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Value Perception, Government Regulation, and Farmers' Behavior toward Continuing to Maintain the Sloping Land Conversion Program

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Abstract: As a major ecological project with the largest investment scale, strongest policy support, most extensive involvement, and the highest level of public participation in the world, the Sloping Land Conversion Program (SLCP) implemented by China is important for protecting the ecological environment and achieving long-term stability. Consolidating the SLCP's achievements is key to its sustainable operation. Based on a sample of 612 farmers in Guizhou Province, this paper discusses the impact of value perception and government regulation on farmers' behavior in terms of their continued SLCP maintenance. The results show that (1) value perception and government regulation are important factors affecting the sustainability of farmers' behavior of continuing to maintain the SLCP. Perceived economic value and perceived cost input, as dimensions of value perception, and policy publicity and economic incentives, as dimensions of government regulation, have important influences on farmers' continued SLCP maintenance. (2) There are complementary effects between value perception and government regulation. Policy publicity and perceived ecological value, technical guidance and perceived economic and social value, and economic incentives and perceived economic value can have complementary effects on farmers' continued maintenance behavior. (3) Value perception and government regulation heterogeneously impact different groups of farmers. In terms of intergenerational differences, perceived cost inputs and punitive measures significantly affect only new-generation farmers. In terms of farmer type, perceived economic value does not significantly affect nonfarmers; perceived cost input significantly affects part-time farmers engaged mainly in off-farm employment, and technical guidance and economic incentives have the greatest impact on pure farmers. In terms of tree species, perceived cost input and policy publicity significantly impact only ecological forest farmers, while technical guidance has a greater impact on economic forest farmers. The findings provide an in-depth understanding of the mechanism underlying farmers' behavior in maintaining the SLCP and offer a reference for promoting the goals of forestry ecological policies against the background of rural revitalization and green development.

Keywords: land resources; sustainable development; logit model; payments for environmental services; Guizhou Province



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1. Introduction

Since 1999, the Sloping Land Conversion Program (SLCP) has been implemented in two rounds, covering 25 of all 34 provinces (municipalities and districts) across China and including forestland exceeding 4% of newly added green areas worldwide during the same period. A total of 158 million farmers have been involved in the program, effectively promoting ecological improvement and increasing income. The SLCP has played an important role in promoting ecological civilization construction and regional economic and social development¹. In 2014, the State Council approved the Overall Plan for a New Round of Conversion of Farmland to Forest and Grassland, marking the official launch of a new round of the SLCP. This new round of policies supports farmers' autonomy and the

law of forestry production, adheres to government guidance considering local conditions, aims to improve both the ecology and farmer livelihoods, comprehensively improves the benefits and strengthens the achievements of the previous round, and continues to support poverty reduction and eradication [1]. By 2019, 22 provinces and autonomous regions had implemented a new round of the program, adding 4.1 million hectares to the area covered by the SLCP, for a total investment of 74.92 billion yuan from the central government².

However, in addition to confronting challenges such as scattered land distribution, arable land protection conflicts, and low subsidy standards, the SLCP commonly faces problems such as difficulty in implementing farmland conversion and a limited degree of policy implementation in all regions [2]. Moreover, the impact of the new round of the SLCP on ensuring food security, enhancing energy utilization, and increasing incomes has not yet been fully demonstrated [3]. For example, the main areas selected for the implementation of the new round of the SLCP are often ecologically functional areas (areas that undertake important ecological functions such as water conservation, soil erosion prevention, windbreaking, sand fixation, and achievement of rich biodiversity) and areas with livelihood vulnerability, which are often home to vulnerable groups and aging populations. Due to the restrictions of off-farm employment, local farmers strongly rely on surrounding environmental resources and usually choose to reclaim sloped farmland to meet their food needs and maintain their livelihoods. Once the SLCP threatens their livelihoods, farmers are likely to fail to maintain their existing achievements and may choose to reuse converted land to reduce losses [4], which poses a challenge to the efforts to consolidate the achievements of the SLCP and subsequent related work.

To coordinate the protection of cultivated land and ecological security, the central government has gradually slowed the task of the SLCP and changed the top-level design of the policy from seeking to motivate farmers to participate and expanding the scale of the SLCP to consolidating existing achievements. As direct participants and final implementers of the SLCP, farmers bear the bottom-line task of ensuring the supply of ecological products, and their behavior determines whether the achievements of the SLCP can be effectively maintained [5]. However, as a type of long-term strategic task of ecological civilization construction, the SLCP's achievements can be consolidated not via one effort but via the efficient cooperation and organic connection of many subjects and links; phased or short-term maintenance behavior is of little significance. The SLCP is a complex project with a strong underlying system. Its sole reliance on government efforts entails problems such as high maintenance costs, strong financial pressure, low levels of farmer cooperation, and poor sustainability. The effective consolidation of results requires the continuous participation of grassroots farmers [6]. Therefore, in practice, related departments should consider the choices of not only current farmers but also future farmers to truly realize the long-term protection of the ecological environment and farmer livelihoods.

In summary, this paper focuses on the consolidation period of the achievements of the SLCP. Based on the microdata of 612 farmers in Guizhou Province, this paper attempts to explain the impact and complementary effects of value perception and government regulation on farmers' behaviors related to their continued SLCP maintenance. Furthermore, the differences in these influences among different farmer groups are discussed.

2. Materials and Methods

2.1. Literature Review

Among the many factors affecting farmers' behavior, the consideration of costs and benefits and the evaluation of the advantages and disadvantages of a certain behavior have the most direct impact on whether the behavior is practiced [7]. Farmers choose to act when they perceive the behavior to have value after weighing the various costs and benefits [8]. Farmers' value perceptions have a good predictive and guiding effect on their behavior and allow them to internalize other micro-level influencing factors, such that value perceptions represent the most important internal motivations for farmers' environmentally friendly behavior [9]. Scholars usually determine the dimensions needed to characterize value

perception according to their research theme and make additions and modifications to meet their research objectives. Previous studies have focused on farmers' management input behavior [7,10], resource utilization behavior [11], technology adoption behavior [12], and consumer purchase behavior [13]. Specifically, regarding the SLCP, no study has considered the impact of value perception on farmers' behavior in maintaining the SLCP, and only a few studies have considered certain aspects of value perception; for example, Cui and Xia [14] discussed the impact of perceived benefits on farmers' behavior of continuing to maintain the SLCP. In the process of maintaining the SLCP, farmers consider not only the benefits or utility brought about by the behavior itself (e.g., economic, ecological, and social aspects) but also the costs or losses (e.g., human, material, and financial resources) and form a value judgment as the basis for whether and how to maintain the behavior.

