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WETLAND IMPORTANCE AND DEPENDENCE AMONG HOUSEHOLDS AROUND THE OGUN RIVER BASIN, NIGERIA

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Abstract. Wetland is particularly important in developing countries for economic purposes. Yet they are often seen as wastelands by those whose livelihoods are not directly dependent on them. Livelihood activities and the monetary value of such support, as well as factors influencing dependence on wetlands, are largely missing in the literature. This study examines livelihood activities, wetland dependence and its determinants among wetland households. Primary data were collected from households using a two-stage random sampling procedure. Both descriptive and quantitative methods were employed for data analysis. The results show that primary occupation in wetland communities was mostly (86.8%) farming with an annual income of ₦246,684.40 (($1541.78@ $1 = ₦160.00). Support for dry season production (57.8%), year-round water supply (48.3%) and water storage and flood control (44.7%) were the most important benefits of wetlands to households. Tobit regression analysis revealed the determinants of wetland dependence with coefficients including gender (13.63), marital status (3.70) and native status (2.06). This study concludes that wetland supports dry season farming and is heavily depended upon for income by households in wetland communities. However, married men and natives depended relatively more on wetlands for income and livelihood. There is therefore a need to intensify awareness and advocacy for wetland protection among males, the married and natives. This, among other things, will help to reduce dependence on wetlands and thus take pressure off them.

Keywords: wetland, benefits, livelihood, dependence, income

INTRODUCTION

Wetlands are characterised by water at or near the soil surface for some part of the year, soils that are influenced by water saturation for all or part of the year and plants that are adapted to living in conditions of water saturation for all or part of the year (US EPA, 2021). Wetlands provide many critical functions in global ecology, including providing habitat and food for diverse species, aiding groundwater recharge, water retention and detention, which allows for maintenance of high-water tables in wetlands, as well as reduced flooding in adjacent ecosystems. They also provide erosion and sedimentation control between adjacent ecosystems, improve water quality through filtering sediment and metals from groundwater and cycle nutrients to terrestrial and aqueous environments within the wetland (Keddy, 2000). Wetlands are also important global sinks and transformers of various elements in the earth's various biogeochemical cycles. As full or part time habitats they function as a significant repository of the world's biodiversity. These functions are important not only within the wetlands themselves, but also to surrounding ecosystems. However, all functions are not equally distributed through the different types of wetlands, and many are influenced by floras and faunas (Greb et al., 2006).

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Globally, wetland food provisioning, which comprises fisheries and wild foods, as well as agriculture, is estimated to range from \$6 to \$2,761 ha^{-1} y^{-1} (de Groot et al., 2002). Thus, wetlands provide and support livelihoods. The term livelihood is often used interchangeably with economic strengthening and refers generally to economic production, employment and household income (USAID, 2013). Livelihoods are the means, activities and entitlements by which people make a living. A livelihood system is dynamic, integrating both the opportunities and assets available to a group of people for achieving their goals. Therefore, certain factors, such as asset base, geographic location and social and cultural traditions, as well as the economic, political and natural environment impact the choice of livelihood. For many developing countries whose mainstay is agriculture and other land-based resources, the population boom coupled with the diminishing reliability of rainfall have resulted in the expansion of livelihood activities into wetlands (Mwakaje, 2010), thereby reducing the incidence of food insecurity. Wetland dependent livelihoods include crop cultivation, herding, hunting, processing, sand or stone collection, artisanal fishing and aquaculture, and water vending etc. Undertaking these activities results in the provision of food, cash and other goods to satisfy a wide range of human needs. It is because of this that wetlands are seen as providing a means of achieving various livelihood outcomes, such as increased income and wellbeing, as well as reduced vulnerability and food insecurity. Wetland is particularly important in developing countries (Lamsal et al., 2015) for rural households that are short of food. For these, wetlands can provide a life-saving safety net. Food, such as fish, prawns, crabs and mushrooms, are freely gathered, thereby alleviating the food insecurity of such households. In West Africa, farmers use water within wetlands, where they often incorporate drains, canals, bunds, terraces, ridges and inland valleys (McCartney et al., 2010). Through such control of water, farmers are able to extend the growing season and reduce risks arising from the consequences of either drought or flooding. The Food and Agriculture Organization of the United Nations has highlighted the importance of wetlands for agriculture in Africa (Frenken and Mharapara, 2002), and many African governments and nongovernmental organisations are encouraging wetland farming to improve food security. Wetlands are beneficial to the immediate communities, but they can also pose some challenges if not well managed.

