



Research Article

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Diseases and Health; Case of Wetland Populations in the Bamenda Urban Area, North West Region of Cameroon



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Abstract

This study examines the impact of diseases and health on the population living within wetlands in the Bamenda Urban Area. The data was generated from primary and secondary data sources. Data was analyzed through the descriptive and inferential statistical techniques. The results indicated that, the wetlands in Bamenda are fast degrading caused by population on land, reclamation, pollution, and agricultural activities. Also results revealed that, most wetland have already been converted to dry land such as the Bamenda food market and the Amour Mezam bus station. More so, the increase concentration of human investment in wetlands has increase the vulnerability of wetland inhabitants to floods hazards and diseases such as malaria, cholera and typhoid. The study strongly recommend that the conservation of the wetlands must involve the collaboration of the states, the council, the public and other development stakeholders who must participate effectively at different levels. Since wetlands are part of the global environment, their conservation should be according much relevance especially as their resources still offer livelihood choices to local populations.

Keywords: Diseases; Health; Wetlands; Population; Bamenda

Introduction

In the past, people considered wetlands as being a threat to human existence. However, this perception has changed overtime. These wetland areas are occupied mostly by the poor who are then faced with many diseases such as malaria, typhoid, and cholera. The increasing attention given to the study of wetlands (Paludology) is gaining a wider dimension both at global and regional scale [1].

Wetlands are specific ecosystems like Bogs, Bottomlands, Fens, flood plains, Mangroves, Sloughs, Swamps, Wet Meadows, marshes, moors, peat lands, reed swamps and wet prairies. These have their formation, processes and characteristics controlled by water [2]. Wetlands are 'heavens' for some scarce and valuable natural resources. They are usually surrounded by uplands; so, they have surface water outlets within geographic depressions or transitional zones between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. This determines the nature of soil development and the types of plant and animal communities living in the soil and on its surface water [2].

Wetlands are very important ecosystems, providing value to people and other organisms. Wetland functions include water purification, groundwater recharge, coastal protection from

extreme events, providing habitat for maintaining biodiversity, habitat for commercially valuable organisms, aesthetic value and research opportunities. Wetlands also provide habitat for vectors such as mosquitoes and this creates a potential conflict for wetland management [3].

According to [4] wetlands are considered as areas that are saturated with water either permanently or seasonally, such that it takes on characteristics that distinguish it as a distinct ecosystem. However, it should be noted that a patch of land that develops a pool of water after rain storms will not be considered as "wetland", even though the land is full of water. Marsh, swamp, fish ponds and flood plains are the main type of wetland existing in the Bamenda urban space.

According to the Ramsar Convention [5] on World Wetland Day, it is viewed that in many parts of the world, human health is closely linked to water-related diseases. Malaria, because mosquitoes breed in wetlands, and diarrhea infection (including cholera) because of sewage contamination are globally the worst in terms of their severity impact, accounting for 1.3 and 1.8 million deaths respectively in 2002 and affecting the health of many. Fatalities are almost entirely in children under 5 years of age. Diarrhea diseases affect both African and south Asian countries, whereas malaria's

impact is largely in Africa but also significant in many parts of Asia and the Americas. While malaria and diarrhea diseases are the two worst in terms of human impact, we might add to these the debilitating effects of other wetland-related diseases such as schistoso-miasis, Japanese encephalitis, filariasis, onchocerciasis and others. Poorly treated human sewage contains pathogens that are a key cause of diarrhea infections - and wetlands (both inland and coastal) can be an important transport mechanism for such pathogens where sanitation is poor. Controlling malaria was one of the driving forces for wetland destruction in the past, especially in Europe, but this has led to the loss of vital ecosystem services such as water and food and is not considered an option today.

According to Horowitz & Finlayson [6], reconsidering the relationship between human well-being and environmental quality is central for the management of wetlands and water resources and for public health itself. They propose an integrated strategy involving three approaches. The first is to make assessments of the ecosystem services provided by wetlands more routine. The second is to adopt the "settings" approach, most developed in health promotion, wherein wetlands are one of the settings for human health and provide a context for health policies. Finally, a layered suite of health issues in wetland settings is developed, including core requirements for human health (food and water); health risks from wetland exposures; and broader social determinants of health in wetland settings, including livelihoods and lifestyles. Together, these strategies will allow wetland managers to incorporate health impact assessment processes into their decision-making and to examine the health consequences of trade-offs that occur in planning, investment, development, and decision-making outside their direct influence. The above mentioned tied with the wetland study in the Bamenda urban area where Environmental as well as Health Impact Assessment are being done to ensure good health of the population inhabiting wetland environment.

