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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

Increase concentration of human investment in wetlands has enhanced the vulnerability of wetland inhabitants to flood hazards and diseases such as malaria, cholera and typhoid. This study examines the impact of diseases and health on the population living within wetlands in the Bamenda urban area. Data was generated from primary and secondary sources and the health conditions of a sampled population over the past decade were analyzed through descriptive and inferential statistical techniques. Results indicate that the wetlands in Bamenda are fast degrading caused by population pressure leading to reclamation, pollution, and urban agriculture. This is typical of the Bamenda food market and the valley occupied by the Amour Mezam bus station where floods, pollution and high population concentration have exacerbated the proliferation of disease vectors. The study strongly recommends that the conservation of the wetlands must involve the collaboration of the state, 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 accorded much relevance especially as their resources still offer livelihood choices to local populations.

Key Words: Diseases, Health, wetlands, population and 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 (Mitsch & Gosselink, 2007). 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 (Richardson, 2001). 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 (Richardson, 2001).

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 (Liegh *et al.,* 1983). According to (Dugan, 1993) 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 (2008) 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 (2011), 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.

Population encroachment into wetlands has created diverse problems which impact on the hydrology, biodiversity as well as human life. Given that the scale of these problems are

expanding within the Bamenda urban space, a study of this nature thus becomes necessary with the main focus to expose the livelihood threats attached to wetland degradation in the area. The study of wetlands has become a major concern to International Organizations, Governments, NGOs and Private individuals. This study therefore examines the relationship between wetland occurrence and the spread of disease in the Bamenda urban area.

MAIN ISSUES

Bamenda urban area has an undulating topography which ranges from 1200m to 1800m above sea level (Neba, 1999) and is punctuated in some areas by plains and low lands where wetlands dominate. Over 75% of the Bamenda urban area has a gentle relief which necessitates the occurrence of wetlands. The plain is 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 poor management of these naturally occurring wetland areas which today are linked with high disease incidence amongst its occupants.

Majority of 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 and when used to irrigate crops such as vegetable, maize, beans and other crops especially during the dry season, they are contaminated with the toxic chemicals emanating from the waste. Furthermore, flood plains and marshlands are used as sites for the construction of pit toilets. Populations living along river banks construct their drains from homes directly into streams leading to high contamination of water. There seem to be absence of synergy between the Ministry of Environment and Nature Protection, the municipality and the population, on the occupation and management of such vulnerable environments. During the rainy season, there is proliferation of many diseases which affect humans and other forms of life.

Due to rapid population growth, encroachment into wetlands has enhanced flood risks and diseases through illegal constructions of embankments to channel run-off. However, the observed level of illiteracy and poverty has made such coping strategies less resilient 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. 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, invasions of other species as well as pests and diseases.

STUDY AREA AND METHODOLOGY

The Study Area

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 (Acho-Chi, 1998). 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 administrative headquarters of the North West Region of Cameroon. Figure1illustrates the study area in Mezam Division of the Northwest Region.

