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Farmers' choice of wetland agriculture: checking wetland loss and degradation in Lagos State, Nigeria

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Abstract The issue of food security has received increasing emphasis in developing countries, particularly in the cities. The emphasis on food security has engendered agricultural expansion and encroachment on the coastal and inland wetlands in these nations. To facilitate and sustain the security of food in the developing countries local and international policies have been designed and employed; they have specifically targeted abounding food production towards ensuring human survival in the cities. However, the various ecological and socio-economic benefits derivable from the preservation of wetlands and inland valleys in these urban environments may be lost, with the transformation in the land use and cover. This study is therefore concerned with how wetland degradation and loss can be checked and mitigated, focusing on the developing countries and their cities. In this respect, the farmer's awareness of the impacts of wetland cultivation and the role of accessibility, socio-economic and biophysical factors influencing the choice of wetland farming are examined. To this end, structured questionnaire on choice of wetland agriculture in the urban and periurban wetland areas of Lagos city was administered to the farmers. Simple frequency analysis is used to explain and interpret the data generated. The data reveals a generally low level of farmers' awareness of the implication of wetland cultivation; it shows different categories of factors influencing the choice of wetland farming. Provision of irrigation infrastructure and improvement in living standard of the people through poverty eradication can discourage disadvantageous encroachment on wetlands in cities.

Keywords Wetlands · Awareness · Farmers · Agriculture · Perception

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Introduction

The current global food and economic crisis has made governments and civil society organizations to pursue development agenda focusing on urban food security, environmental management and human health (IFAD 2011; Scherr et al. 2011). The development agenda, no doubt, have involved the reduction of urban unemployment, alleviation of poverty, strengthening the means of livelihood in the urban centres, community building support, and the provision of educational and recreational services (Konijnendijk et al. 2004; Oyeranti and Olayiwola 2005; Mercado 2008). May and Rogerson (1995) have observed that in developing countries one policy means for achieving food security and poverty alleviation is the urban agriculture. Urban agriculture as an integral part of urban system involves the growing of plants and the raising of animals within

and around cities. The plant cultivation and animal rearing extend the frontier of agriculture to encompass coastal and inland wetlands of the cities in a deliberate bid to meet the nutritional needs of the huge urban population (Scherr et al. 2011). At the household level, the cultivation of wetland is aimed principally at achieving food security, poverty reduction, and employment generation.

According to the Millennium Ecosystem Assessment (MEA 2005) on the Ramsar Convention which was titled "Ecosystems and Human Well-being: Wetlands and Water Synthesis", the ecosystem provides benefits for the wellbeing of humans—especially the wetlands. Similarly, Raisin (1995) affirmed that wetlands help in maintaining the biological health of aquatic ecosystem as well as the terrestrial counterpart that is connected with water courses. In addition, the aquatic and terrestrial ecosystems are important wildlife habitats and they form an integral part of a hydrological regime. Domestic water supply and fishing are important benefits often derivable from wetlands (Mmopelwa 2006). However, wetlands have been regarded as unproductive wastelands whose utility, as afore-stated, can only be enhanced by converting them for some other use (Bond et al. 1988). Hence, large-scale wetland degradation and loss have occurred in most parts of the world due to the agricultural conversion, as well as urbanization ambitions, excessive exploitation of natural resources by local peoples and ill-planned developmental activities (Kabii 1996; Nicholls 2004; Finlayson et al. 1999). In another contribution, it is established that conversion and encroachment on wetlands for agricultural activities—such as paddy fields—can destroy the breeding ground of many resident fish fauna and hinder the possibility of their repopulation (Vass 2006).

Uluocha and Okeke (2005) identified certain anthropogenic and bio-geophysical factors threatening wetlands in Nigeria: population pressure; rapid rate of urbanization; mining, oil and industrial waste pollution; uncontrolled tilling for crop production; overgrazing; logging; unprecedented land reclamation; construction of dams, transportation routes and other physical infrastructure; marine and coastal erosion; subsidence; ocean water intrusion; invasion by alien floral and faunal species; sand storm, desertification and droughts. These and other activities, such as draining wetlands for construction purposes and mosquitoes control, have engendered concerns over the widespread wetland degradation, unsustainable utilization level and its consequences for food and water security (Dixon 2008). Nonetheless, changes in hydrological regime of wetlands through agricultural conversion alter both the habitat and the vegetation. The general ecological functions of freshwater wetlands have been documented in the literature (Bunn 1993; Campbell 1993; Catterall 1993). It is, moreover, noteworthy that the perceptions of these wetlands ecological functions, by the farmers in the community, are rarely understood, consequently shaping their interaction with the wetlands. However, Wood (2006) indicated that farmer's perception of catchment land use, wetland soil depth, and local geomorphological characteristics are critical in wetland agriculture. Calvo-Iglesiasa et al. (2005) also showed that farmer's knowledge is a valuable source of information for documenting past and present land-use practices, local cultural heritage and changes in the landscape, all of which are helpful for the design of landscape-orientated policies. Kundiri et al. (2007) also pointed out that integrating such local knowledge into soil surveys will lead to better practical definition of mapping units and give soil locally meaningful names.

