Economic Valuation of Rural Wetlands and Household Food Security: A Case Study from the North-West Bangladesh

Syed Naimul Wadood and Ayub Ali

Department of Economics, University of Dhaka, Environmental Economics Program, Dhaka School of Economics (DScE)

May 2016

Economic Valuation of Rural Wetlands and Household Food Security:

A Case Study from the North-West Bangladesh

Syed Naimul Wadood[1] **and Ayub Ali**[2]

Wetland ecosystem plays an important role in Bangladesh's rural economy by contributing to household income generation and food security of the neighboring areas. We have examined this issue with regards to the North-Western region of Bangladesh-- we have selected one particular wetland in the district of Pabna (Podmobil) to estimate direct economic benefits from its multiple uses as well as contributions to household food security. We find that one major issue is neighboring households' access to the wetlands (i.e., open-access wetlands as opposed to privately-leased wetlands). We conducted a household structured questionnaire survey among the surrounding population of Podmobil. The questionnaire survey reveals that the loss of access to the wetland caused by changes in the management practices of Podmobil adversely affected particularly poorer households' food security since they could not participate in the new leasing arrangements and experienced a reduced access to this wetland. These results are important for wetland conservation and preservation policy formulation with regards to household food security in the rural areas.

Key Words: Wetlands, Direct Use Value, Probit Regression Model, Open Access, Food Security.

BACKGROUND AND MOTIVATION

1 Associate Professor, Department of Economics, University of Dhaka, Dhaka-1000, E-mail: snwadood@econdu.ac.bd

2Master of Economics in Environmental Economics, Dhaka School of Economics, Dhaka-1000, E-mail: ayubjueco@yahoo.com

“Wetlands are areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres” (Ramsar Convention Secretariat, 2010). Wetland is among the most diverse and productive ecosystem (op. cit, 2010). This provides essential services and supplies fresh water. This also provides a wide range of economic, social and ecological benefits (Dugan1990, IWRB 1992, Khan et al. 2009).These are productive and resourceful areas, which provide food, non-food aquatic resources and retain the ecological balance for the local environment (Dugan 1990, IWRB 1992).

From the perspective of a developing country, wetlands are important sources of open-access and commercial fishing, livestock grazing, wood collection and ecotourism. The major roles of wetlands include soil nutrient retention, support for food chains, fisheries production, and habitat for wildlife, recreation, natural heritage values, biomass preservation, water transport, biodiversity presentation and micro-climate stabilization (Dugan 1990, IWRB 1992, Khanet al. 2009). Despite all these contributions to human livelihoods, many parts of the world have experienced loss or degradation of wetlands on a huge scale because of non-agricultural use, urbanization, excessive exploitation by local population in the recent years (Kabi 1996).

As we are aware of we note that there has not been a single study in Bangladesh to evaluate economic benefits of rural wetlands and their contributions to household food security. Globally rural wetlands are often taken under valuation considering their direct economic benefits like wetland cultivation, fisheries, water for irrigation, wetlands for transportation, vegetation, jute retting and fodder collection (Mukhaerjee,2008).Wetlands and livelihoods are interrelated since these activities and services are influenced by access to a range of livelihoods resources. Open

access wetlands ensure achieving sustainable livelihood outcomes that help to meet the rural food security in the adjacent neighboring resident households of the wetland area.

OBJECTIVES OF THE STUDY

1. One objective is to *examine relationship between direct economic benefits of wetlands and household food security of the residents in the surrounding areas of wetland*.
2. Another objective is to *examine changes in the interrelationships between direct economic benefits of wetlands and food security* aspects *of surrounding area's population over time as a consequence of changes in terms of ownership and management practices of wetlands* (taking *Podmobil* of Pabna as a case to study).

OVERVIEW OF THE LITERATURE

Wetlands help in sustaining livelihoods of wetland communities. Services provided by wetlands include: storm water detention, flood protection, water quality enhancement, freshwater fisheries, food chain support, feeding grounds for juvenile marine fish, biodiversity, carbon storage and climate regulation (Hassan et. al., 2005). The needs of agriculture for flat, fertile land with a ready supply of water implies that wetlands are often a valuable agricultural resource (UNEP and IWMI, 2011).

