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Review Article

Indiscriminate Waste Disposal and Health Hazards in Mamfe, Cameroon

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Abstract: Indiscriminate waste disposal constitute a major deficiency to most Cameroonian cities nowadays. Unorthodox dumping of waste in Mamfe has triggered urban disorder and nuisance in the town. It is in furtherance to this that, this article seeks to address the health hazards accrued from poor waste management in Mamfe. The article advances that the inadequacy of waste disposal equipment coupled with no sustainable policy of management and mentality of the city dwellers have incited the incidence of diseases. Some 150 questionnaires were administered to households in the Mamfe neighbourhood to determine the impact of poor waste disposal to the town. The Spear Rho Rank Order Correlation was used to test the effect of solid waste on the sanitary health of the Mamfe community. Further field survey through observation was done to capture images of poor waste disposal. These varied methods were used to generate data for results and analyses. Results from findings adhere to the fact that the Mamfe community generates 70.59% of biodegradable waste, 25.32% of non-biodegradable and 4.09% of inert materials. A correlation index analysis of the effect of solid waste on sanitary health of the community stood at R = 0.9976 indicating a very strong relationship between waste and sanitary diseases in Mamfe. The poor implementation of waste disposal policies has led to unstable and excessive dumping of waste in the town. Much waste was generated in less privileged neighbourhoods than the privileged ones due to settlement in the unplanned areas of Lala, Banya, Satum and Egbekaw in the expansion process of the town. This paper advocates that, community based organs and NGOs be used to establish a waste management system in Mamfe. Waste education through El-Hager's 4Rs concept of reduce, reuse, recycle and recovery be put in place to render the Mamfe town sustainable for living.

Keywords: Waste Disposal, Health Hazards, Management Policy, Community Based Organs, 4Rs Concept, Mamfe

1. Introduction

Poor waste disposal is one of the major difficulties faced by emerging Sub-Saharan African towns. This is because it does not only pollute the environment and reduces the beauty of the areas, but as well provokes health hazards that affect its inhabitants. Wastes are substances or objects, which are disposed of or are required to be disposed of by the prevision of national law [1]. All forms of human activities result in the generation of waste which can cause changes in the environment and harm to animals, plants and ecosystems. The problem of solid waste in most urban and rural communities in developing countries and Cameroon in particular is

manifested in air pollution as a result of the burning of wastes, water pollution due to the dumping of solid waste in waterways and soil contamination. The wastes constitute a nuisance to the environment and the health of its occupants [2].

Municipal solid waste in Mamfe that emanates from households has become a course for concern due to rapid urbanization in the area. Following the rehabilitation of the Bamenda-Ekok via Mamfe Trans-African road, the economy of Mamfe is expected to grow drastically. The influx of many people into Mamfe will continue to swell and increase the problems of poor health from pollution and land degradation. The problem of urban health planning in Mamfe is the

increase of different types of wastes from poor waste management system of the town. Inadequate infrastructure, limited resources and limited technical and qualified labour increases the management problems of the town. However, with the dumping of waste illegally in open spaces, streams, storm-drainage channels, burnt and or deposited along streets or roadsides, health problems have emerged in Mamfe. This article seeks to address the health hazards accrued from poor waste management in Mamfe. The article advances that the

inadequacy of waste disposal equipment coupled with no sustainable policy of management and mentality of the city dwellers have incited the incidence of diseases.

