Analysis on Farmers' Accepting Willingness of Ecological Compensation of Non-commercial Forest in NFPP Area of China

——Taking six western counties as an example

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Abstract—**In this paper, 578 samples from Yulong County of Yunnan Province, Xiuwen County of Guizhou Province, Huili County of Sichuan Province, Jingbian County of Shaanxi Province, Qingcheng County of Gansu Province and Wulateqian County of Inner Mongolia were used to analyze the farmers' accepting willingness of ecological compensation of non-commercial forest by taking advantage of Logistic Regression method. The results showed that Household Forestland Area Per Capita, Willingness to Invest in Forestland, Whether Farmers Satisfied with Non-commercial Forest Compensation Cashing Policy and Whether Farmers have Intention of Long-term Operation for Forestland have significant impacts on farmers' willingness to accept ecological compensation of non-commercial forest. Furthermore, the following four recommendations were proposed: Develop rural education and improve farmers' scientific and cultural quality; Improve scientific criteria of ecological compensation of non-commercial forest and effectively protect benefit of forest farmers; Renovate compensating approach of ecological forest and stimulate enthusiasm of forestry development; Establish and improve ecological compensation of forest management and supervision mechanisms and stimulate forest farmers to participate in the protection and construction of non-commercial forest.**

Keywords-forest farmer, ecological compensation, willingness of compensation accepting, influencing factor, logistic regression

I. INTRODUCTION

The majority of farmers have been becoming the principle operators for collective-owned forest after the implementation of *Collective Forest Tenure Reform*. How to effectively implement the ecological compensation policy of non-commercial forest and how to stimulate farmers' participating enthusiasm in non-commercial forest operation are directly related to the sustainable development of collective-owned forest. At present, ecological compensation criteria, carried by the existing ecological compensation policy of non-commercial forest, can meet the needs of forest farmers to a certain extent, and forest products from non-commercial forest provided by forest farmers create a considerable economic, social and ecological benefits. However, can implementation of ecological compensation of non-commercial forest meet the farmers' willingness of accepting compensation?

At present, existing research on willingness of compensation accepting usually focused on predicting mean or median number of willingness of compensation accepting. For example, based on the data from Xilinguole grassland, Yang (2006) evaluated the number of willingness of compensation accepting after the implementation of grazing prohibition according to the conditional value. Furthermore, taking the lowest compensation willingness to farmers as the starting point, Yang (2012) calculated farmland ecological compensation criteria based on investigation from Wuhan City. In addition, Li (2013) estimated compensation criteria of forestland operation of sloping farmland to forest using the Hicks Equivalent Change Theory and Contingent Valuation Method based on investigating data from Wuqi County of Shaanxi Province. Wang (2013) estimated average number of willingness to accept land acquisition through Logistic Model, in which the data from four cities of Hubei Province were used. Additionally, Feng (2013) estimated average number of willingness of compensation accepting for sloping farmland to forest in the Three Gorges Areas.

However, there are some limitations about conclusions of above studies, such as treatment method of abnormal value in the questionnaire, deviation of average instead of median, budgetary constraints, and choice of social or private value. Therefore, these questions are obscure and it is hard to accept the value of willingness of compensation accepting by referring farmers in China.

Kong (2007), Li (2009), Luo (2012) and Xu (2012) analyzed impacting factors of willingness of compensation accepting using contingent valuation method through the design of special questionnaires. However, the satisfaction of willingness of compensation accepting by relevant participators in the implementation of forestry projects were not analyzed. For example, the willingness of compensation accepting should be considered into analysis after implementation of ecological compensation of non-commercial forest. Namely, the factors that whether compensation could encourage forest farmers to offer high quality products or services for a long time should be considered. After the implementation of ecological compensation of non-commercial forest, analyzing the willingness of compensation accepting should be taken into account. Therefore, it is important to consider that whether the compensation can be realized to encourage farmers to provide long-term and high-quality non-commercial forest products or services. If farmers disagreed with existing compensation criteria and supposed that it needed to improve the compensation, the willingness of compensation accepting will not be satisfied. Oppositely, farmers' satisfaction about compensation is being in a acceptable range.

