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WETLANDS ATTRIBUTES AND INFLUENCES ON FOOD SECURITY OF HOUSEHOLDS AROUND OGUN RIVER OF NIGERIA

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ABSTRACT

The physical and ecological attributes of wetlands are important in their economic and biological usefulness. To this end, this research answers questions such as: what are the attributes of the wetland in the study area? Do the wetland attributes have influence on food security status of the households? The study was conducted in the wetlands of Ogun River and its tributaries located in the South-western Nigeria. Primary data were collected through the use of personally administered questionnaire and interview. Two stage sampling technique was used in selecting 633 households included in this study. Data were analyzed using descriptive techniques; United States Department of Agriculture (USDA) food security module and binary Logit model. The result revealed that wetlands of upper Ogun have abundance of all wetland attributes examined. Food security situation in households with children was not different from those without children. Majority of wetland residents' households were not food secure leaving about a quarter as food secured. All the eight wetland attributes examined in this study had potential of increasing food security among wetland households as food security was constituently higher in wetlands with abundance of these attributes as against where they are limited. Socio-economic characteristics and wetland attributes have influence on food security status of households. The study therefore recommends that wetlands that are deep and free flowing with unobstructed water ways should be developed by government, international development agencies and non-governmental organizations so as to improve food security status in wetlands areas.

Keywords: Wetlands attributes, food security, Ogun River, resources, livelihood, local communities, subjective indicator

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I. INTRODUCTION

Wetlands – generally referring to marshes, swamps, floodplains, mudflats, estuarine and the littoral areas of large bodies of water – are among the earth's most productive ecosystems (WMDU, 2009). They have been described as "*the kidneys of the landscape*", because of the functions they perform in the hydrological and chemical cycles, and as *"biological supermarkets"* because of the extensive food webs and rich biodiversity they support (Mitsch and Gosselink, 2007). Ramsar (2010) reiterates that wetlands provide food, store carbon, regulate the water flows, store energy, and are crucial for biodiversity and that their benefits to people are essential for the future security of humankind.

Economically, wetlands are important for a nation as they improve water quality without expensive treatment facilities, curb flooding after large storm events which reduces potential damage to buildings, roads and infrastructure, and increase the enjoyment of human habitat by providing places for important wildlife and plants. The local communities in which wetlands are found have been known to depend on them for livelihoods as they are important source of employment, income, food and nutrition which help in achieving a good health status (Friend, 2007). According to this report, people that live in wetland areas depend on them for livelihoods, cultivating wetland crops and harvesting a range of aquatic resources such as fish, crustaceans, amphibians and insects. This dependence thus helps in the achievement of livelihood goals including food security. To this end, most attention towards wetlands conservation interests has occurred as a result of the recognition that degradation of wetlands and water resources will have negative impacts on the people that depend on these resources (Friend, 2007). The major concerns from the study are that loss of wetland functionality will reduce the availability of wild food sources thereby impacting livelihood outcome in form of food insecurity.

Wetland like every other natural resource is subject to competing uses. In Nigeria, the surface wetland water alone accounts for majority (97%) of water supply for various uses (Adeoti, 2009). Such uses include support for fishing, agriculture, forestry, tourism and research on a broad scale (Ramsar, 2014). Specifically, local communities depend on wetlands for livelihood support activities such as livestock grazing, farming, fishing and harvesting of wild resources (Ramsar, 2010). Historically, wetlands' aquatic resources and the rural livelihoods that they support have been overlooked in national economic development planning (Ratner *et al.* 2006). Wetlands are richly endowed with resources which are actively explored for human use and economic gains (Ojekunle, 2011). Wetland dependent livelihoods explore wetland attributes such as provision of water all year round, forested landscapes, sand or stone deposits for activities that result in the provision of food, cash and other goods to satisfy a wide range of human needs. It is to this end that wetlands attributes must be understood so as to provide a pluralistic approach in wetland management. Developing appropriate policies for sustainable wetlands

