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WETLAND USE AND RESOURCE DEGRADATION AMONG SMALL-SCALE FARMERS IN CROSS RIVER STATE, NIGERIA

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ABSTRACT

The paper examines the significance of wetland ecosystems to the socio-economic life of smallholders in Cross River State, and the relationship between socio-economic factors and wetland degradation. A multi-stage sampling procedure was used in selecting respondents for the study. Data for this study was analyzed using descriptive statistics such as means, percentages, frequency distribution and regression analysis. Findings revealed that farming was the major occupation of respondents while trading was the major complementary activity. There was evidence of increasing intensity of land use, with 51 percent of the respondents indicating 0-2 years of fallow. The wetland sector provided 80 percent employment to smallholders whereas other sectors/activities provided 20 percent. The result of the regression analysis based on Linear regression model showed that farm size, household size, respondent's age, fallow period and level of education were all significant determinants of wetland degradation. R squared value of 0.877 implied that 88% of the variations in wetland degradation was explained by the independent variables. The adjusted R squared and Standard Error of the estimate were 86% and 6.78 respectively. The model was significant at 1% probability level. Lack of credit, lack of access to inputs and deforestation were amongst the most severe problems. The study recommends that diversification of income sources through the creation of alternative means of livelihood will help reduce pressure on wetland ecosystems and subsequently reduce wetland degradation.

KEY WORDS: Wetland, Small-Scale, Resources, Ecosystem, Degradation.

INTRODUCTION

In most developing countries the rural economy is closely dependent on the productivity and hydrological benefits of wetlands (Adams, 1985). According to Hollis *et al*., (1988), many rural economies in Africa, South East Asia, and Artic region of Canada are dependent on the utilization of these wetlands due to the fact that the wetlands retain a wide range of their natural functions, and undergo processes which are of great value to the wetland itself, the surrounding ecosystems, and the people. Wetlands provide food, water, and shelter for fish, shellfish, birds, and mammals, and they serve as breeding grounds and nursery for numerous species. Wetland systems directly support millions of people and provide goods and services to the world outside the wetland. People use wetland soils for agriculture, they catch wetland fish to eat, they cut wetland trees for timber and fuel wood and wetland reeds to make mats and thatch roofs (Gren *et al*., 1994). Wetland sites in the forest zones of Nigeria are also used for the gathering of forest products such as bamboos, fish and crabs, fuel wood, medicinal plants and production of palm wine (Akamigbo, 2001). Wetlands therefore play very significant roles in the socio-economic life of the people around it. However, acceptance of wetlands as highly productive ecosystems with a wide range of functions important to humans has grown, along with the recognition that losses and threats to these systems are severe. In the view of Hollis *et al*. (1988), wetlands everywhere are under threat from agricultural intensification, pollution, major engineering schemes and urban development. The increasing attention to the use of wetlands has made them one of the most threatened habitats because of their vulnerability and attractiveness for 'development' and their distinction being cited as among the most productive ecosystems on earth (Mitsch and Gosselink, 1986).

Cross River State has a total wetland area covering 2,212km^2 or 221,000 hectares. This constitutes 10.3 percent of the total land area of the state spreading across the four vegetation zones: mangrove forest and coastal zone, fresh water swamp communities, lowland forest zone and derived savannah zone (Ibanga and Armon, 1992). The original vegetation of Cross River State according to their survey, have been greatly modified in many parts mainly by human activities including lumbering, cultivation, quarring of rocks and sand for construction, felling of trees for firewood and timber, bush burning, establishment of crop plantations and population growth. A farming system survey of Cross River State conducted by the faculty of Agriculture, University of Calabar in 1985 indicated that, apart from the mangrove swamps where little agricultural activity occur, in other vegetation zones, many hectares of land are being brought under cultivation annually, thus allowing for isolated patches of natural vegetation. This situation in the view of Ibanga and Armon (1992) is partly why attention is increasingly paid to the cultivation of wetlands.

