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Sustainable management and farmer's willingness to participate: A case study of Deepor beel

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ABSTRACT

Deepor Beel is the only Ramsar site of Assam and is the only key storm water storage basin for the Guwahati City. In the last few years, Deepor beel restoration has been at the center of discussion in Assam's wetland ecosystem restoration initiative because of the scale and socioeconomic functions of the wetlands to this region. Government has already adopted policies concerning all the issues relating to the deterioration of Deepor beel but a restoration programme will be successful only if locals participate in it. This paper thus tried to assess the views of the farmers, the primary user of the wetland. A case study has been conducted on Mikirpara Chakardo village, where people are engaged in agricultural practice in the fringe areas of Deepor beel. Only (30%) of the farmers are willing to participate in wetland restoration programme in general and the remaining 70% were not willing to participate. Factors that might affect farmers' participation decisions were analysed through the application of binary probit regression model. Education and knowledge of wetland's ecological benefits and values (Benefit knowledge) were found to be significant at 5% level of confidence.

Key words: *Wetland ecosystem, Restoration, Agricultural practice, Willing to participate*

Introduction

Wetlands are among the world's most important environmental resources and in many countries; wetlands are the greatest natural asset for a productive, safe and sustainable environment. Wetlands were generally used for agriculture, fishery or just for recreation. They also serve as a source of fuel, wood and construction material. Wetlands are vital to life as they provide water for our basic needs and our economic prosperity and many people rely entirely on wetlands for their livelihoods and food security. Wetlands are important centres of biodiversity, harbouring endemic species, migratory species etc. Wetlands are essential for a sustainable urban or rural life. The livelihoods of millions of people were contributed by the wetlands in diverse ways. The rapidly growing population in many places, in conjunction with efforts to increase food security, is putting pressure to expand agriculture within wetlands. If wetlands are not used sustainably, the functions which support agriculture, as well as other food security and ecosystem services, including water-related services, will be undermined.

Assam is one of the 8 states of North East India. Except two hilly areas viz. Karbi-Anglong and North Cachar Hills, Assam, by and large comprises a valley of river Brahmaputra and Barak which includes mostly low lying flood prone areas. In the flood plains of these two rivers water bodies and swamps are found and these water bodies are lo-

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cally known as beel, whereas the marshes and swamps are known as Jalah, doloni, pitoni, doba, or hola. Assam Remote Sensing Application Centre identified 3513 wetlands of sizes above 2.25 ha. According to the Directorate of Fisheries of Assam there are 1392 beels in Assam out of which 423 are registered and 962 were unregistered. Wetlands and its resources are the main supplement of the basic needs of the rural poor. According to the National Wetland Atlas, estimated wetland areas in Assam are 764372 ha, which is around 9.74 percent of the total geographical area of the state. Due to various hydrological regime and diverse physic-chemical parameters of soil and water the Beels of the Brahmaputra valley have rich diversity of flora and fauna.

Out of 3513 wetlands of Assam, Deepor Beel is one of the most significant wetland as it is listed as the only Ramsar Site of Assam in November 2002. Deepor Beel is also a wildlife sanctuary and a chief bird area as identified by Bombay Natural History Society (BNHS) and Birdlife International since 2003. The Beel is one of the largest freshwater wetland and is the only chief storm water storage basin for Guwahati City. It is rich in floral and faunal diversity. In addition the wetland eco-system experiences large number of nomadic waterfowl every year. The villages adjacent to the beel depend on the beel directly or indirectly for their livelihoods.

In the last few years, Deepor beel restoration has been at the centre of discussion in Assam's wetland ecosystem restoration initiative because of the scale and socioeconomic functions of the wetlands to this region. Deepor beel helps in reducing the impact of flash floods that Assam experiences every monsoon. Deepor Beel supports a large number of bird species recorded in India. According to the species richness of wetland bird species belonging to seventeen families and their comparison to mainland India designate that Deepor Beel Ramsar site is a hotspot for bird species. The wetland experiences a total number of 232 avian species; some of them are local wetland birds and others migratory. Deepor Beel is also a passageway and water source for animals in the adjacent forest reserves. The wetland not only provide benecial services to the locals and agricultural production, but also play a vital ecological role in sustaining the ecosystem, including water quality improvement, ooding control, climate regulation, protection of wildlife habitat, and prevention of soil erosion and degradation (Gogoi, 2016). However in recent years growing encroachment and other activities like permanent structure construction, agricultural activities, illegal earth cuts, and waste dumping leads to the deteriorating ecological balance and shrinkage of the wetland area over the past few decades.