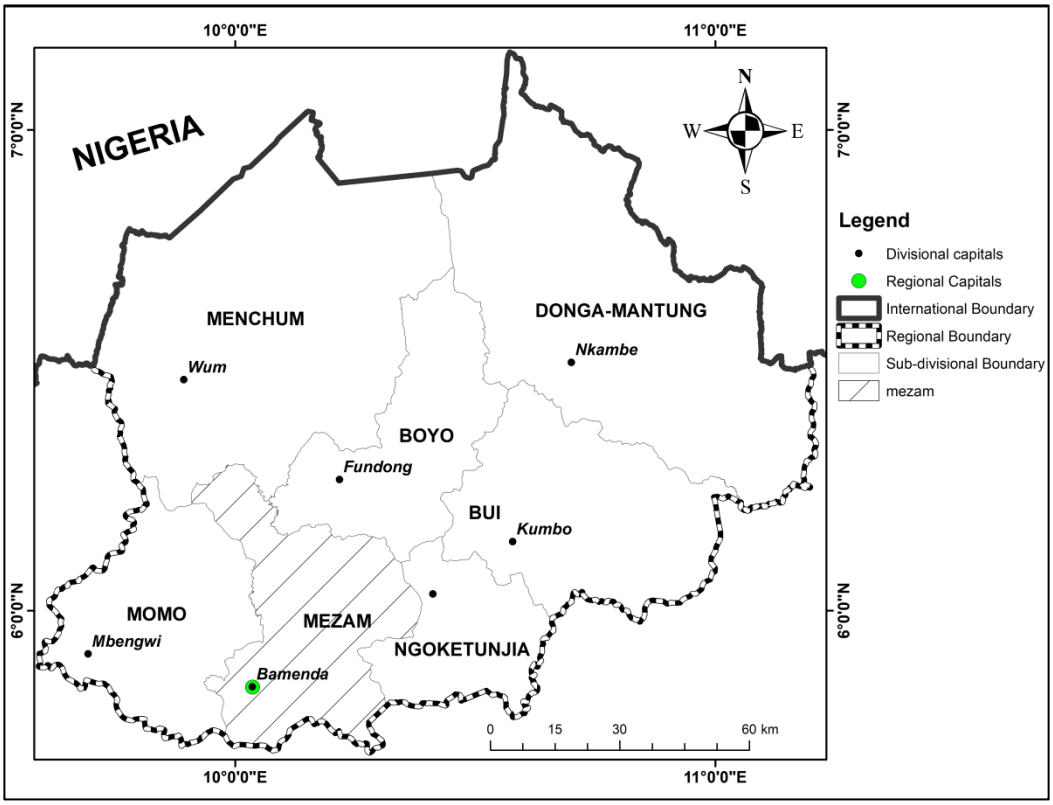

Figure1. Location of Bamenda in Mezam Division of the Northwest Region of Cameroon

Methodology

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 answers concerning wetland activities and situations and focused on house owners and disease prevalence. Interviews were granted to people involved in urban agriculture and other urban dwellers who exploit these wetlands in order to get information on the type of diseases affecting the population living within these environments.

Through field observation, the researchers were able to observe the activities of those inhabiting wetland environments which comprised of 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. 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. The data was analyzed using the qualitative (descriptive) technique. Descriptive analyses comprised the use of tables, pie charts and histograms.

RESULTS AND DISCUSSION

Socio demographic characteristics of respondents

About 75% of the respondents 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. Result on 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 wetlands resulting to it's over exploitation. It is also noticed that the males often engage more in activities such as drilling of wells, construction of houses than the females.

Table 1. Level of education of respondents

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	100.0

Wetland population living within Bamenda urban area has varied educational attainments. The highest proportion of the population (33%) are Ordinary Level holders, followed by those with Advanced Level (26%), the Tertiary sector (16%), Primary education (13%) and the least are those with no formal education (12%) as shown in Table 1. Given that majority of the population are literate (from ordinary level and above), it implies that, the population are aware of the fragility of wetlands when poorly managed such as, pollution and flood risk.

Nature and location of 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 illustrates that wetlands are spatially located and predominate in the north and northwest section of Bamenda, in neighborhoods such as Mulang, Ntenifor in Ntashen and Sisia. Generally, these wetlands are within the flood plains of stream 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.

