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Factors Influencing Farmers' Willingness to Participate in the Conversion of Cultivated Land to Wetland Program in Sanjiang National Nature Reserve, China

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Abstract Sanjiang National Nature Reserve (NNR) is a state-owned natural wetland in China that has suffered severe degradation due to cultivation and wetland reclamation by farmers. As a consequence, the conversion of cultivated land to wetlands (CCW) was proposed by the government of Heilongjiang province and the United Nations Development Programme/Global Environment Facility (UNDP/GEF) project team in 2007. We suggest that voluntary participation in the CCW could be an important tool for accomplishing the integrated objectives of wetland conservation and local development. The purpose of this study was to examine the main factors that influence farmers' willingness to participate in the CCW through a field investigation and a questionnaire. Based on the data from our questionnaire, which provided an effective sample of 310 households in 11 villages, the influencing factors of farmers' willingness to participate were analyzed through binary logistic regression analyses. It was concluded that age, education, the amount of cultivated land, geographical location, and the perceived benefits and risks were important factors for participation. Furthermore, suggestions for improving the wetland compensation system and providing alternative livelihoods are proposed to strengthen participation.

Keywords Conversion of cultivated land to wetland (CCW) · Farmers' participation · Compensation system · Alternative livelihoods · Sanjiang National Nature Reserve (NNR) · China

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Introduction

Wetlands provide important ecological, economic, and social benefits. For example, they improve water quality, control floods, reduce nutrient levels and pollution, and provide habitats for diverse communities of plants and animals and recreational opportunities and economic benefits for rural communities (Herath 2004). However, wetlands are threatened by water extraction, the alteration of natural flow patterns, deforestation, land reclamation for civil construction, agriculture and peat mining. These human impacts have resulted in the loss of more than half of the original wetlands in the world (IUCN 1987; Millennium Ecosystem Assessment 2005). In China, 80% of the wetlands that once existed have been destroyed or degraded due to unsustainable use patterns (Lu 2009), causing losses of biodiversity. At many sites, this loss of wetlands also threatens the sustainable development of communities as the communities become trapped in a downward spiral of natural resource over-exploitation, environmental degradation and poverty (Wang and Sheng 2005). In China, increasing attention is now being paid to the restoration of wetlands and the promotion of the environmental benefits of it (Zhang and Wang 2001). Some examples include the ratification of the Ramsar Convention

on Wetlands of International Importance and the designation of six Ramsar sites in 1992, as well as the ratification of the Convention on Biological Diversity in 1993.

Wetland restoration is not a one-dimensional environmental issue. Rather, it is complicated by a combination of environmental and socio-economic factors (Chen 1996). Most previous research about wetland conservation and restoration has only focused on wetland ecosystems, and there has been a lack of attention being paid to local development and the important role wetlands play in providing resources for local people. As a result, measures and policies related to wetland conversion and restoration have often been ineffective or less effective than intended, especially in developing countries (Lu 2004; Parker 1982; World Conservation Union 1980; Xie and others 2004). We argue that the participation and support of local people, as the most important stakeholders in wetland restoration programs, are critical in achieving wetland restoration objectives. This involvement is particularly vital when the wetlands are in close proximity to local communities, where the establishment of mutually beneficial ways of utilizing such areas is crucial to ensure their continued existence (Pearsell and Mulamoottil 1994).

Past efforts to restore wetlands have often been implemented in a top-down manner and have been insensitive to local conditions in China (Lu 2004). For example, it has been government policy to establish natural reserves, restore wetlands and limit local community use of wetland resources without providing sufficient compensation or guiding communities towards alternative livelihoods and sources of income. Consequently, there have been considerable conflicts between wetland conservation and local development (Morris and others 2000; Zhang and others 2007). Such conflicts have been demonstrated by numerous studies from other countries where a lack of farmer and rural community participation has been detrimental to conservation strategies (Abbot and others 2001; Goosen and others 2007; Salam and others 2005). Therefore, local community participation is deemed critical to ensure the sustainable development of wetland areas. One useful indicator related to this is a local community's willingness to participate in wetland restoration programs. Theoretically, the significance of an individual's willingness (attitude) is linked to their likely behavior (Ajzen and Fishbein 1980). Generally speaking, an indication of positive willingness towards wetland restoration could lead to pro-wetland behavior, such as local participation in wetland restoration and the conservation of the wetland resources. Therefore, it is our hope that the results of this study will contribute to the development of practical wetland restoration policies for local government and environmental organizations that are able to foster willingness to engage in the conversion of cultivated land to wetlands (CCW) and inspire pro-wetland behavior.

Background

Sanjiang Plain in Heilongjiang Province is a vast, low lying alluvial floodplain of approximately five million hectares at the apex of the Heilongjiang and Wusuli rivers (Cui and Liu 1999). It is one of the key wetland areas in China because it is a geographically unique, large wetland area and because of the biodiversity it supports. In its former natural state, the floodplain ecosystem consisted of a mosaic of sedge and reed marshes, wet grass meadows, ox-bow lakes, riverine scrub and wooded hummocks. Approximately 12,800 km^2 of wetlands still exist, which is 11.75% of the total area of Sanjiang Plain, and over 2,130 km^2 of wetlands are protected under two national nature reserves, Sanjiang and Honghe (Liu 2005). These nature reserves contain some of the remaining examples of the natural mosaic of wetland habitats. These habitats provide suitable breeding grounds for globally threatened wetland birds, such as Oriental White Stork (*Ciconia boyciana*), the White Naped Crane (*Grus vipio*), the Red Crowned Crane (*Grus japonensis*) and Chinese Merganser (*Mergus squamatus*). In addition, the agro-ecological environment of Sanjiang Plain is particularly suitable for agriculture. Since the 1950s, the emphasis of development in this area has been focused on food production, so the ecological value of the wetland has tended to be ignored (Liu 2005). During the past 50 years, wetland acreage of approximately 38,829 km^2 has been converted to cultivated land (Liu 2005). In recent years, with increasing concern about the environment, particularly related to biodiversity conservation, Sanjiang Plain has become a problematic area characterized by constant conflicts between wetland conservation and agricultural development.

