UNIVERSITY FOR DEVELOPMENT STUDIES

HEALTH IMPLICATIONS OF INDISCRIMINATE PLASTIC WASTE DISPOSAL: A CASE OF GUMBIHINI –TAMALE METROPOLIS

DISSERTATION SUBMITTED TO THE DEPARTMENT OF COMMUNITY DEVELOPMENT, FACULTY OF PLANNING AND LAND MANAGEMENT, UNIVERSITY FOR DEVELOPMENT STUDIES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF ARTS DEGREE IN ENVIRONMENTAL SECURITY AND LIVELIHOOD CHANGE

TIMOTHY AMANG-BEY AKANPABADAI

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BY:

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OCTOBER, 2012

DECLARATION

CANDIDATE

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere:

Timothy Amang-bey Akanpabadai ---------- **Date** 12-11-12

SUPERVISORS'

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University for Development Studies.

Principal Supervisor's Signature ---------- **Date** 12-11-2012

Benson Konlaan (MPH; PhD)

ABSTRACT

Plastic waste management is a growing environmental and financial problem especially to developing countries like Ghana. In spite of significant efforts by the Tamale Metropolitan Assembly and other partners as Zoomlion to ensure environmental sanity in the metropolis, the environmental situation could still best be described as a menace. This study investigated into the underlying reasons for littering the environment with plastic waste by people and analysed the health implications posed by the indiscriminate littering of the environment with plastic waste in Gumbihini, one of the suburbs of Tamale. Suggestions were made on sustainable ways of dealing with the indiscriminate plastic waste disposal menace.

A survey was conducted among one hundred households in order to generate data to address the research question. The survey data was complimented information gathered from focus group discussions held with some identifiable groups in the community as well as secondary data. High incidence of malaria, cholera, diarrhoea and dysentery in the community were found to have a direct link indiscriminate plastic waste disposal. Choked gutters and unsightly scenes were the most visible effects of poor plastic waste disposal systems in the area. Inadequate numbers of litter bins in the homes and community and endemic poor waste disposal habits were found to contribute to the littering of plastics in the area.

The results also showed that sensitization programmes on the radio and household level education on the dangers of indiscriminate plastic waste disposal could impact positively to help reduce the plastic menace in the community. The provision of adequate litter bins to households and at public places could enhance proper waste disposal in Gumbihini.

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DEDICATION

This work is dedicated to the Almighty God and the Akanbang's Family of Agbong-yeri Balansa, Sandema in the Upper East Region of Ghana.

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LIST OF ACRONYMS

CBD – Central Business District

CO2 – Carbon Dioxide

CWSA – Community Water and Sanitation Agency

ESP – Environmental Sanitation Policy

GNA - Ghana News Agency

GSS – Ghana Statistical Service

HDPE - High Density Polyethylene

LDPE - Density Polyethylene

TAMA – Tamale Metropolitan Assembly

OECD – Organization for Economic Co-operation and Development

PBDEs - Polybrominated diphenylethers

PE - Polyethylene MMDAs - Metropolitan Municipal District Assemble

PP – Polypropylene

PS – Polystyrene

PVC - Polyvinyl Chloride

MTDP – Medium Term Development Plan

SPI- Society of Plastic Industry

TCP – Town and Country Planning

UNCSD – United Nation Commission on Sustainable Development

UNDP – United Nation Development Programme

CHAPTER ONE

INTRODUCTION

1.0 Background

Poor waste management practices, in particular the widespread of dumping waste in water bodies and uncontrolled dumping sites, aggravates the problem of low sanitation levels across the African continent (Mwesigye, et al., 2009). Generally waste management in Ghana is the responsibility of the Ministry of Local Government and Rural Development which supervises the decentralized Metropolitan/Municipal/District Assemblies (MMDAs) (Mwesigye, et al., 2009).

Solid waste management is more a problem in the urban areas in Ghana than the rural areas. The Urban areas produce different kinds of solid waste. The current environmental sanitation status in Ghana leaves much to be desired; less than 40% of urban residents are served by a solid waste collection service as well as less than 30% is served by acceptable household toilet facility. Even those areas where wastes are removed, most are disposed of in unsanitary manner, posing danger to human health and the environment. At the household level, poor hygienic practices by individuals and communities are compounded by insufficient and inefficient hygienic education. Vector-borne diseases such as malaria, bilharzias are rife due to the virtual absence of pest and disease vector control programmes (ESP, 2011).

Municipal solid waste is not only a societal problem with serious human health implications but enormous environmental impacts (Thomas, 2008). There has been steady increase in the use of plastics resulting in a proportionate rise in plastic waste generation over the last decades in the

Municipalities and large cities in Sub Sahara Africa (World Bank, 1999). Plastics are widely used in both food and water packaging because of its inherent properties such as low bulk densities and inertness that make them convenient carriers and low risk contaminant. Plastic bottles and sachets, used to package iced water that is sold to people in transit and in moving vehicles, have become widespread in Ghana (Fobil & Hogarh, 2007).

Towns like Accra, Kumasi, Tamale, and Cape Coast in Ghana are faced with threats of plastic waste as a result of increased sachet water producers, food vendors and activities of the street hawkers. Plastics have slowly perpetuated the ''throw away culture'' in Ghana (Mwesigye, et al., 2009).

Plastic waste currently generated in the country is post consumer waste. They are mainly plastic bottles, Polythene bags, sachets and wrappers. It is estimated that there are over forty plastic producing industries in the country producing over thirty thousand (30,000) metric tons of assorted plastic products per annum (Wienaah, 2007), and about twelve thousand (12,000) metric tons of finished plastic products are imported into the country annually thus compounding the plastic waste menace in Ghana. About 20% to 30% of these end up on the streets. Ghana has few recycling facilities which are located in the southern part of the country. The post consumer plastic waste has therefore become a major issue in Ghana due the inadequacy of recycling facilities (UN, 2010).

The Tamale metropolis does not have plastic recycling industry to recycle its ever increasing amount of plastic waste generated on the daily basis. Only one Non-Governmental Organisation in the Tamale Metropolis is engaged in the production of shopping bags using the light plastic

waste; the aim of which is to reduce the plastic menace. Plastic is routinely commonly gathered and burnt in the communities or are relocated and burnt at dumping sites.

Research has shown that plastics are not easily degradable and a greater quantity of plastic waste in the soil reduces soil fertility. There is widespread of plastic waste littering in the communities within the central business district as well as those communities along the main drainage system. The littering of plastics in the community leaves drains choked and the repercussions of these have damaging effects on human health. Stagnant waters serve as breeding grounds for vectors resulting in the spread of diseases (Alan & Arthur, 1999) and serious environmental problems as a result of improper waste management.

1.1 Problem Statement

Over the past years, plastics have replaced proper leaves, glass, metal and other materials as a cheaper and more effective means of carrying, storing and preserving water, food and other products. Since the 1980s, the use of plastic material has been on the increase. The common examples of these products are ice water rubbers, polythene bags, pure water sachets, etc. From daily tasks to our most unusual needs; plastics have increasingly provided the performance characteristics that fulfil consumer needs for packaging and handling.

The disposal of these plastic waste materials has implications that are both environmental and health related. The indiscriminate disposal or improper management of plastic materials after use pose serious environmental problems as plastic waste is non-biodegradable (Markwei, 2010). The burning of plastic waste can cause cancer and breathing problems. Even though the effect of plastic waste is in the lime light in the print, visual and audiovisual media in Ghana, this has not resulted in a revolution or transformation of waste management practices in the country.

Consequently, very drains continue to be choked with abandoned plastic waste creating conditions that serve as providing breeding grounds for vectors like mosquitoes, bugs, among others that facilitate the spread of diseases in urban and rural areas.

Livestock also suffer from the indiscriminate disposal of plastic waste. These animals feed on the littered wastes which result in indigestion and other digestion complications leading to their death. Post mortems conducted on livestock have shown the cause of death for several cattle and sheep to be plastic products. The littering of plastic waste makes Gumbihini and its surrounding dirty and unattractive; thus posing serious health challenges to the people. The purpose of this study was to shed light on the factors that perpetuate indiscriminate plastic disposal and the health implications associated it, using Gumbihini, a suburb of Tamale.

1.2 Research Questions

1.2.1 Main Research Question

- The research focused on the underlying causes of indiscriminate plastic waste disposal and its attendant health implications on the population in the study area?

1.2.2 Sub Research Questions

- Why do people litter plastic waste indiscriminately?
- What are the effects of indiscriminate disposal of plastic waste?
- What effective measures can be taken to control indiscriminate plastic waste disposal in Gumbihini in the Tamale Metropolis?

1.3 Main Objective

- The main objective of this research was to investigate the health implication of indiscriminate plastic waste disposal in Gumbihini and to suggest sustainable and effective ways of controlling the dumping of plastic waste in Gumbihini.

1.4 Specific Objectives

- To identify and discuss the effects of indiscriminate plastic waste disposal on the environment and its health related problems in Gumbihini.
- To investigate the reasons why people litter the environment with plastic waste in Gumbihini.
- To suggest sustainable ways of reducing the indiscriminate disposal of plastic waste in Gumbihini.

1.5 Significance of the Study

Even though research has been done on solid waste management in the Tamale Metropoolis, special attention has not been given to plastic waste and its health implications. This research is aimed at highlighting this problem to enable decision makers to take a look at plastic waste management in the Metropolis, particularly in Gumbihini and to adopt appropriate measures to curb the littering of plastic waste in Gumbihini and the Metropolis as a whole. The findings of this research would guide policy makers in the design of strategies and programmes for the effective planning and management of solid waste in developing world.

1.6 Organization of Study

The report is structured into six chapters.

- Chapter one covers the introduction; which comprises the problem statement, research questions goals, objectives, significance of the study, methodology, scope of the study and limitation of the study.
- Chapter two focuses on the literature review and definition of terms.
- Chapter three focuses on the methodology for the study.
- Chapter four provides the results and discussions on the findings.
- Chapter five covers the discussion, key findings, recommendation and conclusion.

1.7 Limitations of the study

The research concentrated on light plastics instead of general plastics used in the community. This is due to the fact that light plastics are commonly used daily and littered in the environs, even though hard plastics also pose danger to human health depending on how they are disposed. Respondents' cooperation during the data collection process was difficult to deal with as many of these respondents could not make time to answer the questionnaire timely.

Interviews with households had to be rescheduled to enable interviewee gather the right information from respondents. These therefore contributed to the waste of human capital and other resources as well as time. Also it was hard to get information from the Metropolitan

Assembly as officers were not willing to give out information and kept on giving excuses for their inabilities to provide certain basic secondary information.

Notwithstanding these limitations, the credibility of the research and the findings are intact.

CHAPTER TWO

LITERATURE REVIEW

2.1 Origin and Development of Plastics

The word plastic comes from the Greek verb *plassein*, which means "to mould or shape." Plastics have that capacity to be shaped thanks to their structure, those long, flexing chains of atoms or small molecules bonded in a repeating pattern into one gloriously gigantic molecule (Freinkel, 2011). The first man-made plastic was created by Alexander Parkes who publicly demonstrated it at the 1862 Great International Exhibition in London. The material called Parkesine is an organic material derived from cellulose which when heated could be moulded, and retained its shape when cooled. The first important plastic, celluloid was inventoried by John W. Hyatt in 1872: it is a mixture of cellulose nitrate, camphor, and alcohol and is thermoplastic. However, plastic did not come into modern industrial use until after the production of bakelite in 1909.