Direct use values of a wetland were estimated by using a market price approach (Mukharjee (2008), we also followed Mukherjee in our one previous paper (Wadood and Ali, 2015). Kyophilavong (2011) shows that wetlands are complex ecosystems that provide many benefits and services but these benefits and services can be difficult to recognize, and quantify. Taruvinga

(2009) found that wetland cultivation in the rural setting is profitable with statistically significant positive linear correlations with household food security such that wetland cultivators are more than twice food secure than non-wetland cultivators.

Rahman (1989) finds that wetlands and their biodiversity have been contributing substantially to the socio-economic life of rural Bangladesh by providing opportunities of employment, food and nutrition, fuel, fodder, transportation, irrigation and so forth.

The values of wetland resources were estimated using primary and secondary data, market prices, productivity, and contingent valuation methods (Kakuru et.al, 2013). The valuation exercises in the literature also include the values of supplying drinking water to the city, value of benefits accruing to various people whose livelihoods depend on the wetland, value of preventive measures that people used to avoid water borne diseases and the willingness to pay of the people for enjoying better recreational facilities (Verma 2001).

DESCRIPTION OF THE STUDY AREA

The study focuses on economic valuation of a rural wetland as MUS (Multiple Use System) and household food security aspects of wetland in the district of Pabna. The *Podmobil* is identified as a wetland in the Local Government Engineering Division sub-district maps. This *beel* (wetland) is located within three villages, under two unions and two sub-districts of Pabna, namely *Ramchandapur* and *Nowdapara* of *Majhpara* union at *Atgoria* sub-district and *Kamalpur* of *Debigram* union at *Chatmohar* sub-district. The *Podmobil* is connected by the Chandabroti canal with the *Chandabroti* river and *Kamala* river. It is on the west side of the *Ramchandapur* village and the *Chandabroti* river, the *Kamalpur* village and the *Kamala* river are on the north side. It is

located within five kilometers of the *Gofurabad* railway station, and within 10 kilometers from the national highway.

The *Podmobil* gets flooded during the rainy season and remains waterlogged for three to four months every year (June-July to September–October). Deposition of silt during the rainy season makes the land in the flood plain very fertile. Till the recent past, this wetland was a common property resource with unlimited access to all the neighboring households. But in recent years, this *Podmobil* has been converted into a location for scientific fisheries with a much reduced access to a large number of neighboring households (with newly imposed access restrictions) and now there are problems of water logging for some months almost every year. Jute and Aush or Aman are the main crops cultivated during water logged periods as it can withstand standing water or requires standing water for retting. Apart from fisheries, the wetland bed itself is used for cultivation of Boro rice and jute.

The wetland water is also used for irrigation and jute retting and farmers collect fodder from wetland. The farmers have informed that they found cultivation of rice in the wetland remunerative compared to cultivation in other lands as they can save money in terms of labor, irrigation and fertilizer costs.

WETLANDS AND RURAL FOOD SECURITY

In a natural setting, wetlands can bring significant benefits in terms of food security to neighboring households. The value of wetlands for people arises from the interactions of ecological functions they perform with the human society. Following Mukharjee (2008), we have identified six economic functions of wetlands, such as: (1) use for cultivation; (2) use of wetland as a source of irrigation; (3) wetland fisheries; (4) use of wetland water for domestic uses; (5)

jute retting and (6) source of fodder crops production include cereals (rice & wheat), a variety of vegetables, spices and fruits for farmers own consumption and for sale in the local market.

Besides agriculture, wetlands provide other services which are important for supporting the livelihoods of most poor people in the region. These include grazing during dry season, watering, fisheries, wildlife, wetland plants used for building, crafting, cooking and healing, fuel wood, clay for pottery, water supply for domestic use, irrigation and commercial use (Breen *et al.,* 1997).