Consequently, considerable efforts have been directed towards the formulation and implementation of sustainable management strategies for wetlands in Sanjiang Plain. The wetland biodiversity conservation and sustainable use project funded by the United Nations Development Programme/Global Environment Facility (UNDP/GEF) was initiated in 1999 and continued for 10 years. This project aimed to enhance biodiversity conservation through innovative approaches to organization, planning, training, information management, and the integration of local communities into reserve management. The project selected four representative but different sites with high global biodiversity importance (Sanjiang Plain, Ruoergai Marshes, Yancheng Coast and Dongting Lakes) as study areas. In the Sanjiang Plain sector, one of the main objectives was to protect the existing wetlands and restore wetlands

reclaimed in the wetland reserve. Thus, the CCW has been proposed by the Heilongjiang provincial government and the UNDP/GEF project team. Sanjiang National Nature Reserve (NNR), the largest wetland reserve in Sanjiang Plain, provides a vivid illustration of the existing crisis related to wetland reclamation in China. To protect the endemic biodiversity of wetlands in Saining Plain, this report, which was based on research funded by the UNDP-GEF project, took Sanjiang NNR as a study area. We anticipate that the conclusions from this study may also be relevant to other wetlands in China.

Sanjiang NNR is located at the border of Fuyuan County and Tongjiang town in Heilongjiang province, near the Sino-Russian border. It is the site of the confluence of three major rivers, the Heilong River (Amur in Russia), the Wusuli River (Ussuri in Russia), and the Songhua River. Its total acreage is 1,980 km^2, of which the core zone is 660 km^2, the buffer zone is 280 km^2, and the experimental zone is 1,040 km^2. Before this area was appointed as a reserve, 24 villages existed, and there are currently 26 villages, with 11,000 farmers residing inside the reserve (Sanjiang NNR 2007). Agriculture is the predominant mode of employment and income in the Sanjiang NNR. The average annual income per farmer in the reserve was only 3439 RMB Yuan (452 U.S. Dollars) in 2007 (Sanjiang NNR 2007), which was far below the average for the country of 4140 RMB Yuan (606 U.S. Dollars), making it one of the more economically disadvantaged and materially poor areas in China.

The Sanjiang NNR was created as a provincial reserve by the Heilongjiang government in September 1994, in response to continuous pressure from farmers related to wetland reclamation and wetland degradation (Zhang and others 2008). Subsequently, it was designated as a national reserve in April 2000 by the central government and was listed as a Wetland of International Importance under the Ramsar Convention in January 2002. Despite many national and international initiatives to protect and manage the wetland resources and ecosystems of Sanjiang NNR, additional efforts are required. In particular, there has been little successful demonstration of the integration of wetland conservation with economic development activities, and there has been a lack of mechanisms to involve communities in wetland management (Wang and others 2008). As a result, wetlands are being degraded. Additionally, some illegal reclamation still continues due to a number of factors, including unclear property rights and boundaries, the opportunity to achieve additional agricultural income (after the cancellation of agricultural taxes in 2003), and the limited enforcement capacities of authorities (Zhang and others 2008). Wetland managers and environmentalists working in the area now recognize that the involvement of local people and wetland users in policy-making decisions will help to avoid possible sources of conflict (Zhou and Liu 2005).

Literature Review

Since the 1970s, wetland conservation and restoration has increasingly been studied and analyzed worldwide (Wang and Sheng 2005; Zhao 2005). Research related to environmental management has mostly targeted policies and systems for wetland management, ecological compensation and local development to meet the integrated objectives of wetland conservation and local development (Dickinson and others 2006; Johst and others 2002; Li and others 2006; Turner and others 2000; Wang and Liu 1997; Wang and Li 1997), which are of particular relevance to this study. Furthermore, with the advent of community-based conservation models (CBC), many researchers have focused on community issues in the field of wetland management (Berkes 2004). There is a wide range of literature on the perspectives of local people related to this subject, which has generally included analyses of their attitudes and opinions about wetland conservation and restoration (Christopoulou and Tsachalidis 2004; Dickinson and others 2006; Getzner 2002; Streever and others 1998; Wattage and Mardle 2005), and this remains a subject of growing interest among researchers and managers (Bramwell and Sharman 1999). Recent studies have concentrated on the willingness to participate in conservation activities and valuation and decision frameworks (Ando and Getzner 2006; Stone and others 2008) as well as on participatory decision-making (Antunes and others 2006; Charnley and Engelbert 2005; Farmar-Bowers and Lane 2009). A variety of studies have shown a connection between residents' willingness/attitudes and their behavioral intentions (Hudson and Ritchie 2001; Kim and others 1988; Kim and Littrell 1999; Lepp 2007; Ma and others 2009; Yu and Littrel 2005). Furthermore, McKenzie-Mohr and others (1995) found that while pro-conservation attitudes predicted behavioral intent, pro-conservation attitudes only occasionally predicted pro-conservation behavior. Kaiser and Gutscher (2003) and Kaiser and others (1999) suggested that "willingness to participate" fails as a predictor when general measures of attitude are used to predict specific behaviors. Consequently, they found that a general measure of willingness towards environment conservation was a good predictor of general conservation behaviors. Therefore, we argue that surveying and quantifying "willingness to participate" represents a useful tool for hypothesizing relationships between farmers' willingness towards the CCW and farmers' behaviors.

