Environmental Management (2015) 56:505–518
DOI 10.1007/s00267-015-0505-1

Farmers' Willingness to Participate in the Next-Stage Grain-for-Green Project in the Three Gorges Reservoir Area, China

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Received: 15 May 2014 / Accepted: 13 April 2015 / Published online: 24 April 2015

Abstract The policy implications for success in the next-stage Grain-for-Green Project (GFGP) in China are analyzed from the perspectives of farmers' willingness. The ecological protection belt of the Three Gorges Reservoir Area was chosen as the case study area, where 1207 valid questionnaire surveys based on participatory rural appraisal were collected in 2012. Our study found that farmers with lower levels of education, older age, and higher livelihood dependency on farmland were more prone to reclamation if the compensation ended. Females and non-migrants were more reluctant to participate in the next GFGP than others. Nevertheless, traditional farming was no longer a preferred livelihood by all respondents. The majority of respondents (74.4 %) wished to be liberated from the low-income farmland work through the next GFGP, and half of them (50.6 %) hoped to get non-cash compensation. The Willingness to Accept (WTA) values of the next GFGP showed significant social heterogeneity and regional difference, with an average of annual RMB¥16,665 ha^{-1}, about 4.5 times the local compensation standard in 2000. By revealing some limitations of the uniform nationwide compensation standard system and the single payment form in adapting to evolving socioeconomic conditions, our study highlighted the importance of developing a region-based compensation standard system, integrating the next GFGP into regional sustainable development organically by more comprehensive alternative policy, and bonding a vertical partnership between the local community and the nation. Our study revealed some key elements for success in the future design of restoration projects in China.

Keywords Grain-for-Green Project (GFGP) · Farmers' willingness · Policy design · Three Gorges Reservoir Area (TGRA)

Introduction

Farmers are the stakeholders to carry out ecological restoration in rural areas (De Sherbinin et al. 2008). Directly involving in local changes of natural resources and land use, farmers are both the main participants and the most affected groups in restoration projects (Weinstein 2008; Xu et al. 2010b). However, the interests of farmers were often neglected in policy design, which in turn led to low social acceptance and eventual failure of many ecological restoration projects (Geist and Galatowitsch 1999; Choi 2004; Buckley and Crone 2008). Therefore, farmers' participation is central to the ecological restoration process (Higgs 1997; Hu et al. 2006; Cairns 2000). For the success of ecological restoration, more attention should be paid in policy design to the potential implications of farmers' willingness and expectation toward projects, especially in areas of large population and suffering conflicts between ecological restoration and local economic development.

The Grain-for-Green Project (GFGP) in China is one of the biggest ecological restoration projects in the developing world because of its massive scales and potentially enormous impacts (Liu et al. 2008). The GFGP exploits a public payment scheme directly engaging millions of rural

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households as core agents of project implementation (Lü et al. 2012). It is thus one of the most ambitious "payments for ecosystem services" (PES) projects in China (Bennett 2008; Zhen and Zhang 2011). It was initiated in 1999 and launched nationwide in 2002 in order to achieve multiple goals, including biodiversity conservation (Xu et al. 2006b), soil erosion alleviation (Uchida et al. 2005), and rural household income growth (Zhou et al. 2007). In practice, the GFGP was mainly implemented in middle and upper reaches of the Yangtze River and the Yellow River, where massive ecological degradation had occurred in the past five decades (Zhang et al. 2000). The planned ratio of forestation on converted farmland to that on barren land was 1:1 (Liu and Wu 2010). As compensation, the Chinese central government offered payments to participant households 8 years for ecological forest, 5 years for economic forest, and 2 years for grassland. The annual payment in cash was 300 Yuan per hectare, and as grain was 1500 and 2250 kg per ha in the Yellow River Basin and the Yangtze River, respectively. To achieve the proposed goals, the State Council of China renewed the GFGP for another cycle of up to 8 years in 2007. In this period, the grain payment was canceled, while the annual cash payment was increased to 1050 and 1575 Yuan per ha in the Yellow River Basin and the Yangtze River, respectively. In addition, the original converted land received extra 300 Yuan per ha per year. By the end of 2013, more than 100 million farmers from over 25 provinces (or municipalities) have participated in the GFGP, and about 25.80 million hectares had been converted to forestland via this project (National Forestation Commission 2013). The government investment in the GFGP summed to 300 billion Yuan (State Forestry Bureau 2013). A study by the China National Forestry Economics and Development Research Centre found that the GFGP had substantially changed the rural land-use pattern, increasing the proportion of forest and grassland to the total land in China (Liu and Wu 2010).

To sustain the restoration achievements, the GFGP was approved to further maintain and expand the implementation scope by the 3rd Plenary Session of 18th Central Committee of the Communist Party of China (CPC) in 2013, which is defined as the next stage in this article. Compared with the first stage initiated since 1999, the next GFGP faces complex and evolving socioeconomic conditions, such as influence of neighbor behavior (Chen et al. 2009), compensated transfer of rural land-use rights (Zhu 2014), and urban–rural integration (Xiong 2011). It is pressing to coordinate the GFGP and local social economy. It is a challenge, however, to successfully weave metabolic socioeconomic factors into policy design of such a large-scale complex conservation project. To improve the sustainability of the next GFGP, the Chinese government needs to well comprehend the key factors for successful implementation of this project, by taking a close look at the scientific and socioeconomic dimensions. In the socioeconomic regard, farmers' cognition has been deemed as an effective perspective, since rural households are important stakeholders of local communities in the restoration projects, and their livelihood strategies interplay with the local environmental and socioeconomic changes. In the past decade, research on the performance and sustainability of GFGP has attracted many scholars in different fields (Liang et al. 2012; Grosjean and Kontoleon 2009; Qiu et al. 2011; Xu et al. 2006a; Chen and Yuan 2011; Tian et al. 2011; Wang 2011; Zhang et al. 2011; Lü et al. 2012; Xu et al. 2010a). Among these scholarly work, policy research based on the rural household perspective mainly focused on the following aspects: households' attitude and livelihood strategy toward land cover change (Cao et al. 2009; Xu et al. 2006b; Yan and Pu 2005), assessment on local environmental quality and biodiversity conservation (Xu et al. 2007, 2010b; Dai 2010; Liu et al. 2003), impact of compensation for rural households and local economic structure (Liang et al. 2012; Grosjean and Kontoleon 2009; Qiu et al. 2011) and so on. Scholars have gained some useful findings. For example: Cao et al. (2009) found that farmers in Shaanxi province appreciated the grain and financial compensation offered by the GFGP, but few considered planting of trees or forage species being a priority. Chen et al. (2009) discovered that in addition to the amounts of conservation payment and program duration, social norms at the neighborhood level also had significant impacts on program re-enrollment in China's Wolong Nature Reserve. In addition, local economic and demographic trends were found to have profound implications for sustainable conservation. Wang et al. (Wang et al. 2007a, b, c) pointed out that more attention should be paid to the quality of reforestation programs rather than just their scale and potential carbon sequestration co-benefits enhanced the benefits of cropland conversion programs. Nevertheless, most of these research projects have been devoted to the rural households' cognition and assessment for the past GFGP. Little was taken into account the heterogeneity of public attitudes to execute the next GFGP. In particular, there is a dearth of empirical research focusing on farmers' willingness to help achieve multiple ecological and socioeconomic goals in the next GFGP.

