International Journal of Environment and Bioenergy, 2013, 7(2): 108-128

Modern Scientific Press

International Journal of Environment and Bioenergy

Journal homepage: www.ModernScientificPress.com/Journals/IJEE.aspx

ISSN: 2165-8951

Florida, USA

Article

The Political Ecology of Wetlands in Kumasi, Ghana

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Article history: Received 5 September 2013, Received in revised form 20 October 2013, Accepted 25 October 2013, Published 28 October 2013.

Abstract: Urban wetlands are under serious threats. Rising land values and weak land administration in the urban areas of Ghana aggravate this problem. There have been incessant conflicts between the stakeholders in delineating and managing wetland areas. This research therefore seeks to investigate the political ecology of urban wetlands in Kumasi, Ghana in relation to the definition and delineation of urban wetland areas. The soil, vegetation and drainage conditions of some flood prone suburbs of Kumasi were studied. Questionnaire survey and focus group discussions were used to collect and collate the characteristics, reasons, conditions and experiences of residents of flood prone suburbs of Kumasi. It was found that the houses in these neighbourhoods were built in wetland areas. The nature and type of soil, vegetation and the waterlogged conditions of these suburbs proved them to be wetlands. However, the land ownership system is an impediment to the successful management of these wetlands by the city authorities. The study concludes that the right definition and delineation of wetlands will not solve the problem of people building in wetland areas in Kumasi and Ghana as a whole. The city authorities should not only delineate wetlands but also acquire the area, put it to sustainable use and share the benefits with the land owners.

Keywords: floods, urban, political ecology, wetlands, Ghana

1. Introduction

Man, in changing from wanderer to settler, has always been associated with water bodies. This man-water interaction has been both beneficial and hazardous to both ends of the continuum and the meaning of the wetland sometimes reflects these experiences. However, the term wetland is a recent vocabulary compared to man's association with it (Keddy, 2000). The experiences of man in recent times have resulted in wetlands being associated with floods, swamps, wastelands, mosquito-infested mudholes etc. For these reasons, they are sometimes dredged in some places to facilitate drainage of water, reclaimed for other uses, or simply considered as dumping grounds for all types of refuse (Ramsar Convention Secretariat, 2006).

Several areas of research have been conducted on wetlands but very few of these ever attempt to define wetlands. For example, in the 2005 Millennium Ecosystem Assessment Report, 'wetlands' and 'inland waters' are used interchangeably. Also, "wetlands and mangroves" and "lakes, rivers, wetlands, and shallow groundwater aquifers" are mentioned as habitat types (Millennium Ecosystem Assessment, 2005). It is not surprising that such a renowned publication by a team of experts will have problems with defining wetlands. Most authors therefore prefer to mention the various wetland ecosystem types rather than attempt a definition.

One of the earliest formal definitions has been that of Ramsar as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres" (Ramsar Convention Secretariat, 2006). However, this definition in its form embraces almost all land areas. In urban areas where demand for alternative land uses is very high, such a broad definition will only exacerbate landuse conflicts because landowners will hardly agree to the application of such a definition to delineate wetland areas. A relatively more convenient definition is provided by the US Army Corps of Engineers and the US Environmental Protection Agency which considers wetlands as "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (Federal Interagency Committee for Wetlands Delineation, 1989). This definition is emphatic on inundation and the consequent saturation of the soil to give rise to the associated vegetation. It, however, falls short of the Ramsar's definition because it is silent on artificial wetlands. It is also worthy to note that this definition was formulated as a guideline for selecting places to be designated as landfill sites in the USA and therefore did not consider coastal wetlands.

Keddy (2000) in a later definition also emphasized inundation but rather linked it to a cause-effect relationship and accordingly defined a wetland as an ecosystem that arises when inundation by water produces soils dominated by anaerobic processes, which, in turn, forces the biota, particularly rooted plants, to adapt to flooding. The use of 'forces' in the definition undermines the fact that, wetlands have been a natural part of the environment with plants and animals adapted to such environment. Adaptation of biota is not a function of force. The description of wetlands forcing biota makes wetlands look like a recent artificial creation such that, the biota that are caught up in such a situation are forced to adapt. With these diverse definitions with their shortfalls, some wetland interest groups commissioned a study that merged the definitions of the US Environmental Protection Agency, Ramsar and others as: "a wetland is an area (of marsh, fen, peatland or water, whether natural or artificial, permanent or temporal) that is inundated (up to a depth of 6m at low tide) or saturated by water (surface/ground, static/flowing, fresh/brackish) at a frequency and for a duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions" (Joosten and Clarke, 2002). This all-encompassing definition could be considered the most sufficient for the purposes of delineation, conservation and management of wetlands. According to Maltby and Barker (2009), the definitions of wetlands communicate the importance of substrate, vegetation and water in the identification, development and persistence of wetlands. It is therefore often argued that a robust definition that can provide effective guidance towards wetlands identification and delineation must include these three elements.