The dependence of rural low-income households on wetland resources and the huge potential that open access of these resources offers for the rural food availability is such that wetland ecosystem or biodiversity also affects sustainable livelihood. Accordingly, the implications for a loss of wetland or their access (to these low-income households) may include increases in rural-to-urban migration, unemployment and household food insecurity.

METHODOLOGY AND METHODS

We assume that the two decisions are made separately in two stages. Firstly, valuation of benefits from wetlands, and secondly, increases in probability of households being food secured from interrelation of benefits from wetlands. For the first, we have used direct valuation methods, and for the second, we have estimated by using Probit regression analysis. Thirdly, we have examined changes in food security due to changes that may occur in terms of access to wetlands. First based on the following model is designed:

$$V=\sum \{(P*Q) - C\} \quad \ldots\ldots (1)$$

Where, V= Direct use Value; P=Prices of Product; Q=Amount of Product and C= Cost of Product;

Probit model:

$Y_i = \beta_1 + \beta_2 X_1 + \beta_3 X_2 + \beta_4 X_3 + \beta_5 X_4 + \beta_6 X_5 + u_i$ …… (2)

Where, X_1= wetland's share or values and Y=1 if the households food secured and 0 if the food insecure; X_2= Gross total income; X_2= Amount of Crop land; X_3= Household Size; X_4= Age of the Household Head. Since the probability P_i must be between 0 & 1, we have the restriction:

$0 \leq E(Yi|Xi) \leq 1$

-- the conditional expectation must lie between 0 and 1.

Therefore, (1) equation estimates the wetland direct economic values for the household, and (2) equation explains the impact of the value of wetland on the probability of whether the household is food secured or not.

Sampling Frame

The study has encompassed surrounding areas of the *Podmobil* in Pabna as the sample frame. The households residing within this area are taken as primary sampling units. We have divided these households into three wetland stakeholder groups such as "A"; "B" and "C", based on income and asset levels of the households. The groups were (i) upper income group ("A"); (ii) middle income group ("B"); and (iii) the lower income group ("C").

Sampling Procedure

Firstly, we have listed all the households in all three survey villages, and have classified these households in terms of "A", "B" or "C" on the basis of discussion with some key informants in these villages. Secondly, the field assistants have conducted face-to-face structured questionnaire survey with households selected in terms of random sampling within the sub-categories. Thirdly, we have conducted a follow up survey on the *Ramchandapur* village six months later after the original survey in order to examine more on the food security issues. Some secondary

information was also collected from the local people, particularly from the fertilizer dealers, local political leaders. Local government office records are used in order to prepare an accurate group classification of households.

Sample Size

The *Podmobil* is surrounded by three villages; namely *Ramchandapur*, *Kamalpur* and *Nowdapara*. A total of 150 families/households are selected for face-to-face structured questionnaire interviews and again under the follow-up survey, 30 households (from *Ramchandapur*) are selected for face-to-face questionnaire survey to examine the food security aspects. Table (1) summarizes the distribution of respondents with respect to their income level and asset status. While the total number 150 and 30 follow up survey was chosen considering convenience, number of respondent households in the sub-groups was taken considering proportionality. The socio-economic classification worked fine within our survey households, since we found statistically highly significant differences of average household yearly total incomes from all sources across the three classes (for groups A, B and C, these numbers were TK. 199,790, TK. 107,918 and TK. 45,588, respectively); average crop lands owned by households across these three groups differed marked as well (for groups A, B and C, these numbers were 258 decimals, 104 decimals and 45 decimals, respectively).

Table 1: Sample Size

Survey Villages	Status of Respondents			Total
	Upper (A)	Middle (B)	Lower (C)	
Ramchandapur	20	20	20	60
Kamalpur	25	25	24	74
Nodapara	5	5	6	16
Additional Follow-up in *Ramchandapur*	*10*	*10*	*10*	*30*
Total Households	60	60	60	180

Source: Primary Survey and the Follow-up Survey

Data Collection and Analysis

The data was collected in the month of October 2014 and the follow-up survey data was collected in the month of February 2015, and it took seven days to complete the face-to-face questionnaire interviews in each of the rounds. A total of five field assistants led by one of the authors of this study completed the interviews. Data was then thoroughly checked for consistency checking and editing and then it was preserved for analysis.