management requires two key features of maintaining ecological integrity and also a mechanism that empowers local people to manage and control wetlands in their own landscape (McCartney *et al.*, 2010) especially in developing countries like Nigeria whose mainstay is agriculture and other land-based resources. There is growing concern that current development pathways will continue to underestimate the significance of these resources, and therefore, miss opportunities for reducing food insecurity (Friend, 2007) and for promoting equitable, sustainable development through the management of natural wetland systems. Population boom coupled with diminishing reliability of rainfall have resulted into expansion of livelihood activities into wetlands (Mwakaje, 2009) thereby reducing the incidence of food insecurity. In order to meet the combined needs of habitat conservation and ecosystem service delivery, it is necessary to consider wetlands in a broad context (Stratford, et al 2018). Wetland information needed by wetland decision-makers e.g. regulators, planners, public land use managers) encompasses a broad range of issues and is not limited to functions and values. Most efforts to develop rapid wetland assessment techniques have focused on functions or functions and values; other required information also includes wetland attributes (AFDB, 2017). Physical attributes have been a direct and cost-effective way to begin the evaluation of biological condition of wetlands. Although focusing monitoring efforts on physical parameters only would overlook damage caused by chemical and biological stressors, it is still a valid ground to begin a comprehensive assessment of wetland functionality (U.S. EPA. 2002). Both physical and ecological attributes of the wetlands are important in their economic and biological usefulness. Three basic characteristics are usually used in categorizing wetlands. These are permanence and seasonality of their moisture regime; the main vegetation and land cover types; and the resource pressure from human use (WMDU, 2009). Following this literature, the existence of wetland attributes in abundance or limited state and other characteristics were examined within the catchment area. This is particularly needful as wetlands are important assets upon which many livelihoods depend. This study intends to provide various attributes of Ogun River wetlands which can serve as basis for further chemical and biological assessment. The study could significantly assist policy makers in formulating efficient and preferred wetland development projects based on identified attributes. To this end, the following questions were answered in this study. What are the attributes of the wetland in the study area? Do the wetland attributes have influence on food security status of the households? Specific objectives of this study were to describe wetlands' attributes and assess the influence of wetlands' attributes on the food security status of households across the selected wetland communities around the Ogun River. Research hypothesis of the study is stated as wetland attributes have significant influence on food security status of households around Ogun River.

II. MATERIALS AND METHODS

The study was conducted in the wetlands of Ogun River and its tributaries located in the South-western Nigeria. It is one of the series of West African Rivers which do not drain into the Niger River system but instead discharges into coastal lagoons and creeks bordering the Atlantic Ocean (Sydenham, 1977). Ogun River is a perennial river in Nigeria, which has a coordinate 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). Ogun River catchment area is located in the Southwest Nigeria, and bordered geographically on the latitudes 6°26'N and 9°10'N and longitudes 2°28'E and 4°4'E. The land expanse of the catchments is about 23,000 km^2. Ogun River has a flowing rate and density which change depending on the geomorphology of the area between its spring and the point at which it joins the Lagoon (Okeyode, 2012). Based on sloppiness, therefore, Ogun River basin can be divided into two parts: a high slope (average 15%) terrain marks the upper zone while the lower zone is of extremely low slope (< 1%) characterized by flooding with marshes and swamp. The upper zone is made up of communities in Oyo State while the lower comprises communities in Ogun and Lagos state (Bhattacharya and Bolaji, 2010). 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. The map of study area is presented on Figure 1.

Two stage sampling technique was used in this study. Stage one involves stratification of the entire River into two based on the slope. Ogun and Oyo states were purposively selected at this stage due to similarities in livelihood activities found around the stretch of the river. The second stage involves random selection of communities and households. The selection was made from list of communities sourced from agricultural extension officers that are attached to the area

Communities surveyed in upper Ogun included Ago Are, Tede, Ado Awaye, Agbede, Gbokoyi, Idi Iya, Odo Ogun, Sepeteri etc. Those surveyed in the lower Ogun were Olorunsogo, Ajade, Ilawo, Iro, Itori, Mokoloki, Ogunpa, Saagi, Saare, Ibooro, Sawonjo etc. A total of six hundred and thirty-three households were surveyed in this study in the year 2017-2018.

The subjective indicator was used to measure food security status of households. Thus, United States Department of Agriculture, Food and Nutrition Service (USDA) household food security module (Bickel *et al.,* 2000) was employed.The scale eighteen questions were modified to fifteen items for households with children and eight items for households without children. This is because three questions have three parts that are counted separately to make up the eighteen. Missing values can either be replaced through the direct imputation or to employ Rasch model software to calculate household scale values. Direct imputation methods are simpler and in most cases are quite adequate for the small proportion of missing values typically found in core-module data, following Bickel *et al,* 2000.