Mamfe is located between latitude $9^0\,17^{'}$ to $11^0\,14^{'}$ East and longitude $5^0\,46^{'}$ to $7^0\,8^{'}$ North of the globe. With a population of 19.472 inhabitants [3], Mamfe has an equatorial climate with its highest temperature being 33°C and lowest 21°C and an annual rainfall of 2250 mm (Figure 1).
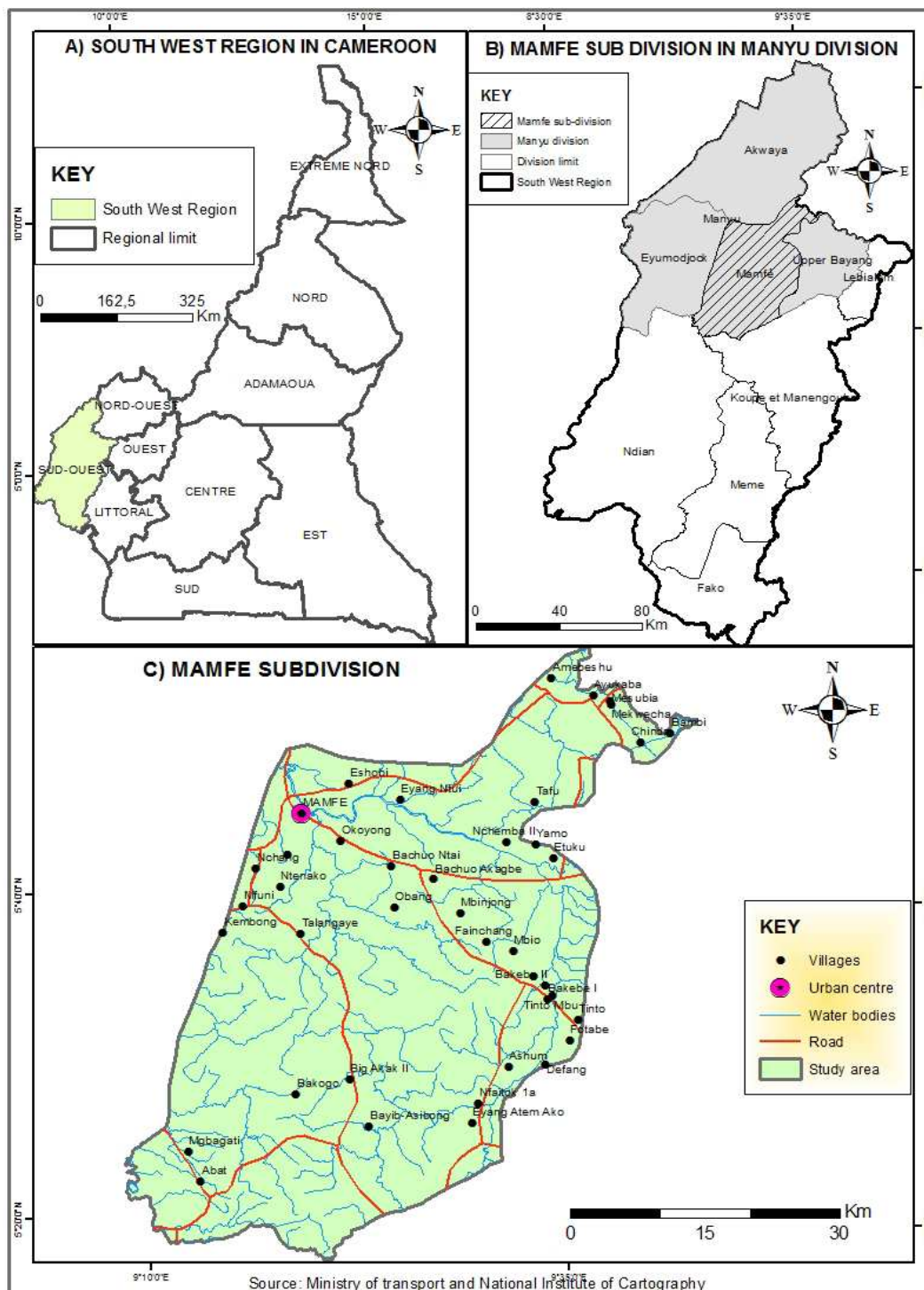
Source: Modified from INS by Ashu-Agboko, 2019