Recognizing the important functions and services provided by wetland ecosystems and the consequences of wetland destruction the state government has adopting several policies in recent years. Various wetland protection and management policies are being implemented or proposed to ensure environmental protection. The Guwahati Water-Bodies (Preservation and Conservation) Act, 2008 ensures for the development and conservation of Deepor Beel, seeking stability between development and conservation, and would safeguard the wetland from further encroachment and deterioration. In terms of the Wetland (Conservation and Management) Rule 2010, the Deepor Beel area is required to be demarcated instantly for its proper protection.

Various non-profit and governmental organizations in the peripheral villages of Deepor Beel have undertaken various socio-economic programs. The main target of these programs is in capacity building, drinking water supply, alternative fisheries, substitute livelihood, education of children, and mainly public awareness for wetland conservation. With the help of financial assistance from the Central Government, ASTEC (Assam Science, Technology, and Environment Council) is presently working on various socio economic capacity building programmes in the peripheral villages of Deepor Beel. ASTEC has been also providing funds for various research and development projects associated with Deepor Beel. A Guwahati-based NGO named "Eco Concept" has provided the locals an alternative source of income through mushroom cultivation. Many environmental activists have raised concern about the detrimental problems causing the shrinkage and deterioration of the Beel (Gogoi, 2016).

Deepor Beel, which is located at the peripheries of the developing metropolitan, Guwahati. Several issues at Deepor Beel are of immediate concern. At the east side of Deepor Beel a 24-hectare municipal garbage dump yard lies, which not only results in the direct impact on the ecology of the wetland but also led to the aggravating daily situation of the villages nearby the Beel's area. Due to the rapid construction only 10 sq. km of the wetland is covered

by water whereas Ramsar convention talks about 40 sq. km area of any wetland area should be covered under water. There is rapid construction close to the Beel's area. The Government has recognized 40 sq. kms as the total covered area of the Beel. Even in the 40 sq. kms designated by the Government as wetland, there have been constructions at a very rapid pace. Presently, out of the declared Ramsar site of 40 sq. km area, only 10 sq. km is covered by water. Construction of railroad on the southern side of the Deepor beel has fragmented the Deepor beel-Rani and Garbhanga Forest ecosystem into two. The rail road is also accelerating the land encroachment and wetland draining process is now accessible to the previously inaccessible areas and the market value of land is growing rapidly.

It is seen that some of the people who reside near the fringe area of the Deepor Beel involve in paddy cultivation. All the cultivators do not possess their own patta land for cultivation. They cultivate paddy on the peripheral area of the Beel which are occupied by their ancestor. But these agricultural activities are also one of the contributing factors to the wetland deterioration (Dutta, 2016). Government is trying to adopt policies concerning all the issues relating to the deterioration of Deepor beel but a restoration programme will be successful only if locals participate in it. Moreover, local farmers' willingness to participate is vital for the success of wetland restoration. But farmer's willingness to participate may depend upon several factors and therefore it is important to identify those factors that affect their willingness to participate in restoration programme. This paper tries to analyse the farmer's willingness to participate in sustainable management of wetland. For this a case study has been done on Mikirpara Chakardo village, where agricultural practice is done in the fringe areas of Deepor beel.

Literature Review

There is variety of literatures on the individual's decision to participate in wetland restoration programmes and the factors affecting their willingness to participate. Some of the literatures are cited below.

Wilson (1996) showed that the important variables such as age, education, length of residency, farming philosophy and the presence of remnant semi-natural habitats on farms explain farmers' outlooks toward wetland conservation. Ambastha *et al*. (2007) study evaluates the economic relationships between the Kabartal wetland and the local people by using Contingent Valuation Method (CVM). While assessing importance of the wetland to the locals more than 50% want that the wetland should be drained for agricultural purpose.