If a respondent doesn't respond to any statement, the statement will be scored as missing i.e., neither positive nor negative and such will be excluded from further analysis. In this study, five respondents had missing values and were excluded in food security analysis. The numbers of affirmative responses for each household were then counted and values were assigned following Bickel *et al.*, (2000) as shown in Table 1. This resulted into four classes of food secure, food insecure without hunger, food insecure with moderate hunger and food insecure with severe hunger. The usual presumption is that the three categories of food insecurity indicate at least some nutritional deprivation (Bickel *et al.*, 2000).

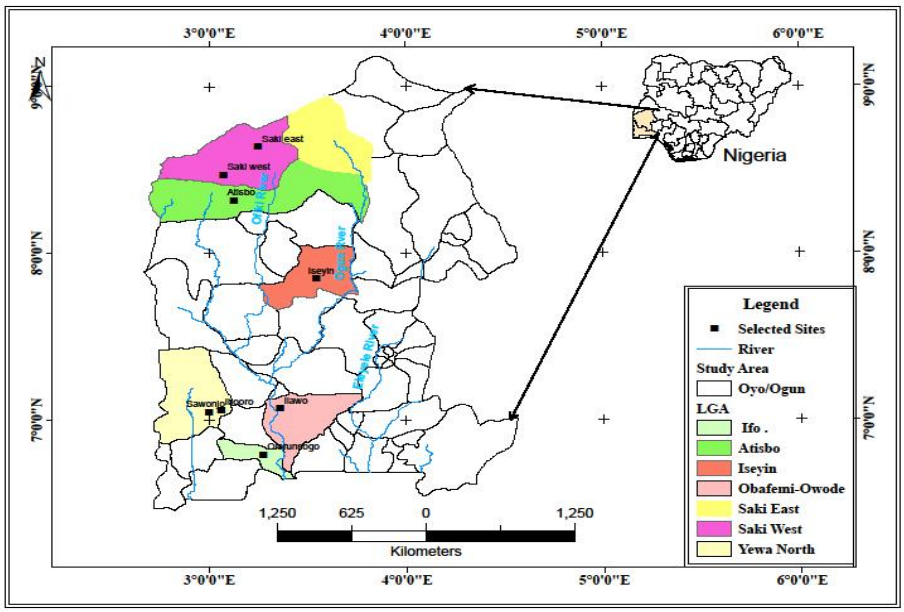

Figure 1: Map of Study Area
Source: Field survey

Table 1: Food Security Scale Values and Status

Number of Affirmative Responses (Out of 15) Households with children	(Out of 8) Households without children	Status
0-2	0-2	Food Secure
3-6	3-4	Food Insecure without Hunger
7-10	5-6	Food Insecure with Moderate Hunger
11-15	7-8	Food Insecure with Severe Hunger

Source: Adapted from Bickel *et al*., (2000)

Therefore, for the purpose of this study, the last three groups were merged into the food insecure while the food secure class was retained as food secure in the pooled data.

Conceptual framework of food security model recognizes that human activity takes place in a given environment, and that this essential condition can have major effects. The environment and consequently natural resources (wetlands) may have either beneficial or negative effects on food security. Wetlands attributes can influence the production, circulation, availability and access to food resources. Food security can become harder to ensure in areas that lack natural resources which have been known to provide safety nets for communities in extreme, marginal or abnormal climates (Duhaime and Godmaire 2002). To this end, the relationship between food security status of households and wetlands attributes along with other socio-economic characteristics of the households heads were examined in a logit model. The assumption behind the inclusion of household head characteristics is based on the fact household decisions on production, consumption and investment are generally made by the household head (Van der Geest and Finkler, 2004). Logistic regression is a binomial response variable which is easy to handle when more than two explanatory variables are to be estimated altogether. Following from Gujarati (2004), the underlying latent model was expressed as below:

$$y_i = \begin{Bmatrix} 1\ if\ y_i^* > 0 \\ 0\ if\ y_i^* \leq 0 \end{Bmatrix} = \alpha + x_i\beta_i + e_i$$

If P is probability of being food secure, then probability of being food insecure is $1 - P_i$, Therefore, the odd ratio $(\frac{P_i}{1-P_i})$ can be rewritten as

$$\frac{P_i}{1 - P_i} = \frac{1 + e^{y_i}}{1 + e^{-y_i}} = e^{y_i}$$

Taking the natural log of the odd ratio thus yielded the logit model. Therefore, the logit model was written and estimated as:

$$L_i = \ln\left(\frac{P_i}{1 - P_i}\right) = y_i = \alpha + x_i\beta_i + e_i$$

Where α represents intercept, $\beta_i$represents the partial effect of a predictor variable on the log of odds, and e_i represents the error term. The exponentials of $\beta_i$which is the odd ratio gives the percentage change in food security status of household relative to a unit change in the associated independent variable, holding the effect of other variables constant. This study therefore presents the coefficients (natural log of odd), odds ratio and marginal effect. The marginal effect estimate gives the change in probability of households being food secure as the independent variable increases by one. This is calculated as

$$\frac{\partial P_i}{\partial x_i} = \hat{\beta}_i(1 - \hat{P}_i)\hat{P}_i$$

Other statistics presented in this study are Wald test values (called z). This is analogous to t-values. A z-statistic is a value drawn from a standard normal distribution; that is, a normal distribution with a mean of 0 and a variance of 1. Given a z-statistic, probabilities can be easily computed using statistical tables or software. A t-distribution closely resembles a standard normal, but with a higher probability of extreme values and a lower probability of values toward the center of the distribution. The t-distribution depends on a 'degrees of freedom' value, which in regression models is equal to N – K, where N is the number of observations and K is the number of parameters (including the intercept). As degrees of freedom increases, the t-distribution converges to the standard normal (Z) distribution. Furthermore, 'z' is computed as coefficient divided by the standard error which is also the same formula for computing t value. T-statistics is computed in OLS using the degrees of freedom but not for logit/probit models because OLS is an unbiased estimator, which means that the average parameter estimates over many samples will equal the true values, regardless of the sample size. Thus, a small sample size (i.e., < 50 or so observations) is acceptable. In practice, the sample size necessary for logit/probit is not exactly known but should be fairly large; it should generally be large enough so that Z and t scores are identical. Therefore, software packages are programmed to compute the p-values based on Z (Statistics in fair lending, 2016). Two tail p-values test the hypothesis that each coefficient is different from zero. To reject this, the p-value has to be lower than 0.10 (90%). If this is the case, then it can be concluded that the variable has a significant influence on the dependent variable. Factors that affect food security among households are influenced by the nature of household and demographic, social, economic, political and environmental factors that surrounds it (Muhammad and Sidique, 2019). Following from this and adapting Agidew and Singh, 2018, explanatory variables in the model include characteristics of household head (age and gender), household characteristics (dependency ratio, farm size and wetland dependence) and attributes of wetland in their area. Socio economic characteristics of household head has been known to have influence on food security (Ibnouf, 2011 (Abdullah *et al,* 2019). Income earning and generation is known to vary over human lifetime. Human starts earning income at about 15 years or more until 50-60 years (Wijaya *et al*, 2020). Dependency ratio is measured as number of dependent household members younger than 15 years or older than 60 years old divided by the number between 15 and 60 years. Households with high dependency ratio are vulnerable to food security as those members may not be economically active and thus depend on others for sustenance. Household farm size is a proxy for household income as majority of the respondents is farmers. Households in wetland communities are known to depend on wetland for income. Therefore, the influence of this dependency on food security was examined. Wetland dependence was calculated as

a ratio of wetland income to total income. Wetland attributes measured as limited and abundant base on respondent's perception were also part of the model variables. This was to test the null hypothesis that wetland attributes do not have significant influence on food security status of households around Ogun River.

Explicitly,

$$y_i = \alpha + x_i\beta_i + e_i$$

Where,

y_i = Food security status of household (Food secure-1, food insecure-0), α = Constant, β_i = Parameters of interest associated with the x_i, e_i = Error term, x_i = Explanatory variables , x_1 = Age of household head (years), x_2 = Gender of household head, x_3 = Dependency ratio, x_4 = Farm size (hectares), x_5 = Wetland dependence (₦), x_6 = Attractive features, x_7 = Deep water, x_8 = Sand deposit, x_9 = Permanent/Seasonal inundation, x_{10} = Serene/forested wetlands, x_{11} = Flowing water all year.

III. RESULTSANDDISCUSSION

The result of personal characteristics of wetland household is given on Table 2. The Table revealed that the males constitute the majority (61.1%) of wetland communities with 41.1% of the respondents aged between 41-50 years. A wetland household had about 5-8 individuals (50.8%) representing a large household size and mouths to cater for. Major occupation is farming (86.7%) with wetland related occupation (aquaculture, fishing, sand mining, hunting, lumbering and NTFP collection) directly employing less than 10%.

