

ADDIS ABABA UNIVERSITY
COLLEGE of SOCIAL SCIENCE
DEPARTMENT of GEOGRAPHY and ENVIRONMENTAL
STUDIES

**Solid Waste Management in Durame Town: Practice and
challenges**

BY:

FELEKE AMARE

September, 2015

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BY:

FELEKE AMARE

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Addis Ababa University

School of Graduate Studies

As thesis research advisor, I hereby certify that I have read and evaluate this thesis prepared under my guidance and direction by Feleke Amare, entitled: S Practices and challenges in Durame Towan, Kembata Tambaro Zone, in SNNPR State.

I recommended that it be accepted as fulfilling the thesis requirements.

Dr. Akililu A.

Major Advisor

Signature

Date

As the members of the examiner board of the first draft of MA open defense, we certify that we have need and evaluate the thesis prepared by Feleke Amare and examined the candidate. We recommend that the thesis be accepted, as fulfilling the thesis requirement for the degree of master of art in Geography and Environment Studies.

Chair person

Signature

Date

Internal Examiner

Signature

Date

External Examiner

Signature

Date

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ACCRONOMY

EPA: Environmental Protection Authority.

EPHTI: Ethiopia Public Health Training Initiative.

ISSWMS: Integrated Sustainable Solid Waste Management.

OECD: Organization for Economic Co-operation.

PAN: Practical Action Nepal.

SLF: Sanitary Land Fill.

SWM: Solid Waste Management.

TALG: Transparent Accountable Local Government.

UNCD: United Nation Statistics Division.

UNCHS: United Nation Centre for Human Settlement.

UNEP: United Nation Environmental Authority.

USEPA: United States Environmental Protection Agency.

WRI: World Resource Institute.

Abstract

The purpose of this paper was to assess the practices and challenges of solid waste management in SNNPR Kembate Tambaro Zone Durame Town; accordingly, descriptive survey research method was used. Questionnaire, Field observation and interview were the instrument employed to collect valid data. Data was gathered from 249 selected sampled households using open ended and close ended questionnaire, and from purposely selected key informants using semi structured interview.

The result of data analysis showed that food waste and their packages were the major type of solid waste in Durame Town. Poor awareness of the community, Lack of solid waste materials are the challenges of Solid waste management in Durame town.

Finally, The conclusion of the study indicated the weak financial status of the municipality to provide solid waste materials along with low awareness of the community were the series problem that challenges the practice of solid waste management system in Durame town.

In sum the municipality should involve the private sector to fulfill the required conditions for the waste management in the town and also it should assign the health officer of the town to engage in awareness creation campaign to enable the people aware of the importance of safe solid waste disposal for their environment and health.

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CHAPTER ONE

INTRODUCTION

This part of the paper will present the background of the study, brief statement of the problem with possible explanation of objective of the study, significance of the study as well as delimitation and organization of the study.

1.1 Background of the study

Waste is any substance (whether solid, liquid or gaseous) that is discharged, emitted or deposited in the environment in such a volume constituency or manner as to cause an alteration in the environment. Waste is also any discarded, rejected, unwanted, surplus or abandoned substance. While solid waste is defined as the organic and inorganic waste materials produced by households, commercial and industrial establishments that have no economic value to owner (EPHTI, 2004).

Nearly all human activities produce waste. Solid waste is generated during the acquisition of raw materials, during refining and manufacturing process and when products are used by consumers. Problems with the disposal of wastes can be traced from the time when humans first began to congregate in tribes, villages and communities, and the accumulation of waste became a consequence of life (Sangho et al., 2007).

From the days of primitive society, humans and animals have used the resources of the earth to support life and dispose of wastes. In early times, the disposal of human and other wastes did not pose a significant problem, because the population was small and the amount of land available for the assimilation of wastes was large. Although emphasis is currently being placed on recycling and fertilizer value of solid wastes, the farmer in ancient times probably made a bolder attempt at this. Indication of recycling may still be seen in the primitive, yet sensible agriculture practices in many of the developing nations where farmers recycle solid wastes for fuel or fertilizers values (Alemayehu, 2007).

The problem associated with the management of solid wastes, in today's society are complex because of the quality and diverse nature of the wastes, the development of sprawling urban

areas, the finding limitations for public services in many large cities, the impact of technology and raw materials (TALG, 2008).

In reality there are a number of critical actions that need to be taken at each of the levels of household, neighborhood, city and nation. Decisions about waste disposal have large effects on the present and future welfare of people in an area. To practice an ineffective technology shifts the burden of clean up efforts to future generations. On the other hand, a wise choice of a logical technology or practice can resolve present problems adequately, while preserving funds for expeditiously resolving other environmental, social or economic problems (Yeuan, 2000).

Municipal solid waste management system involves various activities like storage, collection, transportation, disposal etc. These activities if not properly controlled and with proper precautionary measures adopted, may have adverse impact on land, water, and air environment, human and environmental health, aesthetics and quality of life (Justine, 1993). The environmental and Health Impact Assessment may help in increasing the potential adverse effects of these activities and in formulation of precautions which could prevent these effects from taking place (UNEP, 1999).

More specifically, poor waste management system in Durame town is seriously affecting the environment and the health condition of the community. That is why the researcher is intended to observe as a geographer at Durame town.

1.2 Statement of the problem

The most obvious environmental damage caused by municipal solid wastes is aesthetic, the ugliness of street litter and degradation of the urban environment and beauty of city is more serious. However; often unrecognized is the transfer of pollution to water, ground water. Excess packaging is one of the major sources of solid wastes. Dispose of refuse in an open dump where the refuse is left on the ground. There open dumps are a threat to the environment and a health hazards. Rain carries materials from the dump in to water supplies. Since rats, insects, bacteria and fungi are found in open dumps, such dumps may be source of disease (EPHTI, 2004).

Much of the solid wastes from homes offices and municipal wastes end up littering round sides, floating in lakes and streams, and collecting in ugly dumps. When the wastes are put in to open

dumps, they ruin the attractiveness of the surrounding areas and would potentially endanger the healthy environment necessary for human existence. Ecological phenomena such as water and air also attributed to improper management of solid wastes (Monroe, 1997).

SWM requires among other things effective local planning and citizen participation backed by clear, integrated and comprehensive strategy towards effective and safe solid waste disposal mechanisms (Aarne, *et al*, 2002).

As clearly stated by (Alemayehu, 2007) the world population whether living in developing or developed countries are now worried too much about wastes. Disposable areas are getting scarcer every year. Wastes are getting complex from time to time. Solid waste such as garbage from homes and industries, are probably, the most visible solution. One of the most difficult problems facing humans today is the disposal of solid wastes.

As stated above poor management of solid waste have a devastating impact up on the environment. Unless the responsible body timely aware of the impact of improper management of solid waste and decide to take the necessary measures to tackle the problem, damages on the environment due to uncontrolled solid waste management activities aggravate endangering the safe and healthy existence of the residents. In the same manner, the researcher in his study area observed that little attention is given by the community to realize management of solid wastes. In addition to poor community awareness, the local authorized body also gives less attention about the consequences of inappropriate SWM in Durame town. Therefore, the following research questions are raised and answered in order to attain the objective of the study.

1.3 Objective of the study

The general objective of the study is examining the solid waste management System at Durame town.

The specific objectives of this study are;

1. To assess the existing SWM practices in Durame town.
2. To identify the common types and sources of solid wastes found at Durame town.
3. To identify the factors affecting the SWM system at the town.

4. To identify the possible solutions towards the adoption of safe and effective SWM mechanism in Durame town.

1.4 Research Question

1. What are the common types of solid wastes prevailing in the study area?
2. What do the existing SWM practices of Durame town look like?
3. What are factors affecting the SWM system of Durame town?
4. In what ways the problem of solid wastes is reduced in the study area?

1.5 Delimitation of the Study

Solid waste management activities significantly vary from place to place. Regardless of scale, variation in SWM activities is related to the increasing socio-economic, financial and legal variables. The scope of this study is to assess the SWM system with the special focus of practices and challenges at local level, i.e. Durame town. The study confined to small geographical area due to financial and time constraints i.e. only three kebeles of Durame town in Kembata Tembaro Zone of SNNP were included in this survey. Other towns were excluded from sampling due to stated constraints.

1.6 Significance of the Study

The study is expected to assess the SWM system in general and evaluate the SWM system in the study area. By doing so, the study will have the following major significances.

It is expected to indicate the seriousness of the SWM system in Durame town and serve as a major input for the measures that are being taken by the municipal organ of the town. It also serves as a source of information and further study for similar researches to be conducted concerning the SWM system in the study area. Furthermore, by identifying the challenges and opportunities of ensuring a safe and reliable solid waste disposal system the study be a guide the concerned organs in their effort to tackle the problems of SWM at hand.

Additionally, the study also identifies the major stake holders in efficient SWM system and there by inculcate a sense of responsibility towards ensuring safe and healthy environment. It also

generally serves as a significant addition to the SWM systems in general and SWM system in Durame town in particular.

1.7 Operational definition of Key Terms

Refuse:- it is general name given to all wastes except liquid waste. It includes all putrescible (decompose easily by bacteria) and non putrescible (non decomposable) wastes.

Rubbish:- represent all non putrescible wastes except ash. There are two categories of rubbish

- A. Combustible:- organic in nature and includes items such as paper, card board, wood yard clipping, bedding, plastic etc.
- B. Noncombustible:- are inorganic materials which include metals, glass, ceramics, and other minerals.

Ashes:- are incombustible materials that remain after a fuel or solid waste has been burnt.

Special wastes:- are wastes from residential and commercial sources that includes

- Bulky items (such as furniture, lamps, book cases etc)
- Consumer electronics (includes worn-out, broken and other no longer wanted items such as radio, TV set etc) (EPHTI, 2004).

White goods:- includes large worn out broken household, commercial and industrial appliances such as stoves, refrigerators, cloth washes and driers.

Dead bodies:- dead animals like dogs, cows donkey etc.

Waste reduction:- all means of reducing the amounts of waste that must be collected and disposed off by solid waste authorities.

Source reduction:- any procedure to reduce wastes at the point of generation, in contrast to sorting out recyclable components after they have been mixed together for collection (TALG, 2008).

Recycling:- the process of transforming materials into secondary resources for manufacturing new product.

Resource recovery:-means the obtaining of same economic benefit from materials that someone has regarded as waste.

Reuse:-being used for the same purpose again (Such as refilling a soft drinks bottle) (Joseph, 1993).

Leach ate:- is liquid released by, or water that has percolated through, or waste which contains dissolved and/or suspended liquids and/or gases (EPA, 1996).

Litter:-Solid waste that is out of the tipping area of the land fill site and is not a part of the formal waste collection system (EPA, 1996).

Methane:- is an explosive odorless and colorless gas produced in a landfill by organic waste undergoing an aerobic respiration (EPA, 1996).

1.8 Organization of the Study

This study begins with introduction part of the study in its first chapter. Chapter two elaborates on the basics of SWM in different aspects; and discusses other its related issues in terms of its management by the literature. The third chapter of the study dealt with the methodology, which was used by the researcher. Chapter four presents the qualitative analysis of data collected from the study participants and documents. Finally, Chapter five summarizes the findings, concludes the study and recommends possible solutions.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 The Concept of Solid Waste and its Generation

Wastes are materials that are not prime produces (that is products produced for the market) for which the initial user has no further use in terms of his/her own purposes of production, transformation or consumption, and of which he/she wants to dispose. Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities. Residuals recycled or reused at the place of generation are excluded (UNSD, 1997).

Solid waste is any non-hazardous, solid degradable waste. This included putrescible wastes, garden wastes, uncontaminated bio solids, and clinical and related wastes (including contaminated waste) only where sterilized to a standard acceptable to the department of health (EPA, 1996).

Solid wastes are characterized by a great mixture of substances, including fine dust sander, metal, glass, hard board, textiles, putrescible vegetable materials and plastic. Such qualitative of wasted materials can cause serious disposal system. Collection service is the removal of refuse from collection points to final disposal site. It is the most expensive part of solid waste management as compared with other operation and management procedures (Kebede, *et al*, 1993).

Modernization, technological advancement and increase in global population created rising in demand for food and other essentials. This has resulted to rise in the amount of waste being generated daily by each household (Sha'ato *et al*, 2009).

Every year billions of tones of waste are generated by human beings. Disposal of these unwanted materials are considered as a huge environmental problem with many dimensions. Making the environment unclean with waste products is pollution. Any kind of waste can cause pollution. Waste products can pollute the air you breathe and the water you drink (UNEP, 1999).

Waste generation encompasses activities in which materials are identified as no longer being of value and are either thrown away or gathered together for disposal. Knowledge of the quantities of SWs generated, separated for recycling, and collected for further processing or disposal is of fundamental importance to all aspects of SWM. It is important to have the waste generation information, amounts and composition collected, as this may have a major impact on the planning process (Hall, 1994).