This study was conducted to fill the above-mentioned knowledge gaps, exploiting the ecological protection belt (EPB) located in the Three Gorges Reservoir Area (TGRA) as a case study area. It had three specific objectives: (1) to identify key socioeconomic factors potentially influencing the sustainability of the GFGP in TGRA; (2) to analyze the variation of local communities' willingness to the next GFGP and its potential effect on policy design; (3) to provide some policy implications for the future design and

implementation of restoration projects in areas that have high levels of sensitive ecology and large population.

Methods

Study Area

The Three Gorges Reservoir Area (TGRA) is located in the central territory of the Yangtze River (105°44′–111°39′E, 28°32′–31°44′N), covering an area of approximately 58,000 km^2 with distinct human-land contradictions (population-induced pressure on land resources) and special strategic position. It is not only an area with the most severe soil erosion in China, but also a key region for migrants resettlement, as well as an important ecological buffer of the Yangtze River basin. It has been a hot area with numerous global ecological environment issues in the past two decades (Jackson and Sleigh 2000; Xie et al. 2003; Wu et al. 2004; Dai 1998; Wang et al. 2007a; Li et al. 2009), due to the impact of the largest hydraulic project in the world—the Three Gorges Dam. In order to settle the remaining environmental and social problems stemmed from the dam project and ensure the normal function of the dam, in 2011, the State Council of China determined to carry out several new ecological restoration projects in TGRA, such as the next GFGP, water front protection, and environmentally friendly agriculture (Yangtze River Water Resources Commission 2011).

This paper selects the most sensitive EPB of biophysical environment in TGRA as a study area. EPB is defined as the horizontal projection 100 m-wide rural region that is above from the 175 m water line (backwater flooding line) of the reservoir. It is located in the bottom of the "ecological buffer zone" (Yangtze River Water Resources Commission 2011), the region from the 175 m water line up to the first mountain ridge (Fig. 1). EPB crosses Hubei province and Chongqing municipalities with a total area of 46,547 ha and a total population of 208,000. The area population density is 3.13 times the national average (Yangtze River Water Resources Commission 2011). In terms of land use, farmlands are totally 12,607 ha, in which dry lands are 10,347 ha including 3036 ha with a slope greater than 25°. In addition, orchards are 4544 ha; forest lands 18,104 ha; grasslands 3585 ha; water bodies and water resource facilities 471 ha; construction areas 4598 ha; and others 2636 ha. The annual agricultural land erosion accounts for 60 % of local total soil erosion (Wang et al. 2007b).

In TGRA, the EPB is the most pivotal place for implementing the next GFGP and is regarded as the last buffer for protecting water quality of the reservoir. Its primary functions are to maintain water and soil, reduce pollution burden, preserve landscape around the reservoir, etc. The outcome of the next GFGP implementation in EPB will not only be relevant with the effect of local environment protection, but also profoundly influence the ecological security of the downstream Yangtze River Basin.

As an epitome area that has high levels of both sensitive ecology and dense population, the EPB is ideal to study farmers' willingness to the next GFGP.

Data Collection

The primary data were collected in early 2012 mainly through two ways. One was an interview with directors of local migration offices in Chongqing municipalities and Hubei province by focus group discussion, the other was questionnaire survey based on participatory rural appraisal (PRA).

We interviewed 15 directors to acquire the social and economic status related to the GFGP and policy implementations in EPB. The reason directors of migration offices rather than those of other departments chosen for interview was that: they were better informed and trained, since they were in direct charge of administration and logistics for policy implementations in EPB, such as organizing ecological restoration among local communities, clarifying government policies to rural households, and allocating government subsidies. Through the interview, we obtained some informative facts as follows: (1) The EPB started GFGP since 2000, by implementation of cash payment rather than grain payment at the standard of 245 Yuan/(mu. year). (2) At present, about half of local family income in the rural TGRA was contributed by migrant workers. (3) In the last decade, the per capita GDP of each of six districts/counties, Yiling, Yubei, Banan, Changshou, Wanzhou, and Fuling, has exceeded the average of all 20 districts in TGRA.

The surveys were to inquire the local farmers' cognitions, attitudes, and willingness to participate in the GFGP. We collected four major sets of information through the surveys. The first set was demographic and socio-economic characteristics of respondents. The second set was respondents' cognition attitudes toward the past policies of GFGP. The third set was respondents' most desirable compensation forms toward the next GFGP. The last set was local participation willingness and WTA value of the next GFGP. Both closed and open-ended questions were included in our questionnaire surveys. The former was to acquire data for statistical analyses. The latter was to gain an in-depth understanding of the respondent's opinions, obtaining some information beyond closed-form survey. The reason to select WTA value for compensation valuation is that, given the next GFGP being a PES project