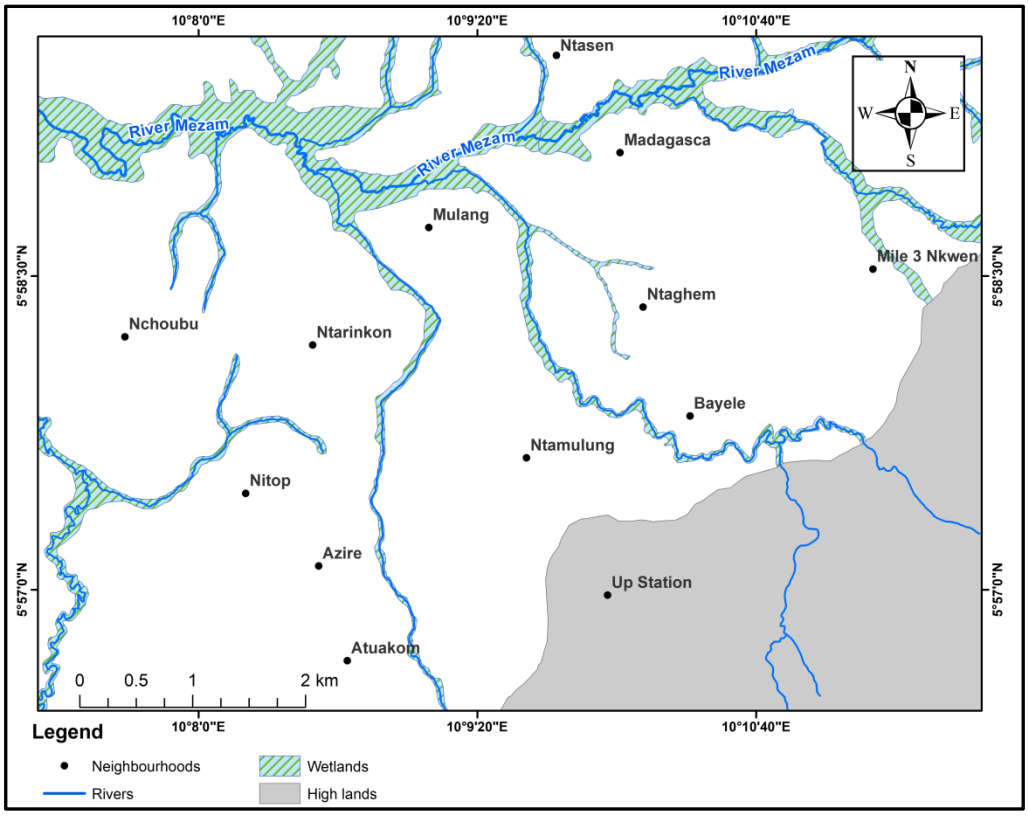

Figure 2: Spatial nature of wetlands in the Bamenda urbanscape

Threats to Wetlands in Bamenda Urban Area.

The study 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 these wetland environments. These threats arise from activities like building, farming and land reclamation.

Use of chemicals, building and construction constitutes the highest threats to wetlands representing 48.94%, followed by agriculture and reclamation with 22% each. The least threat comes from activities like fishing, hunting and harvesting with 04%.

High use of chemicals in farming and pollutants from the increasing household implies that, there is an increase in urbanization which has resulted to an increase in 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 their exploitation since they are used as dump sites. Also the construction of toilets and piggeries in neighborhood such as Mulang, Mile 3, 4, and Sisia has contributed a lot in polluting wetlands. Figure 3 illustrate a wetland used as a dump site at the Sisia neighborhood.

Figure 3: A wetland used as a dump site at Sisia neighborhood.
Source: Field Work March 2015

Urban agriculture and Reclamation are the second major threats to wetlands in Bamenda. The compelling increase in population has diminished the quantity of land 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 like bussh rabbits and bush rats the used to inhabit these areas

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 dwellers that, land value has increased for the more suitable land parcels in the town, pushing them to acquire lands within wetlands which are cheaper. More observed reclamation measures included; the deposition of laterites and subsequent compaction, the construction of drains to channel water from wetlands into 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 vegetables, to have space for commercial activities (Bamenda food market), and to render 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 and water content of wetlands, and altered the wetland ecosystems especially where most indigenous species are threatened.

Table 2: Respondent views on Threats to Wetlands

Threats	Frequency	Percentage
Agriculture	22	32.40
Use of Chemicals pollutant	46	48.94
Reclamation	33	23.40
Others	04	04.26
Total	94	100.0

Human Constraints within Wetland Areas.

The research also intended to investigate some of the problems the wetland inhabitants are exposed to. Based on Figure 4, 55.32% of respondents were of the view that the greatest threat to human life within this environment breeding mosquitoes and host dangerous animals like snakes. These threats were followed by floods with 20.21%, hindrances to development representing 13.83%. 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 reproduce their young ones. . As a result of this, individual living within these zones comes in to contact with the mosquitoes bites and become infected with malaria fever which affect their human health and also making condition unfavorable for them.

Floods were the second wetland risk and common in the rainy season due to excess rain. Floods are common in areas like Below Foncha. A respondent in Mulang, reported on March 15th 2018 that in August 2014, a flood disaster made homeless five families and damaged other properties and farm lands. Figure 4 further illustrates the vulnerability of wetland inhabitants to flood disasters.

Figure 4: An inundated home by flood water in Mulang, in August 2014
Source; Yolar, August 2015.