On a global scale it is difficult to report waste because countries have different definitions of waste and what falls into waste categories, as well as different ways of reporting. Based on incomplete reports from its parties, the Basel convention estimated 338 million tons of waste was generated in 2001 (EPA, 2009). For the same year, OECD estimated 4 billion tons from its member countries (OECD, 2006). Despite these inconsistencies, waste reporting is still useful on a small and large scale to determine key causes and locations, and to find ways of preventing, minimizing, recovering, treating and disposing waste.

As Moeller (2005), waste minimization is a process of reducing waste produced by individuals, communities and companies, which reduces the impact of chemical wastes on the environment to the greatest extent. Household level of proper segregation of waste; recycling, reuse, process and product substitution e.g. use paper bag instead of plastic bags significantly minimize the amount of waste to be generated.

The need for expansion and siting of waste treatment and disposal facilities is increasing worldwide. There is now a growing market in the trans-boundary movement of waste, and although most waste flows between countries go between developed nations, a significant amount of waste is moved from developed to developing nations (Ray, 2008).

2.2 Solid waste management

Waste management is referred to as the proper and correct handling of waste products at the lowest cost and with minimum destruction and pollution to the environment. Improper management of waste has caused numerous cases of contamination of surface and soil water and the atmosphere and threatens the health of the exposed populace. There is therefore need to manage waste to reduce the threat to the environment and to the populace (Sha' Atoet al, 2009),

SWM may be defined as a discipline associated with the control of generation, storage, collection, transfer and transport, processing, and disposal of solid wastes in a manner that is in accordance with the best principle of public health economics, engineering, conservation, and that is also responsible to public attitude (TALG, 2008).

As EPA (1999), SWM is any of the work and programs to eliminate, collect, recycle, or landfill solid waste. This program includes efforts to reduce waste and reduce materials, as well as recycling, composting, trash collection, land filling and incineration. Procurement of recycled content supplies and equipment and education are also part of SWM.

In its scope SWM includes all administrative, financial, legal, planning and engineering functions involved in solutions to all problem of solid waste. The solutions may involve complex interdisciplinary relationship among such fields as political sciences, city and regional planning, geography, economics, public health, sociology, demography, communications and conservation, as well as engineering and materials science (WHO, 1999).

The nature and operation of solid waste management varies significantly from nation to nation. Distinctions of such are not limited to the national scale however, and can be seen at the city and neighborhood level. Regardless of scale, these differences are to some extent attributable to prevailing socio-economic, financial, legal and political variables at the level. There is a clear requirement to reconcile the need for more effective waste management with the constraints that are faced by local municipalities or national governments (Michael, 1995).

Most local governments and urban agencies have, time and again, identified solid waste as a major problem that has reached proportions requiring drastic measures. Three key trends observed was respect to solid waste are increase in sheer volume of waste generated by urban residents; change in the quality or make up of waste generated; and the disposal method of waste collected, by landfill, incineration etc (Sango *et al*, 2007).

Solid waste management is not an isolated phenomenon that can be easily compartmentalized and solved with innovative technology or engineering. It is particularly an urban issue that is closely related, directly or indirectly to a number of issues such as urban life styles. Resource consumption patterns, jobs and income levels, and other socio-economic and cultural issues. All this issues have to be brought together on a common plat form in order to ensure a long term

solution to urban waste (Sandra, 1995). It is apparent that making accurate decisions about municipal SWM issues can be a complex task. Both long term and short term plan is needed to get a balance of cost effectiveness and environmental benefit (Yuan, 2000).

If elimination of wastes is not possible through pollution prevention, then waste management must be accomplished through application of another series of measures reduction, reuse, recycling, recovery, treatment and responsible disposal (UNEP, 1994).

There is a whole culture of solid waste management that needs to be put in place from the micro level of households and neighborhood to the macro levels of city, state and nation, The general assumption is that solid waste management should be done at the city level, and as a result, solutions tried out have been essentially end of pipe ('end-of-pipe' refers to finding solutions to a problem at the final stage of its cycle of causes and effects). In the case of urban solid waste, it means focusing on solid waste disposal rather than solid waste recycling or solid waste minimization. But this approach essentially misses the forest for the trees, in attempting piecemeal and ad hoc solutions to solid waste problems, instead of taking a long term holistic approach (Tchobanglous, *et, al*, 1993).

The UNEPA (2006) stated that, incineration is the process of destroying waste material by burning it. Incineration is often alternatively named "Energy-from-waste" or "waste-to-energy"; this is misleading as there are other ways of recovering energy from waste that do not involve directly burning if incinerations is carried out both on a small scale by individuals and on a large scale by industries. It is recognized as a practical method of disposing of hazardous waste materials, such as biological medical waste. Many entities now refer to disposal of wastes by exposure to high temperatures as thermal treatment.

2.3 Types and sources of solid wastes

Knowledge of the sources and types of solid wastes, along with the data on composition and rate of generation, is basic to the design and operation of the functional elements associated with the management of solid wastes. The source of solid wastes is dependent on the socio-economic and technological levels of the society (Monroe, 1997).

Table 1: Different sources and types of solid wastes. (Source; EPHTI, 2004)

No	Source	Typical waste generators	Types of solid wastes
1	Residential	Single and multifamily dwelling	Food waste, paper, cardboard, plastics, textiles, wood, glass, metals, ashes, special wastes and household hazardous wastes.
2	Industrial	Light and heavy manufacturing, fabrication, construction site.	Housekeeping wastes, packaging, food wastes, construction and demolition Materials, ash and special wastes.
3	Commercial	Stores, hotels, restaurants, Markets, office buildings	Paper, cardboard, plastics, wood, glass, food waste, special wastes.
4	Institutional	Hospitals, prison government center	Same as commercial
5	Construction and Demolition	New construction sites, Road repair, demolition of Buildings, renovation site.	Wood, steel, concrete, dirt etc
6	Municipal services	Street cleaning, beaches, Land scarping, parks and other recreational areas.	Industrial process wastes, scrap materials, Off-specification product, slag tailings.
	Process	Heavy and light manufacturing, refineries, power Plants, chemical plants.	Industrial process wastes, scrap materials, Off-specialization product, tailings
	All of the above should be included as "municipal solid waste"		
8	Agriculture	Crops, orchards, vine yards Dairies, feedlots, farms.	Spoiled food wastes, agricultural wastes, Hazardous wastes (pesticides)

Pollution is not directly transferred from land to people, except in the case of dusts and direct contact with toxic materials. Pollutants deposited on land usually enter the human body through the medium of contaminated crops, animals, food products, or water. Land pollution can also damage terrestrial ecosystems, resulting in the deterioration of the conservation and amenity value of the environment (Medina, 2002).

According to Marshal (1995), open dumpsites are a major problem to the environment, especially on the air that the people inhale. Dumpsites emit obnoxious odors and smoke that

cause illness to people living in, around, or closer to them. Dumpsites maybe a source of airborne chemical contamination via off site migration of gases and the particles and chemicals adhering to dust, especially during the period of active operation of the site.

In a number of community health surveys, a wide range of health problems, including respiratory symptoms, irritation of the skin, nose, and eyes, gastrointestinal problems, psychological disorders, and allergies, have been discovered, Dump sites closer to residential areas are always feeding places for dogs and cats. These pets, together with rodents, carry diseases with them to nearby homesteads (Dolk, 1997).

A major environmental concern is gas release by decomposing garbage. Methane is a byproduct of the anaerobic respiration of bacteria, and these bacteria thrive in landfills with high amounts of moisture. Methane concentrations can reach up to 50% of the composition of landfill gas at maximum anaerobic decomposition (Sandra, 1995).

The incinerated solid wastes contribute to the air pollution; buried, it contributes to the water pollution problem and takes up land and space; if it is dumped at sea, it diminishes marine resources and may even wash up on beach. We have waste problem because our socio-economic system fails to take in to account some of the most basic ecological principles governing material cycles. This flow ultimately piles up and causes problems on the environment (Mandefro, 2005).

Health and safety issues also arise from improper SWM. Insect and rodent vectors are attracted to the waste and can spread diseases such as cholera and dengue fever. Using water polluted by Municipal Solid Waste for bathing, food irrigation and drinking water can also expose individuals to disease organisms and other contaminants. Open dumping sites of municipal solid wastes and the wastes discharged thereby maintains a vicious cycle including these; Degrades water and soil quality, Cancer, Resulted in high algal population in rivers and sea, Nausea and vomiting and etc (Sha' Atoet al, 2009).

As Michael (1995) listed, if sold wastes are not managed properly, there are many negative impacts that may result. Such as;

- The open burning of waste cause air pollution; the products of composition include dioxins which are particularly hazardous

- Uncollected wastes degrade the urban environment, discouraging efforts to keep streets and open spaces in a clean and attractive condition.
- Polluted water (leachate) flowing from waste dumps and disposal sites can cause serious pollution of water supplies.
- Methane (one of the main components of landfill gas) is much more effective than carbon dioxide as a greenhouse gas leading to climate changes.

The location of waste treatment and disposal facilities often has an impact on property values due to noise, dust, pollution, unsightliness, and negative stigma. The informal waste sector consists mostly of waste pickers who scavenge for metal, glass, plastic, textiles, and other materials and then trade them for a profit. This sector can significantly alter or reduce waste in a particular system, but other negative economic effects come with the disease, poverty, exploitation, and abuse of its workers (Wilson *et al*, 2006).

Mustafa (1993) stated that decomposition of organic compounds by microorganisms is a common phenomenon. Most organic materials, such as food, wood products, or other remnants of plants, decay, and finally return to the environment in the form of simple compounds, such as carbon dioxide, water, or ammonia. Surprisingly, this phenomenon starts to create significant economical and environmental problems when landfills overflow with plastic.

2.4 Functional elements of solid waste management program

The activities involved with management of solid wastes from the point of generation to final disposal have been grouped into six functional elements. They are: waste generation, on-site handling, storage and processing, collection, transfer and transport, processing and recovery; and disposal.

Table 2: Description of the functional elements of solid waste management (Source; EPHTI, 2004)

Functional element	Description
Waste generation	Those activities in which materials are identified as no longer being of value and are either through away or gathered together for disposal.
On-site handling, storage And processing	Those activities associated with the handling, storage, and Processing of solid wastes at or near the point of generation
Collection	Those activities associated with the gathering of solid wastes And the hauling of wastes after collection to the location Where the collection vehicle is emptied
Transfer and transport	Those activities associated with (1) the transfer of wastes from the smaller collection vehicle to the larger transport equipment and (2) the subsequent transport of the wastes, usually over long Distance to the disposal site.
Processing and recovery	Those techniques, equipment and facilities used both to improve The efficiency of functional elements and to recovery usable Materials, conversion products, or energy from solid wastes
Disposal	Those activities associated with ultimate disposal of solid wastes Including those wastes collected and transported directly to a Landfill site, semi-solid wastes (sludge) from waste water treatment plants incinerator residue compost, or other substance from the Wires solid waste processing plants that are no further use.

2.5 Collection of solid wastes

Households of high income and single dwelling units generate an average dry refuse of three kilograms per day, while the low income and compound dwelling units generate about five kilograms. Of the five kilograms of refuse in the low income units, garbage constitutes four point two five kilograms, and rubbish constitutes zero point five kilograms. The waste invariably consists of items like vegetables and tuber remains (Freduah, 2004).

Municipal governments are usually the responsible agency for solid waste collection and disposal, but the magnitude of the problem is well beyond the ability of any municipal government. They need help. In addition to other levels of government, businesses and the general community need to be more involved in waste management. More and more, governments are realizing that they cannot handle waste management alone. To respond to the

call, many progressive companies are working as equal partners with governments in developing comprehensive waste management programs (Daniel, 1999).

As the generation patterns of solid wastes are more widespread, the total quantity and complexity increases the logistics of transportation problem associated with the collection becomes complex (Particia *et al*, 1997). Collection program demands special vehicle for different types of wastes, experienced people to manage and administer, more specialized machineries, or simple hand tools and man power, monetary fund's to be used for fuel, salaries and maintenance (Tchobanoglous, *et al*, 1993).

Generally, all low and middle income countries have a high percentage of compostable organic matter in the urban waste stream, ranging from 40 to 85 percent of the total. Local governments should minimize residential waste collection frequency to a maximum of twice per week, which is adequate from a public health perspective, but requires social acceptance. Citizens should be encouraged to place their waste in containers that enhance collection efficiency (Daniel, 1999).

The generation of residential, commercial and industrial waste is a diffuse process that takes place in every home, every apartment building and every industrial and commercial facilities as well as in the streets, parks, offices, institutions, and vacant lots of every community (EPHTI, 2004). Waste accumulate at the pit head, garbage in the dust bins of domestic consumer and then at municipal rubbish dump cause hazards to human health, harm to living resources and ecological system (Kebede, *et al*, 1993).