More commonly, research into residents' willingness towards wetland restoration has been used to judge a wetland restoration program's appropriateness for a particular community, as it is thought that positive willingness is an indication that the social and cultural obligations of wetland restoration are being met. In this regard, a number

of variables have been used to explain residents' attitudes towards wetland conservation and restoration, including personal characteristics, personal beliefs and experiences, spatial distribution, and different economic, legal, social and ecological concerns (Cullington 1981). The relationships between these variables and residents' attitudes merit further discussion. Dickinson and others (2006) have shown that personal variables have a considerable influence on behaviors. The most significant of these variables include gender, age, physical characteristics and personality features. However, in addition to personal variables, participant willingness is influenced by many other factors, including spatial distribution (Wattage and Mardle 2005), resource use interest (Arjunan and others 2006), environmental benefits (Streever and others 1998), household income level, environmental knowledge of the program and program implementation (Ma and others 2009), and perceived advantages and disadvantages (Söderqvist 2003). As this literature review shows, a variety of factors can influence residents' willingness to participate in wetland conservation and restoration.

The Chinese Wetland Conservation Context

Wetland conservation and restoration efforts have begun recently in China. A number of donor-funded technical-assistance projects for wetland protection and biodiversity management have been initiated in China. Wetlands International-Asia Pacific has been working in China through their China Program since the early 1980s to actively promote water bird conservation, wetland management and staff training initiatives. The Wetlands International-China Program was involved in the formulation of the National Wetland Conservation Action Plan (NWCAP), has initiated several mangrove conservation projects in southern China, and has launched a large-scale wetland awareness program throughout the country. The World Wide Fund for Nature (WWF) China program is also actively involved in wetland matters, working on a number of issues. Despite these activities, little is currently known about farmers' perspectives towards wetlands in China. There are few reports related to wetland restoration and community development in China. For example, Zhang and others (2007) discussed the relationships between wetland conservation and local development in Sanjiang Plain, and they suggested that a compensation system is needed to subsidize the economic losses of farmers. This suggestion is based on historical experiences from compensation systems related to the conversion from cultivated land to forest in China. At the time of the writing of this manuscript in October 2010, there exists no authorized compensation system for wetland conservation and restoration in China (Ma 2010). Currently, there are local government plans for the provision of the CCW compensation in Sanjiang NNR (i.e., altering traditional agriculture through increasing technical aids, reallocating or buying new land for farmers and encouraging farmers to engage in non-agricultural industries), but the program has not yet been implemented because of funding problems. Pan and others (2006) and Li (2008) evaluated the degree of dependence of the economies of adjacent communities on resources of the wetland reserve. Their results indicated that the economies of the villages surveyed were closely connected to the wetland reserve, and they noted that approximately 40% of villages' economic income came from the wetland reserve. Therefore, they advised managers to develop mechanisms to involve the community in wetland conservation to alleviate the pressures from economic development. Wang and others (2008) demonstrated the desire of farmers for alternative livelihoods in an investigation of their existing livelihood conditions in Raohe County in Sanjiang Plain. The term "alternative livelihoods" was originally used in the literature related to rural development, and it has been widely used in reserve and environmental protection practices in recent years (Brandon and Wells 1992; Nepala and Webera 1994). In this report, the term "alternative livelihoods" refers to new development models for improving economic development without destroying ecological systems, such as eco-tourism, sustainable agriculture, aquaculture and breeding industries through the development of new skills and types of employment and the provision of services, or the production/provision of goods. Although the development of alternative livelihoods has been described as an effective tool to reduce poverty and protect the environment (Adeel and Safriel 2008), it still faces many problems, such as the need to develop new markets, management plans and resources. The relatively poor circumstances of farmers and a lack of social welfare programs in China will likely influence farmers' judgment regarding the feasibility of new livelihood options (Wang and others 2008).

If Sanjiang NNR is to be conserved or protected, the expansion of agricultural activities in its wetland areas needs to be contained. We argue that one of the primary approaches that should be implemented for the conservation and restitution of these wetland areas is the CCW. The CCW is based on local farmers' willingness to allow a part of their cultivated land be converted to wetlands in Sanjiang NNR. Such a conversion is likely to result in a loss of agricultural income, on which local farmers depend for living. Past research in this area emphasized only the need to recognize the ecological value of wetlands, neglecting the costs of wetland conservation and restoration borne by local farmers (Zhang and others 2007). Additionally, past policies related to the CCW have been top-down approaches that lacked farmers' participation. Furthermore, the

CCW has remained in the preliminary policy stage, so there are no successful experiences with this process for reference. In particular, the current lack of a functional compensation system for the CCW that could help shift farmers to alternative livelihoods is hampering the implementation of the CCW program. All of these problems indicate that a strong requirement for the sustainable management of and policies related to the CCW is that they be deemed acceptable by local communities.

Community (local people or stakeholders) participation is viewed as a key to the success of ecosystem restoration (Stone and others 2008) because decision-makers recognize local people as the main stakeholders of restoration programs who have the power to influence restoration outcomes. Moreover, from the perspective of management, knowledge of people's motivations underlying their decision to participate in restoration is very useful and will assist managers in designing restoration education programs, promoting community involvement and making funding decisions (Stone and others 2008). We suggest that the success of the CCW hinges on farmers' willingness to participate in this process, so it is important to understand their motives for participating or not. The purpose of this study was to measure the farmers' willingness to participate in the CCW and the factors influencing it using a questionnaire and a binary logistic regression analysis. Through this analysis, we were able to further investigate why farmers vary in their level of interest in taking part in the CCW. Additionally, some obstacles to the CCW are discussed, and our results provide a reference for the sustainable management of and policies related to the CCW.

Materials and Methods

Data Collection

Sanjiang NNR has undergone considerable conversion from wetlands to cultivated land since the 1950s. Marsh acreage in the region decreased from 1610 km^2 in 1954 to 170 km^2 in 2005 as a result of the development of the National Grain Production Base (the National Grain Production Base is an area of agricultural specialization in which agricultural production and related industries are highly successful) and disturbance due to farmers (Sanjiang NNR 2007). Consequently, the acreage of cultivated land increased from 20 km^2 in 1954 to 800 km^2 in 2005, and 80 km^2 of cultivated land currently exists in the core zone and the buffer zone (Sanjiang NNR 2007). For conservation reasons, the UNDP/GEF project team and the local government have proposed that cultivated lands in the core zone and the buffer zone should be converted into wetlands as soon as possible. The region that will be influenced by the CCW policy includes 876 households distributed among 18 villages surveyed by the NR Administration (Sanjiang NNR 2007). This report was based on samples of farmers in 11 of the 18 villages. Due to time and labor constraints and the difficulty of accessing some of these villages, seven of them were not included in the study. Six villages in the buffer zone are located in the Wusuli River basin, including Dongxing, Donghe and Dongsheng of Zhuaji town and Haifeng, Haiwang and Liangzili of Haiqing town. The other five villages in the experimental zone are located in the Heilong River basin and include Fuxing, Hongxing, Hongwei, Hongfeng and Jianxing of Nongqiao town (Fig. 1). We selected these villages to provide a representative sample across the buffer and experimental zones.

