with the compensation for returning farmland is, the more they prefer to choose the material object compensation mode rather than cash. This result may be because some farmers are located in remote mountainous areas, and the traffic makes material compensation more effective than cash. However, in the long run, the impact of this index on farmers' compensation mode is not limited to material compensation and needs further investigation. The degree of satisfaction with the policy effect has a significant influence on employment opportunities and technical guidance, and the coefficient is positive. The marginal effects (0.060% and

0.042%) are significant at the 5% and 10% levels, respectively (Table 5). The results show that farmers will pay more attention to their long-term development skills if they agree with the purpose of EPs in maintaining ecological balance. Farmers' participation in other EPs has a significant impact on farmers' ecological migration compensation, but the marginal effect is not obvious. The more farmers participate in EPs, the more likely they are to adjust the production or farming method, which reduces farmers' dependence on the land. Therefore, farmers prefer changing their livelihood strategies through migration.

Implications for Conservation

Conclusions

Based on the results of the survey and using econometric models for reference, our article studies farmers' willingness to participate in EPs, farmers' expectations of compensation income, and their expectations for the compensation mode. The main conclusions include the following:

1. Farmers' consciousness of ecological protection is gradually improving, and farmers' willingness to participate in EPs is stronger than before. The returned farmland area, returned farmland quality, satisfaction degree of policy effect, and the participation of other EPs are positively correlated with the explained variables. Policy cognition, current compensation mode for returning farmland, and satisfaction degree of compensation for returning farmland are negatively correlated with farmers' willingness.
2. The expected income of farmers' ecocompensation is 316.51 yuan/mu/year, and 47.5% of farmers hope to further improve the ecocompensation standard. The regression results show that returned farmland area, degree of satisfaction with policy effect, and farmers' participation in other EPs are primary influencing factors of farmers' compensation income expectation. We also further verify the impact of family size, cultivated land area, and annual income on compensation income.
3. Farmers' demands for compensation mode such as employment opportunities, technical guidance, and ecological migration are improving. It is consistent with the current pro-poor policies of *hematopoiesis* mode advocated by the government. Besides, different independent variables and their marginal effects have different effects on farmers' compensation mode expectation.

Implications

The EPs mainly include two major participants: government and farmers. To encourage farmers to take an active part in EPs and to ensure the long-term effect of the policy implementation and the long-term livelihood of farmers, our article suggests the following policy recommendations.

1. In terms of farmers' willingness to participate in EPs, the government should continue to strengthen its policy propaganda, improve farmers' overall cognition of the policy rules, and their degree of satisfaction with the policy effect and further enhance farmers' ecological protection consciousness. China's government should also enhance the overall design of the policy, pay attention to the fairness and justice of the policy implementation, change the passive participation of farmers, guide farmers to participate in the whole process, and achieve the goal of ecological environmental protection and sustainable ecological resource development.
2. In terms of ecocompensation standards, the formulation of compensation standards should match farmers' compensation needs. It is necessary to fully consider the families' characteristics and farmers' current participation in RFFP, and it is also necessary to ensure that compensation standards are dynamically adjusted over time and with changes in circumstances. The government should optimize the environmental construction of compensation standards; strictly supervise the enforcement of compensation standards from the institutional and legal perspectives; enhance the fairness, transparency, and standardization of the policy implementation; and further improve the enthusiasm of farmers to participate in ecological environmental protection.
3. In terms of ecocompensation mode, the government should adjust the traditional *blood transfusion* poverty alleviation mode. By improving employment opportunities, technical guidance, and other diversified compensation modes, farmers are provided with a variety of renewable and sustainable ways to enrich their livelihood choices. In addition, it is necessary to coordinate the compensation mode with the precise poverty alleviation policy and the rural revitalization strategy, improve the endogenous development ability of farmers, and promote the construction of an ecological civilization.

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Supplemental Material

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