In 1909, Dr. Lee Hendrik Baekeland introduced phenoformaldehyde plastics (or "phenolics", as they are commonly called), the first plastic to achieve worldwide acceptance. More importantly, Baekeland also evolved techniques for controlling and modifying the phenolformaldehyde reaction so that products could be formed under heat and pressure from the material. This characteristic of liquefying the material so that it can be formed into various shapes under heat and pressure is still common to most plastics (Michael, 2007).

The third major thrust in the development of plastics took place in the 1920s with the introduction of cellulose acetate (which is similar in structure to cellulose nitrate, but safer to

process and use), ureaformaldehyde (which can be processed like the phenolics, but can also be moulded into light coloured articles that are more attractive than the blacks and browns in which phenolics are available), and polyvinyl chloride (PVC, or vinyl, as it is commonly called). Nylon was also developed in the late 1920s through the classic research of W.T. Carothers (PPC, 2012).

In the 1930's, there were acrylic resins for signs and glazing and the commercialization of polystyrene, which became the third largest-selling plastic, literally revolutionizing segments of the house wares, toys, and packaging industries. Melamine resins were also introduced; these later became a critical element (in the form of a binder) in the development of decorative laminate tops, vertical surfacing, and the like (PPC, 2012).

Cellulose acetate, a thermoplastic, was developed about the same time as the urea-based resins. Similar in structure to cellulose nitrate, it was found to be safer to process and use. Cellulose acetate was introduced as a moulding compound in 1927. The period 1930-1940 saw the initial commercial development of today's major thermoplastics: polyvinyl chloride, low density polyethylene, polystyrene, and polymethyl methacrylate. The advent of World War II in 1939 brought plastics into great demand, largely as substitutes for materials in short supply, such as natural rubber. In the United States, the crash program leading to large-scale production of synthetic rubbers resulted in extensive research into the chemistry of polymer formation and, eventually, to the development of more plastic materials.

The first decade after World War II saw the development of polypropylene and high density polyethylene and the growth of the new plastics in many applications. Linear low density polyethylene was introduced in 1978 and made it possible to produce polyethylenes with densities ranging from 0.90 to 0.96. Large-scale production of these materials reduced their cost

dramatically. The new materials began to compete with the older plastics and even with the more traditional materials such as wood, paper, metal, glass, and leather. The introduction of alloys and blends of various polymers made it possible to tailor properties to fit certain performance requirements that a single resin could not provide. The demand for plastics has increased steadily; plastics are now accepted by designers and engineers as basic materials along with the more traditional materials. The automotive industry, for instance, relies on plastics to reduce weight and thus increase energy efficiency (SPI, 2012).

In just less than five decades plastics have become useful in virtually all aspects of human life. Plastic materials to a larger extent have replaced material plants products such as leafs, paper among others. The rate at which plastic has gained importance in the world has principally been due to its properties of resilience, resistance to moisture, chemical and photo- and biodegradation, their stability and the fact that they can be moulded into any desired form. Producers of plastics do not take into consideration the dangers that plastic pose to the environment and human health. In the 1980s and 1990s, a hydrophilic or water attracting plastic suitable for use in non-irritating contact lenses have been developed. Plastic reinforce with fibre glass is use for boat, vehicle body, and furniture and building panels (Lardinois & Klundert, 1995).

Plastics are man-made organic consisting of large molecules of materials produced from oil and natural gas as raw material. Plastics can be regarded as a long chains of beads in which the so-called monomers such as styrene, ethylene and vinyl chloride are linked together to form a chain called polymers. Polymers such as polyethylene (PE), polystyrene (PS) and Polyvinyl Chloride (PVC) are end products of the process of polymerization in which monomers are joined together.

Plastics can be thermoplastics or thermosets (Wienaah, 2007). There are four main types of plastics; polyethylene (PE), polypropylene (PP), polystyrene (PS) and polyvinyl chloride (PVC).

Polyethylene (PE): Polyethylene today's most widely used plastic evolved out of the need for a superior insulating material that could be used for such applications as radar cable during World War II. The thermoset polyester resins that only a decade or so later was to radically change the boat-building business in the United States were also a wartime development introduced for military use. And acrylonitrile-butadiene-styrene plastics, or ABS, (the plastic most often used today in appliance housings, refrigerator linens, safety helmets, pipe, telephone headsets, and luggage) owes its origins to research work emanating from the crash wartime program aimed at producing large quantities of synthetic rubber (PPC, 2012).

There are two main types of Polyethylene which are Low Density Polyethylene (LDPE) and High Density Polyethylene (HDPE). LDPE are soft, flexible and easy to cut, with the feel of a candle wax. When very thin are transparent, when thick it is milky and white unless a pigment is added.

Polypropylene (PP): Polypropylene is more rigid and can be bent sharply without breaking. It is used for stools and chairs and high quality home ware, strong mouldings such as car battery housing, domestic appliance among others.

Polystyrene (PS): It is unprocessed form; polystyrene is brittle and usually transparent. It is often blended with other materials to obtain the desired properties. It is used for the manufacturing of transparent kitchen ware, light fittings, bottles, toys and food containers.

Polyvinyl Chloride (PVC): Polyvinyl Chloride is hard, rigid material, unless plasticizers are added. Common application of PVC is for making bottles, thin sheets, transparent packaging materials, water and irrigation pipes, gutters, window frames. When Plasticizers are added the product is known as Plasticized Polyvinyl Chloride which is soft, flexible and rather weak. It is use to make inflatable articles such football as well as hosepipes and cable coverings, shoes, shower curtains among others.

2.2 Plastic Waste

Waste as defined by Nyambok & Davies (1993) is all unwanted and discarded material from domestic, urban, industrial activities and may be in solid, liquid or gaseous forms. Waste may be classified in many different ways, such as according to its original (e.g. domestic, industrial, commercial, chemical, construction, nuclear, agricultural) or its properties (for example, inert, toxic and inflammable). Without suitable treatment waste become a source of contamination of the environment at large, leading to air, water, and soil pollution.

Plastic waste therefore is all unwanted and discarded plastic material from domestic, urban, industrial activities. In Ghana the plastic waste menace cannot be easily quantified because solid waste is not sorted out to enable measurement of plastic waste generated. In the city of Accra alone, the plastic waste produced every day is estimated to be more than 60 metric tons. This equates to about 2200 metric tons every year of which only 2% of plastic waste is recycled (Tsuru, 2010).

The largest category of plastics are found in containers and packaging (e.g., soft drink bottles, lids, shampoo bottles), as well as some durable items like appliances and furniture and nondurable goods (e.g., diapers, trash bags, cups and utensils, medical devices). Recycling of

these types of plastic vary greatly. The overall rate of recycling plastic is only 8 percent, or 2.4 million metric tons (EPA, 2010). In Ghana Solid waste is relocated, that is waste is collected at one point and deposited at dump site. The problem is worsened as modern plastics become more durable and increasingly more disposable,

2.3 Sources of Plastic Waste

Plastic materials are inexpensive, lightweight, strong, durable, corrosion-resistant material with high thermal and electrical insulation properties. . Again plastics are cheaper and readily available instead of firewood in Ghana (Apaak, 2010). Because of their versatility and diversity, polymers are used to make vast array of products that bring medical and technological advances, energy saving and numerous other societal benefits (Ian, 2009). The multiple use of plastics for both industrial and domestic products result to massive plastic waste generation. The main source of plastic waste can be categorized in three forms namely; industrial, commercial and municipal waste

Industrial waste: Is waste obtained from large processing, manufacturing and packaging industries. Many industries discard Polyethylene wrappings that have been used to protect goods which have been delivered to the industry. Plastic factories which also produce plastic products generate a bunch of waste during production.

Commercial waste: Is gotten from craftsmen, shops, supermarkets and wholesale shops. Such waste is normally in the form of packaging materials made of Polyethylene. Hotel and restaurants and market places are often the source of this waste.

Municipal waste: Is waste collected from the streets, households, parks, collect points and waste dumps. The most common waste found in Ghana that belongs to this category is the Sachet

water bags and other light plastic material that is use for packaging (Lardinois and Klundert, 1995).

2.4 Impacts of Indiscriminate Plastic Waste Disposal

2.4.1 Human Beings

Drinking water now comes in sachets that cost a few cents or pesewa. Plastic bags are cheap and convenient; they are sold in shops and by street hawkers. Once water from it has been drunk they are often simply dropped on the ground with no sense of environmental consciousness. This indiscriminate plastic waste disposal contributes to blockage of drains which result in flooding and unsanitary conditions (Anton, 2011). Blocked drains and rain water that is retained in discarded cans, tyres, plastic bags and bottles as well as some broken rubbers are able to store water, thereby serving as fertile grounds for mosquito breeding. Mosquitoes spread disease, including malaria and dengue. Infections and diseases also become rampant as a result of the water stagnation. Flies breed in these stagnant waters and flies are very effective vector that spread chlorella (Adowale, 2009).

Open burning of waste causes air pollution; the products of combustion include dioxins which are particularly hazardous. Polybags, particularly recycled polybags pose a major health hazard. The burning of plastic waste, including empty "pure water" sachets, can cause cancer and breathing problems. Fumes from such burning produced dioxin, which is very poisonous

Pigs, goats and chickens eating grass or food scraps contaminated with dioxins from the burnt plastic will pass it on to humans when these animals are then eaten. Inhaling of fumes from

burning plastic can increase the risk of heart disease; aggravate respiratory ailments such as asthma and emphysema, and cause rashes, nausea, or headaches, damages in the nervous system, kidney or liver, in the reproductive and development system.

The burning of polystyrene polymers - such as foam cups, meat trays, egg containers, and yogurt and deli containers releases styrene. Styrene gas can readily be absorbed through the skin and lungs. At high levels styrene vapour can damage the eyes and mucous membranes. Long term exposure to styrene can affect the central nervous system, causing headaches, fatigue, weakness, and depression. The other most dangerous chemical released by burning plastic containing PVC is dioxin which is carcinogenic is very harmful to newborn children (Wakefield, 2007).

Open burning of plastic waste is dangerous to human and the environment. Plastic such as PVC (polyvinylchloride) is common in such products as: bottles, jugs, plastic packaging and plastic bags from the supermarket. When these plastics are burnt, carbon monoxide, dioxins and furans are released into the air. Studies have linked dioxins and furans to cancer and respiratory diseases, most especially in children as their respiratory systems may not be fully developed. It also causes birth defects in the respiratory and cardiovascular systems when inhaled by pregnant mothers (Penny, 2010).

Although plastics have had a remarkable impact on our culture, it has become increasingly obvious that there is a price to be paid for their use. There were a number of incidents where small children crawled into plastic bags used by launderers to cover clothing, and suffocated. The plastics industry managed to fend off trouble by launching a massive public-education campaign. Plastic was almost too good, as it was durable and degraded very slowly. In some cases, burning it could release toxic fumes. There was also the problem that manufacturing

plastics often created large quantities of nasty chemical pollutants, and depleted the Earth's bounded supply of fossil fuels. Unfortunately, recycling plastics proved difficult. The biggest problem with plastic recycling is that it is difficult to automate the sorting of plastic waste, and so it is labour-intensive.