Urbanisation is currently the biggest physical change that most developing country settlements are undergoing (Bhattacharya, 2002). The ecological consequence of the increasing built environment is the increased range of spatial diversity because, urbanisation leads to fragmentation of the vegetation and changes in structure and floristic composition of the habitat (Niemelä, 1999; Altobelli *et al*., 2007). The diverse urban biotopes that develop as a result of urbanisation may be maintained deliberately by the residents for aesthetics and for their intrinsic value. Apart from the human manipulations of urban vegetation for aesthetic purposes, urban wetland vegetation delivers a wide range of ecosystem services relating to climate change mitigation and or adaptation, water catchments, buffer against flooding, purification of soil, water and air, act as carbon sinks and contribute to human well-being (Joosten and Clarke, 2002; Berkowitz *et al*., 2003; Janssen *et al*., 2005; Ramsar Convention Secretariat, 2006; Nelson *et al*., 2009).

Wetland areas are being destroyed and factors such as rates of population growth, urbanisation, inappropriate macroeconomic, social, and technological policies and choices have been considered as some of the causes and implications of habitat change in Africa (Kidane-Mariam, 2003). For example, in Ghana, almost all the non-agricultural economic activities take place in the urban areas. Peri-urban and rural landowners are therefore usually excited about the potential opportunities that will be available to them when the urban economy and space merge with the peri-urban. This leads to an increase in demand for land for infrastructure, industry, service and housing, thereby causing a drastic landuse change in these transition zones. The values of land rise dramatically and much income is accrued from the sale of lands as they are put to more productive and profitable uses. Due to the high economic incentives and developers' need for lands at already populated areas, wetlands are also sold, although, at cheaper prices (Payne, 1997; Brook and Dávila, 2000).

Apart from the academic controversies over the definition of wetlands, city authorities and landowners in Ghana are also in conflict over wetland boundaries because landowners do not agree with the definition and criteria for designating a place as a wetland. Amidst these controversies, urbanisation and economic expansion have outpaced environmental controls and planning (Grimm *et al*., 2008). The results are unplanned urban neighbourhoods without infrastructure and amenities that are subjected to frequent flooding. The worst affected areas are often the clusters of informal communities or slums associated with wetlands (World Bank, 2007). Knowledge and agreement on the defining characteristics of wetlands in Kumasi will therefore be useful in delineating wetland boundaries and reduce conflicts associated with landuse planning as well as wetland encroachment in areas of similar environmental and socio-economic characteristics. However, the situation is complicated by the land tenure arrangements, micropolitics and power relations in these informal and slum communities. Therefore, can the delineation of wetland boundaries based on the rigorous definition of Joosten and Clarke (2002) be applied to wetland areas of Kumasi? Can the experiences of those already living in these flood zones be a criterion for delineating wetlands? How can the micropolitics, land tenure arrangements and power relations of the stakeholders be harnessed in the management of wetlands in Kumasi? This research seeks to provide a direction for urban wetlands management by investigating flood experiences and political ecology of urban wetlands in Kumasi, Ghana in relation to the definition and delineation of wetland areas.

2. Methodology

Kumasi is located in the moist semi-deciduous forest zone of Ghana. It used to be known as the Garden City of Africa. This was because, during the colonial era, planning interventions in Kumasi were in the form of establishing green belts and recreational parks within the layouts of residential areas. Due to the undulating topography and numerous streams which transect Kumasi, the green belts and recreational parks were invariably situated along the major stream channels. The green belts idea was borrowed from various 'garden city' plans popular in England. They were seen as both sanitary measures and a way of separating residential areas, especially, the European from the non-European zones. The provision of a green belt of about 300 m from buildings surrounding residential areas was designed to protect European officers residing in these areas from mosquito-borne diseases. After independence, these green belts were designated as recreational spaces and named 'Nature Reserves' or 'Parks' on zoning maps (Schmidt, 2005; Kumasi Metropolitan Assembly [KMA], 2006). This garden city status is long lost and these green belts are largely vacant and their borders are slowly being encroached upon for urban infrastructure and housing, subsistence urban agriculture or as dumping grounds (Brook and Dávila, 2000). Attempts by city authorities to reverse this trend have often not been effective because of the land tenure system and difficulty in delineating the wetlands. The suburbs e.g. Dakwadwom, Ahensan, Aboabo and Atonsu situated in or close to these 'vacant' land areas are frequently under floods but owners of these houses do not agree that they are built in wetlands (Campion and Venzke, 2012).

The wetlands in Kumasi were identified and delineated using the definition of Joosten and Clarke (2002). After a detailed study of drainage maps and aerial photographs of Kumasi, physical inspection and ground truthing of these drainage channels was done. Ten (10) large wetland areas (>10 ha) associated with streams within the jurisdiction of the KMA were selected and labelled A to J (letter I was not used) (Figure 1). Starting from the main water channel, 1 m x 1 m quadrats were marked along each line transect at 10 m intervals on either side perpendicular to the water channel. Three line transects were marked out at each wetland site and five quadrat plots sampled on alternating sides. All herbaceous plants and shrubs were identified to species level with their respective relative abundance and cover determined from estimates of vertical plant shoot-area projected to the ground as a percentage of quadrat area using the Braun-Blanquet scale (Table 1) (Wikum and Shanholtzer, 1978; Coroi *et al*., 2004). The names of the species are presented according to Akobundu and Agyakwa (1998), Cook (1996), Haflinger and Scholz (1980a, b), Haflinger *et al*. (1982) and Terry (1983). In each quadrat plot, the presence or absence of surface water was noted. Data was collected between December 2009 and December 2011.