Oladele and Wakatsuki (2008) crop preferences, farming system, culture, and taste, and land tenure, knowledge of wetland cultivation, perceived suitability, farmers' tribe, location of wetland, and farmers' age etc. can be the vital socio-cultural factors influencing wetland agriculture. Dedah (2010), the study investigates the factors that impact the decisions of the landowners to undertake wetland restoration programme in coast of Louisiana. For understanding landowner's decision-making process in the presence of high uncertainty and increasing restoration costs a theoretical model is developed. Application of Tobit and double hurdle models revealed that Landowners who are risk averse make less investment than others in wetland conservation and risk prone area located land owners are less willing to participate.

Ghosh and Mondal (2013) study revealed that agricultural practices in the upland areas resulted in further degradation of wetland resources due the excessive use of chemical fertilisers and pesticides. The study estimated the non-use values of the wetland and the eects of socio-economic factors on willingness to pay in Chanda Beel freshwater wetland.

Kim and Petrolia, (2013), analyses willingness to pay (WTP) for large-scale coastal restoration in Louisiana and the extent to which the locals are conscious of the benecial functions of wetlands restoration. The study applies both ordered probit and binary probit models show that the public observes both a significant association between increased loss of wetland and an amplified storm risk and a considerable likelihood of enlarged storm-protection benets from wetland conservation.

Zhu *et al*. (2016), conducted a study in Poyang Lake wetland area in china where they found farmers willingness to participate as one of the important factor for the success of wetland restoration programme. Willingness to participate is not easy because farmers always had the fear of possible economic loss due to loss of farmland for the restoration programme, uncertainties regarding wetland regulations and compensation policies etc. This study is the rst attempt by using hurdle model to assess individual farmers' consecutive choices of wetland participation. Application of the model

provides valuable perceptions on how different attributes may inuence the probability of participating in wetland restoration, but once the participation decision is made the model is unable to give further insight on the level of participation in wetland restoration.

Objective

i. To investigate Farmers' Willingness to Participate in Wetland Restoration
ii. To analyse factors that will affect farmers' participation decisions.

Methodology

Data sources

The present study is based on primary data. secondary data pertaining to different aspects of wetlands are collected from relevant books, well-known journals, seminar papers, various web sites, PhD thesis and various sources of Government of Assam such as Ministry of Environment and Forest Assam Data from State wetland authority, Revenue circle office data of the selected area, Directorate of Agriculture, Directorate of Economics and Statistics etc. The primary data are collected from the farming household through structured interview schedule and focus group discussion.

Area of the study

The study will be conducted in Deepor Beel which is one of the most significant wetland as it is listed as the only Ramsar Site of Assam in November 2002. Deepor Beel is also a wildlife sanctuary and a chief bird area as identified by Bombay Natural History Society (BNHS) and Birdlife International since 2003. It is located 18 km south west from Guwahati city. It is situated within the direction of 91°35F to 91°43F E. and 26°05′ to 26°11F N. The NH-37 passes away from the eastern margin of the deepor beel while in the southern part there is Rani Reserve Forest and the Meghalaya hills. Earlier the Beel had natural connection with the Brahmaputra through the Borhola Beel and the swampy extents of Pandu, lying to the Northeast. Due to the construction of NH-37 and speedy encroachment the area has been affected. The main inlet to the Beel is the Basistha River.

Sampling design

There are five revenue villages namely Pamehi, Mikirpara Chakardoe, Lakhara, Lakhara NC and Azara adjacent to the Deepor Beel which comes under Rani Development block in Kamrup (M) District. As this study focused on farmer's willingness to participate so the Mikirpara Chakardoe village has been selected as the sample village where agricultural practice is done in the fringe areas of Deepor Beel. Farming households have been undertaken as primary sampling units. Structured questionnaire will be administered to the farmers which will be randomly selected.