While containers are usually made from a single type and colour of plastic, making them relatively easy to sort out, a consumer toy like a cellular phone may be made of many small parts consisting of over a dozen different types and colours of plastics. As the value of the material is low, recycling plastics is unprofitable. For this reason, the percentage of plastics recycled in the US is very small, somewhere around 5%. Research has been done on "biodegradable" plastics that break down with exposure to sunlight. Starch can be mixed with plastic to allow it to degrade more easily, but it still doesn't lead to complete breakdown of the plastic. Some researchers have actually genetically engineered bacteria that synthesize a completely biodegradable plastic, but this material is expensive at present (Packaging Today, 2012)

The unhygienic use and disposal of plastics and its effects on human health has become a matter of concern. Colored plastics are harmful as their pigment contains heavy metals that are highly toxic. Some of the harmful metals found in plastics are copper, lead, chromium, cobalt, selenium, and cadmium (UNEP, 1996). Chemicals added to plastics are absorbed by human bodies. Some of these compounds have been found to alter hormones or have other potential human health effects. Plastic debris, laced with chemicals and often ingested by marine animals, can injure or poison wildlife.

Floating plastic waste, which can survive for thousands of years in water, serves as mini transportation devices for invasive species, disrupting habitats. Plastic buried deep in landfills

can leach harmful chemicals that spread into groundwater. Around 4 percent of world oil production is used as a feedstock to make plastics, and a similar amount is consumed as energy in the process. Also, people with the highest exposure to BPA have an increased rate of heart disease and diabetes, according to one recent study (Knoblauch, 2011).

2.4.2 Animal and Aquatic Life

In Cape Coast, it has been noted by the Deputy Minister of Environment and Science that plastic waste has become a threat not only to humans but also to livestock and aquatic life. Animal mistaken pieces of plastics for food and may choke to death eventually. Plastic bags can also kill animals during grazing. As cattle, sheep and goats as well as other animals graze freely close to the rubbish bins in Tamale, they risk being chocked by the plastic material (GNA, 2010).

Animal tests studies of PBDEs have revealed the potential for damaging the developing brain and the reproductive system (Knoblauch, 2011). Not all plastic floats. As it breaks down it can begin to sink towards the oceans bottom. Dutch scientists have discovered that over 70 percent of discarded plastics eventually sink to the sea bed. Besides being a danger in themselves these vast areas of plastic pollution act as chemical sponge attracting other damaging pollutants, such as persistent organic pollutants (POPs), hydrocarbons and DDT that have been dumped in the oceans, creating even more highly damaging toxins for marine wildlife to mistake for food

The Dutch researchers have counted an astounding 600 thousand tons of plastic sitting on the North Sea floor. As that ocean floor becomes increasingly smothered by descending bits of plastics, sea bed organisms struggle for survival. It is estimated that 10 percent of the world's plastic waste finds its way into the sea and slowly but surely most of it ends up in the Pacific Ocean. The mass of plastic accumulated beneath the sea is slowly broken down into a plastic

dust that marine wildlife mistake for food. Small fish consume tiny bits of plastic as if they were normal plankton. Those fish are then consumed by larger species and the plastic contamination moves up the food chain.

The UN Environmental Program estimates that over a million seabirds, as well as more than 100 thousand marine mammals, die every year from ingesting plastic debris. Dead seabirds having mistaken plastics for food have been found with discarded plastic lighters, water bottle caps and scraps of plastic bags in their stomachs (Ecology Global Network, 2008).

2.4.3 Environmental Degradation

Plastics contribute to degrading the environment, can cause land degradation, air and water pollution when they are not properly disposed. The burning of plastics sends much carbon monoxide in the atmosphere which is harmful to human health (Wienaah, 2007). Plastic materials that unfortunately find themselves in the soil block the free movement of air and water in the soil (aeration), because of their resistance to decay, thus affecting the proper growth of food and cash crops (Zanbanga, 2010). Plastic materials that unfortunately find themselves in the soil block the free movement of air and water in the soil (aeration), because of their resistance to decay, thus affecting the proper growth of food and cash crops.

There is a formidable build-up of "unseen" plastic waste from discarded domestic and industrial tools, appliances, and containers. These include toothbrushes, and containers for talcum powder, body/hair cream, detergents, cooking oil, machine oil, as well as broken toys, and plastic chairs, buckets, and utensils. When all these end up in the refuse dump and eventually find their way into the soil they stay there for a very long time because they cannot decay easily. This can reduce the soil's fertility and/or impede plant growth. It is reported that farm animals and even

fish choke to death when they mistake plastic for food. Small plastic containers such as empty margarine and pomade containers collect rainwater that serves as breeding points for mosquitoes (Addai, 2010).

The production, consumption, and disposal of plastic materials have been found to contribute to the emission of CO2, a chief greenhouse gas. Globally the production of plastics uses fossil fuel contributing to the emission of greenhouse gas hence exacerbating global warming (Wienaah, 2007).

2.5 Causes of Indiscriminate Plastic Waste Disposal

Plastic waste is on the increase in Ghana as products packaged and sold in plastic bags and containers increase. Wherever you buy something, you get a plastic bag. Most products are sold in plastic bags. The results are that most of our gutters are littered with plastic bags; and the situation does not seem to abate despite public education campaigns against indiscriminate littering with plastic waste. It is common to see people throwing empty plastic sachets out of the windows of moving vehicles (Anton, 2008). Causes of indiscriminate plastic waste disposal include:

- Non enforcement of Sanitation Laws.

  The absence of effective law to deter people from the act of indiscriminate plastic waste disposal couple with inadequate personnel to monitor the way people dispose waste is a factor that contributes to the indiscriminate disposal of plastic waste. Governments have done little with regards to what quantities of waste are generated and where it is disposed by those who produce the waste but are only interested in the revenues they get from the

enterprises to the neglect of the impacts of the products these enterprises have on the environment.

- The unavailability of waste collection bins at vantage points and the irregular rate at which these available bins are emptied contribute greatly to the plastic menace in Ghana.

- One of the major causes of indiscriminate plastic waste disposal in Ghana is attitudinal. Primary data collected in Ethiopia showed that poor attitude contributed about 70% of the causes of indiscriminate plastic waste disposal in the country (Bjerkli, 2005).

- Wienaah (2007) in his book Sustainable Plastic Waste Management: A Case of Accra also ranked attitudinal behaviours and weak management policies as the major contributors of indiscriminate plastic waste management in the cities.

- Lack of clear national goal or vision of environmental sanitation as an essential social service and a major determinant of the standard of living also contributes to the poor sanitation problems in our communities, cities and towns.

- The lack of technical capacity of in the Ministry of Local Government and Rural Development to orient and support the District/Municipal/Metropolitan Assemblies in the provision of environmental sanitation also aggravates the poor sanitation situation in our various communities, which are under the direct supervision of the assemblies in Ghana. It therefore makes difficult to empower the various responsible departments at the assemblies to function efficiently and effectively in the execution of their duties.

- Also contributing to the indiscriminate plastic waste disposal is the weak or outdated and poorly enforced environmental sanitation legislation in Tamale and Ghana as a whole (ESP, 2011).

2.6 Methods of Solid Waste Management

The most common methods of solid waste disposal are Sanitary Landfill, Incineration, Open Dumping, and Ocean Disposal. Millions of tonnes of commercial and industrial waste is dumped into landfills, into the ocean or are incinerated every year.

High-temperature incineration: this is the process whereby solid waste such as plastics, pepper, are subjected to intensive heat to enable them burn or transformed into different products for reuse. Another is the sanitary land fill method in which waste is not allowed to burn. Instead, the waste is continually covered with a protective layer of sand or clay available at the land fill site. The waste is thus covered in the unsaturated zone. Here it is subjected to reaction with percolating rain water that has infiltrated the ground surface (Strashler, 1999).

Reuse: is a form of waste reduction that extends to resource supplies to keep high quality matter resource from being reduced to low quality matter waste and reduces energy use and pollution even more than recycling. Two examples of reuse are refillable glass beverage bottles and refillable soft drink bottles.

2.7 Strategies for Indiscriminate Plastic Waste Disposal Reduction

Interest in source reduction and recycling methods have been on an increase due to increase awareness about the dangers posed by landfills and incinerators. Source reduction: means producing less waste in the first place, so as to reduce the volume of the waste stream.

Manufacturers can reduce the amount of plastic, glass use to package food and consumer products.

Some products such as detergents and beverage can be produced in concentrated form and package in smaller containers. Package should be done mostly with biodegradable materials. There are two types of recycling methods of materials such as glass metal and plastics. These are: primary and secondary recycling. The desired method is the primary or close-top recycling, in which waste discarded by consumer (post consumer waste) are recycled to new products of the same type. The secondary or open-top recycling: in which waste materials are converted to different products (Getis, et al, 2005). A number of recycling plants have been established. Examples are the ones found in Kwamo near Kumasi (Asia Africa Intelligence Wire, 2007).

It is proposed that strategies to deal with plastic waste must be three-pronged (Addai, 2010). First there must be plans to permanently get rid of existing plastic waste, by going beyond collecting them from gutters, beaches and streets. Second guidelines must be evolved and popularized to promote proper disposal of plastic waste and minimize indiscriminate littering. Third measures must be instituted to reduce future overuse and wastage of plastic. Education is paramount in all the three strategies, and is a decisive factor towards mitigating the indiscriminate plastic waste disposal practices in Ghana (Addai, 2010). Formal education on waste management should commence as early as possible to train children as to how to do waste sorting; to facilitate collection, recycling, and disposal. One other way to reduce the indiscriminate disposal of waste by Ghanaians is to provide waste bins at vantage points in our communities. Other places such as schools, mosques, churches, playgrounds, theatres, discotheques, fuel filling stations should be provided with waste bins. Sanctions against those who breach regulations on proper waste disposal should be enforced (Ian, 2008).

The plastic menace is not only a disturbing issue in Ghana only but a world over phenomenon, countries such as the United Kingdom, Uganda among others have adopted the payment of hefty fines for dropping waste on the streets to deter littering while charges for each new plastic bag require public re-use. Ban on plastic bags use has been implemented in Uganda in 2007 despite public protest (Finch, 2009). While in Ghana the Ghana Plastic Manufacturers Association (GPMA) is protesting the implementation of ban on plastic bag policy, it calls for regulations that mandate the incorporation of biodegradable additives in the production of plastic carrier bags, water pouches and agricultural films. The Association also proposed that through the Ministry of Environment, Science and Technology, the Government makes compliance with such regulations a pre-requisite for renewal of license of plastic manufacturers to serve as incentive for the manufacturers to comply with regulations on the use of biodegradable additives (GNA, 2012).

Waste management Challenge in Ghana

Waste management in Ghana is a complex issue that has been a major feature on the priority list of successive governments, local authorities, and international donors in recent years. Generally existing public facilities including sanitary facilities are inadequate to serve the user population, and the sheer volume of municipal solid waste generated in the country's urban centres is overwhelming (Peter, 2009). Problems are encountered at all levels of waste management namely:

- ***Collection and transportation of disposal waste.***

  In several cases waste collection vehicles are either broken down or inadequate to collect waste resulting to untimely collection of waste at the household or at public places.