The first global conservation convention – the Ramsar Convention focused solely on the wise use of all

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wetlands, not just with the statutory protection (Hollis *et al*, 1988). At the second international conference on wetlands development held at Dakar in November 1998, the highlights revealed that the issues relating to the conservation of African wetlands were very similar to that elsewhere in the world, but that the institutional and resource constraints were much more severe on the African continent. Besides, the lessons from Africa also indicate that ignoring the degradation of wetlands can have devastating implications for biodiversity and for those who depend directly on these systems for their livelihood. This paper examines wetland use by smallholders and how their use can affect degradation in the Cross River State. Specifically the paper examines the socio-economic characteristics of smallholders in wetland communities, determines the proportion of employment (e.g. part-time, full-time, none) provided by wetlands relative to other sectors/activities in the area, identifies the determinants of wetland degradation (conservation) in the area and the problems and constraints of wetland exploitation by smallholders.

METHODOLOGY

Data for this study was obtained from primary and secondary sources. The primary data were collected by the use of well structured questionnaires to capture information on the socio-economic characteristics of respondents, wetland resources and products, as well as wetland degradation indicators and practices. A multi-stage sampling procedure was used in selecting respondents for the study. Six local government areas with greater concentration of wetlands were purposely selected. These include Abi, Biase, Calabar South, Obubra, Ogoja and Yakurr Local government areas. A list of wetland communities in each of the selected local government areas was prepared, using documented reports from Cross River Agricultural Development Project, Calabar. From the list, two communities were randomly selected form each of the six local government areas to obtain twelve wetland communities. Finally, a list of households in each wetland community was prepared with the assistance of community and youth leaders. Ten households were selected from each of the twelve wetland communities to give a total of 120 household respondents for the study. Data for this study was analyzed using descriptive statistics such as means, percentages, frequency distribution and regression analysis.

The study attempts to capture smallholders who exploit land resources as their primary source of livelihood. The implicit form of the regression equation is given as:

$D_w = f(FS, HHS, FI, OFI, FALP, FA, OH, LE, GS, CPA, DTW, TEN)$

Where D_W	=	Degree of wetland degradation indexed by [labour inputs (man days) per hectare]		
FS	=	Farm size (hectares)	-	(x_1)
HHS	=	Household size (number living with smallholder)	-	(x_2)
FI	=	Farm income (₦)	-	(x_3)
OFI	=	Off-farm income (₦)	-	(x_4)
FALP	=	Fallow period (years)	-	(x_5)
FA	=	Farmer's age (years)	-	(x_6)
OH	=	Occupation of smallholder	-	(x_7)
LE	=	Level of education	-	(x_8)
CP	=	Cropping pattern (sole cropping 1, mixed 0)	-	(x_9)
DTW	=	Distance to wetland from farmer's residence (km)	-	(x_{10})
TEN	=	Tenancy (owned 1, rented 0)	-	(x_{11})

The explicit equation in the linear form is:

$$D_w = bo + b_1x_1+b_2x_2+b_3x_3+b_4x_4+b_5x_5+b_6x_6+b_7x_7+b_8x_8+b_9x_9+ b_{10}x_{10}+b_{11}xb_{11}+b_{12}xb_{12}+U$$

Where bo = intercept

b_i's = Coefficients of the independent variables.
U = Error term

RESULTS AND DISCUSSION

Socio-economic Characteristics of Respondents

The result of the socio-economic characteristics of respondents as presented on table 1 shows that 67.5 percent of the respondents were males while 32.5 percent were females. They include farmers, hunters, fishermen and fruit gatherers. The average age of respondents was 46.1 years as majority fell within the range of 41-50 years. The distribution of respondents by marital status showed that 75 percent were married, with the mean household size of 4.9. Majority of the respondents had household sizes ranging from 4 to 6 persons. The large family size is a common phenomena in most rural communities where the family constitute the core of labour supply to peasant holdings (Olayide *et al.*,1980). The average years of schooling was 6.1 years indicating a low literacy levels. Fallow periods in the study area showed an average of 2.6 years of fallow, even though majority (51.1%) of the respondents fell within the range of 0 to 2 years of fallow. This portrays short years of fallow or high intensity of land use in the area. Results also indicated a close proximity of smallholders to plots as wetland users could only cover average distances of 3.2 kilometres to their plots.