Local governments should focus primarily on residential waste collection, especially from poor and densely polluted areas, and empower the private sector to pick up waste from non-residential sources. Commercial, institutional, and industrial waste collection can usually be self-financing. Local governments should license private haulers to generate revenues and to ensure proper collection and disposal (Daniel, 1999).

As compared to high income countries, municipalities in low and middle income countries allocate the majority of their solid waste management budget to collection and transportation services. Final disposal costs are minimal because disposal is usually accomplished through open dumping (Sinha, 1993).

Different types of collection services are given to residential, commercial and industrial areas. Collection services for residential areas depend up on the type of dwelling (low rise, detached, attached, high rise apartment etc) (Justine, 1993).

The most common types of residential collection services include the following;

1. **Curb:** in this system the home owner is responsible for placing container to be emptied at the curve (road side) on collection day and for returning the empty container back to his house.
2. **Alleys:** this is collection of waste from the alley ways beside houses who take the container to the collection vehicles could be arranged between the owner of the house and the collection crew (the organization).
3. **Set-out:** waste containers are set-out from the home owner's property by additional collection that goes with the collection vehicles. The owner of the house is responsible for returning the empty containers to their storage location.
4. **Backyard/Set-out-Set-back:-** collection crew that goes with the collection vehicle are responsible for bonging out stored waste from the dwelling units and other activities related to collection. It is the only satisfactory system in which the householders do not get involved (Aarne, *et al*, 2002).

2.6 Solid Waste Management (SWM) Planning

Recently, it has become better known result the earth faces several environmental challenges such as acid rain, ozone depletion, climate changes, loss of biodiversity, toxic and hazardous wastes and pollution of water to name a few. These problems led to a more limited accessibility of natural resources, which support human activities and economics (Guy, 2000).

Planning is an important first step in developing public understanding of the need for solid waste management facilities. Planning in the field of solid waste management may be defined as the process by which community needs regarding waste management are measured and evaluated and workable alternatives are developed for presentation to decision makers. Planning of SWM is both exciting and challenging, because most of the technical, environmental economic, social and political factors and the interrelationship that are involved, are not fully understood (TALG, 2008). In case where a state or federal mandate requires a plan, such as mandated waste

diversion goals, it is necessary to add monitoring activities to the frame work (Aarne, *et al*, 2002).

2.7 Effective management of solid waste

A SWM system is a continuous maintenance system. To keep the service running, continuous participation of the community receiving the service, is required.

Solid waste generated at household level should be managed so that zero or minimum community waste is generated.

A. Segregation at household level

Household waste should be stored out or segregated at the source i.e. at household level.

B. Treatment/management of biodegradable household level waste

Effects should be made to treat the segregated biodegradable waste at household level by adopting any one of the following technologies and reuse the treat products;

Composting

Vermin composting

Biogas plants

C. Management of household level non-biodegradable waste

Some of the sorted out non biodegradable waste are of recyclable type (UNICEF, 2008).

Waste which cannot be composed, reused or recycled may be disposed at community level at landfills following appropriate procedure. Treatment of community level biodegradable waste once they segregated waste is collected at the community level, the biodegradable waste may be treated by adopting any of the following technology options; composting, vermin composting and biogas plant. Treatment of non biodegradable waste; the non bio-degradable waste may be further sorted in to various categories (e.g. plastic, paper, metals, cloth etc). Those which are recyclable may be sold or recycled at the community level by adopting suitable technologies (UNICEF. 2008).

In economically effective SWM system money can often be saved with more efficiently designed collection routes, modifying vehicles, and with public education. Environmental policies such as pay as you through can reduce the cost of management and reduce waste

quantities. Waste recovery (that is, recycling, reuse) can curb economic costs because it avoids extracting raw materials and often cuts transportation costs (Carlsson, 2005).

According to Marc (2006), the location of the dumpsites should be properly planned and managed to avoid risks to human health and the environment, at large. Corrective and management measures are likely to be expensive, complex, and pose serious threats to the environment and its inhabitants.

To carry out integrated solid waste management, local governments need partners. National governments must reduce the externalities of waste by considering measures such as full cost accounting, package deposits, manufacturer responsibility, and extended product care. The general community, which is probably the most important stakeholder in waste management activities, must also actively participate in the solutions by modifying their behavior patterns (Daniel, 1999).

2.8 Reuse and recycling of non-biodegradable solid wastes

Recycling is the process by which waste otherwise destined for disposal is collected, reprocessed or remanufactured and used to make a product, while reuse is the process by which waste otherwise destined for disposal is cleaned or repaired for use, for the purposes of prolonging the original product lifetime prior to treatment or reprocessing (EPA, 1996).

Recycling of plastic in all type of solid waste in the urban areas has become a major cause of concern due to;

- Pollution of surface waste
- Random burning here and there causing air pollution problem

There is no proper collection or disposal system of plastic waste.

In spite of composting, reuse and recycling, some waste remains untreated which requires final disposal, either by incineration or by land filling. Incineration is technology where waste is burnt in especially engineered machine hold incinerator. Incineration is not simply burning, but complete combustion. Incinerators are considered to be causes of air pollution. This is not viable option for waste management. A landfill is a properly designated area and used for the disposal of non bio-degradable and bio-degradable wastes (Hall, 1994).

The engines of waste recovery and recycling in the poorer countries includes scarcity or expense of raw materials, the existence of poverty, the low wages of workers, and the large markets for used goods and products. Waste have a value, for compost, the majority of municipal wastes in dump sites as well as materials recovery could be utilized in developing countries (Joseph *et al*, 1993).

2.9 Pollution by solid waste

Disposal of waste materials is a huge environmental problem with many dimensions. Making the environment unclean with waste products is pollution. Any kind of can cause pollution. Waste products can pollute the air you breathe and the water you drink (EPHTI, 2004). As the thermal actions for pollution control of SWs the final target of disposal is isolating solid waste and its environmental impact from any unacceptable hazard from the infection of hazardous components in waste (Yeuan, 2000).

As Yehualashet (2005) stated, solid waste which is called refuse consists of garbage trash from cities and towns, plus byproducts of farming, mining and manufacturing. Such byproducts include animal carcasses and manure from farms and various metals from mines. Almost all methods of waste disposal can cause environmental pollution. Uncontrolled landfill gas emissions are not a sustainable landfill practice. Landfills primarily produce methane and CO₂ which, if not contained, can contribute to the 'green house effect'. Landfill gas can also contain a variety of corrosive, toxic odorous components.

Improper municipal solid waste disposal and management causes all types of pollution: air, soil, and water. Indiscriminate dumping of wastes contaminates surface and ground water supplies. In urban areas, municipal solid waste clogs drains, creating stagnant water for insect breeding and floods during rainy seasons. Uncontrolled burning of and improper municipal solid waste incineration contributes significantly to urban air pollution. Greenhouse gases are generated from the decomposition of organic wastes in landfills, and untreated leach ate pollutes surrounding soil and water bodies (Sha' Ato*et al*, 2009).

Waste attracts rodents and insects, which harbor gastrointestinal parasites, yellow fever, worms, the plague and other conditions for humans, and exposure to hazardous wastes, particularly when they are burned, can cause various other diseases including cancers. Waste can contaminate

surface water, groundwater, soil, and air which cause more problems for humans, other species, and ecosystems (Freduah, 2004).

The closure of existing open dumpsites and the introduction of sanitary landfill is an urgent priority everywhere in the developing world. Even where complementary disposal technologies, such as compositing or incineration (waste to energy plants), are practiced, a landfill is still required and is the backbone of any sustainable disposal system. Matching grants designed to encourage landfill investments and sustainable operations may be appropriate instruments to consider, primarily because the environmental damages and benefits tend to spill over into neighboring municipalities and regions, or into underlying groundwater resources (Daniel 1999).

Most solid wastes are disposed on the land in open dumps. Disposal of solid waste on the land without careful planning and management can present a danger to the environment and the human health. The environment should be clean and less polluted by all means. This means that waste should be managed at all costs to limit its effects to the environment (US E PA, 2006).

2.10 The Urban Environment

The current stoke of urban housing is both insufficient and of very poor quality. The serious deficiencies in sanitation services and inadequacy of sewerage infrastructure and random defection in urban areas have created dangerous health and environmental problems. Environmental changes brought about by the presence of urbanization and counter urbanization; the cause of change with in settlements (Snago, *et al*, 2007).

In general local government is primarily responsible for the service of solid waste management; the most common problem facing solid waste managers is the existence of the adequate services. Among the reasons those leads to these situations are; in adequate resource mobilization, lack of adequate institutional arrangement, and low technical sustainability (Hall, 1994).

In towns, the sanitary board collects refuse from houses and arranges for its disposal. Each house should use a strong dust bin for the storage of house hold refuse (Godman, *et al*, 1994). Costs of waste management include changes in waste storage, collection and disposal, and costs of avoiding leakage of waste in to water courses (Guy, 2000).

With the local governments of developing countries, expenditure for municipal solid waste service is usually from 20 percent to 50 percent of total municipal expenditure. Even at such a high level of expenditure, the level of solid waste services is low and only 50 percent to 70 percent of the solid waste is collected (Sandra, 1995).

2.11 Integrated Sustainable Solid Waste Management (ISSWM)

ISSWM takes an overall approach to creating sustainable systems that are economically affordable, socially acceptable, and environmentally effective. It considered all of the works and programs in solid waste as part of one system. By considering SWM as an integrated system, we can recognize that spending money on one program may save even more money in another program (Karanja, 2005).

The first concept of ISSWM is based on life cycle assessment of a product from its production and consumption point of view. The reduction in consumption and utilization of discarded products within the production system as a substitute for new resources, can lead to reduced end of cycle waste generation; thus less efforts and resources would be required for the final disposal of the waste. And the second concept of ISSWM is based on its generation from different sources including domestic, commercial, industrial and agriculture. 3R approach is applicable both at source as well as at different levels of SWM chain including collection, transportation, treatment and disposal. And the third concept of ISSWM is based on its management, which includes regulations and laws, institutions, financial mechanisms, technologies and infrastructures, and role of various stakeholders in the SWM chain (UNEP, 2009).

As EPHTI (2004) stated, in the wider perspective sustainability implies looking at the whole waste management system, including waste prevention and resource recovery and searching for a system that best suits the society, economy, and environment in question. For integrated sustainable SWM, institutional, Technical and Social aspects are the most important.

Institutional issues includes need for policy changes in order to improve effective and efficient SWM and need to set financial structures at the grass root level to work with communities and institutions.

Technical issues includes needs to focus more on recycling and resource recovery as a common practice and need to focus on environmental impacts (surface and ground water) of solid waste around dump sites.

Social issues include needs to work with informal waste actors such as scavengers at dump sites and environmental education so as to create awareness regarding SWM.

In the whole process from waste minimization to final disposal, how to decide a technical strategy is connected in numerous ways to many decision makers in environmental, economic and social issues. Most of the answers in waste management have a broader implication. It means, a technology or policy has to embody a reasonable balance of feasible, sustainable, environmentally beneficial, and socially sensitive points to municipal SWM problems (WRI, 1991).

2.12 Factors affecting SWM system and solution measures

A lot has been said, written, and demonstrated about the inadequacies in solid waste management and its associated problems. According to the United Nations Conference on Human Settlement report, one third to one-half of solid waste generated within most cities in low- and middle-income countries, end up as illegal dumps on streets, open spaces, and waste lands (UNCHS, 1996).

A major obstacle to the provision of latrines in some urban areas is the small size of the plot allocated for the purpose. Lack of knowledge on the part of householders, unaffordability of household toilets, and several other factors are the main cause of lack of household latrines. Also lack of adequate sanitary facilities results in indiscriminate dumping of refuse and defecation at places not designated for such purposes. Ignorance, negligence, lack of law to punish sanitary offenders, and low level of technology in waste management are the major causes of waste management problems. Awareness should be created among residents to manage household refuse and educate them on the hazards that ill disposed waste could pose to the environment and to themselves (Freduah, 2004).

Waste generation increases with population expansion and economic development. Improperly managed solid waste poses a risk to human health and the environment. Uncontrolled dumping

and improper waste handling causes a variety of problems, including contaminating water, attracting insects and rodents, and increasing flooding due to blocked drainage canals or gullies. In addition, it may result in safety hazards from fires or explosions. Improper waste management also increases greenhouse gas (GHG) emissions, which contribute to climate change. Planning for and implementing a comprehensive program for waste collection, transport, and disposal along with activities requires careful planning, financing, collection, and transport (USEPA, 2002).