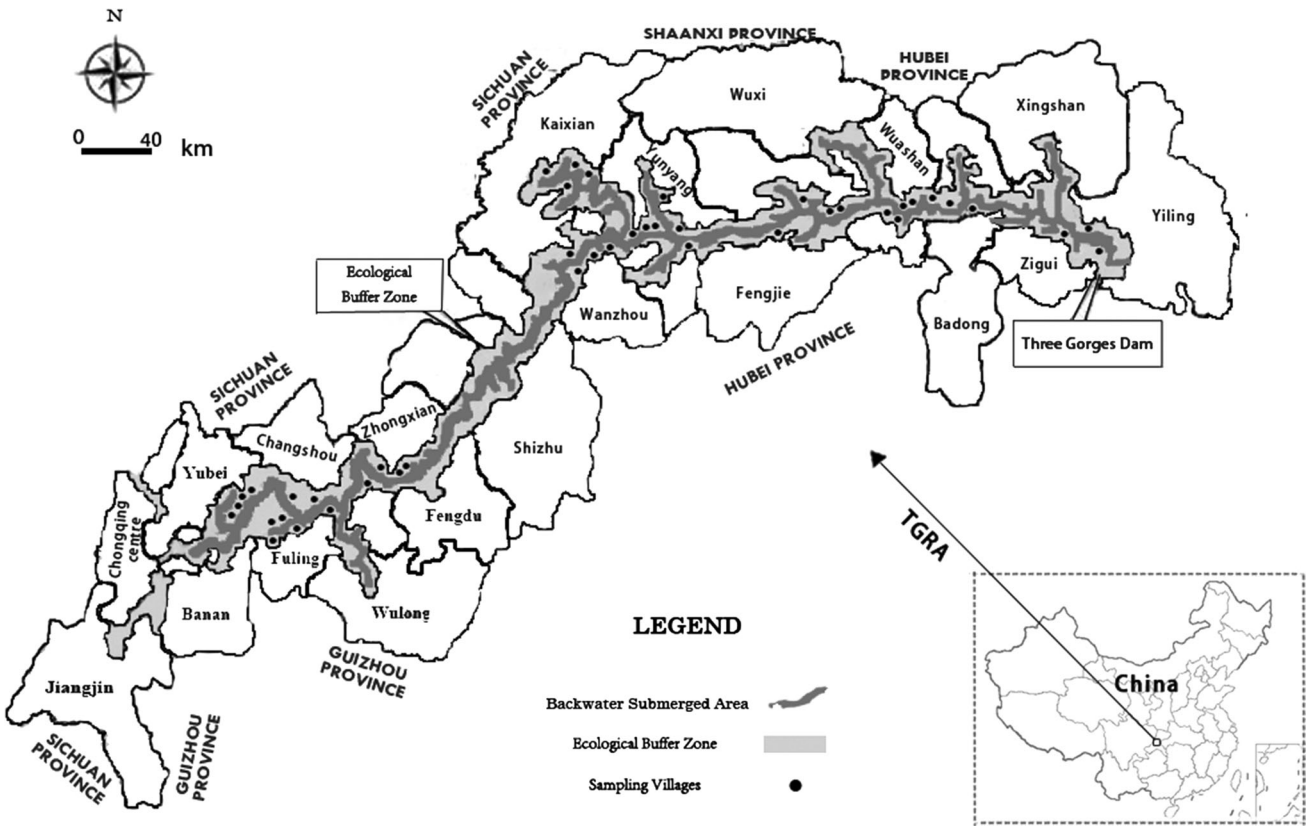

Fig. 1 The Three Gorges Reservoir area and ecological buffer zone, China

facing complex and evolving socioeconomic conditions, how to design a payment standard more in line with the current reality is a core content of project policies. As the important stakeholders of the next GTGP, farmers' potential expectations and attitudes toward compensation policy design are very significant. However, how to evaluate their attitudes and willingness to future welfare loss accurately with a simple but effective method is an important issue. Fortunately, the flexible contingent valuation method (CVM) (Hoehn and Randall 1987; Carson 2000) widely used in non-market valuation field can address it well. Using CVM to measure the minimum acceptable compensation value for the loss of cultivated land, i.e., WTA compensation value, would allow us to collect the first-hand data for understanding the preferences and strategies of stakeholders, providing useful guidance both to payment standard establishment and other incentive policy design for the future GFGP (Carson 2000; List and Shogren 2002). The theoretical framework for estimating values for WTA compensation in our study was as follows: First, we informed the respondent a hypothesis that the next GFGP was to be implemented, and the compensation was supposed at the same time interval as that of the past GFGP, i.e., 8 years for ecological forest, 5 years for economic forest, and 2 years for grassland. Second, we inquired respondent's willingness to participate in the upcoming GFGP, and then his/her WTA value if he/she was willing to participate and had arable land as well. Finally, we aimed to identify a set of factors having significant influence on WTA values by multiple regression analysis. Based on a pre-investigation, we found it difficult for the local respondents to understand the five-point Likert scale and the inquiry of WTA value derived from convergent-bidding-game. Questionnaires were accordingly revised in the formal survey. We used a three-point Likert scale in the second set. In the last set, the improved convergent-bidding-game approach was adopted in WTA value inquiry as follows: A respondent was asked whether he/she could accept the payment of annual 245 Yuan/mu (the payment standard of the past GFGP, 1 mu = 1/15 ha) in the next GFGP. If not, the respondent was then asked for his/her desired value of compensation and reasons. If the value was more than annual 245 Yuan/mu, the minimum payment acceptable by the respondent was acquired through a bargain-style interaction. If the value was lower than annual 245 Yuan/mu, it was recorded as the final WTA value of the respondent. Forty-three administrative villages in 10 districts and counties related to the GFGP in EPB were chosen for survey by stratified sampling method. Samples of each district or county were from at least two

representative villages. One adult (at least 18 year old) from each household was interviewed in his/her residence. A total of 1207 valid questionnaires were obtained after interviewing 1325 rural households with a valid response rate of 91.1 %.

Results

Socioeconomic Characteristics of Respondents

Table 1 presents the demographic features of the samples. 72.2 % of the samples were from male and 27.8 % female. 58.7 % were immigrants of the reservoir. The respondents were at the ages of 25–76, and 73.3 % of them were over 40. According to the interview with directors of local immigration offices, such an imbalance of age distribution reflected a general social phenomenon in TGRA that most young people, especially those unmarried, were migrant workers in nearby cities or towns, whereas aged people stayed in villages. In terms of educational level, 93.8 % of respondents were at the levels of primary school or junior middle school, consistent with the local poor educational level of those aged respondents. About 80 % of the respondents were engaged in agricultural sector, while 20 % were not. Chi-square analysis indicated that regional factor had a significant influence on occupation types of respondents ($df = 9$, $P = 0.000$, $a = 0.05$). Relatively high proportion of respondents engaging in non-agricultural sectors was found in these districts: Zigui, Wanzhou, Kaixian, Fuling, and Yubei. The primary non-agricultural occupations mainly included porters, small business owners, and workers in nearby plants.