The physical process contributing to wetland degradation and loss is complex, varied and not well understood as yet. Limited literature exists on factors that shape the locational choice behaviour of urban farmers in cultivating urban wetlands. There have been considerable social, scientific and technological debates on the subject of crucial determinants of wetland degradation and loss. Socio-economic and cultural factors are recognized to influence the conversion of wetlands for agricultural purposes. In particular, Oladele and Wakatsuki (2008) identified crop preferences, farming system, culture, taste, land tenure, knowledge of wetland cultivation, perceived suitability, farmers' tribe, location of wetland, and farmers' age as important socio-cultural factors influencing wetland agriculture. In the study, the role of wetlands in improving livelihood for the poor in developing countries, like Nigeria, was buttressed. Wilson (1996), on the other hand, showed that age, education, length of residency, farming philosophy and the existence of remnant semi-natural habitats on farms are important variables which explain farmers' dispositions toward wetland conservation. Similarly, Mulugeta (2004) showed food shortage as the main factor behind wetland cultivation in South West Ethiopia.

According to Wood (2006), people's perception and their abilities to obtain benefits using varying technologies in response to changing opportunities influences wetland management options adopted. Indigenous knowledge (IK) and farmer's experience exact strong influence on this environmental perception. Indigenous management practices based on IK have evolved over time, through farmers' experience of the wetland environment. The various indigenous knowledge practices can provide the basis for sustainable wetland use strategies (Dixon 2008). The role of farmer's knowledge and environmental awareness are therefore critical factor in wetland utilization and sustainability. Perceived biophysical characteristics and attributes of wetlands may also influence the decision to cultivate such wetland. Knowledge of soil and wetland attributes are often derived from experience and indigenous knowledge of the soils and water regimes of the wetland (Wood 2006; Kundiri et al. 2007). This indigenous knowledge though not documented, is viable tool of knowledge transfer from one generation to another. This study posits that farmer's knowledge and perception of wetland attributes either implicitly or explicitly influences wetland agriculture site selection. The knowledge is critical in identifying suitable site for cultivation as well as the type of crop to be cultivated, while awareness of the environmental implication of their occupational activities is central to wetland sustainability and its management. It is against this background that this paper seeks to address two interrelated question. These are: (1) do farmers know that cultivating wetlands affects the ecological functions; and (2) what are the factors that influence the farmers' choice of wetlands and which also sustain their farming activities in the area.

Materials and methods

Study area

Lagos State is Nigeria's most populous state with an estimated population of about 18 million residents. A UN study (1999) projected that the population would reach 20 million by 2010 and 25 million by 2015 and then the city would be the third most populous city in the world, meanwhile. The anticipated population swell will likely increase the pressure on wetlands in and around the city, as a natural consequence of the expected rising demand for food support for the population. Moreover, Lagos State is located in the southwestern part of Nigeria on the narrow coastal plain of the Bight of Benin, and the 180 km Atlantic coastline forms the southern boundary of the state (Fig. 1). Mangrove and freshwater swamp forests dominate the coastal areas and the fringes of most lagoons and creeks in the state. Lowland rainforest is prevalent in the upland area. The state experiences double rainfall regime with two climatic seasons, the dry season (November–March) and the wet season (April–October). The drainage system is characterized by a maze of lagoons and waterways constituting about 22% (787 km^2) of the State's total landmass. The major water bodies are the Lagos Lagoon, the Lekki Lagoon and the Yewa and Ogun Rivers. Others are Ologe Lagoon, Kuramo Waters and Badagry, Five Cowries and Omu Creeks (George 2001).

Specifically, the study area covered five wetland locations, Ogudu, Ogolonto, Okokomaiko, Ibeju and Majidun, in Lagos State. Again, the study examined the determinants of wetlands choice for agricultural activities among farmers of the Lagos wetland areas—the dominant influencing factors extending over 20 years up to the present. Wetland farming in Lagos State is largely confined to the freshwater swamp and flood plain areas where farmers use slash-and-burn method of land clearing. Hunting, fishing and wood harvesting were also practiced in the wetlands. While lake water was intensively used for irrigation by the farmers, alternative methods of irrigation for improving efficiency of water use or alleviating hydrological pressures on the wetlands were not employed. The farming practices had resulted in impoverished soils, salinization of the fields and waste of water resources, and agricultural sustainability was at risk (Adetunji 1994).