There is no single solution to the challenge of waste management. The waste management process is usually framed in terms of generation, storage, treatment, and disposal, with transportation inserted between stages as required. Hence, a combination of source reduction, recycling, incineration, and burring in landfills and conversion is currently the optimal way to manage solid waste (Freduah, 2004).

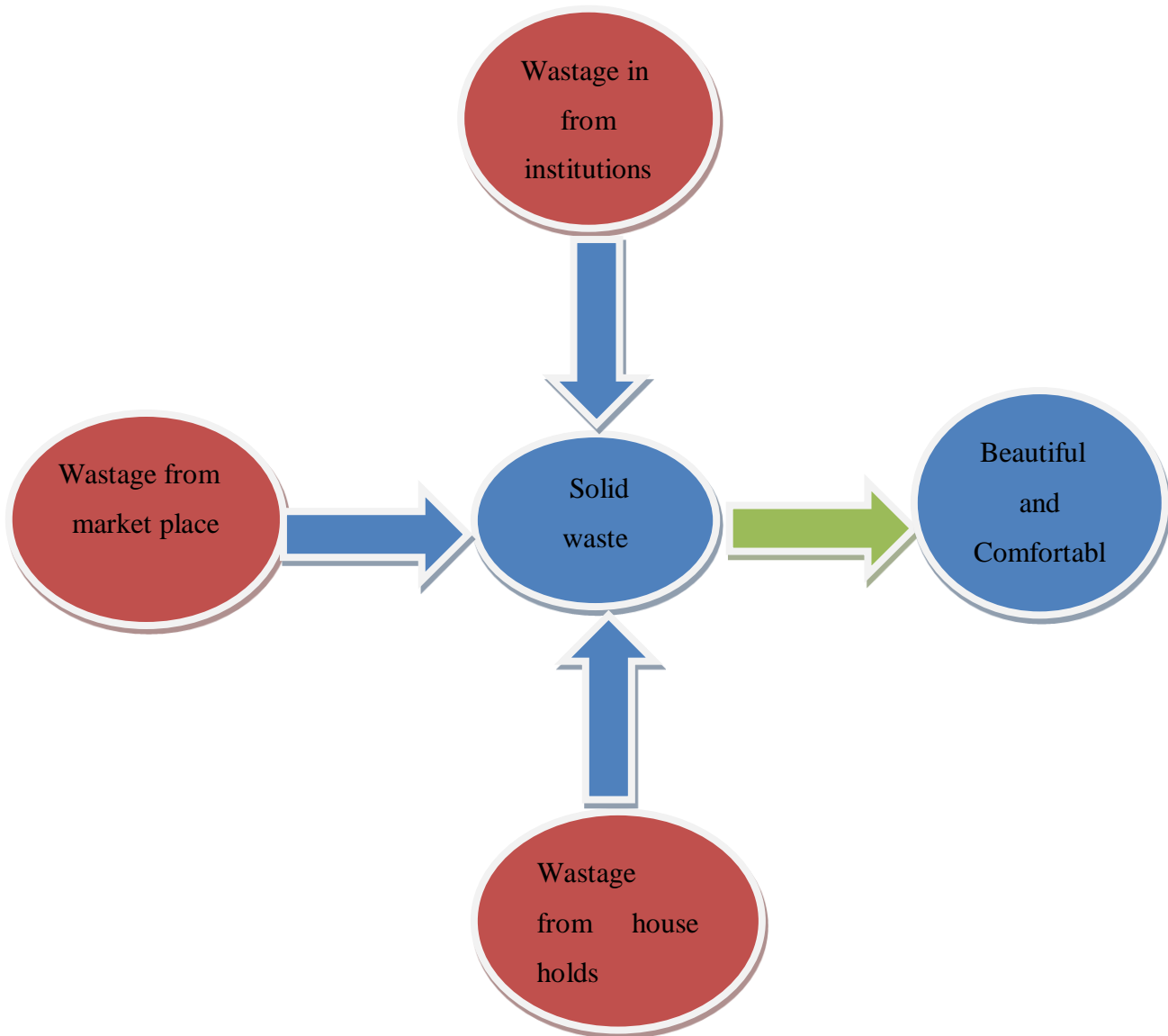
According to Agbola (1993), cultural derivatives, beliefs, perceptions and attitudes are learned response sets. They can therefore be modified or changed through education. These points to the fact that people unconcerned attitudes towards solid waste can be changed for the better through education.

Gourlay (1992) stated that by focusing on the production process itself, examining where wastes are generated, and exploring how they can be reduced, even simple measures, such as separating wastes so that they can be reused more easily, using different raw materials or replacing non-biodegradable products with biodegradable ones, can help achieve large waste reduction results. He also dictated that the greater part of present waste arises not because the producer does not want it, but he fails to use it, or at least use it in such quantities that waste is inevitable.

According to Freduah (2004), pulverization and grinding are means of reducing the volume of waste, or they are used to prepare refuse for final disposal processes. He further stated that in some instances a threefold problem could be overcome by the use of composting. Thus, the feeding of impoverished soils, disposal of large portions of the refuse, and the disposal of sewage sludge can be realized through composting.

Conceptual frame work of the study

This part of the study was presented the conceptual frame work of the study in brief and diagrammatically.



CHAPTER THREE

RESEARCH METHODOLOGY

Under this chapter, description of the study area, location, study population, climate and demographic characteristics of the study area, research design incitation are included. In addition, The selected survey method design indicating the selected survey methods', the total size of the together Population and the techniques employed for the selection of sampled population, different sources of the data collected and instruments used the collect data from different source, and different methods used for analyzing and interpreting the collected data were included.

3.1 Description of the study area

3.1.1. Location

Durame town is found in Kembata Tembaro zone in SNNPRS at a distance of 125km west of the regional capital, Hawassa, 350 km south of Addis Ababa via Shashemene and 298 Kms via Hossana. It also located at a distance of 80 Km south of Hossana town and 12km form the Shashemene Wolata Sodo road form Mazoria which is new part of shone town. Astronomically, the town lies at the coordinate of $7^{\circ} 14^{\circ}$ north latitude and $37^{\circ} 35^{\circ}$ east longitudes. It is boarded by peasant associations in all directions,. In the north by Amberich, Tezaagra, in the east by Abonsa, In the south by Densara, bazana and in the west by Azedebo'o peasant association, Durame is the administrative canter of both Kembata Tembaro zone and kedida Gamelaworeda.

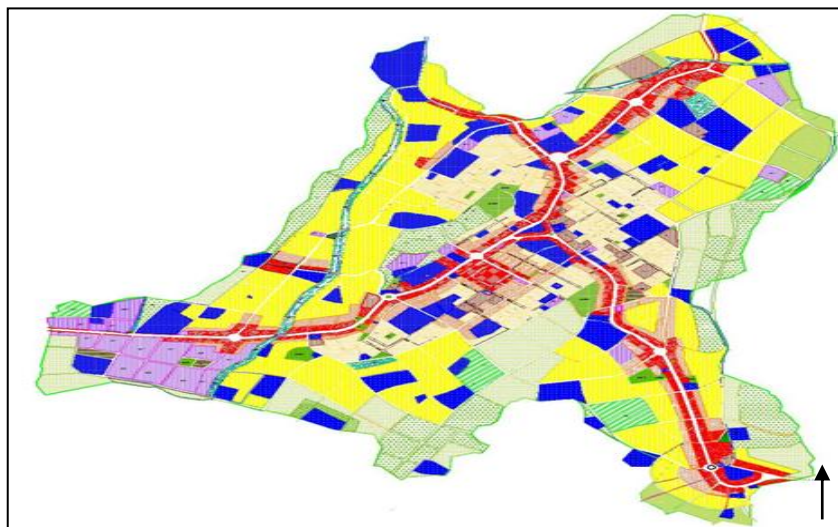


Figure1: Administrative map of Durame Town. Source: Municipality of Durame Town, 2008

3.1.2. Area

Currently the total area of the town is 2006 ha. Out of this only 400 ha accounting for 20% is built up while the remaining area is used for farming and forest (refer to the existing administrative map). The built-up area of the town is found to be consolidated and compact except for few developments found along the exit of main roads crossing the town.

3.1.3. Topography and land form

The topography of Durame town is mixed consisting of gently sloping area at about the center following the main road which falls to the west and east and rises again. In general the town has rolling topography bounded by Ambericho Mountain in the north and also consists of small hills and elevated areas. The elevation of the town ranges from 1990-2240 m.a.s.l showing a difference of 250m within the boundary. The topography of the town has a higher evaluated area at about the geographic center of the town and then falls down and rises to the boundaries of the town in the northeast and south west and west. The land falls from the center of the town to the exits to Matoria, Hosaina and Damboya. The elevation of the town decreases in all directions from the center except the north western part of the town.

3.1.4. Climate

As a result of its topography, within the Ethiopian context, the town of Durame experiences cool temperate climate. According to the traditional temperature zone classification of Ethiopia, (Which is based on altitude) the town is found within the “WoniaDega” Agro –ecological zone. Consequently, it experiences mean annual temperature between 14⁰c and 26⁰c (NUPI, 1999 and AG et al, 2010). The highest temperature is between July and September (National Meteorological services Agency, 2006).

The air is usually humid as a result of abundant vegetation cover and enough rainfall. Durame gets rainfall almost throughout the year. The annual rainfall is 1200-1350mm (Durame, 2011) and reaches up to 2000mm. The highest rainfall is recorded between July and September and the lowest rainfall occurs between November and February which are relatively dry months of the year.

Table 3: Mean Annual rainfall of Durame town

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Rainfall (mm)	1116.5	10990.4	996.6	978.5	123.9	1317.0	730.4	1058.7	1077.0	1326.5

Source National Meteorological service Agency 2006

The planetary wind that blows over Durame changes its direction seasonally in relation to the apparent movement of the sun. From November to February it blows from south west to north or north-east (Kambata –Tembaro zone department of Agriculture and rural Development 2012). Local winds also prevail as a result of the existing physical configuration. These show diurnal change of direction because of unequal heating of the sun and pressure variations. These are of course important winds in modifying the local climate of the town. For the planning purpose it is advisable to locate air pollutant industries and activates related to them in the south western or north waster part of the town in the existing opened spaces. In fact other variables like power supply, availability of water accessibility and distance from source of raw materials and to consumption points have to be considered for location decision of industries.

3.1.5 Demographic Characteristics

The study area is characterized by repaid population growth similar with other parts of Ethiopia. Currently, the total population of the town is 32000 of which 15200 are female and 16800 male (*Source: Durame Municipality*). Accordingly, the ratio of gender indicates that; for every 100 females there are 110 males in terms of composition, the dominance of young age population is high, while old age population is much smaller. This indicates that the study area is characterized by low life expectancy municipality of Durame town, 2014.

3.2 Research Design

The researcher used a mixed approach (both quantitative and qualitative approaches) in the study. For this was a very explanatory study concerned on assessing the current SWM as well as the practices and challenges, a explanatory survey method was employed because of its advantage for describing the existing situation concerning the problem under study in a well manner.

In order to achieve the intended objective of the study, i.e. assessing the SWM system of Durame town with the special focus of practices and challenges, the researcher used both qualitative and quantitative methods to answer research questions. The methods of sample selection for households and key informants were purposive and probability methods respectively.

Qualitative method was used to present phenomena or conditions of the town regarding the problem under study, and it was carried out by presenting, analyzing and interpreting data. This indicates the solution finding system for a problem is based on real evidences. Quantitative method was pertained to computation of simple statistical tests.

3.3 Sample Size and Sampling Techniques

To get reliable data providing the necessary information required to answer the research questions of the study and for the achievement of the intended objectives of the study, both probability and purposive sampling techniques were employed in the study purposive sampling used to gather general information with the issues understudy to provide the general information required to realize the objectives of the study. And probability sampling technique was used to select sample households/respondents of the survey from the target population.

A total of two thousands four hundred ninety two households living/residing in the three/3/ kebeles of town were the target population of the survey. As some studies suggest for social science the researcher by his convenience could select the minimum portion (10% to 30%) of the total population (S.Sarantakos. 2005). Hence; out of these households ten percent of it assumed to be the minimum sample size for this study. Respondents were selected using simple random sampling techniques. Furthermore, stratified random sampling techniques were employed to select the respondent from each. Accordingly; 249 participants were selected using simple random sampling techniques.

Table 4 Total households and sampled respondents/households

No	Kebele	Total households (N)	Sampled households (n)
1	01	903	90
2	02	839	84
3	03	750	75
	Total	2492	249

Key: N- represents census size and
n- Represents sample size

The key informant's officials for the interview were selected using non probabilistic/purposive sampling method from the staff of the municipality and health office workers of Durame town. This is because of the fact that the selected key informants assumed to be well aware of the problem and could provide the relevant information required for the achievement of the intended objectives of the study. Accordingly three (3) officials with different responsibilities from the staff of the municipality and two (2) health inspectors from the health office of the town were selected as key in formals of interview.