Ghana has a multiplicity of buffer zone bye-laws and specifications depending on the landuse. For example, the Town and Country Planning Department (TCPD) demarcates a minimum of 30 m (100 ft) from the stream bank as no development area. This limit could reach 90 m or more in some areas depending on topography and stream flow. In this research, the 100 m recommendation by the Ministry of Lands and Natural Resources was used (Water Resources Commission, 2008). Houses within 100 m from the water channel were identified. Households were randomly selected from this and a structured questionnaire administered to one adult member of the household. In all, 128 respondents answered the survey questionnaire. Respondents who had interest and knowledge about the area were selected for a focus group discussion to help summarise and draw conclusions from the information collected from the questionnaire survey and interviews.

Figure 1. Map of Ghana with an insert showing limits of the Kumasi Metropolitan Assembly and the study sites (sites are labelled in letters: Atonsu Sawmill (A), High School Junction (B), FRNR farms (C), KNUST Police Station (D), Family Chapel (E), Sepe Tinponmu (F), Golden Tulip Hotel (G), Kaase Guinness (H), Bekwai roundabout (J) and Dakwadwom (K))

Various univariate and multivariate analyses were used to analyse the data. Interview and survey responses were presented as graphs and charts. Differences among sampling sites along each stream and sampling periods were found by means of *analysis of similarities* (ANOSIM) tested at statistical significance level, $\alpha = 0.05$. The hierarchical cluster analysis was used to group study sites according to distance from the water channel and the presence or absence of water on the surface. Variations in species composition were estimated using the *importance value index* for all study sites using the following formulae:

i. density$= \frac{Number\ of\ species\ A}{Area\ sampled}$

ii. frequency$= \frac{Number\ of\ plots\ in\ which\ species\ A\ ocuurs}{Total\ number\ of\ plots\ sampled}$

iii. dominance$= \frac{Total\ cover\ of\ species\ A}{Area\ sampled}$

iv. relative density$= \frac{Density\ of\ species\ A}{Total\ density\ of\ all\ species} \times 100$

v. relative frequency$= \frac{Frequency\ value\ for\ species\ A}{Total\ of\ all\ frequency\ values\ for\ all\ species} \times 100$

vi. Relative dominance$= \frac{Dominance\ for\ species\ A}{Total\ dominance\ for\ all\ species} \times 100$

Therefore, importance value index = relative density + relative dominance + relative frequency.

3. Results

The site specific edaphic conditions are described in Table 1. The upper layers of the soils were generally dark brown and deeper layers were yellowish-reddish brown. Mottles were very common in some of the study sites e.g. sites A and F. The texture types are mainly loamy from forest ochrosols and lithosols. All the sites are waterlogged from a minimum 6 months to being permanently waterlogged. Site D had the highest organic matter content of 34.5% and the whole length of the corer was easily inserted into the soil. At sites A, F, G and H, the corers could hardly penetrate up to 20 cm and these sites also had comparatively higher proportion of sand and low organic carbon.

Table 1: Edaphic characteristics of wetland sites sampled in the Kumasi Metropolis

Location of wetland	Description of dominant soil form at 10 m from water channel	Depth of insertion of the corer at 10 m from channel	Texture			Description	Organic matter (%)
			Sand (%)	Silt (%)	Clay (%)		
A	Deep, grey, mottled soil underlained by gleyed clay. Top soil is dark and loose. Permanently waterlogged	28	19	40	41	Clay loam	19.85
B	Shallow soil underlain by hardpan ferricrete with clear evidence of periodic wetness and lateral flow of water in the soil profile. The upper loose soil layer is dark brown and lower hard layer is brown with red bands and gleyed patches. Waterlogged for about 8 months	10	62	12	26	Sandy clay loam	3.84
C	Shallow soil underlain by hardpan ferricrete with clear evidence of periodic wetness and lateral flow of water in the soil profile. Soil is made up of dark and red portions with gleyed patches. Waterlogged for about 6 months	16	38	52	10	Loam	6.09
D	Deep soft layer of organic matter, dark brown, light weight and permanently waterlogged with deeper portions containing gleyed clay.	> 50	21	46	33	Clay loam	34.50
E	Deep, grey, mottled soils underlain by gleyed clay, subject to permanent waterlogged conditions. Upper layer is loose and dark	22	46	38	16	Loam	5.65

	brown.						
F	Shallow grey soils underlain by hardpan ferricrete. Motling is common in upper parts exposed to air by roots of plants. Waterlogged for about 6 months	10	42	30	28	Clay loam	14.03
G	Red well drained shallow soils underlain by hardpan ferricrete with clear evidence of periodic wetness and lateral flow of water in the soil profile. Waterlogged for about 6 months	15	50	32	18	Loam	6.23
H	Deep, grey, mottled soils underlain by gleyed clay, subject to permanent waterlogged conditions. Waterlogged for about 7 months	17	48	30	22	Loam	7.87
J	Shallow loose soils underlain by hardpan ferricrete with clear evidence of frequent waterlogging and lateral flow of water in the soil profile. Waterlogged for about 8 months	20	47	32	21	Loam	5.24
K	Deep, grey, mottled soils underlain by gleyed clay, subject to permanent waterlogged conditions. Permanently waterlogged	39	33	31	36	Clay loam	6.169

A total of 112 species were identified in all the wetland areas studied. There were no seasonal differences in vegetation so the data were pooled and analysed according to the wetland areas sampled. To assess the species' individual contributions to the total wetland vegetation, the importance value index was used. The top five species with the highest importance values for each wetland are presented in Table 2. Some of the species with relatively higher importance value indices were *Coix lacryma-jobi*, *Paspalum vaginatum*, *Thalia geniculata*, *Thelypteris palustris* and *Typha australis*. Most of these important species were found in almost all the wetlands sampled, albeit, in relatively low importance values at some sites. Some species like *Achyranthes aspera*, *Ipomoea carnea*, and *I. aquatica* were found only at one site each but with relatively high importance values. *Paspalum vaginatum*, *Brachiaria deflexa*, *Chromolaena odorata*, *Sporobolus pyramidalis* and the Cyperaceae were ubiquitous. Species like *Thelypteris palustris*, *Coix lacryma-jobi*, *Typha australis*, *Lemna minor* and *Thalia geniculata* each had relatively very high importance values but were present in few wetlands.