The survey illustrated that the average family size is 4.03 (Table 2). About 95 % of annual household incomes were below RMB¥50,000 (Fig. 2). As confirmed by local directors, half of household income was generally contributed by migrant workers. From conversations with the respondents, we found that owing to low levels of education, the majority of migrant workers were often engaged in heavy manual work. Farmland, orchard, and timberland were the three kinds of land use in the EPB. Corn, mustard, potatoes, and vegetables were the main crops on farmland. Due to infertile soil, however, the crop productivity was so low that it could merely feed the family and livestock, and no more for profit gain. The main orchard fruits were citrus and tea. Timberland was mainly for ecological forest. By comparison, Badong, Wanzhou, and Zhongxian had more

Table 1 Demographic data and characteristics of the samples

District	Hubei		Chongqing								Frequency
	Ba dong	Zi gui	Wu shan	Feng jie	Yun yang	Wan zhou	Kai xian	Zhong xian	Fu ling	Yu bei	
Sample size	60	107	90	120	200	200	90	167	113	60	1207
Gender											
Male	43	80	72	81	149	136	82	112	77	38	872
Female	17	27	18	39	51	64	8	55	36	22	335
Migrant											
Yes	59	53	85	49	127	80	90	97	8	60	708
No	1	54	5	71	73	120	0	70	105	0	499
Age											
20–29	6	11	8	7	9	12	4	5	4	3	69
30–39	8	26	23	21	50	48	13	29	26	7	253
40–49	26	36	25	42	71	70	25	38	35	15	373
50–59	15	22	22	32	38	35	25	42	25	10	273
≥60	5	12	12	18	32	35	23	53	23	25	239
Year of education											
≤6	16	28	46	106	68	76	64	115	64	38	620
6–9	37	59	37	14	124	110	23	45	44	19	512
9–12	7	19	7	0	8	11	3	6	4	3	69
>12	0	1	0	0	0	3	0	1	1	0	6
Occupation											
Agriculture	54	79	72	118	183	130	44	158	91	37	966
Non-agriculture	6	28	18	2	17	70	46	9	22	23	241

Table 2 Household socio-economic status of the samples

District	Hubei		Chongqing								Total
	Ba dong	Zi gui	Wu shan	Feng jie	Yun yang	Wan zhou	Kai xian	Zhong xian	Fu ling	Yu bei	
Family size											
Mean	4.82	3.80	4.87	4.77	3.82	3.81	3.87	3.99	3.32	4.07	4.03
SD	1.68	1.70	1.88	1.52	1.37	1.38	1.49	1.99	1.59	2.35	1.71
Farmland use (mu)											
Mean	2.45	0.60	1.4	0.46	1.13	2.30	0.46	2.53	1.75	0.60	1.47
SD	1.90	1.20	1.407	0.79	1.40	1.60	0.43	2.06	1.04	0.52	1.61
Orchard use (mu)											
Mean	0.97	0.72	0.43	1.92	1.17	0.39	0.07	0.16	0.28	0.24	0.66
SD	1.69	0.94	1.13	0.77	1.65	0.78	0.19	0.82	0.58	0.53	1.17
Timberland use (mu)											
Mean	0.12	0.74	1.33	0.00	0.00	1.08	1.19	1.17	0.53	0.92	0.70
SD	0.69	1.52	3.33	0.00	0.00	2.24	1.41	1.59	0.59	2.75	1.74
Pig feeding number											
Mean	1.37	0.10	1.34	0.30	0.65	0.36	2.57	2.08	2.11	0.47	1.07
SD	2.46	0.39	3.16	0.82	1.50	1.30	21.06	15.47	3.11	1.00	8.31
Chicken feeding number											
Mean	68.3	0.11	3.57	0.24	2.61	4.56	11.17	4.02	7.63	5.18	7.24
SD	516.23	0.98	7.28	1.03	6.86	16.33	22.28	8.83	7.23	13.66	115.58

1 mu = 1/15 ha. Pig and chicken feeding number were the average of recent 3 years

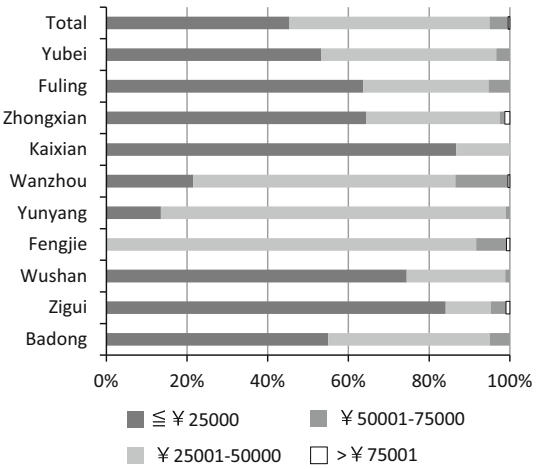

Fig. 2 Annual household income of the samples

farmland, Fengjie and Yunyang had more orchard, Wushan, Kaixian, and Zhongxian had more timberland. Rural livestock, mainly present as chicken and pigs, were either small or concentrated feedlot operation. Farmers engaging in small feedlot operation only consumed part of byproducts of livestock, and sold the rest on market. But they could not rely on livestock and poultry as the main income source because of low feeding quantity. The sectors of chicken and pig concentrated feedlot operation were mainly distributed in Badong, Kaixian, and Fuling. Unsurprisingly, households with concentrated feedlot operation generally had higher annual incomes than others.

Given the potential impacts of spatial difference, we combined the sample districts of similar social and economic conditions for the subsequent policy analysis. There were two merged groups. One was "rich group" that included Yubei, Wanzhou, and Fuling. The other was "poor group" that included the rest of seven districts of relatively poorer economic conditions.