Collected waste is therefore left unattended which create unsanitary conditions in our environs. Wind and animals also aid in the redistribution of the waste in the environment contributing as well to the indiscriminate plastic waste disposal in towns and cities of Ghana. Assemblies also do not have adequate compactors and other heavy equipment required for effective waste management.

- ***Inadequate Engineered Landfills***

Existing final disposal sites for municipal solid waste are not engineered and may be described as crude dumpsites; in such cases the waste is only relocated. Tamale Metropolis with a total population of 371351 has only one engineered landfill (PHC, 2010).

- ***Waste Separation***

There is no waste separation at the sources of generation, and hazardous and clinical wastes are often handled together with municipal solid waste. The situation creates a suitable environment for breeding of disease vectors such as mosquitoes and cockroaches and the proliferation of rodents such as rats and mice. Majority of people do not care what kind of waste they generate, where and how the waste is disposed. The public disposes of rubbish indiscriminately especially in watercourses and drainage channels and often through burning. Huge piles of refuse and overflowing refuse containers are seen throughout the urban centres particularly near markets and squatter settlements.

CHAPTER THREE

METHODOLOGY

3.1 INTRODUCTION

This chapter deals with the theoretical, analytical framework and research techniques that have been used to acquire the necessary information to address the issues investigated or researched.

3.2 Theoretical Framework

The Structural and Concentric theories of Urbanization are used to explain the status of the various actors within the plastic waste management in Tamale Metropolis. It is also used to explain why the plastic menace is increasingly overwhelming, regardless of the various modalities put in place to manage waste in the Metropolis. The structural theory facilitates our understanding of the weak institutions and laws (allocative and authoritative) that exist in the study areas as waste management is concerned. The concentric theory facilitates our understanding of the study area as Gumbihini is characterized as urban poor community with a high population couple with poor housing and poor sanitation facilities.

3.2.1 Gidden's Structural Theory

Structure is defined by Giddens as rules and resources, organized as properties of social systems (Bas Reus, 2009). According to Gidden, structures are defined in relation to rules and resources which actors use in the production of social systems. Rules exist to guide in our social attitude. A knowledgeable actor therefore knows these rules, which serve as guide to make a decision.. He divided resources in two types: "Allocative and Authoritative" (Gidden, 1984). Allocative

resources include control over material relations such as the economy and authoritative resources include control over people in the form of politics.

A structure represents both possibilities and limitation for an actor's action. Gidden view structures and actors as mutually interdependent units (Gidden, 1984). This theory enables us to identify the various actors involve in the generation and management of plastic waste in the Tamale Metropolis, that is the generators of waste, institutions that management waste, laws to ensure good sanitation practices and other actors in the waste menace in Gumbihini.

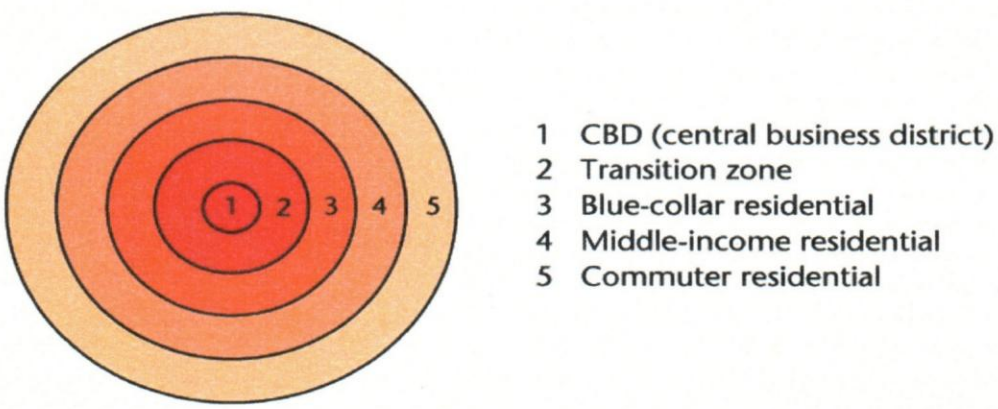
3.2.2 Concentric Theory of Urbanization

Urbanization is the societal trend where the proportion of people living in cities increases while the proportion of people living in the country side diminishes. It also refers to the geographic territory within or close to a city (Cheney, 2009). Urbanization or urban drift is the physical growth of urban areas as a result of global change (Wikipedia, 2008). The world is steadily becoming more urban, as people move to cities and towns in search of employment, educational opportunities and higher standards of living. Others are driven away from land that, for whatever reason, can no longer support them. The UNDP predicted earlier that by the year 2005 urban centers will be home to more than half of the world's people.

Following the trends of urbanization in Northern Region, in 1960, 13% of the population were living in urban areas, in 1970 and 1984, 21% and 24% of the people lived in urban areas respectively. It was estimated that in 2000, 27% of Northern region's population lived in urban areas (Songsore, 2010).

Even though many theories have been used to explain urbanization, this research focuses on the Concentric Theory propounded by Ernest Burgess in 1925. This theory is used to explain the prevailing conditions in the study. The **Concentric zone theory** uses a diagram of the ecological structure to explain urbanisation. The theory posits concentric zones round the central area, defined by their residential composition, moving from the very poor and socially deviant, in the inner zone of transition, to a peripheral suburban commuter ring. It divides urban areas into five zones; Central Business District (CBD), Transitional Zone, Working Class Zone, Residential Zone and Commuter Zone. He arranged the zones in concentric circles around the CDB.

Figure 1: The Concentric Theory of Urbanisation



Source: Cheney Paul (2009)

- Zone one: this area is **Central Business District** where commercial activities are intensified.
- Zone two: this is also called the **Transitional zone**. It is a place with mixture of activities, low rent services, slum residence etc. Usually new immigrants live in this zone. This zone also inhabits the poor in a city. This zone is often characterized by mixed

pattern of industrial and residential land use; rooming houses, small apartments, and tenements attract the lowest income segment. The zone also often includes slums and skid rows. Many ethnic ghettos usually begin here.

- Zone three: this zone is often referred to as the zone of **Independent workers' homes/ Residential**. This area is occupied by the working class. The "workingmen's quarters" Solid blue-collar, located close to factories of zones 1 and 2, more stable than the transition zone around the CBD. The zone is often characterized by ethnic neighbourhoods — blocks of immigrants who broke free from the ghettos spreading outward because of pressure from transition zone and because blue-collar workers demanded better housing.
- Zone Four: is the zone of **Middle Income Residence**, that is, where the middle class live. This zone has "better housing" and often comprises of established city dwellers, many of whom moved outward with the first streetcar network. They commute to work in the CBD.
- Zone five: is the **Commuter zone** or where the rich people live. This zone consists of higher-income families clustered together in older suburbs. They are located either on the farthest extension of the trolley or commuter railroad lines and have spacious lots and large houses. The rich pressed outward to avoid congestion and social heterogeneity caused by expansion of zone four.

The theory therefore postulates that towns or cities are developed in circles with each circle possessing different characteristic. The theory above enables us to understand the social and physical conditions of Gumbihini. The various stakeholders involved in the generations of waste in the community and their ability to manage waste.

3.3 Sampling

The sampling unit for the study is the household. "A household is a small group of persons who share the same living accommodation, who pool some, or all, of their income and wealth and who consume certain types of goods and services collectively, mainly housing and food" (OECD, 2008, p. 4). The sampling frame consists of the 856 households that live in Gumbihini (TAMA MTDP, 2010). A total number of 200 questionnaires were administered representing (21%) of total households covered.

The sample size was determined using the formula proposed by Robert (1970) as shown below:

$$s=X^2 NP (1-P) \div d^2 (N-1) + X^2P (1-P) \text{ (Robert, 1970).}$$

Where

- "s" is the sample size
- "X2" is the table value of chi-square for 1 degree of freedom of the desired confidence level 3.841
- "N" is the population size is 856
- "d" is the degree of accuracy expressed as a proportion of 0.05
- "P" is the population proportion (assumed to be 0.21), though (Robert, 1970) proposed "p" to be 0.5, the 0.21 used has not fallen short of the acceptable percent sample range for a sample size in conducting research.

$$S= 3.841*856*0.21 (1-0.21) \div 0.05^2 (856-1) + 3.841*0.021(1-0.021)$$

$$S= 3.841*856*.21(.79) \div .0025(855) + 3.841*.21 (.79)$$

$$S= 11847.89*.1659 \div 2.1375 + 3.841*.1659$$

$$S = 1965.56 \div 2.1375 + .637$$

$$S = 545.46 \div 2.7745$$

$$S = 196.9$$

$$S = 197$$

3.4 Sampling Design

Simple Random Sampling

This is also known as chance sampling or probability sampling where each and every item in a population is given an equal chance of inclusion in the sample and each one of the possible samples, in case of finite universe, has the same probability of being selected (Kumekpor, 1999). Gumbihini has total number of 856 households. Simple random sampling technique was used to select 197 households to administer 197 questionnaires to sample units while accidental sampling technique was employed to select three individuals for the administering of three questionnaires. These individuals were caught littering or using plastics during the data collection period. Households were numbered and cut-out and dropped in a closed box and mixed thoroughly and 197 households drawn from the box as the households that were to be interviewed. Households were picked one after another without replacement until the 197th household was drawn from the total number of 856 households kept in the box. This technique was employed in order to give equal chance to all the households to be interviewed. Time and resource constrain were considered for the choice of this sample size.

Purposive Sampling

Purposive sampling, also called judgmental, selective or subjective sampling is a non probability sampling technique. Purposive sampling is a deliberate choice of informant due to qualities the

informant possesses. The method was used to identify the Tamale Metropolitan Disease Control Officer and Sanitation and Hygiene Officer to enable me collect data on the health related diseases of poor environment. These key officers were purposely selected due to the fact that they in-depth knowledge in the scope of research. It is their direct responsibility for ensuring a healthy clean environment and health education in the municipality.

Accidental Sampling

Accidental sampling is a type of non-probability sampling which involves the sample being drawn from that part of the population which is close to hand (Wikipedia, 2012). This was used to gather data from persons the research team found littering, holding any item package with plastic, drinking ice water, sachet water at anywhere in the sample area. During the administering of the questionnaire two individuals were met drinking sachet water and handling food in polythene bags. They were therefore interviewed accidentally.

3.5 Data Collection

Questionnaire, Personal Observation, Focus Group Discussion, Key Informants interviews were used to collect data for this study. The questionnaire was employed to solicit information from households on plastic waste disposal systems in Gumbihini. Focus Group Discussion was used to help capture the views of various groups on the subject under study and to help clarify some of the issues that emerged from the household survey.

Key Informant interview was used to seek the views of individuals that have in-depth knowledge in the waste management and health issues in the Metropolis and the community. Such individuals included the Metropolitan Disease Control Officer and the Environmental Health officer as well as other opinion leaders within the community. Secondary Data was collected

from publications of the Tamale Metropolitan Assembly, book, records of Ministry of Health and Environmental Health department.