Moreover, in the government-led SLCP, the contingency function of government regulation must be considered when exploring the impact of farmers' maintenance behavior. The SLCP is a quasipublic good, and farmers, as participants, face environmental externalities regardless of whether the achievements are maintained. Effective resource allocation cannot be implemented by relying solely on the market mechanism [15]. Understanding this situation provides a logical basis for government regulation to intervene in farmers' behavior in maintaining the SLCP. Research on the impact of government regulations on farmer behaviors addresses two aspects. On one hand, policy incentives can provide farmers with various resources, including subsidies and information, to improve their enthusiasm for taking action [16]. On the other hand, at the level of policies and institutions, strict supervision and punitive measures can be adopted to hold farmers accountable for their behaviors, which also plays a restrictive role in this relationship to a certain extent [17]. Government regulation has an incentivizing or constraining effect and is the main external factor affecting farmers' maintenance behavior. Nevertheless, studies on farmers' behavior in maintaining the SLCP tend to address this issue from the single perspective of government regulation (such as policy incentives) [18].

Several previous studies on farmers' behavior in maintaining the SLCP have been conducted. First, despite preliminary evidence that perception factors, policies, and institutions affect farmers' maintenance behavior, systematic theoretical and empirical studies are scarce, and value perception and government regulation have not been defined based on actual conditions; therefore, it is difficult to accurately interpret farmers' maintenance behavior. On the basis of the literature on farmers' behavior of maintaining the SLCP, this paper adds the perceived cost input to value perception and the punitive measures to government regulation to provide a more comprehensive definition of value perception and government regulation and further discusses the complementary role of these two factors. Second, studies generally ignore the continuity of farmers' actions as well as the interaction and heterogeneity of influencing factors, such that their conclusions are not highly relevant in reality. This paper focuses, for the first time, on the continuity of farmers' behavior in maintaining the SLCP and compares the heterogeneity among farmers in terms of intergenerational differences, farmer differentiation, and tree species.

2.2. Theoretical Analysis

When farmers, as bounded rational people, decide whether to maintain the SLCP under certain budget constraints, they often consider the net value of the costs and benefits and decide whether to maintain achievements over the long run based on their individual utility maximization. Therefore, according to the goal of individual utility maximization, the impact of value perception on farmers' continued behavior can be considered from two aspects: perceived benefits and perceived costs. In terms of perceived benefits, in addition to offering economic value, the continuous maintenance of the SLCP by farmers can bring about ecological and social value, such as improvements in the quality of the ecological environment and village appearance. With the continuous operation of the SLCP and the comprehensive promotion of ecological civilization construction, farmers' long-term maintenance behavior concerns not only economic maximization but also the supply

of rural ecological products under the cognition of nonmaterial benefits and ecological social activity on a certain economic basis [19]. Therefore, referring to the studies of Cui and Xia [14], Wu et al. [20], and Gai et al. [21], as well as a field investigation, this paper measures farmers' perceived value from the perspectives of positive perceived economic value, perceived ecological value, perceived social value, and negative perceived input cost. Theoretically, when farmers perceive greater benefits and lower costs, they are more likely to continue to maintain the SLCP.

When the private benefits sought via farmers' continuous maintenance of the SLCP gradually deviate from the public benefits targeted by the government, the government needs to intervene to reduce farmers' incentive for behavior with serious negative externalities and strengthen their incentive for business activities conducive to the consolidation of SLCP achievements [15]. Therefore, farmers' continued behavior is not only driven by internal value perceptions but also influenced by external government regulations [21,22]. The external government regulations that affect farmers' continued maintenance of the SLCP can be categorized as follows: incentives and constraints. In theory, incentive regulation can promote farmers' continued maintenance behavior. The long-term returns brought about by the SLCP are much greater than the short-term returns. However, if farmers have insufficient ability or limited funds to maintain the SLCP, coupled with a lack of knowledge about ecological security and the SLCP in general then they do not consider long-term returns. Instead, they may relinquish management and protection or even destroy forests and reconvert the land in exchange for short-term profits [23]. Government subsidies for the SLCP, as a type of incentive regulation, can indirectly reduce the cost of farmers' maintenance behavior, improve their motivation to maintain the SLCP [5] and enhance their understanding and maintenance ability via policy publicity and technical guidance to effectively promote their continued maintenance behavior, even across generations of farmers. Similarly, by supervising and punishing farmers for neglecting management and protection responsibilities or engaging in deforestation and reversion, constraint regulation motivates farmers to maintain the SLCP [15].

Due to the mandatory characteristic of constraint regulations, public opinion pressure can easily arise. Farmers may also form the habit of maintaining the SLCP to cooperate with government actions and comply with the implementation requirements of government regulations. However, if government behavior is regarded as a dimension of government regulation then only the influence of a specific government behavior on farmers' production behavior, rather than the effect of various government behaviors, can be investigated, and whether farmers accept government regulation cannot be determined [24]. Therefore, in the context of government policies and regulations aiming to consolidate the achievements of the new round of the SLCP, this paper refers to the research of Fei et al. [25] and Gai et al. [21] and undertakes a field investigation to determine farmers' perceptions of various government behaviors and to measure government regulations from four aspects—policy publicity, technical guidance, economic incentives, and punitive measures. In theory, government regulation can effectively encourage farmers to maintain SLCP continuity via incentives and constraints. The theoretical framework of this paper is shown in Figure 1.

2.3. Methodology

Because farmers' continued maintenance behavior is set as a binary variable³, it is more suitable to use the logit model for empirical tests. The specific equation is constructed as follows:

$$P_i = F(s) = \frac{1}{1 + e^{-s}} \quad (1)$$

where P_i represents the probability of farmer i continuing to maintain the SLCP; s indicates the farmer's continued SLCP maintenance behavior; $s = 1$ indicates that the farmer continues to maintain achievements after participating in the new round of the SLCP; and

$s = 0$ indicates that the farmer has interrupted or not maintained the SLCP. In Formula (1), s is a linear combination of the variables G , D , and E ; that is,

$$s = b_0 + \chi G + \kappa D + \vartheta E \quad (2)$$

where G represents a series of control variables, including age, gender, and education level; D represents the government regulation variable, which includes policy publicity, technical guidance, economic incentives, and punitive measures; E represents the value perception variable, which includes perceived economic value, perceived ecological value, perceived social value, and perceived cost input; and b_0 is a constant term.