The ANOSIM showed significant differences in species composition among the wetlands. That is, the sites could be separated hydrologically and the distribution of the species also varied according to distance from the water channel (Global R= 0.24 and 0.37 respectively, at 1%). A cluster analysis performed on this data also showed that the presence or absence of water on the surface best explained species distribution in the various wetlands (Campion and Venzke 2011).

Various types of houses were identified within 100 m from the water channel (Figure 2). These were permanent block structures in the form of multi-family residential facilities commonly called compound houses, single family self-contained structures (detached or semi-detached), L-shaped detached or single room structures and wooden structures. Some wooden structures were found in Aboabo, Ahensan, Atonsu and Dakwadwom. Occupants had all lived in these facilities for less than 10 years. When the economic conditions of these residents improve, most of them transform the wooden structures to more permanent block structures. The predominant housing types for respondents from Aboabo are compound, wooden or L-shaped detached houses. The houses in Aboabo, unlike those of Kwadaso Estates, were mostly multi-family permanent compound structures with relatively large numbers of residents even at the household level. Those in Kwadaso Estates were mostly single family accommodations.

Table 2: Top five important species identified in each wetland in Kumasi (numbers in parentheses are the importance value indices of the species).

Study Sites									
A	B	C	D	E	F	G	H	J	K
Achyranthes aspera (16.3)	Achyranthes aspera (9.9)	Alchornea laxiflora (6.5)	Coix lacryma-jobi (13.6)	Amaranthus spinosus (8.9)	Coix lacryma-jobi (24.1)	Chromolaena odorata (12.2)	Chromolaena odorata (10.9)	Ipomoea mauritiana (7.3)	Bracharia lata (9.3)
Brachiaria deflexa (18.2)	Ipomoea carnea (13.7)	Chromolaena odorata (7.1)	Ipomoea aquatica (14.0)	Coix lacryma-jobi (15.3)	Ipomoea asarifolia (9.8)	Cyperus esculentus (7.8)	Eleusine indica (7.1)	Cyperus cyperoides (6.8)	Brachiaria deflexa (11.8)
Lemna minor (16.9)	Typha australis (13.0)	Mimosa pigra (6.9)	Thelypteris palustris (27.4)	Eleusine indica (10.5)	Paspalum vaginatum (14.7)	Cyperus longibracteatus (7.8)	Ipomoea asarifolia (7.0)	Chromolaena odorata (13.7)	Chromolaena odorata (9.0)
Sporobolus pyramidalis (15.0)	Thalia geniculata (16.3)	Rottboellia cochinchinensis (9.6)	Ludwigia decurrens (15.9)	Thalia geniculata (20.6)	Sporobolus pyramidalis (9.9)	Rhynchospora corymbosa (7.3)	Rhynchospora corymbosa (13.2)	Rhynchospora corymbosa (8.4)	Commelina erecta (13.5)
Thalia geniculata (20.4)	Heliotropium indicum (9.3)	Thalia geniculata (20.9)	Paspalum vaginatum (10.3)	Paspalum vaginatum (14.9)	Typha australis (24.0)	Rottboellia cochinchinensis (11.5)	Thalia geniculata (19.1)	Rottboellia cochinchinensis (9.4)	Rottboellia cochinchinensis (9.3)

Majority of the respondents (62 %) owned the houses they lived in. The largest proportion of home owners was those in wooden and permanent single room structures in Ahensan and Atonsu. Most of the multifamily residential facilities, such as the compound, detached and semi-detached houses, have tenants who are completely separate households. There is also a relatively high tenant turnover in these areas. Most people who did not know of the annual floods usually moved out after one or two flood experiences. The relationship between length of stay and prevalence of flood was assessed using the Pearson Correlation. There was no relationship between number of years of stay in an area and presence or absence of floods (r = -0.135). Access to land for construction of houses by [wetland] residents was very varied in the different suburbs (Figure 3). The commonest forms of access to land for building a house were family inheritance, direct purchase from the chief or other landowner or squattering. Respondents in Aboabo were either squatters (9 %) or living in rented houses (8 %). A total of 14 % of the respondents from Atonsu and Dakwadwom inherited the land or the houses they lived in.