Data collection was carried out from May to August in 2007. We designed a questionnaire with the help of the staff of Sanjiang NNR and of experts (members of the GEF project) who convened a meeting on farmers' willingness to participate in the CCW. This meeting consisted of 20 participants who were selected from different villages inside the reserve using purposive sampling. Considering the fact that community participation in research programs is not generally popular in China due to a range of cultural reasons, the GEF project selected participants who were village leaders and people participating in GEF training programs who had already heard about the CCW program. They were asked about their attitudes toward the wetlands and wetland restoration and the benefits received from the reserve. We built the questionnaire according to the main concerns of the communities about the CCW expressed at the meetings and dispensed the questionnaires to farmers selected randomly from 330 households in 11 villages that were chosen from the list of households provided by the NR Administration. The surveyed farmers completed the questionnaire in the villages with the help of the investigators. In the survey, we obtained as many farmers' comments related to the CCW as possible. Of the distributed questionnaires, 310 (93.9% of the response rate) were returned that were correctly filled out, and the data from these questionnaires were subjected to various analyses (Table 1). The response rate was so high because the surveyed farmers were interviewed face-to-face, and a local coordinator from the villages was employed by the GEF project who helped to facilitate the field investigations and administration of the questionnaire.

The questions on the household characteristics (from 1 to 11) included in the questionnaire are shown in Table 2. Respondents were also asked a series of questions concerning their perception and willingness to participate in the CCW (Table 2: questions 12 to 18). Some questions (Q1, 2, 3, 4, 5, 6, 7, 12, 14, and 17) in the questionnaire were used as indicators to measure factors influencing the farmers' willingness to participate in the CCW. The fact

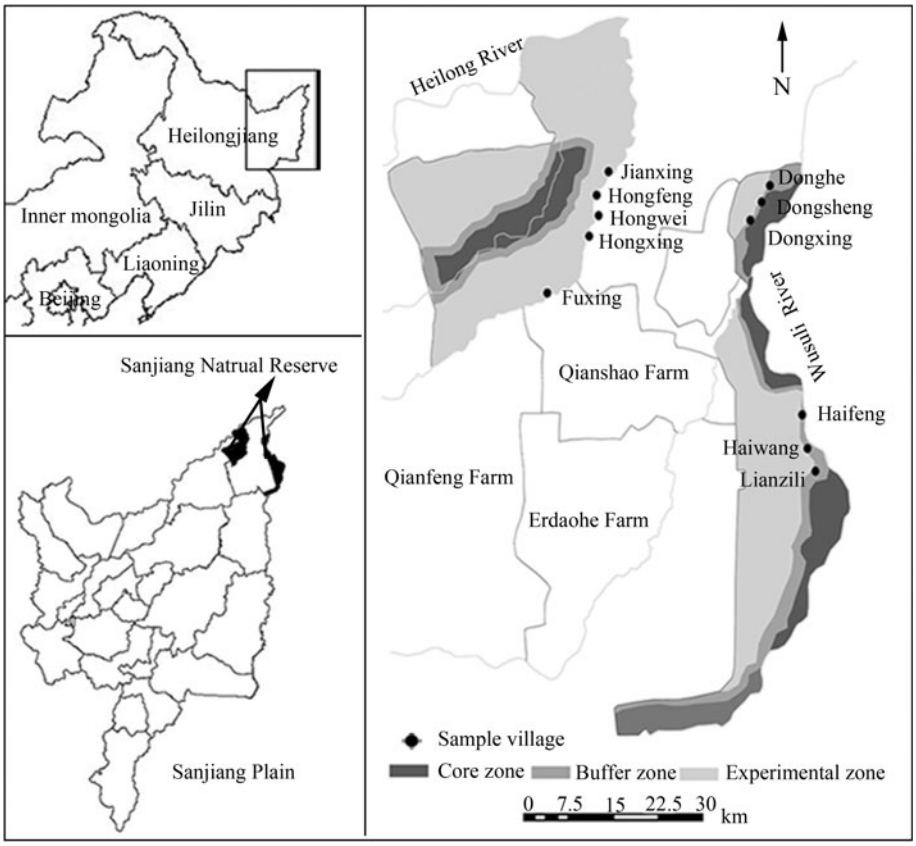

Fig. 1 Distribution of sample villages in Sanjiang National Nature Reserve. *Note*: The core zone is the location of highest environmental and/or cultural value and therefore requires a higher level of management intervention. The aims of the core zone are to protect the original well-established ecosystems, to protect endemic, rare and globally-threatened species, to prohibit any human activities except some by special ratification. The buffer zone is a zone outside but immediately surrounding the core zone. Its purpose is to act as buffer for the core zone-meaning that restricitions can be placed on most activities, with scientific activities such as ecosystem monitoring allowed. The experimental zone surrounds the buffer area, where nondestructive forms of research, education and tourism are permitted, as well as some human settlements.