RESULTS AND DISCUSSIONS

We have examined the issue of estimating economic valuation of wetlands in our one previous paper (Wadood and Ali, 2015). Henceforth, we have concentrated on the relationship between wetland valuations and rural food security in our present paper.

Household Food Security

In the past context of the *Podmobil* area, open access to wetland services facilitated lower income households to achieve their food security. But after the *wetland degradation* (in terms of leasing-in for scientific fisheries), upper and middle class households are now found to have secured more benefits by their rent seeking activities such as scientific fisheries whereas the lower income households have lost much of their access as well as their benefits from the wetland.

In the following table, the dependent variable "all meals" *exhibits how many of the surveyed households have responded "yes" to questions such as whether they could afford to take three (regular) meals in a day all the time during the last one year time period.*

Table 2: All Meals and Household's Status

All Meals?	Status			Total
	Upper (A)	Middle (B)	Lower (C)	
No (0)	0	19	40	59
Yes (1)	50	31	10	91
Total	**50**	**50**	**50**	**150**

Source: Primary Survey Data

Table (2) shows that within status 1 (upper income group) every household reported "yes" to the query regarding whether they were able to afford three meals in a day over the last year. Within status 2 (middle income group), 19 out of 50 reported themselves to be food insecure while within status 3 (lower income group) 40 out of 50 reported themselves to be food insecure.

We also asked the respondent households whether they considered their household to be "food secured". A total of 91 households have reported themselves to be "food secured", again all of them reported "yes" to question such as "all three meals." Similarly, all 59 households which reported they to be "food insecure" also mentioned "no" to query such as "all three meals."

Relationships between All Meals and the Relationships with Wetland Ecosystem

In a natural setting, wetlands make important contributions to the adjacent stakeholders who have relations with the wetlands' ecological functioning and the variety of economic services that the wetland provides. According to our primary survey responses, the neighboring households are closely associated with the wetlands (only two out of a total of 150 neighboring households have reported to have no links with the wetland). Of those 148 households linked with the wetland functioning, a total 59 reported themselves to be *food insecure*, and 89 reported themselves to be *food secured*.

Table 3: Relationships with Wetland Ecosystem with All Meals

All Meals	Relationships with Wetlands		Total
	Without relation (0)	With relation (1)	
(Insecure) 0	0	59	59
(Secure) 1	2	89	91
Total	**2**	**148**	**150**

Source: Primary Survey Data

The Change of Management Practices of Wetlands: Decreased Household Income and the Losses of Benefits

We have also examined recent management changes of the *Podmobil* as this has partly become scientific fisheries, A large number of neighboring households have lost access to the wetland whereas all of them had had unlimited access in the former days. The degradation of wetlands in this manner and the associated loss of access to wetland functions and benefits are expected to have adverse effects on local livelihoods, particularly on the lower-income segments of the society.

We find that low-income households, who are otherwise resource-poor and depend highly on wetland-based livelihoods, are the most affected ones. Marginal farmers, fishermen and women, who used to catch fish or collect vegetables for family consumption, collected fodders and snails have been much affected due to this change in management practices. From the point of view of household food security of neighboring lower-income households, change of management practices from open-access to scientific ones is a cause of concern for them.

Table 4.a: Household's Status and Decreased Household Income with Respect to the Case of Loss of Access to the Wetland in Recent Years

Household Income Decreased?	Socio-Economic Class			Total
	A (Upper)	B (Medium)	C (Lower)	
No (0)	8	6	0	14
Yes (1)	2	4	10	16
Total	10	10	10	30

Source: Follow-Up Survey

The Table (4.a) shows that the change of management practices of the wetlands triggers decreases in the household income earnings (and thereby purchasing capacity), particularly for lower income households. Household income (and purchasing capacity) is the most important indicator for households' capacity to address food security concerns. We notice that majority of high and medium income households did not report any decreases in their household income and purchasing capacity, whereas all low income households reported decreases resulting from changes in management practices of the *Podmobil* in recent years.