Such challenges include tendencies to attract dangerous wildlife (Kapfer, 2011) and the generation of offensive odours (MoDOT, 2007; Lamontagne et al., 2004), and they can also serve as breeding grounds for mosquitos and other disease vectors (NRCS, 2007; USDA, 2008). This study therefore analysed the extent to which the wetlands under study suffer from these challenges. Furthermore, this study provided other information, such as the importance of wetlands, livelihood activities and dependency on wetlands, as well as factors that contribute to wetland dependence among households in the study area. The specific objectives were:

- To describe the benefits, importance and challenges associated with wetland.
- To examine livelihood activities and wetland dependence.
- To determine factors influencing wetland dependence among wetland households.

MATERIALS AND METHODS

This study was carried out in communities around the Ogun River. The Ogun River and its tributaries are located in south-western Nigeria. It is one of a series of West African Rivers which do not drain into the Niger River system but instead discharge into coastal lagoons and creeks bordering the Atlantic Ocean (Sydenham, 1977). The Ogun River is a perennial river in Nigeria, which has the coordinates of 3°28'E and 8°41'N from its source in Oyo State to 3°25'E and 6°35'N in Lagos State, where it enters the Lagos Lagoon (Adeosun et al, 2014). The Ogun River catchment area is located in south-western Nigeria and bordered geographically at latitudes of 6°26'N and 9°10'N and longitudes of 2°28'E and 4°4'E. The Ogun River is of great economic and social importance in its catchment area. The river is used for domestic purposes, such as bathing, washing and drinking. Fishing is also carried out in a major part of the river. Artisanal fisheries are the main industry in the lower Ogun River, with most people deriving their income from sanding and excavations.

A two-stage sampling technique was used in this study. Stage one involves stratification of the entire river into two based on the slope: a steep sloped (average 15%) terrain marks the upper zone, while the lower zone has a gentler slope (< 1%) according to Bhattacharya and Bolaji (2010), i.e., the upper and lower Ogun River. The upper Ogun River covers Oyo State, while the lower

Table 1. Distribution of respondents by state, local government and community

State/Local government	Community	Frequency	Percent
Oyo		363	57.3
Atisbo	Ago-Are	54	8.5
	Tede	19	3.0
Iseyin	Ado Awaye	19	3.0
	Agbede	27	4.3
	Gbokoyi	24	3.8
	Idi Iya	35	5.5
	Odo Ibo	21	3.3
	Odo Ogun	16	2.5
	Otiri	29	4.6
Saki East	Ago Amodu	10	1.6
	Sepeteri	42	6.6
Saki West	Saki	67	10.6
Ogun		270	42.7
Ifo	Olorunsogo	25	3.9
Obafemi Owode	Ajade	15	2.4
	Ilawo	10	1.6
	Iro	37	5.8
	Itori	19	3.0
	Mokoloki	35	5.5
	Ogunpa	10	1.6
	Saagi	10	1.6
	Saare	15	2.4
Yewa North	Ibooro	31	4.9
	Sawonjo	63	10.0
Total		633	100.0

Source: own elaboration.

Ogun River is situated in Ogun and Lagos state. Ogun and Oyo state were purposely selected at this stage due to similarities in livelihood activities found around that stretch of the river. The second stage involves random selection of communities and households. Oyo state covers approximately 28,454 square kilometres, while Ogun covers 16,981km², with the river also flowing through a larger expanse in Oyo state than Ogun state. Therefore, respondents were drawn proportionately across the states and communities at a ratio of 60:40 (3:2) to give the six hundred and thirty-three respondents used in the study. Table 1 gives the distribution of respondents by state, local government and community.