3.5 Data Analysis

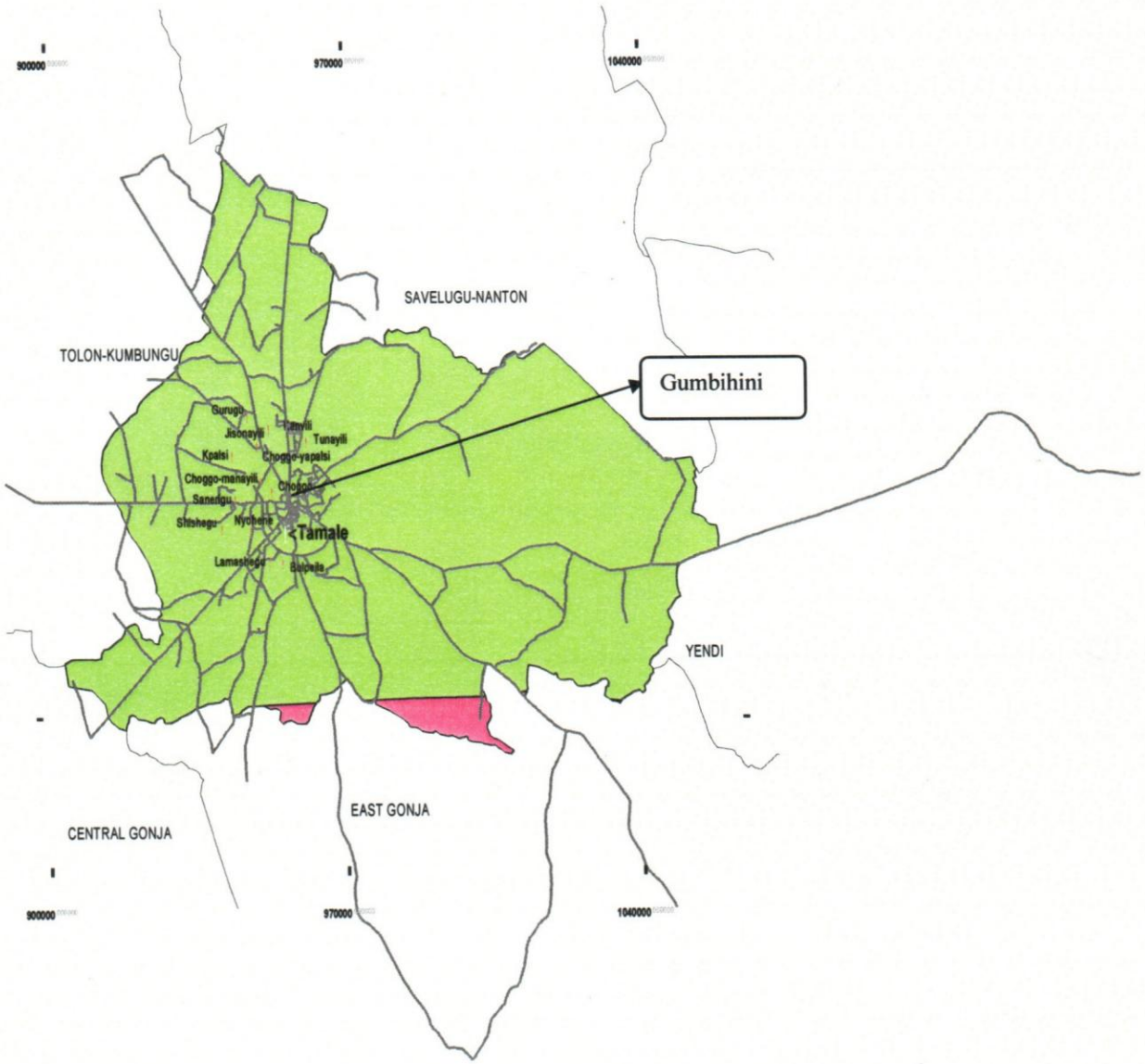
Data analysis was done using Statistical Package for Social Sciences (SPSS). Tables, Graphs and Charts were used to present the results. The concentric and structural theories have being used to help portray conditions that prevail within the study area (Gumbihini). The structural theory describes the various stakeholders involved in the management of plastic waste while the concentric theory illustrates the settlement conditions in the study area.

3.4. The Study Area

3.4.1Tamale Metropolitan Assembly (TAMA)

The Tamale Metropolitan/Municipal Assembly was elevated to a Metropolis in 2004. The Metropolis is one of the six Metropolitan Assemblies in the country and the only Metropolis in the three northern regions. Tamale is the capital of the Northern Region (MTDP, 2010). Below is the map of the Tamale Metropolis.

Map 1: Tamale Metropolis



Source: **(WaterAid, 2008)**

3.4.2 Location and Size

The TAMA is one of the 20 districts and the only Metropolitan Assembly in the Northern Region. The Metropolis is located in the centre of the Northern Region and shares boundaries with six other districts namely Savelugu- Nanton to the North, Yendi Municipal Assembly to the East, Tolon-Kumbungu to the West, Central Gonja to the South West and East Ganja to the South. The Metropolis has a total estimated land size of 750 km sq which is about 13% of the total land area of the Northern Region. The map of Ghana shows the Metropolis in National context. There are a total of 197 communities in the Metropolis of which 33 are urban communities. Most of the rural communities still lack basic social and economic infrastructure such as good road network, school blocks, hospitals, market and recreational centers (MTDP, 2010).

The study was conducted in Gumbihini and the surrounding communities in the Tamale Metropolis. Gumbihini is located in the Tamale Metropolis. Gumbihini is a major dry season farming community that supplies the Metropolis with fresh vegetables in the dry season. It is bounded by Chuggu, Sakasaka, Moshei-Zongo and Nyohini. The houses (Households) that share boundaries with Gumbihini are included in the study. Gumbihini was selected because it is one of the most highly plastic littered environs in the Metropolis. Gumbihini also experiences perennial floods because one of the major gutters in the Metropolis runs through the community. The drains in this community are constantly heavily chocked with plastic materials and other solid waste.

3.4.3 Demographic Features

The Northern Region has vast land cover with smaller population size. According to the 1984 population census, Tamale Metropolis had a population of 135,952 inhabitants (GSS, 2002). This figure rose up to 202,317 in 2000 (GSS, 2002). One possible factor for this big difference could be the fast developments and migration of people into the Metropolis since the 1990s. With an urban population of 67.1%, the Metropolis is the only district in the Region which is predominantly urban. The Metropolis population is not evenly distributed even though it has a population density of 318.6 persons per square kilometers (GSS, 2000). Tamale rural is sparsely populated.

3.4.4 Sanitation in Tamale

The Department of Waste Management in the Tamale Metropolis is responsible for the management of waste collection and disposal in Tamale. It is also responsible for educating the general public on waste management issues, provides sanitation infrastructures, and collaborating with other institutions on sanitation issues. The department also has the responsibility to design and implement programmes that are environmentally acceptable, economically affordable and polices that are directed towards addressing the above issues. A survey conducted by WaterAid in 2008 showed that only 2% of household waste generated in the metropolisis collected. About nineteen percent is burnt, and 49.3% is dumped at a public dump site while 26.9% is dumped anywhere (WaterAid, 2008). The major challenges to the department are; inadequate equipment for effective work and unserviceable machines that cannot stand the work stress in the Metropolis. The department also has funding challenges as waste management is capital intensive. Another challenge is the Community attitude towards waste

management. There is little or no effort on the part of the public to stop littering resulting in the Metropolitan authorities being saddled with this pollution menace (MTDP, 2010).

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents the key findings of the study. The profiles of respondents' as well as the major issues explored in the study are presented.

4.2 Profile of Respondents

Table 1: Presents some basic characteristics of respondents including their level of educational attainment and age.

Education status			Age										%
			4-9	10-14	15-19	20-24	25-29	30-34	35-39	45-49	45-49	50-54	55-59	
Yes	Gender	Male	0	18	33	14	22	4	5	2	1	2		**50.5**
		Female	1	2	8	27	10	5	11	5	1	3		**36.5**
No	Gender	Male			3	0	4	2	1	3	0	1	0	**7**
		Female			0	1	1	4	2	2	1	1	2	**6**

Source: Field survey, 2011

As depicted in Table 1, 87% of the respondents had formal education while 13% of the respondents did not have any formal education. About 51% of male respondents had formal education while 36.5% of female had formal education.

Table 2: The Distribution of Respondents by Gender and Occupation (200)

Sex	% White Colour	% Blue Colour	% House Wife	% Home Maker	% Self Employed	% Student	% Unemployed
Male	8.5	1	0	0	18	26	3
Female	6.5	0	7	1	16	12.5	0.5

Source: Field Survey, 2011

4.3 Plastic Use in Gumbihini

Light Plastics such as Polythene Bags, Sachet Water bags, and pit bottles among others were used daily for packaging of goods/products. The black small polythene bags commonly called "take – away" were conveniently used for packaging by roadside food vendors and ice water sellers. The results presented in the table below indicates that 94% of the respondents say they use plastic daily while only 4.5% of respondents say they used plastic weekly and 1.5% use plastics monthly. This gives a clear indication that majority of people in the community use plastics; hence sustainable modalities should be initiated to reduce the plastic menace.

Table 3: Plastic Use in Gumbihini

Plastic use in Gumbihini	Frequency	%
Daily	188	94.0
Weekly	9	4.5
Monthly	3	1.5

Source: Field Survey, 2011

The table above presents a clear picture of the likely quantum of plastic material waste that was generated daily in Gumbihini. Even though plastic waste was generated daily in the community, there were no litter bins at the household and community level; thereby the indiscriminate disposal of plastic waste and other solid waste in Gumbihini.

4.4 Waste Disposal in Gumbihini.

Results from the table below showed that 59% of respondents said they shared common litter bins with people while 41% had individual household litter bins. Sometimes the dust bins are too small to contain the waste generated in these homes. In order to discourage indiscriminate plastic waste disposal, there is the need to provide households with more litter bins for domestic use and community litter bins for the public. This will enable people to easily dispose off their plastic waste for collection.

Table 4: Ways of Plastic Waste disposal in Gumbihini

Ways of waste disposal	Percent (%)
I have a dust bin to myself for waste disposal	28.0
The household has one dustbin for our waste disposal	13.0
We share the same dust bin with other tenants in the compound for waste disposal	23.5
We share the same dust bin in the neighborhood for waste disposal	35.5

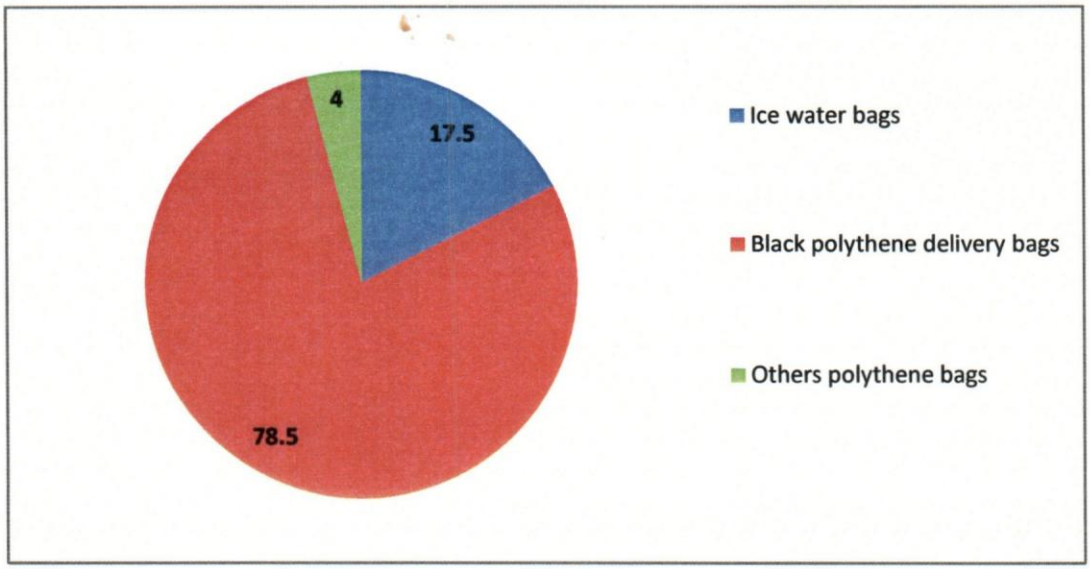
Source: Field survey, 2011

4.5 Common Plastics Waste in Gumbihini

The analysis s showed that, black polythene bags (78.5%), Ice water sachet (17.5%) and other polythene bags (4%) were the most common plastic waste often littered in the area. The Ice water bags and black polythene dumped in the area were noted to serve as breeding places for a variety of disease transmitting insects. The inadequacy of community litter bins coupled with the lack of frequent emptying of the bins has left many of these plastics to the control of the

wind. As a result much of the area was covered with plastics creating unsightly scenes to any visitor of the community.