Table 1 Summaries of basic data from the sampled villages (2007)

	Sampled villages	Sampled households	Total households	Per capita cultivated land (hm^2)	Per Capita annual net income (Yuan)	Total cultivated land (hm^2)
Buffer zone	Dongxing	30	67	3.06	3000	733
	Donghe	30	56	4.55	3100	1023
	Dongsheng	25	85	2.18	2600	667
	Haifeng	25	101	6.12	3300	2528
	Haiwang	25	120	5.76	3000	2934
	Liangzili	25	59	3.04	2000	820
Experimental zone	Fuxing	30	90	1.80	3200	700
	Hongxing	30	79	3.50	4000	1143
	Hongwei	30	88	2.21	3200	807
	Hongfeng	30	62	3.17	3500	827
	Jianxing	30	61	1.60	2800	419

1 U.S. Dollar = 7.5215 RMB Yuan (2007)

that farmers do not yet participate in the program implies that these variables measure intentions rather than actual behavior. However, a positive attitude is likely to be positively correlated with a later decision to participate.

Data Analyses

Binary logistic regression models are often used for analyzing individual decision making when the dependent variable has only two values. In this study, we analyzed which factors would promote farmers' participation in the CCW and their contributions through this type of model. At the same time, we used qualitative descriptions to complement our quantitative results, which cannot explain local farmers' attitudes and incentives towards the CCW.

The dependent variable delineating the willingness of farmers to participate had values of 0 and 1, with 0

Table 2 Questions asked of the sampled households on household demographics, property of cultivated land, the main sources for sustunance, and farmers' perception and willingness to participate in wetland restoration

Personal/household	
1. What is your gender?	open
2. What is your age?	open
3. How long have you been here?	open
4. How about your education?	open
5. How many people are there in your family?	open
6. What is your annual income?	open
Property of cultivated land	
7. Do you own cultivated land? If yes, how much?	open
8. What is your viewpoint on the problems facing cultivated land?	open
Main source for sustain	
9. Which livelihoods do you depend on for living?	open
10. Do you have other skills for living besides agricultural aspects?	open
11. Will you give up cultivation if agricultural income is worse than before?	Yes/No
Farmers' perception and willingness	
12. Are you interested in participating in a wetland restoration program?	Yes/No
13. If yes, in your opinion, which benefits would you like to obtain from wetland restoration? (multiple-choice)	open
14. As far as you are concerned, how many benefits will you get from wetland restoration?	open
15. In which way do you participate or are interested in participating in the program? (multiple-choice)	open
16. If no, in your opinion, which risks would you face with regards to wetland restoration? (multiple-choice)	open
17. As far as you are concerned, how many risks will you face with regards to wetland restoration?	open
18. What plans do you have if you do participate in wetland restoration? (multiple-choice)	open

representing unwillingness and 1 representing willingness. The meaning and distribution of the traits of the variables used in the model are presented in Table 3.

We examined the survey data using a backward conditional logistic regression. First, all independent variables were input into the regression model to determine whether

Table 3 The definitions of the variables included in the model and sample distribution

Factors	Definition	Distribution (%)	Factors	Definition	Distribution (%)
Gender	Male = 1	30.9	Family members	≤1 person = 1	13.9
	Female = 0	69.1		2–3 person = 2	50
				≥4 person = 3	36.1
Age	<30 = 1	23.6	The amount of cultivated land	<2 hm^2	30.3
	30–39 = 2	34.9		2–4 hm^2	29.4
	40–49 = 3	24.6		4–12 hm^2	24.5
	50–59 = 4	14.2		≥12 hm^2	15.8
	≥60 = 5	2.7			
Lengths of residency	<10 years = 1	15.8	Geographical location	Buffer zone = 1	51.6
	10–30 years = 2	45.7		Experimental zone = 2	48.4
	>30 years = 3	38.5			
Education	≤6 years = 1	25.5	Perceived benefits	No benefit = 1	19.7
	7–9 years = 2	59.6		Few benefits = 2	31
	≥10 years = 3	14.9		Benefits = 3	29
				Many benefits = 4	20.3
Annual income	<5000 Yuan = 1	10.7	Perceived risks	No risk = 1	24.2
	5000–12000 Yuan = 2	30.3		Little risk = 2	25.8
	12001–20000Yuan = 3	45.7		Risk = 3	29
	≥20000Yuan = 4	13.3		Much risk = 4	21

Table 4 Results of estimation of farmers' willingness to participate with the Logistic model

Factors	Regression coefficient(B)	Standard deviation (S.E)	Ward	Significance test (Sig)
Age	−3.163	1.189	7.080	0.008
Education	1.177	0.374	9.899	0.002
Amount of cultivated land	−0.915	0.355	6.633	0.010
Geographical location	2.363	0.722	10.702	0.001
Perceived benefits	1.398	0.491	8.096	0.004
Perceived risks	−1.456	0.751	3.762	0.052
Constant	1.990	0.886	5.277	0.022

the respondents' gender, age, length of residency, education, annual income, family members, amount of cultivated land, geographical location or perceived benefits and risks were independently associated with an individual's willingness to participate in the CCW. Independent variables that had no significant correlations with dependent variables were eliminated, and the test was then continued until the independent variables had a significant impact on the dependent variables. As a default, SPSS uses a probability of Entry of 0.05 and a probability of removal of 0.10 (SPSS Inc., Chicago, Ill.). The variables included in our equation are provided in Table 4.

Results

The age of the farmers in the sample ranged from 23 to 68 years. They mainly depended on agricultural income for their livelihoods (3.36 ha of cultivated land per capita). In the sample, 70% of the farmers had cultivated lands in the core zone or the buffer zone. Just over half of the respondents (56.13%, $n = 196$) had positive attitudes toward the CCW. Additional details are given in Table 3. The results of our logistic regression showed that many independent variables, including age, education, amount of cultivated land, geographical location and farmers' perceived benefits and risks from wetland restoration, were closely associated with their willingness to participate in the CCW (Table 4). Three of these variables (geographical location, education, and perceived benefits from wetland restoration) had positive correlations with participation level, whereas the other three variables (age, amount of cultivated land, and perceived risks from wetland restoration) had negative correlations with participation.

However, gender, length of residency, annual income and family members were found to have little or no correlation with willingness to participate. This limit in the correlations between influencing factors was probably because of the farmers' heterogeneity and the limited number of samples collected. Further research might determine the reasons that these variables were eliminated.

