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INVESTIGATION INTO THE ACQUISITION AND DEVELOPMENT OF WETLANDS IN BUILT ENVIRONMENT INDUSTRY: A CASE STUDY IN KUMASI METROPOLIS

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ABSTRACT: *Wetlands are the most important ecosystem of the earth the depletion of ecosystems turn to weaken their ability to provide essential services. This study investigates into the trend acquisition and development of wetland in Kumasi metropolis. The study adopted a cross-sectional survey design with a mixed method approach. 120 respondents from 10 wetland sites were randomly selected from a population of 450 developers for the study. The research used questionnaire to collect data. SPSS and Smart PLS were used to analyse the data collected. The study reveals that, the state of wetlands before they were taken over by construction activities were the presence of natural vegetation, plant and animal species. The study established that the major reason for the development of wetlands is it closeness to social amenities and the main allocator of wetlands are chiefs. Moreover, there is an increasing trend in the acquisition and development of wetlands in Kumasi. Finally the study reveals that the major factor influencing wetland acquisition and development in Kumasi were prime location of wetlands. It is recommends that there should be effectual collaboration between city authorities and traditional land owners in implementing the planned layout of the city.*

KEYWORDS: Wetland, Built Environment, Kumasi, Wetland Development, Allocation of Wetland, Acquisition of Wetland.

INTRODUCTION

The wetlands of Ghana form an ecologically valuable natural resource which has great importance to the environment and the society at large. Wetland ecosystems are distributed over the entire country and constitute about ten percent of the country's total land surface (Food and Agriculture Organisation [FAO] Ghana, 2014). According to Ramsar Convention (2007b), Ghana has 6 designated sites of wetlands of international importance and a total land surface area of 178,410 hectares.

Wetlands offer tremendous ecological benefits to the health of the environment. They help to filter and remove pollutants such as sediments and toxic substances from the ecosystem (Anku, 2006). Wetlands collect and store the excess storm water that runs off uplands as well as the waters from flooding rivers. This helps to provide temporary storage areas for surplus water that may cause destruction to lives and properties (Mitsch & Gosselink, 2000). They provide recreational opportunities, tourism, food production and medicinal purposes.

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Verhoeven, Beltman, Bobbink, and Whigham (2006) proposed that, wetlands must be protected because they support high levels of plant and animal diversity which support the economy of a country. The ecological set up of wetlands provides beauty and well-being to the environment.

The construction industry is one of the most important sectors in our system, with significant contribution to both industrial output and overall Gross Domestic Product (GPD) in Ghana (Osei, 2013). It plays an essential role in the socio economic development of the country, and has a lot of significance to the achievement of national socio-economic development goals of providing infrastructure, sanctuary and employment (Ofori, 2012). Danso and Manu (2013) emphasized that, all other sectors of the economy depend much on building and construction. This is because every sector of the economy depends on it for their infrastructural needs such as accommodation, offices, hospital, school, road network and other infrastructure of the economy (Osei, 2013).

In the olden days wetlands were considered as waste lands. They were normally dredged to facilitate drainage of the water and also reclaimed for other uses such as dumping grounds for all types of refuse (Ministry of Lands and Forestry [MLF], 1999; Ramsar Convention Manual, 2013**)**. Settlements on wetlands were mainly slum dwellers with very poor background.

However, as a result of the effects of the urban expansion, population growth and the high rate of migration to the urban centres in search of urban benefits, most people are now converting wetlands for residential accommodation. This is because land for development in the urban centres have become very scarce and expensive (Akrofi & Whittal, 2013). Betey and Owusu-Boateng (2013) report that demand for alternative land uses is very high in urban areas. This has resulted in numerous settlements on all wetlands in the Kumasi metropolis despite the hazards and defects that such buildings may be prone to.

Also, some researchers both local and international have done some works on the ecological importance of wetlands to the environment and society as a whole. Abdul-Razak (2012) presented an assessment of wetland ecosystem decline in Kumasi and found that, wetlands in Kumasi are undergoing negative transformation by losing their social, economic, and environmental values due to a number of human activities such as waste disposal, agricultural activities and settlements. Betey (2012) assessed the state of wetlands, incidence of flooding and stakeholder needs for the management of wetlands in Kumasi and concluded that, there should be responsible management of wetlands. However this study investigates into the acquisition and development of wetlands: A case study in Kumasi metropolis and this is part of the larger study that focuses on strategies to minimise hazards of construction activities on wetlands: a case study of Kumasi metropolis

Statement of the Problem

Urbanisation coupled with high rate of migration to the urban centres in search of urban benefits has increased demand for housing and accommodation. As a result, land for constructional purposes has become very scarce and expensive in the urban areas. There is increasing pressure on all natural resources including wetlands (Ghana National Commission for UNESCO, 2010) which were less used for constructional purposes in the olden days. Consequently, numerous settlements and buildings are now being developed on all wetlands in the Kumasi metropolis.

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Also wetlands perform ecological functions such as minimising flooding and reducing pollution of water bodies (Mitsch & Gosselink, 2000). Building construction activities that are carried out within the buffer zone of the wetlands or on wetlands eliminate the ability of the wetlands to perform their ecological functions and there must be measures in place to minimise potential ecological hazards. Although development activities are being carried out on wetlands in the Kumasi Metropolis, much is not known about the trend of acquisition and this study therefore intends to fill these gaps in knowledge by investigating into acquisition and development of wetlands. The purpose of the study is to investigate into acquisition and development of wetland in built environment in Kumasi metropolis. The objective of this study is to determine the reasons why people build on wetland, the mode at which people acquire wetlands.`

LITERATURE REVIEW

Meaning of Wetlands

According to Ramsar Convention Secretariat (2007a), "wetlands include a wide variety of habitats such as marshes, peat lands, floodplains, rivers and lakes, and coastal areas such as salt marshes, mangroves, and sea grass beds, also coral reefs and other marine areas no deeper than six meters at low tide, as well as human-made wetlands such as waste-water treatment ponds and reservoirs" (p. 1). Furthermore, Ramsar Convention Secretariat (2007b) elaborated that wetlands are areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary with water that is static or flowing, fresh or blackish or salt including areas of marine water at a depth of which the low tide does not exceed six metres.