3.4 Sources of Data

To achieve the intended objective of the study, relevant data required for this study were collected from both primary and secondary sources.

In order to get first hand information about the problem under study, data were collected from primary sources, particularly from randomly selected sampled households, using both open ended and close ended questionnaires from purposively selected key informants of the study form the staff of the municipality and form the health office of the town using semi-structured interview and form the observation of the researcher made the issue under study using check list were collected from purposively selected key informants in the study area; who are the staff member of the municipality and health office inspectors of the town.

Moreover, secondary data providing relevant information to this study tried to obtain from different documents related to the issues under study and those found in the municipality of Durame town and in the health office of the town.

In addition, published materials and other relevant materials were revised to obtain secondary data.

3.5 Instruments of Data Collection

To obtain sufficient and reliable information required for the achievement of the intended objectives of this study from both primary sources and secondary sources, the following data collection tools were employed.

3.5.1 Questionnaire

In this study, to gather firsthand information from sampled households/respondents, the questionnaire with both open ended and close ended questions was prepared. The questionnaire was prepared in English language and to avoid language barriers it was translated to Amharic language. The questionnaire was pretested and reframed based on the experience gained during the pretest. Then, the questionnaire was distributed to randomly sampled households/respondents to gather the relevant information required for the study to achieve its general and specific objectives.

The questionnaires with close ended items aimed to provide the sampled household/respondents alternative options those helped them to choose one option that best meets/aligns their views regarding the problem under study from the alternatives provided under each question item. In order not to influence sampled respondents to choose only from the given alternative, even if what the respondents believe as the best response of the question is not included in the alternatives provided; for each close ended item one blank space was prepared to specify their response at the end of the alternatives.

The open ended items were included in the questionnaire with the aim of giving the sampled households/respondents an opportunity to express their feelings, perceptions and suggestions related to the problem under study. The open ended items also significantly contributed to obtain qualitative data required for the study.

3.5.2 Interview

Interview aimed with supporting and strengthening to first hand information obtained from the response of sampled households/respondents using both open close ended questionnaires and targeted to examine the response of the sampled households in relation to the response of key informants, were conducted with purposively selected key informants of the municipality and health office of the town.

From the types of interview; semi structured interview was preferably selected to be used for the interview conducted with purposively selected key informants mainly because of its advantage of flexibility to raise or forward new questions based on the responses of the interviewee during the interview. The interview conducted with purposively selected key informants from the staff of the municipality and health office of the study area mainly contributed for this study to collect qualitative data.

3.5.3 Field Observation

In view of supporting and realizing the information obtained from the sampled households/respondents using open ended and close ended questionnaire, and form purposively selected key informants using semi structured interview and with the aim of examining and assessing the existing condition of the study area in favoring and affecting the issue under study the researcher also conducted field observation using check list.

3.6 Method of Data Analysis

On the basic of the data that was collected from both primary (from sampled households from key informants from field observation and secondary data sources (from key informants and published and unpublished materials) the researcher was analyzed and interpreted in accordance with the nature of the data replied by respondents. And the data was summarized by a sample descriptive statistics using tables, graphs and figures.

The quantitative data mainly obtained using close-ended questionnaire was analyzed by simple descriptive statistics like percentage, average and etc..., and the result was summarized in the form of table and graph. The qualitative data (perception, opinion, attitude etc) mainly obtained

using open ended questionnaire and semi structured interview including the researcher's observation were analyzed, described and interpreted in the form of narration.

After the whole efforts attempted above have been made the researcher was endeavored to identify the prevailing problems, comments and suggestions forwarded concerning the problem understudy and improvements that needs to be made over the problem in order to tackle the major clause of the problem and ensure safe and environmentally sound solid waste management system.

3.7 Ethical Issues

The current researcher, first of all, has received a recommendation letter from his department and taken to the municipality of the given town for the sake of informed consent; met a gatekeeper of the community and discussed on some ethical considerations with him. Having mutual agreement on the given issues, the researcher recruited key informants which are more concerned to the study topic among inhabitants and got permission to recruit additional informants. Then after, he recruited the data collectors to conduct interviews with the participants. All recruited respondents have participated in interviews and questionnaires. For the sake of security of the individuals, the responses of the participants were used without the individuals' names. The data collected through the interviews, surveys and observations were used to triangulate the validity of the information.

CHAPTER FOUR

RESULT AND DISCUSSIONS

Under this chapter the data gathered on the problem under study from households using both open ended and close ended questionnaires and from the KI of the staff of the municipality and health office of the town using semi structured interview and the information obtained by the researchers observation using check list were analyzed and interpreted.

4.1 House hold Characteristics

To get the necessary information on the given topic, households were selected using simple random sampling technique were the main target population of this study. There are significant differences among sampled households in terms of their sex, religion, and educational background. The underlying table clearly illustrates household characteristics of the sampled households. As shown in Table 4.1, the percentage of male and female household heads/respondents accounts 72% and 27.7% respectively, the level of education as indicated in the above table about 8%, 18%, 60% and 13.7% had educational status of basic education, elementary, high school and higher education respectively. Regarding the background of respondents' religion 96% of them were Christian and 4% of them were Muslims.

Table 4.1 Demographic Profiles of the respondent households of the survey

No.	Characteristics of respondents	Description of characteristics	Frequency	Percentage
1.	Gender	Male	180	72
		Female	69	27.7
		Total	249	100
2.	Religion	Christian	239	96
		Muslim	10	4
		Total	249	100
3.	Educational Status	Basic Education	20	8
		Elementary	45	18
		High School	150	60
		Higher Education	34	13.7
		Total	249	100

4.2 Types of Solid Wastes Regularly Generated from the Town

According to PAN (2008), SWM in developing countries tend to pay little attention to the issue of reducing organic wastes which make up from 50% to 90% of the total waste generated. While the quantity of solid wastes generated by society is increasing, the composition of waste is becoming more and more diversified with increasing use of packaging materials made of both paper and plastic. In this study in order to identify the major types of solid wastes found in the study area, information gathered from the different data sources. The information obtained from

sampled households; on the major types of solid wastes of the study area using questionnaires presented using table and graph as follows.

Table 4.2 regularly generated types of solid wastes (Durame)

No.	Item choices	Frequency	Percentage %
1	Paper waste	27	10.8
2	Demolition and construction wastes	43	17.3
3	Plastics	38	15.3
4	Food waste and their packaging	173	69
Total	4	281	112.4

The total households participated in this study was 249 but due to multiple response rate the number of households exceeds 249 and reaches 281. The description in Table 4.2 above indicated the major types of solid wastes regularly generated from the town. Accordingly, the sample households were asked about the types of solid waste that prevailed in their town, and more than half of them (69%) responded food waste and their packaging materials, while nearly a little less than quarter of the respondents/households (17.3%) responded demolition and construction waste as a major type of solid waste. Regarding the major types of solid waste of the study area, out of the total respondents/households, (15.3%) and (10.8%) of them responded plastics and paper waste respectively.

The data obtained from the staff of the municipality and health office of the town using interview indicates that the major types of solid waste prevailed in the town are food waste, packaging, papers, wood, plastics, concrete, dirt and etc. The information obtained from the municipality and health offices, to identify the major types of solid wastes of the study area were not good enough to determine the extent of each types of solid wastes because in both offices there were no any statistical documented sources regarding this issue. But they mentioned that since there is no any industry /factory found in the town there were no any solid wastes generated from industrial sources. In addition since there is no strong agricultural activity in the

town, it is difficult to mention agricultural wastes as a major type of solid wastes in the town. Although the information from the municipality and health office regarding the major types of solid wastes were not enough to statistical present the types of solid wastes, it clearly indicated as food waste and different used packaging materials generated from households, hotels, cafeterias as the major type of solid waste .Furthermore, in accordance of the information obtained from the key informants different wastes from the construction and buildings including concrete, wood, dust and etc, were given the position of second dominant types of solid wastes of the study area. The KIs also mentioned used plastics by households and different business institutions as another dominant type of solid waste. The information from both purposively selected KIs also specified paper waste from different government offices and educational institutions as other dominant types of solid wastes.

Generally, concerning the major types of solid wastes of the study area, the data obtained from households and the staff of the municipality indicates food waste and their packaging as the main types of solid waste followed by demolition and construction, plastics and paper wastes respectively. This is because of the poor awareness of most residents concerning the potential impact of poor management of solid wastes on their local environment and their health. As a result they throw their wastes mainly food waste in front of their home and on every corner of the town. In addition, the large number of construction of different buildings and institutions made demolition and construction wastes the other significant types of solid wastes of the study area.

While the quantity of solid waste generated by society is increasing, the composition of waste is becoming more and more diversified with increasing use of packaging materials made by both paper and plastic. (Karanja, 2005). Similar to the above stated literatures, the information obtained from the target population of this study revealed the generation of different types of solid wastes in the study area.

4.3 Major Sources of Solid Wastes Durame Town

As indicated in Table 4.3, there are different types of solid wastes generated from different sources. In this study, it was also targeted to identify the major sources of solid wastes of the study area.

Being one target of this study was to identify and indicate the major sources of solid wastes contributing to the dominant types of solid wastes found in the study area, the data were collected from the sample population of this study. The information obtained from sampled households/respondents using questionnaires regarding the major contributing solid waste sources of the study area revealed the existence of different sources. The underlying table indicates the response of sampled households regarding the major sources of solid wastes found in the study area.

Table 4.3 Dominant sources of solid wastes (Durame town)

No.	Item choices	Frequency	Responses in%
1	Residential	150	60
2	Construction and Demolition	55	22
3	Commercial and institutional	44	18
4	Agricultural	-	-

As clearly indicated in the above table 4.3, 150(60%) of the total households/respondents replied that the major sources for solid wastes regularly generated in the town was from residential sources. While 55(22%) of them responded construction and Demolition sources jointly are the major sources of solid wastes. While 44(18%) from the total respondents replied choosing Commercial and Institutional sources as a major contributor of dominant types of solid wastes in the town. The data in table 4.3 also shows as agricultural sources were not considered as one source of the study area by any of the sampled households. Although, the respondents replied as agricultural sources have no any contribution for solid wastes observed in their town, the researcher observation revealed that there was solid wastes generated from agricultural sources, and especially spoiled food wastes are visible in different disposal sites.

In addition, the information gained from the municipality and health office of the town realized that the major sources of the solid wastes generated in the town is residential contributing the dominant solid wastes of the town such as food waste, wood, ashes and etc. And since new standardized road for the town and different buildings are under construction now a days, construction and demolition also became a significant source of solid wastes in the town

enhancing the generation of wood, steel, concrete, dust and etc. Furthermore, the key informants of the interview mentioned the role of commercial and institutional sources have for the generation of different types of solid wastes commonly found in the town contributing food waste, paper, plastics and etc. in the town.

Therefore, concerning the major sources of solid wastes in the town, the municipality and the staff of health office supported the response of sampled households because they also mentioned residential wastes which includes plastics, wood , glass, food waste, paper etc as the priority sources of solid wastes generated in the town which is followed by construction and demolition sources which are also sources for solid wastes such as packaging, housekeeping wastes, food wastes, plastics and etc, and commercial and institutional sources which includes wood, steel, concrete, dirt etc are the remaining sources of solid wastes regularly generated from the town.

There are different sources which generates the municipal solid waste in large quantities which is difficult to manage. Any place where human activity is involved solid waste is generated in the form of vegetable remaining, food waste, used plastic bags, plastic containers/bottles, from residential area in significant quantity adding another pollutant-thermocool in it. It has created very serious problem of disposal because of its life span. Due to urbanization and population growth many construction activities are seen in recent years resulting in to creation of construction/demolition wastes or debris (Pervezalamet *al*, 2012). Also regarding the major sources of solid wastes of the study area, the data in above table and the response of key informants indicated the presence of different sources responsible for the generation of dominant solid wastes of the town indicated under the topic major types of solid wastes of the study area.

The major sources of solid wastes in developing countries as compared to the developed countries, the major sources of solid wastes generated more is different, since industrial and demolition wastes are the major case in the developed countries (Pervezalamet *al*, 2012). But the obtained information on major sources of solid wastes of the study area indicated the dominance of residential sources.

In general, concerning the major sources contributing for the dominant types of solid wastes in Druame the information gained from the target population indicated, the absence of industrial activity contributing for industrial wastes and absence of strong agricultural activity causing the generation of agricultural wastes, which in turn made the residential source the primary source of solid wastes generated from the town.

4.4 Commonly Practiced Solid Waste Disposal Systems

In order to realize the target of the study regarding the identification of the common disposal system dominantly practiced by the community of the study area, and to examine the disposal methods commonly practiced by the community in relation to their impact both on the surrounding environment and on the health of the community of the study area questionnaires were distributed to sampled respondents/households. The response of sampled households on the major solid waste disposal methods practiced by the community of the study area illustrated using the underlying table and graph.