The encroachments of the population in to wetlands has created diverse problems which impact on the hydrology, biodiversity as well as human life. Given that the scale of these problems is expanding within the Bamenda urban space, a study of this nature thus becomes necessary with the main focus to expose the livelihood threats attach to wetlands degradation in the area. This is particularly because of the common perception that wetlands are "no man's property". This notion is rife in the nation and Bamenda in particular. The study of wetlands has become a major concern to International Organizations, Governments, NGOs and Private individuals. This study therefore examines the relationship between the locations of Wetlands and the spread of disease in the Bamenda urban area.

Problem statement

Bamenda urban area has an undulating topography which ranges from 1200m to 1800m above sea level [7] and is punctuated in some areas by plains and low lands where wetlands dominate. The Bamenda urban area has a gentle relief and a plateau; the

nature of the relief necessitates the occurrence of wetlands in plains and low laying areas. These plateaus and plains are drained by a number of rivers and streams such as River Mezam, Ayaba and Libakan. These streams have developed extensive flood plains which have become wetlands. The problem however lies in the management of these naturally occurring wetland areas which today are linked with high disease incidence amongst its occupants.

Some wetlands are used as dumping sites for liquid and solid wastes. This pollutes the environment and causes diseases. In line with this, during the rainy season when floods are common, diseases like cholera and diarrhea are very common. This arises because most of the streams and springs found along wetland areas are used by the population for domestic and agricultural purposes. When rain falls, it carries away this liquid and solid waste into streams and springs. When this water is used to irrigate crops such as vegetable, maize, beans and other crops especially during the dry season, they are contaminated with the toxic chemicals coming from the waste. When the crops are consumed by the population, they become affected with diseases like cholera, and diarrhea, which sometimes leads to death.

Furthermore, flood plains and the marshes are used as sites for the construction of pit toilets. Unlike in the Bamenda urban areas, population living along river banks constructs their drains from homes directly into streams leading to high contamination of water. This is simply because the Ministry of Environment and Nature Protection are not working hand in hand with the population, less they would have sensitized the population on how to construct drains and also informed them on the implication of discharging waste from toilets into streams. During the rainy season, there is proliferation of many diseases which do not only affect humans but also other forms of life.

The expansion of the urban area towards flood plains and marshy areas is due to rapid population growth, where by many people tend to ignore the risk of flooding and diseases which are common in these areas .However, their adaptation in these areas entails a number of strategies like construction of solid embankments in order to cope with the risk of flooding, such devices are flagrantly absent. However, the observed level of illiteracy and poverty has made such coping strategies less resilience to the increasing flood threat within the wetlands. However, majority of the population are ignorant of the risk of inhabiting wetlands. This is due to inadequate informative programs concerning wetlands in the Bamenda urban area.

Moreover, despite the pressure on wetlands borne by man, there are also natural and biological stressors such as bacteria and fungi found in water, plaguing the natural state of wetlands which include climate change, invasions of other species as well as pests and diseases. Increasing pressure on wetlands from all these stressors has decreased the natural ecological functions such as the ability to enhance ground water storage and reduction in carbon sequestration.

Research Methodology

Location of the study area

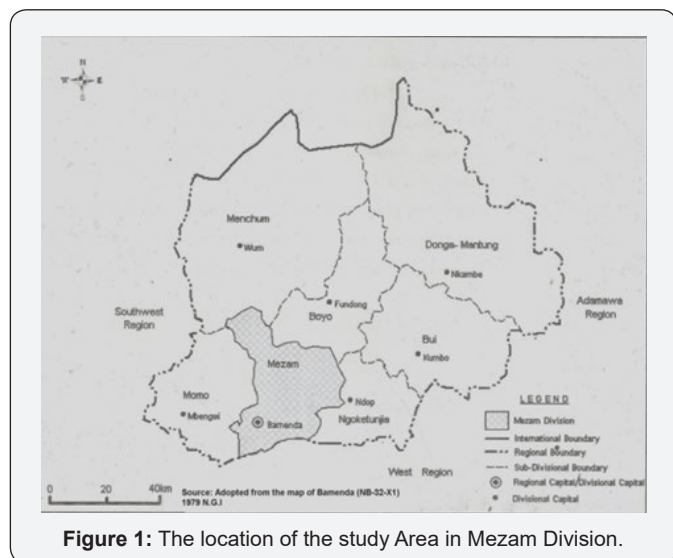


Figure 1: The location of the study Area in Mezam Division.