According to the U.S. EPA (2003), "wetlands are areas where water covers the soil, or is present either at or near the surface of the soil all year or for varying periods of time during the year, including during the growing season" (p. 1). The U.S. EPA (2004) further explained that, wetlands are the link between the land and the water or transitional zones where the flow of water, the cycling of nutrients, and the energy of the sun meet to produce a unique ecosystem characterized by hydrology, soils, and vegetation; making these areas very important features of a watershed.

Wetlands in Kumasi

Kumasi is located in the transitional forest zone with a land area of about 254km^2. The city is blessed with a number of major rivers and streams. According to (2014) Kumasi Metropolis is traverse by one major river known as Some of them are Owabi, and streams like Subin, Aboabo, Wewe, Sisai, Oda, Nsuben, Suntre, Kwadaso, and Asuoyeboa with various wetlands which add beauty and other ecological functions to the environment. However, as a result of the effects of the urban sprawl and population growth, the natural environment has been altered (KMA, 2006). Abdul-Razak (2012), reports that the major wetland sites of ecological, landscape, economic and social interests are Aboabo, Bantama, Kwadaso, Sisai, Subin, and Wewe.

Private developers have encroached upon the green reserves and its environs, and are reclaiming wetlands for the development of private properties (Forkuor, 2010). Some structures have been constructed less than 30m range to the catchment of rivers and streams (Ministry Of Water Resources, Works and Housing [MWRWH], 2011). In addition to this,

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portions of streams and water courses have been filled up for development facilities. This situation has affected most wetlands in Kumasi and its influences are glare; the water bodies have been greatly polluted from human activity to the extent that some are near extermination (KMA, 2006), there is also an increasing occurrence of floods in the metropolis in recent times and their devastating effects on lives and properties.

Due process has not been followed to ensure that developments on and around wetlands are properly constructed with proper guidelines and regulations. Forkuor (2010), states that the system of land administration in the Kumasi metropolis is weak with very little relationship among the institutions responsible for land administration. City authorities look mildly concerned of the devastating nature of the development facilities on and around wetlands in Kumasi. There are a lot of building facilities springing up on wetlands each day as a result, the wetlands in the metropolis are under serious threat. This is partly attributable to rising land values and weak land administration (Betey & Owusu-Boateng, 2013).

Diversity and Biodiversity of Wetlands

The pattern or style of the wetlands in Kumasi was one of a kind in West Africa. It used to be called the Garden City of West Africa (Adjei, 2014). But now all the beautiful natural vegetation has been destroyed due to human activities of which construction activities is the highest emerging factor (Betey & Owusu-Boateng, 2013). Forkuor (2010), reports that, developers have violated the planned layout of the city which has affected the beauty in terms of vegetation and aquatic life. According to Federal Energy Regulation Commission (2004) of the Washington DC, the maintenance of the ecological importance of the wetlands should have at least 50% of the diversity of the original or natural wetlands.

There are many organisms that can be found on the wetlands in Kumasi. The ecosystems of the wetlands are made up of plant and animal species. All these species obtain their survival on the wetlands on which they are located. Any damage to these wetlands may eventually affect the ecological set up of the wetlands. The Ministry of Environment and Science (2002), report that, the country's marine and other aquatic ecosystems is about 2,974 indigenous plant species, 504 fishes, 728 birds, 225 mammals, 221 species of amphibians and reptiles. Unfortunately, most of these species have been lost due to the destruction of wetlands for developmental facilities. Wuver and Attuquayefio (2006) reported that, human activities have been the greatest impact on the biodiversity conservation through degrading of wetlands. Attuquayefio and Fobil (2005) further explained that, the loss of each species comes with the loss of potential benefit.

Policies on Wetlands in Ghana

The Ministry of Lands and Forestry launched the National Land Policy in June 1999, which outlines national wetlands conservation strategy. However as to what extent the policy is been implemented is yet to be known. This is because Ghana continues to lose wetlands to construction and other human activities every day. Yalley, Opintan-Baah, and Darko (2013), disclosed that, more than 50% of developers had never obtained an Environmental permit during their activities. Yalley et al. (2013), through their research, they found out that this was as a result of lack of awareness by the developers of the necessary policies and legislation on land acquisition and development. Dugan (1993) also indicated that the government through its agencies must educate developers; evaluate and strengthen laws governing wetlands in order to protect and deter people from degrading wetlands.

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User Categories of Building on Wetlands

Building structures have taken most portions of the wetlands in Kumasi. These are mainly residential buildings, religious buildings, fuel service stations, industrial plants, ware houses and shops. Betey (2012), emphasize that, various types of houses such as compound houses, single family self- contained structures, single room structures and wooden structures have been built within 20m from water channels. Abdul-Razak (2012), also added that, the main reason why most people are building on wetland areas in the urban centres is that of their relatively cheap cost yet the long term cost of maintenance cannot be ascertained. Construction of these facilities may involve similar range of activities. This may include site preparation, setting out, excavation, substructure construction, superstructure construction, mechanical and electrical installation and finishes. The activities involve in the construction of these facilities may have negative consequences on the wetlands which must be protected in order to maintain the sustainability of our natural resources.

On the other hand, urbanisation coupled with high rate of migration to the urban centres in search of urban benefits has increase demand for housing and accommodation. Unfortunately, lands for constructional purposes are very scarce in the urban centres. Therefore, outside the buffer range of the wetlands are used to substitute the scarcity of land for infrastructural development. According to Sithole and Goredema (2013), rapid urbanization and urban growth have led to the construction of housing units and other buildings on wetlands to cater for the needs of the growing population. Sithole and Goredema (2013) reported that, residents have become vulnerable to water-borne diseases, such as cholera, typhoid, dysentery and diarrhoea among others due to building on wetlands. As a result most residence of these areas may spend huge sums of money to maintain their health. Consequently, cost on importation medical suppliers by the nation may be high, looking at the high inflation rate at 16.90% and the current economic situation of the country. Also, buildings on wetlands may experience some level of structural defects due to the presence of high amount of ground water.