Table 4.4 Practice of solid waste disposal Durame town

No.	Item choices	Frequency	Percentages %
1	sanitary land fill	8	3
2	Open burning	100	40
3	Open dumping	110	44
4	Composting	31	12

Figure 2 common practiced solid waste disposal system Druame town (source: sampled households)



Of the total method of solid waste disposal system commonly practiced in the study area from the sampled households, 110(44%) of them responded as they use open dumping at solid waste disposal site to dispose their wastes. And 100(40%) of the respondents indicated they are using open burning of wastes from the remaining sampled households 31(12%) of them practice composting as 8(3%) of solid waste disposal. The above information indicates open dumping and open burning of wastes have been extensively used in most parts of the town. Even if small number of the respondents replied sanitary land fill as their common disposal system, the information obtained from the municipality indicates lack of sanitary land fill site in their town. Therefore, it is possible to say that sanitary land fill is not among the disposal system of the town.

About the solid waste disposal system commonly practiced Durame town the information obtained from the selected workers of the municipality and health office of the town using interview also indicated open-dumping and open-burning are the primary system used by residents of the town. Being asked about the practice of sanitary land fill and composting the interviewee replied that the above mentioned two disposal system were rarely practiced by the community due to different factors such as lack of appropriate sanitary land fill, and poor awareness of the community on the advantage of composting. They also mentioned as less was done on awareness creation campaign to enable the community to practice the preferable ways of solid waste disposal methods.

Composting of organic waste makes available nutrients for soil replenishments and reduces amounts of waste to land filled (Karanja, 2005). However, the information obtained from the target population indicates as the most advisable way of solid waste disposal method i.e. composting was rarely practiced by the community of the study area due to different factors indicated under factors affecting SWM of the study area. It was the sum total of those factors that made solid waste management activity one of deep rooted problem of the study area, providing the town ugly appearance and bad smell, in addition to its major damage on the environment and health of the residents. The underlying photo was taken from one of the open dumping sites of the town to indicate mainly lack of sanitary land fill sites in the study area.



Figure 3: Open dumping site found behind Teklehaimanot Church, Durame (Source: Field Survey)

Open burning is the most unacceptable method of disposal of solid waste. The low temperature burning of plastics and PVC emit highly toxic gases such as dioxins and nitrous oxides to the atmosphere. Open dumping is uncontrolled and scattered deposit of wastes at a site. It leads to acute pollution problems, fires, high risk of disease transmission and open access to scavengers animals. It is not a scientific way of waste disposal because open dumping is an uncovered site used for disposal without environmental controls (Mohammed *et al*, 2012). Although both open dumping and open burning are environmentally able to cause a serious pollution in the air we breathe and water we drink and soil and land degradation, regarding the communal disposal system of the study area the information obtained from sampled households and key informants makes open dumping and open burning the two dominantly practiced disposal methods Durame town.

Landfill should be designed, located and operated based on national, international guidelines, environmental impact analyses, and environmental friendly which take into consideration the accurate climate data precipitation, evaporation, temperature, and wind direction beside the location from residential areas and the groundwater level. It must also be recognized that good engineering and management of a landfill can be used to maintain a perennial water deficit within the landfill by maximizing runoff and minimizing infiltration into the waste (Abu, 2001). But the open dumping sites of the study area were not sited taking in to account the topography

of the area, the natural environment of the surrounding and the health condition of the nearby residents.

In general, based on the information obtained from various sources magnified, lack of environmentally effective and efficient solid waste disposal methods, the dominance of environmentally hazardous solid waste disposal methods and the need for rapid solution measures to change those environmentally hazardous solid waste disposal methods in to safe and scientifically advisable ways of disposal methods before causing unmitigated damage to the surrounding environment of the study area and health condition of the residents. Unscientific and ordinary Land filling is the common practice for solid waste disposal in many developing countries (Sha' Atoet *al*, 2009). However, it were not only the information obtained from different sampled households, but also, the field survey made revealed lack of Sanitary Landfill Sites in the study area. The underlying photo depicts the dominance of open dumping and the contributions of Institutional sources have for solid wastes of the town.



Figure 4: Open dumping site found in the market center Durmae town) (Source; Field survey)

4.5 Communal Disposal sites of Durame town

To identify the total number of solid waste disposal sites found in the study area, questionnaire was distributed to sampled households. The information obtained from those sampled households revealed significant awareness variation among households about the total number of disposal sites found in their town. The underlying table is the result of sampled households regarding the common disposal sites available in the study area.

Table 4.5 Total number of available communal solid west disposal site (Durame town)

No.	No. of sites	Frequency	Responses
1	No site	25	10
2	3	80	32
3	4	110	44
4	Many sites	34	14
Total		249	100

Regarding the knowledge of the respondents on the availability of communal solid waste disposal sites , the data in table 4.5 shows that, out of the total respondents 110(44%) of them responded the existence of four communal solid waste disposal sites in the town. And 80(32%)of the households responded as there are three communal solid waste disposal sites are found in their town. From the remaining respondents 34(14%) of the households replied as there are many communal solid waste disposal sites are available in the study area. Furthermore, the information in table 9 realized that, 25(10%) of the respondents has no any information about the availability of communal solid waste disposal sites in their town and responded the total absence of disposal site in the study area. This is why they responded as there is no any disposal site used for disposing their wastes.

The response gained from sampled households indicates the existence of big difference among the community regarding the total solid waste disposal sites exist in their town, because out of the total respondents, only 44% of them know the exact number of solid waste disposal sites available in their town.

The information obtained from the municipality of the town using interview regarding the availability of communal solid waste disposal sites signifies as there are four sites (near Tekelehamont in east the in the south and Durame high school in west poly technique college, in the north Durame hospital are available for the disposal of solid wastes in different parts of the town. The information gained from the municipality also indicates that, it is only one of these sites are being used properly by the local people. The underlying problem for this are the absence of the provision of waste disposal equipments by the municipality and improper use of holes allocated for disposal purpose by the people.



Figure 5: Open dumping site Durame Highschool (source: Field survey)

The observation made by the researcher to identify the exact number of communal solid waste disposal sites available in the study area realized the information obtained the municipality i.e. four communal solid waste disposal sites are available in the town. Although four sites are available, due to the above mentioned and other factors, as indicated in the above figures, the researcher observed solid wastes of different types dumped in and around dumping sites, and in every corner of the town.

In general, the information obtained from the sample households, municipality of the town and the researcher's observation regarding the knowledge of the respondents concerning the availability of communal solid waste disposal sites revealed the poor awareness of the people. In addition, the observation of the researcher realized that all of those sites were not properly used by the community, because of the fact that most people dispose their wastes in a near distance of those sites before reaching their exact place. As a result it is very common to see solid wastes of different types dispersed on open fields around those disposal sites.

The Environmental Protection Agency has established a hierarchy of SWM practices that places the highest priority on source reduction and reuse, followed by recycling and composting, then by waste-to-energy, and finally land filling (EPA, 1999). But the data obtained from sampled of the study indicated lack of appropriate expertise engaged in awareness creation and the introduction of recognized activities (source reduction, recycling, and composting) to enable the community of the study area to practice those activities capable of reducing the environmental impacts of solid wastes.

Though sanitary landfill is the most common technology around the world, the conventional and environmentally un friendly methods including open-burning, open dumping and non-sanitary landfill can still be evidenced (UNEP, 2009). In the same way, the study area was significantly characterized by the lack of sanitary landfill sites used for safe disposal of solid wastes, and by the dominance of unsanitary ways of disposal of solid wastes, particularly by open dumping and open burning.

The cheapest and the oldest easy method of managing solid waste disposal is open dumping. It is not a scientific way of waste disposal, because open dumping is an uncovered site used for disposal of waste without environmental controls. Composting of organic wastes makes available nutrients for soil replenishment and reduces amounts of waste to landfill (Mohammed *et al*, 2012).

Although, open dumping is the oldest and scientifically un supported method of solid waste causing high risk of disease transmission and environmental pollution, the information obtained from the target population of this study realized even the existence of such disposal sites un proportion to the total number of the residents. The underlying photo was taken to indicate the feature of the fourth solid waste disposal site of the town and to visualize un controlled solid waste management of the study area. It was the absence of sanitary Landfill Sites and rarely practiced composting to dispose solid wastes of the study area caused the evidenced environmental and health problems.



Figure 6 Photo taken from the open dumping sites around market, Durame town (source: Field

No.	Responses	Frequency	Responses in
1	Yes	29	12
2	No	220	88
Total	2	249	100

survey)

4.6 Labors Available for Daily Removal of Solid Wastes

Safe and environmentally sound SWM system requires various infrastructures and facilities to be fulfilled. In addition, availability of labors in charged with daily removal of wastes generated by the community and engaged in street sweeping are also equally important. The response of sampled households regarding the availability of labors in charged with the above mentioned activities in underlying table as follows.

Table 4.6 Preference of the study population for and against available labors

(Durame town)

In table 4.6, the responses of most households i.e., 220(88%) marked that there was no labor in charged with daily removal of solid waste. Inversely, 29(12%) of them responded as there was labor engaged with daily removal of solid wastes in the town. Most of the respondents replied “no” and they gave their justification that they their SWMs around their home and dispose by using ordinary open burning and open dumping.

As pertaining to the issue stated above, the researcher also conducted an interview with the selected staff of the municipality to get supplementary information and to realize the responses replied by sampled households. The data obtained from the staff of the municipality also revealed the absence of labor engaged in a daily removal of solid wastes in the town. The interviewee from the staff of the municipality mentioned the less attention given for the issue and financial problem as a cause for the absence of employees for daily removal of solid wastes. Also they are now understood that the poor SWM of the town is becoming a serious problem influencing the health condition of the residents and the attractiveness of the town. To solve these problems they said that within a short period of time our office starts taking the appropriate major in order to improve unorganized ways of SWM system of the town. In general, although some households out of the total respondents responded as there is labor in charged with daily removal of solid wastes, the response gained from the municipality of the town and the observation made by the researcher affirmed the absence of labor engaged with daily removal of solid wastes in the town. It is due to these and other factors that solid wastes of different types are visible in every parts of the town.

4.8 Application of Integrated Sustainability in SWM System

ISSWM system is a key principle that helps to achieve effective and environmentally sound SWM, dictating the necessary activities needs to be performed from the generation to the final disposal of solid wastes. To identify the application of such system in his study area, the researcher collected information from the sampled households. The underlying table illustrates the result gained from households regarding the application of ISSWM system.

Table 4.7 Responses of households on the integrated sustainability of SWM system Druame Town)

No.	Items	Frequency	Response in
1	Yes	16	6
2	No	233	94

According to Table 4.7 among from the total respondents' asked about the issues 233(94%) of them replied "No" and 16(6%) of them responded "Yes". From this data one can understand that there was no adequate technical sustainability of SWM system in Durame town. Even if, small percentages of sampled households responded supporting the existence of Integrated sustainable solid waste management system in their town, but without the necessary materials used for collection of solid wastes, in the absence of environmental education and the importance of 3R, in a town without sanitary land fill sites, with allocating enough funds, it is not possible to realize integrated sustainable solid waste management system. In addition, the information obtained from KI, affirmed the complete absence of this program Durame town.

In the same way the data obtained from the staff of the municipality and health office reflects as less emphasis is given for the issue of sustainability regarding SWM of the town. Although the municipality of the town recognized the importance of integrated sustainable SWM for the protection of urban environment and health of its residents, the municipality was unable to assign any appropriate or professional expertise to coordinate the work of SWM in the town. Being asked about the issue the municipality responded that it is the shortage of different infrastructures such as shortage of clean water, electricity and standardized road of the town the office to give priority to tackle the above mentioned problems which in turn influenced other activities of the municipality including SWM. The municipality also mentioned financial constraints as other factor behind the absence of integrated sustainability of SWM program in the town.

Regarding the issue of ISWM, the information gained from the health office also indicated the complete absence of such system in the study area. They mentioned it is lack of ISWM system, which made solid waste of the town the principal source for the causes of environmental diseases; particularly it is a source for population of flies and rodents.

As stated in UNEP (2009), if most of the waste could be diverted for material and resource recovery, a substantial reduction in final volume of waste could be achieved and the recovered material and resources could be utilized to generate revenue to fund waste management. This forms the premise for integrated solid waste management system based on 3R (reduce, reuse and recycle). ISWM takes an overall approach to creating sustainable systems that are economically

affordable, socially acceptable and environmentally effective. However, the collected data indicated as most of the communities of the study area, instead of managing their wastes on the basis of 3R, they commonly deal on the disposal of solid wastes in environmentally hazardous ways.