Occasionally, few farmers applied herbicides first, which dries the vegetation off, and they subsequently set fire on it. In the process of land clearing, the wetlands suffer loss and degradation, and other wetland functions are effectively impaired, due to the loss of vegetal cover and how they were removed. The degradation in soil quality is mainly due to a decline in the soil organic matter (Smith et al. 2000). According to Martins et al. (1991), Lugo and Brown (1993), and Okore et al. (2007), this results in the rapid loss of microbial biomass, particulate organic matter,

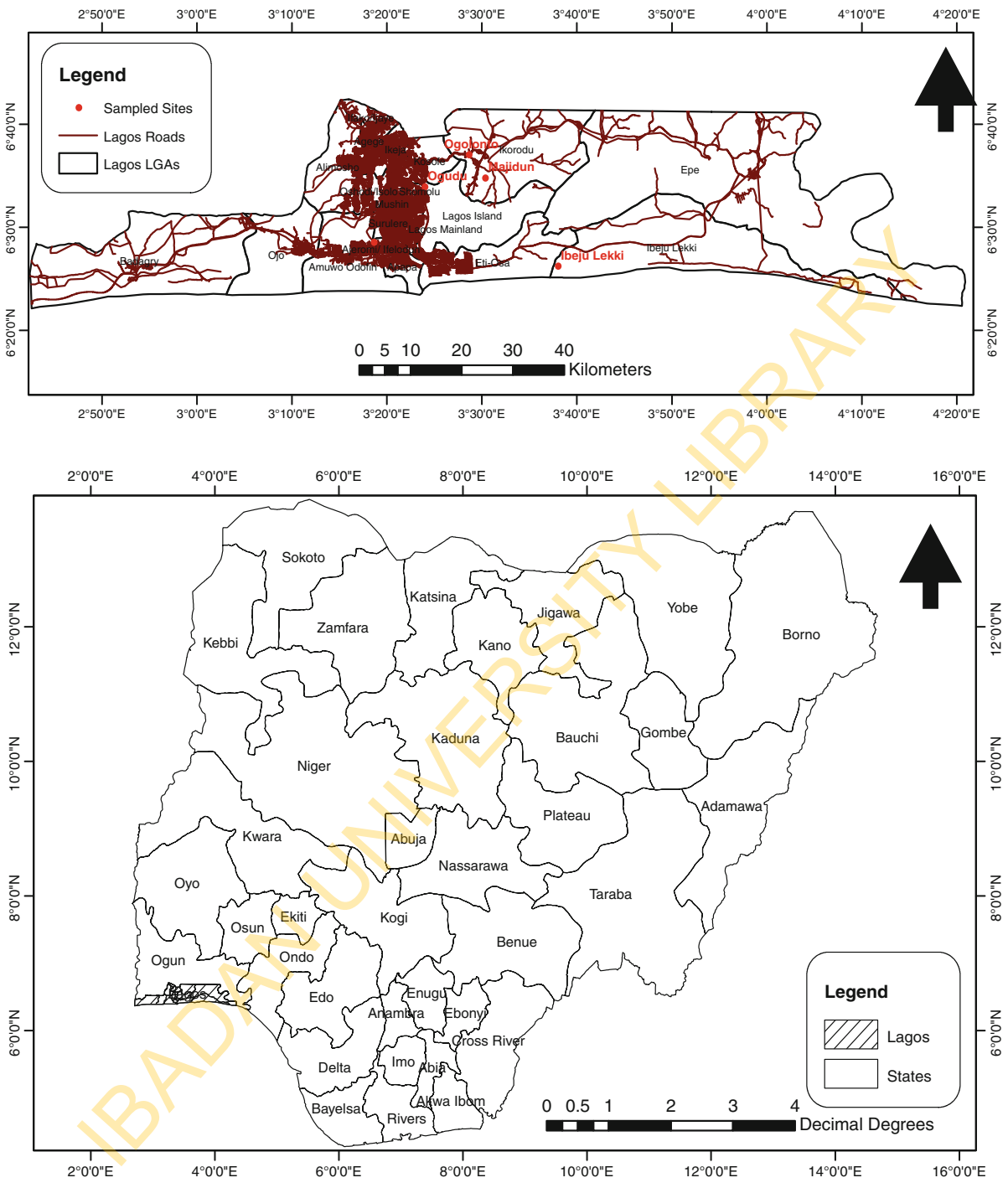

Fig. 1 Lagos State local government areas showing sampled sites

soil carbohydrate and enzymes. Vegetables and cereals are the two dominant crops planted by farmers, while the water application is either through hand watering or sprinkling methods. The water is obtained from shallow wells dug within the field or drawn directly from nearby streams.

Data collection and analysis

In mapping variation in the wetland cultivation extending over the 20 years period under consideration two Landsat satellite images were used. Each of the images was geo-referenced and rectified to the Nigeria Datum using the accompanying metadata file. Known locations on ground which were visible on the images were used in geo-referencing them (the images). Supervised classification (Isocluster) method was used in the classification of the image data into different thematic classes. Basically, developed areas (residential and industrial), mangrove forest, freshwater swamp forest, lowland rainforest, water bodies and farmland were the different landuse/landcover identified. The wetland vegetation was then separated from the non-wetland, and mangrove forest and freshwater swamp forest came under wetland forest. Using image differencing approach, the landuse/landcover map of 1986 was overlaid on the 2006 map to generate another map showing areas where wetlands have been converted to farmlands (Lillesand and Kiefer 1994). The resultant map shows areas where wetlands have been converted to farmlands and where they had remained unchanged over the time period. The map provided the basis for sampling of farmers who were interviewed.