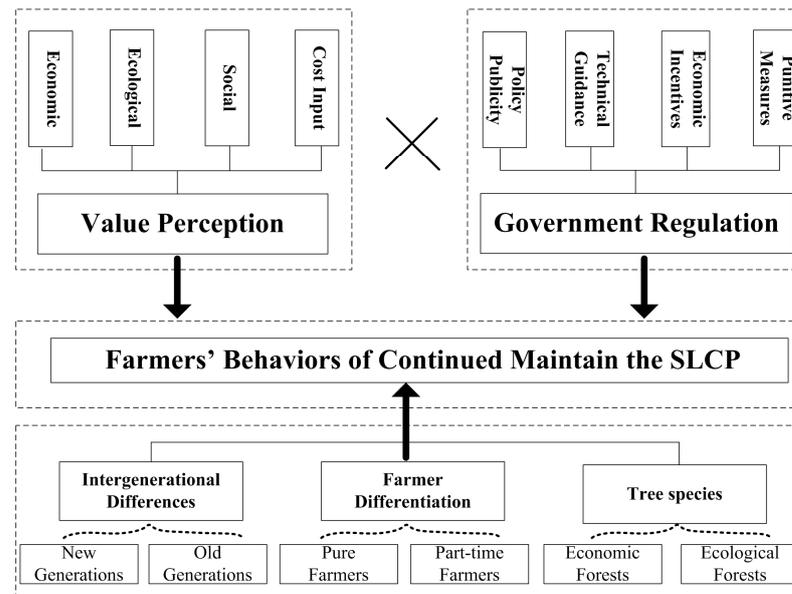


Figure 1. Theoretical framework.

After the proper processing of Formulas (1) and (2), the expression of the binary logit model is obtained as follows:

$$\ln \frac{P_i}{1 - P_i} = b_0 + \chi G + \kappa D + \vartheta E + \tau \quad (3)$$

where τ represents the random error term, and the remaining terms are consistent with Formulas (1) and (2). The selection of either the logit model or the ordinary least squares (OLS) model does not affect the coefficient direction or significance of the variables [27]. Therefore, following Gai et al. [21], the logit model and the OLS model are used to conduct regression analysis and robustness tests, respectively, in subsequent empirical tests.

To address the potential internal correlation among the farmer characteristic variables, which may bias the model results, a multicollinearity test is performed for each variable before conducting the empirical analysis of the logit model.

To further ensure the robustness of the benchmark results, this paper adopts two main methods, namely winsorization and an instrumental variable (IV) approach, for robustness tests.

- (1) Winsorization: referring to the research of Pan et al. [28] and considering the possible impact of extreme values in the data on the estimated results, the main variables are winsorized at the 5% and 95% levels before regression.
- (2) Instrumental Variable (IV): Although this paper comprehensively considers the influence of many relevant variables on farmers' continuous maintenance behavior, the interference of factors that are unobservable or difficult to measure has still not been ruled out. Theoretically, there may also be a two-way causal relationship between

value perception and farmers' continuous maintenance behavior, and the resulting endogeneity problem is likely to interfere with the accuracy of the estimation results. This paper adopts an IV method to solve this problem. Drawing on relevant studies [29], this paper selects the mean value perception of other sample farmers in the same village as the IV because, according to peer group effect theory, individual characteristics are significantly affected by similar characteristics among other individuals in the region. Value perception is highly clustered, which can preliminarily demonstrate that the IV meets the requirements of endogenous variable correlation. Moreover, there is no direct correlation between the value perceptions of other sample farmers in the same village and the continuous behavior of the focal farmer, which meets the externality requirement. This result indicates that it is reasonable to select the mean value perception of other sample farmers in the same village. Using the research of Zhang and Zheng [30] as a reference, an IV-probit model is adopted to test the endogeneity of farmers' continued SLCP maintenance behavior.

The impacts of value perception and government regulation on farmers' continued behavior also differ due to farmers' different characteristics. The benchmark regression can reflect only the average status of farmers but not the differences in the impacts for different types of farmers. Specifically, in terms of intergenerational differences, based on the studies of Duan et al. [31] and Yang et al. [32] and considering the lag in the formation of values influenced by the "intergenerational effect" [33], this paper divides the new and old generations of farmers such that farmers born in 1975 and later represent the new generation of farmers and those born before 1975 represent the old generation of farmers. Considering the classification criteria for the types of part-time farming formulated by the Institute of Rural Development of the Chinese Academy of Social Sciences in 2002, this paper divides farmers into the following types: pure farmers (those with a nonfarm income accounting for less than 10% of total household income), part-time farmers engaged mainly in agriculture (those with a nonfarm income accounting for 10% to 50% of total household income), part-time farmers engaged mainly in off-farm employment (those with a nonfarm income accounting for 50% to 90% of total household income), and nonfarmers (those with a nonfarm income accounting for more than 90% of total household income). In terms of tree species, referring to the relevant study of Gao et al. [34] and considering the actual research situation in the sample area, tree species are divided into two main categories: economic trees, such as cherry, honeybee plum, or apple; and ecological trees, such as Chinese fir (*Cunninghamia lanceolata*) or Huashan pine (*Pinus armandii Franch.*).

2.4. Data Sources

The selection of Guizhou Province as the research region in this paper is based mainly on the following considerations (Figure 2). First, Guizhou Province implemented the SLCP earlier than the other regions and has a good foundation for SLCP implementation. This province is a key area for the new round of the SLCP and for ensuring ecological security in China. The area of this province in the new round of the SLCP accounts for 22.75% of the total area covered, ranking first among all provinces in China⁴. There are 84 counties (cities and districts) in the province and 2.26 million households and 8.33 million people are involved in the new round of the SLCP⁵. Therefore, the new round of the SLCP in Guizhou Province involves a wide range of fields, large investments, and high farmer participation rates, such that the survey samples exhibit a certain degree of representativeness. Second, Guizhou Province contains an ecological barrier area and a fragile, rocky desertification area in the upper reaches of the Yangtze River and Pearl River, and it is a strategic location for ecological construction [35]. With the promotion of the new round of the SLCP, problems such as low-quality management, low-quality forestland resources, and low benefits from using resources to develop an underforest economy are common, and efforts to consolidate the achievements of the SLCP are faced with serious problems that must be solved [36].

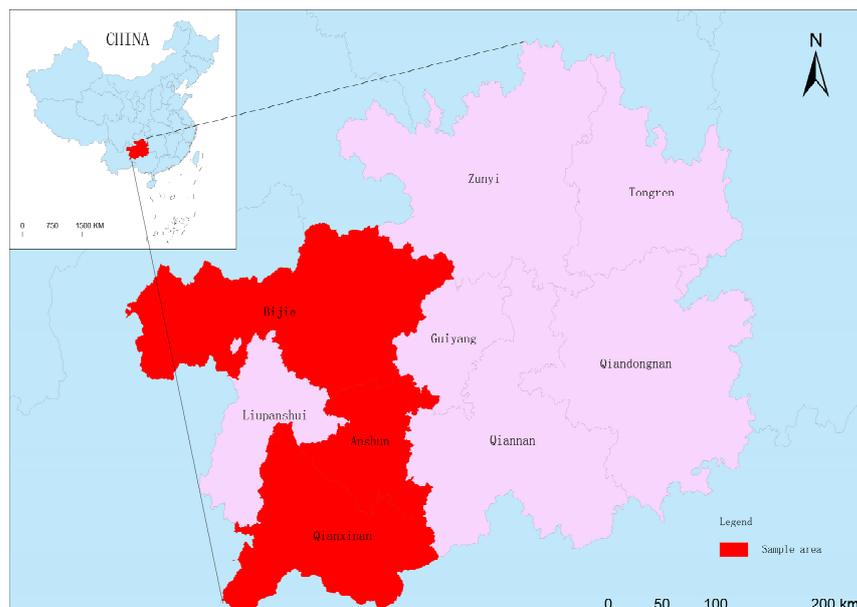


Figure 2. Study area.