Developing and implementing ISWM requires comprehensive data on present and anticipated waste situations, supportive policy frame works, knowledge and capacity to develop plans/systems, proper use of environmentally sound technologies, and appropriate financial instruments to support its implementation.(UNEP, 2009). But, the information gained from the municipality revealed lack of sufficient materials used for hauling wastes, financial constraints to implement Integrated Sustainable Solid Waste Management system and absence of supportive frame work and etc to effectively undertake this program.

The environmental benefit of ISWM includes preventing waste, reducing waste sent to the land fill, which may have negative impacts on ground water, and air quality and it is a wise stewards of the land and its natural resources (EPA, 1999). However, lack of such system in solid waste management activity of the study area aggravated the role of solid wastes in polluting the surrounding environment and its contribution of creating conducive environment for the causes of environmental diseases.

4.11 Factors affecting SWM system In Durame Town

The decomposition of waste into constituent chemicals is a common source of local environmental pollution. This problem is especially acute in developing nations. Very few existing landfills in the world's poorest countries would meet environmental standards accepted in industrialized nations, and with limited budgets there are likely to be few sites rigorously evaluated prior to use in the future (Sha' Atoet al, 2009). This study also identified the major factors those made the solid waste management system of the study area the cause of environmental and health problems.

The information obtained from the sampled households using open ended questioners revealed that some of the factors affecting the SWM system of the town are lack of appropriate skilled man power in the area to coordinate SWM activities as well as the appropriate site, absence of

labor engaged in daily removal of solid wastes and in street sweeping in the town affects the sanitary of the town by making it ugly and smelly, absence of materials/equipments to collect the waste in different parts of town is the another challenge. The other challenge was the municipality didn't work a lot on community mobilization regarding SWM system.

The interview conducted with the staff of the municipality of the town to get the necessary information regarding factors affecting the SWM system of the study area revealed the existence of the following major factors behind the poor management of the town.

Above all it is a financial problem that made the office not to give the necessary attention for SWM, because shortage of various social services (clean water, standardized road) made the municipality to give priority of fulfilling those services. As a result, the municipality was unable to provide the necessary materials used for hauling of solid wastes, to prepare sufficient and safe disposal sites, to employ labor engaged in daily removal of solid wastes, etc. The information gained from the staff of the municipality also indicated that, the absence of local NGOs those contribute financial and technical support on such aspects made the problem to entirely rely on a shoulder of the municipality.

In developing countries, the main motivations for waste reduction are frequently related to legislation, environmental protection, the scarcity of sites for landfills. Urban centers which do not have effective collection and disposal systems should not devote resources to developing waste reduction measures until adequate waste management systems are in place. (Dijk, 2006). Concerning factors affecting the SWM system of the study area, KI from the staff of the health office, mentioned the small number of disposal sites and their improper location as a major factor contributing for SWM problem of the town. Furthermore, KI from health office supported most of the factors stated by sampled households; such as lack of appropriate person to coordinate SWM activities, absence of the necessary materials used for hauling of wastes in different parts of the town, etc.

The researcher's observation made using check lists also signifies the reality of the above mentioned factors as the main problem behind the poor management of solid waste observed in the town. The researcher realized that there are no materials assigned for hauling of wastes in the town. Although there are four disposal sites are found in the town, those sites are not selected

considering the environment and health conditions of the residents of the study area. Particularly near the disposal site that found around Teklahayemanote Orthodox church, there is a stream used for drinking and other home services. In addition, since those sites were selected before (8 years, now they are found town as the town is growing in size in all direction.

As a researchers observation the housing condition of the town revealed poor with high magnitude in regards of their floor, walling, the roof, and their surrounding environment. Poor housing condition predisposes to breeding of insects (vermin) infestation, flies and also improper management of solid waste.

Furthermore, the researcher's observation indicated that the residents of the town are not properly using the available disposal sites because of absence of dust bins as well as garbage storage; it is common to see accumulation of solid wastes in a near distance of those disposal sites and in any open spaces of the town including the road sides of the town in the study area. Also as the data collected from sampled households regarding the major disposal methods used indicates the most common system are ordinary open dumping and open burning which are capable of causing serious environmental and health problem in the study area. Therefore, the methods used for disposal of solid wastes supplied by the researcher's observation are indicators as the residents of the town especially women and children have poor awareness regarding the environmentally friendly methods of SWM and the impact of in appropriate SWM system on their environment and health. Since the throw it in the early morning to the road side

In general, regarding the factors behind the poor SWM system of the study area, responses from the sampled households, KIs, and the researcher's observation revealed the following major factors.

4.11.1 Institutional Factors

Lack of proper plan to realize effective and efficient SWM activities from the municipality and inability of this office and other institutions to set financial structures and to provide the necessary materials and equipment's used for safe solid waste disposal, in addition to the weakness of the municipality to work in cooperation with the community on the issue of SWM are some institutional factors behind the poor SWM of the study area.

4.11.2 Technical Factors

The information obtained from sampled households indicated that most community of the study area are practicing open burning and open dumping as a major disposal methods. This indicates as more attention is not given on recycling and resource recovery as a common practice. In addition the location of solid waste disposal sites of the town also indicates as no focus made on the environmental impacts of solid waste, because there are surface waters around dump sites. As a result it possible to mention technical factors as another cause of SWM problem of the study area.

4.11.3 Social Factors

The response of sampled households strongly reflected the poor awareness of the community about the close relationship existing between solid waste and their environment and their health. This was due to the fact that little effort made by concerned body to give health and environmental education so as to create awareness among the people.

Therefore, in addition to Institutional and Technical factors, Social factors are other factors behind the SWM problem of SWM is one of the functions that have been developed to local government in a number of developing countries. Its proper handling of this task is often taken as an indicator of the successfulness of urban reform. Public services delivery has been failing in developing countries for a long time. The expectation was that decentralization and private sector participation in developing countries would improve service delivery, which has often not happened (Djk, 2006). Similarly, the information obtained from different sources of this study revealed the weakness of the local government to effectively manage the solid wastes generated from the town.

Developing countries face uphill challenges to properly manage their WM with most efforts being made to reduce the final volumes and to generate sufficient funds for WM management (EPA, 1999). In the same manner, in Durame town, the mandated body to undertake the SWM activities of the town, i.e. the municipality of the town, was un able to discharge its responsibility effectively mainly due to financial problem required to run the activities of SWM on sustainable basis.

4.12 The waste disposal system needs to be adopted Durame

Concerning the disposal system they are practicing, households indicated that they are using disposal method such as open burning and open dumping, because they are easy to get rid of their solid wastes. Also they mentioned as they have no a knowledge of the relationship existing b/n the disposal system they are using and their environment. Households claimed that it is the duty of the municipality to create awareness for the community of the town regarding the waste disposal system needs to be adopted which is environmentally friendly.

The response of sampled households indicates as most community of the study area lacks the knowledge of alternative disposal methods and the impact of the methods they are using on their environment and their health. As a result, most households were unable to suggest disposal methods needs to be adopted to replace the environmentally hazardous ways of disposal in the study area..Due to the fact that the information obtained from sampled households, regarding the waste disposal methods needs to be adopted was unsatisfactory, in order to get relevant information about the issue, the researcher conducted interview with selected key informants. Recognizing as the current disposal methods commonly practiced (open dumping and open burning) in their town are causing environmental and health problems, the staff of the municipality expressed their strong belief as changes need to be made to those disposal methods. The municipality also stressed that, it is very difficult for their office to prepare SANITARY LAND FILL sites and to provide the necessary materials and equipments required to effectively manage solid wastes generated from their town within a short period of time. However instead of open burning and open dumping the community should use composting. In order to minimize the impact of solid wastes, the municipality also suggested that, the people should use the available disposal sites properly.

Taking the existing condition in to account i.e .lack of most necessary equipments and materials used for safe and environmentally disposal methods of solid wastes in the town, the staff of the health office suggested composting as the only major option of solid disposal to replace pre dominantly used open dumping and open burning. Composting is the most responsible technical solution for many developing countries especially, where the climate is arid and the soil is in serious need of organic supplements (Sha' Ato *et al*, 2009)

In general the obtained information from all target population i.e. households, the staff of the municipality, the staff of health officer, and the researchers observation depicted that the major disposal methods practiced in the town are open burning and open dumping which are capable of

causing environmental problems such as water pollution and soil and land management problems. Therefore, the municipality and the community need to change those environmentally hazardous ways of solid waste disposal in to more accepted and sanitary ways of solid waste disposal methods such as Sanitary Land Fill and composting.

4.13 Suggested Solutions to Make SWM System of Durame Town

Environmentally Friendly

In developing countries, the main motivations for waste reduction are frequently related to legislation, environmental protection, and the scarcity of sites for landfills. Urban centers which do not have effective collection and disposal systems should not devote resources to developing waste reduction measures until adequate waste management systems are in place.

The information obtained from households concerning the solutions needs to be adopted to make the waste disposal system environmentally friendly using open ended questionnaires indicated the following suggestions.

The response gained from most households indicated as a lot is expected from the administration of the town to make the SWM of the study area environmentally friendly. The large portion of households responded that it is the weakness of the municipality and lack of responsible body assigned with the task of coordinating SWM system of the town properly as a primary cause for the poor management of solid waste observed in the town. They also suggested that assigning such a responsible body is also a primary solution for the problem.

The sampled households also suggested that the municipality of the town needs to employ workers for the daily removal of solid wastes generated from the town. Furthermore, to make the SWM system environmentally friendly, the municipality must used for hauling of solid wastes in different parts of the town.

Regarding the solutions for the poor management of solid wastes of the town, the information obtained from the staff of the municipality using interview, they mentioned as a very little effort was made by their office to take all the necessary measures to make the SWM environmentally friendly. They also stressed that the community have to practice the disposal methods not posing a significant effect on the environment and health of the community like composting. The staff

of the municipality recognized as their office made a little effort to make the community aware of the environmentally safe/suggested disposal methods.

Regarding the solution measures needs to be taken the staff of health office, they indicated as there is weak relationship b/n their office and the municipality on dealing with the issue of SWM. Therefore, in order to make the SWM of the town environmentally friendly a lot is expected from their office and the municipality particularly on providing the necessary equipments and awareness creation campaign.

Concerning the solutions measures needs to be taken to make the SWM activities of their town, the sampled households also made their suggestion. But most of them indicated as the main body expected to take those measures is the municipality of their town. This indicates as most of households were unable to take themselves as a major responsible body for poor management of solid wastes in their town. Households suggested the following measures as a solution for the SWM problem of their town. Those suggested solutions are; the municipality must prepare sufficient solid waste disposal sites, must provide solid waste disposal container[^] in their surrounding, and must employ labor engaged with the removal of those wastes to solid waste disposal sites.

From the sampled households, some of them also stressed, it is not only the duty of the municipality to take the necessary measure to make it environmentally sound, but also solid waste disposal activities practiced by the community needs to be changed.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

The main objective of this study was to assess the SWM system with the special focus of the practices and challenges in Durame town Kemebeta Tembaro Zone, SNNP. Furthermore, this study was intended to identify the common types of solid wastes prevailed in the study area, including the identification of the major sources of solid wastes contributing to those dominant types of solid wastes in the study area. In addition, this study also aimed to assess the methods used to manage solid wastes of the town, i.e. common disposal methods used by the community and the municipality to dispose solid wastes. Subsequently, this study also targeted to identify the major existing factors affecting the SWM system of the town. It was also the core objective of the researcher and this study to assess and identify whether the SWM system of the study area takes in to account the protection of the surrounding environment or not. In addition to the above mentioned objectives, thesis study also intended to identify possible solution towards the adoption of safe and environmentally effective SWM mechanisms at Durame town.

In order to achieve these objectives and realize its intended targets, descriptive survey method, which is preferable for describing the existing situation regarding the problem under study, was used. To obtain relevant and sufficient information, both primary sources (from sampled households, from key informants, and the observation of the researcher), and secondary sources (from published and other unpublished related materials) were used as a source of data. To get the necessary information from the above mentioned sources, questionnaire (both close ended and open ended) was developed and distributed to sample population selected using simple random sampling techniques, while the interview (structured interview) used to obtain information from the purposively selected staff of the municipality and health office of the town. In addition in order to support the response gained from the respondents; field observation was also made by the researcher. Based on the nature of the data and responses gained from the sampled households and key information, the collected data were analyzed using simple descriptive statistics such as percentages and averages, and summarized in the form of tables. Narration also used to describe and interpret the qualitative data gained from different sources.

Based on the assessment made on SWM system made in three kebeles of Durame town, the following dotted points were revealed as major findings, such as:

The major types of solid wastes prevailed in the study area, revealed as food wastes and their packaging takes the line's share of the types of solid wastes in the study area. Following food waste, demolition and construction wastes occupied the second position of the major types of solid wastes. The study also indicated plastics and paper wastes as other significant types of solid wastes of the study area.