Cognition of Respondents to the GFGP Policy

Insights could be gained for the next GFGP policies by investigating the cognition of farmers to the past GFGP policy. The TGRA implemented GFGP since 2000. By 2012, average land conversion area through the GFGP was 2.595 mu per household and 0.66 mu per farmer in the study area (State Statistics Bureau 2010). We found that after the first GFGP, among the 1207 respondents, 21.9 % of households did not have arable land, and 32.3 % only had arable land less than 1 mu. In addition, although 33.1 % of farmers did not think cash payment by GFGP adequately compensated their economic loss, as high as 85.5 % of farmers admitted that their recent life was not negatively affected by the project. Nearly all farmers (99.3 %) agreed that GFGP had significantly improved local ecological environment. However, only 39.3 % of

them explicitly expressed that they would not reclaim even if subsidies ended (Table 3). Contingency table analysis indicated that the respondents favoring reclamation were mainly agricultural laborers (97.2 %), less than 6 years of education (86.5 %) and age over 50 (91.4 %). Meanwhile, the neutrals in reclamation were mainly agricultural laborers (99.5 %), 6–9 years of education (77.6 %), and age over 50 (90.7 %). Distributions of gender, region, and migrant identity were relatively even among the three attitudes toward reclamation. The results illustrated that the implementation of the first GFGP had a wide coverage in EPB, accompanied by farmers' approval of its positive effects on local environment. On the other hand, the GFGP might be at a risk of woodland reclamation, because many local farmers with low levels of education lacked the ability to find alternative livelihoods.

Analysis on the Expectant Compensation Forms

We investigated the most desired form of compensation toward the next GFGP by open-ended questions. The results (Fig. 3) indicated that 49.4 % of farmers chose cash compensation, 36.2 % hoped to be employed with a stable job, 8.7 % wanted to get skill training, and 5.7 % expected some favorable policies for starting business such as citrus plantation or agricultural tourism, etc.

Contingency table analysis indicated that spatial difference mainly appeared in the choices of cash compensation and job opportunity. In the "rich group", the selection for cash support (58.8 %) was evidently higher than that in the "poor group" (43.2 %), while job opportunity (25.0 %) was evidently lower than the "poor group" (43.6 %). Throughout the investigation, we perceived that farmer's choice on compensation form seemed to be correlated with age. So we performed a Chi-square analysis on the age of respondents with four kinds of desired compensation forms. The results showed significant influence of farmers' age on compensation form choice ($df = 4$, $P = 0.000$, $\alpha = 0.01$). Figure 4 is a bar chart for age distribution of farmers to compensation form selection. Cash and job opportunity were the most anticipated compensation forms for local farmers. Age group 1 and 2 (20–39 years old) preferred to attain a stable job in order to secure long-term livelihood by themselves. Age group 3 (40–49 years old) had similar selections on both cash and job opportunity. Age group 4 and 5 (50–75 years old) preferred to get cash, with the selection portion of 59.7 % among over 50-aged

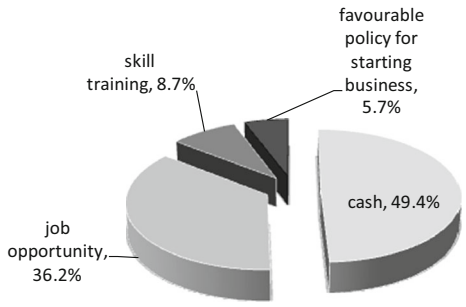

Fig. 3 The most desired form of compensation toward the next GFGP

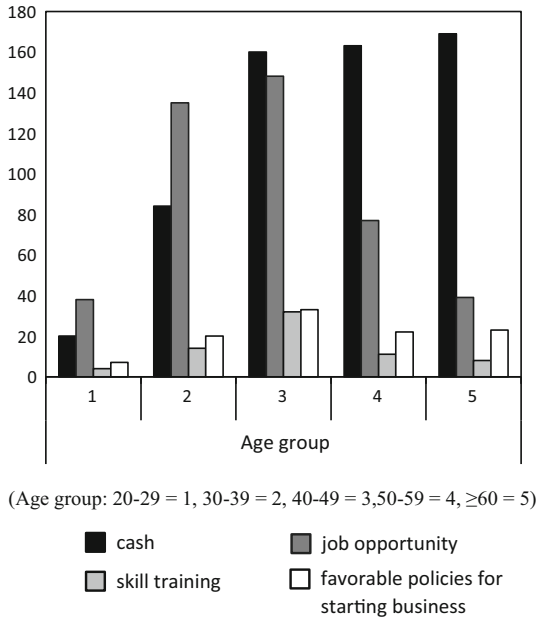

Fig. 4 Age distribution of farmers for compensation form selection

Table 3 Attitude and perception of local farmers to the past GFGP policy

	Disagree (%)	Neutral (%)	Agree (%)	*N*	Mean	SD
Payment compensation for economic loss in GFGP is satisfied	33.1	23.9	43.0	1207	0.10	0.867
GFGP has a negative effect on your current life	85.5	8.3	6.2	1207	−0.79	0.537
GFGP improved local environment	0.3	0.2	99.5	1207	0.99	0.141
You will not reclaim if the payment ends	32.1	28.6	39.3	1207	0.09	0.852

Disagree = −1, Neutral = 0, Agree = 1

and 70.7 % among over 60-aged. Age group 3 (40–49 years old) was the major group in choosing favorable policies for starting business, accounting for 46.4 %. Age group 1 (20–29 years old) was the least in choosing skill training, accounting for 6.7 %, whereas group 3 (40–49 years old) was the most, accounting for 31.4 %, and other groups accounted for about 20 % each.

Respondents' Willingness to Participate

We investigated farmers' willingness to participate in the next GFGP and the associated reasons. The results (Table 4) illustrated that most respondents (74.4 %) agreed to accept the next GTGP with payment. About 91 % of them thought that GFGP might free them from low-paying field work so that they could work outside villages while receiving financial aid. Considerable respondents (16.8 %) were reluctant to quit their farmland with compensation. Among them, 68.6 % insisted that they need farmland to keep livelihood, 25.7 % thought that compensation was far less than their expectation and 5.7 % were unwilling to leave their devoted land. The other 8.8 % were neutral on the next GFGP.

We performed binary logistic regression on the correlation between willingness to participate in the next GFGP and demographic characteristics of respondents. Neutral and opposition were combined as opposition in the explained variable, and the explanatory variables were region, gender, age, education, migrant identity, and occupation. The results (Table 5) showed that gender and migrant identity had significant influences on the respondents' willingness. When gender was similar, non-migrants were more reluctant than migrants to participate. When migrant identity was similar, females were more reluctant than males to participate. Together with Table 4, the analysis suggested that females and non-migrants had higher livelihood dependency on cropland or were relatively unsatisfied with previous payment.