Figure 1. *Location of the study area.*

2. Literature Review

The consequence of indiscriminate waste disposal is the proliferation of health hazards which might end up in deaths if not checked. In order to avoid curative checks which only come after the calamities have occurred, preventive checks are imperative [4]. The work posits how sensitisation campaigns on a malaria-free Kumbo environment worked enormously to reduce the disease attacks on the population. This falls in line with that of [5], on education which facilitates the understanding of health issues and how to pave the way forward in Africa. Sensitisation and education therefore would introduce much prevention to health problems from waste disposal. Furthermore, health hazards that come from indiscriminate waste disposal most often have been attached not only to the mentality and awareness issue in Sub-Saharan countries, but as well on poverty and misery [6]. The inability to improve on the living standards due to inadequate financial support breeds development of anarchical settlements which have little or no health as well as waste collection and disposal facilities. Such characteristics are observed in Mamfe and have thus triggered the health problems identified from waste disposal. Most of the threats that occur from waste disposals are both on the immediate population and on the environment [7]. The health of the environment is affected because of poor urban planning [2] from persistent increase in population and unplanned settlement. The Mamfe town is therefore victim of both poor planning and indiscriminate waste disposal which has exposed the inhabitants and environment to risks of disease attacks and degradation. Raising awareness coupled with legal measures and sanctions is of uttermost importance [1] as salvage means to irresponsible waste disposal habits that can cause health hazards will be addressed.

3. Methodology of the Study

Data collection was done through simple random sampling where some 150 questionnaires were administered to household in Mamfe. With the total households of 2.995 persons [3], a 5% sample [8] was used to determine the number of questionnaires to be administered (5% of 2.995, hence 149.75). The questionnaires were used to measure household existing solid waste practices as well as individual knowledge, attitudes, concerns, willingness to participate in general issues on solid waste. Furthermore, interview sessions were organised with some household heads, private operators, council personnel and scavengers to confirm the results gotten from the questionnaires distribution and have first-hand information on the poor waste disposal situation in Mamfe. Added to this, an in-depth field observation was done to capture images of poor waste disposal for use in the results and analyses.

The Spear Rho Rank Order Correlation [9], was used to determine the relationship between municipal solid waste and sanitary diseases or health in Mamfe town. This is used when two variables are involved with data at ordinal level (that is the data in grouped forms). The objective is to show relationship between the variables X and Y that serves as a determinate to the attachment of health hazards to indiscriminate waste disposal. It is calculated as such:

$$R = \frac{1 - 6\Sigma D^2}{N(N^2 - 1)}$$

Where;
N= No. of Cases
D^2 = (Rank X – Rank Y)^2

According to this correlation, a positive value index is considered very strong relationship, while a negative one will have a poor or no relationship [9]. The data was subjected to descriptive and inferential treatment to generate tables, maps with the Arc GIS software and other figures for analyses.

4. Results, Analyses and Discussion

Results from findings propound that the rapid increase in volume and indiscriminate disposal of waste in Mamfe have instigated the incidence of health hazards in the town.

4.1. The Volume of Waste in Mamfe and Its Impact on the Health Hazard

Waste generation and production in Mamfe is continuously increasing as the population grows as well. This work found out that both biodegradable and non-biodegradable wastes are produced in Mamfe. Biodegradable waste are those that originate from plant and animal sources and can be easily broken-down, while non-biodegradable ones are those that cannot be broken down by other living organisms [10]. Added to this are inert materials which come from dust and air wax in the atmosphere. These categories of wastes are found in and along the streets of Mamfe. The frequency of solid waste production is high indicating a rise in the volume produced (Table 1).

Table 1. The quantity of Municipal waste in Mamfe per week.

Biodegradable	%	Non-Biodegradable	%	Inert Materials	%	Total
Kitchen waste	27.54	Plastic waste	16.24	Others	4.09	
Fruit waste	18.38	Glass waste	5.48			
Food stuff waste	12.05	Metal waste	3.60			
Paper waste	11.02					
Plants waste	1.01					
Textile	0.59					
Total	70.59		25.32		4.09	100

Source: Field Work, 2019

The quantity of metal waste produced in Mamfe per week in table 1 stand at 70.59% for biodegradable, 25.32% for non-biodegradable and 4.09% for inert materials. Biodegradable waste is commonly found in garbage heaps in Mamfe and household bins sometimes called Biodegradable Municipal Waste (BMW) as green waste, food waste, paper waste and biodegradable plastics. Other biodegradable waste includes human waste, manure, sewage, sewage sludge and slaughtering house waste. In the absence of Oxygen, much of this waste will decay to methane by anaerobic digestion. The dominant biodegradable waste in Mamfe emanates from the kitchen waste of 27.54% with the textile waste being the least at 0.59%. The waste is dumped or disposed of by the inhabitants of the town in dump heaps or landfills.