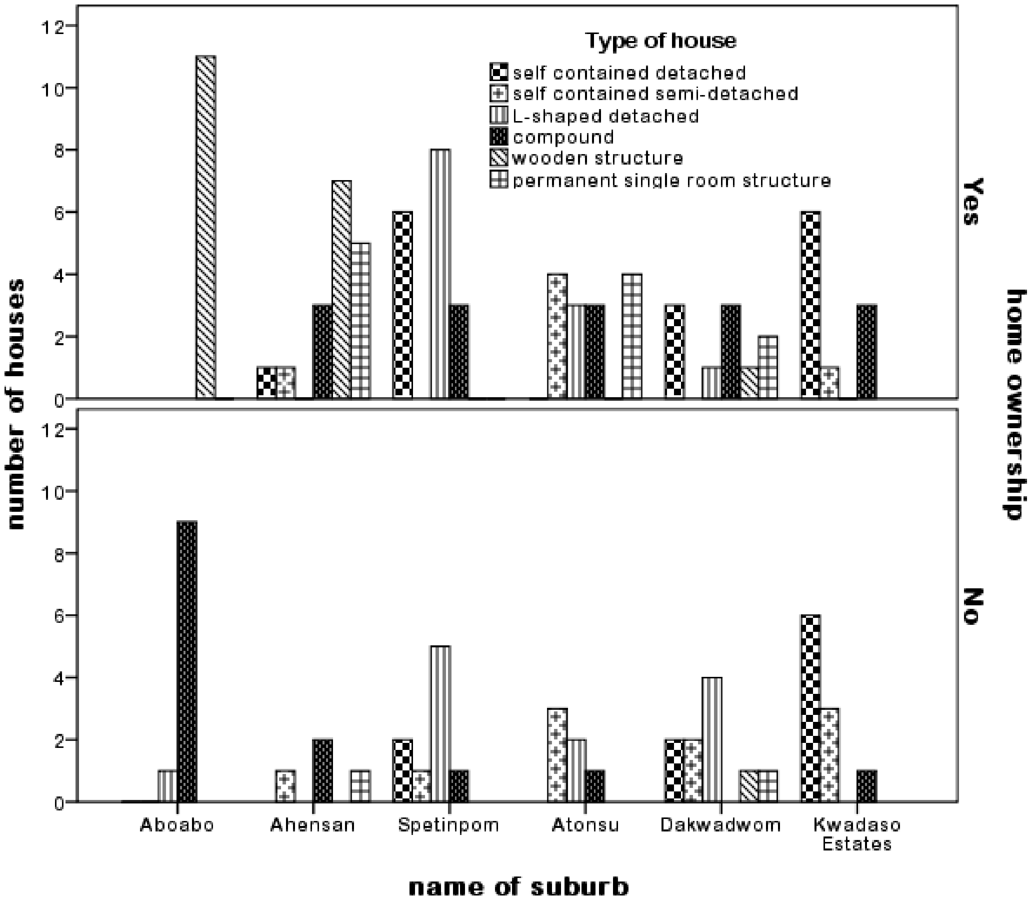

Figure 2. Residential types and homeownership of respondents in the different suburbs of Kumasi

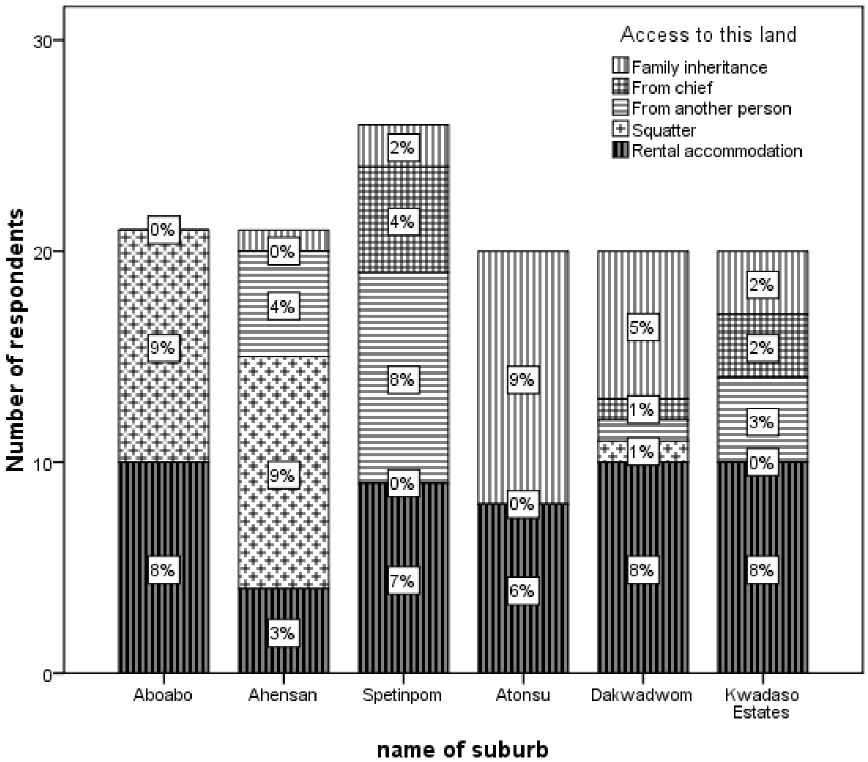

Figure 3. Sources of land for construction of houses in the different suburbs of Kumasi

Various reasons have been ascribed for use of wetland areas for building houses (Figure 4). The commonest reasons were that, wetland areas are cheap, close to other parts of the city and are "no man's land". These are usually areas marked out in the land use plans as natural areas and not to be developed. However, the landowners later bypass the city authorities and sell such areas at very low prices. The city authorities do not also actively protect or use such areas therefore creating the impression that it is a no man's land. For these reasons, the wetland areas in Kumasi quickly develop into informal settlements harbouring squatters and slum communities.