There are 609 households according to the census 2011. After discussing with the village Headman it is found that approximately 80 households were engaged in farming. Due to missing or inconsistent information regarding information on farmer's demographics, characteristics of farm, and knowledge and behaviour toward wetlands, the nal total was 60 farming households. It is head of the household who takes decision regarding any issue so household heads of the farming households whose primary occupation is agriculture were interviewed. Farmers were interviewed regarding their socioeconomic characteristics and were asked to state their willingness to participate if any restoration programme takes place.

Line of analysis

Objectives	Data source	Line of analysis
To investigate Farmers' Willingness to Participate in Wetland Restoration	Primary	Descriptive statistics
To analyse factors that will affect farmers' participation decisions	Primary	Binary Probit model

To analyse the factors affecting farmer's participation decision several variables have been identi-

Mikirpara Chakardo village consists of mainly Schedule Tribes (SC) people. According to the census 2011-

Revenue village	Number HH*	TP*	TM*	TF*	TLIT*	MLIT*	FLIT*
Mikirpara chakardo	609	2802	1409(50.3)	1393(49.7)	2155	1150(53.36)	1005(46.64)

HH*= Household, TP*= Total population, TM*=Total Male, TF*=Total Female, TLIT*=Total Literate, MLIT*=Male Literate, FLIT*=Female Literate

Factors and their effects found in empirical studies of wetland restoration/conservation participation

Study	Identified factors	Effects
Zhang *et al*. (2011)	Gender	Negative
	Education	Positive
	Farmland size	Negative
Ghosh and Mondal (2013)	Education	Positive
	Income	Positive
Kim and Petrolia (2013)	Age	Positive
	Environmental benefits	Positive
	Education	Positive (Signifiacnt)
	Manpower	Positive (Not significant)
Zhu *et al*. (2016)	Farm size	Positive (Not significant)
	Net income	Negative (significant)
	Agriculture profit ratio	Positive (Not significant)
	Policy knowledge	Negative (Not significant)
	Benefit knowledge	Negative (Not significant)

fied from the literatures below-

Model: A binary probit regression model is applied to investigate the factors affecting the decision pattern of farmers in willingness to participate in any wetland restoration programme. Our model consists of the following dependent and independent variables identified from various literatures stated above.

Dependent variable

Willingness to participate in wetland restoration 1 if willing to participate in wetland restoration, 0 otherwise

A farmer is assumed to maximize the expected utility gain from participating in wetland restoration. Let U˝ P = expected utility when a farmer is willing to participate and U˝ N = expected utility of not participating in wetland restoration.

Thus farmer's decision process can be shown as:

$$\text{Willingness to Participate} = 1 \text{ if } U^* P - U^* N > 0$$
$$0 \text{ if } U^* P - U^* N \leq 0$$

A farmer is willing to participate in wetland restoration if and only if the expected utility from participating is greater than that of not participating, that is, U* P > U*N.

The binary choice of willingness to participate is assumed to be generated by a linear latent variable model (Y*)

Independent variables

Variable name	Definition
Age	Farmer's age in years
Gender	1 if male, 0 otherwise
Education	1 if illiterate, 2 if primary, 3 if secondary, 4 if graduate and above
Manpower	Number of available workers in the household (in numbers)
Income (Net Household Income)	Family income of the farmer
Farm size	In bigha's
Agriculture profit ratio	prot ratio proportion of agricultural prot to net household income
Policy knowledge	1 if the farmer knows about the wetland restoration policies taken by govt. and other organizations, 0 otherwise
Benet knowledge	1 if the farmer knows about the ecological benets and values of wetland, 0 if the farmer does not know about the ecological benets and values of wetland
Environmental concern	1 if the farmer is concern about the wetland, 0 if the farmer does not concern about wetland

Willingness to participate $Yi = 1, y^*_i > 0$

where, Y*= latent variable

$0, y^*_i \leq 0$

$Y^*_i = X_i\beta + ei, \quad ei \mid xi \sim N(0, \sigma 2)$

$P(Yi = 1 \mid Xi) = P(Y^*_I > 0 \mid xi) = P(X_i\beta + e_i > 0 \mid xi)$

$= P(ei \geq X_i\beta \mid Xi) = P(ei/\sigma \geq X_i\beta/\sigma \mid xi) = 1 - \Phi(-X_i\beta/\sigma) = \Phi(X_i\beta \mid \sigma)$

y^*_i = farmers' net utility gain by participating in the wetland restoration program

x = independent variables, e = random term

Results and Discussion

In the study area paddy cultivation is practiced during two seasons, they are Ravi (winter) and Kharif (summer) seasons. The Ravi season starts in the months of November-December of a year. The entire process of sowing to harvesting continues till the month of March. From the months of March-April of a year the kharif season starts. Paddies were sown in the months of March, April and May and harvesting takes place during November.