Risk of structural collapse

The various defects that may develop in the building may render the building liable to total collapse. Prolong development of dampness, cracks and other defects may result in the general weakness of the structure which may render the building or the structure to total collapse. According to Sithole and Goredema (2013), there is an increase in the number of people living in wetlands and the inhabitants of wetlands encounter a number of problems that include structural failure of their housing units

Destruction of aquatic and terrestrial lives

The aquatic and terrestrial lives of the wetlands may be destroyed through pollution caused by construction activities. Fisher (1971), cited in Attuquayefio and Fobil (2005), about 1% of the world's recorded species have been lost, of which human activities contributed about 75%. When dangerous and poisonous substances from construction activities get to the wetlands, they have the tendency of harming the organisms of the wetlands. These substances destroy the conditions that support life and existence of aquatic and terrestrial species thereby causing destruction to them.

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Poor sanitation

When there is frequent flooding, it creates subsequent sanitation problems. Flood water normally carries a lot of pollutants. Nelson (2012), express that, floodwaters can concentrate garbage, debris, and toxic pollutants that can cause the secondary effects of health hazards. These pollutants get into the environment and people's houses which are affected by the flood and leave all kinds of filth and pollutants after the flood have subsided. These pollutants can alter the sanitation of the environment. When the sanitation of the environment is altered or polluted, it makes residents vulnerable to water-borne and perennial diseases such as malaria, cholera; diarrhoea and other relate diseases (Sithole & Goredema, 2013). The World Health Organization [WHO] (2009), report that, diarrhoeal diseases are a major problem in developing countries, being a leading cause of illness and death in young children due to sanitation problems.

Changes in the atmospheric pressure

The destruction of the wetlands also causes changes in the atmospheric pressure. The vegetation of the wetlands helps to regulate the amount of air pressure within the environment. The European Commission (2009) account that, terrestrial and marine ecosystems play an important role in regulating climate by absorbing roughly half of man-made carbon emissions. The vegetation of the cities and urban centres are normally minimal and limited to the wetlands since most of the areas within the urban centres are either tarred or bare. Therefore, when the vegetation of the wetlands is destroyed, the regulation of the atmosphere will be reduced thereby affecting the atmospheric pressure. According to Didyk et al. (2012), numerous studies in medical meteorology indicate that abrupt daily variations in the atmospheric pressure have adverse effects on health and different kind of human activity. Also, wetlands remove and store greenhouse gases from the earth's atmosphere, therefore the destruction of wetlands may result in global warming (Sithole & Goredema, 2013).

Reduction in the amount of oxygen in the atmosphere

The destruction of the wetlands can also cause the reduction in the amount of oxygen in the atmosphere. The European Commission (2009), emphasized that, the continuing loss of biodiversity and degradation of ecosystems weakens their ability to provide essential services. Vegetation helps to regulate the oxygen in the environment through its gaseous exchange. In the urban areas amount of pollution is very high because of fumes from vehicles and other industrial machines. When the vegetation of the wetlands are destroyed by the construction activities, the chemical processes of the green plants are also reduced thereby affecting their gaseous exchange, that is green plants taking in or using carbon dioxide from human being other animals to process their food and in the end giving out oxygen as a result of photosynthesis

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METHODOLOGY

The Study Area

Kumasi is the capital of the Ashanti region, located at North West of Accra, the capital of Ghana. It is situated in a transitional forest zone with an area of about 254km^2 (Adarkwa, 2011). The city is the second most populous in the country as it attracts all sorts of immigrants from all parts of the country with a population of about 1,730,249 (Ghana Statistical Service [GSS], 2015). Gregory (2005) report that, the driving reason for most people migrating from rural areas to urban centres is in search for work and other urban benefits. Administratively, the Kumasi Metropolitan Assembly governs the metropolis and the metropolis is divided into 9 sub-metropolitan areas for effective administration. These sub-metropolitan areas are Bantama, Suame, Manhyia, Tafo, Kwadaso, Nhiyaeso, Subin, Asokwa, and Oforikrom. The Metropolis is made up of urban, peri-urban and rural communities. According to the Hydrological Department, the city is blessed with five major rivers, which include the Subin, Wewe, Sisai, Aboabo, and Kwadaso with various wetlands which add beauty to the environment. There are also several rivers and streams that have developed from these major rivers. According to Abdul-Razak (2012), the major wetland sites of ecological, landscape, economic and social interests are Aboabo, Bantama, Kwadaso, Sisai, Subin, and Wewe. However, as a result of the effects of the urban sprawl and population growth, the natural environment has been altered. According to the Hydrological Department, presently, only River Wiwi and part of River Aboabo are of economic importance. As a result of the intensity of pollution, most of the rivers have been drained and some have been converted to storm drains so that flooding can be reduced. Some developers have also built along and across watercourses resulting in occasional flooding in some areas in Kumasi.

Research Design

The study employed a cross-sectional survey design utilizing mixed methods to assess the strategies to minimize hazards of construction activities on wetlands. Cross-sectional survey design was used because it specifies the nature of a given phenomenon and reports things the way they are (Cresswell, 2009). Data was collected under natural settings to answer the research questions which were geared towards determining the status of variables as they occur in natural settings (Burns, 2000). Furthermore, variables and procedures are described as accurately and completely as possible in this study.