In addition, the finding of this study revealed that Durame town was suffered by solid wastes generated from residential sources. Although, the result of the finding indicated residential sources as the major contributor of dominant sold waste types of the study area, it also indicated other sources contributed to the major types of solid wastes in the study area. And they were demolition and construction wastes sources which followed residential sources. Commercial and institutional sources were also other major sources of solid wastes indicated as other sources contributed to solid wastes of the study area.

Furthermore, the result of the assessment revealed ordinary open dumping and open burning as a major disposal method practiced by the residents. Regarding factors affecting the SWM system of the study area significantly identified various factors. Among those factors the less attention given to the issue of SWM by the municipality, the poor awareness of the community about the impact of solid waste on their environment and health.

Finally, the assessment made to identify the main target behind the study i.e. identifying whether SWM system of the study area considers the environment of the surrounding revealed that due to the above mentioned and other related factors, the entire solid waste management of Durame town was environmentally friendly but sometimes no effort made to realize integrated sustainable solid waste management system in the town. It was due to this fact that most of the community used open dumping and open burning methods, which are environmentally hazardous, as a major methods of solid waste disposal. This made environmental problems such as water pollution and poor land management and conservation problems as another major finding of this study. It also revealed that as those environmental problems are becoming the

cause of environmental diseases resulting in population of rodents and flies, and in odor and aesthetic problem.

5.2 Conclusion

Based on the intended general objective and specific objectives of this study, and the findings of the study resulted after the whole efforts stated under the research methodology were made, the following major conclusions were drawn.

The existing practice of solid waste management system in Durame town does not fulfill the required conditions for environmental safeguard; that means i.e. the weak financial status of the municipality, the poor awareness of the community, absence of scientific and sufficient disposal system, the less attention given for environmental protection and lack of private sector involvement are responsible for management of solid wastes of the town to stand against getting scientific and modern.

In regard to the sources of solid waste, it is understood that the poorly collected and managed solid wastes of the study area due to the lack of necessary materials and facilities of solid waste collection, lack of labors engaged in street sweeping and daily removal of solid waste is now becoming the major causes of environmental problems such as surface and ground water pollution problems. In addition the solid waste management system of the study area favored for increased breeding of disease causing agents such as flies and rodents.

Finally, the findings of the study revealed that institutional, technical, social factors (*eg. lack of public awareness*) are major ones that negatively influence the SWM efforts in the given town. Therefore, among a number of social service problems (shortage of clean water, problem of sufficient provision of electricity, lack of standardized roads) found in Durame town, management of solid waste is becoming another big and challenging problem causing a serious problems on the environment and health of the residents. However, intervention is made by all stakeholders and authorized body, the problem and environmental damage. This was why the researcher as a Geographer and committed resident of the town made a serious attempt enabled him to identify the factors causing SWM problems of the study area and suggested solution measures required to tackle and solve the problem before becoming out of control.

5.3 Recommendations

Based on the findings of the study and the conclusion drawn, the researcher has suggested the following recommendations as the solution measures need to be taken by all stakeholders to solve the solid waste management problems of the study area.

Of all, waste management should primarily be focused at household level for sustainability and cost effectiveness and those elements which cannot be managed at the household level should be managed at the community level. Since the poor awareness of the community in the study area was one major cause for poor SWM of the town to achieve effective SWM at local level, the municipality and health office of the town should engage in awareness creating campaign to enable the people aware of the importance of safe solid waste disposal for their environment and health, and help them change their poor SWM practice in to environmentally sound SWM system of the town should be assigned at right place.

In addition, since the total solid waste disposal sites available in the town are few in number and was not managed in proper place, the town should plan to dig an additional waste disposal well based on the number of population. The municipality also should recruit labor in charged with daily removal of solid wastes in the town. Furthermore, awareness creation among key development policy makers and implementers at all levels regarding the advantages of SWM in urban areas and its potential advantages in environment and health protection, recycling and reuse of waste need to be made. It is also needed from the municipality to supply sufficient equipments/ materials used for hauling of wastes in different parts of the town.

It is also imperative to introduce and rely on integrated solid waste management system as a guiding principle of SWM activities of the study area, i.e., the SWM of the town should rely on 3R (reducing the waste at the point of generation, reusing materials for the same purpose again, and recycling of materials to manufacture secondary products).

It is also suggested that SWM should also be planned and implemented following demand responsive approach involving all stakeholders from the beginning, and assuring transparency in management and decision making processes. And all section of urban households should have equal access to safe disposal of SWM, and appropriate technologies, suited to their needs and means should be made available to them. In order to identify the rate and extent of environmental degradation due to poor SWM practice and address the issues which were not included in the current study, further researches should be conducted in the study area. Lastly, it is also essential to create appropriate partnership with local NGOs and private sectors to realized, environmentally sound and effective SWM system in Durame town.

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Appendices
Appendix A
Addis Ababa University
School of Graduate Studies
College of social science

Department of geography and environmental studies

The main purpose of this questionnaires is to collect first hand information for the study that attempt to assess/investigate solid waste management system of Durame town and its consideration of effective environmental management. The success of the study depends on your genuine responses to each question. Your response will be used only for the intended purpose. Therefore please read and respond to each item in the questionnaires and indicate your answer by ticking in the provided box for close ended questionnaires and indicate your answer by on the provided space for open ended questions by using the sign “√”

I appreciate your willingness to support my effort.

General direction

- No need of writing your name.
- Give only a single answer for close ended questions

If your response to the question is not included in the given alternatives, please, specify your answer on the space provided at the end of the alternatives.

I. Respondent's background

A. Sex Male Female

B. Religion Christian Muslim Other

C. Educational status:

Basic education

Elementary school Higher education

High school

II. Survey questions

1. Which waste is the major type of solid waste you/link found in your area?
 - A. paper waste
 - B. food waste and their packaging
 - C. construction and demolition wastes
 - D. plastics
 - E. other type/specify
2. What do you think is the major source of solid wastes found in your area?
The major type of waste you mentioned under question No. 1. Primarily generates from which source of solid wastes?
 - A. agricultural sources
 - B. commercial and institutional sources
 - C. construction and demolition sources
 - D. residential sources
3. Is there any labor in charged with daily removal of solid waste in your surrounding/kebele? A. Yes B. No
4. If your answer to question number 3 is yes, do you think there are enough labors in your town? Are they effectively working? Explain.
5. If your answer to question number 3 is no, what do you think are its negative impacts on SWM activities of your town?
6. Which method of solid waste disposal system is commonly practiced by your family to dispose the solid wastes generated from your house/home?
 - A. Sanitary land fill/SLF/
 - B. Composting
 - C. Open burning
 - D. Open dumping
 - E. Other/specify

7. If your answer to question number 7 is choice B, C, D or E do you think these sites are properly selected and sited? If yes, explain their properness
If no explain the impacts.

8. Are the following materials and equipments used for the collection of solid wastes are available in your town?

- | | | |
|-------------------------|--------|--------|
| A. Collection container | A. yes | B. No |
| B. Collection truck | I. Yes | II. No |
| C. Collection crew | I. Yes | II. No |

9. If your answer to question number 9, choice A, is yes, are they sited at proper place? Are they given necessary services? Explain;

Assuming your answer to question number 9, for each choice is No. what are the major impacts of the absence of those materials on your SWM activities in particular and SWM activities of the town in general? Explain ---

-----Do you think the solid waste management system of your town is based on the principles of ISSWM system? A. yes B. No

10. Do you think that the solid waste disposal system your family is practicing, in particular and the SWM system of your town in general are safe, effective, efficient and environmentally friendly? A if yes how? B. If No, specify the major factors behind;

Assuming that your answer for question number 12 is no, Explain

11. Which of the following causes of environmental diseases is prevailed in your area due to improper and environmentally unfriendly solid waste management?

- A. Aesthetic and order problem

- B. Injury
- C. Population of rodents and flies
- D. Other/specify

12. Which one of the following environmental impact do you think is the major result of poor solid waste management system of the town?

- A. Water pollution problem
- B. Land management and conservation problem
- C. Loss of amenity
- D. Air pollution
- E. Other/specify

13. Suggest alternative disposal system need, to be practiced by the community of your town and by your municipality to replace environmentally hazardous methods of disposal. ----- and state the advantage of the suggested disposal system on your environment;

14. What possible solution measures do you think the waste management system of your town need to be socially acceptable, economically affordable and environmentally effectively? -----

15. Suggest alternative disposal system need, to be practiced by the community of your town and by your municipality to replace environmentally hazardous methods of disposal. ----- and state the advantage of the suggested disposal system on your environment;

16. What possible solution measures do you think the waste management system of your town need to be socially acceptable, economically affordable and environmentally effectively? -----

Appendix B

Addis Ababa University School of graduate studies College of social science

Department of geography and environmental studies

Interview questions for KI from the municipality of Durme town

General information

- A. sex Male/ Female
- B. present work/responsibility in your office
- C. work experience on the present work
- D. total work experience
- E. educational status

II. Interview questions

1. What is/are the major types of solid wastes dominantly found in Duirame town? Indicate their dominance by stating in their decreasing order.
2. What are the major sources of the above mentioned types of solid waste? State them in accordance of their rate of contribution.
3. Is there any appropriate organ/body assigned to coordinate the solid waste management activities of the town by your office?
4. Is there any labor in changed with daily removal of solid wastes of the town? If yes, are they proportional to the total amount of generated wastes? If, No, why? And explain its impacts on SWM activities of your town.
5. Are there solid waste disposal sites in the town? If yes, how many sites are available? Are those sites selected considering the environment of their surrounding and health condition of the residents? Are they enough to dispose the solid wastes generated from your town? Are those sites sited for open dumping or for SLF? Are those sites giving the necessary services? Are those sites used properly by the community?

6. What are the methods of solid waste disposal commonly practiced by your town and the community of your town to dispose solid wastes regularly generated from your town?
7. What are the materials provided by your office for the collection of solid wastes generated from different sources? If any, are they enough? Are they sited at proper place? If No, why? What impacts it have on SWM activity of your town?
8. Do you think that the solid waste management system of your town is based on ISSWMS principles and environmentally friendly? If Yes how? If No why?
9. What are the influences and consequences of poor solid waste management practice in your town on the local environment and as a source of the causes of environmental disease affecting the health condition of the residents?
10. What are the major factors affecting the SWM system of the town?
11. What alternative disposal methods you suggest to change the current environmentally hazardous disposal methods?
12. What possible solution measures are needed to be adopted by your office and by the community of town to make the solid waste management of the town socially acceptable, economically affordable and environmentally friendly?

Appendix C
Addis Ababa University School of graduate studies
College of social science and humanities
Department of geography and environmental studies
Interview questions from the health office of Durame town
I: General information

- A. Sex Male Female
- B. Present work/responsibility in your office
- C. Work experience on the present work
- D. Total work experience
- E. Educational status

II: Interview questions

1. What are the major types of solid wastes dominantly found in Durame town? Explain in accordance of their dominance.
2. What are the major sources of solid wastes contributing to the major types of solid wastes found in Durme town? Explain in terms of their dominance contribution?
3. Do you think the solid waste disposal sites used for disposal of solid wastes generated from different sources are properly selected?
4. Do you think the solid waste disposal sites of the town is environmentally friendly, based on ISSWM system and has no impact on the health condition of the residents?
5. Are there any causes of environmental diseases in the town due to improper solid waste management?
6. What possible solution and disposal system do you suggest to make the SWM activities of the town environmentally friendly?

Appendix D
Addis Ababa University
School of graduate studies
College of social science and humanities
Department of geography and environmental studies

Observation check list

Name of the town _____

Date _____

No	Indicators	Yes/no	Status
1	Presence of appropriate to expertise to coordinates SWM activity.		
2	Availability of labor in charged with daily removal of wastes		
3	Presence of SLF sites		
4	Presence of solid waste disposal sites		
5	Availability of collection containers such as curb and alleys.		
6	Availability of collection crew		
7	Presence of solid waste disposal sites selected taking in to account the environment lex surface and ground water topography, wind direction		
8	Proper use of disposal sites by the community		
9	Presence of follow up and data collection system by the municipality		
10	Existence of uncollected wastes on the streets and open surfaces.		
11	Provision of environmental and health education by the municipality and health office		
12	Practice of open dumping and open burning by the community		

Statement of the Author

I, declare that this thesis is entirely my own work and that all sources of materials used for this thesis has been duly acknowledged. This thesis work has been submitted in partial fulfillments of the requirements of Masters of Arts degree in Geography and Environmental studies at Addis Ababa University and not submitted to any other institution for award of any academic program.

Name: Feleke Amere

Signature: _____

Place: Addis Ababa

Date of Submission: _____