Table 4.b: Household's Status and Wetland Change in Management Practices Results

Status	Agro loss (TK.)	Fisheries loss (TK.)	Livestock loss (TK.)	Health Cost (TK.)	Other losses (TK.)
A	308,000	No Loss	31,000	5,000	1,700
B	116,000	24,000	53,000	6,000	1,500
C	140,000	31,500	75,500	20,200	22,000
Average	188,000	--	53,167	10,400	8,400

Source: Follow-Up Survey

Table 4.b shows that lower-income households were comparatively more vulnerable compared to the upper-income households. Lower class household have lost fisheries income on an average of Tk. 31,500 annually and on the other hand upper class households have no losses of fisheries profit but have achieved the abundant profit from this. At the meantime, health cost is another crucial element that is generated by the water logging problem from the degradation of wetland. This problem pressurizes the lower income people of the concerned areas. In effect, wetland's

adjacent lower class households have been affected in terms of their food availability as well as to continue their livelihoods activities that have increased food insecurity.

Table 5: Number of Years Households faced Problems due to Wetland functioning

Status	5 Years Ago		Problem years within the last 5 years				
	0	**1**	**1**[3]	**2**	**3**	**4**	**5**
A	10	0	9	9	0	0	0
B	10	0	10	4	3	2	1
C	9	1	10	7	2	1	0
Total	29	1	29	20	5	3	1

Source: follow up survey data, 2015

The follow-up survey specially indicates fallouts from wetland degradations. This table is divided into two categories and in the first part "5 years ago" that shows the degradation fixed time period for wetlands activities. "5 years ago" indicates to wetlands degradation for wetland adjacent households, there were no problems in 29 out of 30 households (only one household faced problems due to wetland activities).

Figure 1: Wetland Degradation

The second part indicates the number of years that the household faced problems with regards to change of management practices of the *Podmobil*. The tables (5) and figure (1) shows that maximum households face problems from one and two years ago but alternatively one person report that there were no problems within last five years.

Wetlands Valuation to address Household Food Security

The present study focuses on economic valuation of rural wetland and household's food security as multiple-use system (MUS) in a continuing rural wetland in Pabna. Total wetland benefits will

3 1 year indicates 29 sample households who are adjacent to the wetland are facing problems in the one year except for one sample household. 1to 5 year is mentioned based on the survey year. This table has been designed based on the follow up questionnaire.

be discussed as a direct economic valuation by the economic functions of wetlands and finally economic valuation of rural wetland and household food security will be explored by integrating pathway.

Firstly, we discussed in our previous paper about *"Economic valuation of rural wetlands in Bangladesh"*. There we incorporated six major direct economic functions of the wetland to calculate the direct benefits from wetlands ecosystems. But we will emphasize the rural food security by the wetlands services.

Total Direct Economic Benefits from the Wetland

The table (6) shows the sample total net benefit, per household net benefit and total net benefit for the wetlands' cultivation and services. Total wetland net benefit under the area is calculated to be Tk.7.3 crore (these are based on estimation of benefits throughout the past 12 months). Total area of the *Podmobil* is approximately 1,500 *bighas* or 430 acres. In this connection, it can also be said that one third of the land is leased out to the influential people and the current study does not include this part to estimate the direct economic valuation of the Padma *beel*. Considering this fact into our estimation (i.e. leaving one third of the areas from this calculation), this can thus be concluded that the annual per acre direct values of the Padma *Beel* is Tk. 2.53 lakh.