Socio-economic characteristics of farmers

The age distribution among the farmer's shows that 16.67% were between the ages of 20 and 40 years, 58.33% were between 40 and 60 years, and the remaining 25% were between 60 to 80 years. None of the respondents indicated that they are more than 75 years**.** The data reveals that the bulk of the farmers are within the age 40 and 60 years. The gender pattern also reflects variation as there were more male farmers (76.67%) than female farmers (23.33%). The educational attainment among the sampled farmers revealed that (13.33%) did not have any formal education; (60%) had primary education; and (23.33%) had secondary school education and the remaining (3.33%) indicated graduation and above category. Thus, the implication is that the study area is dominated by people with low educational status.

41.67% farmers have the experience of 10 to 20 years, 23.33% have 20 to 30 years' experience, 30% of them have 30 to 40 years of experience and the remaining 5 % have the experience of 40 years and above. The study finds none of them had indicated that they have more than 45 years of experience. 80% of the farmers owned 2 to 5 bighas of land, 8.33% owned 5 to 8 bighas of land and the remaining 11.67% owned 8 to 11 bighas of land.

For the first objective the questionnaire includes

Table 1. Willingness to participate in wetland conservation among the farmers surveyed

Willingness to participate in restoration programme		
	Willing N (%)	Not-willing N (%)
1. How willing would you be to participate in wetland restoration programme in general?	18 (30%)	42 (70%)
2. How willing would you be to participate if you only had to answer questions in a survey?	34 (56.67%)	26 (43.33%)
3. How willing would you be to participate if the restoration programme is free of cost?	27(45%)	33(55%)
Incentives to participate in restoration programme		
	Important (%)	Unimportant (%)
1. Would you willing to participate because you are concerned about wetland?	29(48.33%)	31(51.67%)
2. How important would be important getting paid money as a reason for you to participate?	41(68.33%)	19(31.67%)
3. Is it important that the restoration programme does not charges from you?	20(33.33%)	40(66.67%)
Reasons for refusal to participate in restoration programme		
	Relevant N (%)	Irrelevant N (%)
1. No time to participate due to busy life	33(55%)	27(45%)
2. He/she is afraid of the side effects	31 (51.67%)	29 (48.33%)
3. He/she is skeptical about the restoration programme	31 (51.67%)	29 (48.33%)

one general question about willingness to participate in wetland restoration programme as a research subject. Other specific questions examined reasons for willingness to participate in and reasons for the refusal to participate in the restoration programme. Responses of the farmers are tabulated below.

Table 1 summarizes only (30%) of the farmers are willing to participate in wetland restoration programme in general and the remaining 70% were not willing to participate. (56.67%) farmers seems to have participate only they had to answer questions in a survey are. (45%) will participate only if the restoration programme is free of cost, while majority of them are still not willing to participate. Due to this the questionnaire contains information regarding reasons for participation and reasons for refusal to participate. Only (48.33%) of the farmers stated that they were concerned about the wetland that's why they are willing to participate. Getting paid money as a reason to participate got the highest percentage of participation rate (68.33%). Most of the farmers (55%) stated that they have no time to participate and many of them are afraid of the side effects and are skeptical about the restoration programme (51.67%) and these are the most relevant reason for refusal to participate.

Binary probit regression model is used to regress the probability of farmer's willingness to participate (WTP) decision. The software STATA is used to derive the results, which are interpreted below.