In this paper, willingness of compensation accepting will be presented in a timely and accurate manner after analyzing the existing implemented ecological compensation policy of non-commercial forests. Meanwhile, The relevant factors will lay the foundation for further improvement of ecological compensation policy. Based on above analysis, this paper analyzed farmers' willingness of compensation accepting and its influencing factors using the econometric method based on the data of 578 forest households in the western Natural Forest Protection Project area of China.

II. DATA SOURCES AND INDICATORS AND SELECTION

A. Data Sources

The data used in this paper were from investigation of six sample counties of western China. All of them were obtained in July, August and December of 2013 and in July, August and September of 2014. Specifically, these six counties are Yulong County of Yunnan Province, Xiuwen County of Guizhou Province, Huili County of Sichuan Province, Jingbian County of Shaanxi Province, Qingcheng County of Gansu Province and Wulateqian County of Inner Mongolia Autonomous Region. In the above six research sample counties, 90 to 100 households were selected from each county, where two or three villages from four towns were selected. Accordingly, data from 578 investigated households, selected from 583 households, will be used after getting rid of invaluable samples in this research.

B. Evaluating Indicators Selection

In this study, Whether Forest Farmer is Satisfied with Ecological Compensation Criteria of Non-commercial Forest is taken as dependent variable, and independent variables are selected according to existing research results. The following factors were taken as independent variables: individual characteristics of respondents, income characteristics of household, production characteristics of forestland, farmers' cognition to ecological compensation policy of non-commercial forest and geographical factors. Therefore, this paper took fifteen variables as independent variables, which could be divided into individual characteristics of respondents, income characteristics of household, production characteristics of forestland, farmers' cognition to ecological compensation policy of non-commercial forest and geographical factors.

C. Research Assumptions

1) Individual characteristics of respondents

X_1 represents *Respondents' Age.* If respondents are older, they will have limited opportunities to be employed. As a result, they will have less opportunities to work outside of their own town and forest farmers will pay more attention to the fact that whether they would obtain more non-commercial forest compensation. It is supposed that this variable will be positively correlated with dependent variable.

X_2 represents *Level of Respondents Education.* Farmers usually easily understand and support ecological compensation policies if they accepted higher level education. Therefore, it is supposed that this factor will be positively related to dependent variable.

X_3 represents *Whether respondent is a village officer.* In general, village officers usually have better understanding about government policies than common families so as to support the implementation of ecological protection. Accordingly, they are usually more satisfied with the compensation policies. Therefore, it is supposed that this factor will be positively related to the dependent variable.

2) Income characteristics of household

X_4 represents *Household Incomes Per Capita.* If household incomes are higher than others, forest farmers usually have higher efficiency on forestry production and management, and have broader source for earning. The dependence of compensation for non-commercial forests is relatively weak, and the level of compensation criteria will not be much considered. Therefore, it is supposed that this factor will be positively related to the dependent variable.

X_5 represents *Proportion of Compensation for Non-commercial Forest to Household Income.* Higher ratio of non-commercial forest compensation to household income indicated that the contribution of non-commercial forest compensation to household income will be greater, and household income is more dependent on the non-commercial forest compensation. Therefore, farmers will be more satisfied with their compensation criteria. In this paper, it is supposed that it will be positively related to the dependent variable.

X_6 represents *Proportion of Forestry Income to Household Income.* Higher proportion of forestry income

to household income indicated that there is a greater contribution of forestry income to household income. Meanwhile, if most of the household income come from forestry, the forest farmer's attitude on existing ecological compensation policy will be more satisfied. Similarly, it is supposed that it will be positively related to the dependent variable.

X_7 represents *Proportion of Non-agricultural Income to Household Income.* Higher proportion of non-agricultural income indicated that the family can obtain more income in various ways. Therefore, forest farmers will not consider too much on compensation criteria of non-commercial forests. Accordingly, we suppose that it will be positively related to the dependent variable.

3) Production characteristics of forestland

X_8 represents *Household Forestland Area Per Capita.* More household forestland area per capita indicated that farmers can obtain more funds from compensation policy of non-commercial forests. They are satisfied with the compensation criteria. In this paper, it is supposed that it will be positively related to the dependent variable.