Moreover, Data on demographic variables of farm operators, characteristics of the farming operation, irrigation practices, attitudes towards environment and the wetland resources, knowledge on the impact of agriculture on the local environment and opinions on the common agricultural policy reform were collected through a survey using a combination of personal interviews and questionnaire. Structured questionnaire was administered to a total of 160 farmers randomly selected in the neighbourhoods where wetlands have changed to farmlands. The structured questionnaire focused on issues of environmental awareness as well as perceived socio-economic and biophysical factors often considered by wetland farmers in their choice of lands for cultivation. The survey was conducted between January and February 2008, which coincided with the dry season when farmers utilize the flood plain mainly for raising vegetables. Information on age, gender, education and length of stay of farmers were obtained from their responses in the questionnaire. Farmers' awareness of wetlands functionalities were assessed based on their understanding of the implications of wetland clearing on water supply, soil quality, wildlife population, pesticide/herbicides usage, fertilizer usage and impacts on aesthetic beauty of environment. The role of distance in influencing the choice of wetland farming was explored using four distance-related variables. These variables include: (a) nearness to place of work; (b) nearness to human settlement/market; (c) nearness to main road; (d) nearness to other farmers; and (e) nearness to water bodies. Moreover, on the locational choice behaviour of the farmers in the study area, five biophysical factors were considered. They were: (a) regular flooding; (b) gentle plain topography; (c) ease of land clearing; (d) soil fertility condition; and (e) water holding capacity of the soils. There was another set of factors considered in the study—the economic factors. The economic factors have direct bearing on the productivity of the farmers. These economic considerations can be broadly categorised into two: cost minimization and profit maximization, and they generally include: (a) availability of cheap labour; (b) free land; (c) affordable land rent; (d) need to meet vegetable demand; and (e) need to supplement personal income.

In addition, focus group discussion (FGD) was also used in harmonising the views of the farmers. The farmers specialised in the cultivation of vegetables and cereals particularly during the dry season, between the month of November and March. The frequency of and percentage responses of the farmers were used to describe their awareness level and perceived socio-economic and biophysical factors often considered in wetland site selection (Oladele and Wakatsuki 2008).

Results and discussions

Socio-economic characteristics of farmers

The age distribution among the farmers shows that 8.0% were between the ages of 15 and 25 years, 64.7% were between 26 and 50 years, and the remaining 27.3% were between 51 and 75 years. None of the respondents indicated that they are more than 75 years. The data demonstrates that the bulk of the farmers are within the age of 26 and 50 years. The gender pattern also reflects variation as there were more male farmers (75.3%) than female farmers (24.7%). The gender variation may be a reflection of

the cultural antecedents associated with land ownership structure, tenancy and agricultural practices in southwestern Nigeria where male folks dominated in agricultural practices.

The educational attainment among the sampled farmers revealed that 21.8% did not have any formal education; 52.8% had primary education; and 19.0% had secondary school education. The remaining 6.4% indicated they had tertiary education. Thus, the implication is that the study area is dominated by people with low educational status. In the regard of the lengths of stay of the farmers, it was discovered that 9.3% of the farmers had spent between 0 and 2 years; 15.4% had spent between 3 and 5 years; 39.4% had spent between 6 and 8 years; and 17.7% had spent between 9 and 12 years. The remaining 18.2% have spent more than 12 years in farming. In all, 75.3% had spent more than 6 years in farming activity in the wetlands. There was marked variation in income among the sampled farmers as 32.4% indicated that they earned between N1,000 and N30,000; 44.1% earned N31,000–N60,000; and 15.4% earned between N61,000 and N100,000. The remaining 8.1% earned more than N100,000 per annum. The maximum area of farmland indicated by the farmers was 2 acres with a mean of 0.6 acres. Farmers with 1 or less than 1 acre of farmland are the majority, 66%. The other 34% had less than 2 acres of land that they cultivate. Generally, the amount of land under cultivation was small and one of the reasons provided for the small farm size was the insecurity of land tenure system. The farmers were uncertain of whether the owner would allow them continue farming their portions of land; therefore, they cultivate small land holdings to reduce their perceived risk.

Farmers awareness of the impacts of wetland development

Awareness of the impacts of agricultural activities on the wetlands ecological functionalities was examined. The awareness nature was assessed using the six indicators derivable from the general response of farmers (Davies and Claridge 1993). These six indicators are water supply, soil quality, wildlife population, herbicide and pesticides, fertilizer, and aesthetic beauty of the environment. Generally, awareness of the impact of farming in the wetland ecosystems was low among the sampled farmers. 86.2% of the farmers indicated they were not aware of any negative effects their farming activities might have or had on the wetland functionalities as well as quality. Only 13.8% were aware of some of the listed impacts. A breakdown of the various impacts examined is contained in Table 1.