In the Table 2, the Iteration log shows how quickly the model converged and here the model converged at 5th Iteration. The output shows that all 60 observations were used in the analysis. The likelihood ratio chi-square of 44.05 with a p-value of 0.0001 indicates that this model as a whole is statistically significant. In the table we see the coefficients, their standard erros, the z statistics, associated p-values, and the 95% confidence interval of the coefficients. The result shows that age has no impact on wetland restoration decisions. Gender and the number of available workers in the household (Manpower) seems to have no significant influence on farmers' participation decisions. It is evident from the result that education level plays an important role in farmers' participation decisions. Its coefficient is positive and statistically significant at the 5% level of significance. People are very much sure about the benefits they received from the wetland and this shows a significant impact on their decision at 5% significant level. Their marginal effects are considered which shows how likely or unlikely the factors affect their decision pattern (Table 3).

Table 2. Estimated coefficients

```
Iteration 0:   log likelihood = -36.651858
Iteration 1:   log likelihood = -16.234451
Iteration 2:   log likelihood = -14.743403
Iteration 3:   log likelihood = -14.629338
Iteration 4:   log likelihood = -14.628947
Iteration 5:   log likelihood = -14.628947

Probit regression                                 Number of obs   =         60
                                                  LR chi2(10)     =      44.05
                                                  Prob > chi2     =     0.0000
Log likelihood = -14.628947                       Pseudo R2       =     0.6009
```

WTP	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
AGE	.0300604	.0254311	1.18	0.237	-.0197836	.0799044
GENDER	1.54041	.9215286	1.67	0.095	-.2657532	3.346572
MANPOWER	.1831762	.3885911	0.47	0.637	-.5784483	.9448007
EDUCATION	2.527768	.7641796	3.31	0.001	1.030004	4.025533
NETHI	8.27e-06	7.02e-06	1.18	0.239	-5.50e-06	.000022
AGRPROFIT	-.0320244	.0443041	-0.72	0.470	-.1188588	.05481
FARM_SIZE	-.0510482	.2337807	-0.22	0.827	-.50925	.4071535
Policyknowledge	.5493273	.6577278	0.84	0.404	-.7397955	1.83845
BENEFIT_KNOWLEDGE	1.739436	.7876904	2.21	0.027	.1955916	3.283281
ENVIRONMENTALLYCONCERN	.8491177	.6449305	1.32	0.188	-.4149229	2.113158
_cons	-11.05283	4.793431	-2.31	0.021	-20.44778	-1.657879

Petrolia and Kim (2013) find a positive impact, and Ghosh and Mondal (2013) and Zhang *et al.* (2011) finds a negative impact of age. Our result is consistent with that of Zhang *et al.* (2011) who finds that age have no significant impact on the decision pattern of the farmers. The average marginal effect demonstrates that an individual farmer's willingness to participate will increase by 0.4 percentage points as his age increases. Gender of the farmer seems to have no significant influence on farmers' participation decisions to participate. Similarly studies of Zhang *et al*. (2011), Ghosh and Mondal (2013) also reveals that gender have no effect on farmer's decision. The number of available workers in the household (Manpower) seems to have no significant influence on farmers' participation decisions, which is also found by Zhang *et al.* (2011) and Zhu et.al (2016). Net income of the household is found to be negatively associated with farmers' participation in the studies of Zhang *et al*. (2011) and Zhu *et al*. (2016). While our study finds no effect on farmer's participation behaviour.

If we look at the education we see that people's willingness to participate will increase by full amount as the education level goes up. Educated people are more concern about the environment so these farmers are more willing to participate in wetland restoration. In addition, farmers with higher education levels have more job opportunities than those with lower education levels, so they are more likely to participate in wetland restoration. Ghosh and Mondal (2013); Zhang *et al*. (2013) and Zhu *et al.* (2016) also find a positive significant impact of education on farmer's willingness to participate decision. Zhu *et al.* (2016) study shows a positive but not significant result for agricultural profit ratio, while our study finds a negative relation but not significant one. The marginal effect of agricultural profit decreases by 0.4 percentage points. If their agricultural profit ratio is more than farmers are less willing to participate this may be because of their fear about losing their profit.