This paper adopts a multistage sampling method for investigation in two phases. The first stage was the presurvey. In May 2023, a small-scale household interview survey was conducted in Nayong County, Bijie City, Guizhou Province. Relevant materials and data were collected, and dozens of questionnaires were preliminarily completed to understand the context of the new round of the SLCP in Guizhou Province and the status of farmers' achievements. This stage laid the foundation for the second stage, which was the formal investigation in July 2023. First, Bijie, Anshun, and Qianxinan cities (prefectures) meeting the sample requirements were selected according to the length of participation, area, and tree species of the SLCP. Second, due to the differences in economic development and living standards among the different regions, which may be further reflected in farmers' decision-making behavior, to ensure sufficient representativeness of the sampling, all the counties (districts) in the three sample cities (prefectures) were divided into two groups according to their median gross domestic product (GDP) in 2022. Grouping according to the median can provide a relatively balanced index to reduce the impact of the variability of each sampling layer. In each group, 1 or 2 counties (districts) were randomly selected. Third, in the sample county (district), 2 townships (towns) were randomly selected according to the same criteria, and 1 or 2 administrative villages⁶ were randomly selected for each sample township (town). Finally, between 10 and 30 farmers were randomly selected from each sample village according to the list of the SLCP's participants, and a questionnaire survey was conducted. A total of 646 questionnaires were sent out, 34 invalid questionnaires were excluded, and 612 valid questionnaires were obtained for an effective response rate of 94.73%.

2.5. Variable Selection

- (1) Explained variables. Based on the above discussion of farmers' continued maintenance of the SLCP and referring to the studies of Gai et al. [21] and Hou et al. [37], the question "Have you decided to protect, maintain, and manage the achievements of the SLCP every year since you started to participate?", with response options including "Yes = 1, No = 0", was used as the explained variable.
- (2) Core explanatory variables. The main explanatory variables in this paper were value perception and government regulation. According to the literature review and field investigation, farmers' perceived value is measured in the following four dimensions: perceived economic value, perceived ecological value, perceived social value, and

perceived cost input. Government regulation is measured in the following four aspects: policy publicity, technical guidance, economic incentives, and punitive measures.

- (3) Control variables. Many studies have shown that the characteristics of the head of household and resource endowment are important factors affecting farmers' maintenance behavior [5,20]. When analyzing the impact of value perception and government regulation on farmers' behaviors, this paper controls for other factors that may affect farmers' maintenance behavior at the head of household and resource endowment levels, such as gender, age, ethnicity, education level, risk preference, health status, nonagricultural employment status, whether the head of household is a village cadre⁷, number of laborers, scale of cultivated land, income level, scale of SLCP participation and family dependency ratio. In addition, regional dummy variables, such as hydrological conditions, pest conditions, geographical factors, agricultural production habits, and institutional characteristics, were introduced to control for the differences between unobserved variables at the municipal level. The specific content and definitions of the variables are shown in Table 1.

Table 1. Descriptive statistics of the variables.

Type	Variable	Definition	Mean	S.D.
Explained variable	Continued maintenance behavior	Have you decided to protect, maintain, and manage the achievements of the SLCP every year since you started to participate? 1 = yes, 0 = no	0.708	0.457
	Perceived economic value	Can the ideal economic benefits be obtained by maintaining the SLCP? 1 = not obvious, 2 = not relatively obvious, 3 = neutral, 4 = relatively obvious, 5 = obvious	3.142	1.178
Core explanatory variables: value perception	Perceived ecological value	Is the ecological environment improved by maintaining the SLCP? 1 = not obvious, 2 = not relatively obvious, 3 = neutral, 4 = relatively obvious, 5 = obvious	3.495	0.859
	Perceived social value	Is the overall progress of rural society promoted by maintaining the SLCP? 1 = not obvious, 2 = not relatively obvious, 3 = neutral, 4 = relatively obvious, 5 = obvious	3.833	0.795
	Perceived cost input	Does it take a large amount of human, material, and financial resources to maintain the SLCP? 1 = low, 2 = relatively low, 3 = neutral, 4 = relatively high, 5 = high	2.983	1.178
	Policy publicity	Type of policy publicity farmers perceive from the local government regarding consolidating the achievements of the SLCP ⁸	2.759	1.673
Core explanatory variables: government regulation	Technical guidance	Annual frequency of technical training on the maintenance of the SLCP in the village	1.625	2.015
	Economic incentives	Whether the farmer receives subsidies for the SLCP or other subsidies related to the SLCP: 1 = yes, 0 = no	0.938	0.241
	Punitive measures	Whether the local government has implemented severe penalties to maintain the achievements of the SLCP: 1 = yes, 0 = no	0.915	0.279
	Gender	1 = male, 0 = female	0.846	0.361
Control variables	Age	Actual numerical value	52.910	10.967
	Ethnicity	1 = ethnic minority, 0 = Han	0.549	0.498
	Education level	Farmer's number of years of education	5.627	3.502
	Risk preference	1 = low, 2 = relatively low, 3 = neutral, 4 = relatively high, 5 = high	2.170	0.838
	Health status	1 = healthy, 0 = other	0.827	0.379
	Off-farm employment	1 = yes, 0 = no	0.480	0.500
	Village cadre	1 = yes, 0 = no	0.121	0.326
	Labor number	Number of household members in the labor force	3.037	1.261
	Scale of cultivated land	Actual area of cultivated farmland (ha)	0.240	0.335
	Income level	Sum (logarithmic) of annual household income	11.261	0.922
	The scale of the SLCP	Actual area of the SLCP (ha)	0.608	0.569
	Family dependency ratio	Dependents as a proportion of total family size	0.258	0.298
	Regional dummy variables	Bijie = 1, Anshun = 2, Qianxinan = 3	2.704	0.850

As shown in Table 1, male farmers composed the majority of the sample (84.64%). The majority of the farmers were aged between 50 and 60 years, with an average age of 52.91 years. The overall education level of the farmers was low; most had less than 9 years

of education, and the average education level was 5.63 years. There were 294 farmers engaged in nonagricultural employment, representing 48.03% of all farmers. The average labor force of the sampled households was 3.037. The scale of land cultivated by the sample farmers was much smaller than the scale cultivated by the SLCP, with values of 0.240 ha and 0.258 ha, respectively. Given the above findings, the results of this survey are basically in line with those of previous studies and official statistical data⁹, indicating that the sample of this survey is representative to a certain extent.