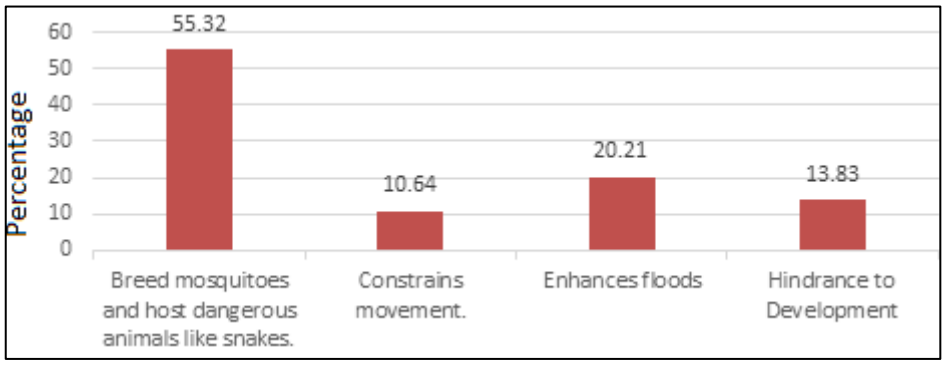

Figure 5: Human constraint within wetland Area.

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. Swamps and thick bushes host snakes. These snakes are a major problem to the population, especially the farmers who exploit wetlands on daily basis. A majority of them have suffered from snake bites and fright. Information from the Mulang District hospital 2015 says an average of 4 farmers were reported of snake bites monthly during the year 2014

The study also aimed at investigating diseases most common within wetlands in Bamenda urban area. The results are as shown on figure 6. Malaria is the highest disease affecting 65% of wetland population, followed by cholera with 16%, typhoid 14.5% and the least being

diseases like rashes and fungi with 5%. Respondent's views of wetland diseases indicate that diseases have a lot of negative impact on the population living within these areas.

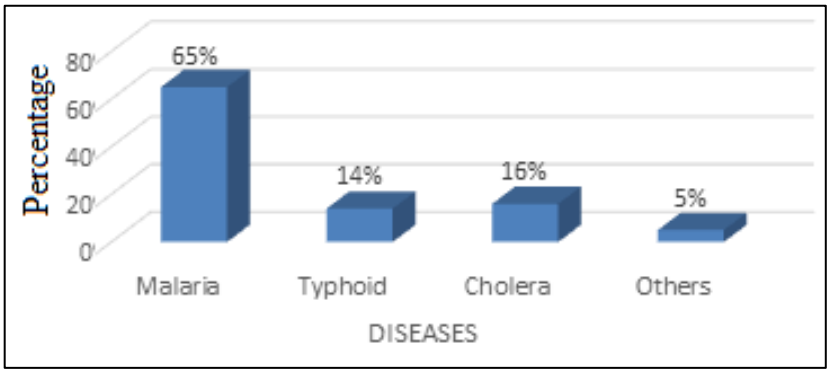

Figure 6: Respondents view on most prevalent diseases within wetland areas.

Seasonal variation of diseases in wetlands

Field survey reveals that disease occurrence within wetlands of Bamenda depends on seasons as shown in figure 7. 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 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 constitute breeding grounds for mosquitoes. Flood occurrence also lead to the contamination of water sources and reduce its quality, which further exposes the population to diseases like cholera. According to data from the **Mulang Integrated Health Center Bamenda (2015)** 2, 1, 3 cases of cholera was recorded in 2013, 2014 and January to June 2015 respectively

Table 3: Diseases common within wetland areas

Period	Consultations	No of patients tested for typhoid	No of patients positive for typhoid	No of patients tested for malaria	No of patients positive for malaria	Cholera cases.
2013	30,004	1483	270	1670	431	2
2014	3670	1083	448	1086	281	1
January –June 2015	1742	306	154	565	161	3

Source: Mulang Integrated Health Center Bamenda (2015)

Also waste from homes, markets and other surroundings dumped in these areas are transported by rain water and deposited in the low lying areas like Mulang, Sisia, Mile 3 and 4 which are hazardous to human health. It was reported by the farmers that the deposited waste contain chemicals and toxins like carbon dioxide, arsenic and cadmium 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.