Bamenda is located between latitudes 5°56" N and 5°58" North of the equator and longitude 10°09" and 10°11" East of the Greenwich Meridian. The town covers an area of about 290 square kilometers, and it is at an altitude which ranges from about 1200m to 1800m above sea level ("Bamenda today", Ministry of information and culture). The town lies at an altitude of 1430m above sea level with a surface area of 3125square kilometers [8]. The town is situated along the Cameroon Volcanic Line and exhibits two very distinct relief environments; that is, the High Lava plateau (Up Station) with an altitude of about 1400m, comprising part of the highland villages of Njah and Mendankwe and the Lower plateau (Down Town) with an average altitude of 1100m above sea level, this half of the town spread from the original hamlet of Abakpa, to incorporate part of the villages of Nkwen, Mankon, Mbatu and Chomba. Bamenda is the regional headquarters of the North West Region of Cameroon, and it is worth noticed by it physical and human characteristics. Bamenda Municipality consists of physical environment such as relief, geology, drainage, vegetation, climate, and soils. And also, human activities such as economic structure and population which varies within the town. From Figure 1, the study area is located in the Mezam Division.

Data collection

Data was generated from two main sources: the primary and the secondary sources. Primary data was generated through the use of questionnaires, interviews, and field observations. A total of 150 questionnaires were administered to the wetland population of the Bamenda urban area, 94 questionnaires were returned. These questionnaires were distributed randomly in three major neighborhoods where wetlands dominate which were; Mulang, Sisia and Mile 3 and 4 to obtain information on the major threats to wetlands, seasonal variation in diseases, the most frequent diseases common in these environments, and its impact

on the population living within these areas. The questionnaires administered exempted 0-15 years of age because they are young to responses concerning wetland activities and situations.

Interviews were also used to get primary data. These interviews were granted to palm wine tappers, some farmers as well as quarter heads who exploit these wetland areas in order to get information on the type of diseases affecting the population living within these environments. Field observation was also used to generate primary data. Through field observation, the researcher was able to observe the activities of those inhabiting wetland environments. These activities include farming, fishing, construction and irrigation. On site, photographs were also taken showing flooded zones and waste disposal sites along some neighborhoods in Bamenda urban space. The secondary source of data was acquired from relevant books in the university of Buea school library, journals, articles, documented materials, thesis and dissertations related to the various wetland activities to man and the environment as well as the main threats to their survival.

Data analyses

The data analyzed was mainly using the Qualitative (descriptive) technique. Descriptive analyses comprised the use of tables, pie charts and histograms.

Results and Discussion

Table 1: Demographic information of the study population.

Age (Years)	Frequency	Percentage
15 - 30	43	46.2
31 - 45	27	28.7
> 46	24	25.1
Total	94	100
Sex	Frequency	Percentage
Male	42	44.7
Female	52	55.3
Total	102	100
Educational Level	Frequency	Percentage
No Formal Education	11	12
Frist School	12	13
Ordinary Level	31	33
Advance Level	25	26
Tertiary	15	16
Total	94	100

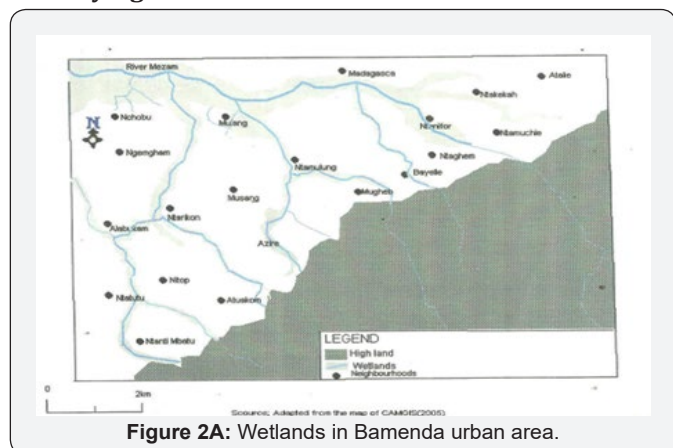
Table 1 indicated that, 46.2% of the population were of the youthful age group of 16-30, followed by those in the adult age group of 31-45 with 28.7%, while the least represented were those in the aged group 46 and above representing 25.1%. About 75% are made up of youth who are still very active, given that there are those engaged in activities such as construction, farming, wine/liquor tapping, and fishing since they have the strength and the ability to work. While the aged of over 46+ are not as active as the youth since they have been working in these areas and their

strength no longer permit them to do much. Given that a bulk of the population is youth, birth rates are likely high to further increase human pressure on wetland resources in the future.