X_9 represents *Proportion of Tenure Issued Forestland Area to Total Forestland Area.* There are two types of collective forest tenure issue in sample counties. One type is that collective forest tenure is issued to family and the other one is to team or group. In general, tenure form reflects the clarity of forest tenure. If forest tenure is more clear, forest farmers usually pay more attention on the income. Therefore, they will be thinking about the compensation criteria of non-commercial forest much more than other farmers. On the contrary, they will not. It is supposed that it will be negatively correlated with the dependent variable.

X_{10} represents *Forest Quality.* If farmers' forest quality is good, farmers usually request for higher compensation criteria of non-commercial forests. Therefore, it is usually negatively correlated with the dependent variable.

X_{11} represents *Willingness to Invest in Forestland.* If farmers are willing to invest large amounts of money in the forestland, they usually expect to obtain more revenue. However, it is difficult to realize the expectations of forest farmers in the background of established criteria of compensation of non-commercial forest. Here, we suppose that it is negatively correlated with dependent variable.

X_{12} represents *Proportion of Forestry Labors to Total Household Labors.* If families put more labors in the process of production, it means that they invest more resources than others. Therefore, they usually request for more compensation. In this paper, we suppose that it has a negative correlation with dependent variable.

4) Farmers' cognition to ecological compensation policy of non-commercial forest

X_{13} represents *Whether Farmers Learn About Compensation Policy of Non-commercial Forest.* If farmers understand the non-commercial forest compensation policy and the implementation of non-commercial forest protection policy, they usually support them. Therefore, they are more satisfied with the compensation policy of non-commercial forests. Here, it is supposed that it will be positively correlated with the dependent variable.

X_{14} represents *Whether Farmers Satisfied with Non-commercial Forest Compensation Cashing Policy:* If the compensation can be cashed in time, it will enhance farmers' recognition of the ecological compensation criteria of non-commercial forests to a certain extent. Therefore, it is usually positively related to dependent variable.

X_{15} represents *Whether Farmers have Intention of Long-term Operation for Forestland.* If farmers have long-term plans to operate forestland, they usually agree with ecological compensation criteria of public forestry. Otherwise, forest farmers will not intend to operate it for a long time. Therefore, it is positively related to the dependent variable.

Characteristics of geographic factors is also set as dummy variables by county. Because there are a lot of differences in natural and socio-economic conditions of different regions, the development of forestry resources and economic situation can influence the forest farmers on the compensation policy of non-commercial forest satisfaction.

III. ECONOMETRIC ANALYSIS

A. Method

In this study, *Whether Forest Farmer is Satisfied with Ecological Compensation Criteria of Non-commercial Forest* is taken as dependent variable. The binary logistic regression will be used and the dependent variable is limited to range of [0,1]. Furthermore, "No" is defined as Y=0, which means that forest farmers hope to increase compensation, while "Yes" is defined as Y=1, which means that they do not hope to increase compensation. The binary logistic regression model is:

$$In[p/(1-p)]=\beta_0+\beta_1X_1+\beta_2X_2+\ldots\ldots+\beta_{16}X_{16}+\mu \quad (1)$$

where *P* is the probability if *Y*=1; 1-*P* is the probability if *Y*=0; X_1, X_2, ……, X_{15} are independent variables respectively and X_{16} is the geographical factor according to the county's location; β_0, β_1, β_2, ……, β_{16} are parameters to be estimated and μ is a disturbance term.

B. Results

Binary Logistic regression analysis was used to analyze the variables of 578 forest households using software *SPSS16.0*. The results were shown in Table 1.

Seen from Table 1, there are four variables which have a significant relationship with dependent variable. They are *Household Forestland Area Per Capita* (X_8), *Willingness to Invest in Forestland* (X_{11}), *Whether Farmers Satisfied with Non-commercial Forest Compensation Cashing Policy* (X_{14}) and *Whether Farmers have Intention of Long-term Operation for Forestland* (X_{15}) respectively. In terms of significant relationships, the *Household Forestland Area Per Capita* (X_8) and *Whether Farmers Satisfied with Non-commercial Forest Compensation Cashing Policy* (X_{14}) are significant at 1% level, while *Willingness to Invest in Forestland* (X_{11}) and *Whether Farmers have Intention of Long-term Operation for Forestland* (X_{15}) are significant at 10% level.