Figure 2: Common Plastic Waste in Gumbihini

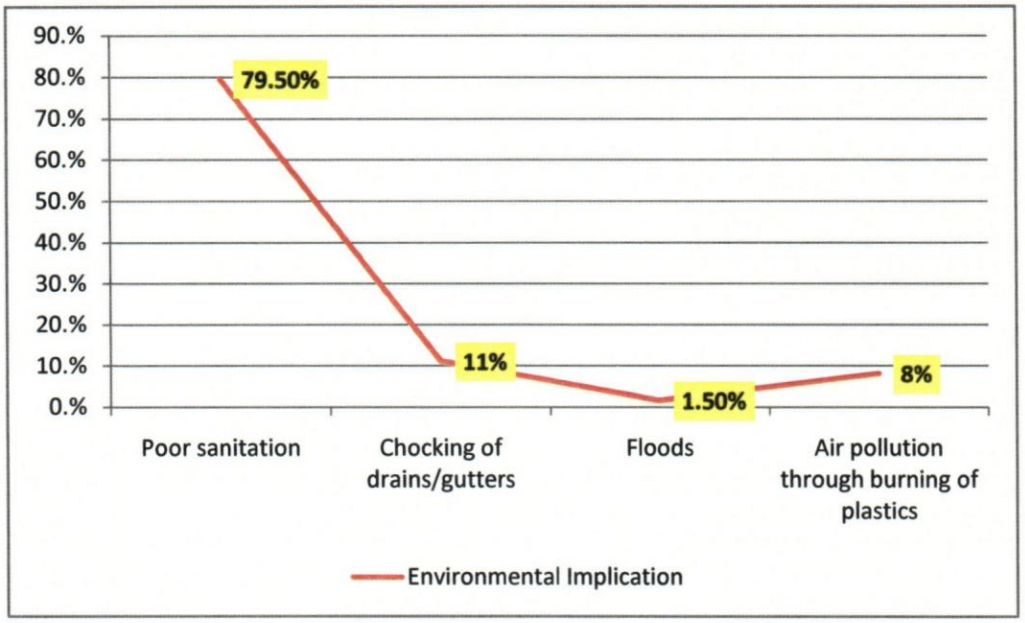


Source: Field survey, 2011

4.6 Effects of Indiscriminate Plastic Waste Disposal on the Environment

From the analysis, it was revealed that79% of respondents' attributed to the poor sanitation in Gumbihini to plastic waste littering. About 11% of respondents agreed that the chocked drains in Gumbihini were as a result of the indiscriminate plastic waste which makes the community prone to perennial floods, leading to destruction of life and properties

Figure 3: Environmental Implications of Indiscriminate Plastic Waste disposal



Source: Field survey, 2011

4.6. Expenditure on Health

The health of one is very important in life. Even though people often spend sums of money on their health, majority (71.5%) of people in Gumbihini did not know how much they spend on their health in a month or year. Out of the 71.5% who do not know how much they spent on health, 61.5% constituted persons with formal education.

Only 24.5% persons could estimate their expenses on health in a month on their families. Even though people in the community spend huge sums of money on their health, some did not take the pain to calculate the amounts they spend. Others also relied on the National Health Insurance Scheme for health service settlement and hence considered this service free. Another important

thing noted was that people hardly went to the hospitals for minor ailments as they relied on chemical shops for services. They spend in bits which they find it difficult to account for as part of their health cost.

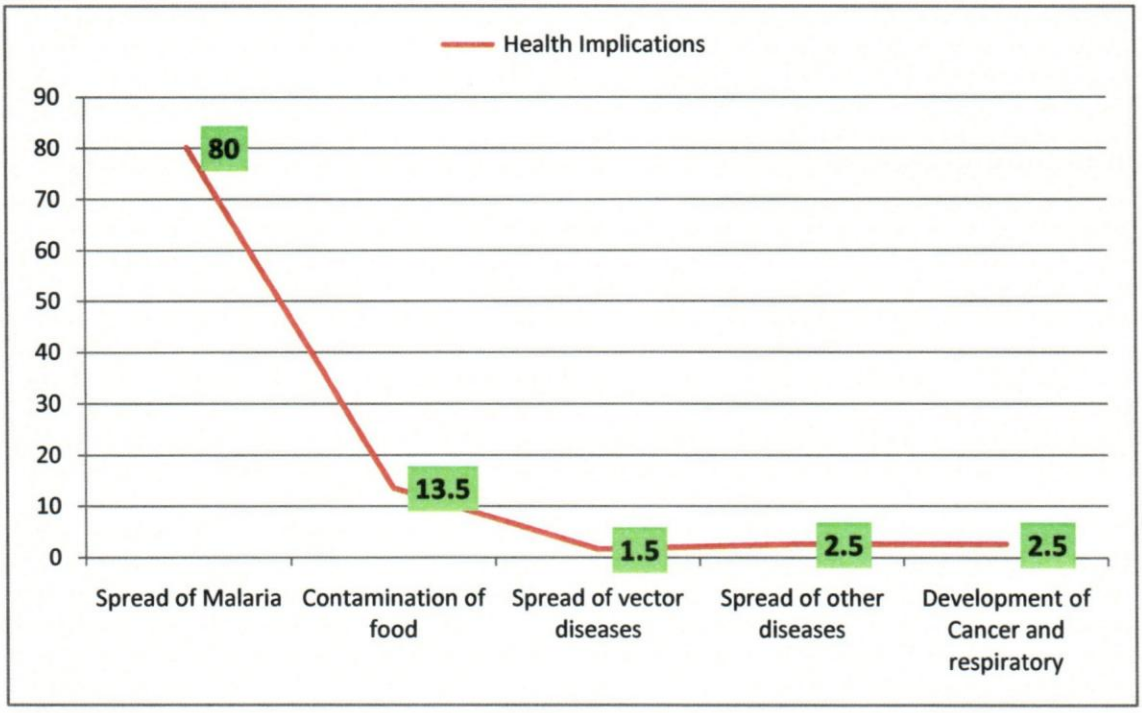
Table 5: Expenditure and Educational Status of respondents in the study (200)

Amount spent on hospital bills	Formal Educational status		Total (%)
	Yes	No	
I do not spent any money	123	20	71.5%
> 50 Gh. Cedis	5		2.5%
50 -100 Gh Cedis	20	5	12.5%
101- 150 Gh. Cedis	2		1%
151-200 Gh. Cedis	9		4.5%
251-300 Gh. Cedi	4	1	2.5%
301 - 350 Gh. Cedis	4	1	2.5%
351-400 Gh. Cedis	4	1	2.5%
>400 Gh. Cedis	1		0.5%

Source: Field survey, 2011

4.8 Health Implications of Indiscriminate Plastic Waste Disposal

Figure 4: illustrates the health implications of hapharzard plastic waste disposal in the study area.



Source: Field survey, 2011

Figure 4 showed that 80% of respondents said poor sanitation caused by indiscriminate plastic waste disposal created good breeding grounds for mosquitoes leading to an increase in malaria cases in the community. Also 13% agreed that indiscriminate plastic waste disposal could lead to contamination of food resulting in cholera/diarrhea/dysentery and other diseases in the community.

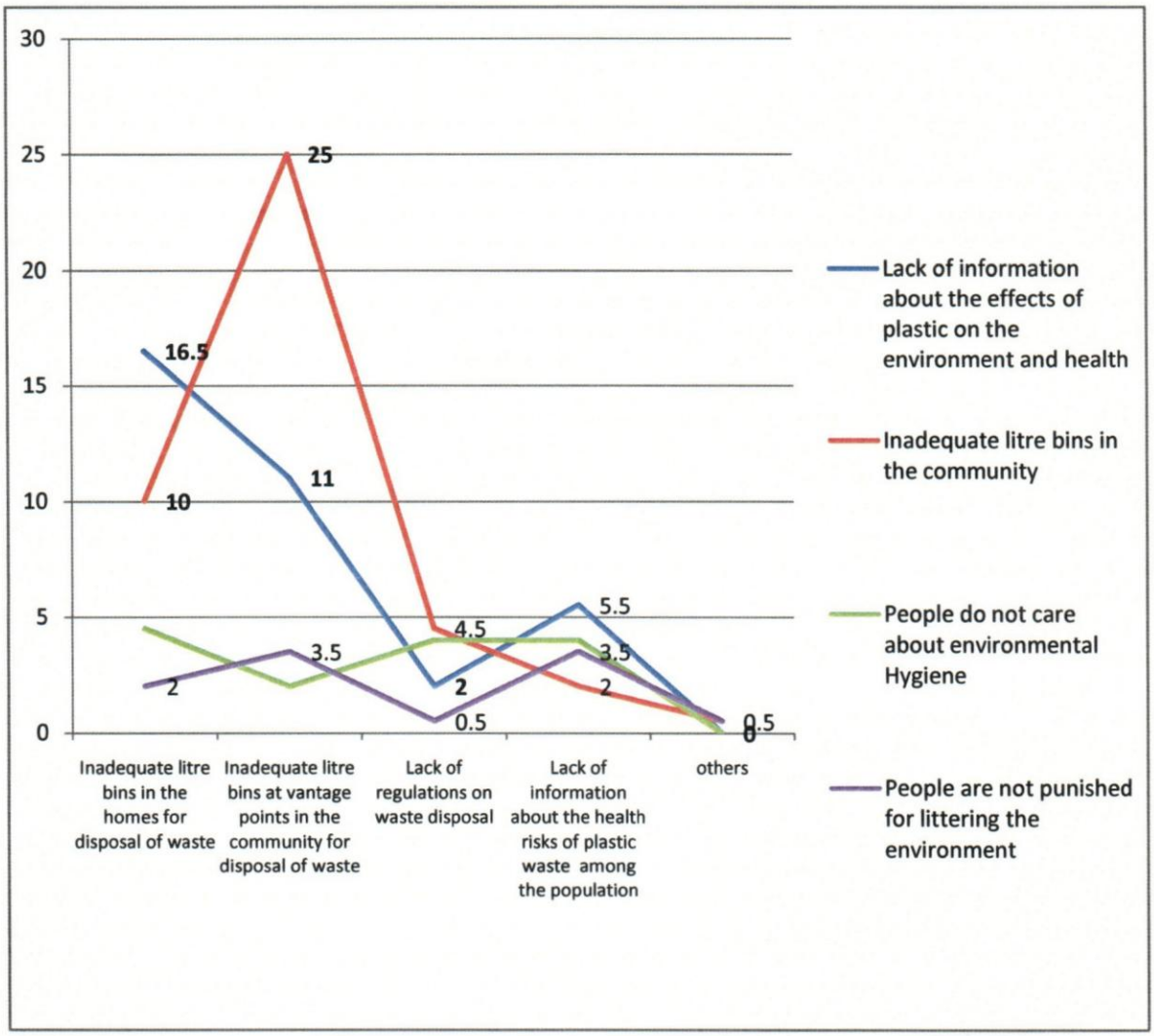
4.8 Why people Litter plastic waste in Gumbihini

The reasons for people littering plastics in Gumbihini were many. The results showed that about 25% of respondents cited the inadequacy of public litter bins at vantage points in the community as one of the main reasons for the littering of plastic waste in Gumbihini. Also about 16% of

respondents attributed the problem to inadequacy of litter bins in the home and the lack of information on the effects of plastic waste as factors that contributed to the littering of plastic waste in the area. Table: 5 shows that about 11% of respondents said the inadequacy of public litter bins and lack of information on the effects of plastic waste as the third major reason for the indiscriminate littering of plastic waste while 10% said inadequacy of litter bins at public and household levels contributed greatly to the littering of plastic waste in Gumbihini.