Population

The targeted population identified for the study was developers in the major wetland areas in Kumasi. The population and housing units of the city are distributed among 9 sub metros as shown in table 1:

Table 1: Population and Number of Houses of the Kumasi Metropolis

Sub Metro	Population	No. Houses
Kwadaso	251,215	61,379
Nhyiaeso	134,488	35,354
Subin	174,004	48,678
Asokwa	140,161	36,726
Oforikrom	303,016	75,156

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Manhyia	159,668	43,960
Old Tafo	146,024	37,403
Suame	161,199	41,794
Bantama	260,474	66,521
Total	**1,730,249**	**446,971**

(Source: GSS, 2015)

Sample and Sampling Techniques

According to Abdul-Razak (2012), the major wetland sites of ecological, landscape, economic and social interests were at Aboabo, Bantama, Kwadaso, Sisai, Subin, and Wewe. There were wetlands at other areas such as Asuoyeboa and Suntre which were of equal importance to the study. Some of the communities around these rivers are Aboabo, Bantama, Kwadaso Estate, Atonsu, Ahensan, Dakodwom, UST, Oforikrom, Airport Roundabout, Asafo, Asokwa, Breman and Asuoyeboa.

Ten wetland sites of the communities were purposively sampled for the study. The selection was based on literature that, they are the worse affected of floods anytime there is heavy rain fall (Abdul-Razak (2012).The selected areas were Tanoso, Asuoyeboa, Kwadaso Estate, Atonsu 'S' Line, Bantama, Dakodwom, Ahensan fitting area, Anloga Junction, Family Chapel, and Ahodwo-Daaban.

These areas were zoned or put into strata and developers (buyer of land for building purposes) outside the buffer range of about 30m from the rivers or streams channel were selected as the population for the study depending on the size of the area which amounted to 450 structures. According to MWRWH (2011), building development must be restricted within a buffer range of about 30m from the channels of rivers or streams. The table 2: Shows sample size of estimated number of structures.

Table 2: Estimated Number of Structures and Sample Size

Zone (Description)	Estimated No. of Structures	Sample Size	Response
A (Tanoso, off Denkyemuoso road)	50	15	14
B (Asuoyeboa, IPT off Nyankyerenease road)	30	9	9
C (Kwadaso Estate, near Ohwimase)	60	18	17
D (Bantama, between Bantama and Sentreso North)	40	12	10
E (Ahodwo-Daaban, Unity oil area)	40	12	9
F (Ahensan Fitting Area)	60	18	16
G (Atonsu 'S' Line)	60	18	14
H (Anloga Junction)	30	9	8
I (Family Chapel, Susuanso)	40	12	12
J (Dakodwom)	40	12	11
Total	**450**	**135**	**120**

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According to Asamoah-Gyimah and Duodu (2007), a sample size of about 10-30% of the population is acceptable for quantitative research. A sample size of 135 which is 30% of the population was chosen for the study.

Questionnaire Administration

Structured and unstructured questionnaires were administered to about 135 developers of the selected study area. Developers were randomly sampled from ten wetland sites and structured questionnaire related to the study were administered to solicit information relevant to the study. This gave equal opportunities or chances for each developer in each of the areas to be selected (Creswell, 2012). In all, 120 questionnaires were received indicating 89% responds rate.

Reliability and Validity of Instruments

The questionnaires were pre-validated by competent assessors both in research and on the field of work. This helped to assess the contents and items included in the questionnaire so that it would be able to measure the expected outcome accurately (Creswell, 2012). The questionnaires were pre-tested on the subjects of this research as suggested by Dillman (2005) and Martin et al. (2007). This is because, effective and efficient questionnaires may not emerge fully-fledged. They are normally created or adapted, fashioned and developed to maturity after many trials (Dillman, 2005). After the pre-testing of questionnaire it was revised accordingly based on the feedback received. As a result, all the constructs achieved a reliability and validity standards required by scientific research (Hinton et al., 2004; Creswell, 2012). The factors had a Cronbach's Alpha of 0.815 and KMO value of 0.824.

Data Analysis

The data were then computed and analysed using Statistical Package for Social Sciences (SPSS) Version 20, after the factors had satisfied the validity and reliability test. The data collected were analysed quantitatively and qualitatively using both descriptive and inferential statistics.

Relational analysis was conducted using one-way ANOVA and their statistical significance (Cresswell, 2012). Also, Microsoft Excel and Smart PLS were used. Smart PLS was used to test the relationship between the factors that has much influence on wetland acquisition and development in Kumasi. The results were presented using distribution tables, percentages means, standard deviations and graphical formats for easy interpretation

RESULTS/FINDINGS

The purpose of the study was to investigate into trend of acquisition and development of wetlands in Kumasi metropolis.

The State of Wetlands before they were converted into buildings

As part of the objectives of the study, the study found out the state of wetlands before they were taken over by construction activities. Table 3: shows how the wetlands in Kumasi were before they were taken over by construction activities. Using a theoretical mean of 3 from the 5 point likert scale, Table 3 shows that the respondents strongly agreed that all the conditions

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presented existed before construction activities were done on the wetlands. These conditions were the presence of natural vegetation on their lands (4.4250), the presence of important plant and animal species on their lands was high (4.2917), there was less incidence of flooding in wetland areas (4.2750), surface runoff was less in wetland areas (4.2583) and there was high level of water in streams or rivers (4.2333). Also, respondents agreed that, the sanitation of the wetlands was relatively good (3.9250).

Table 3: The State of Wetlands before they were converted into Buildings

State of Wetlands	N	Mean	Std. Deviation	Ranking
Presence of natural vegetation	120	4.4250	.49642	1st
Presence of important plant and animal species	120	4.2917	.55603	2nd
Less incidence of flooding	120	4.2750	.63461	3rd
Less surface runoff	120	4.2583	.65460	4th
High water level of stream or river	120	4.2333	.65764	5th
Good sanitation	120	3.9250	.99716	6th

Reasons why People Build on Wetlands

Table 4 presents reasons why people build on wetlands in Kumasi. With a theoretical mean of 3 from the 5 point likert scale, Table 4 shows that, respondents strongly agreed that, closeness of wetlands to social amenities is the main reason for its development into buildings (4.1167). Also, scarcity of land in the urban areas for constructional purposes (3.9083), proximity of wetlands to economic activities (3.6583) and lack of importance attached to wetlands or wetlands been described as waste lands (3.0417) are some of the other reasons for the development of wetlands into buildings. Inversely, respondents disagreed that, wetlands are cheaply leased out (2.4333) in the Kumasi metropolis.