Table 5 Relationship between willingness to participate and demographic characteristics

Explanatory variables	Willingness to participate			
	B	SE	df	Sig
Region (reference = rich group)	0.013	0.146	1	0.928
Gender (reference = male)	−.473	0.143	1	0.001*
Age (years)	0.002	0.006	1	0.696
Education (years)	0.013	0.039	1	0.733
Migrant identity (reference = migrant)	−.396	0.141	1	0.005*
Occupation (reference = agriculture)	−.258	0.172	1	0.134
Constant	1.211	0.537	1	0.024*

* Significant at the level of 0.05

Influence Factor of WTA

We investigated the WTA among the 681 respondents who indicated willingness to participate in the future GFGP and had arable land. When calculating compensation, the respondents tended to take the following as references: recent output value of crops per year, domestic basic living expense, current national compensation standard, and rural land usufruct granting fee in near villages.

In order to quantitatively analyze influence factors on WTA, the WTA value [Yuan/(mu. year)] of respondent was taken as an explained variable, and the explanatory variables were from respondent's characteristics, attitude to reclamation, and the most desirable form of compensation. The enter regression method was used to get the model parameters and fitting effect, and variance inflation factors

Table 4 Respondent's willingness to participate in the next GFGP and the associated reasons

Attitude	%	Reasons	%
Agree	74.4	Farmland is infertile and the income from it is very low	48.8
		GFGP is good for environmental conservation. Moreover, young people can go out for a work or migrate to town without worry, and the aged may gain payment without farming	42.0
		Follow the national policies, and believe that our government will gradually optimize the policies	10.2
Disagree	16.8	The whole family live on farmland, or farming can at least sustain livelihood	68.6
		Previous payment standard was too low. Farmland will have a higher price if requisitioned by the government or transferred through usufruct granting	25.7
		Land is essential for us to subsist	5.7
Neutral	8.8	Although GFGP benefits the environment, it is not worth if the payment is low	41.3
		Without endowment assurance, I'm fare of losing land	10.5
		I need to consult with my family	48.2

(VIFs) about the explanatory variables were measured as well (Table 6).

The results showed that the residuals of the model obeyed normal distribution. The multicollinearity among explanatory variables was relatively weak, and there were multi-factor association and certain particularity in the formation of WTA values in EPB.

The following factors had significant influence on WTA: region, cultivated land area, the most desirable form of compensation, and occupation. Observing through the symbols of coefficient estimation, the respondents living in rich region had relatively higher WTA values; whereas farm laborers and those respondents with more cultivated land area or choosing "job opportunity" as compensation had relatively lower WTA values. Speculated reasons were: (1) Respondents living in rich region usually had more consumption choices and higher daily expenses. They had higher psychological expectations on future income, which spontaneously weighed their consideration for a higher WTA value. (2) Households owning more cultivated land might have farmland left after the next GFGP, which likely bring them more assurance of land and less demand for compensation. (3) The expectant livelihoods of respondents choosing "job opportunity" as the most desired compensation form were mainly in non-agriculture sectors. They were not concerned much with the revenue from and risk-defense function of farmland, but were rather eager to quit agricultural work. So their WTA values were relatively low. (4) Agricultural laboring respondents tended to consider WTA in reference to their annual crop output value, which was low because of the local barren soil. Consequently, their WTA values were also relatively low.

The following factors had no significant influence on WTA: orchard area, forest area, number of feeding pig and chicken, gender, education, age, migrant identity, annual family income, and attitude to reclamation. Land-use change in the GFGP was mainly about farmland, so the orchard and forest area reasonably had no significant impact on WTA. Livestock feeding in EPB was not closely related to farmland use. According to local farmers,

Table 6 Regression results of the influence on WTA

Categories	Explanatory variables	*B*	SE	*t*	Sig	VIF
Respondent's characteristics	Region (reference = poor group)	701.792	58.519	11.993	0.000*	1.336
	Gender (reference = female)	18.702	56.654	0.330	0.741	1.050
	Age (years)	−3.134	2.424	−1.293	0.197	1.366
	Education (years)	−1.521	14.227	−.107	0.915	1.211
	Family income ¥25001–50000 (dummy, reference ≤ ¥25000)	−36.580	56.846	−.643	0.520	1.335
	Family income ¥50001–75000 (dummy, reference ≤ ¥25000)	40.287	134.206	0.300	0.764	1.308
	Family income ≥ ¥75001 (dummy, reference ≤ ¥25000)	−184.673	527.994	−.350	0.727	1.365
	Family size	−23.625	15.611	−1.513	0.131	1.214
	Migrant identity (reference = non-migrant)	−22.474	57.089	−.394	0.694	1.285
	Cultivated land area (mu)	−108.172	16.659	−6.493	0.000*	1.278
	Orchard area (mu)	12.645	28.169	0.449	0.654	1.073
	Forest area (mu)	16.109	13.201	1.220	0.223	1.099
	Number of feeding pig	−1.306	2.634	−.496	0.620	1.381
	Number of feeding chicken	−11.903	8.540	−1.394	0.164	1.084
	Occupation (reference = non-agriculture)	−161.792	66.613	−2.429	0.015*	1.217
Attitude to reclamation	Neutral (dummy, reference = disagree)	86.139	61.202	1.407	0.160	1.351
	Agree (dummy, reference = disagree)	−45.011	59.952	−.751	0.453	1.350
The most desirable form of compensation	Job opportunity (dummy, reference = cash)	−222.719	63.684	−3.497	0.001*	1.459
	Skill training (dummy, reference = cash)	−83.388	99.846	−.835	0.404	1.092
	Favorable policies for starting business (dummy, reference = cash)	−9.034	102.884	−.088	0.930	1.137
Constant		1555.411	204.535	7.605	0.000*	

Explained variable: WTA value [Yuan/(mu. year)], 1 mu = 1/15 ha

* Significant at the level of 0.05

chickens were fed with outdoor insects and pigs were fed with wild grasses in small feedlot, while concentrated feedlot mainly relied on both feed and wild grasses. Thus livestock feeding had little influence on WTA. Distributions of age, gender, education level, and attitude toward reclamation were approximately equal in the high, medium, and low WTA values, indicating no significant influence of these factors. Migrant identity and annual family income had relatively high correlation with the region factor. So, when the region category was controlled, they had little influence on WTA.