There are various local laws, customs and beliefs that help in the protection and management of wetlands. These were, however, not being adhered to and respondents believe several factors are responsible for this (Figure 5). Respondents in Aboabo and Ahensan did not believe that political influence contributed to communities not managing the wetlands. Rather, it is the lack of political will by stakeholders to protect the wetlands. In Sepe Tinponmu and Kwadaso Estates, respondents were of the view that corruption and the lack of political will to enforce the laws were the two important factors debilitating wetland management in Kumasi. In all the suburbs, poverty was viewed as a very strong factor (more than 50 % responded in the affirmative) accounting for wetlands not being protected.

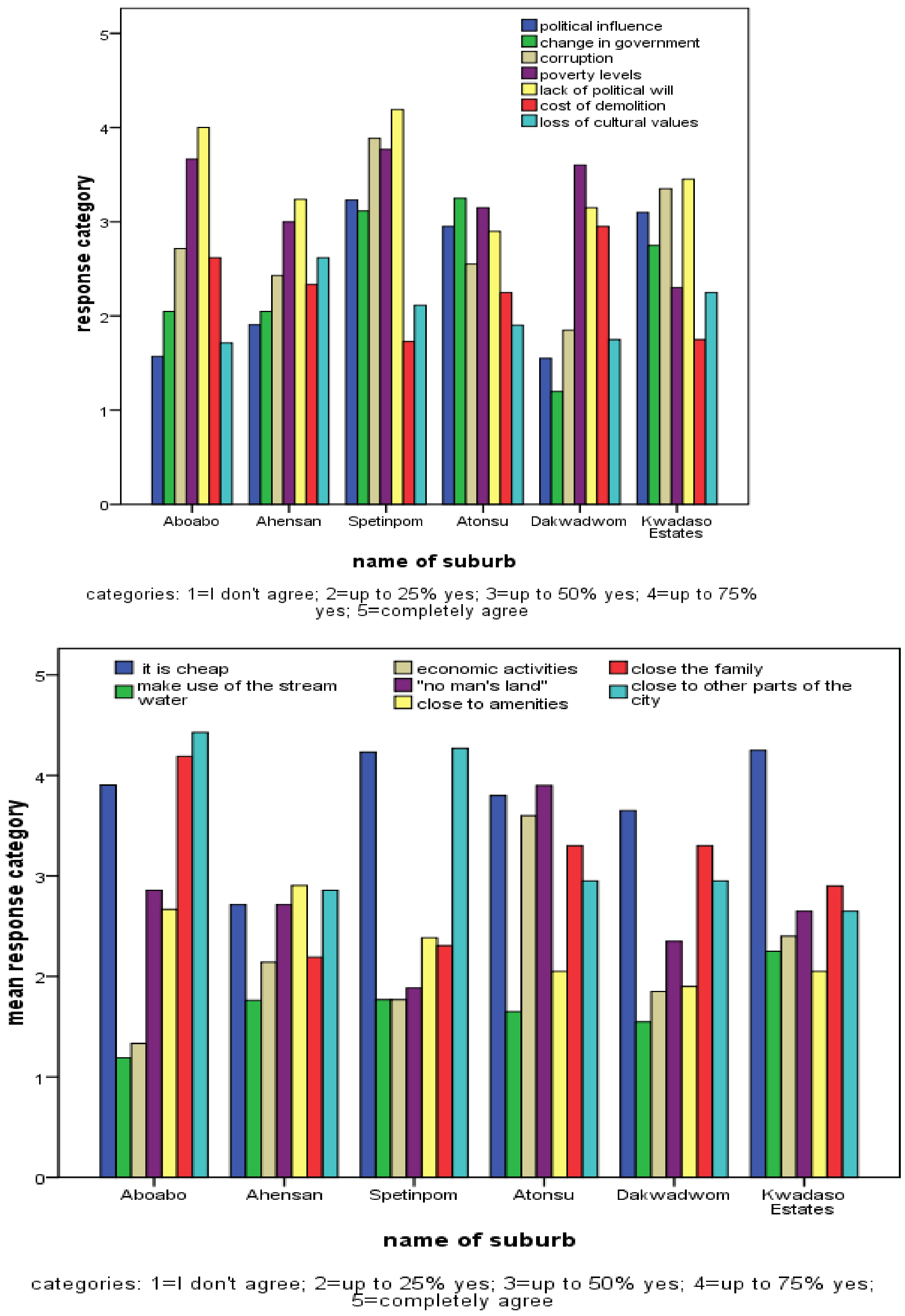

Figure 4. Reasons for choice of wetland area for construction of houses in the flood prone suburbs of Kumasi