The primary data used in this study were collected through the use of a personally administered questionnaire. Both descriptive and econometric procedure was used for data analysis. Wetland livelihood dependence (*Y*) was calculated as the percentage of wetland income of total household income. The Tobit or censored regression model was used to analyse the factors that influenced wetland livelihood dependence among the respondents. This model was appropriate in this case as some households may not have wetland income (Fisher, 2004) and are thus represented below as zero, while those earning wetland incomes at the other end can be up to +∞.

In this study, we hypothesize that the factors affecting wetland dependence are as follows:

Physical/natural assets: The size of farm belonging to the household is expected to affect the dependence on wetland. Reliable access to water throughout the year is expected to influence the size of farm that will be cultivated by households.

Human assets: The quality and quantity of household labour are expected to affect wetland dependence. The quality of household labour is captured by the capacity to work proxied by the age of the manager of the farm household. The quantity of household labour can either be investigated by household size or ratio of family members that are not earning an income to those who are (dependency ratio). Dependency ratio is favoured in this study as the number of household members who can assist on the farm or through other income generating activities i.e., the ration of dependents – children and the elderly – to all household members (Owoo, 2021) can actually be a reflection of human assets compared to "liabilities" in the household. The gender of the manager of the household is included to examine its influence on wetland dependence. A positive relationship is hypothesized for males as gender often controls access to and use of natural resources in Sub Saharan Africa. The same explanation also holds for marital status of household managers as the married are better esteemed and often favoured in decision-making and use of natural resources. Educational attainment of the household
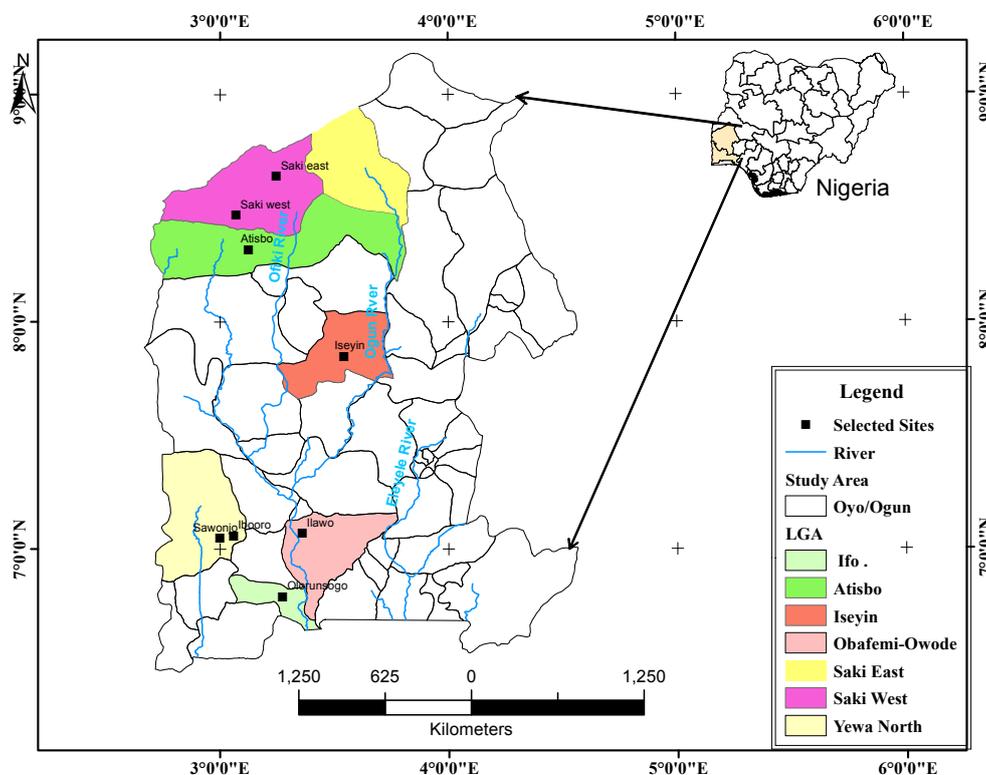
Fig. 1. Map of wetland communities covered in Ogun and Oyo State
Source: own elaboration.

manager is considered to be another human asset because it determines the livelihood options, such as paid or salaried jobs, that can be engaged in. Completion of different levels of education is certified and used for seeking employment, hence the inclusion of these educational levels and not number of years spent in schooling.