Impact of fertilizer usage on wetland waters and aquatic organisms had the highest farmer's awareness level (3.3%) and use of pesticides on wetland had the least (1.6%). A Chi-square analysis of the relationship between farmer's awareness and level of education, income and radio ownership shows that the variation in the level of awareness is explainable in terms of different educational levels ($F = 34.12, P > 0.05$). Of all the variables used to explore the determinant of the level of awareness of the farmers about the ecological impacts, it was only their level of education that turned out significant. The low level of awareness of the implications of farming in wetlands could have arisen from the prevailing low level of education among the sampled farmers. Establishing this fact, more than 63% of the sampled farmers indicated they possessed primary school leaving certificate.

Distance effect on choice of wetland agricultural location

The assessment of the farmers' view of distance-related variables shows that closeness to place of work was particularly important for respondents who engaged in wetland agriculture as secondary occupation. This category of respondents prefers wetland location close to their place of work so that they could return to farm after each day's work. This characteristic is particularly common among the artisan group. Similarly, nearness to human settlement provided the needed market for vegetables and cereals brought from the wetland farms. While this guaranteed the required market to sell the vegetables and cereals, it at the same time reduced the cost of transporting the produce to market. Nearness to the main road is another distance-related indicator of the choice of wetland for cultivation and it was desirable for ensuring cost reduction. The nearness of wetlands to main road implies the farmers' perception of the importance of accessibility in farm production. The advantage inherent in agglomeration of scale is measured by the nearness to other farmers. Nearness to other farm locations ensures that farmers can benefit

Table 1 Awareness of the environmental implication of wetland cultivation (%)

Awareness indicators	Aware	Unaware
Effect of agricultural activities on water supply	2.1	14.6
Effects of agricultural activities on soil quality	1.9	14.8
Effects of agricultural activities on wildlife population	2.2	14.5
Effects on the pesticides on wetland	1.6	15.1
Effects of the use of fertilizers on wetland	3.3	13.3
Effects of agricultural activities on aesthetic quality	2.7	13.9
Total	13.8	86.2

from knowledge of other farmers, apart from sharing agricultural inputs as well as cost of transporting the farm produce. Perhaps, most important is the factor of wetlands' nearness to water body, in the study area. Nearness to water body is particularly important because of the mostly seasonal nature of farming in the wetlands. The wetlands were cultivated typically during the dry season when water would have receded and the soil will only be relatively wet.

From the data generated, about 73% of the farmers indicated that they implicitly considered all or some of the factors, above-mentioned and contained in Table 2, in choosing where to farm in wetlands in the study area of Lagos State. Notwithstanding, this locational choice was arrived at in an iteratively objective manner. As a factor, nearness to water bodies recorded the highest frequency of 17.0%; nearness to other farmers was 14.9%; and nearness to human population/market was 14.5%, ranking the third most important factor in the choice of wetlands farming. These three variables together constituted the most important distance-related factors that influenced choice of wetland cultivation among the farmers. The factor of nearness to water body can be regarded as the most significant factor that determined where the wetland farming took place. The other factors rather indirectly influenced the farmers' locational choice: they enabled profit maximization for the farmers, especially given that wetland agriculture largely takes place in dry season when the water level recedes. In the Table 2, the importance of economies of scale in wetland farming is also shown.

Table 2 Distance related indicators of wetland cultivation (%)

Distance based factors	Important	Unimportant
Nearness to place of work	12.9	7.1
Nearness to market or human population	14.5	5.5
Nearness to main road	14.1	6.0
Nearness to water bodies	17.0	3.0
Nearness to other farmers (economic of scale)	14.9	5.0
Total	73.4	26.6

The economies of scale accounted for why it was almost difficult to see a whole flood plain occupied by one single farmer, but rather a group of farmers. In fact, there were a number of local associations that worked to improve the socio-economic wellbeing of farmers in the area. Although the factor of nearness to work place, though important, did not directly determine choice of wetland farm location. The low percentage of respondents on this factor might be as a result of the low number of farmers who took wetland farming as secondary occupation.

Perceived biophysical factors' influence on wetland agriculture

The results show that while there seems to be a good understanding of most of the biophysical factors among the sampled farmers, the consideration of vegetation, as a factor, in identifying choice wetland locations appears to be poor. Wetland vegetation in the study area is almost similar across the state; and, most times, the vegetation does not necessarily reflect soil fertility. Among the various biophysical indicators of wetland conversion, regular flooding regime appeared to be the most important visible factor influencing choice of wetland locations, as 13.9% of the respondents indicated so. This is closely followed by the topographical condition of the wetlands; the locational advantage ensured that agricultural activities can go on throughout the year. 12.70% of the farmers preferred gentle well drained soil rather than undulating soils. The ease of vegetation clearing is the third

Table 3 Biophysical factors considered in wetland selection (%)

Biophysical factors	Important	Unimportant
Regular flooding	13.9	2.8
Gentle plain topography	13.4	3.2
The ease of land clearing	12.7	4.0
Fertile soils	11.8	4.9
Water holding capacity	11.5	5.2
Type of vegetation	7.5	9.1
Total	70.8	29.2

most important biophysical factor determining wetland site selection for agricultural purposes. Based on these findings, it is evident that the perceptions of biophysical factors are also important in the choice of wetland for farming (Table 3).