Table 1: Distribution of Respondents by Socio-economic Characteristics

Variable		Frequency	Percentage
Sex:	Male	81	67.5
	Female	39	32.5
	Total		120
100.0			
Age:	≤30	15	12.5
	31-40	24	20.0
	41-50	34	28.3
	51-60	33	27.5
	>60	14	11.7
	Total		120
100.0			
Marital Status:	Married	90	75.0
	Single	17	14.2
	Divorce/Separated	3	2.5
	Widow/widower	10	8.3
	Total		120
100.0			
Educational	0	35	29.2
Attainment:	1-6	45	37.5
	7-12	28	23.3
	12-18	12	10.0
	Total		120
100.0			
Household Size:	1-3	41	34.2
	4-6	59	49.2
	7-9	3	2.5
	>9	17	14.1
	Total		120
100.0			
Length of fallow	0-2	62	51.7
Period (yrs):	3-5	52	43.3
	>5	6	5.0
	Total		120
100.0			
Distance of	1-3	60	50.0
Wetland plot (km):	3-5	46	38.3
	>5	14	11.7
	Total	120	100.0

Source: Field survey data, 2005.

Wetland Resources and Products

The acceptance of wetlands as the earth's most productive ecosystem (Barbier, 1993) is occasioned by the range of goods and services it provides thereby supporting the livelihoods of people around it. The reliance on products derived from wetland resources is a typical feature of the rural economy. The result of the distribution of respondents by products obtained from wetland resources is presented in table 2.

Table 2: Distributing of Respondents by the Product Obtained from Wetland Resources

Land Resource		
Product	**Frequency**	**Percentage***
Arable crops	120	100
Tree crop/fruits	61	50.8
Pasture	25	20.8
Livestock	50	41.7
Minerals	Nil	Nil
Water/aquatic Resource		
Fish	72	60.0
Shrimps	15	12.5
Periwinkles	44	36.7
Crayfish/prawns	20	16.7
Snails	27	22.5
Irrigation water	82	68.3
Forest Resource		
Games	37	30.8
Palm wine	18	15.0
Timber	19	15.8
Fuelwood	104	86.7
Fruits/vegetables	70	58.3
Bush mango	66	55.0
Others	15	12.5

Source: Survey Data, 2005.
* Multiple responses recorded

The result of the analysis shows that respondents obtained a variety of products from land, water and forest resource. These products include a wide range of arable crops, tree crops, pasture and livestock; aquatic products such as fish, periwinkles, snails, crayfish etc; and forests product such as fuel wood for domestic energy, timber, games, among others. Considering the land resource, result shows that all (100%) the respondents obtained arable crops. This is followed by tree crops (50.8%), livestock (41.7%) and pasture (20.8%). Household dependence on water/aquatic resources is a common phenomenon among wetland inhabitants (World Bank, 2003). Fuel wood was the major product obtained by respondents from the forest resource. Analysis shows that it is the primary source of domestic energy for 86.7% of the respondents. These findings are consistent with that of World Bank (2003) who reported that fuel wood is the main source of energy for 90% of the households in both Hadejia-Nguru and Niger Delta.

Wetland Use and Employment Provision

The increasing adaptability of smallholder families who are responsible for over 90% of agricultural output, to effectively use their labour in meeting the demands of rural development and growth is of prime importance to the Nigerian small farmers. According to Olayide *et al.* (1975), labour supply appears to be a most important and limiting factor in tropical Africa's primary production activities.