Social assets: This is represented by the native status of the household manager. Participation in communal activities is expected to increase when managers are native to the land. Such social status will also improve access and exploration of wetland resources and, consequently, wetland dependence.

Financial assets: This is proxied by assets owned by farm households. This also depicts the wealth and financial capabilities of households which may have either positive or negative effects on wetland dependence.

The adapted model was specified as:

$$y_i = \alpha + x_i \beta_i + e_i \tag{1}$$

Where:

y_i – is wetland livelihood dependence, or the dependent variable,
α – is regression constant,
β_i – are parameters of interest associated with the x_i,
x_i – are the explanatory variables,
e_i – are the error terms.

Wetland dependence of a household is the ratio of wetland related income to total household income.

x_1 – age of household managers (years)
x_2 – gender dummy variable (1 – male, 0 – female)
x_3 – educational attainment (1 – no formal school education; 2 – primary school education; 3 – secondary school education; 4 – tertiary school education)
x_4 – marital status (1 – single; 2 – married; 3 – other)
x_5 – dependency ratio (ratio of the number of dependent household members younger than 15 years old or older than 60 years old divided by the number between 15 and 60 years old)
x_6 – farm size (hectares)

x_7 – native status dummy variable (1 – native, 0 – non-native)

x_8 – depreciated asset worth (₦)

x_9 – length of stay in the wetland catchment area (years).

RESULTS AND DISCUSSION

The socio-economic characteristics of the respondents are presented in Table 2. The table shows that 41% of wetland is between 41 and 50 years old. This implies that the wetlands we currently have are youthful and economically active. The table also reveals that the majority (61.1%) of respondents are male with at least primary school education as only a minority (18.5%) of them were not formally educated. Also, almost all (93.5%) the wetland residents enumerated were married and predominantly farmers (86.1%). About half (48.9%) of the wetland households have farms of less than 1Ha, indicating that they are small holder farmers. Cassava (36.9%) and maize (34.7%) are the main crops grown in this area. This is against the expectation that rice will be more common. The farmers, however, explained that most of the swampy areas used for rice cultivation had been taken over by property developers.

The importance of wetland benefits to households were captured on a 3-point Likert scale. The result is presented in Table 3. The provisioning and regulating benefits of wetlands were perceived as the most important according to the evidence in Table 3. The majority of wetland residents agreed that wetlands provide these benefits. However, support for dry season production was the most important thing (57.8%). This was not surprising as the majority (86.7%) of wetland residents are farmers, as evidenced in Table 2, thereby confirming the reliance of the farmers on wetlands for dry season production. Wetland support for all-year water supply comes next (48.3%) as the most important wetland benefit as about half (48.3%) of the respondents stated this. Water storage and flood control (44.7%), which is a regulating benefit of wetland, is the third most important to wetland households. It is therefore evident that provisioning/physical benefits, particularly as seen here, in support of wetlands for livelihoods, are more important than regulating, cultural or supporting benefits to residents. In essence, wetland benefits were not well appreciated among the respondents, except for the limited consumptive use of some of the wetland resources