TABLE 1. RESULTS OF BINARY LOGISTIC REGRESSION

Variables	B	S.E	Wals	df	Sig.
Respondents' Age (X_1)	1.154	0.862	1.794	1.000	0.180
Level of Respondents Education (X_2)	0.110	0.249	0.197	1.000	0.657
Whether respondent is a village officer (X_3)	0.312	0.426	0.535	1.000	0.464
Household Incomes Per Capita (X_4)	-0.062	0.345	0.032	1.000	0.858
Proportion of Compensation for Non-commercial Forest to Household Income (X_5)	-0.315	0.236	1.786	1.000	0.181
Proportion of Forestry Income to Household Income (X_6)	0.007	0.156	0.002	1.000	0.966
Proportion of Non-agricultural Income to Household Income (X_7)	0.149	0.169	0.775	1.000	0.379
Household Forestland Area Per Capita (X_8)	0.614	0.231	7.064	1.000	0.008
Proportion of Tenure Issued Forestland Area to Total Forestland Area (X_9)	-0.004	0.198	0.000	1.000	0.984
Forest Quality (X_{10})	-0.111	0.143	0.605	1.000	0.437
Willingness to Invest in Forestland (X_{11})	0.819	0.491	2.790	1.000	0.095
Proportion of Forestry Labors to Total Household Labors （X_{12}）	0.228	0.231	0.972	1.000	0.324
Whether Farmers Learn About Compensation Policy of Non-commercial Forest (X_{13})	0.594	0.468	1.611	1.000	0.204
Whether Farmers Satisfied with Non-commercial Forest Compensation Cashing Policy (X_{14})	2.369	0.564	17.663	1.000	0.000
Whether Farmers have Intention of Long-term Operation for Forestland (X_{15})	-0.944	0.509	3.439	1.000	0.064
Constant	-0.078	0.147	0.284	1.000	0.594

C. Discussion

(1) *Household Forestland Area Per Capita* was significantly and positively correlated with the dependent variables. Namely, the more household forestland area per capita is, the current compensation criteria for non-commercial forest are more satisfactory to farmers, which is the same as the original hypothesis. Because the majority forest were non-commercial forest in the investigated forest farmers' families, therefore, when the compensation criteria is constant, the more household forestland area per capita is, the more compensation from the ecological compensation policy of non-commercial forests are. Therefore, the compensation criteria of forest farmers to the non-commercial forest will not pay more attention to the compensation criteria of non-commercial forest.

(2) *Willingness to Invest in Forestland* is significantly and positively related to the dependent variables. Namely, if forest farmers are willing to invest a lot of money in forestry development, they are usually satisfied with the current ecological compensation criteria. Therefore, this result is contrary to the original hypothesis. Theoretically, since government issued the ecological compensation policy about collective ecological forest, it meant that it had already supported the fundamental development for the forestry industry in the collective ecological forest area. As a result, this policy protected farmers' right to benefit from forestry. The effective protection towards farmers in their forestland will stimulate them to invest in forestry industry.

(3) *Whether Farmers Satisfied with Non-commercial Forest Compensation Cashing Policy* is significantly and positively related with dependent variable. Namely, if forest farmers are more satisfied with the current policy of compensation for non-commercial forest cashing policy, they are satisfied with the current policy of compensation criteria. Whether the cash compensation scheme of non-commercial forest is fair and transparent will directly influence the recognition degree of ecological compensation policy. To no surprise, if current cashing policy is better, forest farmers will continue to support ecological compensation policy of public forest so as to enhance their acceptance of compensation criteria.

(4) *Whether Farmers have Intention of Long-term Operation for Forestland* is significantly and negatively correlated with dependent variable. If farmers have a plan about long-term operation of the forestland, they are satisfied with the existing non-commercial forest ecological compensation criteria. This result is contrary to the original hypothesis. Whether there is plan to operate the forestland for a long-term reflect farmers' expectations of implementation of relevant policies (Zhi, 2016). If farmers have the plan to operate forestland for a long term, they will be benefited from forestry business so as to hope to improve the ecological compensation criteria for non-commercial forest. In addition, the higher compensation criteria can release the pressure of long cycle of forestry production, and achieve the win-win goal of forest vegetation growth and forest farmers' livelihood.