Table 6: Total Net Benefit from Wetland, One Year Calculations (Tk.)
Source: Based on Field survey, 2014

Survey Villages	Class	Sample Total (Tk.)	Sample Number	Per HH (Tk.)	Total No. of Households within Class	Total Net Benefit (Tk.)
Ramchandrapur	Upper	7992952	20	399647.6	95	37966522
	Middle	854157	20	42707.85	114	4868694.9
	Lower	745075.6	20	37253.78	171	6370396.38
Kamalpur	Upper	2285732	25	91429.27	120	10971512.4
	Middle	906888.3	25	36275.53	133	4824645.49
	Lower	460118.9	24	19171.62	190	3642607.8

Nowdapara	Upper	631073	5	126214.6	15	1893219
	Middle	526336.5	5	105267.3	20	2105346
	Lower	74845.02	6	12474.17	30	374225.1
Grand Total						73,017,169.07
Area of the Wetland under consideration (Acres)						288.1
Calculated Direct Economic Benefits, per Acre of Wetland						253,443.8

Food Security Probability Measurement with Respect to the Wetland Share

The Probit model shows that "all meals" is the dependent variable and it is defined in context of the household food security. Food security depends on various independent variables.

Probit allmeals lnshwetoutfish lngtotal hh_size age_head lncropl, vce (robust)

Table 7: Probit Regression Results

Probit regression	Number of obs = 126					
	Wald chi2(5) = 26.68					
	Prob> chi2 = 0.0001					
Log pseudolikelihood = -59.602235	Pseudo R2 = 0.2630					
	Robust					
allmeals	Coef.	Std. Err.	Z	P>|z|	[95% Conf. Interval]	
lnshwetoutfish	.3837046	.2127792	1.80	0.071	-.033335	.8007443
lngtotal	.1145442	.1644488	0.70	0.486	-.2077696	.436858
hh_size	-.0753473	.1175971	-0.64	0.522	-.3058334	.1551387
age_head	.0037607	.0125157	0.30	0.764	-.0207697	.028291
lncropl	.8379872	.2280344	3.67	0.000	.3910479	1.284927
_cons	-8.945981	2.637162	-3.39	0.001	-14.11472	-3.777239

Nevertheless household food security is affected by wetland share, total income, household size, age head, cropland. Household size *(hh_size)* and constant negative sign was expected as the food security perspective. Hence, cropland (*lncropl)* and wetland share (*lnshwetoutfish)* is statistically significant at level 10% level and constant value at 1% level. Probability of chi2 is highly significant at 1% level and log likelihood absolute value is 59.6. In this study, mainly

focus to take the probability for all meals. There are three dependent variables influences all meals. So, when wetland share value will increase the probability of all meals will increase to take for wetland adjacent households. Wetland share values are positively related with all meals. Over all 71.21% has been correctly classified in this model that explains all meals or food security phenomena. In middle class and lower class some of the households have experienced food insecurity, characterized by low harvest and households having a single meal in a day. Especially, wetland adjacent lower class people utilize the wetlands' resources as an alternative source of household food. Wetlands are the basis of food security, directly providing resources for consumption, indirectly supporting crops and livestock production, materials that are sold for purchasing food in emergency situations and services that support food production. With increasing population around the wetlands, coupled with land shortage and weather variations, the poor people, especially in the study areas will continue generally to rely on wetland ecosystem services directly for subsistence and income generating activities for sustaining their livelihoods unless alternative livelihood options are provided.

CONCLUSION

This study attempted to investigate the extent of role of the wetland in the North–Western region of Bangladesh and its trading between wetland functioning and adjacent household's food security. The study mainly focuses on the wetland share and adjacent households' food security and wetland degradation scenario status. Besides agriculture, wetlands provide other provisioning services which are vital for supporting the livelihoods of poor section of the people

in the wetland areas. These include: livestock grazing and watering, fishing, wildlife and wetlands' plants.

Finally, the study showed that adjacent wetland households' food securities are closely related to the contributions of wetland to household income (*wetland share*) and its functioning activities as well as this study also suggesting policy recommendations for Bangladesh government and local government to take initiative to conserve and preserve the wetland ecosystems in ensuring the wetland sustainability for maintaining the food security for the concerned people.