Table 2. Socio economic characteristics of respondents

Characteristics	Frequency	Percent
Age		
Less or equal to 30	63	10.0
31–40	131	20.7
41–50	260	41.0
51–60	91	14.4
Greater than 60	88	13.9
Gender		
Female	246	38.9
Male	387	61.1
Educational attainment		
None formally	117	18.5
Primary	172	27.2
Secondary	197	31.1
Tertiary	147	23.2
Marital Status		
Single	33	5.2
Married	592	93.5
Widowed	6	1.0
Divorced	2	0.3
Major occupation		
Farming	545	86.1
Aquaculture, Fishing, sand mining	14	2.2
Hunting, lumbering and NTFP collection	10	1.5
Agro-processing, trading	26	4.1
Wage employment	10	1.5
Artisanship, crafts and others	28	4.4
Farm size		
Less or equal to 1 ha	308	48.9
1.01–5 ha	214	33.9
5.01–10 ha	64	10.0
10.01–15 ha	12	1.8
Greater than 15 ha	35	5.4
Main crop grown		
Cassava	201	36.9
Maize	189	34.7
Leafy vegetables	80	14.7
Fruit vegetables	21	3.9
Rice	31	5.7

Source: own elaboration.

Table 3. Importance of wetland benefits to the community

Wetland benefits	Not important	Important	Very important
Provisioning			
Support dry season farming	5.2	37.0	57.8
Support all year water supply	6.9	44.9	48.3
Support fishing	19.7	35.6	44.7
Supply of building material	25.7	35.7	38.6
Supply of medicinal materials	25.8	45.1	29.1
Regulating			
Store water & control flood	13.4	39.5	47.2
Provision of cool breeze	19.8	39.8	40.4
Purify the air	26.7	38.2	35.1
Serve as windbreaks	25.4	38.3	36.3
Microclimate stabilization	18.7	56.0	25.3
Cultural			
Provide attractive landscape	38.4	41.2	20.4
Support recreation	47.7	34.7	17.6
Attract tourists	50.5	38.3	11.7
Supporting			
Support biodiversity	40.5	36.9	22.6

Source: own elaboration.

Table 4. Challenges associated with community wetlands

Wetland challenges	Large extent	Some extent
Attracts dangerous wildlife and reptiles to the neighbourhood	50.1	49.9
Generate offensive odours due to stagnant water and indiscriminate dumping of wastes	57.0	43.0
Serve as breeding ground for mosquito and other disease vectors	38.4	61.6
Flooding	100.00	

Source: own elaboration.

(Raburu et al., 2012). The above is further corroborated by the findings of Bakema and Iyango (2000) in the Uganda wetlands. They submitted that the presence of a wetland is only appreciated by a limited group of direct users. This is partly due to the fact that many derive no apparent immediate benefits from them, and partly because most people take the services that wetlands perform for granted.

Wetland residents claimed that wetlands attract dangerous wildlife (50.1%) and generate an offensive odour (57.0%) according to Table 4. This is evidence of poor management and shortcomings in the natural functioning of the wetlands. The wetlands are also adjudged to be serving as breeding grounds for mosquitos and disease vectors (61.6%). This finding further strengthens the poor management of the wetland and thereby means that it cannot control diseases. The residents also agree that the wetlands in their neighbourhood contribute to incessant flooding (100%) in the study area.

Table 5 reveals the livelihood pattern and associated returns in wetland areas. This is of particular interest as it suggests the economic uses which the wetlands were being explored for. The returns shown are for individual households involved in each of the livelihood options, while the average for wetland and non-wetland related livelihood categories are only for households involved in four different livelihoods altogether. The results presented in Table 5 show that the most prevalent occupation in wetland communities was (86.8%) farming, with an annual return of ₦246,684.40 ($1541.78@ $1 = ₦160.00). This may be closely related to the availability of water all year round in the wetland catchments. It was therefore possible to rely on water from the wetlands for dry season farming. Furthermore, other wetland related livelihood activities in the area were aquaculture, fishing and sand mining, hunting and the collection of non-timber forest products (NTFP). These directly employ and provide income for about 7% of the wetland residents. The resources of the wetlands therefore provide a safety net for the wetland residents, as is the case with other natural resources (USAID, 2006). Fishing and its allies provide ₦106,538.46 ($665.87 @ $1 = ₦160.00) per year; the annual livelihood resources compared well with similar pecuniary contributions of wetland fishing activities found in the fishing community of Nijhum Dwip in Bangladesh (Rahman et al., 2012). In the latter case, 46% of the population was found to earn between $625/yr (or ₦100,000.00 @ $1 = ₦160.00) and $937/yr