Furthermore, non-biodegradable waste such as plastic waste, glass and metal (iron from cars, dismantling of damaged or bad objects) are found along the streets in Mamfe. The dominant waste type is plastic with 16.24% with metal being the least at 3.60%. The town is also made up of inert materials of dust and air wax in the atmosphere which constitute the remaining 4.09% of waste type identified. These biodegradable and non-biodegradable wastes in Mamfe are deposited without control in the town, provoking health problems to its inhabitants.

4.2. Indiscriminate Waste Disposal in Mamfe and Its Consequence

Indiscriminate waste disposal in Mamfe is either done through landfill, incineration or combustion and waste composting. Landfill waste disposal is the burying of waste in land to eliminate odours and dangers [11]. This form of disposal is practiced in Mamfe as the most popular one due to available unoccupied space in the city. With the increasing nature of the population, space colonisation is progressing and available space for landfill is reduced. Added to this, landfill has negative effects such as the presence of methane and other gases which are detrimental to the health of the people. This practice is thus gradually diminishing in the town.

Incineration or combustion on its part is a type of disposal method in which municipal solid wastes are burned at high temperatures so as to convert them into residue and gaseous products [12]. This method reduces the volume of solid waste to about 20 or 30% of the original, decreases the space they take up and reduce the stress on landfill. It is also known as thermal treatment where solid waste materials are converted by Incinerators into heat, gas, steam and ash. Incineration is practiced in Mamfe in the process of waste disposal and the resulting effect is detrimental to the environment and the people (Figure 2).

Photo Ashu-Agboko, 2019

Figure 2. Waste Disposal in Mamfe.

Figure 2 shows the disposal of waste in Mamfe through landfill in the Satum neighbourhood in A, and incineration in Egbekaw in B. The waste in Satum is burnt in the dry season to reduce the volume.

Aside landfill and incineration, waste disposal in Mamfe takes place through composting. Composting is an easy and natural bio-degradation process that takes organic wastes such as remains of plants and garden and kitchen waste and transform into nutrient rich food for plants [13]. Composting, normally used for organic farming occurs by allowing organic materials to sit in one place for months until its being decomposed by microbes. It is one of the best methods of waste disposal as it can turn unsafe organic products into safe compost. In some neighbourhoods of Mamfe, composting is practiced to reduce the volume of waste that emanates from the households. The volume of waste produced in Mamfe and the indiscriminate disposal of such waste have triggered health hazards in the town.

5. Waste Disposal and Health Hazards in Mamfe

Indiscriminate waste disposal in Mamfe affects both the inhabitants and the environment of the town.

5.1. Effects of Indiscriminate Waste Disposal to the Inhabitants of Mamfe

Results from findings of this paper concluded that there is a strong relationship between poor waste disposal and the health of the inhabitants in Mamfe. Using the Spear Rho Rank Order Correlation, data collected was tested to produce the following results (Table 2).

Table 2. *Poor waste disposal and consequences to the People of Mamfe.*

Class of respondent	Frequency	Rank X- Yes	Rank Y-No	D (X-Y)	D² (X-Y)2	Diseases
Scavengers	5	5	-	5	25	Typhoid, Malaria
Council workers	5	5	-	5	25	Malaria, Diarrhoea
Business persons	30	23	7	16	49	Typhoid, Malaria
Households	50	41	9	32	1024	Malaria, Worms
Bike riders	20	14	7	7	49	Malaria, Diarrhoea
Mechanics	20	16	4	12	144	Malaria, Skin rashes
Students	20	12	8	4	16	Intestinal worms
Total ($\sum$)	150	116	34	81	1332	

Fieldwork, 2019

With the Spear Rho Rank Order Correlation, the index of assessment was calculated as follows:

N= 150

$$D^2 = 13332 R = \frac{1-6(1332)}{150(22500-1)}$$

$$R = 1 - 7992 R = \frac{1-7992}{150(22499) \text{ or } 150(22500-1)}$$

$$R = \frac{1-7992}{3374850}$$

$$R = 1 - 0.0024$$

Therefore, R = 0.9976

The results of 0.9976 indicate that there is a very strong relationship between waste disposal and health hazards in Mamfe. Owing to the fact that a positive index connotes a strong relationship and a negative one a poor relationship, this work found out that the habit of disposing waste anyhow in Mamfe has increased the incidence of diseases in the town. Mamfe is not the only town, as several others experience such problems due to the poor habit of waste disposal in the city. This is the case of Obala, a satellite town to Yaounde which experienced cholera attacks in 2008 due to water contamination from poor waste disposal and drainage [14]. Therefore indiscriminate waste disposal is tantamount to health hazards if checks are not meted.

The health hazards that are frequent in Mamfe from poor waste disposal are malaria, diarrhoea, intestinal worms and bilharzia. Results from field work revealed that malaria is the most frequent disease in the area (Table 3).

Table 3. *Frequency of diseases observed in Mamfe from poor waste disposal.*

Types of Diseases	Frequency	Percentage
Malaria	72	48
Diarrhea	51	34
Bilharzia	5	3.33
Intestinal worms	22	14.67
Total	150	100

Fieldwork, 2019

Some 48% of the sample households in Mamfe have suffered from malaria. This figure was confirmed by the results of the Mamfe District Hospital which declared that more than 75% of their patients are being diagnosed of the ailment. Poor waste disposal which accumulates in stagnant water and even in dump sites serve as reception breed spots to mosquitoes. This of course has an effect on the inhabitants of Mamfe as a majority of those ill suffer from malaria.

Field results from both the sampled households and the Mamfe District Hospital as well confirmed that 34% of the inhabitants in this town suffer from diarrhea. Diarrhea is caused by a variety of micro-organisms including viruses, bacteria and protozoans [15]. Diarrhea causes a person to lose both water and electrolytes, which leads to dehydration and, in some cases to death. It is the most important public health problem directly related to water and sanitation. The population of Mamfe is exposed to the disease through water contamination from poor waste disposal. It is therefore incumbent for the municipality to sensitize the population on their waste disposal habits and also improve on collection and treatment strategy to curb the situation. The simple act of washing hands with soap and water can reduce diarrhea disease by one-third and providing adequate sanitation facilities is the key to preventing waterborne diseases.

Some 14.67% of sampled households in Mamfe have suffered from intestinal worms from contaminated soil and food. People become infected with intestinal parasitic worms or helminthic through contact with soil that has been contaminated with human faeces from an infected person, or by eating contaminated food [16]. Children are particularly susceptible and typically have the largest number of worms as confirmed by medical reports in Mamfe which can lead to malnutrition, anaemia or retarded growth. It is thus necessary for the inhabitants and authorities of the Mamfe town to develop environmentally friendly activities that will reduce poor waste disposal.

Some traces of bilharzia were identified in Mamfe as well in the course of field work. Bilharzia is a disease caused by parasitic worms [17]. Some 3.33% of the sampled population affirmed that they had suffered from Bilharzia in Mamfe. At various stages of the life cycle, worms and their eggs live in certain types of freshwater, water (where they can survive for 48 hours) and human hosts. The worms penetrate the skin of

people swimming, bathing or washing in contaminated water such as the Baku stream, the Badi River and the Cross Manyu River especially in the dry seasons when their flow is much reduced or almost stagnant. This can cause infection and eventually damage the liver, intestines, lungs and bladder of the affected persons. Nevertheless, just a hand few of cases were discovered in the course of field work and from the hospital. The population of Mamfe will be free from such diseases if poor waste disposal is remedied. Aside the population, poor waste disposal also affects the Mamfe environment.