Age and Participant Willingness

We divided the population data into five subpopulations based on age: <30, 30–39, 40–49, 50–59 and >60 years old. The percentage of farmers who were willing to participate in wetland restoration within these categories were 84.9% (<30; $n = 62$) of the total $n = 73$, 67.0% (30–39; $n = 73$) of the total $n = 108$, 52.0% (40–49; $n = 40$) of the total $n = 77$, 45.5% (50–59; $n = 20$) of the total $n = 44$, and 12.5% (>60; $n = 1$) of the total $n = 8$.

The regression results also indicated that age had a negative impact in explaining the level of participation; i.e., the older farmers were less likely to participate. For the older farmers, traditional agriculture had been their occupation for nearly their entire life, so they were either unwilling or had no capacity to change their occupation. Additionally, the older farmers regarded cultivated land as the most basic source of sustenance for themselves and their offspring. However, there were several exceptions noted in the interviews who indicated that that they might be willing to participate in the CCW because of two main factors: (1) a lack of labor available in their family, leading to limited cultivation and decreased agricultural income; and (2) the possibility of receiving appropriate compensation with which to live an easier life in their remaining years. The younger farmers expressed their dissatisfaction with the agricultural lifestyle and poor economic conditions, and they exhibited a higher demand for increased living standards. Additionally, many of the younger farmers wanted to engage in multiple industries or relocate to towns or cities to seek economic opportunities using the compensation for the CCW. Therefore, they tended to be willing to participate in CCW and were the main supporters of the CCW.

Education and Participant Willingness

There was a significant correlation between education level and willingness to support the CCW (Table 4). Individuals with higher education levels generally had more favorable attitudes towards the CCW than those with lower education

levels. Of individuals who had been educated for ≥10 years, 89.1 % were willing; of individuals with 7 to 9 years of education, 78.5% were willing; and for individuals with ≤6 years of education, 60.3% were willing.

From the survey, we learned that education level and knowledge related to wetland conservation and restoration resulted in more positive views from the respondents. Better educated people were more aware of the potential ecological benefits derived from wetland conservation than individuals who were poorly educated. However, face-to-face interviews revealed that a portion of the better educated people were unwilling to participate in the CCW because their greater knowledge about the policies and systems related to the CCW cause them to consider more issues. For example, they regarded community participation as a complicated and difficult process without the existence of previous successful experiences for reference. They also doubted whether they would receive reasonable compensation payments in a timely manner because a compensation system had not yet been implemented by the government. These responses revealed that previous wetland conservation policies had not effectively addressed the most important of the local farmers' concerns (e.g., the compensation system and the mechanisms of community participation).

Amount of Cultivated Land and Participant Willingness

Respondents with different amounts of cultivated land had different attitudes towards the CCW (Table 4). All individuals without cultivated land had positive attitudes probably because they not only would be subjected to no loss of economic benefits from the CCW, but they could also obtain indirect environmental benefits from the wetlands. The survey results showed that over 50% of individuals who owned cultivated land of <2 hm^2, 2 to 4 hm^2 or >12 hm^2 were willing to participate in the CCW. More specifically, 70.72% of respondents with cultivated land of <2 hm^2 held positive attitudes because agriculture was not their dominant source of income. They received lower profits from their smaller cultivated land areas compared to the other industries in which they were engaged. Individuals with cultivated land of 2 to 4 hm^2 generally depended on their cultivated land for sustenance, and most of these individuals were suffering poor economic conditions as a result of unsteady agricultural income; in this group, 61.5% of people reported being tired of agricultural production and willing to retire from cultivation (based on interviews). Individuals with cultivated land of >12 hm^2 were rarely engaged in agricultural production alone but also rented out parts of their cultivated land. These individuals had reliable incomes and were materially wealthy; 55% of them exhibited concern for environmental benefits. In their opinions, the conversion of a portion of their cultivated land to wetlands would not only contribute to wetland conservation but also offered sufficient compensation for their lost cultivated land. Therefore, they were more positive towards the CCW program (based on interviews).

Individuals with cultivated land of 4 to 12 hm^2 exhibited a surprisingly negative perspective related to wetland restoration (62.21%: unwillingness, 37.79%: willingness). One of the reasons for this result that we obtained through the survey was that these farmers divided their cultivated land into two parts: one they cultivated and one they rented out. Thus, they could obtain an abundant income from the two sources. However, they had less land from which to derive income than the >12 hm^2 cohort, and therefore, they seemed unwilling to give up a portion of their cultivated land.

The results from the interviews also showed that the poorest households, whose annual income was less than 10,000 yuan (1316 U.S. Dollars), were likely to participate in the CCW due to a lack of income generation sources or having no steady income generation sources. These people thought that the CCW could represent a potential income source if it were to be implemented.

Geographical Location and Participant Willingness

In this study, geographical location refers to the proximity of farms and households to wetlands. People who lived in close proximity to the wetlands exhibited a stronger personal interest in the CCW program because it was most likely to affect them as a group. In Dongxing, Donghe and Dongsheng of Zhuaji town, which are located in the buffer zone, at least half of the farmers were favorable towards the CCW (Dongxing: 50%, Donghe: 63% and Dongsheng: 50%). The proportions were higher than those in Haifeng, Haiwang, and Liangzili of Haiqing town, which are also in the buffer zone (Haifeng: 47.8%, Haiwang: 45% and Liangzili: 44%). In our field survey, three villages in Zhuaji town near the marsh were low-lying and inaccessible due to inundation. In addition, less cultivated land in the core zone and the buffer zone meant that the CCW was likely to have less negative impacts on farmers' incomes in these villages. However, farmers in another three villages of Haiqing town, which lies on the Wusuli River border, frequently obtained income from fishing and wetland resources (e.g., crabs and reeds). Therefore, wetland conservation and restoration would result in a loss of access to wetland resources and cultivated lands for these farmers. As a result, farmers in these villages adjacent to the Wusuli River were more hostile towards the CCW.