Still in Table 1, females are the dominant population living within the wetland with 55.3% while the males make up 44.7% of the population. Result of some studies like the study of immunity by the immunologists, has confirmed that women are the most active population and are resistant to diseases than men due to their stronger immune systems. Bamenda is an urban center and vegetables have become a market gardening crop for most women. As a result of this, many women inhabit Wetlands in order to engage in vegetable cultivation. This leads to an increase invasion of wetland resulting to it's over exploitation. It is also noticed that the males often engaged in activities such as drilling of wells, construction of houses than the females.

Wetland population living within Bamenda urban area have varied educational attainments. The highest proportion of the population (33%) were GCE Ordinary Level holders, followed by the GCE Advanced Level with 26%, those in the Tertiary with 16%, Primary education 13% and the least are those with No formal education 12%. Given that majority of the population are literate (from ordinary level and above), it implies that, the population are aware of the ills wetlands bring such as disease propagation, pollution and flood risk. Despite their educational levels, they still not have a board knowledge of wetland threats and this is worsened by the greater number of uneducated persons who were not very aware and informed of the threats of wetland ills like floods and diseases.

Identifying wetlands in the Bamenda urban area



This study had as an objective to identify and map out the wetlands within the Bamenda urban space. Figure 2 shows the spatial distribution of wetlands in Bamenda. As shown on Figure 2, most of the wetlands are located in the North and North West section of Bamenda, predominantly in neighborhoods such as Mulang, Ntenifor in Ntashen and Sisia. Generally, these wetlands are within the flood plains of streams courses such as River Mezam because of its low- laying terrain. These wetlands are under increasing human pressure through its varied activities such as farming, settlement construction, fishing and irrigation.



Figure 2B: Plate 1: A wetland used as a dump site at Sisia neighborhood.

Source: Field Work March 2015.

Threats to wetlands in Bamenda urban area

Table 2: Respondent views on the Threats to Wetlands.

Threats	Frequency	Percentage
Agriculture	22	32.4
Use of Chemicals Pollutant	46	48.94
Reclamation	33	23.4
Others	4	4.26
Total	94	100

The research also investigated the threats to wetlands in Bamenda urban area. From the field observation, the study found out that a variety of factors served as threats to this wetland environment. These threats arise from activities like farming and land reclamation Table 2. From the analysis, use of chemicals is the highest threat to wetlands representing 48.94%, followed by agriculture and reclamation with 22% each. The least is threats come from activities like fishing, hunting and harvesting with 0.4% [9].

High use of chemicals in farming and pollutants from household implies that, there is an increase in urbanization which result to an increase waste disposal (municipal and solid waste). Also, the conception people have about wetlands is that it is a common property resource as well as land with a low value. This has led to unsustainability in the exploitation of wetland since they are used as dump sites. Also, the construction of toilets and piggeries in neighborhood such as Mulang, Mile 3, 4, and Sisia have contributed a lot in polluting wetlands. Plate 1 illustrate a wetland used as a dump site at the Sisia neighborhood [10].

Agriculture and Reclamation are the second major threats to wetlands in Bamenda. The compelling increase in the population of Bamenda has diminished the quantity of lands vital for agricultural production. Since most of the urban dwellers still depend on agriculture for their livelihood, they have sought to exploit the wetlands. The study observed that the agricultural practice within the wetlands are for subsistence and almost done all year round. Though very intense during the dry season, it was also observed that the farmers also make use of chemicals

to sustain the growth of crops. This practice has contributed significantly to the degradation of the wetland environment especially the extinction of species.

Land reclamation which is a function of population increase is a major threat to wetlands in Bamenda. It was reported by most of the wetland inhabitants that, land value has become too expensive within the suitable land parcels in the town, pushing them to acquire lands within wetlands which they consider cheaper. More observed reclamation measures included; the deposition of laterites and subsequent compaction, the construction of drains to channel water from wetlands in to the main stream channels and the use of sand bags. The reasons for reclamation were varied; to construct houses, to step down the water table for agricultural production such as vegetable cultivation, to have space for commercial functions such as the Bamenda food market, and to make the environment hospitable (safe from mosquitoes and snakes) among others. The impact of land reclamation in these areas is also varied. It has drastically reduced the size of wetlands, reduced the water content of wetlands, and altered the wetland ecosystems especially where most indigenous species are threatened.