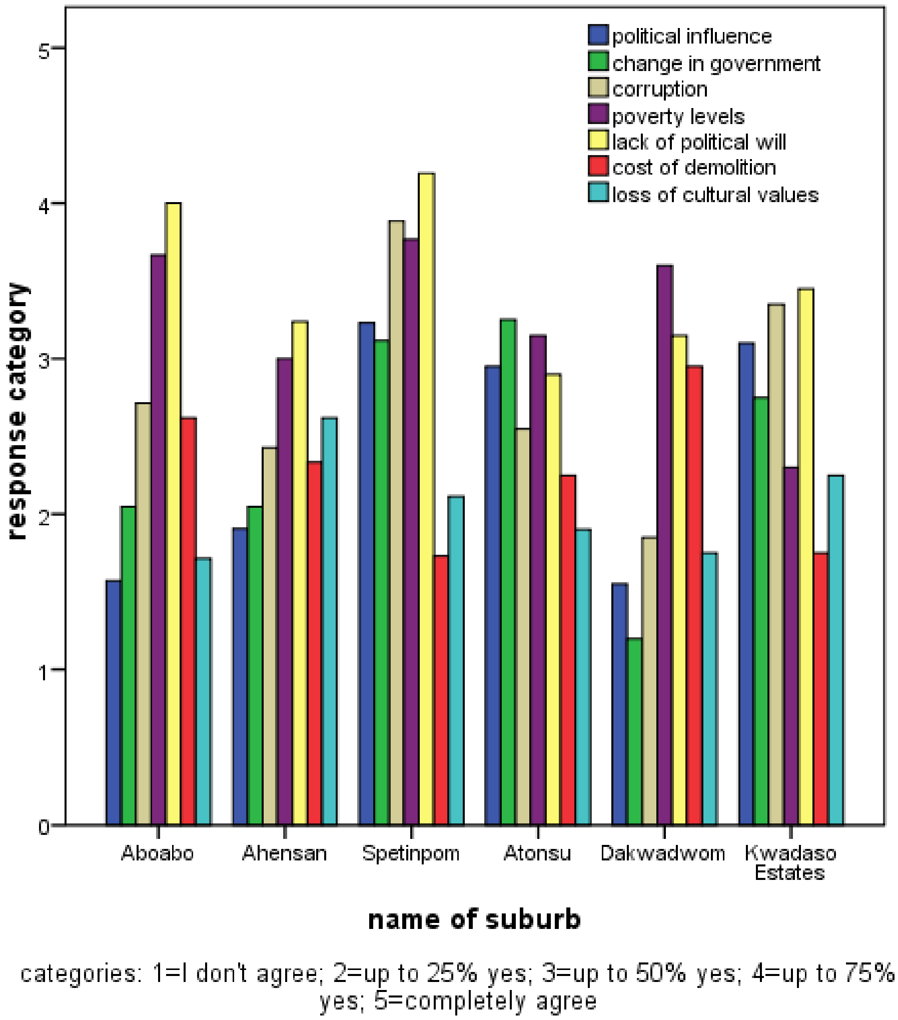

Figure 5. Reasons for the continual destruction of wetlands in the various suburbs of Kumasi

4. Discussion

The urbanisation of Kumasi is severely affecting various ecosystems. According to Owen (1999), natural landscapes, especially, wetlands are greatly altered during urbanisation resulting in alterations in the hydrology and water chemistry of wetland and local plant communities. Also, urban agriculture, harvesting or various forms of removal, grazing and dumping of solid and liquid wastes could cause changes in vegetation. Despite these physical alterations or disturbances in the various study sites in Kumasi, wetland vegetation persisted where wetland conditions prevailed. The high importance values of obligate wetland species and the saturation of the soil with water also shows these areas are wetlands. Therefore, whilst the land may be cleared to build the houses, the patches of land in these localities still exhibit wetland characteristics with the associated vegetation. According to the definition of Joosten and Clarke (2002), the soil characteristics, vegetation and the long durations of waterlogged conditions mean that these suburbs are situated on wetlands.

Like most developing country urbanisation, that of Kumasi is characterised by very high population growth and physical expansion merging up the city with its peri-urban regions. The suburbs considered in this study have large immigrant populations and therefore not only serve as a social network basket for first time immigrants, but as political hotspots. These residents have also vehemently resisted all efforts by the KMA to demolish their illegal structures. The only open and "free" areas available in these suburbs to construct a house are often the wetland areas. The migrants therefore find these areas convenient for erecting temporal dormitories with active assistance from old residents. It is however, surprising that most people after several years of living there and having improved their economic standing will continue to live in such structures or their improved forms in the same locations.

Majority of these wetland associated inhabitants are natives. These natives continue to live in such neighbourhoods due to their historical ties and strong social and economic capital developed over the years. For an immigrant however, early social networks and the cost of accommodation might be the determinant of their choice of such locations. It is not surprising that these immigrants first live in makeshift shelters made of wood and may later move to more permanent single room block structures. Suburbs such as Aboabo, Ahensan and Dakwadwom might be providing these favourable initial conditions to attract the high immigrant squatter population. Ownership of such structures might be through a form of transfer of title or a rental arrangement with the new tenant whilst the economically better off tenant moves out. Due to the high demand for these neighbourhoods by immigrants, landowners and chiefs also take advantage of these illegalities to lease out or sell the plots to these tenants giving them title to the land. For any given environmental challenge, it is expected that there is a tipping point at which an individual finds a particular environment unsuitable for habitation. These suburbs, just other slum suburbs of the world, are among the densest in Kumasi. The pull factors motivating people to move in and to continue staying there are stronger than the dissuading environmental pressures in these neighbourhoods.