Another comparison between the six villages in the buffer zone and the five villages in the experimental zone showed that farmers in the experimental zone were more

favorable towards wetland restoration than those in the buffer zone (buffer zone: 49%, experimental zone: 61%). This result may be explained by the fact that farmers in the experimental zone were farther away from wetlands than those in buffer zone, which meant that they neither relied on wetland resources nor were likely to be heavily impacted by the conversion of cultivated land to wetland. Therefore, most the farmers in the experimental zone were willing to participate in the CCW. In summary, households that would lose cultivated land under a CCW scheme tended not to support the CCW, and those who used wetland resources heavily were often opposed to wetland conservation.

Farmers' Perceived Benefits and Participant Willingness

There was a significant positive correlation between perceived benefits and participant willingness (Table 4). Respondents who thought that wetland restoration could provide more benefits to them were more willing to participate in the CCW. Correspondingly, respondents who thought that wetland restoration programs would result in greater negative effects were opposed to participation. These results suggest that high amounts of compensation would stimulate farmers' participation. Many studies in developing countries have shown that people receiving benefits from conservation programs are more likely to express positive attitudes (Studsrod and Wegge 1995; Udaya Sekhar 2003).

Additional questions were asked of farmers holding positive attitudes towards the CCW about which benefits farmers could receive from the CCW and regarding the reasons for farmers' interest in participation in the CCW (Table 2, Q13, and Q15). According to the categories listed in Table 5, many respondents preferred environmental benefits (69.46%). This result indicated that a general improvement of the environment was, to some extent, perceived as a personal benefit; that is, the existence of a private share of the public good of environmental quality was acknowledged. Obtaining reasonable compensation was welcomed (23.01%), and it represented an important perceived economic benefit for farmers.

The sampled farmers reported that the most popular compensatory method would be cash compensation in the form of government payments (45.5% of respondents) followed by job opportunities for farmers (27.7% of respondents) (Table 6). Having a steady non-agricultural income (26.1% of respondents) or equivalent land replacement (24.2% of respondents) also were also popular options. Only 2% of respondents would give up agricultural production if their agricultural revenue was worse than before. We also found that 85% of the farmers selecting cash compensation hoped to obtain sufficient compensation in one payment, while only 25% of them hoped to obtain a portion of compensation per year for many years. Respondents were asked hypothetically if they received compensation, what they would do with this money. Most of the respondents did not yet have any specific plans.

Farmers' Perceived Risks and Participant Willingness

In general, the potential risks from wetland restoration were perceived as relatively low by respondents who positively participated in wetland restoration (Söderqvist 2003). Risk refers to a loss of income in this article. Our results showed that the perceived risk from the loss of cultivated land was a variable significantly influencing farmers' willingness to participate. However, the degree correlation with this parameter was lower than some of the factors already discussed (Table 4), partly because some respondents believed that there would be concurrent benefits and risks of the CCW. In terms of answers to Q13 and

Table 5 Benefits for willingness to participate in CCW (multi-choice)

Benefits	Environmental benefits	Obtaining reasonable compensation	Having enough time to engage in other industries	Having more economic opportunities	Development of intensive agriculture	Have more leisure time
Percentage	69.46%	23.01	12.55	10.04	9.21	1.26

Source: 176 answer

Table 6 Reasons farmers were interested in participation in CCW (multi-choice)

Ways	Cash compensation	Job opportunities	Having steady non-agricultural income	Equivalent land replacement	Agricultural revenue was worse than before
Percentage	45.5	27.7	26.1	24.2	2

Source: 176 answer

Table 7 Risks farmers' perceived and the reasons for farmers' unwillingness to participate in CCW (multi-choice)

Risks	Regarding cultivated land as the most basic source for sustaining their livelihoods	Having no other employment skills	Lack of enough money to do other economic activities	not obtaining reasonable compensation	Not obtaining compensation on time
Percentage	38.1	33.6	28.8	17	8

Source: 286 answers

Q16, we found some respondents who wanted to obtain benefits also worried about risks derived from the CCW.

For a better understanding of the risks that farmers perceived and the reasons for farmers' unwillingness to participate in the CCW, Q16 (Table 2) was asked of all respondents, irrespective of whether they would participate. The three main stated perceived risks were (Table 7): regarding cultivated land as the most basic source for sustaining their livelihoods (38.1% of respondents), having no other employment skills (33.6% of respondents) and lacking enough money to engage in other economic activities (28.8% of respondents). These results indicated that farmers were strongly concerned about the loss of livelihood caused by the CCW. Other important reasons given were, for example, that farmers worried about either not obtaining reasonable compensation (17% of respondents) or not obtaining it on time (8% of respondents). These answers also demonstrated that the lack of a functioning compensation system for the CCW is a major impediment to its implementation.

Discussion and Conclusions

With respect to individual characteristics, individuals with different ages and different education levels held different attitudes towards the CCW. The younger farmers and the better educated farmers were more likely to participate in the CCW. A close examination of the study area provided insights related to this result. Farmers' ability to make a living, the expectation of higher living standards and the attitude towards environmental benefits were important determinants of farmers' willingness. An explanation for our finding that age had a negative impact in explaining the level of participation was given by Dolisca and others (2006) related to forestry management programs. They pointed out that older farmers were mainly interested in collecting forest resources, while young people were willing to participate in and contribute to the process of decision making affecting forestry programs. This result was similar to our findings for the different age groups in our study of the CCW in China. We also found that the less educated farmers were less likely to participate in wetland activities. This finding was consistent with observations that have been made by several other scientists (Cihar and Stankova 2006; Dolisca and others 2006).

The amount of cultivated land and geographical location influenced the main income sources of local farmers. Whether farmers were willing or not willing to participate in the CCW partly depended on whether they were satisfied with the agricultural lifestyle and economic conditions. This result indicated that attitudes to support the CCW or not were associated with farmers' livelihood concerns. Wattage and Mardle (2005) showed that spatial distribution was associated with livelihoods and resulted in different stakeholder preferences towards conservation versus development. However, the amount of cultivated land as an indicator has not been studied before. We regarded cultivated land as an indicator because of the special socio-economic background of the Sanjiang NNR, where the cultivated land is the main income generation source (Wang and others 2008).