The result on Figure 2 indicated that the wetlands in the upper Ogun River had more of all the desirable and undesirable attributes. Attractive features such as falls, springs and historically relevant points were less evident (62.6%) in the lower Ogun as compared to the relative abundance of these attributes in upper Ogun (72.3%). Evidence therefore suggests that the lower Ogun wetlands are better suited for or suitable for tourism development. Landscape features such as falls are usually harnessed for tourism development. Although, many of such features as observed in this study are still lying fallow. Notable wetlands used for tourism purposes in Nigeria include Erin Ijesha waterfall, Oguta Lake, Gurara waterfalls, Ikogosi warm and cold spring and the Wikki spring located in Yankari National Park (Omon, 2014). The prominent wetland attributes explored in these scenarios are mainly attractive features i.e., waterfalls and spring. Also, the wetlands in lower Ogun were broader (95.5%) and relatively slow moving as against those of upper Ogun (88.7%). This result readily supports the submission by Bhattacharya and Bolaji (2010) that the river has different slope along its stretch. The sloppy gradient will ideally impact on the speed at which the river flows. Thus, naturally, the lower Ogun should consist of more swamps and marshes as the finding in this study has

indicated. Wetlands that are permanently inundated are more available in lower Ogun (81.8%) as against the upper part (72.0%); meaning that the wetlands in the upper Ogun do not overflow their banks all year round. This readily revealed the possible damming of the river and other developmental project which can limit its flow pattern. The wetlands at their upper and lower ends had extensive sand, stone and mineral deposits thereby supporting extraction of these resources for economic gains. However, more sand deposits were found at the lower end of the river network (91.3%). Fashae and Faniran, (2015) confirmed that downstream of River Ogun; there exist alluvium along the banks, while the channel-bed materials become slightly fine grained. They further lend credence to the finding in this study that there is variability in the morphologic characteristic of River Ogun. The waters from the wetlands were also revealed to be available all year round, thus supporting both agricultural and domestic uses (i.e., 95.5%, and 78.0%, respectively). It was also evident that conservational activities on wetlands in upper Ogun must be duly considered as the wetlands do not possess much wildlife and water birds (68.7%).

Table 2: Distribution of Wetland Residents by Personal Characteristics

Characteristics	Frequency	Percent
Gender		
Female	246	38.9
Male	387	61.1
Age (year)		
Less or equal to 30	63	10.0
31-40	131	20.7
41-50	260	41.1
51-60	91	14.4
Greater than 60	88	13.9
Household No.		
1-4	255	40.3
5-8	319	50.4
9-12	38	6.0
Greater than 12	21	3.3
Major occupation		
Farming	457	72.19
Aquaculture, Fishing, sand mining	31	4.90
Hunting, lumbering and NTFP collection	10	1.60
Agro-processing, trading	63	9.95
Wage employment	72	11.36