Zhang *et al*. (2013) finds a positive relation and Zhu *et al.* (2016) finds positive coefficient but not a significant result in case of farm size. In our study the marginal effect of farm size decreases by 0.6 percentage points. This may be due to the fact that the marginal utility of holding an additional farmland will increase their monetary gain than the marginal utility of obtaining monetary compensation for wetland restoration. The marginal effect of policy knowledge is positive but it does not have any significant impact on the willingness to participate. Certain policies has been undertaken to restore the Deepor beel but during the survey it was found that most of the farmers does not know about policies that well. Farmers also prefer monetary support policy rather than any workshops or training or awareness campaigns. Study of Zhu *et al.* (2016) finds that policy knowledge has no significant impact on farmers' willingness to participate decision. Although significant impact of knowledge of

Table 3.

```
Average marginal effects                        Number of obs   =         60
Model VCE    : OIM

Expression   : Pr(WTP), predict()
dy/dx w.r.t. : AGE GENDER MANPOWER EDUCATION NETHI AGRPROFIT FARM_SIZE Policyknowledge BENEFIT_KNOWLEDGE
               ENVIRONMENTALLYCONCERN
```

	Delta-method dy/dx	Std. Err.	z	P>|z|	[95% Conf.	Interval]
AGE	.0040813	.0033139	1.23	0.218	-.0024138	.0105763
GENDER	.2091393	.1136702	1.84	0.066	-.0136503	.4319288
MANPOWER	.0248696	.0524788	0.47	0.636	-.0779871	.1277262
EDUCATION	.3431915	.057236	6.00	0.000	.2310111	.455372
NETHI	1.12e-06	9.17e-07	1.22	0.221	-6.75e-07	2.92e-06
AGRPROFIT	-.0043479	.0058577	-0.74	0.458	-.0158288	.007133
FARM_SIZE	-.0069307	.0317391	-0.22	0.827	-.0691382	.0552767
Policyknowledge	.0745814	.0870094	0.86	0.391	-.095954	.2451168
BENEFIT_KNOWLEDGE	.2361608	.0856828	2.76	0.006	.0682256	.4040961
ENVIRONMENTALLYCONCERN	.1152835	.0810677	1.42	0.155	-.0436063	.2741734

wetland's ecological benefits and values (Benefit knowledge) is found on farmers' willingness to participate, the marginal effects shows that farmers' willingness to participate increases by 23 percentage points. Similarly Kim and Petrolia (2013); Zhang *et al*. (2011) finds a positive relation that farmer's decision choice is dependent on the benefits they perceived from the wetland. While Zhu *et al*. (2016) found no significant impact of benefit knowledge of wetland. However, environmental concern is found not to be a significant factor in farmer's willingness to participate decision. This may be due to the fact that people are more concerned about their individual benefits rather than wetland environmental concern. Poverty could be one of those reasons for this behaviour of the farmer's.

Conclusion

Deepor Beel is a very important and significant environmental asset as it supports the livelihoods of the local people. The wetland provides various benecial services such as sustaining the ecosystem, including water quality improvement, ooding control, protection of wildlife habitat, and prevention of soil erosion and degradation and also supports agricultural production. Considering these services provided by the beel, this study is undertaken to know how much value the locals specially the farmers has given to the Deepor beel. The study finds that people of the locality were not very willing to participate for the sustainable management of the wetland, which is evident from the result of the first objective as most of the people (68.33%) prefer money for any kind of participation.

This study uses survey data from to provide a insight into farmers decision in sustainable wetland management. The binary probit model suggests that that farmers' education level and their benefit knowledge about the wetland have a significant, positive influence on farmers' willingness to participate, while the other factors considered in the model to assess farmers willingness decision does not have any impact on their decision to participate. Education level plays an important role in their decision pattern as the study shows that as their education level goes up their concern about the wetland are positive. As this individual and farm characteristics are imporatnt determinants in their decision patter so government must pay attention to it. Anything can be improved if and only if the local's participation is positive.Thus understanding farmers' decision is important for designing an effective and efficient wetland restoration program.