From these results above, one could say that in order for the community to stop this phenomenon, adequate litter bins should be made available and accessible to people in the community. Various households should be encouraged to own litter bins to decrease the burden on the few public litter bins. People should be sensitized also on the effects of plastic waste on the environment and health. Enforcement of laws regarding waste disposal in the community should be stepped up. The finding clearly confirms how weak the allocative and authoritative resources are as pointed out in the structural theory.

Figure 5: Why people litter plastic waste in Gumbihini



Source: Field survey, 2011

Table 6: Perception on how to promote Effective waste disposal

How to promote proper waste disposal	Frequency/ (%)
Embark on community sensitization on the dangers of plastic waste to human health and environment	83 (41.5%)
Hold radio discussion to educate the public on plastic waste disposal	41 (20.5%)
Embark on house to house campaign on plastic disposal	29 (14.5%)
Provide litter bin for waste collection at vantage points in the community	47 (23.5%)

Source: Field survey, 2011

When the respondents were asked how we can promote proper plastic waste disposal in Gumbihini, about 41.5% suggested the need to embark on community sensitization on the dangers of plastics waste to human health and the environment. Also, 23.5% said litter bins should be provided to enable easier waste collection in the community to prevent wind from blowing the light plastic. A 21% said radio discussions should be held to educate the public on plastic waste disposal. There is the need for community sensitization, radio discussion and the provision of litter bins to enable Gumbihini and its environs to solve the indiscriminate plastic waste disposal in the community.

CHAPTER FIVE:

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter discusses the key findings and proposes a way forward combating the plastic menace in sub-urban communities.

5.2 Discussion of Key Findings

Plastics are littered everywhere in the community: It was discovered that people in Gumbihini relied heavily on plastics in their daily activities. Plastics were mainly used for storage and packaging of food and non food items. Ian (2009) found the versatility and diversity of plastics as contributing to their high demand for the manufacturing of a good number of products that bring medical and technological advances, energy saving and numerous other societal benefits. These qualities of plastics were found to allow many people to use plastics in various ways for the benefit of their benefit. The glaring presence of plastics everywhere in the community found to positively correlate with the plastic use in the area and compounded by poor environmental management practices and inadequate access to waste disposal bins in the community. This glaring display of plastics around the community did not only disturb the aesthetic of area but was unpleasant to the eyes and embarrassing to a first timer in the community.

Other potential effects of the haphazard disposal of plastics include; its negative effect on soil quality for small gardening in the area, its facilitative effect on the spread of diseases as

diarrhoea, cholera among others. Anton (2008) found that indiscriminate plastic waste disposal contributed to blockage of drains which result in flooding and unsanitary conditions that serve as fertile grounds for mosquito breeding.

Adwole (2009) also found that infections and diseases were rampant poorly plastic disposed communities as a result of the stagnant water harvested in the used plastics containers. Apaak (2010) indicated that the burning of plastic waste, including empty "pure water" sachets, can cause cancer and breathing problems. Fumes from such burning produced dioxin, which is very poisonous.

Waste bins in the community were found to be inadequate: The community was faced with a challenge of inadequate litter bins at both the community and the household levels. These inadequacies were observed to perpetuate the haphazard disposal of plastics in the community. Even though "Zoomlion" a renowned private company is operational in the community and offer households and the public litters bin for a token, this has not had significant effect on environmental cleanliness of the community.

Households who have acquired these litter bins also complain of the delay of "Zoomlion" to collect the waste. About 41.5% of respondents acknowledged that the community does not have enough litter bins which thus warrant the "throw away" culture of plastics waste in Gumbihini. The inadequate litter bins at the household level coupled with the limited number of public litter bins in the community and the delay in waste collection has greatly influence people's attitudes and behaviour on environmental sanitation. Anton (2008) mentioned inadequacy of litter bins to be one of the major causes of indiscriminate plastic waste disposal in Ghana.

Focus group discussion held with youth groups in the community indicated that people found it difficult to 'throw away' plastic waste in public places indiscriminately but were compelled to do so because of the inadequacy of litter bins. The problem persists mainly because of the inadequacy of the waste collection bins and none emptying of the bins when they are full to the brim. Often, waste that is collected falls back to the ground littering the environment.

Lack of concern on the part of majority of households on environmental sanitation: In spite of the obvious reason that the poor sanitation in Gumbihini is mostly attributed to poor waste management, there is an apparent lack of concern of households in ensuring the cleanliness of their environment. People do not care when, where and how waste is managed in the community. Majority of people in the community feel that it is the responsibility of the Tamale Metropolitan Assembly to clean their surrounding and to manage the waste they generate. People therefore pay little attention to environmental sanitation issues. Cleanup campaigns which used to be an enthusiastic communal activity in Gumbihini have also lost its purpose. The community people in recent times pay less attention to such communal activities due to the fact majority of the populace do not care about the negative effects of indiscriminate waste disposal in the community. Addai (2010) also confirms the attitudinal character of people in Ghana as waste management is commonly and rottenly managed poorly in society Bjerkli (2005) found in Ethiopia that about 70% of the people pay less attention to sanitation issues in their environment.

Common type of plastic found in the community: The most common plastic waste found in the community was light plastic waste which was found in open and close drains and other places. About 78.5% of respondents said black polythene bags contribute massively to the plastic menace in the community. While 17.5% of respondent said empty Ice Sachet Bags are either found in gutters, farmland or anywhere in the environment which is an eye saw in the

community. These common plastics are light and can easily be carried away by winds into drains, resulting in chocking of the drainage system in the community.

High level of awareness of the effects of indiscriminate waste disposal: The plastic materials littered in the environment harvest rain water and running water from household chores and thus creating an enabling environment for the breeding of mosquitoes. These effects are not on the blind side of households. About 80% of the people attributed the infestation of the community with Mosquitoes to the poor sanitation. Malaria is widely spread among young and old people in Gumbihini and poses enormous challenge to the health and livelihoods of residents. During the focus group discussions, individuals complained tremendously about the sums of monies they spend on the treatment of minor illness. Others who ended up at the hospital also narrated the frustrating ordeals they went through to access services at private and public hospitals. Even though majority of the population have good knowledge on effects of indiscriminate plastic waste disposal much is not known to the people about the dangers of the elements of plastics. As discussed by UNEP (1996),t the unhygienic use and disposal of plastics are noted to have effects on human health. The plastic pigment contains heavy metals that are noted to be highly toxic. Some of these compounds have been found to alter human hormones; something not known to most common people.

Food vendors and ice water producers are major contributors to the plastic menace: The research also discovered that food vendor and Ice water producers were some of the contributors to the plastic waste problem in the community. Many of the food vendors use the small black polythene "Take-Away" for packaging of food. These vendors do not even care where and how the plastic waste is handled in the community.

It is considered erroneous and unhelpful to blame the plastic waste menace on any group of people such as plastic manufacturers or water sachet producers as argued by (Addai 2010). The situation in Gumbihini is totally different as majority of the people put the blame on the ice and sachet water producers and food vendors whom they consider as the biggest contributors to the plastic phenomenon. The people rather hold the view that it is the responsibility of the metropolitan or municipal or district administrations that are the law enforcers and therefore should contribute significantly to reduction of the plastic waste menace in the community. This view of the community is affirmed by Addai (2010) who also found that people held the wrong perception that assemblies are solely responsible for the management of waste.

Poor record keeping of health expenditure: The survey conducted also showed that people in the community did not keep records of their health expenses. Consequently, most people could not tell how much they spent in a month due to ill health. From the survey 140 respondents out of the 200 interview could not estimate how much they spend on their health monthly even though majority of people during the focus group discussion complain of the frequency at which family members fall sick in the community.

Families admitted the burden their health conditions put on the meager incomes. Another important fact to mention is the services of National Health Insurance Scheme (NHIS) which majority of the population were patronising. People saw NHIS service to be free and therefore pay little attention to the cost involved when they access health services.

Punishment for deviant: The uncontrollable nature in which people in Gumbihini dispose their plastic waste is so deplorable such that it calls for much attention of both private and public

sector interventions. The survey conducted it indicated that defiance of good environmental sanitation practices should be sanctioned through the payment of fines to deter others from committing such offences. About 39.5% agreed that persons who violated the laws should be made to face the rigorous of the law.

Even though, Addai(2010) emphasized on education as the best alternative to reducing the plastic waste canker in Ghana, the situation is different in Gumbihini. People in Gumbihini preferred punishment meted out to recalcitrant persons in the community who do not obey good sanitation practices. The Gumbihini situation therefore confirms sanctions as proposed by Ian (2008). It is professed by many respondents that the best and effective way to dealing with indiscriminate plastic waste disposal in Gumbihini was through immediate sanction and prosecutions of defaulters.

5.3 Recommendations

Based on the key findings summarized above it is recommended that the following measures should be put in place to address the indiscriminate disposal of plastic waste in Gumbihini and its environs.

- Community sensitization and campaigns should be organized to educate the public on their role and the necessity of their involvement and cooperation in ameliorating the plastics menace in communities.
- Radio discussions should be held to bring to bear some of the practices of the populace that propels the indiscriminate plastic waste disposal in the community.

- Litter bins should be made available in the communities and at homes to inculcate the sense of proper disposal of waste in homes and communities. This will help stop the littering culture among people.
- Cleanup campaigns and health talks should be organized and intensified at least twice in a month and participants rewarded sometimes for participating and practicing some of the best practices of proper waste management in the community.
- Environmental Sanitation Hygiene Department in collaboration with the Ministry of health should be deployed to educate the people on the dangers of plastic waste and waste in general.
- Community laws on environmental hygiene should be formulated, implemented and enforced by Chiefs and Opinion Leaders with the support of the MLGRD as well as the various MMDAs.
- The polluter pay principle should be made to work in the Gumbihini and its environs so that people are made to pay for their irresponsible actions.

