

Study on Influence Factors of Famers' Willingness to Accept Ecological Compensation Living in Wetland Area

Based on the Investigation for 322 Households in Poyang Lake Wetland

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Abstract—Since a reasonable standard of ecological compensation is the base of ecological protection of Poyang Lake Wetland, the Willingness to accept ecological compensation of farmers living in Poyang Lake Wetland is analyzed according to “Logistic model” based on survey data collected from the households living in Poyang Lake area, which shows that the households' Willingness has a significant correlation with education, income source, location, attention of wetland environment improvement, agricultural acreage, water area by contract, and survey time. Finally, giving some proposals based on the conclusions as follows: enhance publicity and education of wetland protection, increase education investment for the farmers, build an ecological compensation mode, and accelerate to establish farmers' professional cooperative.

Keywords—logistic model; Poyang Lake Wetland; famer; willingness to accept ecological compensation

I. INTRODUCTION

Wetland is an important natural ecosystem, not only can alleviate environment pollution, but also has great economic value, provide a variety of important functions and services to human in aspects of protection of biological diversity, leisure and tourism, economic products of animal and plant, water storage for flood control, climate regulation, degradation pollutants, water transportation and so on. Poyang Lake Wetland is the largest freshwater lake wetland of China, "Poyang Lake Ecological Economic Zone Planning" implemented in December 2009, has strengthened supervision of fishing, grazing, poaching during closed fishing season, has been protecting wetland resources, however it has caused economic losses to the households living in wetland which should be compensated in order to make the policy obtain support from the households.

II. AREA INTRODUCTION

Poyang Lake Wetland studied in this paper is located in Nanchang, Xinjian, Jinxian, Dean, Xingzi, Hukou, Gongqing, Xingzi, Hukou, Lushan, Duchang, Yongxiu, Yugan and Poyang which are located in “Lakeshore Control Development

Zone” and “Lake Core Protection Area”.

The households living in Poyang Lake Wetland are mainly engaged in aquaculture, planting and other traditional farming. According to the GDP of farming industry accounted for the whole GDP ratio which comes from statistical yearbook of Poyang Lake Ecological Economic Zone of 2012, zone the research areas according to the type of agriculture as follows: the area is smaller area where the ratio is 10%; the area is middle area where the ratio is 10% ~ 20%; the area is the larger area where the ratio is more than 20%. The details are shown in “Table I”.

TABLE I. RESEARCH AREAS

Regional Level	County	Ratio (%)	Areas Size
I	Duchang, Poyang, Yugan	>20	larger
II	Xinjian, Xingzi, Jinxian, Hukou, Yongxiu	10~20	middle
III	Gongqingcheng, Dean, Lushan, Nanchang	<20	smaller

III. DATA SOURCES AND MODEL SELECTING

A. Sampling Plan and Data Source

Without considering the whole research, the simple random sampling formula is $n = (1 - p) \times p \times Z^2$, of which n is the sampling number [7]. Taking a conservative assumption, make P equals to 0.5, under the confidence interval of 95%, the error e cannot be greater than 0.05, the Z value is about 1.5 through trial survey and estimate [7]. Based on the data above, the minimum sampling number is 225. The data in this paper respectively comes from some surveys that were taken to the farmers living in Poyang Lake Wetland in 2013, 2014, and 2015. A total of 384 questionnaires were issued, of which 322 questionnaires were effective and taken back, the effective rate of questionnaire was about 83.85%.

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TABLE II. SAMPLING PLAN

Stage	Sampling Unit	Sampling number	Sampling method
I	Town	24	Step sampling
II	Village	1	PPS (putback)
III	Famer	16	SRS

As shown in "Table II", three stage sampling is used to ensure the validity and unbiased of samples [7]. Stratified sampling is used in first stage to respectively select 2 towns as sample from all towns of the 12 counties located in Poyang Lake Wetland; cluster sampling is used in second stage to respectively select a village as sample from the 24 samples selected in the first stage; simple random sampling is used in the third stage to select 16 households from the 24 villages selected in the second stage.

B. Selecting Variables

1) *Determining dependent variables:* It is the purpose of this paper to analyze the influence factors of farmers' compensation willingness living in Poyang Lake Wetland. In questionnaire design, the question is designed as "cooperate with the government to protect Poyang Lake Wetland and get some ecological compensation, whether you are willing", the answers are "yes" or "no". Define "Q=1" when have compensation willingness, otherwise Q=0. In the surveyed 322 farmers, 271 households chose "yes", while 51 households

chose "no", each of which respectively accounted for 84.16% and 15.84%.

2) *Selecting independent variable:* Eleven independent variables (as shown in "Table III") are selected in view of the relevant literatures avoiding to arbitrary selection. As shown in "Table III" the average gender, age and schooling year of the invested households respectively were 0.84, 46.65 and 6.73, which indicated that most of the surveyed households are male with low education; the surveyed households' population and average annual income respectively were 4.32 and 55430, at the same time, the standard deviation of annual income was up to 79583, which indicates that per capita income is lower, while the income difference between households still is large; the residential location value of surveyed households was 1.98, which shows the number of households surveyed in these three areas roughly are same; the main income source, land area and average water area by contract respectively were 2.13, 3.22 and 4.57, which indicates that the average land of each household is less, the income of most surveyed households were relying on migrant working which can make money that is generally more than agriculture or cultivation according to the survey; the average value of emphasis on wetland environment improvement was 0.72, which shows that most of the households are more aware of the importance of wetland environment; the average value of survey year is 2.07, which indicates that the number of survey samples in 2013, 2014 and 2015 are quite same.