5.2. Effects of Indiscriminate Waste Disposal to the Environment of Mamfe

The Mamfe environment is being affected by indiscriminate waste disposal. The impact of this disposal is felt directly on the immediate surface as well as to stream water flows in the town. The decomposition of waste into constituent chemicals is a common source of local environmental pollution. Rapid urbanization and poor waste behaviours from the Mamfe dwellers has degenerated into aesthetical degradation of the environment. Waste dumps are created in the heart of the city at residential sites and burnt by inhabitants after gross accumulation without disposal. Furthermore, improper handling of waste propounds potential risks to the environment and the health of the population. The solid waste in water courses result to toxic that is very poisonous to aquatic life, act as a breeding ground for mosquitoes and other related water borne diseases such as diarrhea and cholera. The main risks to health are indirect and arise from the breeding of disease vectors, primarily flies and rats (Figure 3).

Photo Ashu-Agboko, 2019

Figure 3. Poor waste disposal and environmental effects in Mamfe.

Figure 3 exhibits environmental degradation after poor waste disposal and burning at the Mamfe main market neighbourhood in C and uncontrolled hazardous waste household and municipal waste at the Banya stream course in D. It is worth nothing that poor waste disposal in Mamfe has been one of the major causes of disease attacks in the area. The mentality of the population coupled with the rising urbanization of Mamfe has provoked this increase. There is therefore need for an assessment, monitoring and remedy that will reduce health hazards and improve on the wellbeing of the population [18].

Results from findings further revealed that indiscriminate waste disposal has a negative impact on the environment. It does not only block streams from flowing easily, but as well influence the proliferation of rats, mosquitoes and cockroaches which affect the people of the town. Furthermore, the persistent dumping of waste all over the town with no management system leaves the area with stinking odours which are not suitable for human settlement. However, poor waste disposal in Mamfe has provoked soil and air pollution which affects the health of the people in the town. Soil pollution is the presence of toxic chemicals as pollutants or contaminants in soil in high concentrations to be of risk to human health and ecosystem [19]. In addition, even when the levels of contaminants in soil are not of risk, soil pollution may occur simply due to the fact that the levels of the contaminants in soil exceed the levels that are naturally present. Soil pollutants include a variety of contaminants or chemicals (organic and inorganic), which could be both naturally-occurring in soil and man-made. The Mamfe environment therefore experiences much pollution from man-made sources which have affected the people. It is therefore important to raise awareness through this paper in order to salvage the situation.

6. Conclusion

Indiscriminate solid or liquid waste disposal is tantamount to health hazards in the immediate and even extended community [20]. It is therefore binding for the people of Mamfe to be watchful against indiscriminate waste disposal in order to avoid health perils. This paper which sought to find out the consequences of indiscriminate waste disposal and health hazards in Mamfe discovered that the habit of disposing waste anyhow in Mamfe has increased the incidence of diseases in the town. This relationship was examined through a correlation index analysis of the effect of solid waste on sanitary health of the Mamfe community. With an index of R = 0.9976, the paper concluded that a very strong relationship exists between waste and sanitary diseases in Mamfe. This was confirmed by the several ailments such as malaria, diarrhoea, intestinal worms and bilharzia which affected the people of Mamfe. It was observed that the poor implementation of waste disposal policies led to unstable and

excessive dumping of waste in the town. Much waste was generated in less privileged neighbourhoods than the privileged ones due to settlement in the unplanned areas of Lala, Banya, Satum and Egbekaw in the expansion process of Mamfe. This unfortunate situation did not only cause damage to the health of the people, but to the Mamfe environment as well. Waste disposal was observed to have an impact on the immediate surface as well as to stream water flows in Mamfe. Findings from this paper noticed that the decomposition of waste into constituent chemicals was a common source of local environmental pollution. Rapid urbanization and poor waste behaviours from the Mamfe dwellers degenerated into aesthetical degradation of the environment. This of course caused the creation of waste dumps in the heart of the city at residential sites. The resulting effect was therefore environmental degradation and pollution.