Spatial Difference of WTA

Given the significant influence of region factor on WTA, we analyzed the spatial difference of WTA in 10 surveyed districts further. The results showed that (Table 7), the average WTA value was 1111 Yuan/(mu. year) (about annual \$ 2673 ha^{-1} based on the currency rate of September 2012) in EPB. Although it was 4.5 times the local compensation standard in 2000, it was close to 1000 Yuan/(mu. year), the average output value of local agriculture in recent 3 years. Therefore, WTA as a whole truly reflected the increase in opportunity cost of farmland conversion within a decade. The average WTA values of 10 surveyed districts ranged from 624 to 1868 Yuan/(mu. year). The ranking from high to low was: Wanzhou, Yubei, Zigui, Fuling, Fengjie, Kaixian, Badong, Wushan, Zhongxian, and Yunyang. WTA values in Wanzhou, Yubei, and Zigui were higher than the mean value in EPB. According to the interviews and surveys, we deemed that this result might be related to the opportunity of farmers in contact with the outside world. Wanzhou, Yubei, and Zigui are located in the central, the end and the beginning part of TGRA, respectively, Zigui is also the site of the Three Gorges Dam. Along with the construction of the Three Gorges Dam, these three districts had gradually become not only water port, but also airport, railway, and highway transportation hubs in TGRA. More convenient transportation results in easier communication with the outside for rural farmers in these three districts. They could perceive information of socioeconomic development more promptly, and have more non-agricultural job opportunities than farmers in other districts. In some degree, the geographic advantages determined their higher WTA values.

Discussion

GFGP is a complicated and systematic ecological restoration project, with the core to improve human-nature harmony (Liu et al. 2007). Restoration success depends not only on scientific validity and technical feasibility but also on social acceptance. Social acceptance and feasibility are necessary prerequisites for restoration success and need to be addressed first in the restoration planning and implementation process. Using a bottom-up management mode can help link an ecological restoration project with its stakeholders, improve community involvement in decision-making, and reduce obstacles of restoration process in the future. Rural farmers are fundamental units linking the environment and social economy in countryside. Usually, their desire and behavior have some interaction with and feedback mechanism toward local ecological environment. Gaining insights into the connotation of this feedback mechanism and its complex natural-social-economic background would enable policy makers to make appropriate decisions. The variations in the participation willingness, most desired form of compensation, and WTA values of the next GFGP we observed among different demographic characteristics clearly highlighted the importance of acknowledging and considering this feedback mechanism.

The investigation revealed some gaps between rural ecological consciousness and behavior choice of farmers. Basically, they recognized the ecological effects of GFGP, but reacted differently to reclamation after the end of financial compensation. The respondents chose reclamation

Table 7 Spatial difference of WTA in EPB

WTA value	Hubei		Chongqing								Total
	Ba dong	Zi gui	Wu shan	Feng jie	Yun yang	Wan zhou	Kai xian	Zhong xian	Fu ling	Yu bei	
N	44	30	61	25	96	117	77	94	84	53	681
Min	175	200	85	500	125	0	750	180	300	405	0
Max	2400	4000	2350	2500	3000	3550	1900	3000	1800	4000	4000
Mean	905	1335	892	1090	540	1868	1027	624	1107	1680	1111
SD	733.7	1081.8	657.3	562.4	466.9	848.2	160.7	400.3	325.8	917.4	774.8

The unit of WTA value was Yuan/(mu. year), and 1 mu = 1/15 ha

or remained neutral were mainly agricultural laborers and over 50 years old. This finding was consistent with the GFGP study results in North China by other scholars. For example, Wang and Maclaren (2012) found that although 60 % of respondents supported the GFGP, a fair proportion (16 %) planned to reclaim at the end of subsidies in Dunhua county, China. Cao and his colleagues also revealed that while 63.8 % supported the project, a large proportion (37.2 %) planned to reclaim if the subsidies ended in Shaanxi province, and elder farmers were the main class inclining to reclamation (Cao et al. 2009). This gap superficially resulted from the long-term preference of aged farmers to crop farming. However, the more underlying reason was the conflict between public interest in environmental resource and rural financial benefits (Fan et al. 2005; Xu et al. 2006b, 2007, 2010b). The objective of the GFGP in China was to attain a comprehensive improvement of both ecology and economy. In reality, it tended to first achieve ecological benefits, especially in some ecologically sensitive areas. Given the national needs for environmental health, the prior wood species of GFGP was usually ecological forest in ecological function areas (Xu et al. 2006b). In this circumstance, local farmers could not get any long-term economic benefits from ecological forest, apart from a limited short-term payment. Nevertheless, farmers will generally choose to do something from their standpoints of own interest (Ferraro and Kiss 2002). They will reclaim an ecological forest if they can make more profits than by protecting it. In addition, owing to their low level of education, most of aged farmers lacked the ability to make a new living if a project such as the GFGP failed to provide alternative livelihoods. That is to say, as a traditional livelihood, reclamation is indeed attractive after the end of payment, if farmers are under financial pressure. Lessons from restoration projects in other countries also showed that, surplus rural labor might really be a potential threat on ecological protection in ecological function areas (International Institute for Environment Development 1994). All these indicate that it is very important to link the next GFGP with alternative policies, helping farmers possess ability and opportunity to make a new living.

Analysis on expectant compensation forms showed approximately equal proportions for selection of direct (49.4 %) and indirect payment (50.6 %). Aged farmers (over 50 years old) preferred direct payment, while young (20–39 years old) and middle-aged (40–49 years old) preferred the indirect. In general, a direct payment approach will be more cost-efficient than any indirect approach (Ferraro and Simpson 2002; Ferraro 2011; Ferraro and Kiss 2002; Wunder 2007). However, about half of the farmers were interested in indirect payment, supporting that a single direct payment was inadequate to meet the diverse demands of farmers. It potentially reflected limited local opportunities for non-agricultural investment or employment. From another perspective, this investigation result partially reflected farmers' positive response to dynamic socioeconomic changes in China. In recent years, rapid development of urbanization and implementation of urban–rural integration policy in China have fostered ample interactions between countryside and city (Xiong 2011). For example, surplus rural laborers unceasingly participated in urban construction, urban residents often visited rural area for experiencing a new life style or leisure travel, and companies invested in modern agriculture through land usufruct granting in rural areas (Zhu 2014). These economic activities have brought new livelihood opportunities to local rural farmers, especially to the young and middle-aged farmers full of vigor. Hence, many of them preferred to solve long-term livelihood by indirect payment. Overall, diverse payment demands among farmers reflected their varying concerns on current and long-term interests. In order to coordinate these concerns, it's necessary to integrate local ecological restoration projects into regional sustainable development organically by market mechanism. In the long run, increasing greenery coverage rate and improving farmers' income by alternative livelihoods are equally crucial to project success.