The differences of farmers' perceptions towards the benefits and risks associated with wetland restoration implied that individuals had different perceptions and attitudes towards the CCW; farmers were more positive to the CCW if they were aware of the benefits associated with their participation. In contrast, farmers were more hostile to the CCW if they paid more attention to risks associated with their participation. In this regard, much of the literature on this topic has demonstrated that the perceived advantages and disadvantages tend to be the most important determinants for the acceptance of the CCW (Arjunan and others 2006; Söderqvist 2003; Stone and others 2008; Wattage and Mardle 2005). Therefore, it is necessary to develop management mechanisms involving community participation in Sanjiang NNR to share opinions and ideas on how the CCW can benefit farmers and how it can be viewed as a benefit. Regular meetings or working groups with the participation of the NR Administration and local farmers would be a good starting point for learning from and listening to each other. For such a program to work, farmers should have some power to influence specific decisions of local governments and the NR Administration. Principles of democracy could be better applied in the decision-making processes after consultations with participants. The development of effective compensation systems and more equitable and transparent policies regarding the CCW are required to attract more farmers to participate

voluntarily and to eliminate farmers' concerns about the effectiveness and risks associated with the CCW.

The farmers' responses showed that more than half of the respondents were in favor of the CCW, regardless of their geographical location or economic interests. Most farmers realized the wetland's ecological and utilitarian values. Streever and others (1998) surveyed public attitudes and values related to wetland conservation in New South Wales, Australia, and showed that over 90% of the respondents thought that there was intrinsic value to wetlands and that it was important to conserve wetlands for future generations. However, Ambastha and others (2007) reported that in some cases, people who were highly dependent on wetland resources for their livelihoods remained reluctant to protect wetlands. We also found that the overriding concern of farmers was maximizing their own economic benefits, and following that, they might begin to consider ecological/environmental benefits. In this scenario, although the concept of conservation was well supported, households that would be affected by the CCW tended not to support wetland restoration. Therefore, the CCW must ensure that farmers experience no economic losses, or wetland restoration goals cannot be accomplished. These results also explain why wetland reclamation has not been effectively prevented in Sanjiang NNR without a functioning compensation system for wetland conservation and alternative livelihoods for local farmers.

Implementing the CCW in developing countries represents a challenge because a large number of farmers depend on cultivated land for sustenance (Arjunan and others 2006). Therefore, the compensation system for the CCW is extremely important for making up for the loss of agricultural income. Ando and Getzner (2006) showed that wetlands with high use values cannot be protected without extensive compensation. A functioning compensation system would also play a significant role in persuading farmers to be willing to participate. In our study, most of farmers would not give up cultivated land without an acceptable compensation system. Moreover, farmers' preferences towards economic compensation and job opportunities were the most important incentives in stimulating farmers' willingness to participate. Some studies have revealed that without creating opportunities for local people to benefit from wetland restoration, it is difficult to spur farmers to become involved in wetland restoration programs (Crépin 2005). Therefore, the compensation system for the CCW is a principal precondition for carrying out the CCW program. The compensation system should be focused on the needs of farmers, and compensation should consist of the restoration costs, opportunity costs and development costs for farmers (Xiang 2006). Restoration costs and opportunity costs represent the basic needs of farmers. However, after farmers lose cultivated land, they will more strongly depend on a social welfare system, unless alternative income sources are generated through alternative employment schemes. The required social welfare system could be focused on economic development opportunities provided by government, such as capital, skills and knowledge related to various livelihoods.

A shift towards alternative livelihoods may play a decisive role in striking a balance between economic gain and unacceptable environmental impacts (Mbile and others 2005). Considering farmers' perceived risks, we found that farmers were uncertain about future development and that they lacked a sense of security, both of which were latent reasons influencing farmers' willingness to participate. When the CCW is implemented in Sanjiang NNR, it will inevitably lead to social problems of common concern, raising questions such as whether there are other economic opportunities for farmers and how farmers can improve their living standards. Most of the sampled farmers expressed uncertainty about their future, and they were awaiting the results of government welfare policies. This outcome showed that farmers lacked empowerment and options related to their livelihoods. In addition, it was evident that local government lacked effective measures to guide and support alternative livelihoods. It is clear that a variety of alternative livelihoods need be introduced to farmers to avoid farmers being overly dependent on cultivated land, which has been identified as a long-term and powerful method for implementing wetland conservation and restoration (Arjunan and others 2006; Cihar and Stankova 2006). In response to this goal, educational programs could be provided by local governments and the NR Administration that are involved in initiating wetland restoration activities to provide communities with case studies of prior restoration projects and their benefits to communities. Such case studies should focus on livelihoods and restoration techniques that would be appropriate for Sanjiang NNR. For instance, once the CCW has been carried out, farmers could be provided with economic incentives (such as loans, pilot programs, and allocations) and training to engage in new livelihoods (such as tourism, particularly eco-tourism, conservation and ranger activities, non-exhaustive use of non-timber products, and less damaging agricultural or aquaculture activities).

The farmers' responses directly present the main obstacles existing to the CCW. One of these obstacles is that it is difficult for a wetland restoration policy to consider both economic benefits for farmers and wetland conservation. Additionally, the lack of a compensation system and policies to support alternative livelihoods are the most significant obstacles. Therefore, the CCW needs to be carefully designed and implemented in Sanjiang NNR. Willingness surveys should be conducted prior to

program implementation, which will help to identify the main concerns of local farmers and to design a more effective intervention program for promoting farmers' participation. Additionally, the government should increase wetland conservation publicity through the dissemination of information and technical training, enhancing the fairness and transparency of wetland restoration policies, and improving farmers' understanding of the CCW activities and their ability to participate, thereby improving farmers' positive participation in this process.

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