3. Results

3.1. Benchmark Regression

According to the multicollinearity test, the variance inflation factors were all less than 5, far less than the critical value of 10, and none of the correlation coefficients exceeded 0.5. Therefore, the problem of multicollinearity could be preliminarily excluded, which provides a basis for the further testing of the rationality of the empirical tests.

Table 2 shows that value perception and government regulation have relatively consistent significance levels in the estimation results of the logit and OLS models, indicating that the estimation results have strong robustness. This paper analyses and explains the estimated results based on the logit model. In terms of value perception, perceived economic value has a significant positive impact on farmers' continued maintenance behavior, while perceived cost input has a significant negative impact. In terms of government regulation, policy publicity, and economic incentives have a significant positive effect on farmers' continued maintenance behavior.

Table 2. Results of farmers' continued SLCP maintenance behavior.

	Logit	OLS
Perceived economic value	0.9384 *** (0.1406)	0.1026 *** (0.0131)
Perceived ecological value	0.2727 (0.2353)	0.0359 (0.0238)
Perceived social value	0.0125 (0.1995)	−0.0128 (0.0212)
Perceived cost input	−0.4537 *** (0.1421)	−0.0305 ** (0.0133)
Policy publicity	1.0347 *** (0.1211)	0.1232 *** (0.0101)
Technical guidance	0.0911 (0.0728)	0.0088 (0.0071)
Economic incentives	2.8631 *** (0.8032)	0.3315 *** (0.0609)
Punitive measures	0.9610 (0.7741)	0.0774 (0.0560)
Gender	−0.2395 (0.4201)	−0.0118 (0.0400)
Age	−0.0308 * (0.0176)	−0.0030 * (0.0015)
Ethnicity	0.5360 * (0.2893)	0.0490 * (0.0277)
Education level	0.0447 *** (0.0109)	0.0836 *** (0.0156)
Risk preference	0.3935 ** (0.1930)	0.0316 * (0.0176)
Health status	0.3883 *** (0.0861)	0.3709 *** (0.1336)
Off-farm employment	0.3421 (0.3153)	0.0261 (0.0289)
Village cadre	0.8025 (0.4886)	0.0673 (0.0438)
Labor number	0.0485 (0.1538)	0.0051 (0.0124)
The scale of cultivated land	0.0032 (0.0259)	0.0002 (0.0028)
Income level	0.4786 ** (0.2224)	0.0490 *** (0.0181)
The scale of the SLCP	−0.0229 * (0.0131)	−0.0017 (0.0014)
The family dependency ratio	0.1112 (0.5672)	0.0061 (0.0524)
Regional dummy variables	0.3979 ** (0.1696)	0.0362 ** (0.0161)
Cons	−13.2837 *** (2.8472)	−0.9212 *** (0.2249)
Pseudo R ²	0.5247	
Adjustment R ²		0.4955
Obs.	612	612

Note: *, **, and *** indicate significance at the levels of 10%, 5%, and 1%, respectively, and robust standard errors are in parentheses.

The results for the control variables are basically similar to those of previous studies [21,22,37]; age, ethnicity, education level, risk preference, health status, and the

scale of the SLCP can all significantly affect farmers’ continued maintenance behavior, which will not be discussed here.

Notably, the influences of government regulation and value perception on farmers’ continued behavior are not invariable, and value perception and government regulation are likely to have complementary impacts on farmers’ continued behavior [21]. Therefore, this paper further analyses the complementary effects of value perception and government regulation and adds their interaction terms to the model for testing. The estimated results are shown in Table 3.

Table 3. Results of farmers’ continued behavior in SLCP maintenance with interaction items.

	Logit
Perceived ecological value × Policy publicity	0.3840 *** (0.1459)
Perceived economic value × Technical guidance	0.1991 ** (0.0901)
Perceived social value × Technical guidance	0.3182 ** (0.1425)
Perceived economic value × Economic incentives	1.1961 *** (0.4529)
Control variables	Controlled
Pseudo R ²	0.5398
Obs.	612

Note: due to space limitations, interaction items that are not significant in the regression results are omitted. ** and *** indicate significance at the levels of 5%, and 1%, respectively, and robust standard errors are in parentheses.

As shown in Table 3, the interaction terms of policy publicity and perceived ecological value can have a significant positive impact on farmers’ continued maintenance behavior.

The interaction terms of technical guidance and perceived economic value and of technical guidance and perceived social value have significant positive effects on farmers’ continued maintenance behavior.

The interaction terms of economic incentives and perceived economic value have a significant positive impact on farmers’ continued maintenance behavior, while the interaction terms of punishment measures and value perception have no significant impact.

3.2. Robustness Tests

- (1) Winsorization. The results, shown in Table 4, are basically consistent with the above benchmark results, indicating that the research conclusion is robust.

Table 4. Robustness test.

	Winsorize
Perceived economic value	0.6924 *** (0.1143)
Perceived ecological value	0.2166 (0.1958)
Perceived social value	0.0431 (0.2435)
Perceived cost input	−0.3701 *** (0.1192)
Policy publicity	0.7747 *** (0.1051)
Technical guidance	0.4043 (0.3521)
Economic incentives	2.3311 *** (0.6629)
Punitive measures	0.4385 (0.3887)
Control variables	Controlled
Pseudo R ²	0.4998
Obs.	612

Note: *** indicate significance at the levels of 1%, and robust standard errors are in parentheses.

- (2) Instrumental Variables (IVs). The F values of the first stage are all greater than 10, indicating that there is a correlation between the endogenous variables and the IV. In the second stage, both the endogeneity of persistent behavior and the Wald test of weak IVs reject the null hypothesis at the 1% level¹⁰. The significance and influence direction of the regression results are basically consistent with those of the benchmark

regression results, which again indicates that the estimated results in this paper have a certain degree of robustness.