TABLE III. VARIABLES

Type	Name	Unit or Value	Max	Min	Average	Standard deviation	Affect orientation anticipated	Literatures involved
Dependent variables	Households' Ecological Compensation Willingness Living in Poyang Lake Wetland (Y_1)	Yes=1, No=0	1	0	0.84	0.37		
Personal characteristic variables	Gender (Y_2)	Male=1, female=0	1	0	0.80	0.40	-	[5, 6, 7]
	Age (Y_3)	year	81.0	18.0	46.65	12.21	+	[5, 7, 9]
	Schooling time (Y_4)	year	16.0	0.0	6.73	3.07	-	[5, 7, 9]
	Family population (Y_5)	person	12	1	4.32	1.60	+	[5, 7, 9]
	Family annual income (Y_6)	Yuan	500000	2000	55430	79583	-	[5, 7, 9]
Family characteristic variables	Main family income source (Y_7)	Aquaculture and livestock breeding=1, cultivate=2, others=3	3	1	2.13	0.85	-	[5, 7, 9]
	Residential location (Y_8)	I level zone=1, II level zone=2, III level zone=3	3	1	1.98	0.82	-	[7, 9]
	Whether emphasis on wetland environment improvement (Y_9)	yes=1; no=0	1	0	0.72	0.45	-	[5, 7]
	Agricultural acreage (Y_{10})	mu	50	0	3.22	6.77	+	[5, 7, 9]
	Water area by contract (Y_{11})	mu	75	0	4.57	13.25	+	[7, 9]
Other variables	The year of survey (Y_{12})	Year 2013 =1; Year 2014 =2; Year 2015 =3	3	1	2.07	0.82	-	[10]

3) *Establishing model*: The research object of this paper is the ecological compensation willingness of farmers living in Poyang Lake Wetland, the answer is "yes" or "no", which is a typical two classification variable which is more suitable for Logistic two classification model that is used in this paper to analyze the influence factors of households' willingness to accept compensation who are living in Poyang Lake Wetland. The model is as follows:

$$Q_j = \frac{1}{1 + e^{-Z_j}} = \frac{1}{1 + e^{-(\theta + \gamma_j)}} \quad (1)$$

This can be converted to:

$$\ln \frac{Q_j}{1 - Q_j} = Z_j = \theta + \gamma_1 Y_1 + \gamma_2 Y_2 + \gamma_3 Y_3 + \dots + \gamma_j Y_j + \delta_j \quad (2)$$

Of which Q_j is signified as the probability of willingness to accept compensation, Y_j is signified as the explanatory variable influence on accept willingness of the jth household, γ_j is signified as the coefficient of the jth explanatory variable, θ is signified as intercept, δ_j is signified as residual.

IV. REGRESSION CALCULATING AND ANALYZING

A. Data Standardization

Firstly, each explanatory variable is standardized to eliminate the influence of different magnitude orders which is shown as Formula3:

$$Q_{ij} = \frac{Y_{ij} - Y_{\min}}{Y_{\max} - Y_{\min}} \quad (3)$$

Of which Q_{ij} is signified as the standardized data, Y_{\min} is signified as the minimum observed value of the same explanatory variable, Y_{\max} is signified as the maximum observed value of the same explanatory variable.

B. The Calculating Result

In this paper, a logistic regression analysis has been taken through SPSS16.0, of which regression results are shown in "Table IV", "Table V" and "TableVI". It can be concluded from "Table IV" that using H-L to detect fitting degree of the model, the obtained chi-square value is 6.095 that is not significant, which shows that the original hypothesis is rejected, therefore the model has a good fitting degree. It also can be concluded from "Table V" that the model has passed the significance test, which shows that the model is effective in view of arrangement.

TABLE IV. H-L TEST

Step	Chi-square	df	Sig.
1	6.095	8	0.637

TABLE V. OMNIBUS TEST OF THE MODEL COEFFICIENT

		Chi-square	df	Sig.
Step1	Step	110.165	11	.0000
	Block	110.165	11	.0000
	Model	110.165	11	.0000