Perceived economic factors' influence on wetland agriculture

Gbadegesin (1991), noting the high percentage of low income earners among the farmers in the peri-urban and urban areas, suggested that farming in the urban environment for most developing countries might be driven by the human struggle for survival. This implies, most importantly, the need to supplement personal income compelled some farmers to find supportable wetland for agricultural cultivation. 18.9% of the respondents identified this factor as a very important reason for taking to wetland farming. Another 17.9% engaged in wetland farming for the purpose of meeting the demands for vegetable by the Lagosians (Table 4). Vegetable farming in the wetland areas was also popular because the production could be done all year round, given the growing population of the city, Lagos. Availability of free land was also an encouraging factor in wetland cultivation. In most of the wetlands where there were farming activities, the farmers did not pay rent; only in few locations did the farmers pay rent. In the Table 4, 10.8% respondents indicated that affordable rent was not important in their choice of wetland site selection. Moreover, availability of labour in the study area was not a critical factor in wetland site selection also. The farm size was relatively small and labour hardly exceeded three people on the average, as Gbadegesin (1991) and Oladele and Wakatsuki (2008) have also established. Conclusively, the three dominant economic considerations for wetland site selection are: need to supplement personal income, need to meet the vegetable requirement of the city and availability of free lands.

Table 4 Economic factors considered in wetland selection

Economic factors	Important	Unimportant
Availability of cheap labour	4.4	15.6
Free land	14.4	5.5
Affordable rent	9.3	10.8
Need to meet the Vegetable/cereals needs	17.4	2.6
Need to supplement personal income	18.9	1.1
Total	64.4	35.6

Other factors that influence wetland agricultural decision

Table 5 shows the data on three additional factors that might affect the spatial distribution of farmers in wetlands in and around the urban and peri-urban areas of Lagos. Only 2.1% indicated that their choice of wetland location is influenced greatly by government policy, especially on land allocation for agriculture. The agricultural land zoning policies of Lagos State government might have influenced the choice of wetland farm sites by the farmers. The state government often allocated plots of land for people to farm on either short or long term tenure. Furthermore, wetland cultivation specifically for mosquito control purpose was insignificant among the respondents, as well. Only 0.47% indicated they cultivated wetlands in their neighbourhoods in order to reduce the risk of mosquitoes. Unlike the other two variables, the fear of delayed rain was one major factor that usually attracted people to wetlands. With the increasing uncertainties about climate (i.e. climate change),

Table 5 Other factors considered in wetland selection

Others	Important	Unimportant
Government allocation	2.1	31.2
Fear of delayed rain fall	24.6	8.7
Mosquitoes reduction mechanism	0.5	32.9
Total	28.2	71.8

wetlands are more prone to come under continuous cultivation, particularly in the vicinities of large cities like Lagos having burgeoning populations.

Discussion and conclusion

Gbadegesin (1991) noted that urban farming in the cities of developing countries is predominantly a coping strategy adopted by households where the monetary incomes are generally insufficient. The agricultural conversion was a dominant factor responsible for wetland conversion in the mid 1950s to mid 1970s (Dahl and Johnson 1991), and through the 20th century it has been stimulated by technological innovations, demographic change, commercialization and government policies, particularly those emphasizing improvement in food security (Dixon and Wood 2004; Wood 2006). Agricultural expansion into wetlands has therefore engendered wetland loss and degradation. The conversion of the wetlands for agricultural purposes has produced isolated wetland clusters, disrupted the ecological, social and cultural functions of these wetlands, while it has satisfied only the economic needs of the farmers. It should be noted that "while wetland drainage and cultivation can make a key contribution to food and livelihood security in the short term, in the long term there are concerns over the sustainability of this utilization and the maintenance of wetland benefits" (Dixon and Wood 2004; Wood 2006).

An understanding of the consequences of wetlands functional alteration, through its conversion to agricultural land use, depends on factors bordering on awareness of the ecological importance of wetlands and on the value placed on it by individuals and society at large (Wood 2006). The awareness of the ecological functions of wetlands can be obtained through formal education and training, government and non-governmental organization sensitization programmes and through the media. However, because of the limited number of non-governmental organizations whose priorities are preservations of wetland ecosystems, coupled with the absence of suitable government policy on wetland preservation, wetlands in Lagos State have suffered loss and degradation, on a large scale, by farming activities, as well as speculations on the lands. Some of the farmers actually viewed wetlands as inexhaustible natural resource, and this has informed the way they interact with the wetlands.