REFERENCES

1. Convention on Biological Diversity (2005). *Handbook of the Convention on Biological Diversity, including its Cartagena Protocol on Bio-safety, 3rd Edition*. Secretariat of the Convention on Biological Diversity.
2. De Groot, M. S. R. (2006). *Valuing Wetlands:Guidance For Valuing The Benefits Derived From Wetland Ecosystem Services.* Gland, Switzerland.
3. Dugan, P.J. (Eds.) (1990). *Wetland Conservation: A Review of Current Issues and Required Action*. IUCN, Gland, Switzerland.
4. Emerton, L. (1998). *Economic Tools For Valuing Wetlands In Eastern Africa.* Nairobi: IUCN Eastern Africa Regional Office.
5. Haq, A. H. M. R. (2004). *Cultivating Wetlands In Bangladesh.* Khulna: Keisa Magazine.
6. Hassan, R., et. al. (2005). *Ecosystems and Human Well-Being. Current State and Trends.* Washington, DC: Island Press.
7. Islam, D. (2011). *State Of Leased Of Wetland In Bangladesh: Who Are The Gainers And Who Are The Losers?* Oxfam, Dhaka. Sustainable Rural Livelihoods (CSRL)
8. Islam, S. M. (2012). *Present Status of Wetland Biodiversity - A Study in SujanagarUpazila, Pabna,*
9. IWRB (1992). *IWRB Seaduck Bulletin*, International Waterfowl and Wetlands Research Bureau, No. 2, November 1992.

10. Kakuru, W., Turyahabwe, N., &Mugisha, J. (2013). Total economic value of wetlands products and services in Uganda. *The Scientific World Journal*, *2013*. http://doi.org/10.1155/2013/192656
11. Kakuru, W.N.J (2013). *Total Economic Value of Wetlands Products and Services in Uganda*.
12. Kyophilavong, P. (2011). *A Simple Manual for Estimating Economic Value of Wetland for Laos Policymakers*
13. Mombo, F. S. S. (2012). Determinants of Access Patterns to Goods and Services from Wetlands in Tanzania and the Impact on Sustainable Wetland Management. *African Journal of Agricultural Research*, Vol. 7(41) , 5585-5593.
14. Mukherjee, S. (2008). *Economic Valuation of a Wetland in West Bengal, India*. MPRA Working Paper, No. 14365
15. Rahman, M. M. (2010). *The Aggression Of Human Activities On Chalanbeel A Threat On Wetland Environment: Study On Natore - Rajshahi Region Of Bangladesh.*
16. Ramsar Convention Secretariat (2010). *Wise use of Wetlands: Concepts and Approaches for the Wise Use of Wetlands.* Ramsar Handbooks for the Wise Use of Wetlands, 4th Edition, Vol. 1. Ramsar Convention Secretariat, Gland, Switzerland.
17. Taruvinga, A. (2009). *Economics of Wetland Cultivation in Zimbabwe: Case Study of Moshanaland West Province*, M.Sc. in Agriculture (Agricultural Economics) Dissertation, University of Fort Hare, South Africa.
18. Thang, Nam Do, J.B. (2005). *An Economic Valuation Of Wetlands In Vietnam's Mekong Delta: A Case Study Of Direct Use Values In Camau Province. Canberra, Australia*. the Environmental Management and Development Programme, Asia Pacific School of Economics and Government, the Australian National University.
19. Turyahabwe, N., Kakuru, W., Tweheyo, M., &Tumusiime, D. M. (2013). Contribution of wetland resources to household food security in Uganda, 1–12.
20. UNEP And IWMI. (2011). *Ecosystems For Water And Food Security.* United Nations Environment Program and International Water Management Institute.
21. Verma, M. (2001). *Economic Valuation of Bhoj Wetland for Sustainable Use in India*.
22. Wadood and Ali, (2015). *Economic Valuation of Rural Wetlands in Bangladesh: A Case Study of the Padma Beel (Podmobil) of Pabna.* Dhaka School of Economics (DScE), Dhaka.

23. World Bank aided India (2001). *Environmental Management Capacity Building. Economic Valuation of Bhoj Wetlands for Sustainable Use.*