C. Analysis of Regression Result

As shown in "Table VI", the surveyed households' gender (Y_1), age (Y_2), family population (Y_4), family income (Y_5) have no significant correlations with households' willingness to accept compensation; while the number of schooling years (Y_3), main sources of family income (Y_6), home position (Y_7), whether emphasis on wetland environment improvement (Y_8), cultivated area (Y_9), contracted water area (Y_{10}), survey year (Y_{11}) have significant correlations with households' willingness to accept compensation. Among them, the coefficient of schooling years is negative and has a significant negative correlation with households' willingness to accept compensation, which is because that the more the schooling time of the surveyed farmers, who are more aware of importance to protect Poyang Lake Wetland, the more hope that the government will increase investment on wetland protection, and are willing to provide power for wetland environment improvement, but do not want to receive more compensation in that the country have more funds put into ecological protection; the coefficient of main sources of family income (Y_6) is negative and has a significant negative correlation with households' willingness to accept compensation, which is because that the farmers relying on planting and breeding have high dependence on wetland, if the government ask them to take measures for wetland protection (Returning farmland to lake, no breeding etc.), it will affect the income sources of farmers to a certain extent; the coefficient of family residential location (Y_7) is negative and significant correlation with the willingness to accept compensation, this is because the family living in the I area and II area are more engaged in the first industry, more depend on Wetlands for income, if the governments want to protect the wetland, so the compensation achieved by households who have more affect by protection from government; the coefficient of whether emphasis on wetland environment improvement (Y_8) is negative and significant correlation with willingness to accept compensation, this is because the more attention of households to wetland environment improvement of, who more understand the importance of wetland environment, want the government to increase protection of wetland environment and obtain relative less compensation so as to the government put more money into wetland environment improvement; the coefficient of cultivated land area (Y_9) is positive and significant relationship with willingness to accept, while the coefficient of waters area by contract (Y_{10}) is positive and has a marginal significant relationship with willingness, this is because that the more the farmland /contract water area, the more obtained

from farmland and water in income, of which income will be affected by wetland protection measures, who hope to obtain compensation; the coefficient of survey year (Y_{11}) is negative and a willingness to accept and showed a significant negative correlation with willingness, this is because that in recent years, governments have been increasing addressing corruption, and continuing to strengthen people's livelihood project investment, which makes farmers more trust in government, who believe the government will put more money into wetland protection, so farmers' willingness to accept will decrease..

TABLE VI. REGRESSION RESULT

Variable	No-standard coefficient t	Standard ization coefficient t	Standard deviation	Wald-value	df	Significance level
Y_1	.166	.066	.183	.131	1	.717
Y_2	-.008	-.096	.200	.228	1	.633
Y_3	-.450***	-1.384***	.236	34.399	1	.000
Y_4	-.138	-.221	.229	.927	1	.336
Y_5	-6.55E-7	-.052	.195	.072	1	.789
Y_6	-.637**	-.541**	.216	6.261	1	.012
Y_7	-.523**	-.431**	.204	4.463	1	.035
Y_8	-1.018**	-.456**	.222	4.240	1	.039
Y_9	.358*	2.424*	1.174	4.267	1	.039
Y_{10}	.198	2.374*	1.457	2.654	1	.103
Y_{11}	-1.247***	-1.027***	.266	14.867	1	.000

Notes: ***, **, * respectively are signified as significant correlations at 1%, 5% and 10%.

V. CONCLUSION AND POLICY SUGGESTION

A. Demonstration Conclusion

As shown in the willingness to accept compensation analysis that, the surveyed households' gender (Y_1), age (Y_2), family population (Y_4), family income (Y_5) have no significant correlations with households' willingness to accept compensation; while the number of schooling years (Y_3), main sources of family income (Y_6), home position (Y_7), whether emphasis on wetland environment improvement (Y_8), cultivated area (Y_9), contracted water area (Y_{10}), survey year (Y_{11}) have significant correlations with households' willingness to accept compensation.

B. Policy Proposal

1) *Enhancing publicity and education of wetland protection*: Through demonstration analysis, the more attention to improvement of wetland environment farmers pay, the lower the willingness to accept compensation are relatively. Therefore, we can further increase publicity and education of wetland conservation, so that more farmers will join wetland protection, meanwhile ecological compensation funds can be

directly invested into the promotion of Poyang Lake Wetland environment.

2) *Increasing investment in education for farmers living in Poyang Lake Wetland*: As shown in the empirical study, the higher the willingness to accept of the farmers, the more understanding of the importance of wetlands in Poyang Lake, who have low willingness to accept ecological protection compensation of Poyang Lake Wetland. At the same time, it is found that the education level and quality of Poyang Lake area were lower. Therefore, increasing investment in education in these regions especially in rural areas will make better education for the new generation, so as to provide more effective support for Poyang Lake Wetland protection.

3) *Establishing a targeted ecological compensation mode*: In order to improve the efficiency of ecological compensation funds, we should avoid a ecological compensation method of "one size fits all", and establish more targeted ecological compensation mode. According to the empirical results, the farmers who incomes mainly come from living in I area and II area, have relatively more willingness to accept compensation, who can obtain more ecological compensation, so as to establish ecological compensation mode with difference to make good use of the compensation funds.

4) *Accelerating establishment of "farmers professional cooperatives"*: As shown in the empirical results, the more the cultivated land area and contracted water area owned by farmers, the stronger their willingness to accept. Establishment of "farmers professional cooperatives" can reduce the average owned area of cultivated land and contracted water so as to reduce the willingness to accept compensation, on the other hand, it also can improve the unit area production value of land and water, so as to further increase farmers' income.

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