Human constraint within wetland areas

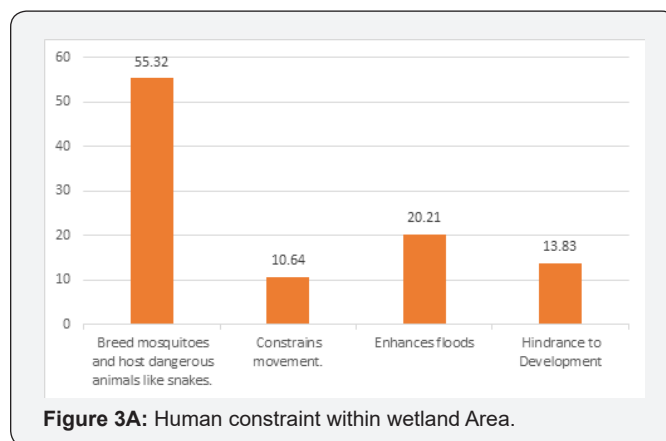


Figure 3A: Human constraint within wetland Area.

The research also intended to investigate some of the problems the wetland inhabitants are exposed to as shown Figure 3. From Figure 3 majority of respondents were of the view that the greatest threat to human life within this environment breeding mosquitoes and host dangerous animals like snakes. This threat to wetland constitute 55.32%, followed by floods with 20.21%, hindrances to development representing 13.83% and the least constrains movement representing 10.64%.



Figure 3B: Plate 2: An inundation home by flood water in Mulang. Source: Yolar [10].

The vast amount of water gives room for mosquitoes to breed. During the rainy seasons mosquitoes are greater since there is a lot of water where they feed and reproduces their young ones. As a result of this, individual living within these zones comes in to contact with the mosquito's bites and become infected with malaria fever which affect their human health and also making condition unfavorable for them. Floods was the second wetland risk and are common in rainy season due to excess rain which turns to overflow it banks. Floods are common in areas like Below Foncha. In an interview granted to a participant on 15th March 2015 in Mulang, it was reported that in August 2014, a flood disaster made homeless five families and damaged other properties and farm lands. Plate 3.2 further illustrates the vulnerability of wetland inhabitants to flood disasters.

The risk of flooding has often exposed wetland inhabitants to poverty, misery and property destruction on a yearly basis. Wetland areas hinder development in the sense that these zones

require high cost to construct, are expensive to reclaim, fear of hazard such has floods and hostility repels the population. The swamps and thick bushes host snakes. These snakes are a major problem to the population, especially the farmers and tappers who interact with wetlands on daily bases. Most of them have suffered from snake bites and fright.

Common diseases within wetlands in the Bamenda urban area

The study also aimed at investigating diseases most common within wetlands in Bamenda urban area. The results are as shown on Figure 3. From Figure 4, malaria is the highest disease affecting 65% of wetland population, followed by cholera with 16%, typhoid with 14.5% and the least being diseases like rashes and fungi with 5%. Respondent's views of wetland diseases indicated that diseases have a lot of negative impact on the population living within these areas.

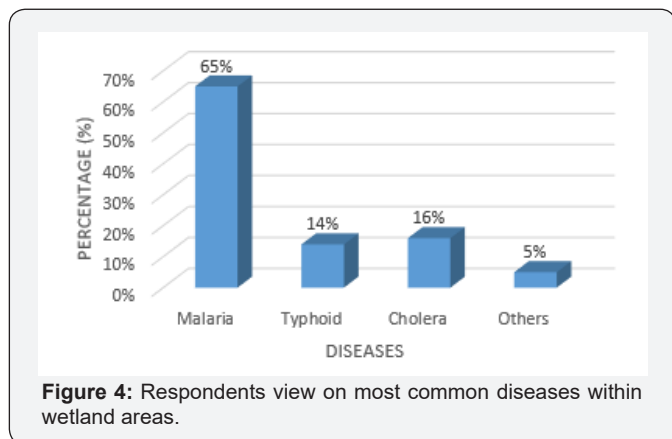


Figure 4: Respondents view on most common diseases within wetland areas.