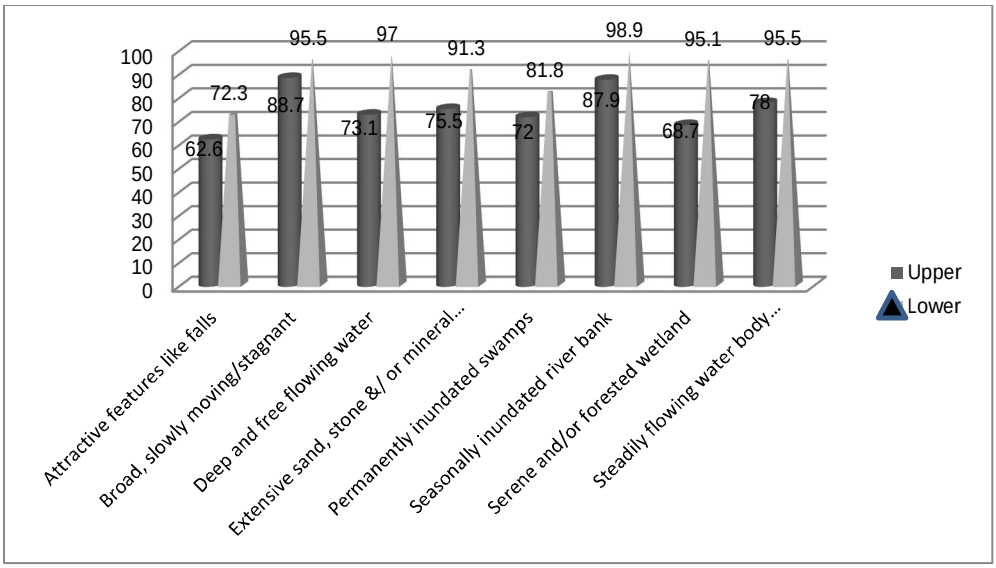

Figure 2: Attributes of Community Wetlands

The results of food security status of the wetland communities indicated a worrisome situation (Table 3). Majority (70.1%) of the households without children had food items and were not worried about them running out of food stuffs. Also, the procured food stuffs lasted for most (54.8%) households. It is worth noting that about one-third (32.3%) of these households were not eating balanced meals. Thus, adults had to cut the size of their meals (55.4%), go hungry at times (60.8%), lost weight due to hunger (61.6%) or could not eat sometimes in a whole day (75.6%). Food security situation in households with children was not different from children to adults as about half of the children (42.0%) were fed with few low-cost meals because there was neither food nor money to buy meals. Not less than one out of every three children of wetlands' households (37.3%) were being fed with unbalanced diets.

More worrisome were the facts that majority (61.3%) of the households reported children had their size of food cut, were hungry sometimes (51.9%), skipped meals (64.6%) and could not eat for a whole day (70.4%). These outcomes appear plausible as the perception of rural households' about eating may be very different from what is obtainable for households in the urban centre. The analysis of food security status of households with and without children revealed hunger and reduction in meal sizes which are closely linked to under-nutrition. Under nutrition is defined as the pathological state arising from inadequate amount of food and hence of calories. The observation in this study is in agreement with the findings of Ajao *et al.* (2010). Although Ajao *et al*. (2010) surveyed women of child-bearing age who are with at least one under-five child, the core survey module questions were used to arrive at the food security status of households in Ile-Ife, Osun State,

Nigeria. Households with children reported inability to eat enough (61.2%) thereby comparing well with the 61.5% reported for this study. Also 56.8% in the Ile-Ife study skipped meals while 64.6% in the Ogun River Basin households skipped meals.

Table 3: Households Food Security Situations

Food Security Module	**Response**	
	No	Yes
a) Household without children (n_1=181)		
We were worried our food would run out before we got money to buy more	70.1	29.9
The food we bought just didn't last and we didn't have money to get more	54.8	45.2
We couldn't afford to eat balanced meals	67.7	32.3
Some adults in the household had to cut the size of their meals or skip meals because there wasn't enough money to buy food	44.6	55.4
Some adults couldn't eat what we felt we should eat because there wasn't enough money for food	53.7	46.3
Some adults were hungry but didn't eat because of not been able to afford enough food	39.2	60.8
Some adults lost weight because there wasn't enough money for food	38.4	61.6
Some adults in the household could not eat for a whole day because there wasn't enough money to buy food	24.4	75.6
b) Household with children (n_2=447)		
We relied on only a few kinds of low-cost food to feed the children because we were running out of money to buy food	58.0	42.0
We couldn't feed the children a balanced meal because we couldn't afford that	62.7	37.3
The children were not eating enough because we just couldn't afford enough food	51.1	48.9
Had to cut the size of the meals of at least one of the children because there wasn't enough money to buy food	38.7	61.3
The children were hungry, but we just couldn't afford more food	48.1	51.9
At least one of the children had to skip a meal because there wasn't enough money to buy food	35.4	64.6
At least one of the children could not eat for a whole day because there wasn't enough money to buy food	29.6	70.4

Further, the number of affirmative responses by the respondents was used to map the food security, and hence insecurity status of wetland households. Increasing number of affirmative responses to the food security module suggests the likelihood of household being food insecure. The analysis combined households with and without children. As shown in Table 4, about one of five (14.9%) wetland households had no affirmative response while about one in every four (22.0%) had

just two affirmative responses. Therefore, a very large proportion (78%) of the sampled households was food insecure leaving about a quarter (22%) as food secure. This is in line with 23.7% food security status obtained by Obayelu (2012) for households in Kwara and Kogi States using the core food security module. Also, Ajao *et al.* (2010), reported 65% food insecure and 35% food secure status for households with under-five children in Ile-Ife, Osun State using the same methodology. The proportion of food insecurity with severe hunger in households with children (35.6%) is lesser than obtainable in households without children (65.7%). Food security is also higher in households with children (23.7%) than in households without children (18.2%). Generally, household with children are more preoccupied with food provision as against those without children. Children can't endure hunger like adults who may ration meals to meet other needs.