7. Recommendation

Faced with these undesirable impacts of poor waste disposal in Mamfe, this paper therefore recommends that a community based management organ to collect and dispose waste in Mamfe is mandatory. In this way, waste will be collected regularly and disorganised dumping avoided hence, a health friendly environment. Added to this, the introduced clean-up campaigns organised in Mamfe town which helped in keeping the environment clean be respected to the later with sanctions meted on defaulters. As such, the population will cultivate proper waste disposal habits and learn to keep the environment clean. Above all, the El Hager's 4Rs concept of reduce, reuse, recycle and recovery is suggested in this community. Through it, the people of Mamfe will be educated on the necessity to reduce the quantity of waste dumped in the environment. The unavoidable ones should be reused through sorting and recycling such as aluminum into iron rods. Besides, the waste could further be recovered through the creation of Biogas plant which has been announced in Mamfe town in the nearest future. These recommendations and more if implemented will rescue the Mamfe community and environment from health hazards of poor waste disposal.

References

[1] Achankeng, E. (2003). Globalization, Urbanization and Municipal Solid Waste Management in Africa. Agency, Bristol. 425p.

[2] Olu Sule, R. (2007). Urban Planning and Environmental Health Criticality. Thumbprints, London. 412p.

[3] BUCREP. (2005). Third population and housing census results of Cameroon, 647p.

[4] Ndi, H. N and Tungla, G. V. (2011). The Prospects for Mutual Health Organisations in the North West Region of Cameroon: The case of the Kumbo Mutual Health Organisation. African Journal of Social Sciences, Vol 2 (3): 19-34.

[5] Nguendo Yongsi, H. B. (2010). Education and religious beliefs: supportive determinants in the understanding of health issues in Sub-Saharan Africa, studies on Ethno-Medicine, 4 (2): 81-94.

[6] World Health Organisation. (2014). Health in 2015: From MDGs to SDGs. Geneva, 204p.

[7] Meade, M and Earicksn, R. J. (2005). Medical Geography, 2nd Edition, New York: Gulford Press, 312 p.

[8] Oloyo, R. (2001). Fundamentals of Research and Methodology for Social and Applied Sciences ROA Educational Press, Aloro Nigeria. 305p.

[9] Takor-Ojong. (2012). Community-Based Organizations: Types, Potentials, and Constraints in the Northern Part of the Korup National Park. 137p.

[10] El-Hagar, S. M. (2007). Sustainable industrial design and waste management: Cradle-to-cradle for sustainable Development, Oxford: Elsevier/Academic Press. 424p.

[11] Dongquing, Z., Tan, S., Gersberg, R. (2010). A comparison of municipal solid waste management in Berlin and Singapore. Integrated Waste Management, 130p.

[12] Parrot, L., Sotamenou, J., Kamgnia and Dia, B. (2009). Municipal solid waste management in Africa: strategies and livelihoods in Yaoundé, Cameroon, Waste Management, USA. pp: 286-295.

[13] Yetunde, A. (2013). Sustainability of Municipal Solid Waste Management in Nigeria: A Case Study of Lagos. Water and Environmental Studies, Department of Thematic Studies, Linköping University, 124p.

[14] Nga, A. M. (2008). Mise En Evidence Des Facteurs De Distribution Des Maladies Infectieuses A Partir Du Case De L'Épidémie Du Choléra Dans Le District De Sante D'Obala. Pp 130-140.

[15] Bartone, C. (2000). Strategies for Improving Municipal Solid Waste Management: Lessons from World Bank Lending and CWG Activities. Workshop on Planning for Sustainable and Integrated Solid Waste Management, Manila, Urban Management Division, World Bank. 285p.

[16] Gladding, T. L. and Coggins, P. C. (2007). Exposure to microorganisms and health effects of working in UK materials recovery facilities – a preliminary report. Ann Agric Environ Med, 141p.

[17] Williams, P. T. (2005). Waste treatment and disposal. 2nd ed. John Wiley & sons Ltdwest Sussex England. World Bank Infrastructure Notes, Urban No. UE-12.87p.

[18] Twardowska, I. (2004). Solid Waste: Assessment, Monitoring and Remediation. Waste Management Series, Volume 4, 2004. pp 3–32.

[19] Dickerson, G. W. (1999). Solid Waste: Trash to Treasury in an Urban Environment. 174p.

[20] Ndi, H. N and Nguendo Yongsi, H. B. (2018). Introduction to Health Geography. The Book Guild Ltd, Great Britain, 1st Edition, 215p.