Around 48.33% farmers' have supportive attitudes toward wetland restoration and they do understand what kinds of benefits (study finds significant impacts) they are receiving from wetlands but even though these are not sufficient to influence them to participate. This may be due to income related factors. As most of the people are low income earners so they better prefer maintaining their household financial situation rather than wasting time on participating in wetland restoration programs. 68.33% of the farmers mentioned that they would participate only if they get paid money. Hence, government should introduce monetary incentives like per day basis money to attract the farmers' involvement and only then it will be efficient and effective management of the wetland. Government could also look at some examples of many Ramsar Sites around the world where agricultural production is an integral part of both the ecological character and the wise use of that wetland. Kabukuri-numa wetland in Japan Rice paddies are grown organically and also managed so as to attract wintering waterbirds. Farming families in the Laguna de la Cocha in Colombia have given up unsustainable practices of charcoal production in favour of more sustainable activities. These examples could be used in the awarness programme among the farmers, which might help to maintain the sustainable management of the wetland.

Taking policies is easy but it would be helpful only if they are implemented and governed well. The model shows that policy knowledge among the farmers are less, most of them do not know about the policies taken by the governments or any other organizations. For a better management active participation of the locals is very much important because no one knows about the wetland environment better than them. It is also important to make people aware that the ecological systems are very much fragile so they should adopt for sustainable use of it. Government can organise workshops, awarness campaign to educate people which may result in the active participation of the people. The result of the model shows variations in willingness to participate among the farmers so the government must create policies in such a way so that wetland environment does not get affected as well as interest of the farmers are also maintained.

Farm size and agricultural profit of the farmers does not play a role in their decision patter, it may be due to the fact that they fear about lossing their farmlands if any restoration programme is undertaken. Loosing farm land may lead to decline in their agricultural profit so this may be also the reason not to participate. Thus the government must ensure the farmers that they won't get affected for any kind of restoration programme. Hence government must introduce a policy where both agricultural practice and wetland restoration programmes go hand in hand and for that active participation of the farmers is very important.

References

Ambastha, K., Hussain, S. A. and Ruchi Badola, R. 2007. Social and economic considerations in conserving wetlands of indo-gangetic plains: A case study of Kabartal wetland, India. Published online: *Springer Science+Business Medi*. LLC 2007, Environmentalist (2007) 27:261–273 DOI 10.1007/s10669-007-9003-1

Dutta, J. 2016. *Economic Valuation of the Deepor Beel, Assam*. Ph.D Thesis, Gauhati University, India (Assam).

Dedah, C.O. 2010. *Incentives, Risk, and the Role of Private Investments in Louisiana Coastal Wetland Restoration*, Ph.D. Thesis, Louisiana State University, LA, USA.

Ghosh, P.K. and Mondal, M.S. 2013. Economic valuation of the non-use attributes of a south-western coastal wetland in Bangladesh. *Journal of Environmental Planning and Management*. ISSN: 0964-0568 (Print) 1360-0559 (Online) Journal homepage: https://www.tandfonline.com/loi/cjep20.

Gogoi, P. 2016. Saving deepor beel: assam's lone ramsar site", volume 1, 2016 http://www.nluassam.ac.in/joelraa9.htm#sdfootnote16anc

Kim, T. and Petrolia, D.R. 2013. Public perceptions of wetland restoration benets in Louisiana. *ICES J. Mar. Sci.* 70 : 1045–1054.

Oladele, O.I. and Wakatsuki, T. 2008. Social factors affecting wetlands utilization for agriculture in Nigeria: A case study of sawah rice production. *Rice Science*. 15 (2) : 150.

Wilson, G. A. 1996. Farmer environmental attitudes and ESA participation. *Geoforum.* 27 (2) : 115-131.

Zhang, C. 2011. Factors influencing farmers' willingness to participate in the conversion of cultivated land to wetland program in Sanjiang National Nature Reserve, China. *Environmental Management*. 47: 107–120.

Zhu, Guan and Wei 2016. Factors Inuencing Farmers' Willingness to Participate in Wetland Restoration: Evidence from China. *Sustainability*. 8(12) : 1325; https://doi.org/10.3390/su8121325, http://www.mdpi.com/journal/sustainability