TABLE 3: Proportionate Analysis of Wetland Labour Requirement Relative to other Sectors/activities

Resource/Activity	Part-time	Full-time	None
Land resource			
Arable crops	15	105	0
Tree crops	26	73	21
Pasture	25	-	95
Livestock	45	5	70
Minerals	N/A	N/A	N/A
Water/aquatic resource	40	48	49
Total*	181	272	267
Percentage	25.14%	37.78%	37.1%
Other sectors/Activities			
Trading	27	20	73
Civil service	-	24	96
Tailoring	4	4	112
Carpentry	3	6	111
Blacksmithing	-	-	-
Repairs/shoe making	1	-	119
Bricklaying/masonry	3	4	113
Hair dressing/plaiting	2	4	114
Others	4	3	113
Total*	44	65	851
Percentage	4.58	6.77	88.65

Source: Survey Data, 2005.
*Multiple responses recorded

The analysis of table 3 shows that wetland activities provide about 63 percent employment to smallholders, with 25.14% as part-time and 37.78% as full-time respectively. Other sectors/activities provide only 11.35% employment to small holders with 4.58% representing part-time while 6.77% represent full-time employment. Comparatively, wetlands provide 80% employment while other activities provide 20%, an indication that wetlands play a major role in providing employment to rural households. It also confirms a high dependence on wetland resources by smallholders in the study area.

Determination of Wetland Degradation

The measure of degradation is indexed by labour inputs (man days) per hectare. Labour input was used as a proxy to quantify wetland degradation. The linear regression model was chosen as the lead equation on the basis of the value of R^2, F-value, number of significant variables and conformity of the parameter estimates with a priori expectations. Results of the analysis show that R square was 0.877. This implied that 88% of the variation is Y (wetland degradation) was explained by the independent variables (X's). The adjusted R-squared value was 0.864 (86%) and standard error of the estimate was 6.783. The F-test was significant at 0.01 probability level as presented in table 4.

Table 4: Determinants of Wetland Degradation based on Linear Regression Model.

Explanatory variables	Regression coefficient	Standard Error	T-value
X_1 = Farm size (ha)	-2.067*	0.917	-2.254
X_2 = Household size	1.263**	0.240	5.255
X_3 = Farm income (N)	2.351E-06	0.000	0.786
X_4 = Off-farm income (N)	5.246E-06	0.000	0.627
X_5 = Fallow period (years)	-3.89**	0.790	-4.925
X_6 = Respondents Age (years)	-0.467**	0.094	-4.962
X_7 = Respondent's occupation (Farming = 1) otherwise = 0)	0.958	1.534	0.624
X_8 = Level of education (years)	-0.789**	0.236	-3.344
X_9 = Cropping pattern (sole = 1, mixed = 0)	1.290	1.442	0.907
X_{10} = Distance to wetland from residence (km)	3.497E -02	0.326	0.107
X_{11} = Tenancy (owned = 1 rented = 0)	-0.308	1.354	-0.224
Constant	80.215**	5.463	14.683
R^2	0.877		
Adjusted R^2	0.864		
F	69.926**		
	Se=6.78		

Source: Survey Data, 2005.
Note: * = Significant at 5%
** = Significant at 1%

From the regression results in table 4, farm size was significant at 5% level while household size, fallow period, respondent's age and level of education were all significant at 1% level. Considering the farm size, it's relationship with wetland degradation was found to be inversely related and statistically significant at 5% level. This implies that, the smaller the farm size, the greater the level of degradation. This contradicts a priori expectations. However, this situation according to Barbier (1997) is made possible considering the fact that poor households are often found in marginal agricultural areas where they tend to extract short-term rents through resource conversion and degradation, so long as there are sufficient additional resource available in frontier areas that can be exploited relatively cheaply and the cost of access remains low. This leads to increase in both land degradation and expansion of agricultural activity on marginal lands, resulting in further processes of degradation. This result agrees with the findings of Ngailo et al (2001), who observed that average farm size of Tanzania farmers had decreased while fallow period had become shorter, not allowing for sufficient time for regeneration and recovery of soil fertility. Conversely, Onianwa et al (1999) in their study confirmed a direct relationship between farm size and degradation. They reported that for each 1% increase in total farmland, there was a 0.00007% decrease in tree cover. This implies that increase in farm size will lead to an increase in degradation.