Table 4: Distribution of Affirmative Response

Number of Affirmative responses	Frequency	Percent
0	94	14.9
1	11	1.7
2	34	5.4
3	19	3.0
4	12	1.9
5	50	7.9
6	31	4.9
7	44	7.0
8	41	6.5
9	14	2.2
10	41	6.5
11	39	6.2
12	42	6.6
13	49	7.7
14	55	8.7
15	52	8.3
Total	628	100.0

The contribution of wetland attributes to food security status of households was assessed by the abundance of wetland attributes. Abundance of wetland attributes was captured as either limited or abundant while proportion of the food secure or insecure in communities was examined across the two attributes levels. The proportion of food secured household was cross tabulated against the two levels of wetland attributes was used. The result is presented in Table 5. The proportion of the food secure was consistently higher in communities where wetlands abundantly provide some desirable attributes (Table 5). Communities where wetlands have abundant attractive features such as falls, springs and historical sites, households were more food secure (77.5%) as against where the features were limited (73.5%).

Also, wetlands with abundant broad, slowly moving or stagnant water were better food secure (96.2%) than those communities limited (72.9%) in this attribute.

Table 5: Contribution of Wetland Attributes to Households' Food Security Status

Wetland Attributes	Proportion of Food Secure	
	Limited	Abundant
Attractive falls like springs	22.5	26.5
Broad, slowly moving or stagnant water	3.8	27.1
Deep and free flowing water	9.4	28.4
Extensive sand deposit	23.2	25.6
Permanently inundated swamps	18	27.4
Seasonally inundated swamps	8.5	26.5
Serene / forested wetlands	12.6	28.3
Steadily flowing water available all year round	9.8	27.8

The highest influence of wetland attribute on food security was observed with broad, slowly moving or stagnant water where the difference between the food secured in communities with abundance of this feature and those limited in the feature was as much as 23.3%.

This suggests that wetlands that are broad, slowly moving or stagnant are beneficial for food security of wetland residents. The same can be said of deep and free flowing water where food security between communities with abundance of the feature was 19.0% higher than what was obtained in communities where it was limited. In fact, all the eight wetland attributes had potential of increasing food security among wetland households as food security was constituently higher in wetlands with abundance of these attributes as against where they are limited. This result was corroborated by Turyahabwe *et al.* (2013) findings. They submitted that 80% of respondents reported that wetland resources provide products and services that contribute enormously to their household food security. Besides, they also indirectly contribute to food security by providing services that foster food production such as weather modifications and nutrient retention.

Table 6 presents summary statistics of variables used in binary regression. The share of reference categories was presented for dummy variables while the mean (average) values of other continuous variables are included.

Evidence from binary logit regression model on Table 7 showed that both socio-economic variables and wetland attributes had influence on food security status of households in wetland areas. The coefficient of age indicates that the log of odd ratio of age (household head) while holding every other variable constant is 0.15, negative and significant ($p<0.01$). In other terms, its exponential value which is the

odd ratio showed that a unit increase in age reduces the odd of being food secured by 18%. As the household head age increases therefore, the likelihood of the household being food secure decreases corroborating the findings of Agidew and Singh, 2018. This result is expected as increase in age limit the productive ability of household head, and consequently the capacity for food security of households also decreases. However, this decrease in probability of being food secure in relation to age of household head is not continuous as revealed by age square. Since, age square has a positive and significant influence ($p<0.01$) on food security, it therefore portends that increase in age increases food security after the initial decrease. A very old household head may have less household members to cater for as the children will by then be on their own and somehow engaged in economic activities with which they cater for themselves and their parents, thereby making the older ones open to remittances or inflow from working children. The marginal effect estimates of age on food security revealed a 0.02 decrease in the probability of household being food secured as age of household head increases by one. Also, the more a wetland resident stayed in the wetlands, the lesser he/she is likely to be food secure as the variable (length of stay) has negative and significant relationship ($p<0.01$) with food security. The odd of being food secure decreases by 2% for every additional year the resident stays in the wetlands i.e., the probability of being food secure decreases as the resident stays an additional year in the area.

Table 6: Summary Statistics of Regression variables

Variables	Mean or share	SE
Dependent Variable		
Food secure=1, otherwise 0	22%	
Household head characteristics		
Age	47.14	0.09
Age square	2369.25	47.44
Male=1, otherwise 0	74.9%	
Length of stay	26.11	1.26
Dependency ratio	1.08	
Farm size (Ha)	3.01	0.04
Wetland dependency	78.62	0.23
Attractive features like falls, springs and historically relevant points=1, otherwise 0	10.8%	
Broad, slowly moving/stagnant and open water body=1, otherwise 0	27.8%	
Deep and free flowing water with unobstructed water ways=1, otherwise 0	35.4%	
Extensive sand, stone and/ or mineral deposits=1, otherwise 0	44.4%	
Permanently/seasonal inundated swamps and marshes=1, otherwise 0	12.3%	
Serene and/or forested wetland richly endowed with wildlife and water birds=1, otherwise 0	34.5%	
Steadily flowing water body that is available all year round=1, otherwise 0	38.6%	