Majority of the farmers are not aware that the process of water extraction for irrigation purpose as well as canalization can alter wetland hydrology at the local level. Canalization from farmer's view is an attempt to reduce energy expended in fetching water for irrigation. Contrarily, canalization also drains water from the wetland and hence creates isolated patches of dry land which subsequently altered the vegetation (Dixon 2008). The process of vegetal removal either through the slash-and-burn means or through the use of herbicide exposes wetland soils to elements of weather. This situation normally allows for subsequent soil erosion. Expectedly, soil loss and leaching occur and the soil fertility is thereby reduced, hence demanding the need to add fertilizers (Adetunji 1994).

In a bid to sustain and boost crop productivity and yield, farmers employ different types of fertilizers. Agro chemicals are used without due consideration for the physical and chemical properties of soils in most farms. However, because of the continuous and intensive use of land, farmers often applied both fertilizers and poultry manure to improve their harvest. In this regard, Adetunji (1994) noted that the intensive cropping of these soils necessitates the use of fertilizers, especially nitrogen which is applied annually at about 100 kgNha-1 as urea. Ironically, the possible contribution of nutrients from fertilizer application to underground and surface waters is a major concern among soil and environmental scientists (Logan et al. 1980; Milburn and Richards 1994; Adetunji 1994). This is particularly important because the predominant soil (Igbessa series—Oxic Tropaquent) along the flood plain and valley bottom have their water table within 140 cm of soil surface. The adjacent streams are usually the main source of water for domestic use without any other supplementary sources (Adetunji 1994). Farmers oftentimes do not embark on soil testing prior to land cultivation—probably because of the prohibitive cost or lack of knowledge of its importance. Hence, most of these farmers depend on observable visual attributes of soils and vegetation to determine nutritional status of soils (Wood 2006).

Agro chemicals are applied without consideration for its impact on adjacent water bodies; fertilizers and other agro chemicals are washed from farmlands to water bodies and streams; and thus the water bodies in

the vicinity of the wetlands are massively polluted (Adetunji 1994). It is clear that the value that the society places on wetlands determines to a large extent the way people interact with it. It is therefore no surprise that most of the farmers indicated that they do not believe that clearing wetland for agriculture altered the aesthetic beauty of the environment. To them, wetlands are more or less waste lands and their value can only be enhanced through various conversions; in their pristine state, wetlands hardly have any usefulness. Their aesthetic appreciation of the wetlands is subjective and it shapes the farmers' interaction with their environment.

Among the categories of wetland farm sites choice factors that have been considered in this study are those related to accessibility, or distance. Nearness to place of work, nearness to market and human population, nearness to road, nearness to water bodies and stream, and nearness to other farmers all belong to the distance-related factors category. Some of the farmers, for instance, chose certain wetland site because of the proximity to their places of work. These farmers were mainly those that took agriculture as a part-time activity, and are largely the artisans who combined artisanship with farming in supplementing the household incomes. Most of them also employed labourers for different farming operations; hence, their role is just supervisory. On accessibility to market and human population, the choice of wetland farm site was informed by the desire for cost efficiency (i.e. cost minimization) and profit maximization in moving both inputs and produce between market and farm, as well as by the consideration of the perishable nature of the produce. There were no storage facilities to preserve farm produce. Majority of the farmers had preference for a wetland location within 3 km from market. The vegetables were harvested in the morning and transported to the market; and sometimes market women often came to the farms to buy the vegetables in bulk directly from the farmers, and then transported them to market. Usually, about five market women chattered a car to load all the vegetables and drop each of them with her portion in their various market stands. According to the market women, the transportation cost was so reduced by about 50%.

Nearness to road network, another accessibility-related factor, was no doubt very important for the evacuation of produce from farm to market, given the bulky nature of the farm produce. The closer the farms were to the road, the easier for farmers to transport their produce to markets. However, many of the farmers indicated that the roads to their farms were in poor condition; most of the times, they depended on the use of motorcycles for the transportation. Yet, only 34% of these farmers had their own personal motorcycles. Others used the services of commercial motorcycles for the purpose. Indeed, commercial motorcycle service was more attractive to them because it cost less to transport the same unit of produce in comparison with chattering commercial taxi cabs.

Suitable hydrology in the area of wetlands was generally recorgnised by the farmers as a critical factor that influenced their locational choice. Even in a flood plain, farmers still preferred river bank, because they could not afford digging shallow wells or embarking on canalization. Some of the farmers also posited that farmland productivity was highly dependent on closeness to river, or water source. Shallow well, watering cans and other such farming facilities were shared by farmers within the same area of wetland. Direct fetching of water was employed by 2/3 of the farmers while the remaining 1/3 depended on shallow wells. However, it should be noted that excessive water extraction and the building of additional canals to channel water may affect the functionalities of wetlands.

Most of the farmers indicated that they were attracted to their present farm locations because other farmers were already cultivating the sites. The relative ease of finding other farmers from whom agricultural inputs could be borrowed or with whom they could be shared was encouraging. Sometimes, farmers share techniques of cropping that yielded better productivity. It was also easier for agricultural extension officer to reach the farmers in clusters. In addition, the existence of farmers' association providing loan facilities as a cooperative society, drew the farmers to wetland farm sites, in the same vein. Hence, nearness to other farmers, apart from helping farmers reduce cost of agricultural inputs, also duly furnishes the farmers with constructive ideas and occasionally facilitates farming finances towards sustained agricultural productivity, in the wetlands.