The investigation indicated that most of the farmers (74.4 %) were willing to participate in the next GFGP, so as to reallocate their labor to rural–urban migration or off-farm activities with higher income. A considerable number of farmers (25.6 %) with high livelihood dependency on cropland or unsatisfied with previous project compensation were opposite or neutral to the next GFGP. Binary logistic regression indicated that females and non-migrants were more reluctant to participate than others. The influence of migrants on willingness might only be unique to the TGRA, but the gender effect was consistent with the findings by other studies. Some scholars have pointed out that the gender factor plays an important role in behavior decision because it can influence attitudes, beliefs, opinions, and values (Byrnes et al. 1999; Eisler et al. 2003). In addition, females were considered more vulnerable than males in rural China's restoration projects because they had less income and education, and thus were more difficult in securing a new job (Cao et al. 2009; Xu et al. 2007). Our study showed that, as a whole, the level of local participation in the next GFGP was high, but it was necessary to link alternative policy and indemnificatory measures with the next GFGP for the weak (females, the older, and those with the lowest income and least education), so as to reduce the potential resistance during future implementation process.

WTA survey can learn more about preferences and strategies of stakeholders, thus providing important and

direct reference for policy design in ecological restoration (Goldar et al. 2001; Li et al. 2010; Moreno-Sanchez et al. 2012; Carson 2012). Our results showed that the average WTA of 10 survey districts in 2012 was 4.5 times the local compensation standard in 2000, which exhibited obvious social heterogeneity and regional difference. It further illustrated that, with the development of society and economy, the opportunity cost of GFGP in rural China was increased. For a long time, the implementation of compensation standard of the past GFGP in China had a strong maneuverability, but it might overlook social heterogeneity and regional differences of the opportunity cost that farmers participated in the ecological restoration. To some extent, it might have reduced the enthusiasm of farmers' participation, the fairness of ecological compensation and the effectiveness of fund use. A restoration policy design should match with the current local social conditions and system (Sterner 2012). China's GFGP is a large-scale restoration project involving a wide range of ecological and social conditions. In an implementation area with large population, it is particularly important to balance the local farmers' socioeconomic demands for alternatives and the national needs for environmental health. Therefore, in order to improve the efficiency of the next GFGP investment, it is necessary to build a vertical partnership (Cao et al. 2009) between the local community and the nation, helping projects adapt to unique local conditions.

Conclusion

Our study found that, farmers with lower levels of education, older age, and higher livelihood dependency on farmland were the most vulnerable in GFGP. They had no other living skills except for farming, and in the absence of career training and employment projects, could hardly find new jobs. Consequently, they had more tendencies to reclamation after the end of payment. Females and non-migrants were more reluctant to participate in the next GFGP than others. However, traditional farming was no longer preferred by most of the respondents. Most of them (74.4 %) wanted to be liberated from the low-income work in farmland through the next GFGP, and more than half of them (50.6 %) hope to get indirect payment. The average WTA was annual ¥16,665 ha^{-1} in EPB, which was 4.5 times the local compensation standard in 2000. The main factors with significant influence on WTA were as follows: region, cultivated land area, whether to choose "job opportunity" as compensation, and whether engaged in agricultural production.

In summary, there were diverse needs among participating farmers, and the opportunity cost of the next GFGP was substantially higher than before. Also, the high demands for alternative livelihoods by a large local population are actually the greatest challenge for the next GFGP in the study area. Therefore, the success of the next GFGP depends on assurance of farmer's long-term interests, which will require decision-makers not only to increase compensation standard appropriately meeting farmers' current interests, but also to solve local popular basic demands and rights beyond the ecological consideration, by using more comprehensive policy (not just special focus on grain and payment). For example, the government must provide reliable social security for farmers, more education and training (to improve farmers' knowledge level and operational ability on future employment alternatives), and occupation development projects (to provide alternative employment). Given the actual situation of TGRA, specific measures are suggested as follows. First, the proportion of economic forest or ecological-economic species forest could be increased in suitable areas that are less ecologically sensitive. Second, technical training and employment about planting and deep processing of forest products should be well operated through some well-demonstrated modes, such as "leading enterprises + production base + farmers". It will help farmers adapt to modern forestry technology, catch the employment opportunities close to their residence, and benefit from forestry economy eventually. Finally, other skill training projects such as livestock breeding, computer use, cooking, handcrafting and so on should be regularly carried out. It will help farmers master one or two practical technologies so as to develop their desired agricultural tourism or find jobs outside countryside in the future.

In a nutshell, the EPB case delivered the following two key messages for future design and implementation of restoration projects in China. First, when the government proposes to implement restorations projects for ecological benefits, it needs to supplement comprehensive policies to mitigate negative impacts on local communities' livelihood; it also needs to proactively provide the local communities with more education, training, and alternative employment. Second, since there is usually some social and regional heterogeneity in WTA for the restoration projects among local communities; the uniform national compensation standard system may likely reduce the investment efficiency of projects. So, differential region-based compensation standard system and a vertical partnership between the local community and the nation should be established, especially in areas with high levels of sensitive ecology and many heterogeneous local communities, so as to help projects adapt to unique local conditions and modify unsustainable ecological-economic feedbacks promptly.

Acknowledgments We would like to thank Dr. Wei Hu, Dr. Ding Li, Prof. Xin Yu, Associate professor Wei Zhang, Mr. Yong Yu, Ms. Jinghan Di, and Mr. Zhuang Gao for their helpful suggestions and discussion in writing this paper. We gratefully acknowledge the financial support from Key Technologies R&D Program of China (2012BAC06B04), State Three Gorges office Program of China (2013HXKY2-1), and the National Natural Science Foundation of China (41271552).

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