IV. RECOMMENDATIONS

The above empirical analysis showed that farmers were influenced by various factors. If their understanding about ecological compensation criteria for existing non-commercial forest are different, there will be different in their willingness to accept the compensation. In order to stimulate forest farmers to participate in the construction of non-commercial forest and promote the protection and construction of non-commercial forests, the following items were recommended.

A. Perfect Non-commercial Forest Circulation Policy and Optimize Resource Allocation

The empirical analysis showed that *Household Forestland Area Per Capita* was positively correlated with the forest farmers' satisfaction with the ecological compensation criteria of non-commercial forest. This results meant that the larger the *Household Forestland Area Per Capita is,* the higher the ecological compensation criteria of non-commercial forest will be satisfactory. However, as for the forest farmers whose forest area are relatively small, the ecological compensation policy of the existing non-commercial forest is lack of incentive function. Therefore, in order to improve the recognition degree of forest farmers to ecological compensation criteria of non-commercial forest, improving the management scale of forest land should be implemented at the beginning because they are more acceptable to the compensation policy. Therefore, it is necessary to perfect the policy of non-commercial forest circulation, optimize the allocation of non-commercial forest resources and improve the scale of forest management.

B. Improve Compensation of Non-Commercial Forest and Effectively Protect the Benefit of Forest Farmers

The empirical analysis showed that if forest tenure is clear enough and farmers have plan for long-term forestry operation, farmers usually request to improve the ecological compensation criteria of non-commercial forest. The purpose of developing public forest is to maintain the ecological balance and provide public goods or services, with non-exclusive and non-competitive characteristics. Therefore, we must take farmers' willingness to accept ecological compensation into account in order to satisfy farmers' needs in terms of production. In order to protect forest farmers' benefit, we need to improve the ecological compensation criteria of non-commercial forest, change the practice of one-size-fits-all and implement classification compensation.

C. Renovate the Compensating Approach of Ecological Forest and Stimulate the Enthusiasm of Forestry Development

The empirical analysis showed that farmers who are willing to invest in forestland are more satisfied with existing ecological compensation criteria. Non-commercial forest that provides positive externalities is the very strong public goods, however, the capital is always profit-oriented. How to continue to maintain and turn willingness of investing in the process of forestry development into a reality of investment behavior is an important problem that need to solve. However, the current approach of compensation criteria is difficult to cope with all challenges, because it will be paid attention if the project can benefit for investors. Therefore, in addition to enhance the scientific setting of ecological compensation criteria of non-commercial forest, changing the single direct compensation into indirect compensation is imperative. Indirect compensation, which aims to improve the self-development capacity of forest farmers, usually includes preferential loans, employment guidance, technical support and assistance, and support of development of new industries. In terms of indirect compensation in the construction of non-commercial forests, national and local governments should actively cultivate and popularize multi-purpose tree species, actively develop and popularize shrubbery resources processing and utilization technology, scientifically compile under-forest economic development planning, formulate and improve the development of forestry eco-industrial preferential policies, strengthen forest management of technical training, optimize the investment environment of forestry, and stimulate the enthusiasm of forestry development forestry.

D. Establish and Improve the Ecological Compensation of Forest Management and Supervision Mechanisms and Improve Forest Farmers to Participate in the Protection and Construction of Non-Commercial Forest

The empirical analysis showed that the satisfaction of the policy of compensation cashing is significantly related to the dependent variables. The compensation cashing of ecological compensation is one of the important contents of compensation policy implementation. The results of the compensation is directly related to whether the forest farmers can really be satisfy with the ecological compensation and the credibility of the ecological compensation policy. Therefore, governments at all levels and relevant departments should establish and improve the ecological compensation supervision and management mechanism of non-commercial forest, constantly strengthen the capacity of policy implementation and awareness of service, optimize the implementation of policy environment, and improve forest farmers to participate in non-commercial forest protection and construction.

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