Seasonal variation of diseases in wetlands

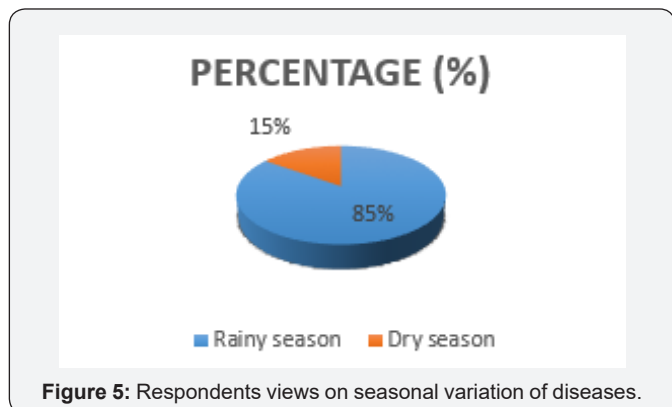


Figure 5: Respondents views on seasonal variation of diseases.

Field survey reveals that disease occurrence within wetlands of Bamenda depends on the seasons as shown in Figure 5. From Figure 5, the result shows that the rainy season records the highest proportion of diseases (85%), while the dry season records 25%. This implies that diseases associated with wetland areas are more common during the rainy season than the dry season. During the rainy season, the environment is humid and due to high rainfall which result to pools of stagnant water and bore holes, they all constitute breeding grounds for mosquitoes causing malaria to wetland inhabitants. Also, during the rainy season floods occur thereby leading to the contamination of water sources and reduce its quality, which further exposes the population to diseases like cholera.

Also waste from homes, market and other surroundings dumped in these areas are transported by rain water and deposited in the lowlying areas like Mulang, Sisia, Mile 3 and 4 which are hazardous to human health. It was reported by the farmers that the deposited waste contains chemicals which are toxic to man. When this water is used for cultivation of crops especially vegetable which is consumed by the population, individuals become contaminated.

Awareness of wetland conservation

The study also investigates the inhabitant’s awareness of wetland conservation strategies. The responses are shown in Figure 6. From Figure 6 majority of the respondents were of the view that they are not aware of wetland conservation

strategies. More than 79.80% were ignorant of these wetland conservation strategies while only about 20.20% were aware of such strategies. The reasons why many people are not aware of wetland conservation strategies is simply because of inadequate information since most of the inhabitant had not attained higher levels of education. Many occupy wetlands but they do not know what wetlands all are about.

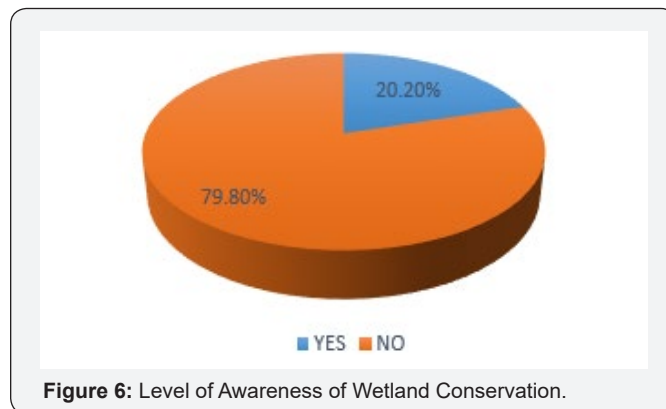


Figure 6: Level of Awareness of Wetland Conservation.

Current strategies to conserve wetlands

Table 3: Respondents Views on Current Strategies to Conserve Wetlands.

Conservation Strategies	Observation
Regulation by the Government	Laws governing wetlands are created but inapplicable to these zones
Sensitization	Inadequate personals to sensitize the wetland population
Avoidance of Wetlands	Wetlands are still inhabited.

The research also found out from the inhabitants if there were aware of strategies to conserve this wetland. The results are as shown in Table 3. From the observation, laws governing wetlands in Bamenda have been put in place by the Ministry of Environment and Nature Protection, but these laws are inapplicable to wetland zones as reported by the wetland dwellers. Also, there are inadequate teams of environmentalists to sensitize the population living in wetlands. The inhabitant is not aware of wetland threats, they continue to inhabit these areas [11].