3.3. Heterogeneity Analysis

In recent years, with the rapid development of urbanization and industrialization in China, the structure of the agricultural labor force has changed. Many young and middle-aged laborers migrate for work, and the gradual aging of the agricultural labor force has become a common phenomenon. According to the survey results, older generations of farmers and pure farmers are still the main actors who continue to maintain the SLCP. With the change in the urban–rural population structure, the proportion of new-generation farmers and part-time farmers engaged in agricultural production will continue to decrease. More importantly, there are differences in cognition and behavioral ability between the new and old generations of farmers and between pure farmers and part-time farmers, which will affect behavioral decision-making to varying degrees [32]. In addition, the type of tree species is an important endowment condition that affects SLCP farmers' behavior and decision-making [5]. Therefore, it is necessary to investigate the impact of value perception and government regulation on farmers' continued maintenance behavior from the perspectives of intergenerational differences, farmer type, and tree species.

As shown in Table 5, in terms of intergenerational differences, perceived cost input has a significant negative impact on continued maintenance behavior only for the new generation of farmers. Likewise, punitive measures have a significant positive impact on continued maintenance behavior only for the new generation of farmers.

Table 5. Heterogeneity tests.

	Intergenerational Differences			Farmer Differentiation		Tree Species		
	New Generation of Farmers	Older Generation of Farmers	Pure Farmers	Part-Time Farmers Engaged Mainly in Agriculture	Part-Time Farmers Engaged Mainly in Off-Farm Employment	Nonfarmers	Economic Forest Farmers	Ecological Forest Farmers ¹¹
Perceived economic value	1.0776 *** (0.3307)	0.9342 *** (0.1688)	1.3383 *** (0.5421)	1.5454 ** (0.6149)	1.0958 *** (0.2161)	0.5769 (0.6164)	1.2616 *** (0.2182)	1.5835 *** (0.4855)
Perceived ecological value	0.3165 (0.4496)	0.1366 (0.2512)	0.9296 (0.9327)	0.8351 (1.1708)	−0.2378 (0.2785)	0.3769 (0.7773)	0.1923 (0.2383)	−0.3508 (0.6156)
Perceived social value	−0.1089 (0.5320)	0.4125 (0.2957)	0.0631 (0.6838)	1.9165 (1.4337)	0.4026 (0.3301)	0.3106 (0.9746)	−0.0736 (0.3142)	0.1053 (0.6046)
Perceived cost input	−0.6061 *** (0.2276)	−0.4941 (0.1724)	−0.1648 (0.3840)	−0.4877 (0.5647)	−0.6232 *** (0.2119)	0.5189 (0.7635)	−0.1229 (0.1926)	−0.7798 * (0.4255)
Policy publicity	1.7788 *** (0.3645)	0.9774 *** (0.1477)	1.4662 * (0.7809)	1.4166 *** (0.5135)	1.0233 *** (0.1849)	1.5474 *** (0.4520)	0.9296 (0.1464)	5.3783 *** (1.9861)
Technical guidance	0.1960 (0.1876)	0.0113 (0.0883)	0.9154 ** (0.3877)	0.0952 (0.3117)	0.0183 (0.0942)	0.3564 (0.4579)	−0.0428 (0.0778)	0.4569 ** (0.2140)
Economic incentives	5.1333 ** (2.1230)	2.4547 *** (0.9399)	7.0964 *** (2.4867)	3.1672 (2.0342)	3.8666 ** (1.6511)	0.4531 *** (0.0744)	2.1355 ** (0.9860)	5.3784 *** (1.9861)
Punitive measures	1.0111 *** (0.2635)	−0.0194 (0.8941)	−1.3792 (1.6834)	−3.4806 (4.514)	1.6991 (1.1178)	0.5656 (2.7049)	0.2754 (0.8708)	3.2025 (2.3108)
Control variables	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Obs.	195	417	151	143	225	93	426	186

Note: *, **, and *** indicate significance at the levels of 10%, 5%, and 1%, respectively, and robust standard errors are in parentheses.

In terms of farmer differentiation, perceived economic value does not have a significant impact on nonfarmers. The perceived cost input has a significant negative impact only for part-time farmers who are engaged mainly in off-farm employment. Technical guidance

has a significant positive effect only for pure farmers. Economic incentives have the greatest impact on pure farmers among all farmer types.

In terms of tree species, the perceived cost of input does not have a significant impact on farmers maintaining economic forestland. Policy publicity has a significant positive impact only on ecological forest farmers. Technical guidance has a significant positive impact only on economic foresters.

4. Discussion

The research results of this paper are based on a survey in Bijie, Anshun, and Qianxinan, Guizhou Province, in July 2023. These three regions are all major forested cities (prefectures) in Guizhou Province. According to the survey, when the new round of the SLCP was deployed at the end of 2014, the SLCP area in the three cities (prefectures) accounted for more than 70% of the total SLCP area in Guizhou Province. The implementation of the new round of the SLCP has provided policy opportunities for the development of local agriculture and has made outstanding contributions to optimizing agricultural planting structures, promoting farmers' wealth and income, and protecting the rural ecological environment¹². However, according to the survey, due to the natural environment, market competition, livelihood problems, and many other factors, not all farmers participating in the new round of the SLCP can benefit from it. There are serious challenges in consolidating SLCP achievements and carrying out a new round of SLCP work.

- (1) The benchmark regression results show that in terms of value perception, rational thinking remains the dominant factor in farmers' long-term decision-making, and the tradeoff between economic costs and benefits is the premise for behaviors supporting the long-term consolidation of SLCP achievements. The higher the economic returns are, the greater the likelihood of farmers continuing to maintain the SLCP. The above results, from the perspective of the SLCP, also support the conclusion of Gai et al. [21] that value perception can effectively promote farmers' continued SLCP maintenance behavior. In terms of government regulation, the more diversified the government's policy publicity methods and the greater the degree of publicity intensity are, the more effectively farmers' continuous consolidation of achievements can be ensured in the long run. Economic incentives can also ensure the effectiveness of government regulation, improve farmers' motivation to maintain the SLCP, and enhance the continuity of such maintenance behavior. Gai et al. [38] also suggest that policy publicity can improve farmers' perception of public opinion pressure, which has a positive effect on farmers' continued behavior. However, the new finding in this paper is that economic incentives have a larger impact coefficient than policy publicity; that is, economic incentives can more effectively encourage the continued behavior of farmers, which also indicates that compared with policy publicity, government regulations such as economic incentives have a more direct influence on and are more in line with farmers' aim to maximize economic benefits.
- (2) The results of the complementary effect analysis show that the main content of the current policy on consolidating the achievements of the SLCP is in line with the realization of ecological value. Zhang [19] believes that ecological rationality is the endogenous motivation for farmers' participation in the SLCP and determines the extent to which farmers participate in the SLCP. Policy publicity can help farmers understand the long-term significance of maintaining the achievements of the SLCP. Policy publicity is also beneficial for the development of long-term-oriented values, leading farmers to consider the construction of an ecological civilization a long-term task handed down from generation to generation. Farmers' perceptions of high ecological value can thus be further strengthened to promote their continued maintenance behavior. This result provides a new approach to the adjustment and optimization of incentive policies for the SLCP.