Table 5. Distribution of livelihood activities and Income per year in wetland areas

Income from all sources	Households deriving income from source			
	Frequency	%	Returns (₦)	Standard Error
Wetland dependent				
Farming	545	86.78	246,684.40	8,586.66
Aquaculture	18	2.87	207,222.22	46,888.87
Fishing, water vending, sand mining	13	2.07	106,538.46	18,513.55
Hunting, lumbering NTFP collection	10	1.59	72,300.00	32,648.99
Average			158,186.27	8,493.82
Non wetland dependent				
Agro processing, trading and hospitality	63	10.03	119,777.78	11,728.199
Artisanship and crafts	36	5.73	229,000.00	17,555.581
Wage employment	72	11.46	269,544.44	24,078.787
Others	14	2.23	227,642.86	73,720.113
Average			211,491.27	31,770.67
Total income			216,858.69	20,132.24

Source: own elaboration.

(i.e., ₦149,992.00). However, wage employment, which accounted for about 12% of wetland residents, yielded the greatest income (i.e., ₦269,544 = $1684.65 per year). Annual wetland dependent income per household was ₦158,186.27. This represents about 73% (72.9%) of total income accruable to households in wetland communities. This exposition further confirms the claim that local communities often depend on natural resources for sustenance and income generation. Households in communities around the Ogun River also explored their wetland resources for economic gains. There is evidence of heavy reliance on wetlands for income in the study area. As much as 72.9% of annual household income was derived from the wetlands; the non-availability of wetland resources would definitely have serious implications for households' welfare.

The result of factors influencing households' dependence on wetlands for income generation is presented in Table 6.

The socio-economic factors that positively influenced dependence on wetlands included gender (i.e., respondents predominantly male), marital status, and native status. The males were more likely to depend on

Table 6. Tobit regression of socio economic factors influencing wetland dependency

Wetland dependency	Co-efficient	t-ratio
Age	–0.4618	0.0771
Gender	13.6312	1.6701
Educational attainment	–1.5114	0.8039
Marital status	3.7020	2.1257
Dependency ratio	0.0441	0.1846
Farm size	–0.6547	0.7495
Nativity dummy	2.0629	2.1257
Asset worth	2.07e–06	7.07e-07
Length of stay	–0.0288	0.0464
Constant	83.7492	7.4646
Log likelihood	–11 654.43	
LR chi^2(9)	124.83	
Probability > chi^2	0.0053	

Source: own elaboration.

wetlands for income as the coefficient of gender (male) dummy was significant ($P < 0.01$). This was in line with Olarewaju et al. (2011), who found that males constitute the majority (73.6%) of those engaged in wetland related activities. Also, marital status ($P < 0.05$) positively influenced dependence on wetlands for income. The married were likely to depend on wetlands more than their single counterparts. Natives ($P < 0.05$) were also more dependent on wetlands for income than non-natives.

There are several marginal effects depending on the outcome of interest. The default is the expectation of the latent variable, and this is a linear function of the explanatory variables. In the foregoing, marginal effects are the same as the coefficients of Tobit regression in the Stata applications software used for this result (Bius, 2014). The males in wetland communities, therefore, were fourteen times (13.63) more dependent on wetlands than their female counterparts. Also, the married were almost four (3.70) times and natives two times (2.06) more dependent on wetlands than the singles and non-natives respectively after all other factors were held constant.

CONCLUSION AND RECOMMENDATIONS

This study concludes that wetlands support dry season farming and are heavily depended upon for income by households in wetland communities. However, males that are married and natives depended relatively more on wetlands for income and livelihood. There is therefore a need to intensify awareness and advocacy for wetland protection among males, married and natives. This, among other things, will help to reduce dependence on wetlands and thus take pressure off them.

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