The household size of respondents was equally a significant determinant of wetland degradation at 1% level. The result on table 4 showed that there was a direct (positive) relationship between household size and wetland degradation, implying that an increase in household size will also lead to an increase in wetland degradation. This result conforms with a priori expectations and is consistent with the findings of Bamire and Olubode (2001) who reported that increased household may suggest increased consumption level which has the possibility of enhancing land intensification and exposing the land area to further degradation, if adequate measures for land improvement are not made. The result also agrees with that of Sheng (1989) who found that household size exert a significant negative effect on investment in soil conservation. This implies that the larger the household size, the less amount of money the farmer can invest in soil conservation since a higher proportion of his income will be spent on consumption rather than saving for investment. The average household size in the study area was 4.9 members. Fallow period was equally identified as a significant determinant of wetland degradation at 1% level. Regression results showed that fallow period was inversely related to wetland degradation. This implies that wetland degradation will increase with a reduction in the years of fallow. The average fallow period in the area was 2.6 years.

The Age of respondent was also statistically significant at 1% level. From the regression result, age was inversely related to wetland degradation, which implies that the rate of wetland degradation decreases as the farmers grow older. As farmers grow old, they may lack the strength needed to work large expanse of farm land. Moreover, farmers' experience over the years gives him adequate knowledge to employ ideal conservation practices and other control measures on the farmland. Young households are more likely to have greater tendency to degrade land due to their mobility and vigour as reported by Kohlin and Parks (2001) in his study of fuel wood collection in South Asia. This gives credence to the inverse relationship between age and wetland degradation. The average age of respondents from the study was 46.1 years.

The level of education was a significant indicator of degradation at 1% level. Table 4.13 shows that the level of education of respondents had an inverse relationship with wetland degradation. Analysis indicates that each 1% increase in the level of education leads to a reduction in wetland degradation by 78%. This finding conforms with *a priori* expectations and is consistent with the findings of Onianwa and Wheelock (1999) whose study on factors affecting conservation practice behaviour of farmers in Alabama showed a positive and strong significant relationship between high school education and the adoption of tree planting. The average number of years of schooling in the study area was 6.1 years.

Problems/ Constraints of Wetland Exploitation

The use of wetland resources by smallholders in the area is of immense benefits but not devoid of some constraints. Table 5 shows the distribution of respondents by problems/constraints of wetland used. From the results, lack of access to inputs, and deforestation and improper agricultural practices were identified as the most severe problems; Lack of knowledge of effective means of soil improvement as well as water logging condition of the solids were of intermediate severity; whereas problems resulting from declining prices of wetland products and conflict among wetland users were among those of least severity.

Table 5: Distribution of Respondents by Problems/Constraints of Wetland Users

PROBLEM	SEVERITY	FREQUENCY	PERCENTAGE
Lack of credit	***	17	14.2
Lack of access to inputs	***	13	10.8
Lack of legislation on use of resources	*	3	2.5
Conflicts among wetland users	*	5	4.2
Declining yield from wetlands	**	6	5.0
Declining prices of products	*	4	3.3
Lack of knowledge on effectiveness of soil improvement	**	11	9.2
Water-logging conditions	**	10	8.3
Insecure land tenure	*	7	5.8
Incessant flooding of plots	*	8	6.7
Erosion	*	7	5.8
High incidence of pest & disease	*	8	6.7
Inadequate knowledge controlling degradation	*	9	7.5
Deforestation and improper agricultural practices	***	12	10.0
		120	100

Source: Survey Data, 2005.
Note: * = Least Severe, ** = Intermediately Severe, *** = Most Severe

In a similar study, conducted by World Bank (2003), farmer/herder conflicts, low flood water and pests were identified as the most important constraints in Hadejia-Nguru wetlands, while over-exploitation of resources and deforestation were among the most severe problems in the Niger Delta. These findings conform with the results of the study.

CONCLUSION AND RECOMMENDATIONS

The findings of the study showed that socio-economic, physical and demographic factors are important determinants of wetland degradation. The intensive use of wetland resources is bound to produce adverse economic and environmental effects unless adequate conservation measures are undertaken. The need to reduce concentration through the creation of alternative means of livelihood cannot be over-emphasized. Government could encourage smallholders to diversify their income sources by providing them with credit facilities to enable them engage in other productive income generating activities such as small scale enterprises and micro-credit schemes of their interest. Government intervention is essential through appropriate policies that will support land improving investment and better management of resources.

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