If farmers with greater economic and social rationality levels believe that it is profitable to maintain the SLCP for a long time and recognize the support of technology then the

probability of their continued maintenance behavior will significantly increase. In contrast, if farmers think that the technology used to maintain the SLCP is complicated and troublesome then they will not consider maintaining the SLCP worthwhile, even if long-term maintenance can achieve greater benefits. Although farmers may be willing to engage in maintenance behavior, they may find it challenging to use maintenance technology. Therefore, technical guidance can alleviate economically and socially rational farmers' concerns about maintaining technology and increase their confidence and ability to continue to maintain the SLCP. Shi et al. [39] believe that economic rationality is an important basis for farmers to participate in the SLCP and that improving farmers' forest management technology is the fundamental reason that farmers maintain the SLCP. The results of this paper expand upon Shi's research conclusions from the dimensions of social rationality and continuity.

Additionally, economic incentives and perceived economic value have complementary effects supporting continued behavior. Economic incentives can strengthen the positive effects of perceived economic value and promote farmers' continued behavior. The conclusions of Zhang and Yong [40] also support the results of this paper; that is, when government regulation plays an active and effective intervention role, farmers with greater perceived economic value are more willing to actively participate in pro-environmental behaviors than those with lower perceived economic value.

- (3) The heterogeneity results show that older farmers have declining labor ability and cognitive levels, and despite the constraints of punitive measures, their own endowments and family livelihood needs lead them to engage in some behaviors that are not conducive to maintaining the SLCP, such as reconversion or the failure to maintain previous achievements. New-generation farmers are less dependent on the converted forestland, and their income sources are more diversified compared to old-generation farmers. Therefore, cost is usually the most direct factor determining whether individuals choose to maintain their behavior for a long time. This result from the perspective of reducing cost input expands upon the conclusion of Gai et al. [21] that only good perceived economic benefits can effectively promote the continued pro-environmental behavior of new-generation farmers; moreover, compared with strict punishment measures, economic incentives may be more beneficial for old-generation of farmers in maintaining the SLCP for a long time.

Nonfarmers rely more on nonagricultural income due to their wider income sources than do farmers. Therefore, even if they recognize the economic benefits of maintaining the SLCP, nonfarmers may discontinue such behaviors and pay more attention to nonfarm employment than to the relative benefits of on-farm employment. For farmers engaged mainly in off-farm employment, excessive agricultural inputs will inevitably occupy nonagricultural inputs, and farmers may stop supporting the SLCP to ensure the balance of income sources. Pure farmers have been engaged in land management activities for a long time, their income channels are relatively limited, and economic incentives usually account for a large proportion of their income, which can easily stimulate their long-term enthusiasm. Ma et al. [41] believe that increasing the proportion of nonagricultural income in the income of pure farmers via agricultural subsidies and other means is an effective method for promoting the pro-environmental behavior of pure farmers. The above authors also showed that technical guidance can boost the business confidence of pure farmers and help them learn better management techniques, enabling them to gain more economic benefits from maintaining the SLCP. This paper adds new evidence from the perspective of the SLCP.

Finally, this paper also provides new findings related to tree species, such as the characteristics of the growth cycle and the input-output asynchrony of economic forest tree species. An economic forest requires more input in the early stage, and the benefits appear only after a certain period. Therefore, even if the perceived cost input is high, farmers who understand the characteristics of economic forests will continue to maintain the SLCP to obtain the income provided in the later period. Notably, the management and protection

of economic forests are at relatively high levels, and with insufficient technical guidance, farmers may not be able to effectively manage economic forests and thus fail to achieve continued SLCP maintenance. For ecological forest farmers, since economic benefits are not obvious, policy publicity provides a positive basis on which to improve the long-term orientation of these farmers and has become an important measure for enhancing their continued SLCP maintenance behavior.

5. Conclusions

Using a sample of 612 farmers in Guizhou Province, this paper empirically tests the impact and complementary effects of value perception and government regulation on farmers' behavior in terms of continued SLCP maintenance and further discusses the differences in these effects among different groups of farmers. The results show that (1) perceived economic value and perceived cost input, as aspects of value perception, and policy publicity and economic incentives, as aspects of government regulation, have important influences on farmers' continued SLCP maintenance. (2) There are complementary effects between value perception and government regulation. Policy publicity and perceived ecological value, technical guidance and perceived economic and social value, and economic incentives and perceived economic value can all have complementary effects on farmers' continued maintenance behavior. (3) Value perception and government regulation have heterogeneous impacts on farmers' continued SLCP maintenance. In terms of intergenerational differences, perceived cost inputs and punitive measures have significant effects only for the new generation of farmers. In terms of farmer type, perceived economic value has no significant effect on nonfarmers, while perceived cost input has a significant effect on part-time farmers engaged mainly in off-farm employment; additionally, technical guidance and economic incentives have the greatest impact on pure farmers. In terms of tree species, the perceived cost input and policy publicity have significant impacts only on ecological forest farmers, while technical guidance has a greater impact on economic forest farmers.

According to the main conclusions, this paper puts forward the following policy implications. First, to guide farmers in continuing maintenance behavior, we can introduce supportive tree species and supporting technologies that are appropriate for local endowment conditions, promote the development of characteristic industries of the SLCP, and strengthen the circulation system of converted farmland to maximize farmers' net income. Under the conditions of ensuring the net income associated with different tree species, the relationship between farmers and farmland should be strengthened via the aspects of ecological protection and social development, farmers' value perception of the achievements of the SLCP should be improved, and the potential risks of reconversion should be alleviated. Moreover, various media should be used to widely promote the consolidation of the SLCP via multiple channels. By means of complementary online and offline traditional and modern methods, a larger number of farmers can learn about the importance of consolidating the SLCP. Moreover, the follow-up policies of the SLCP should be further improved, and economic incentives should be provided to farmers via corresponding ecological compensation programs. The value realization mechanism and market compensation mechanism of ecological products should be explored, and farmers' continued motivation and actions to maintain the SLCP should be ensured both cognitively and practically. In addition, more targeted punishment measures should be explored to guide farmers who stop maintaining the SLCP or who perceive the program to be of low value.