Table 4: Reasons Why People Build on Wetlands

Reason	N	Mean	Std. Deviation	Ranking
The wetland is closed to social amenities	120	4.1167	.93650	1st
There is scarcity of lands in urban areas	120	3.9083	1.20221	2nd
The proximity to economic activities	120	3.6583	.99153	3rd
Wetlands are described as waste lands	120	3.0417	.86380	4th
Wetlands are cheaply leased out	120	2.4333	1.00196	5th

Trend of Wetland Acquisition and Development in Kumasi

Figure 1 indicates that, wetland acquisition and development in Kumasi started before 1990 with 15.8% and increased to 20% between 1990 & 1994 but decreased to 12.5% between

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1995 & 1999, and 8.3% between 2000 & 2004. On the other hand, wetland acquisition and development in Kumasi increased between 2005 & 2009 from 18.3% to 25% after 2009.

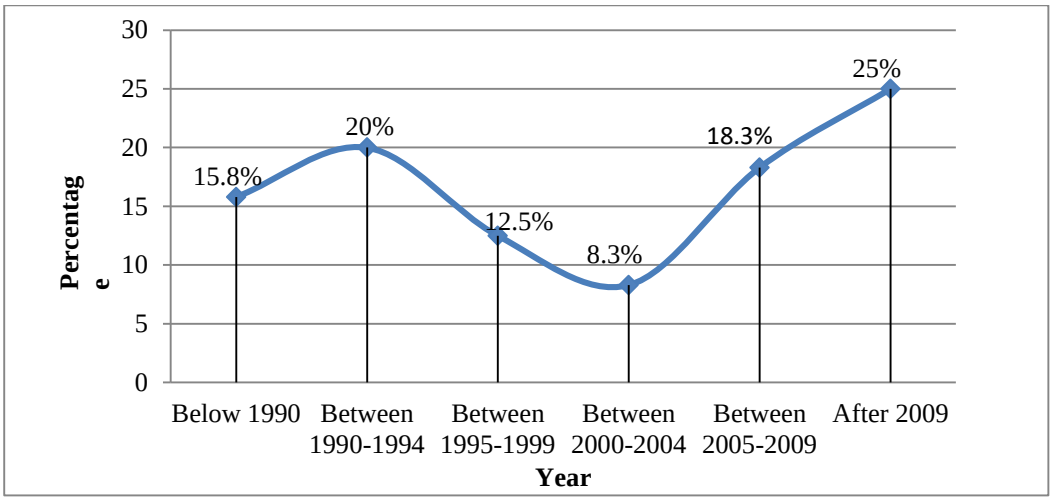

Figure 1: Trend of Wetland Acquisition and Development in Kumasi

The Purpose of Structures on Wetlands

Figure 2 indicates that majority of the structures studied were residential buildings. This accounted for 43.3% of the structures whilst 24.2% were commercial, 13.2% were religious, 15.8% were industrial and 3.3% were educational buildings.

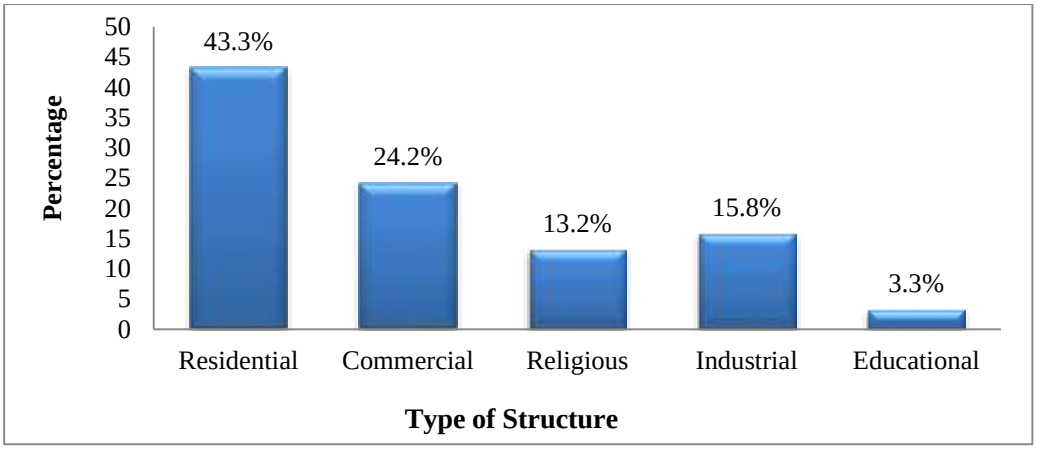

Figure 2: Type of Structure

The Purpose of Building and when it was constructed

The results from Figure 3 show that, residential buildings on wetlands started before 1990 with 12.5% and decreased to 9.2% between 1990 & 1994, 3.3% between 1995 & 1999 and 2.5% between 2000 & 2004 but between 2005 & 2009 residential buildings on wetlands increased to 3.3% and 12.5% after 2009. Also, commercial buildings on wetlands started marginally before 1990 with 1.7%, increased to 2.5% between 1990 & 1994 and 4.2% between 1995 & 1999 but decreased between 2000 & 2004 with 0.8% and started increasing again between 2005 & 2009 with 6.7% and 8.3% after 2009. In addition, religious buildings

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on wetlands started marginally before 1990 with 0.8% and increased slightly to 3.3% between 1990 & 1994 but decreased to 2.5% between 1995 & 1999, increased between 2005 & 2009 with 4.2% and decreased again to 2.5% after 2009. Furthermore, industrial buildings on wetlands started marginally before 1990 with 0.8% and increased to 4.2% between 1990 & 1994 but decreased to 2.5% between 1995 & 1999, increased between 2000 & 2004 with 3.3% and between 2005 & 2009 with another 3.3% but decreased to 1.7% after 2009. Finally, educational buildings on wetlands started between 1990 & 1994 with 0.8% and increased to 1.7% between 2000 & 2004 but decreased to 0.8% between 2005 & 2009.