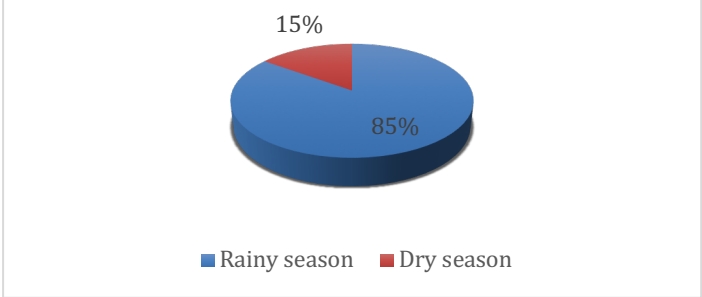

Figure 7: Respondents views on seasonal occurrence of diseases

Awareness and Conservation of Wetlands

The study also investigates the inhabitant's awareness of wetland conservation strategies. The responses shown in figure 8 indicate that 79.80% are ignorant of these wetland conservation strategies while only about 20.20% are 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 wetland dwellers had not attained a good level of education. Many occupy wetlands but they do not know what wetlands are all about.

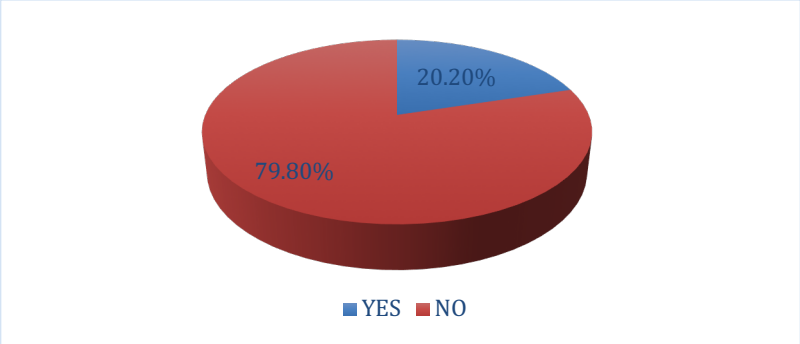

Figure 8: Level of Awareness of Wetland Conservation

The research also found out from the inhabitants if there were aware of strategies to conserve this wetland. From the observation and as shown in Table 3, laws governing wetlands in Bamenda have been put in place by the Ministry of Environment and Nature Protection but these laws are inapplicable as reported by the wetland dwellers. Also very limited efforts are undertaken by development actors to sensitize the population living in wetlands. The inhabitants are not aware of wetland threats as greater numbers continue to inhabit these areas.

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.

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 represented by 42%, followed by the implementation of laws governing wetland exploitation (32%), other methods such as avoiding wetland areas completely (13%) and to stop cultivation on wetland (12%). This implies that the main and the most important way of conserving wetlands is by educating the people. A close way to conservation is by implementing laws governing wetlands. From this, it is also clear that most urban dwellers exploit wetlands indiscriminately because the laws governing their exploitation are inapplicable so they feel wetlands are of limited importance due to little attention from the Local Government.

From the respondents views, avoiding wetlands completely will not be the best option or strategy to wetland conservation because most of the population depend them for their livelihood and sustenance. Sustainable agriculture and environmental awareness amongst other practices will help the wetlands maintain its existence and perform its role on the environment. The results shows that the highest proportion of respondents view wetlands as owned Government land (50%), followed by private individuals (24%) and the community (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 proffers some recommendations to the government, the local authorities and to the wetlands inhabitants which when implemented can lead to a better conservation of wetland in Bamenda.

To the Government

Conservation cannot be achieved 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. 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 sanctions imposed on defaulters. Constant demolition and resettlement exercises can help protect the environment and upgrade the lives and properties of those who are liable to floods and other hazards in the wetlands.

To the Local Administrations

The council should enforce the sensitization of the population on the importance of proper waste disposal. Wetlands should be developed as touristic and green sites and protected in ventures that can raise income to the council. There should be synergy between the local panning institutions, the government and population in the management and conservation of wetlands.

To Wetlands Dwellers

In order to achieve a balance between wetland conservation and meeting the needs of people, and to ensure its continuous 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 plant species must ensure sustainability. This will help ensure sustainability. Urban dwellers should take the responsibility to avoid developing permanent structures within the wetland areas as well as upgrade their knowledge on the most appropriate conservation practices in such areas.

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 changed 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 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 widespread consequences ranging from the increasing vulnerability of human life and property to flood hazards and diseases, collapse of wetland ecosystems, extinction of species, increasing levels of pollution, and decline in the

moisture content among others. Considering the consequences and the potential of wetlands, there is need for governments, individuals and other stakeholders to ensure their sustainable exploitation and conservation through policy regulations, institutional structures and sensitization

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