Second, heterogeneity among farmers should be considered. From the perspective of intergenerational differences, various beneficial policies should be developed to support labor transfer, increase agricultural and forestry production levels, improve the quality of agricultural and forestry products, and reduce the participation cost of the new generation of farmers, thereby improving the economic value perception of farmers of both the new and old generations. From the perspective of farmer differentiation, emphasis should be

placed on strengthening publicity to encourage nonfarmers to maintain the SLCP and circulate converted farmland. Given the relatively limited technical guidance and economic incentives provided by the SLCP, pure farmers should be given priority over other farmer types. From the perspective of tree species, more ecological forest ranger jobs and other positions should be established, the management and protection costs of ecological forest farmers should be further reduced, and ecological forest farmers should be guided to generate and increase income. Additionally, guidance and publicity should be designed to strengthen ecological forest farmers' understanding, and technical guidance should be offered to develop economic forest farmers' skills. Such measures will encourage all kinds of farmers to continue to maintain the achievements of the SLCP.

Of course, there are still some limitations: this work discusses the characteristics, influence mechanism, and optimization path of farmers' continued maintenance behavior in Guizhou Province against the background of the consolidation period of the achievements of the SLCP. However, the SLCP is a complex system, and the particularity and typical characteristics of the program at the provincial level are quite different. Since this field survey was conducted only in Guizhou Province, whether the conclusions obtained can be applied to other provinces remains to be tested. To further enhance the robustness of the research conclusions, multiple provinces can be investigated in future studies. Furthermore, the spatial heterogeneity of value perception and government regulation should be analyzed.

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Institutional Review Board Statement: Ethical review and approval were waived for this study due to the type and nature of the dataset used. For this research (Value Perception, Government Regulation, and Farmers' Behavior Toward Continuing to Maintain the Sloping Land Conversion Program), the corresponding author's team used a sample survey dataset with all individual identifiers removed. All final participants were informed of the research purposes and provided written consent for the use of their responses in future analyses. Participants were also informed that their participation was voluntary and anonymous and that the researchers observed Committee on Publication Ethics (COPE) obligations in terms of handling the data. No monetary or in-kind compensation was offered to participants. The investigation and research methodology conform to the principles outlined by the COPE. The dataset for this study was obtained by the corresponding author's team, and access to and use of the sample dataset described in this study required approval from the corresponding author.

Data Availability Statement: Data are available from the authors upon reasonable request.

Conflicts of Interest: Author Qiheng Zhong was employed by the company Shandong Guokong Capital Investment Co., Ltd. The remaining 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.

Notes

- ¹ Source: Twenty Years of Conversion Farmland to Forest and Grassland in China (1999–2019). Available online: https://www.forestry.gov.cn/html/tghl/tghl_934/20200630113833040795001/file/20200630114248886864236.pdf (accessed on 22 January 2024).
- ² See Notes 1 above.
- ³ "Continued behavior" is strictly a multistage dynamic problem, but considering the difficulty of obtaining multistage data, it is simplified as a binary choice problem by referring to Eriksson and Nilsson [26].
- ⁴ Source: Guizhou Forestry Bureau. Available online: https://lyj.guizhou.gov.cn/xwzx/sjdt/202308/t20230830_82124566.html (accessed on 22 January 2024).

- ⁵ Source: General Office of Guizhou Provincial People's Government. Available online: http://drc.guizhou.gov.cn/xxgk/xxgkml/gjhj/zqfzghgy/202111/t20211126_71808405.html (accessed on 22 January 2024).
- ⁶ The sample villages are Yingshang village, Zhongxin village, Chuandong village, Gaoke village, Huaqi village, Songjiazhai village, Dapo village, Heishakua village, Shuiyuan village, Sanhe village, Tongxin village and Dazhai village in Bijie City; Najian village, Zhifu village, Farao village, Wengjie village, Shage village, Maochang village, Dayan village and Guanxin village in Anshun City; Guanghui village, Hama village, Dongfanghong village, Liangshui village, Rongran village, Dingan village, Banhuai village, Poai village, Baxu village, Weibang village, Geliang village and Luojiang village in Qianxinan Prefecture.
- ⁷ As important supervisors of the smooth implementation of the policy related to the SLCP, village cadres are better able to respond to the call of the government and play a leading and demonstrative role in maintaining the achievements of the SLCP. Therefore, village cadres need to be controlled.
- ⁸ The value (the minimum is 0) is assigned according to the type of policy publicity the farmer perceives from the local government regarding consolidating the achievements of the SLCP, e.g., brigade radio, television and radio, village slogans, newspaper columns, publicity brochures, village meetings, cadres visiting the household or field, and mobile phone network. For example, when farmers adopt three policy publicity methods—village slogans, village meetings and cadres visiting households or the field—the value of policy publicity at that time is 3.
- ⁸ The value (the minimum is 0) is assigned according to the type of policy publicity the farmer perceives from the local government regarding consolidating the achievements of the SLCP, e.g., brigade radio, television and radio, village slogans, newspaper columns, publicity brochures, village meetings, cadres visiting the household or field, and mobile phone network. For example, when farmers adopt three policy publicity methods—village slogans, village meetings and cadres visiting households or the field—the value of policy publicity at that time is 3.
- ⁹ Economic Development Research Center of State Forestry Administration, Department of Development Planning and Fund Management of State Forestry Administration: "A report for monitoring and assessment of the socioeconomic impacts of China's key forestry programs (2019)".
- ¹⁰ The specific results are omitted here to save space but can be provided upon request to the author.
- ¹¹ According to the Criteria for the Identification of Ecological Forest and Economic Forest in the SLCP issued by the State Forestry Administration, ecological forest refers to the trees planted in the SLCP with the main purpose of reducing soil erosion and the damage of wind and sand, while economic forest refers to the trees planted in the SLCP with the main purpose of producing fruit, edible oil, industrial raw materials and medicinal materials. Different tree uses and purposes may cause differences in maintenance behavior. However, because some trees have the dual use of ecology and economy (that is, ecological economic forest), their functions need to be divided according to different growth stages. Based on the field investigation, these include such as walnut or Sichuan pepper, with a long growth cycle and mainly ecological benefits at this stage, due to their small proportion, these species are classified as ecological forests in this paper.
- ¹¹ According to the Criteria for the Identification of Ecological Forest and Economic Forest in the SLCP issued by the State Forestry Administration, ecological forest refers to the trees planted in the SLCP with the main purpose of reducing soil erosion and the damage of wind and sand, while economic forest refers to the trees planted in the SLCP with the main purpose of producing fruit, edible oil, industrial raw materials and medicinal materials. Different tree uses and purposes may cause differences in maintenance behavior. However, because some trees have the dual use of ecology and economy (that is, ecological economic forest), their functions need to be divided according to different growth stages. Based on the field investigation, these include such as walnut or Sichuan pepper, with a long growth cycle and mainly ecological benefits at this stage, due to their small proportion, these species are classified as ecological forests in this paper.
- ¹² Source: Guizhou Forestry Bureau. Available online: http://lyj.guizhou.gov.cn/zfxxgk/fdzdgnr/zdgc/tghl_5620852/202101/t20210129_66612354.html (accessed on 18 February 2024).

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