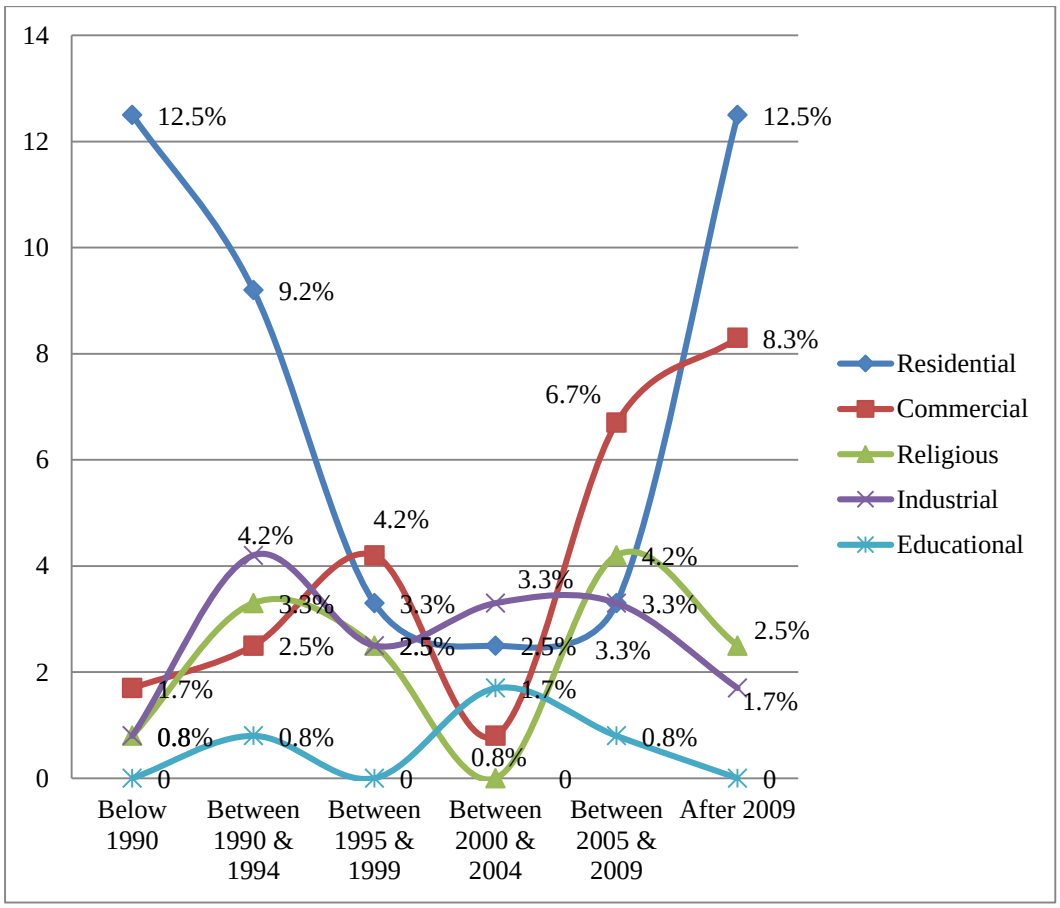

Figure 3: The Purpose of Building and the Trend of Acquisition and Developmen

Mode of Access to Wetlands

Table 5 presents mode of access to wetlands in Kumasi. Using a theoretical mean of 3 from the 5 point likert scale, Table 5 indicate that, developers strongly agreed that, the wetlands are allocated by the chiefs in Kumasi (4.4250) and wetlands can be owned as family inheritance (4.3333). On the other hand, respondents disagreed that, the wetlands are describe as 'no man's land' (2.5333), the wetlands can be allocated by some assembly members (2.4167) and some people live on wetlands as squatter's (2.3667).

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Table 5: Mode of Access to Wetlands

Access	N	Mean	Std. Deviation	Ranking
The wetlands are allocated by the chiefs	120	4.4250	.83679	1st
Wetlands are owned as family inheritance	120	4.3333	.87287	2nd
Wetlands are describe as 'no man's land'	120	2.5333	.74398	3rd
Some assembly members allocate wetlands	120	2.4167	.84598	4th
Some people live on wetlands as squatters	120	2.3667	.66019	5th

(Source: Field Study, 2015)

Factors for Wetland Acquisition and Development in Kumasi

A model was developed to test the factors for wetland acquisition and development using Partial Least Squares-Structural Equation Model (PLS-SEM). The factors that were used in the model are prime location (closeness to social amenities and economic activities), awareness of regulations governing wetlands, access to wetlands, scarcity of lands for constructional development in urban centres, cost of securing wetlands and lack of importance attached to wetlands. Figure 4 shows the constructs and their attributes for the relationship. The model tests the influence of wetland acquisition and development in Kumasi.