Besides the accessibility-related factors, biophysical factors were also identified by farmers as influencing their choice of wetland farming. In particular, annual flooding of the wetlands had its use; this

allowed the soil to retain water which became useful during later dry season for planting vegetables. In fact, farming operations were mostly limited to the dry season, from November to April. The ability of the soils to retain flood water is therefore critical for the sustained crop production in the wetlands. Fortunately, the water-holding capacity of wetland soil is relatively high because of the predominance of clay in the soil profile. Closely associated with this water-holding capacity of the soils is the fertility nature of the wetlands. Wetland soils are mostly rich in alluvium and other essential mineral elements that are left behind after the storm water recedes. Principally, farmers are lured to convert wetlands to farmlands because of its rich fertile soil content (Rouvalis 1988; Pyrovetsi and Daoutopoulos 1997). Showing the fertility, soils in wetlands are dark-grey in colour. Since most of the wetland areas covered in this study was within the flood plain of inland water, the topography is equally relatively plain. This particular attribute helped in water retention for crop production. Site devoid of trees and stumps were, though, desirable, but those with short grasses were most preferred by the wetland farmers. Fallow areas in the wetlands also attracted the farmers.

Availability of affordable local labourers, moreover, stimulated farmers' interests in certain wetland sites. The farming operations yet, largely, used manual labour and were highly labour-intensive. The labour consideration was more germane because most of the family members who could assist in farm works were in schools, or they were apprenticed to artisans. The farmers were compelled to seek for labour outside the family unit; otherwise, they might be unable to cope with the various activities involved in farming. Availability of free and affordable lands was another economic factor that attracted farmers to the wetland area. Many of the farmers engaging in wetland agriculture are actually low income earners, with some others actually engaging in farming to earn themselves personal income (Gbadegesin 1991). It is therefore understandable that the farmers prefer land that is absolutely free or where they pay very minimal rent. This situation has created intensive competition between wetland agriculture and urbanization. Urban expansion continues to displace agriculture due to the activities of land speculators. It is common to notice large concentration of farmers mainly on government lands or within a public right of ways which are vacant. The farmers put these land spaces to productive use until the time government comes and drives them away. The apparent insecure and uncertain land tenure tells on the crop types and the adopted management strategies employed by farmers. Indeed, some farmers always cultivated small plots of land, in the wetland area, just to meet the vegetable requirement of their immediate families. Nonetheless, mostly, the farmers interviewed had practiced agriculture because of the need to supplement their personal incomes, particularly the off-season income for the full-time farmers.

Other factors that influenced sites for wetland agriculture include government land allocation policies which zone farming activities to a particular part of the city, as in the case of the Iba-Lasu area of Lagos State. Also, some of the farmers abandoned upland areas for wetland areas because of the fear of delayed rainfall. Climate change is therefore one determining factor in the increasing transformation of wetlands to agricultural lands. Ambastha (2007) has noted that some people held negative views about wetlands as breeding sites for mosquitoes. This study, on the contrary, reveals that mosquitoes reduction is least among the factors influencing choice of wetlands for cultivation—notwithstanding few farmers in the urban wetlands vicinity indicated mosquito breeding ground as a determinant factor.

Wetlands have remarkable benefits, which may be lost due to intensive threat arising from increasing urbanization, agricultural expansion, pollution, dam construction, unsustainable government policies and poverty (Mitsch et al. 2000; Tiltons 1995). Based on these stated factors, it is deducible that a number of factors interact together to determine the observable pattern of wetland agriculture. Principally, awareness of the ecological advantages of wetlands does shape what the people do with the wetlands. The awareness can come in the form of perceived attractive features of the wetland, and this could be biophysical or economical. Knowledge of these factors would help government and urban planners to alleviate challenges of wetland loss and degradation, particularly in the metropolitan areas of developing countries.

Summarily, in a general sense, wetland farmers seemed to have a more negative attitude toward the wetland resources, their conservation issues and the impact of their practices on the ecosystem. Their awareness and willingness to adopt an ecology-

friendly type of farming can be very poor. Without gainsaying, a better understanding of farmers' awareness, their perception of farm accessibility and of socio-economic and biophysical factors can help in making accurate predictions and arriving at clearer consensus on how best to reduce and mitigate wetland loss and degradation in large cities. The identification of these various factors often considered by farmers in the choice of wetland for cultivation will facilitate formulation of policies for wetland preservation and, at the same time, to ensure food security. Importantly, if government can give more attention to the provision of irrigation infrastructure and improvement in living standard of the people within the vicinity of urban and peri-urban areas of cities, through effective implementation of poverty eradication programmes, ecological sanity will be restored in the wetlands.

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