Table 7: Determinants of Households' Food Security in Wetlands

Variables	Coefficient	Odd ratio	Std. Error	Z	Marginal effect
Age	-0.1518***	0.8591	0.0522	-2.9080	-.0268
Age square	0.0017***	1.0017	0.0005	3.4000	.0002
Gender	-0.0285	0.9719	0.2214	-0.1287	-.0050
Length of stay	-0.0215***	0.9788	0.0071	-3.0282	-.0037
Dependency ratio	0.0257	1.0268	0.0934	0.2752	.0045
Farm size	0.0523	1.0537	0.0326	1.6043	.0092
Wetland dependence	0.0046	1.0046	0.0032	1.4375	.0008
Attractive features	-0.1156	0.8909	0.2750	-0.4204	-.0207
Deep water	1.2040***	3.3334	0.4607	2.6134	.1661
Sand deposit	-0.7488**	0.4729	0.3422	-2.1882	-.1493
Permanent/Seasonal inun	-0.1164	0.8901	0.6284	-0.1852	-.0211
Serene/forested wetlands	0.8209**	2.2726	0.3918	2.0952	.1253
Flowing water all year	0.5124*	1.6693	0.4374	1.1715	.0819
Constant	0.9332	2.5427	1.4711	0.6344	
Log likelihood	-281.9245				
LR $Chi^2(14)$	58.1100				
Prob > Chi^2	0.0000				
Pseudo R^2	0.0934				

***, **, * represents significance @1% (p<0.01), 5% (p<0.05), 10% (p<0.1) respectively

Dependence on natural resources alone cannot sustain household food security. If wetlands are not used sustainably, the functions which support agriculture, as well as other food security and ecosystem services, including water-related services, are undermined (Mccartney *et al*., 2011). Overdependence on wetlands is one of major causes of food insecurity and poverty in wetland communities. Three wetland attributes had significant relationship with food security when all other factors are held constant. Deep water that is freely flowing with unobstructed water ways was helpful in achieving food security. The variable exerted a positive and significant (p<0.01) effect on household food security. The abundance of wetlands with these attributes increased the odd of households being food secure. Therefore, this attribute in wetland communities increased the likelihood of households being food secure by 18%. On the contrary, the abundance of sand reduced odd of being food secure by 14% as sand deposit increased from being limited to abundance in a community. Further, serene or forested wetlands bore a positive and significant (p<0.05) relationship with food security. Therefore, abundant serene or forested

wetlands increased households' food security in such wetland catchment areas by 12%. Water animals are sources of protein mostly depended on by rural households. Protein is expensive and the intake is grossly inadequate in rural areas especially (Meludu and Ajibade, 2009). Therefore, the presence of serene or forested wetlands can be a good source of is not affordable especially for rural people in developing. The coefficient of four wetland attributes (deep and free flowing water with unobstructed water ways; extensive sand, stone and/ or mineral deposits; serene and/or forested wetland richly endowed with wildlife and water birds; and steadily flowing water body that is available all year round) were not equal to zero as they were significant. Therefore, this study fails to accept the null hypothesis that wetland attributes do not have significant influence on food security status of households around Ogun River.

IV. CONCLUSION AND RECOMMENDATION

This study concludes that attractive features such as falls, springs and historically relevant points were less evident in the lower Ogun as compared to the relative abundance of these attributes in upper Ogun. Also, the wetlands in lower Ogun were broader and relatively slow moving as against those of upper Ogun. Wetlands that are permanently inundated are more available in lower Ogun as against the upper part. The wetlands at their upper and lower ends had extensive sand, stone and mineral deposits thereby supporting extraction of these resources for economic gains. Food security situation in households with children was not different from children to adults. Majority of wetland residents' households were not food secure leaving about a quarter as food secure. Contribution of wetland attributes to food security in wetland areas indicated that the proportion of the food secure was consistently higher in communities where wetlands abundantly provide some desirable attributes. The highest influence of wetland attribute on food security was observed with broad, slowly moving or stagnant water. The study therefore recommends that wetlands that are deep and free flowing with obstructed water ways should be developed by government, international development agencies and non-governmental organizations so as to improve food security status in wetlands areas.

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