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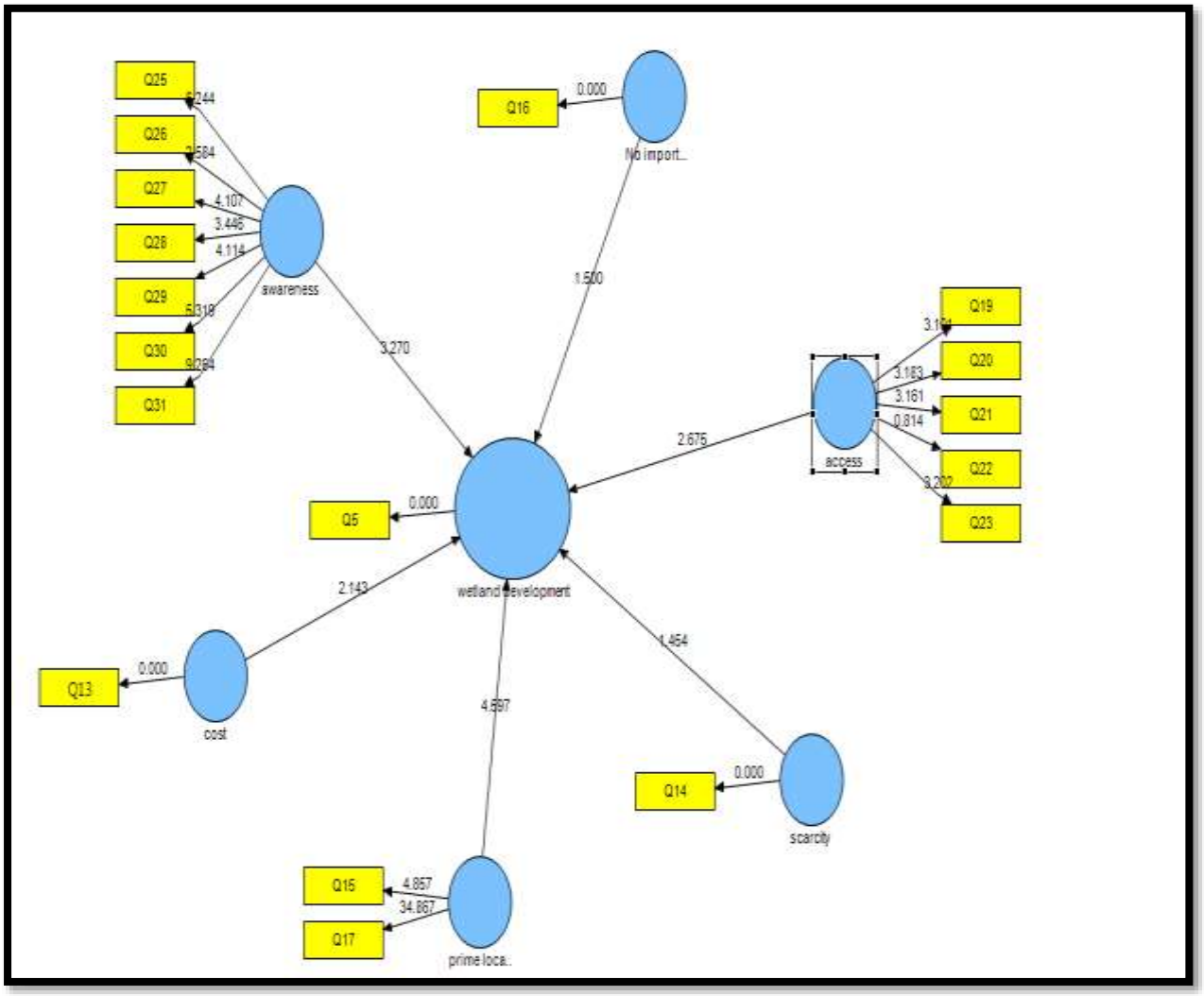

Figure 4: Structural Equation Model for Factors for Wetland Development

Table 6 shows the relationship between the factors that has much influence on wetland acquisition and development. From Table 6, there was significant relationship between the prime location of wetlands, respondents' awareness of regulations and procedures, access to wetlands and the cost of wetlands. This accounted for prime location of wetlands, which consists of closeness of wetlands to social amenities and economic activities, being the highest predictor of wetland acquisition and development in Kumasi with a relational value of 4.597 and a p-value of 5.3E-06, followed by awareness of regulations and procedures with a relational value of 3.270 and a p-value of 0.000. Also, access to wetlands significantly predicted wetland acquisition and development with a relational value of 2.674 and a p-value of 0.004. The cost of wetlands significantly predicted wetland acquisition and development with a relational value of 2.143 and a p-value of 0.017. On the other hand, it was clear that, lack of importance attached to wetlands and scarcity of lands in the urban centres had no significant relationship with wetland acquisition and development in Kumasi as they had p-values of 0.068 and 0.074 respectively.

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Table 6: Factors Influencing Wetland Development

Factor	Original Sample	Sample Mean	Standard Deviation	T Statistics	P-value
Awareness of regulations and procedures	0.187	0.212	0.057	3.270	0.000
No importance attached to wetlands	0.100	0.091	0.066	1.499	0.068
Access to wetlands	-0.339	-0.334	0.126	2.674	0.004
Scarcity of land	0.134	0.116	0.092	1.453	0.074
Prime location of wetlands	-0.306	-0.305	0.066	4.597	5.3E-06
Cost of wetland	-0.164	-0.151	0.076	2.143	0.017

(Source: Field Survey, 2015)

DISCUSSION

The state of wetlands before they were converted into buildings

The study found that, the state of wetlands before they were taken over by construction activities are the presence of natural vegetation, the presence of important plant and animal species, less incidence of flooding in wetland areas, surface runoff was less in wetland areas and there was high level of water in streams or rivers. The findings confirms Fazio, (2010) that Shade from trees slows water evaporation which can cause extermination of water bodies. Trees also transpire a lot of moisture into the atmosphere to regulate the atmospheric conditions. They also have the ability to reduce the volume of water rushing through gutters and pipes following a storm (Fazio, 2010). The vegetation of the wetlands helps to regulate the amount of air pressure within the environment. The European Commission (2009) account that, terrestrial and marine ecosystems play an important role in regulating climate by absorbing roughly half of man-made carbon emissions. KMA (2006) confirms that in the wet season the vegetation is lush and the presence of rich soils coupled with adequate rainfall supports the growth of vegetables, plantain and tubers as cassava and cocoyam. There are patches of vegetation cover scattered over the peri-urban areas of the metropolis.