Ownership and conservation of wetlands

In order to conserve wetlands, the study unraveled some wetland strategy that can be applied by the population living within the wetlands. The need to education was considered the highest strategy of wetland conservation with 42% responses, followed by the implementation of laws governing wetland exploitation with 32%, other methods such as avoiding wetland areas completely with 13% and least to stop cultivation on wetland with 12% [12].

This implies that the main and the most important way of conserving wetlands is by educating the people. Reason being that people are still uneducated and are not aware of the benefits from wetlands and still hold the perception that wetlands are naturally problematic areas. This explains why they are not properly managed.

A close way to conservation is by implementing laws governing wetlands. From this, it is also clear that most people exploit wetlands indiscriminately because they are no laws governing their exploitation, so they feel wetlands are not so important because they are not a center of attention from the Local Governments. From the respondents views, avoiding wetlands completely will not be the best option or strategy to wetland conservation because most of the population depend on these wetlands for their livelihood and sustenance. If agriculture is constraint it will help the wetlands regain it fertility. Wetlands are considered as no mans' land the study finds it necessary to investigate who owns these wetland areas. The results show that the highest proportion of respondents' views of wetland has been owned by the Government with 50%, followed by Individuals with 24% and the least the community with 20%. These responses varied between individuals

Recommendations

Given that the wetlands and their resources hold so much to the future of man and his environment, the study has address some recommendations to the government, the municipal council, the local authorities and to the wetlands inhabitants which when implemented will improve wetland conservation in Bamenda.

To the government

The study recommends that the government should change her strategy towards wetland conservation. Conservation cannot be achieve only by the development of laws but must be barked with a strong political will for implementation. The government must put in place structures with the responsibility to enhance wetland protection, and rehabilitation of those with degraded status. The government should also integrate the conservation of wetlands as an activity to be enforced by the various state structures such as town planning and housing, tourism, agriculture and environmental protection, and others. Should the different state structures and ministries engage actively this will help achieve management and conservation of wetlands at different levels.

The state should investigate the current procedures governing land acquisition and exploitation within the wetland environments. The state regulations and prohibitions should be made known to the general public and specific sanctions impose on defaulters. She should also carry out demolition and resettlement exercises to safe the lives and properties of those who are liable to floods and other hazards in the wetlands.

To the Council

The council should enforce sanitation campaigns as well as sensitize the urban population on the importance of proper waste disposal. This will help reduce the amount of waste dumped directly on the wetlands or littered in the environment. Such efforts will reduce the current trend of pollution occurring within the wetlands in Bamenda.

The council should also develop the wetlands in ventures that can raise income to the council. She should transform some into

potential recreational resort like artificial lakes, fish farming and even conserve wetlands biodiversity worthy of attracting research and tourism. These ventures are vital in generating huge income to the council while adding the value of wetlands.

The council should work in collaboration with the officials of town planning, and the chiefs to prohibit the issuing of land title certificates and building permits to individuals wishing to construct within the wetlands.

To the wetland's inhabitants

In order to achieve a balance between wetlands conservation and meeting the needs of people, and to ensure it continues provision of livelihood services to people new techniques in the exploitation of wetland resources must be introduced and implemented. The new practices be it in fishing, agriculture, harvesting of plants species must ensure sustainability. This will help ensure the future dependent of the population on these wetland resources. Individuals should take the responsibility to avoid developing permanent residence within the wetlands. Given the huge losses incurred, the population should avoid these risk zones most especially as the respond and management is often slow and often without compensation to victims.

Conclusion

The conservation of wetlands and their resources has become a global campaign gaining much support in most parts of the world and Cameroon in particular. This campaign is rooted in the necessity to protect the environment and its components which are inter-linked. The perception that wetlands are waste lands has change over the past decades. Today, wetlands and their resources offer enormous development opportunities in supporting agriculture, fishing, acting as a home for unique plants and animal's species, as well as influencing the local climate and hydrology conditions of an area. In spite of the enormous potentials of wetlands to livelihood enhancement, and support the natural environment, mankind in most parts of the world have continued to execute practices that are fast exhausting and have degraded wetlands.

Human encroachment into wetlands has led to wide spread consequences ranging from the increasing vulnerability of human life and property to floods hazards and diseases, collapse of wetlands ecosystems and extinction of species, increasing levels of pollution, decline in the moisture content and others. Considering the consequences and the potential of wetlands, there is need for governments, individuals and other stakeholders to ensure sustainable exploitation and conservation of wetlands through policy regulations, institutional structures, sensitization and a host of other activities.

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