5.4 Conclusion

Solid waste management is a growing environmental and financial problem especially in developing countries like Ghana. Plastics even though convenient to use, the waste of these plastics are detrimental to the environment and human health if not properly managed. Plastic waste is not easily biodegradable and if can be avoided should be avoided.

The Tamale Metropolis faces numerous challenges in solid waste management coupled with increasing population and unplanned development in the Tamale Township. The study through the use of data collection tools such as structured questionnaire, focus group discussion

secondary data sources among others discovered that the two major health implications were spread of malaria and other diseases and sicknesses as cholera, diarrhoea and dysentery in the community. Poor sanitation and choking of gutters were considered as the most serious environmental effects of indiscriminate plastic waste disposal in Gumbihini. It was also realized that inadequate litter bins for domestic and public waste collection in community are the two major causes of the littering of plastics in Gumbihini and the Metropolis as a whole. The results also showed that sensitization programmes on the radio and household level education on the role of households and the necessity of their involvement in combating the plastic menace when intensified could impact positively to help reduce the plastic menace in the community and Tamale metropolis. The availability of litter bins in adequate quantities to households and at public places will inculcate the sense of good sanitation in the lifestyles of the people. The "3Rs" practices should be observed, that is Reduction in plastic waste generation, Reuses of plastic waste and Recycling of plastic should be encouraged in our development setting.

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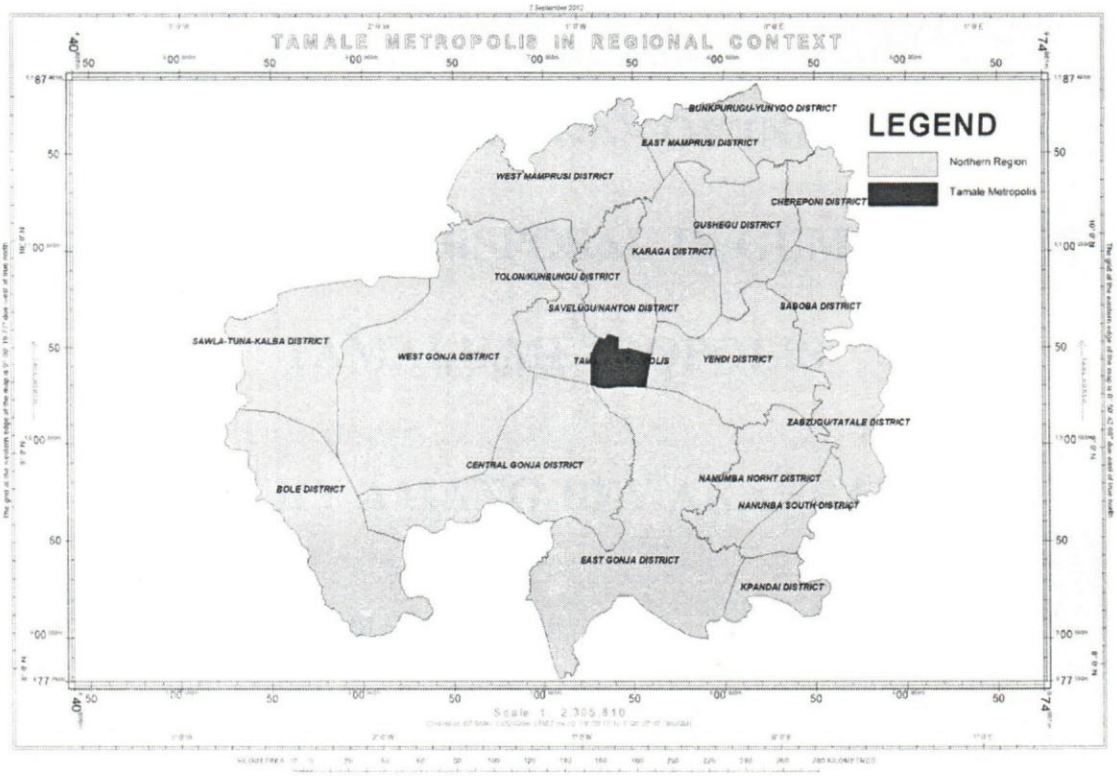
APPENDIX I

Map 2: Map of Northern Region



(Source: TCP- Tamale, 2012)

APPENDIX II

QUESTIONNAIRE

Title: HEALTH IMPLICATIONS OF INDISCRIMINATE PLASTIC WASTE DISPOSAL IN GUMBIHINI OF TAMALE METROPOLIS

Author: TIMOTHY AMANG-BEY AKANPABADAI

MAE/0027/2010

Name of Community/Electoral Area.....

Name of Household Head .....*Household No*.....

Name of Respondent .....*ID No*.....

(MA ENVIRONMENTAL SECURITY AND LIVELIHOOD CHANGE)

UNIVERSITY FOR DEVELOPMENT STUDIES - GRADUATE SCHOOL

Bio-data

(Check the appropriate box IN ALL CASES)

The following questions are about **YOU**

1. How would you describe yourself?

A. ☐ Male

B. ☐ Female

2. How old are you (in years)?

A. ☐ 4-9 B. ☐ 10-14

B. ☐ 15-19 D. ☐ 20-24

E. ☐ 25-29 F. ☐ 30-34

G. ☐ 35-39 H. ☐ 40-44

I. ☐ 45-49 J. ☐ 50-54

K. ☐ 55-59 L. ☐ 60 +

3. Your marital status

A. ☐ Married B. ☐ Separated

B. ☐ Single D. ☐ Widow

E. ☐ Divorced F. ☐ Widower

The following question(s) are about your EDUCATION

4. Do you have formal education?

A. ☐ Yes

B. ☐ No

5. If 'Yes' in question 4, how many years of schooling have you done so far?

A. ☐ 1-6 years

B. ☐ 7-9 years

C ☐ 10-12 years

D. ☐ > 12 years (College, Poly, Univ. etc)

6. Have you received any other form of education other than the above (e.g. Makaranta)?

A. ☐ Yes

B. ☐ No

7. How many Languages do you speak?

A. ☐ One

B ☐ Two

C. Three

D. ☐ Four

E. ☐ If more than Four (How many)? ……,

The next set of questions is about your HOME

8. Do you own the house in which you live now?

A. ☐ Yes (Owner **lone** occupier)

B. ☐ No

9. If YES in **Question 8 above,** how many persons are in your household?

A. ☐ One

C. ☐ Two

D. ☐ Three

E. ☐ Four

F. ☐ Five

G. ☐ Six

H. ☐ Seven or more

10. If 'Yes' in **Question 8** above, how many are male?

A. ☐ 0

B. ☐ 1-3

C ☐ 4-6

D ☐ 7 and over

11. If 'Yes' in **Question 8** above, how many are female?

A. ☐ 0

B ☐ 1-3

C ☐ 4-6

D ☐ 7 and over

12. If **No in Question 8** above, which of the following forms best describes your living form?

A. ☐ Accommodation provided by my/wife's/husband's employer

B. ☐ I am renting with my family **only** from a private developer

C. ☐ I am renting **together** with other families in the same compound

D. ☐ I am the house owner; **living with some tenants** in the same compound

E. ☐ I am living in my father's/mother's house with my wife/husband and Child/-ren

The following question(s) are about your EMPLOYMENT and INCOME

13. What work do you do? I am a

A. ☐ White colour worker; which? (Nurse, teacher, clerk, etc.)

B ☐ Blue colour workers (cleaner, watchman,

C ☐ House wife

D ☐ Home maker (various)

E. ☐ Self employed (various)

F. ☐ Student

G ☐ Unemployed

14. Approximately how many hours per day do you work/school?

A. ☐ 1-4 hours per day

B. ☐ 5-8 hours per day

C. ☐ 9-12 hours per day

D. ☐ >12 hours per day years

15. As a father (mother), in a year, how much do you spend on hospital bills because of ill health incurred for your own health or your children?

A ☐ I do not spend any money

B. ☐ < Than 50 Gh. Cedis

C. ☐ 50 to 100 Gh. Cedis

D. ☐ 101 to 150 Gh. Cedis

E. ☐ 151 to 200 Gh. Cedis

F. ☐ 201 to 250 Gh. Cedis

G. ☐ 251 to 300 Gh. Cedis

H. ☐ 301 to 350 Gh. Cedis

I. ☐ 351 to 400 Gh. Cedis

J. ☐ > than 400 Gh. Cedis

The following Questions are about your usage of plastics and Disposal of Waste

16. Do you use or have you ever used plastic products?

A. ☐ Yes

B. ☐ No

17. If YES in **question 15**, how often do you use plastic products?

A. ☐ Daily

B. ☐ Weekly

C. ☐ Monthly

19. How do you personally (or members of your household) dispose of household waste (including plastic waste)?

A. ☐ I have a dust bin to myself for waste disposal

B. ☐ The **household** has one dustbin for our waste disposal

C. ☐ We share the same dust bin with other tenants **in the compound** for waste disposal

D. ☐ We share the same dust bin in the **neighborhood** for waste disposal

20. Which is the common plastic waste generated by you or your household daily?

A. ☐ Ice water bags

B. ☐ Black polythene delivery bags

C. ☐ Others polythene bags (specify) ----------

21. Who is responsible for the disposal of waste in the household?

A. ☐ Wife
B. ☐ Husband
C. ☐ Children
D. ☐ Others (specify) ----------

22. What is the distance of your house to the dumping site?

A. ☐ 100 meter – 200 meter
B. ☐ 300 meter - 400 meter
C. ☐ 500 meter - 600 meter
D. ☐ 700 meter – 800 meter
E. ☐ 900 meter – 1Kilometer
F. ☐ Others specify ----------

23. Why do people litter plastics in Gumbihini?

A. ☐ Lack of information about the effects of plastic on the environment and health
B. ☐ Inadequate litre bins in the community
C. ☐ People do not care about environmental Hygiene
D. ☐ People are not punished for litering the environment.

24. Does Gumbihini have community litre bins?

A. ☐ Yes
B. ☐ No

25. What are the causes of indiscriminate plastic waste disposal in Gumbihini?

A. ☐ Inadequate litre bins in the homes for disposal of waste
B. ☐ Inadequate litre bins at vantage points in the community for disposal of waste
C. ☐ Lack of regulations on waste disposal
D. ☐ Lack of information about the health risks of plastic waste among the population

Focus Group Discussion

1. What are the common plastic wastes we see in Gumbihini?
2. Do you have community litre bins?
3. Where do you dump your household waste after collection?
4. What is your view about plastic waste disposal in Gumbihini?
5. What are some of the causes of indiscriminate plastic waste disposal in the community?
6. What are some of the effects of indiscriminate plastic waste disposal in the community?
7. What are some of the health implications of indiscriminate plastic waste disposal in the community?
8. How often do you fall sick and visited a clinic, health centre or hospital
9. In your opinion, how can one deal with the menace of indiscriminate plastic waste disposal in the community?
10. Are there laws governing how plastic waste is disposed in Gumbihini?
11. If Yes in Question 10, name them
2. If No in Question 10, what Laws do you suggest?

Which waste management company collects waste in Gumbihini

What can the opinion leaders do to arrest the plastic menace in the community

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