Reasons of developing wetland

Moreover, there are many reasons why people build on wetlands at any particular point in time. The data shows that, the main reason for wetland acquisition and development in Kumasi is its closeness to social amenities. This means that, any wetland that is closed to good roads, hospitals, schools, market centres and recreational centres may highly be developed into buildings. Similarly, lack of importance attached to wetlands or described as waste lands may cause its development into buildings. The results show that, most of the respondents do not know the importance of wetlands which is in tandem with the report of Hollis (1990) that, there are relatively few studies from the less developed parts of the world of the concept of wetlands. Evidently, the wetlands may be developed into building purposes if it is closed to economic activities which agree with Abdul-Razak (2012),

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The trend of wetland acquisition and development in kumasi

The trend of wetland acquisition and development is very essential as far as developing strategies to control or minimise the effects of construction activities on wetlands is concerned. The results indicate that, there is increasing trend of wetlands acquisition and development in Kumasi (Refer Figure 1). This accounted for 25% of the structures. This implies that, wetland acquisition and development is on ascendency which confirms the report of Linli and Shi (2012), that urban population is increasing at a faster rate and this has accelerated economic, social and infrastructural development. Also, Betey and Owusu-Boateng (2013) added that, most rural communities are becoming peri-urban, and peri-urban are becoming more urbanised, which has led to an increase in demand for land for infrastructure, industry, service and housing, thereby causing a drastic land use change in the transitional zones. As a result, most people resort using wetlands for constructional purposes especially in major cities in the country (Betey & Owusu-Boateng (2013).

On the other hand, wetland acquisition and development in Kumasi showed an initial declining trend before it started increasing on a very high rate after year 2000. This trend can be explained that, probably when developments on wetlands started experiencing serious defects from the wet conditions of the wetlands, most people were discouraged to build on wetlands. Consequently, when people realised that, the effects of wet conditions on buildings on wetlands and other effects such as structural flooding, can be controlled by appropriate technologies, wetland acquisition and development started emerging on a very high rate. Agyekum et al. (2013), the subject of rising dampness and public health gained much impetus in research industry in the latter part of the 19th century, since it has become necessary to build on wetlands to meet current housing demand and urban expansion (Sithole & Goredema, 2013).

The purpose of structures on wetlands

Furthermore, majority of the structures on wetlands in Kumasi that were studied were residential buildings (43.3%). This is in tandem with KMA (2006), indicating that, as a result of the effects of the urban expansion, population growth and the high rate of migration to the urban centres in search of urban benefits, most people are now converting wetlands for residential accommodation. This report also agrees with the report of Betey and Owusu-Boateng (2013) which indicate that, most rural communities are becoming peri-urban, and peri-urban are becoming more urbanised, which has led to an increase in demand for land for infrastructure, industry, service and housing, thereby causing a drastic land use change in the transitional zones. According to Adjei (2014), residential development has the highest land use distribution in Kumasi.

Mode of access to wetland

Additionally, the mode of access to wetlands in Kumasi is very important for the development of strategies to control wetland acquisition and development. The results indicate that wetlands are allocated by the chiefs and can be owned as family inheritance without any reservation in Kumasi. This is in line with the report of Forkuor et al. (2013) that, in Ghana, most lands are owned by traditional authorities and therefore most of the lands are allocated by them. Also, Abdul-Razak (2012), report that, the traditional chiefs in Kumasi are the major driving force behind land use changes, as more land and wetland areas are sold out

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to churches and individuals for residential development due to the land tenure system operating in Ghana.

Factors for wetland acquisition and development in kumasi

In addition, it was significantly evident that, the main predictor of wetland acquisition and development in Kumasi is its prime location which consists of the closeness of wetlands to social amenities and economic activities. As a result, there was an increasing trend in development of wetlands for residential and commercial purposes (Figure 4.5). Apart from these factors, awareness to regulations and procedures, access to wetlands and the cost of acquiring wetlands also significantly affected development of wetlands into building facilities. However, the relationship between scarcity of lands for constructional purposes and lack of importance attached to wetlands and wetland acquisition and development in Kumasi was not significant. This means that, wetland acquisition and development is highly influenced by its closeness to social amenities and economic activities. It is therefore necessary for city authorities as well as interested groups to promptly acquire and develop wetlands in such areas into a state that will protect and conserve its usefulness to the environment.

Implication to research and practice

The study has reveal that the trend of acquisition and development of wetland has increase since 2009 onwards and this account for 25% of infrastructure project. The chiefs mostly allocate wetlands to developers. This implies that if prudent measures are not taken by city authorities to stop the chiefs from allocating wetlands to developers, by five years to come most wetlands in Kumasi will be depleted and as a result perennial flooding will occur at all the buffer zones in the event of rain fall. The findings offer stakeholders the broader understanding on how vegetation, plant and animal spices in wetland contributed positively on our environment and the consequences when depleted. Again the study has alerted stakeholders the factors that contribute to wetland acquisition. The study recommends that, there should be effectual collaboration between city authorities and traditional land owners in implementing the planned layout of the city. The wetlands that are located at prime areas as well as those that are closed to urban centres must be acquired and developed into tourist sites by city authorities in order to protect and conserve its usefulness to the environment. There should be more educative campaigns on the ecological importance of wetlands by city authorities as well as non-governmental organisations

CONCLUSIONS

The following conclusions were drawn based on the major findings of the study.

The study found that, the state of wetlands before they were taken over by construction activities are the presence of natural vegetation, the presence of important plant and animal species, less incidence of flooding in wetland areas, surface runoff was less in wetland areas and there was high level of water in streams or rivers. Also, the study shows the reasons for the development of wetlands into buildings as closeness of wetlands to social amenities, scarcity of land in the urban areas for constructional purposes, proximity of wetlands to economic activities and lack of importance attached to wetlands. Moreover, the study has shown that there is an increasing trend in the acquisition and development of wetlands in

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Kumasi. This is as results of rapid population growth and urbanisation in the Kumasi metropolis. This has led to the conversion of wetlands mostly for residential and commercial purposes. Again the study reveals that the wetlands are allocated by the chiefs and families who owned as inheritance. The factors influencing wetland acquisition and development in Kumasi were prime location of wetlands, developers' awareness to regulations procedures on wetlands, access to wetlands and cost of securing wetlands.

FUTURE RESEARCH

The study can be replicated in other areas of the country to assess the general trend of the acquisition and development of wetlands. Further research can be made into technologies that can be used to avoid dampness in wetland construction.

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