It is widely expressed in literature that, increased incomes or improved economic conditions would lead to improvement in the environment or in this case, a desire for better housing environment away from annual floods (Munasinghe, 1999; Magnani, 2001; Panayotou, 2003; Dinda, 2004; Costantini and Monni, 2008; Wagner, 2008). The findings of this study do not support this theory. Rather, improved economic conditions only led to improved housing in the same environment. For example, wooden structures were converted to more permanent block structures. This is still true even when frequency and scale of floods are increasing. Homeownership in Ghana is a cultural and societal requirement or an expectation as one grows older; as having your house is a sign of success. This is aggravated by a national housing deficit and a very poor mortgage system. Most people therefore acquire the land and build their houses over several years. Land prices are very high in urban areas and the prices also reflect the quality of the potential houses and services and infrastructure availability in the neighbourhood. Poor people therefore go for the cheapest available lands which are usually wetland areas and therefore not part of the official city layout scheme. It is these cheap unapproved houses built in wetland areas that bear the full brunt of the annual floods. According to Lant (1994) the core of the conflict in wetland destruction is a question of property rights. However, does the owner of the wetland have the right to alter that wetland for his or her own purposes? Does the public have the right to the ecological functions and values of a private wetland? Do individual rights acquired through the purchase of wetlands override national and local government laws? Does the owner of a wetland have the right to alter it for private purposes at the public expense? How can the externalities from such alterations be internalised? When can such an individual right be revoked for the public good?

These questions describe the myriad of challenges that city authorities, land owners and wetland residents face in Ghana. In demarcating the wetland areas as natural areas, it is unfortunate that the city authorities (KMA) do not make any effort at assigning and enforcing property rights to such areas. If the city wishes to acquire property rights to such areas, it will have to pay a compensation (buy the rights) to the landowner. By delineating these wetland areas as 'Nature Reserves' or 'Parks' the authorities give *de facto* property rights to the public. The landowner is therefore assumed not to have the right to sell such lands. The land tenure system in Ghana, however, does not recognise such ownership. The proposals by Panayotou (1997) and Eppinka *et al*. (2004) for more secured property rights will not work in the Ghanaian context where wetlands delineated for public good or environmental protection is not paid for. The city (public) therefore does not have the ownership rights to the wetlands. Whilst it may be expensive for the government to pay compensation to designate these wetland areas as public lands, it is also widely known that government has not been good managing existing public lands. Therefore, distribution of benefits and costs of maintaining wetlands among stakeholders as advocated by Magnani (2001) may be a better option to management of such spaces. The Otumfuo Children's Park in Dakwadwom is an example which could be replicated in other wetland areas. Names, uses and attributes should be assigned to the wetlands and benefits accrued shared between the landowner and authorities for management of the wetland area. Hereafter, better enforcement and effective environmental regulations will then be needed to maintain the wetland as such.

Unless land that has been acquired and protected for the public good, the system of land ownership in Ghana does not augur well for the environment. Urban land value is always on the ascendency. For example, wetland areas gain value due to urbanisation and improved construction engineering feats. Like all other jurisdictions, there is market failure in the environmental services of these wetlands. Wetland uses for residential and commercial developments therefore often out-compete their use for environmental services as a land use priority. Urban wetland areas are therefore very popular sites for fuel stations in Kumasi and other urban areas of Ghana. The Ghana Environmental Protection Agency's regulations for siting such businesses promote the use and destruction of urban wetland areas rather than protecting them.

The current level of economic development of Ghana is also a contributory factor to ineffective implementation or non-enforcement of environmental laws. Most obviously, law enforcement has financial implications and will therefore depend on the wealth of the country. Developed countries may be more capable and willing to comply with their environmental obligations than poorer countries because implementation places relatively less burden on the national cake. On the other hand, if the cost of implementation is very low, or if implementation produces a net economic gain, a country's level of economic well-being may not be very critical for its success. This is because the decisive factor is the relationship between the cost of implementation and the capacity of a country's economy to absorb them. Apart from a nation's economic situation, national environmental consciousness and institutions are also very necessary for the protection and management of wetlands. Ghana needs the birth of a green party. In many developed countries, rising environmental consciousness has given birth to green parties (or the *vice versa*) that are revolutionising the political landscape with green politics by putting environmental issues to the fore in national policy debates. The challenge now lies in whether it is the economy or the people that give rise to green politics. If it is the economy, then Ghana needs to reach a certain level of economic independence for businesses to go green and still survive the competition. The Ghanaian economy and businesses are not yet there. If it is the people, there is the need for a critical mass of people to have a level of dissatisfaction with the environment. That also, Ghanaians are not yet there. The option left is for the developed countries to dictate the pace towards a better urban environment through strings tied to bilateral and multilateral assistance or the introduction and enforcement of environment related trade barriers and conditionalities.

5. Conclusions

This study sought to investigate the political ecology of urban wetlands in Kumasi, Ghana by identifying and applying a robust definition to delineate such urban wetland areas. It was found that the houses in these neighbourhoods were built in wetlands. People build and continue to immigrate to these flood prone suburbs because of the strong social networks. The nature and type of soil, vegetation and the waterlogged conditions of these suburbs proved them to be wetlands. However, the land ownership system is an impediment to the successful management of these wetlands by the authorities. The right definition and delineation of wetlands will not stop landowners from selling wetlands. It is recommended that, land areas correctly delineated as wetlands be developed for public recreational use to maintain its environmental functions and prevent encroachment. The benefits of this arrangement should be shared equitably among stakeholders. Also, there is the need to develop institutions and environmental movements and also, to introduce and enforce environment-related trade barriers and conditionalities to put pressure on authorities and citizens to act.

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